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# Econometric Assessment of Social Indicators' Influence on the Regional Economic Growth Dynamics
## (Case Study of the Subjects of the Volga Federal District)*

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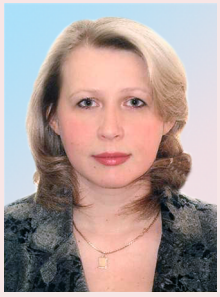

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**Abstract.** Social factors of endogenous economic growth are becoming the subject of modern research increasingly frequently. The contribution of human capital individual parameters and income inequality indicators are the most studied ones. Cross-country studies lead to conflicting conclusions. The results of Russian research are generally unambiguous, since the regional level of analysis is more similar in terms of institutional conditions and the level of socio-economic development. However, they do not define the nature of the impact of a number of significant social indicators on regional economic growth. In this regard, the purpose of the paper is to determine the nature of the influence of a set of social indicators on the regional economic growth dynamics by means of econometric modeling tools. The methodological basis is made up by the epistemological tools, in particular, system, hypothesis-deductive and dialectical

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approaches, as well as the methods of content analysis and econometric modeling. The most significant results characterizing the scientific novelty of the presented research include the following: 1) it is determined that the impact of the population's birth rate, mortality and morbidity on GRP corresponds to the nature of the dependencies identified for countries having experienced the second demographic transition; 2) it is established that the character of influence of the indicators of "life expectancy", and "the number of students studying in bachelor, specialist, master degree programs" and "the number of employees with higher education in the region's economy" on the GRP does not correspond to the trends in developed countries; 3) it is proved that the inconsistency of the obtained results is a consequence of the underestimation of human capital as the main factor in the development of the Russian economy at the present stage; 4) the extent and consequences of the restraining effect of the analyzed social indicators on the dynamics of regional economic growth are determined. Based on the results of econometric modeling, the priorities of regional socio-economic policy for the medium term are identified, depending on the level of their impact. The authors associate the prospects for future research with a deeper study of the impact of life expectancy and mortality factors on the regional economic growth, as well as the verification of this model for the entire set of regions of the Russian Federation.

**Key words:** social indicators, regional economic growth, human capital, health capital, education capital, birth rate, mortality, life expectancy, income differentiation, econometric modeling.

## Introduction

Currently, there is a wide range of foreign and domestic studies devoted to identifying the connection between the economic growth and individual indicators of the development of national and regional economic systems. For example, S.N. Durlauf, P.A. Johnson, and J.R.W. Temple identified more than 100 such parameters [1]. However, in most studies, the emphasis often shifts from measuring the dynamics of the size of the economy in each country and the level of its national wealth to the need to measure the dynamics of the level of each individual's well-being and society as a whole (for example, [2; 3]). Thus, the importance of social indicators of the development of modern socio-economic systems is emphasized. Among them, a special role is assigned to the qualitative parameters of human capital as determining factors of modern economic growth [4; 5]. At the same time, the importance of two elements of human capital is emphasized: the capital of education and the capital of health [6–9]. The capital of education allows ensuring that human capital meets constantly changing requirements for its quality because of science-intensive, technetronic renewal, and the transformation of productive forces. Health affects the level and quality of human capital; it has a positive effect on productivity and return on its usage at all economic levels [10]. In addition, attention has recently been focused on interconnections between the level of health of individuals and their greater ability to generate new ideas, adapt to new technologies and changes [11], which is one of employers' modern requirements to the quality of employees' human capital (so-called soft skills)[1]. We would like to emphasize that the health capital and education capital are overviewed in the interconnection, since,

[1] We would like to remind that these requirements also include competencies related to the ability of self-education and the ability to learn, the ability to work in a team, motivation to achievements, a high level of empathy, self-awareness, and a constructive response to criticism.

from an individual's point of view, the duration of the usage of human capital becomes a necessary condition for increasing investments in education, because this is the only way when investments in the education capital will be profitable [10; 12; 13].

In addition, scientists identify the level of population's income inequality as one of social parameters that influence the pace of modern economic growth, create conditions, and determine opportunities for the formation and implementation of human capital, [3; 14; 15].

In recent years, the contribution of these social indicators to the efficiency of the development of socio-economic systems has been confirmed by using tools of economic and mathematical modeling of the fact of influence and quantitative measurement. However, unlike theoretical studies, empirical dependences, obtained by foreign and Russian scientists, have different results.

In addition, currently, the influence of the interconnection between fluctuations of economic dynamics and individual social indicators of the development has been studied on the data from these countries and Russian regions, which, on the one hand, limits the scope of research, and, on the other hand, leads to contradictory and sometimes even unreliable results. It seems that the proposed econometric model will allow removing these restrictions and comprehensively determining the significance and contribution of the social component into the economic growth. The justification of the choice of social indicators that allow a comprehensive assessment of its impact on current fluctuations of economic dynamics and form the potential for sustainable development of information, innovation and technology components of regional systems is presented in previous works of the authors [16; 17].

Following the logic of our work, let us dwell on the analysis of the results of empirical studies that assess the impact of the number of indicators of substantial and qualitative changes in the reproduction of human capital, in wealth and depth of social inequality on the pace of the economic growth in Russian regions.

**Theoretical and methodological basis of the research**

We would like to start by analyzing the results of studies that measure the contribution of human capital to modern economic growth.

Thus, M. S. Delgado, D. J. Henderson, and C.F. Parmeter analyzed 15 different models that reveal the significance and nature of the impact of human capital on economic growth, and demonstrated that scientists come to completely different conclusions: from a positive significant impact to a negative one. Using the traditional Solow model, based on data from 75 countries for the 1950–2005 period, they proved that there is no statistically significant dependence between the economic growth and the rate of human capital accumulation, which was measured using the average number of years of study [18].

The study of E.A. Hanushek and D.D. Kymco, on the contrary, revealed a significant and reliable influence of the quality of human capital on the rate of the economic growth [19].

There are also differences in the results of empirical research on the interconnection between the level of health of the population and GDP. For example, D. Acemoglu and S. Johnson, on the basis of panel data from 47 countries for the period from 1940 to 1980, found that the increase of life expectancy has a positive effect on the population growth but a negative effect on GDP per capita [20]. This result, as emphasized by M. Cervellati, U. Sunde [21], and K. Minamimura, D. Yasu [13], is somewhat surprising, since it challenges

previous theoretical and empirical studies which state that the reduction of mortality and the improvement of public health have a positive impact on the economic growth in the country.

We agree that these paradoxical results depend on the hypothesis's fallacy, the quality of empirical data (for example, on the low quality of human capital data [18; 23; 24], and the model specification [13; 18; 22]. For example, M. Cervellati and U. Sunde divided the sample of D. Acemoglu and S. Johnson between countries into two groups based on classification criteria used in demographic literature: countries before and countries after the demographic transition[2]. The results of the study show that the increase of life expectancy negatively affects GDP per capita in countries that have not yet experienced the transition period, but it positively affects GDP in countries where the transition has already occurred [21].

Undoubtedly, it is caused by the contribution of various factors to GDP growth. Countries that have experienced demographic transition are more likely to develop at the expense of human capital, which, as we noted earlier, is more profitable to invest in if life expectancy increases. In addition, such possibility, as emphasized by a classic of the demographic school K. Davis, appeared only after the transition from a wasteful type of reproduction (high birth rate balances high mortality) to an efficient one (low birth rate with low mortality) which was determined by the industrial revolution [25, p. 7]. The latter released a huge amount of energy from the eternal reproduction – energy chain that can be spent on other aspects of life [26, pp. 68–69]. The result of these processes, using the terminology of K. Davis, "is a striking victory in human efficiency", because the quantitative increase of human capital has been replaced by the increase of its quality (see more [26–29]).

This conclusion is confirmed by the results of the research by K. Minamimura, D. Yasu. In the model, they consider the impact of the quality of human capital of the population and the level of mortality in the country on the dynamics of GDP per capita. In countries with a high level of education, the decrease of the death rate leads to the increase of GDP per capita, while in countries with a low level of education (and fewer resources), on the contrary, opposite dependencies appear [13].

In addition, as confirmed by the study of A. Anori and Y. Psycharis on the example of data from 13 regions of Greece for the 1995–2012 period, the contribution of different levels of education of the population to GRP is differentiated. The greatest positive contribution to GRP is made by secondary and higher education, while primary education has a negative impact on the dynamics of GRP. These differences were also typical for regions with high and low GRP levels. Moreover, in regions with a low level of income, the greatest effect on the formation of GRP is caused by secondary education, with the highest income – higher education [30]. Of course, in this case, the structure of the economy, where the human capital is implemented, is important. It is no accident that more and more empirical studies focus on the interconnection between the quality of human capital, the ability of the economy to create and reproduce innovations, and the economic growth.

[2] Let us remind that this concept explains the change of types of population reproduction, which is understood as a characteristic of this stage of social development unity of intensity of demographic processes (mortality, marriage, birth rate) and mechanisms of their social regulation. *Bol'shoj jenciklopedicheskij slovar',* gl. red. A.M. Prohorov. 2nd ed. Moscow: Bol'shaja rossijskaja jenciklopedija; Saint Petersburg: Norint. 2002. P. 341.

S. Barcenilla-Visu, C. Lopez-Pueyo, using data from 28 EU countries for the 1950–2011 period, the Benhabib and Spiegel model, and taking into account the time lag in return of the human capital, confirmed its impact on the rate of the economic growth in a country. Using the postulates of endogenous economic growth models, they found out that the quantitative increase of human capital increases productivity through the imitation of the innovation, while the improvement of the quality of human capital (the increase of the share of highly skilled workers) affects the ability to create innovations, providing the technological advantage of the national economy [23].

However, empirical estimates of the impact of changes in the technological structure of the economy and related changes of the quality of human capital on the growth of national and regional economic systems are ambiguous. For example, P.M. Gil, O. Afonso, and P. Brito used a modified endogenous growth model that takes into account the flexible structure of technical changes to identify structural relationships between the economic growth, technology structure (high-tech or low-tech), and employee skill structure (highly skilled or low-skilled). Based on cross-country data for Europe, the authors conclude that there is a statistically insignificant interconnection between studied parameters, except for a significant positive connection between the structure of employee skills and the structure of technology. According to P.M. Gel, O. Afonso, and P. Brito, it is caused by high barriers to entry into the high-tech sector, which limit mobility on the inter-country and national labor markets. They weaken the impact of the share of highly skilled labor on the rate of the economic growth of the national economy since enterprises in the high-tech sector of the economy are the only employers for highly skilled workers. Consequently, the improvement of the employees' skills structure does not automatically lead to the increase of the share of the high-tech sector along with the increase of the rate of the economic growth, as indicated in the European development strategy "Europe 2020: A strategy for smart, sustainable and inclusive growth", without policies aimed at reducing barriers to entry into this economic sector [31].

We would like to note that V.E. Gimpelson, analyzing the problems and prospects of using human capital in the Russian economy, also focuses on the need for changes in the country's economic policy from the supply and demand sides of labor. First, inefficient (unprofitable) firms, which are quite common on the Russian market, are not able to pay competitive wages to highly qualified employees. Secondly, in an unstable external environment, it is not profitable for firms to improve the skills of their employees, i.e. "to increase, in G. Becker's terminology, the level of specialized training and invest in the health capital of their employees" [12, p. 57]. Third, the current institutional environment in Russia primitives the structure of the Russian economy and does not promote the development of knowledge-intensive and high-tech activities. As a result, the structure of labor demand in our country is still dominated by simple performers of medium and low qualifications [32]. This conclusion is particularly important for our research, because it focuses on the fact that, in Russia, the contribution of the quality of human capital to the modern type of the economic growth is underestimated.

The results of empirical studies on the nature of the impact of income inequality on the economic growth (for example, [33; 34]), using different specifications of economic models according to different groups of

countries in various time periods, are also controversial. At the same time, as G.A. Cornia and J. Court showed that the depth of the differentiation of the population income is important. Scientists, using data from 73 countries for 1960–1990, concluded that the Gini Index value in the range from 0.25 to 0.40 has a stimulating effect on the economic growth, while the increase of income inequality constrains it at the value of 0.45 or higher [35].

We would like to note that, in the long discussion of economists, devoted to the analysis of the interconnection between the income inequality and the economic growth, scientists more often support the opinion on its negative nature, especially for the possibility of the economic development [3; 36].

Without further dwelling on contradictory interconnections between various social indicators of the economic development, we would like to note that Russian scientists also studied the parameters we analyze. Their results are generally unambiguous, because, unlike cross-country studies, the regional level of an analysis has a greater similarity of regions in terms of institutional conditions and the level of the socio-economic development.

Thus, R.M. Nizhegorodtsev and M.Y. Arkhipova used various modifications of econometric models to estimate the contribution of labor, capital, and scientific and technological progress (information) to the formation of GRP in a sample of 80 regions for 1996–2004.

Clustering of obtained data allowed the authors to reveal that these factors are not significant in most regions of the Russian Federation. It indicates the institutional conditionality of regional economic growth in our country [37]. We emphasize that the "labor" factor was assessed by the indicator of the total amount of wages of hired employees, i.e. qualitative characteristics of human capital were not considered.

K.V. Krinichansky and A.S. Lavrentiev applied the modified neoclassical model of R. Barro and H. Sala-i-Martin, presented in the OECD [cit. 38], to separately assess the structural policy priorities of Russian regions in the following areas: 1) education; 2) healthcare; 3) research and development, small business. The sample included data on 75 entities of the Russian Federation for 2002–2014. The conclusions obtained by K.V. Krinichansky and A.S. Lavrentiev, which are important for our research task, include the assessment of the contribution of education to the economic growth of Russian regions. A significant positive connection between the GRP impact of indicators such as employed population with different levels of professional education and budget expenditures on education were acquired in models. At the same time, the parameters for variables "investment in education" and "entry of young professionals with different levels of education into the labor market" were insignificant. The latter, as emphasized by K.V. Krinichansky and A.S. Lavrentiev, indicates the imperfection of labor market in regions of the Russian Federation [38]. However, it should be noted that, while the education sector was analyzed by the authors from the supply side and the formation of labor demand, in case of evaluating the health sector, individual health indicators, which allow drawing conclusions on the health capital's impact on GRP, were not assessed.

O.V. Michasova, using the Solow-Sven and Nelson-Phelps models, based on data for 2003–2010, established that the level of human capital stock is a significant factor for the development of Russian regions. The results of the study show the following: entities of the

Russian Federation are characterized by the existence of conditional convergence, i.e., it cannot be assumed that lagging regions will grow faster than leading ones. In addition, there is no "fast start" effect for the Russian economy, i.e. the lag of regions behind Moscow and Saint Petersburg reduces slightly over time [39]. These results allow us to draw a conclusion on the deepening of inter-regional differentiation in the development of the Russian economy, which is now being identified as one of the limitations in rates of positive economic dynamics.

At the level of Russian regions, the nature of the impact of income inequality on regional economic growth was also analyzed. For example, I.P. Glazyrina and E.A. Klevakina, using the hypothesis of S. Kuznets[3], which is based on data of Russian regions for 2000–2011, revealed that the majority of Russian regions (72 out of 82) are characterized by the increase of income inequality with the increase of GRP per capita. There is no statistically significant connection between GRP per capita and the Gini Index in eight regions: the Altai Krai, the Karachay-Cherkess Republic, Buryatia, Kalmykia, and Mari El republics, the Tyumen Oblast, Chukotka, and Yamalo-Nenets AO. Only in two regions – Moscow and Khanty-Mansiysk AO – the inequality decreases with the growth of GRP per capita [40]. The positive interconnection between the level of social inequality and the GRP of Russian regions was also confirmed by the results of other studies (for example, [33; 41]).

The presented review of the results of foreign and Russian scientists forms the theoretical and methodological basis of the author's research concerning the significance, nature, and magnitude of the contribution of the social component to the economic growth.

**Data and the results of the econometric modelling of the impact of social processes on regional economic growth**

The analysis was conducted using data from 14 entities of Privolzhsky Federal District (PFD) for the period from 1995 to 2015[4]. We would like to note that cost indicators were converted to 2015 prices to exclude the impact of inflation and to ensure comparability of their dynamics with the dynamics of other indicators expressed in natural measurers. 2015 was chosen as the basis year, since the latest data, published by statistical agencies on GRP per capita, were limited to the specified period at the time of the study[5].

The efficient feature in the model is GRP per capita since it allows quantitative measurement of the region's economy and the determination of the quality of regional socio-economic systems' development indirectly individually characterizing the level of each individual's well-being. The list of explanatory variables and their designations is presented in *table 1.*

In this study, data with panel structure will be reviewed. These data are two-dimensional arrays. One of dimensions has a temporal interpretation, and another one – a spatial interpretation. The choice of data type is determined by the purpose of the study and the presence of some advantages of its usage. Panel

[3] We would like to remind that this hypothesis assumes that inequality of income distribution in the process of the economic development initially grows, but then, as per capita income increases, it declines.

[4] *Regions of Russia. Socio-Economic Indicators. 2017: Statistics Collection.* Moscow: Rosstat, 2017. 1402 p.; *Regions of Russia. Socio-Economic Indicators. 2012: Statistics Collection*. Moscow: Rosstat, 2012. 990 p.; *Regions of Russia. Socio-Economic Indicators. 2007: Statistics Collection*. Moscow: Rosstat, 2007. 991 p.; *Regions of Russia. Socio-Economic Indicators. 2002: Statistics Collection*. Moscow: Goskomstat Rossii, 2002. 863 p.

[5] This methodology and database were used earlier to identify the current phase of the social cycle at the level of regional socio-economic systems [16].

Table 1. Variables for modeling

| Factor | Designation | Characteristics | Units of measurements |
|---|---|---|---|
| Birth coefficient | fertility rate (FR) | Shows the ratio of the number of births to the average annual number of population per 1000 people | permille |
| Mortality coefficient | mortality rate (MR) | Shows the ratio of the number of deaths to the average annual number of population per 1000 people | permille |
| Life expectancy | life expectancy (LE) | Number of years that a person from the generation born would have to live on average, provided that, over the lifetime of this generation, age-related mortality remains at the level of the year for which the indicator is calculated | years |
| Morbidity coefficient | incidence rate (IR) | Ratio of the number of patients with a first-time diagnosis to the average annual number of population per 1000 people | permille |
| Fund coefficient | assets ratio (AR) | Ratio of average income of the population in the tenth and first decile groups | times |
| Number of srudents | number of students (St) | Number of students enrolled in programs of bachelor's degree, specialty, master's degree in educational institutions of higher education, designed for 10.000 people | per 10.000 people |
| Per capita monetary income of the population | per capita income of the population (Income) | Ratio of the amount of monetary income of the population per month to the average annual population | rubles |
| Employed with higher education | employed with higher education (EHE) | Share of employees with higher education in the total structure of employed population | % |

data, as noted by B. Baltagi and A. Deaton: 1) contribute to the increase of the number of observations, therefore, it improves the efficiency of assessments; 2) allow tracking important socio-economic processes and phenomena that cannot be analyzed by time series and cross-sectional data separately; 3) eliminate the problem of aggregation shift; 4) allow tracking individual effects of objects in the time section [42; 43].

During this work, various model specifications were reviewed:

1) linear models with a dependent variable GRP per capita; 2) logarithmic models with a dependent variable "logarithm of GRP per capita" and logarithms of factor features. The second specification proved to be the most acceptable since the usage of a logarithmic specification is more justified when variables are censored by a zero on the left. Different model specifications were compared according to the Schwarz information criterion, the lowest value of which is observed in the best model.

The next step was the comparison of models with fixed and random effects and the selection of the most appropriate one (*Tab. 2*). We would like to remind that models with random effects are used when objects are selected randomly from a large general set of elements. The model with fixed effects implies that an individual effect could be correlated with variables. In this case, MLS-estimates will not be consistent [44]. The meaning of the effect is to reflect the influence of omitted or unobservable variables that characterize individual characteristics of studied objects which do not change over time [45].

In order to select between models with fixed and random effects, it is accepted to use the statistical Hausman criterion, the null hypothesis of which states that individual effects may be random, that is, a model with random effects is preferable [46]. According to *table 2*, the null hypothesis is not acceptable because the model with fixed effects is better (prob.= 0.00001). This conclusion seems logical because

Table 2. Simulation results for the dependent variable – the GRP logarithm

| Indicator | Model with fixed effects | | Model with random effects | |
|---|---|---|---|---|
| | Coefficients | Robust standard errors | Coefficient | Robust standard errors |
| const | 44.758*** | 10.427 | 52.966*** | 9.781 |
| ln(FR) | -1.028*** | 0.164 | -1.203*** | 0.239 |
| ln(MR) | -2.939*** | 0.399 | -3.188*** | 0.433 |
| ln(LE) | -9.043*** | 2.371 | -10.589*** | 2.144 |
| ln(IR) | -0.844*** | 0.202 | -0.846*** | 0.205 |
| ln(St) | 0.658* | 0.381 | 0.766* | 0.415 |
| ln(Income) | 2.305*** | 0.315 | 2.190*** | 0.286 |
| ln(EHE) | -0.861* | 0.512 | -0.964* | 0.542 |
| ln(AR) | -0.291 | 0.345 | -0.195 | 0.316 |
| Schwartz criterion | 223.213 | | 311.264 | |
| Coefficient of determination | 0.818 | | Statistics of Hausman test | 418.37 |
| Within coefficient of determination | 0.731 | | prob. Hausman | 0.00001 |
| ***, **, * – significance at 1, 5, and 10% levels, respectively. | | | | |

data on Russian regions cannot be considered the result of a sample study, and each object of observation (region) has its own individual characteristics that distinguish it from other entities of the Russian Federation. Models with included "time fixed effect" are also reviewed, but, according to Wald's criterion, the hypothesis on the absence of time fixed effects was not rejected.

The table shows that the results of the impact of social indicators, reflecting the development of regional socio-economic systems, on the growth of GRP are ambiguous.

First, for our country, which survived the second demographic transition and acquired reverse dependencies of the impact of fertility, mortality, and morbidity levels on the economic performance of Russian regions are logical.

Low birth level allows spending all region's resources on the production of goods without investing in children's upbringing. The level of women's participation in the production process does not substantially change, the dependency burden on working population does not increase, the level of families' income does not decrease. Consequently, the consumption level and the standards of savings do not decline [47; 48].

Within the reduction of population mortality, as it was noted before, the economic growth in developed countries is ensured by greater returns on the usage of human capital.

Lower morbidity level reduces direct costs of providing medical care and social assistance to ill people during the period of partial disability and the indirect cost in the form of GRP losses, caused by the loss of disability due to illness, the absence of people at work, and (or) the decrease of labor productivity [49; 50].

For example, according to A.V. Konceva, O.M. Drapkina, Ju. A. Balanova, A. Je. Imaeva, E.I. Suvorova, M.B. Hudyakov, sole economic damage from cardiovascular diseases in Russian in 2016 was 2.7 trillion rubles (3.2% of GDP)[6] [51]. At the same time, indirect costs account for more than 90% of the damage structure.

However, the question arises why, in such conditions, the economic growth in Russian regions is accompanied by the decrease of life

[6] The authors' calculations also consider the premature mortality among economically active population as one of components of the indirect cost of the "national burden of disease" of Russian population.

Table 3. Comparative analysis of main demographic indicators in Russia and other countries

| Indicator | RF data | Countries with similar indicators to the Russian Federation |
|---|---|---|
| Birth rate, permille | 12.8 | Australia (12.9); Ireland (13.0); New Zealand (12.6); Chile (12.5); Iceland (12.1) |
| Mortality rate, permille | 12.7 | Central African Republic (12.4); Chad (12.2); Nigeria (12.0); Hungary (12.5); Georgia (12.8) |
| Life expectancy, years | 72.29 | Bangladesh (72.15); Venezuela (72.13); Grenada (72.39); Libya (72.70); Republic of Cape Verde (72.70) |
| According to: *World Population Prospects 2019.* Available at: https://population.un.org/wpp2019/Download/Standard (accessed 11.11.2019). | | |

expectancy, whereas, according to previous studies, countries that experienced the second demographic transition should be characterized by a reverse dependency. In our opinion, this paradox can be explained by a phenomenon called the "Russian cross", which characterizes the steady excess of mortality rates over birth rates on a scale that is hardly compensated (or not compensated) by external migration[7] [52]. We would like to note that such trends are not natural for other countries. At the same time, if a value of the birth rate coefficient in Russia is at the level of developed countries, a value of life expectancy largely corresponds to indicators of developing countries (*Tab. 3*).

The gap in life expectancy in Russia and developed countries is caused by differences in the mortality rate of population, especially in working age. According to A. G. Aganbegyan, with a comparable age structure, the mortality rate in Russia exceeds European numbers by 600 thousand people per year. At the same time, the mortality rate among people of working age in the Russian Federation is 2.5 times higher than in Western Europe, which, according to Aganbegyan's calculations, is more than 300 thousand people a year. If we take into account "that one employee produces a GDP of more than 50 thousand US dollars per year in PPP terms (about 3 million rubles) or, at the market rate, he produces goods which are equal to almost 1.5 million rubles", then the reduction of the number of deaths among working-age population to European countries' indicators may provide an annual GDP growth equal to 450 billion rubles [53, p. 15]. Moreover, the intensification of mortality rates among working age people is typical for men. So, according to UN estimates, there are more than 7 million "lost men"[8] in Russia. If we consider that the cost of human capital per person in Russian prices is equal to, approximately, 12 million rubles [53, p. 15], losses of the Russian economy from male super mortality alone amounted to 84 trillion rubles. It is no accident that WHO considers health as a social institution that can act as a social prerequisite for the economic growth.

Based on dependencies of the impact of life expectancy on the dynamics of GRP we obtained and the review of research results presented before, we may conclude that Russian regions continue to develop primarily due to other factors, and the contribution of human capital to GRP is underestimated. The confirmation of this conclusion is the reverse dependency between the number of employees with higher education in the region's economy and GRP.

[7] We would like to note that this concept has also been used by foreign scientists. Thus, D. Coleman and J. Goldstein use the term "Russian cross" in their report "On the impact of demographic factors on global conflict in 2019–2035".

[8] *Human Development Report 2007/2008.* Moscow: Whole world, 2007. Available at: http://www.on.org/russian/esa/hdr/2007 (accessed 16.11.2008).

In addition, let us note that a factor called "a number of students enrolled in bachelor, specialist, and master's programs in institutions of higher education" was not significant in the obtained model. Clearly, it, on the one hand, indirectly confirms that Russian education system is not significantly modernized, and the training of specialists still does not consider requirements of employers. Most of all, these trends are typical for the system of higher professional education. As A. Zudina emphasizes, it is no accident that among unemployed people aged 15–24 years, who belong to so-called NEET group (Not in Employment, Education or Training), most of them have higher professional education [54]. On the other hand, the situation when graduates of educational institutions cannot immediately find a job after their graduation, and they are not in demand due to the lack of experience indicates the imperfection of the Russian labor market.

The direct dependency between the dynamics of the population's monetary per capita income and GRP obtained in the model is logical. This is the third most important parameter that affects the formation of GRP. The increase of the population's per capita income by 1% leads to the 2.31% increase of GRP. In addition, there is a known multiplication effect of increasing the population's income. It leads, first, to the increase of the quality of individuals' human capital due to large investments in health and education capital, the possibility of its recovery. Second, it leads to the subsequent growth of the regional economy due to increasing consumption of goods and services.

In our opinion, it is necessary to consider reasons for the absence of a statistically significant impact of the level of income inequality on the explained GRP variable. However, we would like to note that the reverse dependency between these two variables, which we obtained, was confirmed by the results of other studies.

In general, if we follow the logic of our previous works [16][9], it turns out that greatest problems, based on the results of econometric modeling, are a group of resulting indicators that form the potential for subsequent economic development of regional systems. It included the birth rate, life expectancy, and a number of students enrolled in bachelor, specialty, and master's programs. The nature of the impact of these indicators on GRP, according to the parameters obtained in the author's model, except for the birth rate, does not correspond to developed countries' trends. Therefore, they may become significant barriers to the progressive development of the Russian economy in the future.

**Conclusions**

The comprehensive analysis of the results of econometric modeling of social processes' impact on the dynamics of GRP, based on data from 14 entities of the Privolzhsky Federal District for the period from 1995 to 2015, allowed us to reveal causes, scope, and consequences of the underestimation of human capital as the main factor of the development of the Russian economy at the current stage, despite strategic priorities declared by the President of the Russian Federation in 2016[10].

First, significant losses of GRP caused by premature deaths among population, especially

[9] According to the author's research methodology, social indicators of modern economic growth, presented in table 1, were divided into groups: 1) indicators that ensure the economic growth on a new technological structure of the economy; 2) indicators that characterize social processes in society; 3) resulting indicators that form the potential for subsequent economic development of regional systems.

[10] Presidential Address to the Federal Assembly, dated 01.12.2016. Available at: http://kremlin.ru/events/president/news/53379 (accessed 25.11.2019).

deaths of working age people, disability due to illness, and (or) reduced labor productivity are partially compensated by the intensification of the usage of other production factors.

Second, the structure of the economy that has developed in Russian regions is not based on common informatization, innovatization, capitalization of labor resources, service-based production, knowledge-intensive, technetronic renewal and transformation of productive forces [55]. Therefore, it does not create conditions for the demand for highly qualified human capital.

Third, the inertness of the education system and the imperfection of the labor market limit the timely renewal of human capital in enterprises due to the influx of graduates from bachelor, specialist, and master's programs. As the result, the human capital of graduates is devalued, investments in human capital do not pay off, an additional burden on the working population is created, and the unemployment rate grows. In the end, everything will lead to the reduction of GRP in Russian regions and GDP.

Obtained dependencies, according to the results of foreign studies, do not correspond to the development trends of countries that have experienced the second demographic transition and have a high level of education among population. In the future, the extension of these sets in the formation and usage of human capital will significantly limit the possibility of Russia's transition to the knowledge economy, which was announced by Expert Council under the Government of the Russian Federation while defining priorities of the Strategy of the socio-economic development of Russia until 2030[11]. In addition, in such conditions, as we have shown earlier, we may only expect the increase of the productivity through the imitation of innovations that do not provide the technological advantage of the national economy.

The proposed econometric model for assessing the impact of social processes on the dynamics of the economic growth in regions of the Russian Federation actually allowed us to determine medium-term priorities of regional socio-economic policy, depending on the level of their impact: 1) reduction of the mortality rate among population, especially among working age people; 2) increase of the population's per capita income; 3) restructuring of the regional economy toward the development of knowledge-intensive and high-tech activities, ensuring the formation of a stable demand for highly qualified human capital; 4) reduction of the level of morbidity among population; 5) improvement of the institutional structure of regional labor markets in order to reduce unemployment among university graduates.

It seems that obtained contradictory dependencies between indicators of mortality and life expectancy and GRP per capita, as well as the lack of such studies within all entities of the Russian Federation, actualize further study of the impact of these factors on regional economic growth. It should be noted that these variables have the highest elasticity coefficients, i.e. the degree of its impact on GRP, in comparison with other social indicators, is more significant.

Restraining factors of the regional economic growth not only constitute a hidden reserve of the development of Russian economy and its regions but these factors are also a necessary condition of its sustainable development in the future.

[11] *"Strategy–2030": Defining goals and priorities.* Available at: https://open.gov.ru/events/5514805/ (accessed 28.11.2019).

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