Health Status of Working Pensioners

Elena Chistova
Center for economic security
Institute of Economics,
Ural branch of RAS
Ekaterinburg, Russia
ORCID: 0000-0002-0446-1555

Alexander Tyrsin
Department of applied mathematics
Ural Federal University named after the first President of Russia B. N. Yeltsin
Ekaterinburg, Russia
Department of applied mathematics and programming
South Ural State University
(national research University)
Chelyabinsk, Russia
ORCID: 0000-0002-2660-1221

Abstract—This article draws out two points of view regarding the health of working pensioners. The study presented in the article is aimed at testing two hypotheses put forward on the basis of analysis of theoretical models and sociological surveys of the population. The first hypothesis is about that the labor activity of pensioners contributes to the preservation of their health, and the second – only those healthy pensioners continue to work. As a criterion for verifying the research hypotheses, two multivariate linear regression models were constructed that estimated the statistical relationships between employment, health status of pensioners, and other variables. Based on the calculation of determinant of correlation matrix, the presence of a linear relationship between the explanatory variables in the regression models was excluded. The study was conducted on the example of women of 55-59 years of age according to statistical data. The results of the regression analysis confirmed only the first hypothesis, the second one was rejected.

Keywords—health, employment, elderly, labor activity, regression, pair correlation.

I. INTRODUCTION

Recently developed state measures in the field of improving the quality of life of elderly population are based on a new approach, which focuses not so much on providing various mechanisms of social protection as on stimulating the development and use of the potential of the elderly. Within the framework of this approach, new terms have appeared relatively recently – people of the “third age” [1] and the “fourth age” [2], who deny past ideas about old age. The concept of active longevity, formed in the 1990s and aimed at solving the problem of aging populations, was also widely used [3]. According to the World Health Organization [4], active longevity is the process of optimizing opportunities in terms of health, participation and security in order to improve the quality of life as people age. Here, the labor and physical activity of the elderly is considered as the basis of their health [5]. These ideas are reflected not only in the studies of Russian scientists [6], but also in government documents (“new pension formula”, “Strategy for action on elderly citizens until 2025”).

However, this approach may encounter serious barriers in the form of social stratification and differentiation in terms of health, income level, activity of the elderly population, etc. As A. Vishnevsky rightly notes [7], in Russia, in contrast to European countries, aging occurs almost entirely due to the low birth rate over many decades, and the continued high mortality rate is a significant limitation that does not allow building up the potential for active longevity. Researches Maleva T.M. and Sinyavskaya O.V. [8] showed that by the time a person reaches retirement age, he usually has a number of chronic diseases, and often disability. A population survey conducted in 2013 by the Institute of Social Analysis and Forecasting of the RANEPA (Russian Presidential Academy of National Economy and Public Administration) [9-10] showed that the reasons for stopping work to reach retirement age are poor health and fatigue, since it is they that determine the ability of an elderly person to work. At the same time, a number of sociological and medical studies [11-12] show that working pensioners are healthier. Thus, in the scientific literature there are two points of view regarding the health of working pensioners. The first point of view is based on the concept of active longevity and involves the involvement of older people in labor, which is supposed to solve not only the problems of population aging (labor shortages, burden on the employed population, etc.), but will also contribute to maintaining health. The second point of view takes into account the fact that Russian seniors approach retirement with poor health, and continued work may aggravate their condition. The study of the cause-effect relationship between the employment of pensioners and their health will make it possible to substantiate an effective state policy in the field of improving the quality of life of older people. Therefore, in the framework of this research, the objective was set – to identify these relationships.

II. METHODS

Based on the considered theoretical models and sociological surveys of the population, the following research hypotheses were put forward:

- H1: retirees continue to work, which keeps them healthy.
- H2: only healthy retirees continue to work.

The study was conducted on the example of women 55-59 years old according to statistics for 2002-2018. To test the hypotheses H1, the age-specific mortality rate for women 55–59 years old, ppm, was taken as the dependent variable Y. Obviously, in retirement age, health is clearly associated with mortality by a close correlation. In addition, if medical statistics may not reflect the full picture due to latent morbidity and the problem of detectability, then in statistical reference books the mortality rate is presented more clearly.
A number of indicators were used as input (explanatory) variables: \( X_1 \) – the proportion of women aged 55-59 years in the total amount of employees, \( \% \); \( X_2 \) – the number of doctors per 10,000 people; \( X_3 \) – emissions of air polluting substances per person, in kg; \( X_4 \) – average cash income of the population per capita (in prices of 2018), in thousand rubles; \( X_5 \) – expenses of the consolidated budget of the constituent entity of the Russian Federation and the territorial state extra-budgetary fund for health care per person (in prices of 2018), in thousand rubles.

To test the \( H_2 \) hypotheses, the proportion of women aged 55-59 in the total amount of employed, in \( \% \), was considered as a dependent variable \( Y_2 \). As input (explanatory) variables, such indicators are used as: \( X_6 \) – expected life expectancy when women reach 55 years, in years; \( X_7 \) – the number of doctors per 10,000 people; \( X_8 \) – emissions of air polluting substances per year per person, in kg; \( X_9 \) – unemployment rate (according to the methodology of the International Labor Organization), in \( \% \); \( X_0 \) – the proportion of the over the working age population in the total population, in \( \% \); \( X_{10} \) – replacement rate (pension replacement level of lost working age population in the total population, in \( \% \); Organization), in \( \% \).

The logic of the study is as follows. If the variable \( X_7 \) (in the case of solving the hypothesis \( H_2 \)) is statistically significantly related to the dependent variable \( Y_2 \), then the hypothesis is not rejected (accepted). As a criterion of statistical significance, the statistical significance of the coefficient in front of the variable \( X_7 \) in multidimensional linear regression dependence was used. At the same time, the regression model should satisfy quality indicators. Similar logic was applied to solve the \( H_2 \) hypothesis. The calculations were carried out in the Statistica software.

### III. RESEARCH RESULTS

To identify the relationship between the employment of women 55-59 years old and their health, a regression analysis was performed. Table I shows the correlation matrix for the input and dependent variables to test hypothesis \( H_1 \).

**TABLE I. CORRELATION MATRIX FOR INPUT AND DEPENDENT VARIABLES**

| X1  | X2  | X3  | X4  | X5  | Y1  |
|-----|-----|-----|-----|-----|-----|
| X1  | 1.000 | -0.136 | -0.430 | 0.797 | 0.786 | -0.848 |
| X2  | -0.136 | 1.000 | 0.362 | 0.155 | 0.213 | 0.143 |
| X3  | -0.430 | 0.362 | 1.000 | -0.637 | -0.483 | 0.787 |
| X4  | 0.797 | 0.155 | -0.637 | 1.000 | 0.944 | -0.912 |
| X5  | 0.786 | 0.213 | -0.483 | 0.944 | 1.000 | -0.846 |
| Y1  | -0.848 | 0.143 | 0.787 | -0.912 | -0.846 | 1.000 |

The input variables turned out to be multicollinear – the determinant of the correlation matrix is 0.0058. After removing statistically insignificant factors (\( X_7 \) and \( X_8 \)) from the model, a regression model was obtained (Tables II and III).

There is no multicollinearity with respect to the three remaining significant factors – the determinant of the correlation matrix is 0.2902.

**TABLE II. RESULTS OF REGRESSION ANALYSIS**

| Indicator | Beta | Std.Err. of Beta |
|-----------|-----|------------------|
| Intercept | -0.41793 | 0.07887 |
| X1        | 0.466521 | 0.055641 |
| X2        | -0.2925 | 0.081138 |

**TABLE III. RESULTS OF REGRESSION ANALYSIS**

| Indicator | Value |
|-----------|-------|
| Multiple \( R \) | 0.9846 |
| Multiple \( R^2 \) | 0.9694 |
| Adjusted \( R^2 \) | 0.9623 |
| \( F(13,15) \) | 137.2551 |
| \( p \) | 0.0000 |

To test the \( H_2 \) hypothesis, a correlation matrix was also constructed for the input and dependent variables; its results are presented in Table IV.

**TABLE IV. CORRELATION MATRIX FOR INPUT AND DEPENDENT VARIABLES**

| X1  | X2  | X3  | X4  | X5  | Y1  |
|-----|-----|-----|-----|-----|-----|
| X1  | 1.000 | -0.024 | -0.632 | -0.835 | 0.957 | 0.531 | 0.704 |
| X2  | -0.024 | 1.000 | 0.391 | 0.111 | -0.206 | -0.048 | 0.304 |
| X3  | -0.632 | 0.391 | 1.000 | 0.249 | -0.724 | -0.861 | -0.023 |
| X4  | -0.835 | -0.111 | 0.249 | 1.000 | -0.780 | -0.144 | -0.902 |
| X5  | 0.957 | -0.206 | -0.724 | -0.780 | 1.000 | 0.548 | 0.613 |
| Y1  | 0.531 | -0.048 | -0.861 | -0.144 | 0.548 | 1.000 | 0.049 |

As the calculation of the determinant of the correlation matrix showed (it is 0.00027), the input variables are multicollinear, to exclude this, statistically insignificant factors (\( X_6 \), \( X_7 \) and \( X_8 \)) were removed from the model. The resulting regression model is presented in Tables V and VI. There is no multicollinearity with respect to the two remaining significant factors – the determinant of the correlation matrix is 0.3045.

**TABLE V. RESULTS OF REGRESSION ANALYSIS**

| Indicator | Value |
|-----------|-------|
| Intercept | 0.5941 |
| X2        | 0.9837 |
| X3        | 0.3803 |

As the calculation of the determinant of the correlation matrix showed (it is 0.00027), the input variables are multicollinear, to exclude this, statistically insignificant factors (\( X_6 \), \( X_7 \) and \( X_8 \)) were removed from the model. The resulting regression model is presented in Tables V and VI. There is no multicollinearity with respect to the two remaining significant factors – the determinant of the correlation matrix is 0.3045.
In addition, pairwise and partial correlation between the input variables and the dependent variable were calculated. The results for hypothesis $H_1$ are presented in Table VII, for hypothesis $H_2$ – in Table VIII.

### TABLE VII. PAIRED AND PARTIAL CORRELATION COEFFICIENTS BETWEEN INPUT VARIABLES AND DEPENDENT VARIABLE (FOR HYPOTHESIS $H_1$)

| $R_{x_1y_1}$ | 1  | 2  | 3  | 4  | 5  |
|--------------|----|----|----|----|----|
| -0.848       | 0.143 | 0.787 | -0.912 | -0.846 |
| $R_{x_2y_2}$ | -0.744 | -0.122 | 0.789 | -0.028 | -0.366 |

The results presented in Table VII are consistent with the results of a regression analysis. The variables $X_2$ and $X_3$ also turned out to be uncorrelated with the dependent variable $Y_1$ when other factors were fixed. The high pair correlation between $X_2$ and $Y_1$ was caused by the influence of other factors (the effect of multicollinearity of input variables).

### TABLE VIII. PAIRED AND PARTIAL CORRELATION COEFFICIENTS BETWEEN INPUT VARIABLES AND DEPENDENT VARIABLE (FOR HYPOTHESIS $H_2$)

| $R_{x_1y_1}$ | 6  | 7  | 8  | 9  |
|--------------|----|----|----|----|
| 0.704        | 0.304 | -0.023 | -0.902 | 0.613 |
| $R_{x_2y_2}$ | -0.040 | 0.051 | 0.575 | -0.682 | 0.247 |

The results presented in Table VIII are also consistent with the results of regression analysis. The variables $X_6$, $X_7$, and $X_8$ also turned out to be uncorrelated ($X_6$, $X_7$) or weakly correlated ($X_8$) with the dependent variable $Y_2$ when other factors were fixed. The differences between the partial correlation coefficients and from the pair coefficients and, accordingly, was caused by the influence of other factors due to the multicollinearity effect.

### IV. CONCLUSION

The results of the study confirmed the hypothesis about that the labor activity of pensioners preserves their health. The proportion of working women aged 55-59 years is statistically significantly related to the mortality rate of women of the corresponding age. With the remaining factors fixed, an increase in the share of working women by 1% on average reduces their average mortality by 0.347 ppm for 2002-2018, or by 3.79%. The hypothesis about the decisive role of health status in the continuation of labor activity of women of retirement age was rejected. Statistically significant factors affecting the employment of women of 55-59 years were economic growth (accompanied by anthropogenic environmental pressure in the form of atmospheric emissions), labor market tension (causing unemployment) and the level of pension provision (the level of pension replacement for lost earnings). Based on the obtained results, it can be concluded that the decision of retirees to continue working is affected more by material incentives than their health status. Hence, the existing employment of pensioners in Russia is not a result of a policy to stimulate the activity of the elderly, but the consequence of a poorly thought-out pension system that does not provide a decent level of pension. The effect of the federal law [13] is acting as a confirmation for the additional income is the main factor for the employment of pensioners. According to this law, indexation of pensions to working pensioners was canceled, which led to reduce their share from 35.7% to 22.9% only in the first year of its implementation. Therefore, in the context of an aging population and the threat of labor shortages, state policy in the field of improving the quality of life of the older generation should include the financial security of pensioners so that their labor activity is not forced, on the one hand, and the employment provision for the elderly, taking into account their capabilities and requests, on the other hand.

### REFERENCES

[1] P. Laslett, “The Emergence of the Third Age,” Ageing & Society, Vol. 7, No. 2, pp. 133-160, 1987. [https://doi.org/10.1017/S0144686X00012538](https://doi.org/10.1017/S0144686X00012538)

[2] C. Gilleard and P. Higgs, “Aging without agency: Theorizing the fourth age,” Aging & Mental Health, Vol. 14, No. 2, pp. 121-128, 2010. [https://doi.org/10.1080/1360786093228762](https://doi.org/10.1080/1360786093228762)

[3] A. Walker, “A strategy for active aging,” International Social Security Review, Vol. 55, No.1, pp. 121-139, 2002. [https://doi.org/10.1111/1468-246X.00118](https://doi.org/10.1111/1468-246X.00118)

[4] WHO, Active Aging. A Policy Framework. Geneva: Switzerland: World Health Organization, 2002.

[5] M.G. Kolosnitsyna and N.A. Khorkina, “Public policies of active ageing: evidence from the world experience,” Demograficheskoe obozrenie (Demographic Review), Vol. 3, No. 4, pp. 27-46, 2016. (in russ.)

[6] I.A. Grigoryeva, L.A. Bershadskaya and A.V. Dmitrieva, “On the Way to the Normative Model of Relationships between Society and Older People,” Zhurnal sotsiologii i sotsialnoy antropologii (The Journal of Sociology and Social Anthropology), Vol. 17, No. 3, pp. 151-167, 2014. (in russ.)

[7] A.G. Vishnevsky, S.A. Vasin and A.V. Ramanov, “Retirement Age and Life Expectancy in the Russian Federation,” Voprosy ekonomiki (Economic Issues), No. 9, pp. 88-109, 2012. (in russ.)

[8] T.M. Maleva and O.V. Sinyavskaya, “Pension Age Increase: Pro et Contra,” Zhurnal novoy ekonomicheskoy asociatsii (Journal of the New Economic Association), No. 8(8), pp. 117-137, 2010. (in russ.)

[9] T.M. Maleva, “A Man in a Joint Pension System,” Ekonomicheskaya politika (Economic Policy), No. 2, p. 55-84, 2014. (in russ.)

[10] T.M. Maleva, E.E. Grishina, Yu.A. Dormidonova, Yu.M. Kazakova, V.Yu. Lyashok and E.A. Tsatsura, Age workers in the Russian labor market. Moscow: Business, RANEPA, 2016. (in russ.)

[11] A.V. Korolenko and V.N. Barsukov, “Health status as a factor of labor activity of the retirement-age population,” Vestnik Permskogo universiteta. Filosofiya. Psikhologiya. Sotsiologiya (Perm University Herald. Series Philosophy, Psychology, Sociology), No. 4(32), pp. 643-657, 2017. (in russ.)

[12] E.A. Tolchenova and O.V. Egorova, “Role of the administrative board of establishments of public health services in health protection of working women of pension age,” Vestnik Posijskogo universiteta družby narodov. Seriya: Meditsina (Rudn Journal of Medicine), No. 4, pp. 705-706, 2009. (in russ.)

[13] Federal Law of December 29th, 2015 No. 385 “On the Suspension of Certain Provisions of the Legislative Acts of the Russian Federation, Amendment of Certain Legislative Acts of the Russian Federation and the Peculiarities of Increasing the Insurance Pension, Fixed Payment to the Insurance Pension and Social Pensions”. 

---

**TABLE VI. MAIN STATISTICS OF REGRESSION ANALYSIS**

| Indicator | Value |
|-----------|-------|
| Multiple $R$ | 0.9508 |
| Multiple $R^2$ | 0.9040 |
| Adjusted $R^2$ | 0.8903 |
| $F(2,14)$ | 65.9108 |
| $p$ | 0.0000 |
| Std. Err. of Estimate | 0.7517 |