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The value of human capital and health behavior

Alexander S. Skorobogatov
National Research University Higher School of Economics

Abstract

The paper examines an effect of the return to human capital on health behavior. An approach is assumed in the paper which implies that health is an investment good complimentary for human capital. The latter is treated as actual skills and knowledge yielding a bonus above earnings. We propose a model relating health demand to human capital. According to the model, human capital determines health behavior via the expected effect of health on the return to human capital. The main implication of the model is that the educated people will not much differ from those lacking any education with regard to health behavior if their education does not generate the bonus.

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Contact: Alexander S. Skorobogatov - skorobogat@mail.ru.

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1. Introduction

An established point of health economics is the positive relationship between schooling and health behavior. As Grossman (1972, 1973) puts it in his classical works, the more educated are more inclined to take care about their health because of better knowledge of the 'health production function' (2008, 286). A world cross-country statistics, as a whole, confirms this proposition indicating a positive correlation between the accumulated schooling and life expectancy.

However, the transitional economies and the emerging markets seem may challenge the theory. Russia is one of the world leaders in its stock of human capital if it is measured through average accumulated schooling, or shares of population having completed upper-secondary school or even higher level of education (World Development Indicators 2011, 82). At the same time, Russia is known as a country with quite low and, during the transitional period, even shortening life expectancy (120, World Health Statistics 2011, 50). According to the WHO estimates, health, and thereby life expectancy, is heavily determined by health behavior. In light of this fact, one can infer that Russians neglect their health despite their high education. These well-known data calls for a model which would accommodate the anomaly mentioned.

This paper addresses a problem of seemingly unrelated or abnormally related human capital and health behavior. The main question is what, if any, is the effect of human capital on demand for health. The related question is how in the context of this effect one can explain the addressed problem. In the paper, human capital is treated as abilities, skills, knowledge, and experience which enable their owners to earn bonus above wage paid for an unqualified labor. Obviously, such a definition does not include health in the notion of human capital — an exclusion which is strongly required for the addressed problem to make sense. At the same time, human capital, according to this definition, while encompassing all the valuable skills, does not reduce to a formal education. This definition of human capital corresponds with the literature treating human capital in terms of its return (Machlup 1984, Coleman 1990, Le et al. 2006).

The reminder of the paper is organized as follows. The next section discusses the literature from which we borrow our approach. In the third section, a model of health demand is put forward. A discussion of the model's implications is contained in the fourth section. The fifth section discusses some historical trend relevant for checking our main prediction. In the sixth section, prospective empirical research is discussed. The seventh section closes the paper.

2. An economic analysis of health behavior

Our approach is based on the standard neoclassical assumption about human behavior as a result of rational choice, given individual preferences and restrictions are definite and realizable by an individual. Rational activity is conventionally treated in terms of production and factor prices, and consumption and consumer prices. An important addition to this framework contributed by the New Institutional economics is that the opportunity cost-related restrictions imposed on a rational individual take form of institutional environment (Williamson 2000), along with the other conditions of societal life.

Our argument borrows from several strands within this general framework. The first is Becker's economics of time allocation (1965) which suggests, in particular, that a higher reward is consistent with a more optimal quantity of labor. So, if an activity available for an individual pays little he/she dedicates more time to leisure and, *visa versa*, a profitable available employment

makes opportunity cost of leisure higher and thereby induces an individual to work more or, in a broader sense, dedicate more time to active life (Fogel 2004).

Another premise on which we base our study is the conventional treatment of human capital as a source of a higher reward (Mincer 1974). In light of just mentioned Becker's theory, this premise implies that human capital increases opportunity cost of leisure, so that the more an individual's human capital, the more is to be his/her labor supply. Hence, a higher human capital, *ceteris paribus*, is to be consistent with a less time dedicated to any kind of leisure.

At the same time, our study borrows from the literature pioneered by Stigler (1962), Arrow (1973), and Spence (1973) which treats human capital as abilities unrelated to schooling, i.e., human capital is considered as an autonomous variable (Hunter and Leiper 1993). In the context of the issue addressed, it means that, while schooling *per se* may have a little effect on health behavior, the effect of human capital as far as it yields a positive return is to be much more significant. In other words, it is actual skills demanded and evaluated high by labor market, rather than just schooling, which matter.

Finally, we base our study on Schultz's classical idea that human capital contributes to value of a human being for a society and for him/herself (1968) and thereby increases health demand (Coburn and Pope 1974, Spratt 1975). A specific version of an idea that human capital is related to health care is proposed and tested by Sab and Smith (2002). They treat health and education as a result of joint investment. Accordingly, human capital and health prove to be a joint asset every part of which pays depending on existence and size of the other one.

Once again, the incentives for health care may be related to the rational allocation of time. In this case, a disease is a forced leisure imposing on an individual opportunity cost. Like the other kinds of leisure, the forced leisure involves more losses for a skilled worker than for an unskilled one.

As a whole, the approach assumed here claims that health behavior is driven by pecuniary incentives rather than information about a proper lifestyle with respect to health (as it is implied within Grossman's approach (1972, 1973)), time preferences (Fucks 1982, Gourdel et al. 2004, Zhang and Rashad 2007), or some social factors (e.g., according to the approaches originated by Marmot (Stafford 2004) and Wilkinson (Attanasio and Emmerson 2003, Kaplan et al. 1996)). Health is treated here as an investment good, and health behavior is analyzed in terms of investment demand for health. Accordingly, an individual's incentives to take care about his/her health are to arise from the pecuniary gains from his/her health (Thurow 1970). As for the way of getting these gains, health is considered as a complementary capital for human capital, being a necessary condition of the latter's efficient use. In other words, health capital is treated as paying not by itself, but in conjunction with the valuable human capital.

3. The model

Following this approach, one can formally relate an individual's incentives for health care with the value of his/her human capital. The assumptions underlying our formal analysis are following:

a. An individual's utility function has a simple money-metric form

   $U(S) = S,$

   where S denotes an individual annual income. Here we use the approach outlined by Thurow (1970, 122) according to which a money-metric utility function is advantageous with respect

to an opportunity to draw clear conclusions about rational decisions, not to mention simplicity. Under these considerations, the utility function reduces to the income, and maximizing the latter is equivalent to maximizing the former. It also means that utility of health may only be derived from its pecuniary benefits, while health *per se* does not yield any utility;

b. To reveal the effect of human capital, the simple labor is introduced, i.e., a labor not equipped with any skills;

c. For simplicity, an annual wage for the simple labor is normalized to unity, i.e., an individual earns a unity wage for a year if he/she works for all the working days during a year;

d. Human capital yields a return in the form of bonus above the annual wage;

e. Thus, an individual's annual income is comprised of his/her day's earnings (there is not sick-lists);

f. A physical inability is the only possible cause of absence from work.

Annual work time N is a sum

$$N = W + L, \tag{1}$$

where W is days worked, L is days of absence from work because of sickness or indisposition. Let w denote a share of days worked in annual work time

$$w = \frac{W}{N}, \tag{2}$$

and let h be health capital coefficient (below used as a health capital variable) measured as ratio of an existing health capital stock H_1 to an initial one H_0

$$h = \frac{H_1}{H_0},\ h \in [0, 1], \tag{3}$$

i.e., following Grossman (1972), we assume that health capital is just what an individual has managed to save from his/her birth. An individual's annual income S can be written as

$$S = b(q)w(h), \tag{4}$$

where $b(q)$ is the bonus as a function of human capital q. Also let us put in the Leontiev type function of human capital:

$$q = \min\{a, s, e\},\ q \geqslant 0, \tag{5}$$

where a denotes abilities, s is schooling, and e is work experience by profession obtained in educational institution. Thus, here we assume a perfect complementarity between the three factors of human capital. Abilities are assumed to be indispensable for producing human capital, whereas schooling and its realizing on workplace are principally essential for their development. Contrary to the well-known assumption about interdependency between abilities and schooling, we assume their independency since it fits the stylized facts of the contemporary Russian economy. According to Kuzminov, Chair of the Commission for Education Development of the Civic Chamber of the

Russian Federation, currently overall higher education coverage is 86-87% of youth completing secondary school (2011), so that the educational attainment does not necessarily reflect presence of good abilities.

According to the assumption c., $b(q)$ must satisfy the following condition

$$b(0) = 1. \tag{6}$$

At the same time, let the functions comprising the income function S satisfy the standard requirements of diminishing return, namely, $b'(q) \geqslant 0$, $b''(q) < 0$, $w'(h) \geqslant 0$, $w''(h) < 0$.

Meeting these requirements, let these functions be given by

$$b = 1 + q^{\alpha},\ \alpha = \begin{cases} -\infty \text{ if the return to human capital} = 0 \\ \alpha^* \in [0, 1[\text{ if the return to human capital} > 0 \end{cases}, \tag{7}$$

$$w = h^{\beta},\ \beta = \begin{cases} -\infty \text{ if the return to health capital} = 0 \\ \beta^* \in [0, 1[\text{ if the return to health capital} > 0 \end{cases},\ w \in [0, 1]. \tag{8}$$

α and β are the functions' elasticities of human capital and health, respectively. They equal to minus infinity if q or h do not yield any return in terms of b or w, respectively. The admissible values of α^* or β^* are written in line with the mentioned requirement of diminishing return. They equal to zero if additional quantities of q or h do not produce additional quantities of b or w, respectively, and they are positive otherwise. Also, given h is a fraction, a higher β^* is consistent with a lower w. This elasticity, thus, expresses the sensitivity of a job's productivity, and thereby wage, to attending. Given the high sensitivity, poor health will result in heavy pecuniary losses and *visa versa*.

The interval for w reflects the assumption that an individual lacking any health, say, being dead, cannot work at all. And, *visa versa*, having a unity stock of health provides an individual with full physical ability to work for all the working days during a year. Here we assume fixed values of α and β. Let the constant elasticities of the two factors equal to 0.5. Then an individual's income will be written as the following Cobb-Douglas type function

$$S = (1 + \sqrt{q})\sqrt{h}. \tag{9}$$

Since the individual's utility function reduces to his/her income, his/her health demand is limited by the latter's net pecuniary benefits. These benefits are the difference between the marginal pecuniary benefits of health and its marginal pecuniary cost imposed on the individual by a healthy lifestyle. For simplicity, let the total cost of health C be a linear function of health

$$C = ph, \tag{10}$$

where p denotes a pecuniary price of health. Now we can get hereof an optimum level of health. The maximization problem for the individual's health has the following form

$$\max_h \{(1 + \sqrt{q})\sqrt{h} - ph\}. \tag{11}$$

Solving this problem, we have

$$p = \frac{1+\sqrt{q}}{2\sqrt{h}}. \tag{12}$$

This solution is an inverse function of the health demand. Expressing h from here, we will have a function of health demanded by an individual:

$$h = \left(\frac{1+\sqrt{q}}{2p}\right)^2. \tag{13}$$

Difference between health demands on the part of skillful workers (with $q > 0$) and unskillful ones is

$$q > 0 \Rightarrow h - h_u = \left(\frac{1+\sqrt{q}}{2p}\right)^2 - \left(\frac{1}{2p}\right)^2 > 0, \tag{14}$$

where h_u denotes health demand on the part of unskillful workers. Thus, given the adopted assumptions, health demanded by skillful workers is higher than that demanded by unskillful ones. *Ceteris paribus* (namely, assuming the health price is an exogenous factor), human capital proves to be the only factor increasing health demand comparing with its quantity induced by the opportunity cost of the forced leisure for an unqualified worker.

Health is needed by the individual only for the sake of pecuniary benefits arising from his/her physical ability and, according to (8) and (9), his/her full utilization as a worker is achieved if

$$\sqrt{h} = 1.$$

Using these conditions and (13), we can set a relation between health price and human capital which makes the individual demand just such a quantity of health which enable him/her to utilize all work time:

$$q = (2p-1)^2. \tag{15}$$

Here if human capital is more than $(2p-1)^2$ it provides the individual with more than sufficient incentive to demand health enabling him/her to work for all work time; being human capital less than that expression, its relative pecuniary benefits are not so significant to make it rational for the individual to bear the cost of the lifestyle which is required for the health consistent with his/her full utilization as a worker.

The essence of this model is that human capital determines health behavior via the expected effect of health on the return to skills. So the causation can be summarized as follows: human capital $\longrightarrow$ expected labor income $\longrightarrow$ opportunity cost of leisure (including the forced one) $\longrightarrow$ health behavior $\longrightarrow$ health $\longrightarrow$ the return to skills $\longrightarrow$ expected labor income $\longrightarrow$ etc. Thus, since interdependence between health and the return to human capital is allowed to be known by an individual, he/she demands the more health, the more his/her human capital because of the more opportunity cost of the leisure. In other words, the potential losses inflicted by any kind of invalid condition will be more in case of an individual having a significant human capital because they include the bonus.

The model also gives an opportunity to capture the distinction between human capital and any other kind of capital which can be alienated from its owner. The point of the distinction is the incentives for health behavior.

Consider an individual owning some non-human capital who in addition to the capital dividends earns wage, while lacking any human capital. Then an income function of such an individual will be given by

$$S = b(0)w(h) + y(c), \tag{16}$$

where $y(c)$ is a return to the non-human capital. Then using (16) and (9), we have

$$S = \sqrt{h} + y(c). \tag{17}$$

Now by the same token as in the case of the health demand function, (10), (11), and (12), let us write the inverse function of health demand as

$$S'(h) = p = \frac{1}{2\sqrt{h}}, \tag{18}$$

so that health demand will be determined as

$$h = \left(\frac{1}{2p}\right)^2. \tag{19}$$

Here (18) and (19) are just (12) and (13) if q is set equal to zero. Hence, given the model assumptions, the incentives which determine the health demand are not related to size of the non-human capital since its return does not depend on the capacity for work on the part of its owner.

We are aware of a potential incentive for health care arisen from any wealth, including the non-human capital. A person may take care about his/her health to enjoy his/her wealth, whatever its origin. Owners of both human capital and the non-human one are equally driven by this incentive. At the same time, the specifically pecuniary incentives, formally outlined in our model, are set in motion by only human capital, so that it is the latter, not the non-human capital, that, *ceteris paribus*, is to induce health care if the pecuniary incentive is the only driving force. Otherwise, given all the incentives, human capital is to induce health care more than the non-human capital is. Thus, our analysis, as soon as it is based on the money-metric utility function and thereby abstracts from the non-pecuniary incentives, allows us to draw clear conclusions, while not much distorting the picture.

A more general corollary hereof is that the effect, if any, of the non-human capital on health is not related to the incentives concerning health as a capital asset. The key distinction here is one between human capital non-alienable from its owner, which pays given that is alive and in a good health, and non-human capital capable pay independently on health condition of its owner. At the same time, human capital, like alienable capital, yields return depending on not only its size but also market value. In other words, value of human capital is determined by its cost (for instance, schooling measured in years of education) as well as its expected return which determines demand for it on the part of a tenant (an employer) and a buyer (an employee). In contrast to the model claiming a positive effect of earnings on health, this model implies the same effect, but through the incentives arising from expected earnings forgone due to the forced leisure rather than through the very resources necessary for health care which are provided by any earnings.

4. The model's implications

Our result, though it implies the same relation between human capital and health behavior as the classical idea of Grossman does, still differs from it by both explanation of the relation and implications. Grossman's model (1972, 1973) suggests that education, while being a source of information about a proper technology as to health production, lowers cost of health and thereby, via the income effect, induces higher demand for health. So, the role of education reduces to providing an individual with knowledge as to health care and does not depend on work experience and work-related pecuniary incentives.

The proposed model, in contrast to Grossman's one, links the role of education with the opportunity to earn additional labor income, rather than to the information about a healthy lifestyle. Education induces health behavior only if it provides an individual with additional labor income. Form of the human capital function (5) means that education as such does not pay unless an individual has sufficient abilities and proper work experience. Formal schooling is a necessary, but insufficient condition of having nonzero human capital. Also, even subject to positive human capital, if it yields zero return, which is expressed in (7) as $\alpha = -\infty$, it will have the same effect as that of zero human capital. To sum up, education in our model affects health behavior via the opportunity cost of the forced leisure only so far as it goes along with positive abilities and work experience and, provided all the three factors are positive, subject to positive return to them.

Different transmission mechanism from education to health behavior produces implications distinct from those of Grossman's model. The main theoretical implication is that education does not affect health behavior unless an educated person realizes his/her education for earning the bonus for qualification. Getting such a bonus normally requires employment by specialty obtained in an educational institution as well as proper estimation of an individual's education by his/her employer. Otherwise, education will produce no additional health demand comparing with that on the part of an uneducated person.

A policy implication which can be derived from the theoretical one is that allocation of human resources affects the assumed strategies of health behavior. On macro level such an allocation takes form of aggregate demand for human capital and thereby determines the opportunity cost of loss of physical ability. Hence, the wide-spread lifestyle is to depend on the structure of economy in which it is human capital-intensive industries which are to have key importance for health behavior. It suggests a prediction that the more the share of human capital-intensive industries in an economy, the more health care on the part of people employed therein.

Another practical implication on micro level is that benefits from conformity between an individual's education and his/her work include, along with the purely economic ones, those arising from his/her higher physical ability since more health care is to be took on the part of skilled valuable workers rather than just educated ones, i.e., not education *per se* plays key role, but real skills and inherent capabilities demanded by labor market and thereby providing additional earnings. While these may be important implications for both policy-makers and labor employers, they may also comprise a fruitful theoretical premise for study of economic growth as driven by use of human resources.

These implications seem to fit the mentioned facts which would be abnormal from the perspective of the standard approach relating schooling and health. Russia, though it is characterized by high average level of accumulated years of education, currently has a resource-intensive economy with relatively little demand for skilled labor.

For many people it typically results in work not by a specialty obtained in an educational institution and thereby zero return to human capital. In such a case, any educational certificate as well as the past work experience by the acquired specialty prove to be useless with respect to the human capital bonus above wage. So, many well-trained and experienced specialists do not have jobs according to their level and type of education. Their poor earnings and lack of professional satisfaction make them by their standard of life, habits and health behavior not much differ from those lacking completed education and belonging to common labor (Algieri 2006).

5. A historical retrospect concerning human capital, earnings and workweek

The main point of the presented model should be properly tested against alternative hypotheses by revealing conditions under which it could work. As a preliminary test, one can consider historical trends in human capital, health and earnings. Some facts seem to contradict the main prediction of the model, namely, that through the twentieth century along with growth of per capita income in the Western world, the bulk of which are attributed to accumulation of human capital, there has been persistent shortening of workweek (Becker 1965). So, human capital-related additional earnings appear not have induced people to work more.

Two explanations of these facts which are consistent with the model can be proposed. The first is the lexicographical preferences when it comes to survival rather than utility maximization problem. An opportunity to choose between leisure and labor is present only after crossing survival threshold. In pre-industrial and industrializing times wage used to be fixed at the subsistence level which was usually consistent with the very long working day (1965, Fogel 2004, Cuffaro 2001). Under such conditions, rising wage, while increasing opportunity cost of leisure, was decreasing quantity of labor consistent with the subsistence wage and thereby minimal labor supply necessary for survival. It is reasonable to suppose that the latter effect had to be stronger in case of an individual who was utterly deprived of leisure, namely, under conditions of 12-16 hour working day. Additional earnings first gave people an opportunity to choose between leisure and additional goods, and the first units of the former were to be valued very high and strongly preferred to additional consumption.

The other consideration is related to vanishing difference between labor and leisure in the modern world. As Fogel puts it, the distinction between work and leisure, as activities imposed upon an individual by the economic need and those freely chosen (2004), is becoming more and more obsolete giving rise to another key distinction — one between active life and passive one. Now many activities among those freely chosen are the main source of income for many people. It prompts that people derive income from their human capital in various creative activities, even though not being formally employed. Hence, human capital increases return to any activity, if it has a form of paid work or not, and thereby an opportunity cost of passivity.

6. A prospective empirical research

A prediction arising from the presented model is that the more is the return to an individual's human capital, the more is his/her health care. This prediction, while implying a positive effect of health on earnings, has a similarity with the well-known hypothesis in this field which also predicts this relation on the premise that health enables an individual to work much and intensively (e.g.,

Elstad 2004, Chakraborty and Das 2005). Differences between these hypotheses consist in explanation of the relation in question and its implications. Whereas the mentioned hypothesis attributes the relation to the physical ability arising from health, our model places the main emphasis on the incentives for health care arising from its prospective gains. It is the expected benefits from health which make an individual lead a healthy lifestyle.

Such a change of emphasis involves the issue addressed as well. Namely, we analyze an effect of human capital on health behavior rather than that of health condition on earnings. Actually, our model develops the intuition behind the mentioned hypothesis as it suggests that while that relation holds people are aware of it and take it into account making decisions about a degree of their health care.

Health behavior is assumed to be a pragmatic one. An individual is to take care about health so far as it yields him/her a positive net pecuniary benefit. The more immediate the effect on the physical ability from some rule of a healthy lifestyle, the more is to be the incentive to observe it. To check the validity of the model, one can examine various aspects of health-related lifestyle including various addictions so as to pick out those relevant for testing the main prediction. Specifically, a person rather may neglect the harm of smoking than that of drinking because the latter has an immediate weakening effect on his/her physical ability: a person drunk or having a hangover hardly can work as intensively as a sober healthy person can. One with high value of work time is to be unhappy because of such an effect of drinking while tolerating the prospective weakening effect of smoking in a remote future.

A relevant hypothesis should be tested against alternative hypotheses such as the schooling hypothesis (Grossman 2008), the time preference hypothesis (Fuchs 1982, 2005, Clark et al. 2005) or sociological hypotheses like those related to Wilkinson's model of relative wealth (see, e.g., Anitua and Esnaola 2000, Kaplan et al. 1996).

Like any other one, the used approach has its own limitations. Health behavior depends on various factors among which some may outweigh the effect of the factor in question. For example, in Russia alcohol abuse is much more usual among men than women, so that a male person is likely to drink more spirits even if he is a more paid and educated than a female one. So, the predictions of the model can be tested given the proper specified ceteris paribus.

The approach used here can be developed in another direction as well. Human capital may induce care about an individual's health on the part of not only the individual him/herself, but the other people. The latter aspect may produce a new research in which an emphasis would be laid on the incentives to take care about people's health on the part of employers as far as the latter treat their subordinates as their firms' valuable assets. In the similar fashion, the incentives of state officials can be analyzed.

7. Conclusion

The model presented in this paper identifies the contribution of the return to human capital to a healthy lifestyle. It specifies a classical idea that economic value of a human being determines his/her care about him/herself and extends some established results in the field of health economics making predictions distinct from those in the literature. In particular, it claims that education affects the lifestyle only so far as it provided an individual with the valuable human capital. From the perspective of the model, it is relatively insignificant role of human skills in generating the GDP which accounts for the widespread unhealthy lifestyle in Russia.

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