

Marijana Cvetanoska Mitev

Faculty of Economics,
University Ss. "Cyril and Methodius" Skopje,
North Macedonia

✉ marijana.cvetanoska@eccf.ukim.edu.mk

Predrag Trpeski

Faculty of Economics,
University Ss. "Cyril and Methodius" Skopje,
North Macedonia

✉ predrag.trpeski@eccf.ukim.edu.mk

THE IMPACT OF HEALTH EXPENDITURE ON ECONOMIC GROWTH IN NORTH MACEDONIA – APPLICATION OF LUCAS MODEL

UTICAJ IZDATAKA ZA ZDRAVSTVO NA PRIVREDNI RAZVOJ SJEVERNE MAKEDONIJE – PRIMJENA LUCAS MODELA

Summary: *As most empirical evidence indicates, health has a positive impact on economic well-being and contributes to solving fundamental economic problems, this paper aims to analyze the relationship between health expenditures, as an indicator of human capital, and economic growth. In the process of globalization, human capital is a critical factor for an economy based on knowledge. Therefore, applying the Lucas model, the study aims to present the role and analyze the impact of human capital on economic growth in North Macedonia from 2000 to 2019, using econometric analysis of health expenditures time series that are widely accepted in theory and empirical research. In this regard, regression analysis (OLS method) is performed, followed by an examination of the stationarity of the series, as well as an examination of the necessary conditions for selecting the best model from the available alternatives. The results show a positive relationship between health expenditures and economic growth in North Macedonia, while this analysis contributes to the broader literature on the importance of human capital for economic growth in North Macedonia. Moreover, the results show that by adding an additional unit of human capital, the returns on investments in physical capital will be higher. The paper emphasizes the importance of human capital accumulation in North Macedonia, showing that health (measured by health expenditures) is an important factor in understanding the role of human capital in the process of economic growth.*

Keywords: economic growth, health expenditures, human capital, Lucas model, North Macedonia

JEL Classification: F43, H51, J24

Rezime: *Kako većina empirijskih dokaza pokazuje da zdravlje ima pozitivan uticaj na ekonomsku dobrobit i doprinosi rješavanju ključnih ekonomskih problema, cilj ovog rada je analiza veze između rashoda za zdravstvo, kao indikatora ljudskog kapitala, i ekonomskog rasta. U procesu globalizacije, ljudski kapital je ključni faktor za privredu koja počiva na znanju. Stoga je, uz primjenu Lucasovog modela, cilj ovog rada da predstavi ulogu i analizira uticaj ljudskog kapitala na ekonomski rast u Sjevernoj Makedoniji u periodu od 2000. do 2019. godine, koristeći ekonometrijske analize vremenskih nizova rashoda za zdravstvo koje su široko prihvaćene kako u teoriji tako i u empirijskim istraživanjima. U tom pogledu, rađena je regresiona analiza (OLS metoda), praćena ispitivanjem stacionarnosti nizova, kao i ispitivanjem neophodnih uslova za odabir najboljeg modela u okviru dostupnih alternativa. Rezultati pokazuju da postoji pozitivna veza između rashoda i ekonomskog rasta u Sjevernoj Makedoniji, a ova analiza doprinosi široj literaturi koja se bavi značajem ljudskog kapitala za ekonomski razvoj Sjeverne Makedonije. Štaviše, rezultati pokazuju da dodavanje dodatne jedinice ljudskog kapitala uvećava povrat na ulaganja u fizički kapital. U radu se naglašava važnost akumulacije ljudskog kapitala u Sjevernoj Makedoniji, te pokazuje da je zdravlje (mjereno zdravstvenim rashodima) značajan faktor u razumijevanju uloge ljudskog kapitala u procesu ekonomskog razvoja.*

Ključne riječi: ekonomski razvoj, zdravstveni izdaci, ljudski kapital, Lucas model, Sjeverna Makedonija.

JEL klasifikacija: F43, H51, J24

Paper presented at the 11th Scientific Conference with International Participation "Jahorina Business Forum 2022: Economic Lessons Learnt from the 2008 and 2020 Crises: Experiences and Recommendations for Entrepreneurial Nations"

1. INTRODUCTION

There is a broad consensus in the academic literature that human capital is an important determinant of economic growth, productivity and other economic terms, both at the individual and aggregate levels, and that its role is particularly crucial in today's knowledge-based economy. The great influence of total factor productivity growth on the economic growth researched in a large part of the academic literature gives a sign that besides the physical capital there are other factors that are

important for the economic growth. However, since total factor productivity growth is calculated as a residual, it is not clearly defined which factors are represented by the growth of total factor productivity. Whether it is technology, as is often assumed in research, or any other factor, no definitive conclusion can be drawn based on this calculation. This poses a greater dilemma in early development economics, when development was seen as the result of physical capital accumulation. As physical capital accumulation was later included in growth accounting, the growth of total factor productivity simply began to be interpreted as a technological growth. However, with the increasing importance of other social indicators, such as health, literacy and education, the growth of total factor productivity may reflect the growth of these indicators.

No country can achieve sustainable economic development without significant investment in human capital. The link between economic growth and human capital has long been recognized. Negligible amounts of human investment in underdeveloped countries contribute little for expanding the capacity of people to meet the challenge of accelerated growth and development. The additional role of human capital can be an engine for attracting other factors, such as physical investment, which also significantly contribute to income growth. If there is insufficient investment in human capital, the rate of application of additional physical capital is limited, as technical, professional and administrative people are needed for effective use of physical capital. Natural resources, physical capital and raw materials are not enough to develop a highly productive economy. The wide range of human skills is essential in fostering the development dynamics of a country.

Human capital as an economic term is represented through health, education and other human capacities that can increase individuals' productivity. The physical capital and natural resources are passive factors of production, while human resources are active factors of production and hence human capital is the most valuable resource of a country. Quality and good health is a healthy economic investment, which not only increases the quality of life, but also increases market productivity.

Several models have been developed for explaining economic growth through human capital, but those that have the greatest impact on the empirical literature are the extended neoclassical growth model, the Lucas model, and the Romer model. Although the empirical predictions derived from these models are largely "equivalent," or, although it is difficult to distinguish between them empirically, the models tend to agree that human capital is important to a country's economic growth.

Health standards have a strong positive impact on a country's economic performance in the short and long term. Health improvements can boost economic growth. There are several ways in which health improving can affect and increase growth. Health can affect output or economic growth directly as well as indirectly. Improvements in health care contribute to better well-being in society as a whole. A healthier labour force contributes to increased productivity, as well as less absence compared to an unhealthy labour force. Increased life expectancy leads to changes in spending and savings decisions, resulting in increased savings rates, which in turn lead to higher investment rates and economic growth. On the other hand, health can indirectly affect economic growth through education, where healthier children have a higher school attendance rate, that in turn improves the overall quality of the workforce, which in turn will result in increased output. (Sovina 2000, 24).

As human capital is increasingly recognized as a key asset in modern knowledge-based economies by economists and policymakers, it is important to accurately measure its contribution to economic growth. Healthier people spend more time on productive activities, live longer and feel better. Companies need healthy employees to sustain their production and profits. This indicator is considered important in early childhood (similar to education) when it has a particular impact on the creation of human capital and the development of individual activities. Here, of course, the role of the state is important by creating better conditions for children upbringing, education, and medical and health care. In this regard, the state can improve human health and increase life expectancy, and therefore have a positive impact on economic growth and stability.

The paper is structured as follows: after the introduction, there is a review of relevant literature on the importance of health and investment in health as an indicator of human capital. The methodological approach to the empirical analysis and the application of the Lucas model, together with the results are presented in the third part of this paper. The conclusion is reflected at the end which reflects the obtained results.

2. LITERATURE REVIEW

The interest in the economic importance of human capital dates back to the late 1950s and early 1960s, primarily through the writings of Theodore Shultz and Gary Becker. Most empirical studies closely identify human capital with education. This practice ignores the reasons for considering health as a key indicator of human capital, and thus a critical component of economic growth. The link between health and long-term economic growth is powerful, much stronger than it certainly is. Since human capital is generally considered as a determinant of economic growth, people can only supply and accumulate capital if they are both mentally and physically healthy. In theory, health can boost economic growth because it is a key factor of human capital, and therefore recent studies have shifted the focus to human capital by incorporating health into their models.

Health, as an indicator of human capital, is used in many empirical studies of growth, and researchers usually find that it has a significant positive impact on economic growth rate and there is a strong and positive correlation between them.

Barro (1996) describes a framework in which the concept of health capital is incorporated. A key feature of his analysis is the two-way causation between health and the economy. According to him, better health tends to enhance economic growth, and at the same time economic advance encourages further accumulation of health capital.

In terms of the long-term relationship between health and economic growth, Mayer (2001) has shown strong evidence for the positive impact of health to economic growth which is important for the modern economy.

Van Zon and Muysken (2001) presented a simple model for endogenous growth based on the Lucas model where they showed that the role of health is an important condition for individuals to be able to behave and work in the labor market. They concluded that health sector is an important determinant of growth as the productivity of the human capital accumulation process itself.

Gyimah - Brempong and Wilson (2004) investigated the effects of health human capital on the growth rate of per capita income in Sub-Saharan African and OECD countries. They found that the growth rate of per capita income is strongly and positively influenced by the stock of, and investment in health human capital.

Erdil and Yetkiner (2009) examined the relationships between real GDP per capita and real health expenditures per capita in low- and high-income countries. They found a two-way and one-way causality between health care expenditures and income levels. They found a one-way causality from economic growth to health in the underdeveloped countries, while in the highly developed countries they found a causality from the health to the economic growth.

Aghion et al. (2010) revisit the relationship between health and growth in light of the modern endogenous growth theory. Based on cross-country regressions over the period 1960-2000, they found that a higher initial level and a higher rate of health improvement, both have a significantly positive impact on GDP per capita growth.

According to Weil (2014) it is possible to imagine a history in which economic growth (technological advance, accumulation of physical and human capital, institutional change) took place roughly, but in which life expectancy and other measures of health remained stuck at their 18th century levels. But it is not similarly possible to imagine a history in which knowledge regarding health advanced and was implemented.

Wang (2015) made an empirical analysis for OECD countries which indicates that when the ratio of health spending to gross domestic product (GDP) is less than the optimal level of 7.55%, increases in health spending effectively lead to better economic performance. Above this, more spending does not equate to better care.

Empirical results in Bedir (2016) have indicated that economic growth is an important factor in explaining the difference in healthcare expenditures among countries. Therefore, he showed that increases in income level stimulate healthcare expenditures for some of the emerging market economies.

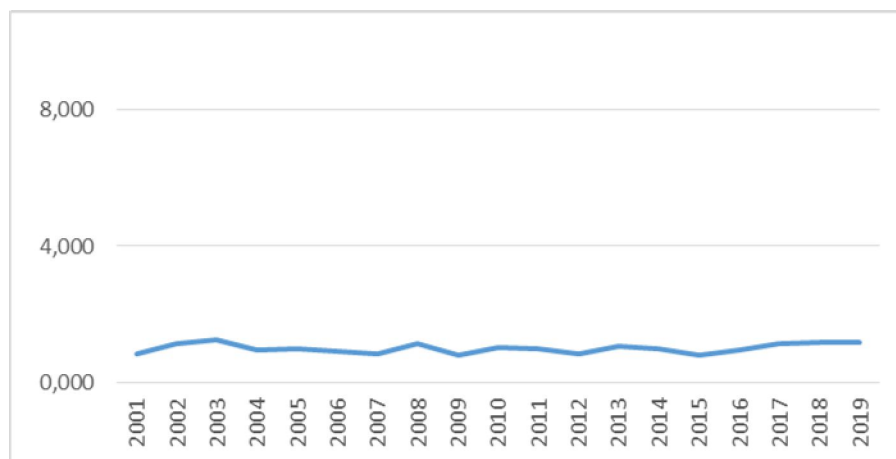
The study by Pasara et al. (2020) explores the causality between education, health and economic growth in Zimbabwe. They showed that the effect of education on economic growth is not direct, but it is through improving health, pointing to the conclusion that health is a transmission mechanism through which education leads economic growth. In doing so, they found no causality from health to education and from economic growth to education and health.

3. METHODOLOGICAL APPROACH AND EMPIRICAL ANALYSIS OF THE IMPACT OF HEALTH ON ECONOMIC GROWTH IN NORTH MACEDONIA

The cost approach for measuring human capital takes into account all the costs incurred in forming human capital where almost every aspect of human capital should be calculated separately (costs of education, health, etc.). The Lucas model will be used to analyze the impact of health spending on economic growth in North Macedonia. This chapter will briefly attempt to distinguish between new growth models and elaborate on the chosen model. Basically, these are two models whose pioneers are Romer (1990) and Lucas (1988). Empirically, the difference between the two sets of theories is that endogenous growth in Romer (1990) is caused by accumulated technology (or knowledge), thus establishing a link between the level of human capital and economic growth. In this regard, human capital is seen as "knowledge" and "ideas" that have no characteristic of rivalry and are partially excluded. In the theory of Lucas (1988), the formation of human capital creates endogenous growth. In short, to achieve endogenous growth, the effort required to produce an additional unit of human capital must be the same, regardless of the level of human capital. Thus, Romer's (1990) model is based on technological growth (which depends on the level of human capital), while Lucas's (1988) model is based on the accumulation of human capital (growth of human capital determines economic growth).

Both, Lucas model and Romer model predict that gross domestic product and physical capital growth should be equated to a balanced path. However, Lucas model predicts that human capital growth is almost equal or (due to the positive external effect) slightly lower than physical capital growth and gross domestic product growth. In Romer model, human capital increases significantly slower than physical capital. Hence, if we find an almost constant ratio between human and physical capital or between human capital and GDP, then Lucas model dominates. Chart 1 shows the ratio of human capital to physical capital, using health expenditures and gross fixed capital. It can be seen that this relationship is almost constant and this analysis of the ratio between human capital and physical capital suggests that in the case of North Macedonia it is Lucas's growth that dominates and therefore the same model will be used in the analysis of the impact of human capital (health expenditures) on economic growth.

Chart 1. Ratio of human capital : physical capital using health expenditures and gross fixed capital



Source: Authors' calculations based on World Bank Data 2021

The economy in Lucas model is completely abstracted from demographics, taking population growth as a whole. Given that the last census in North Macedonia was conducted in 2002, this is an additional reason and justification for using the Lucas model in analyzing the impact of human capital on economic growth in North Macedonia.

For the purposes of the empirical analysis for the impact of human capital on economic growth, we begin with the basic form of Lucas model:

$$Y_t = A * K_t * (u_t, h_t, L_t)^{1-\beta} h_{a,t}^{\gamma} \quad (1)$$

In this form, the level of technology "A" is assumed to be constant, and according to Lucas, it is acceptable for this variable to be dropped from the expression. Because the increase in human capital per capita in Lucas model also leads to greater investment in physical capital, we can express the relationship between economic growth and human capital as follows:

$$Y_t = K_t^{\beta_1} * H_t^{\beta_2} * (K * H)_t^{\beta_3} * \varepsilon \quad (2)$$

that is,

$$Y_t = \beta_0 + \beta_1 * K + \beta_2 * H + \beta_3 * (K * H) + \varepsilon \quad (3)$$

where

Y_t is economic growth,

K is physical capital,

H is human capital,

$(K * H)$ is the interaction between physical and human capital,

$\beta_0, \beta_1, \beta_2$ и β_3 are input coefficients, respectively and

ε is error term.

Economic growth will be analyzed through gross domestic product per capita, gross fixed capital formation will be used for physical capital investments, and health expenditures will be used as an indicator of human capital. In Lucas model, health expenditures are input of human capital. The idea of treating health expenditures as an indicator of human capital has been prominent since the last century, in Becker (1962) and Mincer (1974).

For the purposes of this paper, in order to analyze the impact of human capital through health expenditures, the following regression model is constructed:

$$GDPC = \beta_0 + \beta_1 * GCF + \beta_2 * HE + \beta_3 * (GCF * HE) + \varepsilon \quad (4)$$

where,

GDPC is gross domestic product per capita

GCF is gross fixed capital formation

HE is health expenditures.

Using a regression analysis, the aim of this study is to examine whether human capital, i.e. health expenditures have a positive impact on economic growth in North Macedonia. In other words, do they have a statistically significant impact and can be used to predict the economic growth. Based on the above, the following hypotheses are made:

H1: Health expenditures have a positive impact on economic growth in North Macedonia

H1a: Human capital has a positive impact on economic growth in North Macedonia.

The analysis is based on time series because they are more important in identifying the sources of economic growth for particular countries. Data for the empirical analysis refer to the period 2000-2019 on annual basis, which are taken from the database of the World Bank and they are expressed in denars (Macedonian national currency).

Since this empirical analysis is based on time series data, the problem of stationarity is the basic segment that needs to be examined. Time series are stationary if the change in time does not cause changes in the shape of the distribution. The test was performed using the Unit Root test (Augmented Dickey - Fuller test (ADF)). The ADF test showed that the variables are non-stationary at the level. After the differences, all variables are stationary at first level. The test results are shown in Table 1.

Table 1. ADF Unit - Root test results

Series	t - stat	Prob.	Level of differentiation
D (gross domestic product per capita)	-3,915649	0,0089	1
D (gross fixed capital formation)	-7,515642	0,0000	1
D (health expenditures)	-4,083514	0,0063	1

Source: Authors' calculations

Table 2 shows the results of the regression analysis using the Ordinary least squares method (OLS), in which the estimated coefficients before the independent variables¹ are statistically significant:

Table 2. The relationship between economic growth and human capital in North Macedonia in the period 2000 - 2019 (OLS method)

Independent variable	Coefficient	Std. error	t - stat	Prob. P< t
B_0	1,282e+05	2598,693	49,33	0,000*
GCF	3,996e+04	2,06e+04	1,939	0,012*
HE	1,212e+04	1,45e+04	0,835	0,017*
$GCF*HE$	3,758e+04	2,91e+04	1,290	0,021*
R^2	0,965			
Adjusted R^2	0,958			
F - statistics	139,1 (0,000)			

Dependent variable: GDPC

Note: $p < 0,05^$*

Source: Authors' calculations

The results show that investments in physical and human capital have a positive impact on economic growth, i.e GDP per capita. The adjusted R^2 is 95.8%. This shows that over 95.8% of the variations in GDP growth can be explained by the independent variables. Also, this coefficient shows a good regression adjustment. F-statistics show that the explanatory variables are important factors which determine GDP growth rate in North Macedonia, i.e that the model is good and corresponds to the data. When testing significance, the effects of all independent variables on economic growth are statistically significant, as evidenced by the t-statistical values and their corresponding probabilities which are lower than the significance level of 5%. Regression analysis shows that human capital measured through health expenditures can be used to predict economic growth in North Macedonia. The results showed that we can accept the alternative hypotheses for the positive impact of health expenditures on economic growth in North Macedonia, i.e the impact of human capital on economic growth in North Macedonia. The increase in health expenditures per capita by one unit, i.e by one denar will lead to an increase in gross domestic product by 12,120 denars per capita.

This analysis contains complementary information about the interaction between physical and human capital, which is in the focus of Lucas model. Namely, the coefficient before the variable $GFC * HE$ shows the following: how much an additional investment in health will contribute when physical capital investments (infrastructure, machines) are at a higher level? This shows the effects of the interaction between physical capital and investment in human capital. This input factor is complementary and corresponds to Lucas model if the coefficient before the variable $GFC * HE$ is positive and significant (in our analysis the coefficient is positive and statistically significant). Therefore, our analysis shows that investing in human capital yields higher returns when the capital investment is already higher. This means that in parts of North Macedonia with higher capital investments, investing in human capital will have a greater reward, or in other words, a higher growth (in places where capital investment is greater) will be achieved by investing the same amount of human capital.

The results of this analysis reflect health as an indicator and factor that independently and in interaction with physical capital contributes to economic growth caused by its positive and significant impact.

¹ GDPC = gross domestic product per capita; GCF = gross fixes capital formation; HE = health expenditures; $GCF*EE$ =interaction between physical and human capital

4.CONCLUSION

The economic concept of human capital is closely related to the investments in human capital, which are mostly obtained through education and improved health. Hence, the future production capacity of individuals and their contribution to economic growth depend on the human capital. Human capital participates in the production process, increases productivity and therefore causes income growth in the country. The analysis showed that health has a positive contribution to the growth process. It is indisputable that investments in health should be increased in order to ensure individual, social and economic development of North Macedonia.

This paper provides evidence for the positive impact of human capital, i.e health expenditures on economic growth in North Macedonia, using regression analysis. The study showed that the impact of health expenditures is statistically significant and health has a positive impact on economic growth in North Macedonia. Therefore, the hypotheses about the impact of health and human capital on economic growth proved to be positive. Health and human capital contribute to positive GDP growth per capita and health expenditures can be used to predict economic growth in North Macedonia.

Moreover, with the regression analysis we showed that the interaction between physical and human capital is positive and statistically significant. We have seen that total human capital generates externalities, enabling the economy to maintain steady growth, characteristic of Lucas's original model. While physical capital is specific to the production of final production, the production of human capital is the basic engine of growth. By adding an additional unit of human capital, the returns from investing in physical capital will be higher. Given that production is more modern and follows modern technology, there is a greater demand not only for skilled, but also capable and healthy workers, which is why it is necessary to invest in human health.

This study highlights the accumulation of human capital by showing that health is an important factor in understanding the role of human capital in the process of economic growth. Hence, as human capital is important, investments in human capital should be increased and its structure should be optimized, while giving priority to the accumulation of human capital. Increasing the level of human capital will make economic growth sustainable and stable, and it is important to monitor developed regions that can encourage policy makers to imitate, thus creating a coordinated interaction between developed and developing countries. Pragmatic and objective guided expansionary government policies can contribute to achieving a better health outcome as well as faster economic growth. Structural reforms in the health sector are needed and it has to be strengthened to ensure a healthy population ready to learn new skills and capable of working and boosting productivity.

REFERENCES

- Aghion, Philippe; Howitt, Peter & Murtin, Fabrice. 2010. "The Relationship Between Health and Growth: When Lucas Meets Nelson-Phelps". *Review of Economics and Institutions* 2 (1). Dipartimento di Economia, Università di Perugia (IT). doi:10.5202/rei.v2i1.22.
- Barro, Robert J. 1993. "Health and economic growth." *Annals of Economics and Finance* 14 (2): 329-366.
- Barro, Robert J & Sala-i-Martin, Xavier. 1995. *Economic growth*. 1st arg. Cambridge: MIT press.
- Barro, Robert. J., and Jong-Wha Lee. 1994. "Sources of economic growth." *Carnegie-Rochester Conference Series on Public Policy* 40: 1-46. [https://doi.org/10.1016/0167-2231\(94\)90002-7](https://doi.org/10.1016/0167-2231(94)90002-7).
- Becker, Gary S. 1962. "Investment in Human Capital: A Theoretical Analysis". *Journal of Political Economy* 70 (5, Part 2): 9-49. University of Chicago Press. doi:10.1086/258724.
- Bedir, Serap. 2016. "Healthcare Expenditure and Economic Growth in Developing Countries". *Advances in Economics and Business* 4 (2): 76-86. Horizon Research Publishing Co., Ltd. doi:10.13189/aeb.2016.040202.
- Bloom, David, David Canning, David Evans, Brayan Graham, Patrick Lynch, and Erin Murphy. 1999. "Population change and human development in Latin America." *Working paper for the Inter-American Development Bank*.
- Erdil, Erdil, and Hakan I. Yetkiner. 2009. A "A Panel Data Approach for Income-Health Causality," *Working Papers FNU-47, Research unit Sustainability and Global Change, Hamburg University*, : <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.462.1318andrep=rep1andtype=pdf>
- Gallup, JL & Sachs, JD. 2001. "The economic burden of malaria". *The American Journal of Tropical Medicine and Hygiene* 64 (1_suppl): 85-96. American Society of Tropical Medicine and Hygiene. doi:10.4269/ajtmh.2001.64.85.
- Gyimah-Brempong, Kwabena & Wilson, Mark. 2004. "Health human capital and economic growth in Sub-Saharan African and OECD countries". *The Quarterly Review of Economics and Finance* 44 (2): 296-320. Elsevier BV. doi:10.1016/j.qref.2003.07.002.
- Lucas Jr, Robert. E. 1988. "On the mechanics of economic development." *Journal of Monetary Economics* 22(1): 3-42.
- Mayer, David. 2001. "The long-term impact of health on economic growth in Latin America." *World Development* 29(6): 1025-1033.
- Mincer, Jacob A.. 1974. *Schooling, Experience, and Earnings*. New York: NBER.
- Pasara, Michael Takudzwa; Mutambirwa, Tapiwa Kelvin & Diko, Nolutho. 2020. "The Trivariate Causality among Education, Health, and Economic Growth in Zimbabwe". *Sustainability* 12 (4): 1357. MDPI AG. doi:10.3390/su12041357.
- Romer, Paul M. 1990. "Human capital and growth: theory and evidence." *Carnegie-Rochester Conference Series on Public Policy* 32: 251-286.
- Sovina, Jakub. 2000. „*Human capital and models of economic growth*." PhD Diss., Faculty of Social Sciences, Charles University, Prague.
- Van Zon, Adriaan & Muysken, Joan. 2001. "Health and endogenous growth". *Journal of Health Economics* 20 (2): 169-185. Elsevier BV. doi:10.1016/s0167-6296(00)00072-2.
- Wang, Fuhmei. 2015. "More Health Expenditure, Better Economic Performance? Empirical Evidence From OECD Countries". *INQUIRY: The Journal of Health Care Organization, Provision, and Financing* 52: 004695801560266. SAGE Publications. doi:10.1177/0046958015602666.
- Weil, David N. 2014. "Health and economic growth." In *Handbook of Economic Growth edited by Philippe Aghion, and Steven N. Durlauf*, 623-682. Oxford: Elsevier.
- World Bank Data 2021. Accessed December 21 <https://data.worldbank.org/>