

# The Impact of Demographic Indicators on Gross Regional Product

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**Abstract.** The socio-economic development of regions depends on a combination of historical, geographical, resource, demographic and other factors. The gross regional product indicator characterizes economic activity in the region and serves as an indicator of the successful development of the region. Formation of a regional development strategy requires determining the level of influence of various factors on the resulting indicator, which can be the gross regional product. This article examines the impact on the gross regional product of a number of parameters characterizing the demographic situation in the region. The study is conducted by the method of correlation and regression analysis of statistical data. Based on the results of the analysis, an economic-mathematical regression model is proposed, showing the relationship between factor and resulting features, the significance of the model is verified by test criteria. The resulting model can find application in the activities of regional authorities in the development of managerial decisions aimed at increasing the growth rate of the gross regional product.

## 1. Introduction

The gross regional product is a general indicator characterizing the economic activity of the region, on the basis of which changes it is possible to judge the socio-economic development of the region. The socio-economic development of the regions is influenced by a combination of historical, geographical, resource, demographic and other factors, as well as the regional management system [1]. Moreover, the management system can be crucial for increasing the region's economic growth by creating an effective development strategy that takes into account the opportunities, favorable trends and strengths of the region and minimizes or eliminates potential threats. To build a regional development strategy, it is necessary to study the impact of various factors on economic growth. Currently, in conditions of fierce competition and the pursuit of profit, the "human" or social factor occupies an important place,

since the organization's welfare is largely determined by the attitude of consumers and the loyalty of employees [2].

The aim of our study is to identify the impact of demographic indicators on gross regional product. In the future, you can use the findings to develop strategic measures to improve the demography of the region.

## 2. Literature review

According to studies, health has a positive and statistically significant effect on economic growth, that is, an increase in the life expectancy of the population by one year contributes to an increase in production by 4%. This is a relatively large effect, indicating that the increase in health improvement costs can be justified solely on the basis of their impact on labor productivity [3]. Studies in developing countries also confirm these findings [4]. In support of the above, an increase in life expectancy of one year is associated with an increase in the gross inflow of foreign direct investment in low- and middle-income countries by 9%, and this result seems rather stable. These results are consistent with the view that health is an integral component of human capital for developing countries, and suggest that the return on improved public health may also include increased levels of foreign direct investment [5]. Pelinescu, E. emphasizes the importance of human capital in ensuring economic growth, expressed in gross domestic product per capita. A positive relationship was found between gross domestic product per capita and the innovative potential of human capital (as evidenced by the number of patents) and the qualifications of workers (secondary education) [6]. Human capital and the dynamics of industrial specialization of countries are decisive factors for economic growth. The lack of production structures capable of properly integrating highly educated people into the productive system leads countries to unsatisfactory economic results [7]. A study by McGuirk, H., Lenihan, H., & Hart, M. expands the standard measure of human capital, developing a unique and far-reaching concept of innovative human capital, and emphasizes its impact on small business innovation and therefore growth (jobs, sales and performance). This new concept of innovative human capital includes four elements: education, training, willingness to change in the workplace, and job satisfaction to overcome measurement limitations. [8] The region's high economic growth is determined by its ability to offer innovation. Factors such as the level of costs of technological innovation and the number of personnel engaged in research and development have a direct impact on the results of innovation in the region [9].

It is believed that the growth of gross domestic product is a dubious social task. Society can steadily improve its welfare, including the well-being of its natural assets, but only by abandoning GDP growth as a goal in favor of more comprehensive measures of public welfare [10]. A study conducted in ten CIS countries showed that such indicators of human capital as life expectancy and education positively affect economic growth [11]. An analysis of the impact of migration on economic growth for 22 OECD countries from 1986 to 2006 led to the conclusion that there is a positive impact of migrants' human capital on GDP per capita, and, secondly, the constant growth of migration flows has a positive effect on productivity growth. However, the impact of immigration on economic growth is small even in those countries that conduct selective migration policies [12]. It should be noted that in the coming years, the share of the working-age population in the total population will begin to decline in all countries of the European Union. Other things being equal, this so-called demographic burden will have a negative impact on economic growth [13]. Studies of the age structure of Australia's population also support these findings. The authors believe that Australia needs a demographic and immigration policy, which provides for an increase in the number of skilled working-age people in order to balance the problems associated with an aging population [14].

## 3. Problem statement

This work explores the impact of demographic indicators on gross regional product. As the research information base, the data of the Federal State Statistics Service for 2017 were used. in 86 regions of the Russian Federation. The gross regional product belongs to the studied indicators, the following

demographic indicators were also taken: population, general fertility rates, migration growth rates, general marriage rates, average annual number of employed, unemployment rate, average per capita income of the population, average consumer spending per capita, life expectancy at birth.

The hypothesis of this study is the thesis that the economic growth of a region depends on the state of its demographic indicators.

To test the hypothesis, we use the method of correlation and regression analysis. Using this method, we check the presence of a dependency and determine the form of this dependence.

#### 4. Theoretical part

One of the leading areas of economic science at present is demo-economy, which studies the influence of demographic processes on economic. The close interconnection of the economic and demographic subsystems of the "Population – Economy" system is due to the mutual influence of economic and demographic processes, due to which a continuous cycle of reproduction is formed: population – labor activity — economy — consumption of goods — new population [15].

At present, the demographic transition or the transition from expanded to narrowed reproduction of the population is considered a natural stage in the development of all the national communities of the planet. At certain stages of the transition, a decrease in the birth rate creates favorable conditions for economic growth, leads to a reduction in the proportion of children ages and, accordingly, increases the share of the working population. In addition, able-bodied citizens, not previously burdened by parental concerns, show much higher economic activity. As a rule, this stage of the "demographic transition" coincides with the accelerated growth of the gross domestic product. Subsequently, the narrowed type of reproduction begins to slow down economic development due to an aging population and a decrease in the proportion of people of working age. This situation not only limits the labor resources of countries that have completed the "demographic transition", but also requires an increase in social costs for the maintenance of disabled elderly citizens. In addition, a significant shift in the age proportions towards the elderly makes it difficult to modernize the economy, makes labor resources more conservative, less prone to changing professions and mastering new technologies. A tangible slowdown in GDP growth in developed countries, which half a century ago, they were the economic locomotives of the planet, including the demographic reasons mentioned here [16]. Along with the age structure, one of the factors for achieving sustainable development and effective economic growth is gender equality. The role of women in the economy and business remains insufficient in the context of satisfying the needs of modern society related both to the development of traditional markets and the formation of new ones. It has been established that achieving gender balance increases the stability of the economy not only at the macro, but also at the meso and micro levels, since it is an important factor in socio-economic development [17]. Currently, the following features of the demographic situation in Russia can be distinguished. The preservation of the depopulation mode of reproduction of the population, projected for the long term, may lead to the loss by Russia of the status of one of the most populous and economically significant states in the world. As a result of the reduction in the economically active population, a new type of reproduction of the population is emerging, including younger and older than working age, which will undoubtedly contribute to a reduction in the number of labor resources and a compression of the national labor market. Reducing the influx of young labor, the retirement of qualified personnel will violate the traditional regime of generation change in many sectors of the economy. The consequences of the aging process affect both the prospects of population reproduction and the development of the labor market [18]. Although population aging certainly creates new challenges, nonetheless, the demographic shift in population aging can stimulate behavioral changes and technological and institutional innovations. Mitigating the negative effects of an aging population will require a series of measures to increase the labor supply of women, immigrants and older people, investment in education and training at any age, increased savings rates during working years, a slower increase in benefits and a faster increase in tax deductions to finance government transfers older people [19].

A study of the impact of education capital and health capital on GRP growth in 77 regions of the Russian Federation over 11 years (2003–2013) revealed that investment in education is a very significant factor in the change in GRP in the group of predominantly manufacturing regions (influence 68–75 % in different years, based on the indicators of GRP elasticity), and the state of health is in the group of predominantly extractive (69–76%) [20].

## 5. Results

The hypothesis that the gross regional product depends on the demographic situation in this region is the initial hypothesis that is supposed to be tested in the framework of this study. This hypothesis is based on the assumption that for economic activity producing a gross regional product, labor is needed, consumers who are able and willing to show solvent demand are needed, a high quality of life is needed, which stimulates marriage and childbearing.

As initial data, Rosstat information for 2017 was used in the context of the constituent entities of the federation, collected according to the following parameters:

- 1) gross regional product by constituent entities of the Russian Federation (gross value added at basic prices), million rubles. - Y;
- 2) population, thousand people - X1;
- 3) the number of births per 1000 population, person - X2;
- 4) the coefficient of migration growth per 10,000 people - X3;
- 5) the general marriage rate per 1000 population - X4;
- 6) the average annual number of employees, thousands of people - X5;
- 7) unemployment rate,% - X6;
- 8) per capita cash income per month, rubles - X7;
- 9) consumer spending on average per capita, per month, rubles - X8;
- 10) life expectancy at birth, number of years - X9.

To test the hypothesis, we first carry out a pair correlation analysis, which will allow us to verify the existence of a relationship between individual parameters and exclude from the model those parameters that do not have a significant relationship with other indicators and, accordingly, will only distort the dependencies in the model.

Based on the results of the pair correlation analysis, it was decided to exclude the following indicators from further analysis: the number of births per 1000 population, the person - X2; migration growth rate per 10,000 people - X3; general marriage rate per 1000 population - X4; unemployment rate,% - X6; life expectancy at birth, number of years - X9.

The remaining indicators were subjected to regression analysis, and the indicator of gross regional product acted as the resulting feature, and the rest as factor.

As a result of the regression analysis, the following model was formed:

$$Y = -378\,362.98 - 1\,148.98 * X1 + 3\,368.87 * X5 + 15.73 * X7 - 2.70 * X8 \quad (1)$$

Evaluation by Fisher and Student criteria showed that the model is significant, dependencies exist, factor signs have a significant impact on the resulting sign.

The coefficient of multiple determination, equal to 0.96, shows that the factor attributes included in the model determine the oscillation of the resulting attribute by 96%.

## 6. Conclusion

Thus, we can conclude that the gross regional product substantially depends on the demographic situation in the region. Moreover, factors that have a strong influence can influence both positively (number of employed, average per capita incomes of the population) and negatively (number of population, consumer spending). Using the resulting model, you can adjust the management decisions that are made, stimulating positive factors. Thanks to this, it is possible to achieve more sustainable growth of gross regional product.

**References**

- [1] Pyankova A V & Dorokhova E I 2013 Methodological approaches to assessing the influence of individual factors on the state and trends of the socio-economic development of the region *Modern problems of science and education* vol 5 pp 386-386
- [2] Nadreeva L & Abramov V 2018 Improving the Efficiency of Social Policy at Enterprises as an Instrument of Personnel Incentive System IBIMA 2018- Vision 2020 *Proceedings of the 31th International Business Information Management Association Conference* (Milan)
- [3] Bloom D E, Canning D & Sevilla J 2004 The effect of health on economic growth: a production function approach *World development* vol 321 pp 1-13
- [4] Ngangue N & Manfred K 2015 The impact of life expectancy on economic growth in developing countries *Asian Economic and Financial Review* vol 54 p 653
- [5] Alsan M, Bloom D E & Canning D 2006 The effect of population health on foreign direct investment inflows to low-and middle-income countries *World Development* vol 344 pp 613-630
- [6] Pelinescu E 2015 The impact of human capital on economic growth *Procedia Economics and Finance* vol 22 pp 184-190
- [7] Teixeira A A & Queirós A S 2016 Economic growth human capital and structural change: A dynamic panel data analysis *Research policy* vol 458 pp 1636-1648
- [8] McGuirk H, Lenihan H & Hart M 2015 Measuring the impact of innovative human capital on small firms' propensity to innovate *Research Policy* vol 444 pp 965-976
- [9] Bakeeva I, Bakeev B, Trutnev V, Mingaleev G & Babushkin 2018 Influence Of Level Of Development Of Innovative Potential Of Region On Results Of Innovative Activity 2018 *In International conference" Economy in the modern world"ICEMW* vol 61 pp 28-32 Atlantis Press August
- [10] Ward J D, Sutton P C, Werner A D, Costanza R, Mohr S H & Simmons C T 2016 Is decoupling GDP growth from environmental impact possible? *PloS one* 1110 e0164733
- [11] Azam M & Ahmed A M 2015 Role of human capital and foreign direct investment in promoting economic growth: evidence from Commonwealth of Independent States *International Journal of Social Economics* vol 422 pp 98-111
- [12] Boubtane E, Dumont J C & Rault C 2016 Immigration and economic growth in the OECD countries 1986–2006 *Oxford Economic Papers* vol 682 pp 340-360
- [13] Van Der Gaag N & De Beer J 2015 *Tijdschrift voor economische en sociale geografie* From Demographic Dividend to Demographic Burden: The Impact of Population Ageing on Economic Growth in Europe vol 1061 pp 94-109
- [14] Uddin G A, Alam K & Gow J 2016 Population age structure and savings rate impacts on economic growth: Evidence from Australia *Economic Analysis and Policy* vol 52 pp 23-33
- [15] Kostromina E V 2017 Application of single-circuit demo-economic modeling for forecasting the dynamics of economic growth in the Volga Federal District *Intellect Innovation Investments* vol 9 pp 20-25
- [16] Timakov V V 2018 Narrowed reproduction of the population in Russia as a factor hindering economic growth and stability of the pension system *Social and Labor Studies* vol 4 **33** pp 73-92
- [17] Grinenko S V, Bogomolova I S & Zadorozhnaya E C 2014 Gender features of the development of human capital *National interests: priorities and security* vol 10 **38** pp 20-35
- [18] Mamedov A A 2016 Features of the demographic situation in russia in the context of labor market prospects *Science Vector of Tolyatti State University* vol 1 **35** pp 99-105
- [19] Bloom D E & Luca D L 2016 The global demography of aging: facts explanations future In *Handbook of the economics of population aging* vol 1 pp 3-56 (North-Holland)
- [20] Khaliulina V V, Shabashev V A & Shabasheva S V 2018 Influence of health and education on development of human capital and economy of the region *Herald of Omsk University Series "Economics"* vol 2 **62** pp 190-197