

Digitization of socio-economic development: the problem of choosing age limits in the complex economic evaluation of losses related to the population premature mortality

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Abstract — Modern approaches to the management of socio-economic systems are based on the key processes digitization. Production and consumption are the main processes that characterize any socio-economic system, its nature and potential for development. A comprehensive economic evaluation of losses due to the population premature mortality are among the main points in determining the viability of the socio-economic system from both the production and consumption perspective. The main problem in this area is the choice of reasonable age limits for the population which is the basis of complex economic losses calculations. The study reviewed the materials of this problem, made a structure of current approaches to the selection of age limits when assessing losses. In conclusion, the author suggests and justifies an approach based on a synthesis of the approaches presented at the International Labor Organization and the World Health Organization which should take into account the population ranging from 0 to 72.

Keywords — *digitization of the economy, economic losses, premature mortality, age limits*

I. INTRODUCTION

The need for continuous growth and development of the economic system is increasing in modern society. It is obvious that the development of modern socio-economic systems is impossible without the digitalization of their processes. This is especially evident at the regional level as the region is the main structural state unit. The regions create a gross product and ensure the fullness of the budgets of all levels of the Russian Federation budget system. The current model of economic growth of the Russian Federation primarily based on the development of the energy and oil spheres simultaneously generates a whole complex of "side effects": environmental degradation, increased morbidity and, of course, increased mortality. At the same time, the main problem of digitalization at the fundamental level is the choice of indicators that will form the basis for the automated information management systems.

This article is devoted to the problem of choosing age boundaries to make a comprehensive economic assessment of losses related to premature mortality. Since the age boundaries present different by quality and quantity data sets describing the state population. It is necessary to choose the reasonable

boundaries that will allow to systematically monitor and evaluate the socio-economic indicators associated with economic losses due to premature mortality.

The study of the influence of demographic factors on economic development dates back to the 18th century from the work of Thomas Malthus "The Experience of the Law of Population and its Impact on the Improvement of Public Welfare, with comments on the research of Mr. Godwin, Condorcet and other authors", in which the author gives a quantitative estimation of the interdependent variables of the demographic factor influence on the average per capita income [5].

All subsequent development of research on this topic is based on two theoretical ideas: the law of "diminishing performance" A. Turgot and the law of "increasing returns" A. Marshall. The regression models of L. Rostas [11], M. Frankel [8], D. Peigi G. Bombak [10] are also based on the law of "decreasing productivity" - -

Though these models are based on microeconomic theories, they establish the relationship between demographic and economic variables and make it possible to understand the important link between population growth and human labour activity in creating a gross domestic product. Therefore, most of the subsequent studies in the field of the demographic factors influence on the economy estimate the size of the gross product created by each individual.

Numerous approaches to quantifying the impact of the demographic variable on the economy within this legal fold led to the construction of regression models. This was the starting point for the construction of modern multi-factor regression models.

II. RESEARCH METHODOLOGY

The main approach to the study of such relationships, as mentioned earlier, is modeling. Moreover, the role of the endogenous variable is performed by GDP (for a country) or GRP (for regions), and the role of exogenous variables is assigned to various socio-demographic indicators (population growth rates, mortality rate, age structure, etc.) [6, 7].

Gross regional product (hereinafter - GRP) is the resulting indicator of the region economic performance created by the

labour of people involved in economic sectors. This fact is often forgotten, and economic indicators have more priority than people and their quality of life. At the same time, the most important non-economic variables are the ones related to human health as the main driving subject of the region's economy.

A number of foreign and domestic scientific papers on the topic of the mortality impact on the socio-economic development come to the conclusion that "in general, the overall decline in mortality expressed in the increase in life expectancy as a whole"[1, 4, 12]. At the same time, mortality as a resultant indicator of public health is influenced by many factors not directly related to the state of medicine and the healthcare system but related to the socio-economic sphere [2, 9].

Economic relations are part of social relations, therefore economic development is a part of the overall development of the region.

In this regard, the most important aspects of human economic activity are production (the application of labour and abilities) and consumption (maintenance and reproduction).

GPR is the main macroeconomic indicator around which the entire regional system of planning and forecasting development is built.

GRP and its constituent elements (production, education and income distribution, final consumption and accumulation expenses) are included into the system of indicators of regional development forecasting and are used by the Ministry of Finance of the Russian Federation to distribute a fund for financial support of territories, and are also included into the effectiveness indicator system of the activity of the government bodies of the Russian Federation units.

As part of the national accounts system implementation, state statistical bodies at the regional level calculate data for each one of the economic cycle stages: production, education and income distribution, final consumption and accumulation expenses. The actual household final consumption is the most important indicator characterizing the total use of goods and services in the region. Households consume goods and services at the expense of their own incomes, as well as individual non-market health care services, education, culture and others at the expense of the state and non-profit organizations transferred to the households in the form of in-kind transfers. There will be no distribution and accumulation of income without production and consumption, and therefore without the people who are involved in these processes.

Consequently, GRP and actual household final consumption are the most significant in socio-economic terms from the point of view of population loss due to mortality. A very high correlation between mortality and these indicators has been clearly demonstrated in a number of domestic studies [3]. Therefore, the population mortality rate and the socio-economic development of the region (primarily the growth of the gross regional product and the volume of actual household final consumption) are closely interrelated and the increase in the population mortality rate slows down the process of the socio-economic development of the region.

The "consumption" side is hardly studied except a number mentioned works. Meanwhile, the change in the volume of actual final consumption due to changes in the level of population premature mortality opens up a "new component" of economic losses.

The most important task for the regional government and society is to make optimal management decisions and create the necessary socio-economic conditions for the population reproduction, reducing the mortality rate to normal.

The indicator of actual final consumption which shows us how much products were purchased and consumed by the population of this region is not less important than the GRP. Production and consumption are two sides of the general socio-economic reproduction process in the region.

In the context of economic losses due to premature mortality in the region, it is important to choose the population categories whose mortality should be considered in the losses calculation.

III. RESULTS OF THE RESEARCH

Scientific materials related to this topic have no single established approach to choosing the population age range for the purpose of estimating the economic losses due to premature mortality. The age interval should be limited to certain values of years, while it is inextricably linked with the concept of "premature mortality." In general, the age of premature mortality is established through the expertise and a value equal to the age of average life expectancy, as a rule, is established as the upper threshold. As we will see later, such a "floating" border is inconvenient and impractical for assessing the regional complex economic losses. Tab. 1 summarizes the existing approaches to the choice of age limits.

TABLE 1. APPROACHES TO CHOOSING AGE LIMITS FOR THE PURPOSE OF ASSESSING THE COMPLEX ECONOMIC LOSSES DUE TO PREMATURE MORTALITY

№	Approach to the age group choice	Age range	The possibility of using the approach for the purpose of assessing the complex economic losses
1	The World Health Organization Approach	age from 0 to 70 ¹	It is difficult to use this age group for calculations due to the lack of complete information (no statistics) about the mortality age. For European states, a threshold age of 70 may be relevant, but not always for the developing countries.
2	Life expectancy approach	age from 0 to 71 ¹	The length of average life expectancy will change, besides, it is different in all regions of the Russian Federation, and, therefore, cannot be a single border for determining the category of the population in order to assess economic losses.
3	The working population approach ¹	age from 16 to 54 (women) / age 59 (men) ¹	According to Art. 63 of the Labor Code of the Russian Federation individuals can start their official career in Russia from the age of 16. However, this rule has an exception which allows starting labour relations from the age of 15 if the individuals have already completed their school education or continue receiving general education in the form of remote education. The upper bounds of this age group are also not constant. This is connected, firstly, with the possibility of changing the retirement age, and secondly, reaching the retirement age in the Russian Federation does not mean that the individual has ceased to participate in labour relations, has ceased to produce and consume goods and services.

4	The approach based on the economically active population (labour force) according to the methodology of the International Labor Organization	age from 15 to 72	This approach is associated specifically with the labor activity, and the ILO and the Russian Federation official state statistics bodies which use this approach when considering labour resources focus on the population employed in the economy or the unemployed. It is advisable to consider the population at the age of economic activity which is inactive at the same time since they perform the functions of consumption and reproduction in the regional economic system, therefore, their premature mortality will affect the magnitude of complex economic losses.
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¹WHO uses the age of 70 as an indicator of average life expectancy.

² According to Rosstat, the average life expectancy is 71.39 years in 2015.

³The working population is a set of people mostly at working age (in Russia, 16–54 for women, 16–59 for men) who are able to participate in the labour process according to their psycho-physiological data. Age limits of the working population are determined by social norms and traditions.

⁴As at November 1, 2018, the retirement age has been raised in the Russian Federation. Its gradual increase to the age of 65 for men and of 60 for women will come in 2028, and before that the transitional stage will last.

IV. DISCUSSION OF RESULTS

Having considered the main approaches to the choice of age group, the author proposes to use a synthetic approach based on a combination of WHO and ILO approaches. Each of the selected approaches has both obvious advantages and disadvantages. To estimate the economic losses due to premature mortality, the author suggests that premature mortality means the age at which the individual is classified as economically active / inactive, that is 72. At the same time, it is advisable to assess the complex economic losses from the age of 0 when the individual begins to participate in economic relations as a consumer.

In accordance with the WHO approach, we choose the lower limit of the age interval in the sample of the study: starting from infancy (0 years), since babies and children generate consumer spending through their parents, guardians,

relatives, and adolescents independently, due to the family income. The ILO's approach, in this case, will not meet the goals and objectives of the study due to the exclusion of a large formation of consumers (age group 0-15) from the calculation of a comprehensive assessment of losses. The author suggests choosing the upper limit of the age range in accordance with the ILO approach using the age of the end of economic activity - 72. The choice of this border is based, on the one hand, on the statement that at the age of 72 the statistical categorization of a person as economically active one ends, and on the other hand, the retirement age and average life expectancy are below this limit which will allow to “capture” almost all the population. To prove the reasonableness of this approach the data can be provided by Table 2. The population in the age of 0-72 in the Russian Federation on average for 2017 is 93% of the total.

TABLE 2. THE AVERAGE POPULATION OF THE RUSSIAN FEDERATION IN 2017 BY VARIOUS AGE GROUPS, PEOPLE

	Total population of both gender	Total male population	Total female population
Aged 0 to 72	136131609	65100552	71031057
% to total	93	96	90
Over 72	10710793	2981555	7729238
% to total	7	4	10
Total amount	146842402	68082107	78760295

We should summarize the main characteristics of the selected age group and highlight its benefits:

1. population aged 0-72 forms the basis of the regional socio-economic potential: creates an additional product and generates consumption;
2. the age group 0–72 is subject to detailed accounting and analysis by the official bodies of the Russian Federation state statistics and its subjects;
3. The age group 0-72 combines two categories of citizens: employed in the economy producing and

consuming goods and services, as well as persons not engaged in the economy and carrying out only the consumption of goods and services.

A synthetic approach based on the integration of ILO and WHO approaches makes it possible to categorize the population participating in the economic life of the region into producing and consuming, and only consuming goods and services. The selection of these categories allows studying the regional economic losses due to premature mortality separately and in aggregate.

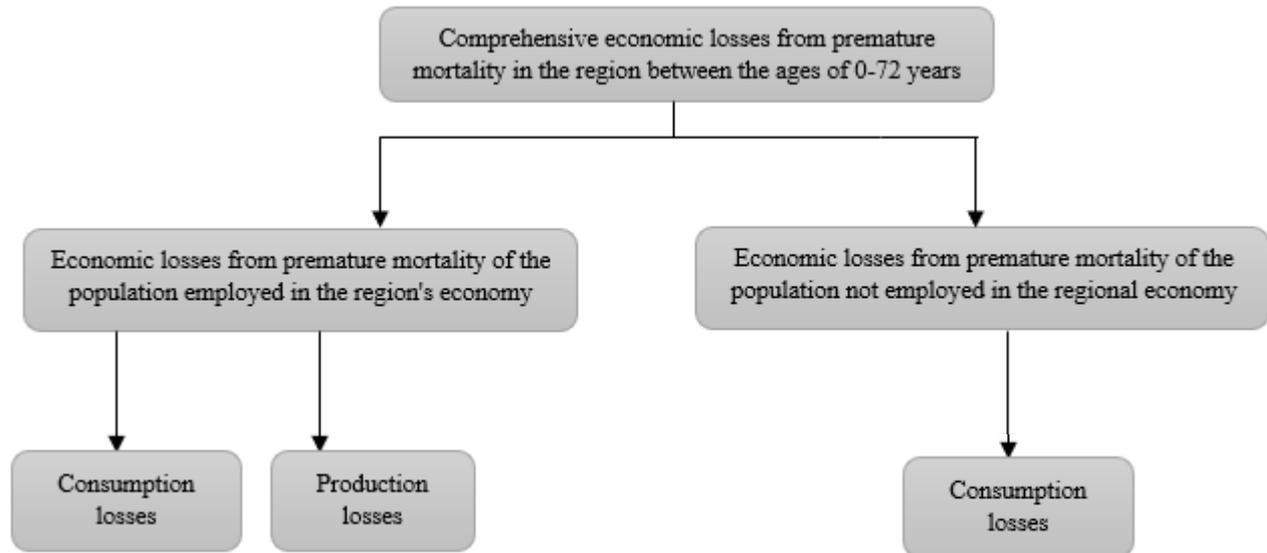


Fig. 1 The regional economic system loss due to premature mortality of the population aged 0-72 (compiled by the author)

It can be noted that the population premature mortality leads to losses in significant phases of the economic cycle. Losses associated with production and consumption (Fig. 1). Taking into account the multiplicative effect in the economy, the loss in monetary terms can be much higher than the initially arising ones.

V. CONCLUSION

As mentioned above, the nature of economic losses is diverse and consists of losses associated with production, consumption, taxes and losses for future periods. That is, the economic losses are complex. Consequently, a methodological tool is needed for the valuation of complex economic losses associated with the population premature mortality which would allow differentiation of cost losses by various factors. The presence of such a tool will not only allow to make management decisions but also build a system of priorities to prevent premature mortality.

The choice of adequate indicators of monitoring the development of the socio-economic system will allow obtaining accurate data the use of which can improve the quality of management. The population aged from 0 to 72 is the basis of the state and regional socio-economic system; therefore, it is this age group that forms the basis for the assessment of complex economic losses to provide more accurate data on the scale of the processes.

Summarizing the above, we can emphasize the urgent need for strategic management tools for the economic development of the region associated with a comprehensive economic assessment of losses from premature mortality.

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