ANALYSIS AND PREDICTION OF POPULATION LIFE EXPECTANCY

Kendjayev R.X.
candidate of physical and mathematical sciences, associate professor
Sharipova L.D.
candidate of physical and mathematical sciences, associate professor
Hakimova D.A.
assistant
Ochilova N.K.
assistant
Tashkent State University of Transport
+998(99) 780 57 07
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Annotation: In the article, life expectancy is a very important demographic indicator, which is a recognized indicator of the quality of life and health of the population. Life expectancy determines how many years a newborn baby will live during his life if the conditions at the time of birth are maintained. Therefore, the country's demographic policy should be aimed at increasing life expectancy. The life expectancy index was taken as the research object, and the factors and models influencing the life expectancy index were considered as the subject. In the study, it was studied that a mathematical model was created for the analysis and prediction of population life expectancy for the countries of the world.

Keywords: Factors affecting the life expectancy of women and men, correlation and regression analysis, regression model

136 national statistics were obtained for the factors affecting the life expectancy of the population, and we will consider the analysis of these factors separately for the effect on the life expectancy of women and men.

We analyze the factors affecting the life expectancy of women and men through the Minitab program and enter them into the Minitab program by marking them as follows.

Y(f)-Life expectancy at birth for women (years)
Y(m)-Life expectancy at birth for males (years)
X1(f)-Expected years of education 2019 for women
X1(m)-Expected years of education 2019 for men
X2(f)-Gross National Income (GNI) per capita for women 2019 (in dollars)
X2(m)-Gross National Income (GNI) per capita 2019 for men (in dollars)
X3(f)-Percentage of women over 25 with (at least) post-secondary education: 2015-2019
X3(m)-Percentage of males over 25 years of age with (at least) post-secondary education: 2015-2019
X4(f)-Labor force participation rate of women aged 15 and over (in percent): 2019
X4(m)-Labor force rate of males aged 15 and over (in percent): 2019

Life expectancy for women and men is influenced by many factors, the main ones being education for women and men, gross national income per capita, and (at least) post-secondary education for women and men over 25. lim is the labor force rate of women (men) aged 15 years and older. It is very convenient to use the Minitab function analysis to propose a regression prediction model based on the factors affecting the life expectancy of women and men.

These indicators are closely related to each other, as they all serve to estimate the life expectancy of women and men, in particular, they affect life expectancy at first birth. Based on these data, a multivariable regression model is created and analyzed. When choosing a model, first their correlation matrix is calculated and analyzed. In this case, the correlation matrix reflects the values of the correlation coefficient for all possible pairs of the analyzed variables. When choosing predictors for a multivariate regression equation, it is important to follow the following rule: the variables should be strongly correlated with the dependent variable and low with each other.

The found correlation coefficients help to determine the relationship between all the variables and to determine whether there is a problem of multicollinearity among the explanatory variables. If there is a problem of multicollinearity, dependence on the regression model reduces the accuracy of parameter estimation. An easy way to avoid this problem is to drop one or more predictors that are strongly correlated with each other from the model.

Now we will do a correlational analysis for the factors that affect the life expectancy of women and men, for this we will build a correlation matrix and compare the factors that affect the life expectancy of women and the factors that affect the life expectancy of men

First, we will conduct a correlation analysis between the life expectancy of women and the factors affecting it. For this, we will perform the following sequence in the minitab program: Stat-Basic Statistics-Correlation and we will get the following result.

The correlation matrix between the factors affecting the life expectancy of women is given above. It can be seen that women's life expectancy and expected years of education (r=0.844), gross national income (r=0.717), the percentage of women over 25 years of age (at least) who received post-secondary education (r=0.780) has a strong positive correlation, but there is a weak negative correlation between female life expectancy and the labor force rate of women aged 15 and older (r=-0.183). That is, as the amount of positively correlated factors increases, the life expectancy of the population increases, and as the negatively correlated factors increase, the life expectancy of the population decreases.

Now, if we look at the correlation between the factors that influence the life expectancy of women: Expected years of education and gross national income (r=0.753), the percentage of women over 25 years of age with (at least) post-secondary education There is a strong positive correlation (r=0.778) between the gross national income per capita of women and the percentage of women over 25 with (at least) post-secondary education (r=0.656). there is a positive correlation, but there is a weak negative correlation between the labor force participation rate of women aged 15 and over and expected years of schooling, gross national income, and the percentage of women aged 25 and over with (at least) post-secondary education.

Looking at these correlations for men: We need to recalculate the following correlation matrix.

Therefore, there is a strong positive correlation between life expectancy and years of education for men (r=0.757). We can see that the correlation between male life expectancy and per capita gross national income (r=0.777) shows a slightly higher value. However, there is a weak positive correlation with the percentage of men over 25 (at least) with post-secondary education (r=0.675). as there is a weak negative correlation between r=-0.108.

There is a weak negative correlation between the labor force participation rate of males aged 15 and older and expected years of education, Gross National Income, and the percentage of males aged 25 and older with (at least) post-secondary education.

Now we will consider the analysis of the life expectancy of the population by the level of development of the countries.

For this purpose, we divide the selected countries into 4 levels of development.

- Very high human development-Very strong developed countries (vh)
- High human development-strongly developed countries(h)
- Medium human developmet-moderately developed countries (m)
- Low human development-less developed countries (lhd)

In this case, we can select the following as the factors affecting the life expectancy of the population in each stage of development:

Y-Life expectancy at birth (years)

Expected years of X_1-Education 2019

X_2-Gross national income per capita (in dollars) 2019

X_3-Maternal Mortality Rate: Number of deaths from pregnancy-related causes per 100,000 live births, 2017

X_4- the number of mothers aged 15-19 out of 1000 selected women. 2015-2020

X_5-Share of seats held by women in parliament: The proportion of seats held by women in the national parliament is expressed as a percentage of the total number of seats. For countries with bicameral legislatures, the percentage of seats is calculated on the basis of both chambers.

Percentage of people aged 6-25 years and older with at least post-secondary education, 2015-2019

X7- state investment for public education 2013-2018

Y(f)-Life expectancy at birth for women

Y(m)-Life expectancy at birth for males

X1(f)-Expected years of education 2019 for women

X1(m)-Expected years of education 2019 for men

X2(f)-Gross National Income (GNI) per capita 2019 for women

X2(m)-Gross National Income (GNI) per capita 2019 for men

X3(f)-X3(m) - percentage of women over 25 and men (at least) with post-secondary education

X4(f)-X4(m)- labor force rate of women and men aged 15 and over (in percent): 2019

By conducting a correlational analysis of these factors, it was determined that the life expectancy of the population is divided between women and men (that is, it was considered which factors have a stronger influence on the life expectancy of women compared to the life expectancy of men). It can be concluded that the life expectancy of women in the given statistics is higher than that of men. Correlational analysis shows that the correlation between the life expectancy of women and the factors that affect it is greater than that of men. In highly developed countries, there is a significantly stronger relationship between the life expectancy of the population and the factors that affect it. But a strong population life expectancy in developed and medium-developed countries, and the only factor with a very strong negative impact is increased maternal mortality from pregnancy-related causes. However, while the maternal mortality rate and the number of mothers aged 15-19 out of 1,000 selected women have a negative impact on life expectancy in countries with a low development index, the life

expectancy of the population increases with the increase in the number of women working in the parliament. Based on the analysis, we can reduce the factors and build a prediction model based on the regression analysis.

Accordingly, we will conduct a correlational analysis between the life expectancy of the population and the factors affecting it. For this, 136 countries were selected and entered in the minitab program by marking them as follows.

- Y-Population life expectancy
- X1- expected years of education of the population
- X2-gross national income per capita
- Maternal deaths from pregnancy-related causes per 100,000 live births x3
- Number of mothers aged 15-19 out of 4-1000 selected women
- Number of seats held by women among those working in the X5th Parliament
- Percentage of people aged 6-25 and older who have at least a post-secondary education
- Investment allocated by the X7 state for the education of the population

These selected statistical data were selected from the 2020 Human Development Index statistics.

We select a model based on the correlation analysis based on the initially selected factors. The "Best subsets" and "Stepwise" functions in the Minitab program help in choosing a model equation, and hypothesizing that the correlation coefficient of the sample for the found prediction model equation is significantly different from the correlation coefficient of the main set is selected by two-sided (one-sided) selection. , based on the indicators analyzed by "T-test", it is determined whether there is a linear relationship or not. We conduct an "F-test" for the variables, that is, it explains whether the explanatory variable selected for the model can explain a significant part of the change in the explanatory variable. A hypothesis is selected by comparing the F-statistic value and the F-critical value. The equation that fully satisfies these analyzes is selected as the model equation and used in practice. Based on the above analysis, we selected the regression equation that is connected to the indicators that affect the activity of banks.

$$\mathbf{Y = 68.9 + 0.441\ X_1 + 0.000097\ X_2 - 0.0158\ X_3 - 0.0285\ X_4}$$

So, if all the factors affecting the life expectancy of the population have a value of 0, the expected life expectancy will be equal to 68.9 years. it can increase per year. If only the gross national income per capita increases by 10,000 dollars and our remaining influencing factors remain unchanged, life expectancy increases by 1 year. But when the number of maternal deaths due to pregnancy-related causes increases by 100 per 100,000 live births, life expectancy decreases by 1.6 years. Life expectancy decreases by 2.85 years when the number of mothers aged 15-19 increases by 100 out of 1000 selected women.

If we construct confidence and prediction intervals based on the equation we obtained above and predict the life expectancy of the population for the future time, we get the following conclusion.

Summary

So we took the 137th new country for our prediction and 20 years of expected school years, $25,000 per capita gross national income, Maternal Mortality Rate: 50 pregnancy-related deaths per 100,000 live births , Maternal Mortality Rate: Assuming 20 pregnancy-related deaths per 100,000 live births, the estimated life expectancy with 95% confidence is 79.13 years, confidence intervals 77.66 to 80.61 years, prediction intervals 34 to 124.65 years

it will be. We can give a conclusion to our chosen model with 86.7% in life. The built model can be recommended for practical use.

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