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Evaluation of Health Influence upon an Individual's Income

Iveta PAUHOFOVA – Liliya BUKHARBAEVA** – Yuliya EGOROVA***

Abstract

Health is a constituent part of an individual's human capital. Health is interrelated with other constituent parts of human capital including education and experience determining this capital's efficiency that is an individual's income. This study of interrelation between health and future income of an individual resulted in a posteriori estimate of the economic consequences borne by changes in the health of an individual.

We paid special attention to building variable-based health indices as their objectivity is crucial to obtaining correct simulation results. The results obtained reveal that good health positively influences future income of an individual.

Keywords: *health standard, influence of health upon income, human capital, RLMS, evaluation of health, endogeneity*

JEL Classification: C52, I14

Introduction

Today no one would deny the value of health. However, many believe that some aspects of health can be sacrificed in order to enhance other aspects of their social and economic well-being. Studying the influence of health upon his income can answer the question whether good health does indeed guarantee an individual's economic well-being and find the health indicators that are the key factors to building economic well-being as well as the lifestyle aspects influencing an individual's income. Speaking the language of economics, evaluating human capital efficiency requires evaluating the impact of its key constituent

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that is health, upon such efficiency (Bukharbaeva and Egorova, 2016a; 2016b). An important objective here is measuring health as an asset and its change with time for an individual.

1. Review of the Currently Available Research Works

Social selection theory defines health as a determinant factor for an individual's social and economic status. According to this theory, health determines an individual's socio-economic status and thus influences his income (Kislitsyna, 2017).

The other theory, which can be called the social causality theory, proves that there is an inverse effect: an individual's socio-economic status influences his health through material and other factors.

Many present-day references speak of the interrelation between income level and health status (Kislitsyna, 2017). Early studies concerned with the impact of income upon health go centuries back. Thus, Schulz (in Kislitsyna, 2017) studied social inequality and obtained 17th-18th century mortality statistics for Europe's major cities. This statistics clearly showed direct correlation between income level and health of public.

In the 19th and 20th centuries, English and French public figures as Chadwick and Villerme, continued studying the connection between health and social status (in Kislitsyna, 2017).

In the 20th century the ideology of "universal equality" hindered the research work concerned with study of the income's impact upon health status, as such studies got no support from the government, their results weren't published or encouraged. The statistics that was published later on disclosed the difference in health status of social groups with different income levels.

In recent years, study of interrelation between health and the fundamentals behind it has been the subject of papers by many foreign and Russian researchers. Worth mentioning are the studies by Mackenbach et al. 1997; Kislitsyna, 2017; Kuzmich and Roschin, 2007) and others. However the latest research work done in Russia provides ambiguous and often contradictory results. Thus, the researchers studying the influence of income level upon health still see a direct relationship: mortality and morbidity are lower and appreciation of health is higher among citizens with higher income level (Kuzmich and Roschin, 2007).

This phenomenon could be explained by the influence of income level upon accessibility of healthcare, yet other researchers disconfirm this reasoning. The example they use is the USA, where accessibility and quality of healthcare are high, yet health status of the nation is lower compared to other developed countries.

Especially noteworthy are the well-known studies of the influence of an individual's income level and investments in health upon an individual's health: the research works by Grossman (2000) and others. However, in Russia inverse influence of income level upon health is poorly studied. Many of the research works use perceived evaluation of health status as criterion although it may be biased, as it is mainly based on comparison of an individual with other people surrounding him ("I'm healthier than some of the people around") and on the current situation. These studies also rarely use time lag models although any influence of the investments in health upon an individual's health or income level, pay off as the time passes only.

Stehlíková and Pauhofová (2015) point to a link to health and low income from the point of view of unemployment. They draw attention the need for deeper exploration in this area, in particular through stratification and income polarization mapping. They gradually reveal a broad framework of contexts of income polarization at the level of the regions of the Slovak Republic (Pauhofová et al., 2017). The impact of health on income is a part of their cooperation with experts from the Russian Federation.

2. Theoretical Background of the Research

Health is a constituent part of an individual's human capital. Health is interrelated with other constituent parts of human capital including education and experience. Some researchers believe that the life expectancy of Russians, which is much lower compared to that in the developed countries, might be associated with the general public's improper attitude towards their health status, and poor understanding of the interrelation between treating it as a valuable asset and economic efficiency of such investments. One of this research work's objectives is to unearth the key factors of health buildup that have the strongest influence upon an individual's income level.

Theoretical grounds for influence of health upon income are the following:

1. An individual's total income is the product of hourly wage rate by total work time, hence the healthier a worker is the more time he can spend working and the higher his total income is.

2. Good health expands useful life of human capital through cutting down the number of sick leaves thus increasing the number of workdays and also prolongs lifetime and promotes readiness to work at older age.

3. Bad health may also narrow down one's access to education, which is yet another constituent of human capital and has additional detrimental effect through lowering an individual's income level.

3. Goals and Objectives of the Study

The goal of this research work is to make a posteriori estimate of the economic impact that changes in an individual's health status have.

In order to achieve this goal we need to do the following:

1. Construct a health status index based on objective health characteristics (pre-existing conditions, surgeries, self-evaluation of health).

2. Evaluate the influence of health status upon an individual's income level and number of worked hours.

The research work is done using the database of the Russian Longitudinal Measurement Survey for the years 2013 – 2016.

4. Description of Data and Methods

4.1. Informational Background of the Research

The database of the Russian Longitudinal Measurement Survey (RLMS) provides rich resources for such research work. This longitudinal household monitoring carried out by HSE is a series of annual nationwide representative surveys based on statistically distributed strata-bound multi-tier area sample developed with the help of the world's lead experts in the field. The information collected includes data on the composition of income and expenditures, standard of living, immigration behavior, health and food patterns, on approach to education and pastime etc. In fact, this is the only representational socioeconomic survey of households in Russia with a significant panel component, which is crucial to the objective of this research. It keeps track of everyday life of the same individuals over a long period of time thus offering us opportunities not only for statistic, but also for dynamic analysis. The structure of the questionnaires used in the survey meets the world's best standards, which makes cross-country comparison possible too. The master sample includes the respondents 16+ years old, who were employed at the moment of the interview. The original sample size was 77310 observations.

4.2. The Problem of Endogeneity in this Research Work

The fact that health status is susceptible to income level (because the amount of investments in health ultimately depends on an individual's income) is the source of endogeneity by the attempts to evaluate the influence of health upon income and employment using regressive models.

Researchers suggest various solutions to this problem, both the content--related ones involving selection of the health characteristics providing most objective description of an individual's health status and the instrumental ones involving the use of more complex techniques of econometric model evaluation. Despite the attempts of many researchers to go beyond the framework of standard evaluation using OLS model in order to resolve the problem of measurement error and endogeneity of health, there is hardly an unambiguous solution for it.

The key methods used by the researchers to tackle the endogeneity problem are the following:

- solving of a simultaneous equations system, which includes regressions of health upon income level and those of income level upon health (however, there are difficulties with interpretation of the evaluations obtained);
- using of instrumental variables (however there are difficulties with selection of a qualitative instrument not associated with income yet adequately reflecting the health status);
- using of lagged variables. This is the method of choice for the problem of endogeneity because it simultaneously reflects the content-related entity (the influence of the health status in the past upon the current income through the accumulated health capital), and as a matter of fact, lagged variables can be also regarded as instrumental ones by verification of absence of correlation with the current income level. This is why these research implements models of dependence of an individual's income level and the amount of hours worked on his health status at the moment and in the past (lagged models).

For this reason the original sample was reorganized so that every observation included the respondent's personal information recorded over the latest four years. A respondent's total income was estimated as an average monthly salary in rubles earned at all respondent's jobs. Missing values of this key variable were filled in by the values of the respondents' actual incomes from all jobs and the average monthly employer's debt to worker if there was any. As the research studies earned income, only the respondents of working age with working income were included in the sample. After the culling was done, the final sample included 7015 observations.

4.3. Research Methodology

The hypothesis tested in this research work can be worded as the following: the health status measured using objective indices, influences an individual's income level both through the amount of work hours and per se.

Health is hard to formalize as a property because direct measurement of health is not possible. In this research work health status is evaluated based on

the pre-existing conditions the respondents admit to have because the researchers dealing with RLMS recognize this method as the most accurate and objective one.

We suggest breaking up all indices describing a respondent's health into three groups:

1. The indices describing health problems that occurred in the respondents in the last 30 days before the survey;

2. The indices revealing the respondents' pre-existing conditions;

3. The indices revealing the respondents' self-assessment of their overall health.

Based on these indices are three composite health indices: *health1*, *health2*, *health3*.

The first composite health index, *health1,* shows current health problems in the respondents over the period of the latest three months before the survey including hospital admission cases. The index takes account of both physical and mental health of the respondents (neuropathies and depressions are registered).

The second composite health index, *health2,* shows the chronic diseases the respondents admit to have (chronic cardiac diseases, lung diseases, hepatic and renal disorders, GIT disorders, vertebral disorders, endocrine diseases, joint, ENT, eye, urogenital, skin diseases as well as neurological conditions, allergies, cancer, hypertension, varicose veins etc. were taken account of).

The third index, *health3,* was estimated as an index of health self-evaluation. It is worth mentioning that the health self-evaluation index is used in numerous research works, which don't use the data obtained from medical examinations. The bias of the self-evaluation index can be explained by the fact that an individual's self-evaluation is based on comparison of their own health to that of others ("I'm healthier than some of the people around me"), and also on the current situation at the moment of interview. However the research works reveal that it is possible to use the self-evaluation index as it is connected with fact--based health characteristics (Kuzmich and Roschin, 2007). It proves appropriateness of polling method for study of the public health situation not with status of respondent's gender, age or education level. Spearman correlation coefficients have been estimated by analyzing of the interrelation between the self-evaluation index and other respondents' health indices as they reveal their statistically significant interrelation.

4.4. Models of Influence of Health upon an Individual's Income Level

To evaluate the influence of health upon income level we suggest a model constructed as a linear regression using OLS. The model constructed adds health characteristics to the standard Mincer equation for the dependence of income on

education and professional experience. Here, the selected dependent variable is the logarithm of total income obtained in the past month, and the regressors are individual characteristics vector *X*, professional characteristics vector *P* and health vector *He*.

Thus, the equation is as follows:

$$\ln W = a_0 + a_1 X + a_2 P + a_3 He$$

where

W – total income earned in the past month;

X – individual's personal characteristics vector (age, age squared, an education, and marital status, number of children, socioeconomic status, and type of residency township);

P – professional characteristics vector (logarithm of the number of hours worked in the past month, branch of activity);

He – health vector (health status index at the moment and in the past).

Total earned income is understood as all earnings made at all principal and additional work places in the current year, recalculated using the consumer price index for the respondent's residency region.

The authors of this research suggest studying three various models obtained by introducing one composite health index at a time into each of them so that the modeling results would reflect separate effects of specific health characteristics upon the total income (models 1, 2, 3).

Models of Influence of Health upon the Amount of Work Hours

In order to evaluate the influence of health upon the amount of work hours we suggest a model constructed as a linear regression using OLS. Logarithm of the hours worked in the past month is the dependent variable here, and the regressors are individual characteristics vector *X*, income vector *S* and health vector *He*.

Thus, the equation is as follows:

$$\ln O = a_0 + a_1 X + a_2 S + a_3 He$$

where

O – stands for the number of working hours in the latest month;

X – vector of an individual's personal characteristics (age, age squared, education, marital status, number of children, socioeconomic status, and type of residency township);

S – vector of income (logarithm of income including salary and occasional earnings).

He – vector of health (health status indices at the moment and in the past).

The authors of this research also suggest studying three various models so that the modeling results would reflect separate effects of specific health characteristics upon the number of hours worked (models 4, 5, 6).

Descriptive statistics for some of the individuals' personal characteristics used for model building is shown in the following tables and histograms.

T a b l e 1

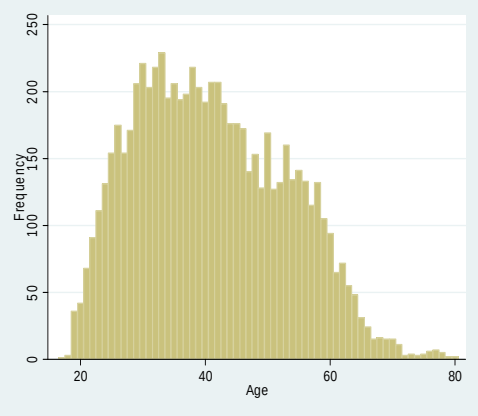
Frequencies of Factors

Sex	**Freq.**	**Percent**
Male	3 369	48.03
Female	3 646	51.97
Total	7 015	100.00
Marital status		
Single	1 939	27.64
Married	5 076	72.36
Total	7 015	100.00
Education		
High school partially completed	623	8.89
High school completed	2 109	30.11
Vocational school or college completed	1 862	26.58
University degree	2 410	34.41
Total	7 004	100.00
Type of residency township		
Region's capital city	3 011	42.92
City	2 118	30.19
Small town	448	6.39
Village	1 438	20.50
Total	7 015	100.00

Source: Own calculation.

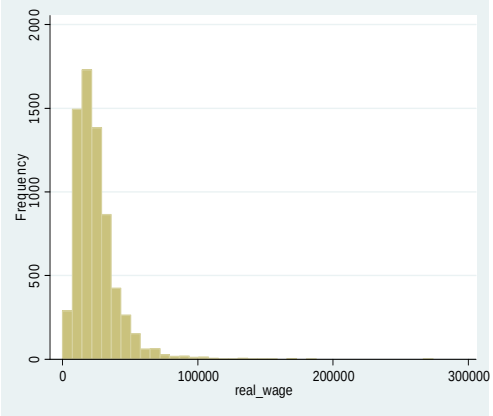
F i g u r e 1

Age of Respondents



F i g u r e 2

Real Income of Respondents



Source: Own calculation.

T a b l e 2

Descriptive Statistics of Dependent Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Real income	6 845	24 633.7	16 552.5	0	273 972.6
Hours of work	7 014	179.0	52.0	5	720

Source: Own calculation.

T a b l e 3

Frequency Table for Health Status Indices

Current health problems	Freq.	Percent
Not mentioned	4 400	63.16
Mentioned	2 566	36.84
Total	6 966	100.00
Current chronic diseases		
Not mentioned	3 189	47.22
Mentioned	3 565	52.78
Total	6 754	100.00
Self-evaluation of health		
Good and excellent	3 173	45.52
Poor and satisfactory	3 798	54.48
Total	6 971	100.00

Source: Own calculation.

4.5. Results and Discussion

The modeling results are shown in Table 4. Models 1 – 3 are models of influence of health upon an individual's income level and models 4 – 6 are models of influence of health upon the amount of work hours.

T a b l e 4

Modeling Results

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	0.0317*** (0.0057)	0.0339*** (0.0062)	0.0335*** (0.0058)	0.0018 (0.0037)	0.0007 (0.0037)	0.0021 (0.0038)
Age^2	–0.0004*** (0.0000)	–0.0004*** (0.0000)	–0.0004*** (0.0000)	–0.0000 (0.0000)	–0.0000 (0.0000)	–0.0000 (0.0000)
Education						
High school partially completed	0.0860*** (0.0328)	0.0937*** (0.0358)	0.0872*** (0.0323)	0.0023 (0.0226)	0.0168 (0.0244)	0.0046 (0.0226)
High school completed	0.2062*** (0.0340)	0.2102*** (0.0369)	0.2018*** (0.0336)	–0.0205 (0.0235)	–0.0017 (0.0245)	–0.0238 (0.0238)
University degree	0.4697*** (0.0342)	0.4805*** (0.0375)	0.4626*** (0.0338)	–0.0594*** (0.0222)	–0.0389* (0.0236)	–0.0597*** (0.0226)
Marital status (married)	–0.0335 (0.0231)	–0.0285 (0.0256)	–0.0241 (0.0239)	–0.0293** (0.0143)	–0.0302** (0.0148)	–0.0299** (0.0144)
Sex (female vs male)	–0.2505*** (0.0210)	–0.2580*** (0.0221)	–0.2553*** (0.0209)	–0.0539*** (0.0133)	–0.0591*** (0.0139)	–0.0508*** (0.0134)
Number of children	0.0047 (0.0120)	0.0049 (0.0128)	0.0026 (0.0120)	0.0046 (0.0078)	0.0032 (0.0085)	–0.0003 (0.0078)

Type of residency township						
City	–0.1611*** (0.0204)	–0.1582*** (0.0223)	–0.1503*** (0.0204)	–0.0166 (0.0126)	–0.0285** (0.0135)	–0.0127 (0.0128)
Small town	–0.2425*** (0.0356)	–0.2649*** (0.0368)	–0.2265*** (0.0360)	0.0252 (0.0183)	0.0158 (0.0198)	0.0249 (0.0185)
Village	–0.3287*** (0.0231)	–0.3353*** (0.0248)	–0.3168*** (0.0233)	–0.0032 (0.0150)	–0.0000 (0.0147)	–0.0021 (0.0151)
Status						
Employed at an enterprise, organization	–0.2633*** (0.0491)	–0.3128*** (0.0532)	–0.2827*** (0.0511)	–0.0414 (0.0384)	–0.0377 (0.0406)	–0.0380 (0.0374)
Employed out of an enterprise	–0.3823*** (0.0569)	–0.4422*** (0.0612)	–0.4130*** (0.0582)	–0.0313 (0.0447)	–0.0163 (0.0460)	–0.0204 (0.0438)
Work hours (log)	0.2999*** (0.0376)	0.3148*** (0.0386)	0.3118*** (0.0379)			
Branch						
Education, healthcare, culture	–0.2273*** (0.0253)	–0.2405*** (0.0276)	–0.2242*** (0.0257)	–0.0421*** (0.0384)	–0.0345** (0.0164)	–0.0383** (0.0160)
Media	–0.1900* (0.0971)	–0.2327** (0.1009)	–0.1952** (0.0972)	–0.0867 (0.0714)	–0.0876 (0.0773)	–0.0840 (0.0723)
Trades and services	–0.1317*** (0.0235)	–0.1204*** (0.0249)	–0.1237*** (0.0235)	0.0093 (0.0146)	0.0122 (0.0150)	0.0040 (0.0146)
Army and government	–0.2331*** (0.0290)	–0.2401*** (0.0314)	–0.2183*** (0.0295)	0.0229 (0.0165)	0.0322* (0.0174)	0.0263 (0.0166)
Total income (log)				0.1011*** (0.0134)	0.1000*** (0.0136)	0.1053*** (0.0136)
Health1	–0.0246* (–0.0246)			–0.0065 (0.0080)		
Health1 (t – 1)	–0.0109 (0.0119)			–0.0000 (0.0077)		
Health1 (t – 2)	0.0104 (0.0124)			0.0049 (0.0074)		
Health1 (t – 3)	–0.0363*** (0.0116)			–0.0058 (0.0079)		
Health2		0.0015 (0.0098)			0.0056 (0.0056)	
Health2 (t – 1)		0.0099 (0.0103)			–0.0066 (0.0064)	
Health2 (t – 2)		–0.0231** (0.0094)			0.0044 (0.0061)	
Health2 (t – 3)		–0.0029 (0.0102)			–0.0049 (0.0063)	
Health3			0.0142 (0.0192)			–0.0063 (0.0132)
Health3 (t – 1)			0.0027 (0.0194)			0.0262** (0.0126)
Health3 (t – 2)			0.0431** (0.0191)			–0.0103 (0.0123)
Health3 (t – 3)			0.0255 (0.0193)			0.0155 (0.0129)
Constant	8.6152*** (0.2538)	8.5125*** (0.2622)	8.1826*** (0.2633)	4.3234*** (0.1556)	4.3419*** (0.1652)	4.1764*** (0.1653)
Observations	3 705	3 302	3 667	3 705	3 302	3 667
F-test	69.61***	61.16***	64.79***	10.40***	9.49***	10.94***
R-squared	0.3085	0.3041	0.3053	0.0774	0.078	0.0812

Note: Robust standard errors in parentheses; ***p < 0.01; **p < 0.05; *p < 0.1.

Source: Own calculation.

We use the OLS estimator, as is often done in practice, but we use alternative estimates of the VCE (robust standard errors) that are valid when assumptions 2, assumptions 3 of OLS or both are relaxed.

In all total income models (models 1 – 3) the factors of age and age squared are significant, and their signs indicate the dependence type expected by the researchers: an individual mostly receives peak working income in the middle of his lifetime.

The other significant factor is education. Total income grows as the education level increases. Thus a university degree increases the average total income by more than 45% compared to high school incomplete. On the average, women earn 25% less than men, which the significant gender factor proves throughout all three models. However, neither the number of children non marital status has any significant influence upon the income level.

Adding a variable like type of residency and town ship to the model reveals lower total income for the respondents residing in villages, small towns and cities compared to that of the people residing in the region capital cities. Thus, in the cities total income is 16% lower, in small towns – 25% lower and in villages it is 30% lower than in the region capital cities. An individual's social status also influences his income level. Thus on the average, self-employed entrepreneurs earn 25 – 40% more compared to salaried employees.

Coefficients of the model equations revealing the influence of a branch are significant in all models and show that compared to industrial and agricultural sectors, workers of healthcare, education and public culture sectors earn more than 20% less and in servicing and trade sectors workers earn 20% less.

The number of hours worked has positive and significant influence upon the earned income (0.000). It is expedient to use it by analyzing the factors influencing earned income through the number of hours worked.

The composite health index revealing current health problems is significant, and its third lag is equally significant. Both coefficients are negative, which shows that on the average, total income is 2.5% lower in the respondents, who mentioned current health problems and 3.6% lower for those, who had mentioned any three years earlier. In our opinion this reflects both short-term and long-term effects of health state upon income. The short-term influence may show in wage lowering due to hospital admission, loss of additional earnings due to diseases, while the long-term effects may include a respondent's essential denial of additional earnings or promotion.

The composite health index based on chronically diseases present in the respondents is significant in its second lag and also negative. Thus, an additional chronic disease mentioned lowers the expected total income by 2.3%. This fact

can be explained by the individual's inability to work as intensively as healthier people do, and this proves our initial hypothesis. The second lag of the self-evaluation index is also significant. An improvement in health self-evaluation by one grade on a five-grade scale increases the expected earned income by 4.3%. In our opinion, besides the immediate influence of health upon the expected earned income, the health self-evaluation indirectly shows an individual's readiness to work intensively as a person, who regards himself as unhealthy does his best to "spare" himself at work.

Overall, adding composite health indices to the total income models makes it possible to prove right the hypothesis concerning the influence of an individual's health upon his income and confirm the principle mentioned at the beginning of the article claiming health is a constituent part to human capital, investing in which pays off in higher work earnings. Taking into account the fact that more than 52% of the respondents mentioned having chronic diseases and more than 54% of them admitted their health is poor or satisfactory, the need to invest in the nation's health becomes obvious.

Models 4 – 6 with the work hours dependent variable help study the influence of health upon income and provide answers to the questions concerning the factors influencing it immediately and those influencing it through the work hours. These models are of no forecasting value; hence the determination coefficient lows in these models should not embarrass the readers. Analyzing these models we arrive at a conclusion that the influence of such factors as age, education level, residency location, social status upon the number of hours worked is insignificant, which means that they can be regarded as factors influencing income levels immediately. Gender has significant influence, as on the average, women work 5% less hors than men, which means that the lower income they get is partially due to this fact. On the average, single people work 3% more hours, which is fair enough.

Among the composite health indices only the first lag of self-evaluation is significant, as increasing self-evaluation of health by one grade on a five-grade scale increases the number of hours worked for the next year by 2.6%, and this fact also partially proves indirect influence of health self-evaluation upon the desire to work. Reflecting on these results, the authors considered the factors motivating individuals to work. All other things being equal, the individuals with higher self-evaluation of health status are ready to work more hours. There is a good explanation for insignificance of the corresponding factor for the current year alongside with the importance of its analogue for the previous year: people cannot respond to changes in their well-being by immediately increasing or lowering the number of hours worked and might do it over a period of time

(by finding additional work or, rejecting them to get more rest and pay more attention to their health).

Insignificance of other health indices shows that their influence upon the income levels is immediate (not through the number of hours worked).

Undeniable is also the fact that if an individual's health and investments into it influence his current and expected earnings, then studying this phenomenon at macro level should reveal similar results: public health definitely does influence the nation's gross income. These avenues of research are definitely of vital importance to any government and can be carried on based of the software code for the data from a different period of time, for a specific region and for specific periods of time in the future. Moreover, the authors of this article will continue research in this area of focus in order to find additional accessible health indices and evaluation of similar models as related to specific regions or industries.

Similar research can be held in the Slovak Republic if results of opinion polls similar to those used by our team are available.

Conclusion

Construction and evaluation of econometric models confirmed the influence of health, measured using a system of objective composite indices, upon an individual's income level both through the number of work hours and per se. The results of the modeling attest to the influence of an individual's well-being and health self-assessment in the past upon the number of hours worked. Income level is influenced immediately (not through the amount of hours worked) by such factors as current health problems, pre-existing conditions and health self-assessment in the past. Despite the fact that the fact-based results of the respondents' health examination aren't available to the research workers, there is no doubt that health does influence individuals' income levels, although this effective output is not very high. The authors may continue the research work to empirically evaluate economic efficiency of healthy lifestyle and evaluate the influence of the lifestyle upon health indices.

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