

Socioeconomic Determinants of Life Expectancy: Southeastern European Countries

By Emiljan Karma¹

Abstract

This paper analyses the socioeconomic determinants of life expectancy in Southeastern Europe countries highlighting the most important factors that can affect life expectancy in this part of Europe.

Two Panel Data Regression with fixed-effects model was applied for 20 years from 2000 to 2019. Eight socioeconomic and environmental explanatory variables were used to verify their influence on life expectancy.

The analysis highlights the important influence of factors such as urbanization; GDP per capita; fertility rate; education; marital status; CO2 emission and the non-significant influence of other factors, such as health expenditure or health care out-of-pocket healthcare expenditure. This study points out that healthcare spending (public and/or household out-of-pocket spending) is not a significant factor in improving life expectancy in SEE countries. Results illustrate that GDP per capita; urbanization, CO2 emissions, and fertility rate are the most influential and significant explanatory factors. A surprising result concerns marital status, which in this study affects life expectancy inversely in one of the panel regressions.

Life expectancy is a very important and expressive outcome indicator for public health. Each country is committed to spending public money to improve people's quality of life, which translates into a longer life (Life expectancy), or even better, a longer and healthier life (Health Adjusted Life Expectancy). The results of this study, considering the demographic development of the SEE countries (low fertility rate and aged people), show that policymakers need to consider public healthcare organization and reassess the effectiveness of public health expenditure. On the other hand, the balanced urbanization process with a clean ecosystem (less CO2 emissions) conducts a better life quality (consequently an improved life expectancy).

Keywords: Panel data analysis; Life Expectancy; Public Health; SEE Countries

Jel Classification: C33; H51; I15

1. Introduction

Life expectancy is one of the main indicators that is used by both national and international health systems to measure the state of health of a country (OECD, 2022). In general, population longevity is an indicator of the human well-being of a country: the most developed countries have a higher LE than other countries. In any case, LE depends on various factors such as genetics, economic, social, cultural, health and environmental factors (IFTF, 2003). The state of health of the people would be conditioned 50% by socioeconomic and cultural factors; the other factors are much less important: environmental factors, genetic factors, and healthcare (Figure 1). Therefore, a human

¹University Our Lady of Good Counsel, Tirana, Albania.

generation is responsible for approximately 80% of life expectancy (as a single human generation cannot influence our gene pool).

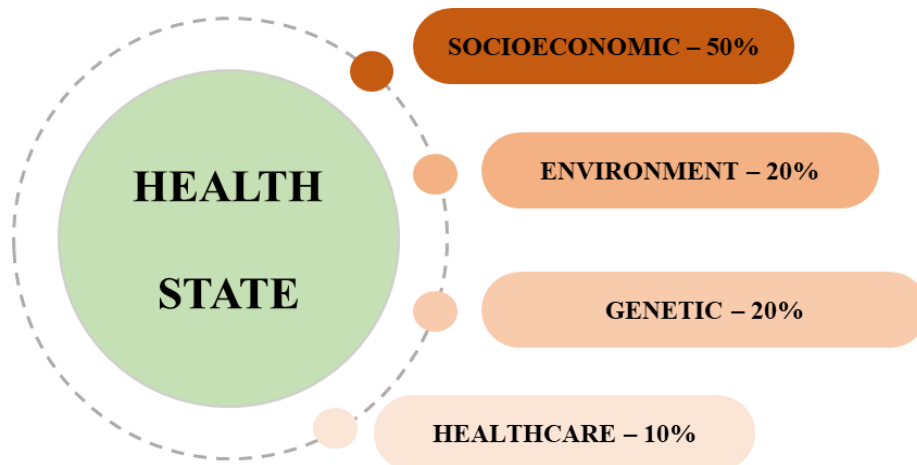


Figure 1. Key Factors influencing health state
Source: Institute for the Future, 2003

This study considers the controllable factors that can influence life expectancy in eleven SEE countries: in this analysis, it was not possible to include Montenegro, Moldova, and Kosovo due to a lack of available data. The average life expectancy is determined by different socio-economic factors. Life expectancies are calculated using life tables presenting age-specific mortality rates: $e(x) = T(x) / l(x)$, where $e(x)$ - the (remaining) life expectancy of persons alive at age x ; $T(x)$ - total number of person-years lived by the cohort from age x until all members of the cohort have died; $l(x)$ - the number of persons alive at age x . For example, at age cohort 45 – 50, the average life expectancy for both genders in Albania was $e(45 - 50) = T(45 - 50) / l(45 - 50) = 2.889.303 / 96129 = 30.05$.

After the 1990s, the SEE countries went through a very intense transition period: changes in political regimes, economic system revolution, important population movements, changes in individual and family lifestyles, etc. These socioeconomic and cultural changes have affected all the countries considered by this study (Roaf et al., 2014; Haynes, 1996; Kipas, 2020). In 2019 six of these countries are full members of the European Union (Cyprus, Romania, Greece, Slovenia, Bulgaria, and Croatia), while the other five countries are candidate members of the EU (Albania, North Macedonia, Turkey, Serbia,

Montenegro, Moldova). Bosnia-Herzegovina and Kosovo do not yet have a relationship with the European Union.

Analysis of Life Expectancy in SEE countries confirms that there are differences between the countries. Slovenia, Greece, and Cyprus have the highest value of LE (81,53; 81,64; 80,98 respectively). Bulgaria has the lowest LE at birth (75,11 years in 2019).

Regardless of their similarities and/or factorial differences, all the countries in this region have improved life expectancy during the last two decades. WHO data shows that this trend will continue in the coming decades as well (Figure 2).

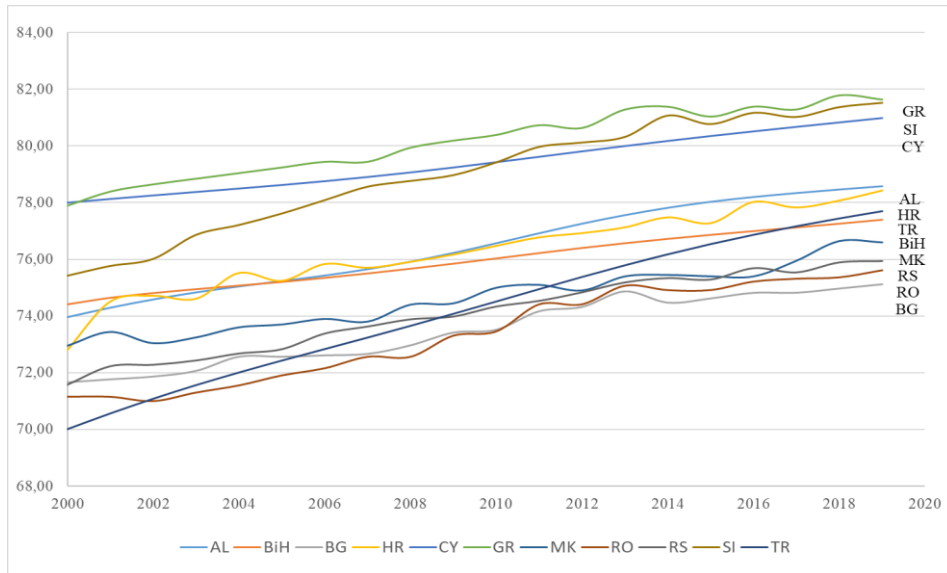


Figure 2: SEE countries life expectancy(2000 – 2019)

Source: World Bank data

As shown in other studies, a lot of factors impact health status (Mackenbach et al., 2019; Bayati, Akbarian, & Kavosi, 2013; Favissa & Gutema, 2005). Income forms the condition of people's lives (Mikkonen & Raphael, 2010) and is a main socioeconomic determinant of health. Several studies (e.g., Mackenbach et al., 2019; Bayati, Akbarian, & Kavosi, 2013; Favissa & Gutema, 2005; Shing-Jong, 2009; Bayati et al., 2013) considered income as one of the main determinants of health.

Tobacco and alcohol consumption can deteriorate people's health and therefore could affect life expectancy (Martikainen et al., 2014; Wang-Hong, 2007; Trias-Llino' et al., 2018). Unemployment causes social deprivation and anxiety. (Mackenbach et al., 2019; Or, 2000). Education is another important factor that determines health in several ways (Mackenbach et al., 2019; Bayati, Akbarian & Kavosi, 2013; Favissa & Gutema, 2005; Mohan & Mirmirani, 2007). People with high education are more likely to have better jobs, higher incomes, and lower risky behaviors (Mikkonen & Raphael, 2010).

Marital status has also been studied to see the influence on life expectancy. Marriage was considered an institution that affects the well-being of a family, thus having a positive impact on people's health (Haomiao & Lubetkinb, 2020; Zueras, Rutigliano & Llimós,

2020). Urbanization is another determinant of health (Mackenbach et al., 2019; Bayati, Akbarian, & Kavosi, 2013; Torres, Canudas-Romo & Oeppen 2019; Leeson, 2018) which can have both positive (increasing access to medical centers and information) and negative (pollution) impacts on overall health. The issue of the relationship between environmental degradation and human health has been widely addressed by medical doctors. However, economists have sparsely debated it. The release of carbon dioxide (CO₂) into the air can cause several environmental problems and, thus, can affect human health. (Murthy et al., 2021).

These explanatory factors do not affect life expectancy similarly in different world countries. Empirical studies show that the relationship between the explanatory variables and life expectancy varies between regions of the world, mainly based on their income capacity (low income, middle income, and high income).

Shariful et al. (2018) have investigated, in accordance with the World Bank (WB) classification, seventy-nine low- and lower-middle-income countries. The results indicate that to increase the Life Expectancy in low- and lower-middle-income countries, it is necessary to reduce Total Fertility Rate as well as to increase the mean years of schooling, freedom of the press, and the achievement of a level of health-related Millennium Development Goals.

Passarino et al. (2016) have investigated the relationship between genetic factors and lifestyle concluding that interventions modulating the interaction between genetic background and environment is essential to determine the individual chance to attain longevity.

Trpkova - Nestorovska (2018) studied life expectancy in different group of countries (high-, medium- and low life expectancy countries). GDP per capita, urbanization and fertility rate are important factors in all three groups.

Trpkova – Nestorovska (2015) has investigated determinants of life expectancy at birth by using panel regression model for twelve Southeastern European during the period 2000 – 2015.

Husain (2002) examines life expectancy at birth in developing countries. Life expectancy can be improved if there is a reduction in fertility and if calorie intake is improved.

Bilas et al (2014) have analyzed life expectancy in the European Union. GDP per capita and education are the most important factors influencing Life expectancy in this region.

2. Methods

The purpose of this analysis is to identify differences within SEE countries selecting two groups of countries (a. "SEE countries with Life Expectancy < 80" and b. "All SEE countries") and performing a regression method.

The reason for the selection of this subgroup (average life expectancy less than 80 years) has to do with the fact that in the period 2000 - 2019, the countries of this subgroup tend to converge in terms of average life expectancy, but diverge with the average life expectancy of countries like Cyprus, Greece and Slovenia (with an average life expectancy over 80 years), as shown in Figure 2.

To achieve the goal of this study, firstly panel data regression analysis was considered to define differences between countries and than a linear regression was performed to see

differences within each country. The explanatory variables were selected based on literature review and data availability for SEE countries. Due to the lack of data, this study was unable to include Montenegro, Kosovo, and Moldova. The data were collected mainly by World Bank (World Bank data, 2022) except for education level data. Regarding the level of education, the data were extracted from National Human Development Reports (UNDP, 2020). SEE countries with Life Expectancy higher than 80 years were 2019 Slovenia, Greece, and Cyprus. Other SEE countries had Life Expectancy in 2019 lower than 80 years.

The explanatory variables are the same for the two groups. Descriptive statistics of variables are presented in Table 1.

Table 1. Descriptive statistics of the variables in SEE countries, 2000 - 2019

Variable (unit) – Source	Mean	St. Dev.	Min.	Max.
LE (Years) – World Bank	76,09	2,76	70,01	81,79
HE (ppp/capita \$, % of GDP) –World Bank	776	667	56,5	2840,5
EDU (HDI Index) – HDI report	9,4	3,3	2,03	17,45
GDP (ppp / capita, \$) – World Bank	17875	9047	3860	42339
MS (marriages / 1000 inhab.) – World Bank	5,9	1,9	2,9	15,1
OPEH (% HE) – World Bank	31,4	13,3	8,8	60,4
FER (births /woman) – World Bank	1,5	0,3	1,2	2,5
CO2 (metric tons per capita) – World Bank	5,3	1,9	1,0	9,4
URB (Urban pop. % total) – World Bank	59,7	9,9	41,74	79,39

Life Expectancy (LE) was determined by economic (HE, GDP, OPEH), social (EDU, MS, FR), and environmental factors (CO2, URB):

$$LE = f(HE, EDU, GDP, MS, OPEH, FER, CO2, URB) \quad (\text{equation 1})$$

LE: In this study, LE at birth is used as a dependent variable.

HE: Health Expenditure as a proportion of GDP

GDP: Gross Domestic Product per capita in Purchasing Power Parities (GDP, PPP, \$) was used as a measure of income per capita.

MS: Marriages per 1000 inhabitants: according to the literature there are differences in life expectancy between singles and married people.

OPEH: Out-of-Pocket spending, as % of HE: higher OPEH can deteriorate social conditions worsening poverty eradication.

FER: The total fertility rate of a population is the average number of children that would be born to a woman over her lifetime.

EDU: Mean Years of School were used as a measure of education level.

URB: The percentage of the urban population.

CO2: CO2 emission, indicating the effect of air pollution on health status.

For estimating the models, the following steps were taken. To prevent spurious regression and autocorrelation problems, stationary and cointegration tests were performed. Moreover, Im-Pesaran and Shin stationary test, and Kao cointegration test were used to verify respectively stationarity and the presence of long-term relationship among the variables. STATA 16 software was used for performing the tests. After transforming the

data into a natural logarithm function (except marriage data) to make it stationary, the econometric model looks as follows:

$$\text{LogLEit} = \beta_0 + \beta_1 \log \text{HEit} + \beta_2 \log \text{GDPit} + \beta_3 \log \text{MSit} + \beta_4 \log \text{OPEHit} + \beta_5 \log \text{EDUit} + \beta_6 \log \text{URBit} + \beta_7 \log \text{CO2it} + \text{uit} \quad (\text{equation 2})$$

where: β_1 to β_7 indicate the elasticity of LE with respect to the explanatory variables. uit is error term with classical assumptions. Country and time were shown by i and t, respectively.

After detection of stationarity and cointegration properties, the panel data regression model was selected between the random-effects model and the fixed-effects model. Considering the Hausman test result (1763,53; prob>chi2 = 0,0000), it was selected the Panel Data Regression with fixed-effects model.

2.1 Regression results

The model was estimated for "SEE countries with LE < 80 years" (group 1) and for "All SEE countries" (group 2). The results are shown in Table 2.

Table 2. Fixed-effect estimates of life expectancy in SEE countries, 2000 - 2019

Variable	SEE, LE < 80		SEE Total	
	Coefficient	P	Coefficient	P
Constant	3,910***	0,000	3,548***	0,000
LogHE	-0,009***	0,000	-0,0012	0,624
LogEDU	0,005	0,306	0,014**	0,013
LogGDP	0,064***	0,000	0,043***	0,000
LogMS	0,001	0,829	-0,013**	0,017
LogOPEH	-0,004	0,311	-0,006	0,179
FER	-0,026***	0,000	0,009*	0,098
LogCO2	-0,019***	0,001	-0,031***	0,000
LogURB	-0,018	0,436	0,104***	0,000
F stat	172,7		159,09	
P	0,000		0,000	
Rho	0,93		0,95	

***, **, and * indicate coefficient is significant at 1, 5 and 10 per cent level, respectively

The results show that changes in LE in this region can be explained by changes in the independent variables (depending on the model with group 1 or group 2).

The estimated coefficients indicate that the most important and significant factors for group 1 are: GDP per capita, fertility rate and air pollution. Instead, for group 2 the most

important and significant factors are: GDP per capita, urbanization, education, air pollution and marital status.

-In group 1, Health Expenditure has practically zero but very significant effect on LE, while in group 2 the effect of HE is practically zero but not significant on LE.

-Education level has nearly zero effect on LE in group 1, while in group 2 the effect of EDU is important and significant.

-GDP per capita is a very important and significant factor for both groups.

-Marital status is enough important and significant for group 2, but not important and not significant for group 1.

-Out-of-Pocket Healthcare Expenditure does not affect LE in both groups.

-The fertility rate is very important and significant for group 1, while group 2 has little impact on LE.

-Air pollution is an essential factor for both groups, but the negative elasticity coefficient is two times greater for group 2.

-Urbanization is a positive key factor for group 2 in terms of LE, but negative and insignificant for group 1.

On the other hand, to see if there are influences of the explanatory variables within each analyzed country, the results obtained from the regression analysis show that their influence is mostly not significant (Table 3).

Table 3. Effect estimates of life expectancy in each of SEE countries, 2000 - 2019

Country	Variables (LOG)							
	HE	EDU	GDP	MS	OPEH	FER	CO2	URB
Albania	0.02	-0.01	0.03	0.03*	-0.04	-0.02	0.01	-0.04
BiH	0.02	-0.01	-0.08	0.03	-0.01	-0.03	0.02	0.78
Bulgaria	-0.01	-0.01	-0.04	0.00	-0.02	0.02	0.02	2.41**
Croatia	-0.1	0.13*	0.27	-0.09	0.01	0.07	0.07	0.03
Cyprus	-0.02**	-0.15	0.03	-0.01	-0.01	-0.07	0.01	-0.53
Greece	0.03**	0.02	-0.00	-0.01	-0.01	-0.00	-0.01*	-0.43
N. Macedonia	0.01	-0.05*	0.02	-0.14***	0.02	-0.06	0.03	-0.88
Romania	-0.00	0.02	0.01	-0.00	-0.01	-0.04	-0.02	1.37**
Serbia	-0.00	0.01	-0.01	0.01	0.01	0.00	0.01	0.56
Slovenia	0.04**	-0.02	0.00*	0.01	-0.03*	-0.00	0.00	0.61

***, **, and * indicate coefficient is significant at 1, 5 and 10 per cent level, respectively

3. Conclusions

In the first step, this study was an attempt to define, considering literature and socio-economic developments, the factors influencing life expectancy in SEE countries. Secondly, this study tried to identify existing differences between a. SEE countries, highlighting two groups: group 1 (8 countries with LE < 80 years), and group 2 (all SEE countries) and b. within each of SEE countries.

The reason for the selection of this subgroup (average life expectancy less than 80 years) has to do with the fact that in the period 2000 - 2019, the countries of this subgroup tend to converge in terms of average life expectancy, but diverge with the average life

expectancy of countries like Cyprus, Greece and Slovenia (with an average life expectancy over 80 years), as shown in Figure 2.

By extrapolating from all SEE countries those with LE < 80, we can design the way forward for countries with shorter life expectancy.

Considering differences in SEE countries, this study finds that the explanatory variables influence life expectancy in different ways regarding the two groups studied. At the same time this study finds that the impact of explanatory variables on average life expectancy (during the period 2000- 2019) is mostly not relevant and insignificant (Table 3).

The conclusions drawn from this study comply with the Principles of Sustainable Development of the United Nations, mainly Goal 3 – *Ensure healthy lives and promote well-being for all at all ages* (United Nation, 2022). Life Expectancy as an important indicator of the country healthcare is impacted by many social, economic, cultural, genetic factors, etc. This means that life expectancy (as well as the quality of the population's life expectancy), in a long-term perspective, can be increased not only by improving the healthcare system of a country, but by upgrading other indicators, such as education, economic development, balanced and sustainable urbanization. The sustainable development goals are interconnected, so better health cannot be understood without social peace, without economic development, without preserving the balances of the ecosystem (other sustainable development goals), etc. (Fong et al, 2022).

Like other studies, wealth has an important effect on health. But economic development must be sustainable and respect the environment. For countries of group 1, this means that urbanization must be sustainable and in harmony with the environment to prevent congested and inhospitable cities.

HE measures healthcare provision to the society (Mohan, Mirmirani, 2007). Generally HE influence is considered positive (Halicioglu, 2010). While it has negative effects in some studies (Fayissa & Gutema, 2005), it has shown no importance in this study. Policymakers need to consider public healthcare organization and reassess the effectiveness of public health expenditure in SEE countries, in such a manner to become a significant factor as in developed countries (Grigoli & Kapsoli, 2013; Auró & Deeg, 2021) .

With the current and expected values, fertility rate will probably increasingly become a less significant factor for group 1 in the future, as in more developed countries (Slovenia, Cyprus, Greece). Currently, the results on fertility correspond with all the macro-level studies carried out about the fertility rate effect on LE (Mackenbach et al., 2019; Bayati, Akbarian, & Kavosi, 2013; Favissa & Gutema, 2005).

The results of this study show that marriage no longer helps improve people's health and consequently does not affect (or perhaps can affect negatively) life expectancy. Recent studies show that marriage no longer plays the role of physical and emotional well-being for spouses, as it was considered a decade ago (Liu & Umberson, 2008; Perelli-Harris, 2018). This process is not to the benefit of men, as the positive impact of marriage has been particularly directed towards them.

In developed countries, education level is an important factor to improve LE. It can be deduced that the development path of the group 1 countries is that of education, research,

and technological development. Policymakers need to consider these aspects while attempting to allocate funds efficiently and effectively in education and research.

References

- Auró, SD., & Deeg, DJH. (2021). New thinking about health expectancy: introduction to the special section. *European Journal of Ageing*, 18, 439–441. <https://doi.org/10.1007/s10433-021-00630-w>.
- Bayati, M., Akbarian, R., & Kavosi, Z. (2013). Determinants of Life Expectancy in Eastern Mediterranean Region: A Health Production Function. *Int J Health Policy Manag.*, 1(1), 57–61. <https://doi.org/10.15171/ijhpm.2013.09>.
- Bayati, M., Akbarian, R., Kavosi, Z., Sadraei, JA., Amini, RM., & Delavari, S. (2013). Socioeconomic Determinants of Health in Western Pacific Region: A Panel Data Analysis. *Social welfare quarterly*, 12(47), 111-130.
- Bilas, V., Franc, S., & Bošnjak, M. (2014). Determinant Factors of Life Expectancy at Birth in the European Union Countries. *Collegium Antropologicum*, 38(1), 1-9.
- Fayissa, B., & Gutema, P. (2005). Estimating a health production function for Sub-Saharan Africa (SSA). *Application Economy*, 37(2), 155-164. <https://doi.org/10.1080/00036840412331313521>.
- Fong, BYF., Law, VTS. (2022). *Sustainable Development Goal 3. Health and Well-being of Ageing in Hong Kong*. Routledge: New York.
- Grigoli, F., & Kapsoli, J. (2013). Waste Not, Want Not: The Efficiency of Health Expenditure in Emerging and Developing Economies. *IMF Working Paper*, 13, 1-25. <https://doi.org/10.5089/9781484364260.001>.
- Halicioglu, F. (2010). Modelling life expectancy in Turkey. *MPRA Paper No. 30840*. Available at: <http://mpra.ub.uni-muenchen.de/30840/>, 2010. (Accessed on 06 July 2022).
- Haomiao, J., & Lubetkinb, EI. (2020). Life expectancy and active life expectancy by marital status among older U.S. adults: Results from the U.S. Medicare Health Outcome Survey (HOS)SSM. *Population Health*, 12(6), 1-9. <https://doi.org/10.1016/j.ssmph.2020.100642>.
- Haynes, M. (1996). Eastern European Transition: Some Practical and Theoretical Problems. *Economic and Political Weekly*; 31(8), 467-71 & 473-482.
- Husain, AR. (2002). Life expectancy in developing countries: a cross-section analysis. *The Bangladesh Development Studies*, 28(2), 161-178.
- Institute for the future (2003). *Health and Healthcare 2010. The forecast, The challenge*. Jossey-Bass: Princeton.
- Kipas, M. (2020). The transition of Southeastern European societies towards civil democracy and market economy: problems and perspectives. *Cahiers balkaniques*, 46, 230-244. <https://doi.org/10.4000/ceb.14869>
- Leeson, GW. (2018). The Growth, Ageing and Urbanization of our World. *Journal of Population Ageing*, 11, 107–115. <https://doi.org/10.1007/s12062-018-9225-7>
- Liu, H., & Umberson, DJ. (2008). The Times They Are a Changin': Marital Status and Health Differentials From 1972 to 2003. *Journal of Health and Social Behavior*, 49(3), 239-253. <https://doi.org/10.1177/002214650804900301>.
- Mackenbach, PJ., Valverde, RJ., Bopp, M., Brønnum-Hansen, H., Deboosere, P., Kalediene, R., Kovács, Katalin, et al. (2019). Determinants of inequalities in life expectancy: an international comparative study of eight risk factors. *The Lancet Public Health*, 4(10), 529-537. [https://doi.org/10.1016/S2468-2667\(19\)30147-1](https://doi.org/10.1016/S2468-2667(19)30147-1).
- Martikainen, P., Mäkelä, P., Peltonen, R., & Myrskylä, M. (2014). Income differences in life expectancy: the changing contribution of harmful consumption of alcohol and smoking. *Epidemiology*, 25(2), 182-190. <https://doi.org/10.1097/EDE.0000000000000064>.
- Mikkonen, J., & Raphael, D. (2010). *Social Determinants of Health: The Canadian Facts*. Toronto:York University School.
- Mohan, R., & Mirmirani, S. (2007). *An Assessment of OECD Health Care System Using Panel Data Analysis*. Rhode Island: Bryant University.
- Murthy, U., Shaaru, MS., Mariadas, AP., & Abidin, NZ. (2021). The Relationships between CO2 Emissions, Economic Growth and Life Expectancy. *Journal of Asian Finance, Economics and Business*, 8(2), 801-808. <https://doi.org/10.13106/jafeb.2021>.

- OECD. (2022). Life expectancy at birth (indicator). Available from doi: 10.1787/27e0fc9d-en (Accessed on 06 July 2022).
- Or, Z. (2000). Determinants of Health outcomes in industrial countries: A Pooled, Cross-Country. Time-Series Analysis. *OECD Economic Studies*, 30, 53-78.
- Passarino, G., De Rango, F., & Montesanto, A. (2016). Human longevity: Genetics or Lifestyle? It takes two to tango. *Immunity and Ageing*, 13, 12-18. <https://doi.org/10.1186/s12979-016-0066-z>.
- Perelli-Harris, B., Hoherz, S., Addo, F., Lappegard, T., Evans, A., Sassler, Sh., & Styrc, M. (2018). Do Marriage and Cohabitation Provide Benefits to Health in Mid-Life? The Role of Childhood Selection Mechanisms and Partnership Characteristics Across Countries. *Population Research Policy Review*, 37(5), 703-728. <https://doi.org/10.1007/s11113-018-9467-3>.
- Roaf, J., Atoyán, R., Joshi, B., Krogulski, K. & IMF staff team. (2014). *25 years of transition: post-communist Europe and the IMF*. Washington, D.C.: IMF.
- Shariful, I., Mondal, NI., Tareque, I., Aminur Rahman, A., Hoque, N., Ahmed, M., & Khan Hafiz, TA. (2018). Correlates of healthy life expectancy in low- and lower-middle-income countries. *BMC Public Health*, 18(1), 476-487. <https://doi.org/10.1186/s12889-018-5377-x>.
- Shing-Jong, L. (2009). Economic fluctuations and health outcome: a panel analysis of Asia-Pacific countries. *Application Economy*, 41(4), 519-530. <https://doi.org/10.1080/00036840701720754>.
- Torres, C., Canudas-Romo, V., & Oeppen, J. (2019). The contribution of urbanization to changes in life expectancy in Scotland, 1861-1910. *Population Studies (Camb)*, 73(3), 387-404. <https://doi.org/10.1080/00324728.2018.1549746>.
- Trias-Llino, S., Kunst, EA., Jasilionis, D., & Janssen F. (2018). The contribution of alcohol to the East-West life expectancy gap in Europe from 1990 onward. *International Journal of Epidemiology*, 47(3), 731-739. <https://doi.org/10.1093/ije/dyx244>
- Trpkova-Nestorovska, M. (2018). Determinants of Life Expectancy: Comparative Analysis for Different Groups of Countries Using Panel Regression. *Annual of the Faculty of Economics-Skopje*, 53, 581-591.
- Trpkova-Nestorovska, M. (2015). Life expectancy at birth in Southeastern Europe: applied cointegrated panel regression. *Annual of the Faculty of Economics-Skopje*, 50, 619 – 634.
- UNDP. (2021). *Human Development Report 2020: The Next Frontier: Human Development and the Anthropocene*. New York.
- United Nation. (2022). Sustainable Development Goals – Goal 3: Ensure healthy lives and promote well-being for all at all ages. Available at <https://www.un.org/sustainabledevelopment/health/>. (Accessed on 23 December 2022).
- Wang-Hong X, Xiang-Lan Zh, Yu-Tang G, Yong-Bing X, Li-Feng G, Wei Zh, & Xiao-Ou Sh. (2007). Joint effect of cigarette smoking and alcohol consumption on mortality. *Prev Med.*, 45(4), 313–319. <https://doi.org/10.1016/j.ypmed.2007.05.015>.
- World Bank (2018). World Development Indicators (online database) available from: <https://data.worldbank.org/indicator?tab=all>. (Accessed on 06 July 2022).
- Zueras, P., Rutigliano, R., & Llimós, ST. (2020). Marital status, living arrangements, and mortality in middle and older age in Europe. *International Journal of Public Health*, 65(5), 627–636. <https://doi.org/10.1007/s00038-020-01371-w>.