

Health, Income and Economic Transition: An Econometric Analysis Using Micro-level Data¹

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Abstract

This paper investigates the impact of market incomes on health using individual-level data from the household survey conducted in Ukraine, the second largest transition economy in Eastern Europe and the former Soviet Union. A two-equation simultaneous equation model is used in the regression analysis to address the issue of potential reverse causality between health and income. The model is estimated by using two-stage least squares (2SLS) and three-stage least squares (3SLS) procedures. The observed discrete health variable is transformed into the latent health variable to make the least squares approach tractable. The estimated market income equations are corrected for potential selectivity biases that may arise from using a sample of those individuals only for whom market incomes are observed.

We find a strong causal link from market income to health confirming that higher income individuals tend to be healthier. The inclusion of a number of controls such as age, education, marital status, place of residence, and others does not undermine this relationship. However, evidence in support of a reverse causality (i.e., from health to market income) is weak.

Keywords: health, market income, transition economy, simultaneous equation model

JEL classification: I 1, I 12, C 31

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1. Introduction

The process of economic transition in Eastern Europe and the former Soviet Union has brought about a severe contraction in output, a fall in real incomes and a rise in income inequality and poverty. The data indicate that life expectancy has declined significantly during the transition. These developments pose a question to what extent the health status, which is one of the aspects of the quality of human capital,² is economically determined, and this study seeks to answer it.

This paper uses individual-level data from the 1995 Living Standards Measurement Survey (LSMS) conducted in Ukraine to study the relationship between market incomes and health. Ukraine represents an interesting case to analyze for several reasons. With a total population of 51 million Ukraine is the second largest, after Russia, country in Eastern Europe (EE) and the former Soviet Union (FSU) experiencing the transition from a centrally-planned to market economy, and hence it is quite representative for the transitional region as a whole. While the declines in output had been reversed in most transition economies by mid-1990s, the economic situation in Ukraine continued to deteriorate until very recently. In fact, the magnitude of the economic decline in Ukraine has been the third largest in the transition region - only Moldova and Georgia that went through war conflicts experienced larger declines.³ Macro-level data indicate that life expectancy, the aggregate measure of the nation's health, has fallen (in unison with a sharp decline in real incomes) from 71.0 years in 1989 to 66.9 years by the end of 1995. Since health represents an inextricable component of human capital, it is important to analyze its determinants. The fact that the adverse developments in both real incomes and health in Ukraine have been synchronized since the beginning of transition suggests that these two variables are interrelated. Indeed, a number of studies corroborate this hypothesis for industrialized countries. However, to our knowledge, the mutual relationship between income and health has not been studied yet for transitional countries. This paper attempts to fill this gap, employing a simultaneous health and income equation model that treats health capital and income as jointly determined.

² Human capital, broadly defined as "a stock of knowledge, skills and experience, physical and psychological health" (Kooreman and Wunderink, 1996), is a significant determinant of personal wellbeing and sustainable economic growth. It enters many growth models as a separate variable in addition to labor.

³ The real per capita GDP in Ukraine was declining steadily since 1989. It has fallen to 47% of its 1989 level by the end of 1995, the year of our survey. The decline has continued further and by the end of 1999 real output has reached 36% of its 1989 level. It is only in year 2000 that Ukraine witnessed positive growth for the first time since independence.

However, the fact that health is measured in the survey as a discrete variable makes the simultaneous equation estimation based on the least squares approach intractable. To circumvent this problem, we transform the categorical health variable into a latent health variable. This transformation proves to be convenient for the estimation because the latent variable is assumed to represent values from continuous distribution of unobservable health.

The rest of the paper is structured as follows. Section II briefly reviews some previous literature on the interrelationships between health and incomes. Section III is devoted to the specification of the model and the description of the estimation technique. In section IV the data and variables used in the estimation are described. Section V analyzes the estimation results. Section VI provides concluding comments and policy implications of the findings.

II. Previous Studies

The theoretical framework of health capital as an endogenously determined variable was first developed in Grossman (1972a, 1972b). These theoretical works suggest that the investment in health capital increases with wages as the return to this investment rises, and that better health, in turn, contributes to higher wages through rising productivity and increases in labor supply.

There have been numerous empirical studies testing the relationships between health and wages proposed by these theoretical models. The joint dependence of health and wages is studied in Lee (1982), who used a general simultaneous equation model with multiple discrete health indicators. The data come from the U.S. National Longitudinal Survey of Men. The sample is restricted to males aged 45 to 59 and having positive earnings. The empirical results suggest that wages and health capital are strongly jointly dependent. It was also found that wages have greater effect on production of and demand for health capital than education.

Wagstaff (1986) estimated the health capital equation with health capital as a latent variable using a single equation maximum likelihood framework. Wages are found to be positively and significantly associated with good health. Although being positive, the coefficient for being married or cohabiting is not significant. Age is strongly and negatively related to health status, and living in an urbanized area also adversely affects health.

Haveman et al. (1994) estimated a three-equation simultaneous model consisting of structural equations for health, work-time and wages. The panel estimation (the Michigan Panel Study of Income Dynamics) captures the time dependent nature of the relationship

among these variables. The sample covers males aged 24 to 65 who report positive work-time and labor earnings. On the empirical side, wages are found to be positively and significantly associated with good health. Among other explanatory variables in the health equation, age is positively associated with health limitations while education is associated with better health. Being married is positively related to good health. The amount of work-time is not found to affect health status. In the wage equation years of education and work experience are significant determinants of wages. The presence of health limitations in the prior period is found to be negatively associated with wages. On the methodological side, they found that the estimates from the equation-by-equation estimation differ significantly from those obtained when equations are estimated jointly. This is explained by the fact that the former approach does not account for the endogenous nature of health, work-time and wages.

Sundberg (1996) uses a model similar to one used by Haveman et al. (1994) to study the interrelationship among health, wages and work-hours in Sweden. The sample includes people (both men and women) aged 18 to 76 years who are employed in market work. A discrete self-assessed health variable that consists of three categories is converted into the latent health variable. Wages and health are found to be positively jointly dependent. Long work-hours are negatively related to health, but only for women. Marital status is not found to affect health. Living in a big city adversely affects health, but the finding is significant for men only.⁴ Education is found to be a significant determinant of wages but not of health. Being married is positively associated with wages, but for men only. Wages increase with age at a decreasing rate, and they are higher in big cities.

Case (2001) found a strong link from income to health using household-level data from South Africa. The results of her study, which are based on the estimation of a single health equation, suggest that personal income has a significant positive effect on health even after controlling for age and education. The dependent variable used in the estimation is self-reported health status measured on a five-point scale, and the sample is restricted to adults aged 18 and older. To tackle the issue of potential reverse causality between health and income she also used the eligibility of someone in a household for a state pension as an indicator of household's improved economic welfare (since state pensions in South Africa

⁴ In this study individual is defined as living in a big city if he/she lives in Stockholm, Gothenburg, or Malmo, which are the three largest Swedish cities. Since the environmental situation in these cities is good, and job characteristics such as stressful work are controlled for in the study, it is not very clear

are relatively large). It was found that the presence of a pensioner in a household where incomes are pooled is associated with better health for all household members.

Carlson (2000) used logistic regressions with self-rated categorical health as a dependent variable to study educational differences in health using data from the survey conducted in the Russian industrial town Taganrog.⁵ The sample is restricted to individuals aged 25 to 54 years. Significant health differences between educational groups were found in the regressions that do not control for people's material prosperity. However, when either subjective self-assessed material prosperity or the household's per adult equivalent income have been introduced among explanatory variables, the educational differences in health turn insignificant. Economic prosperity, whether measured by subjective or objective measure, though, has been found to be strongly and positively associated with health. These findings suggest that education affects health through the delivery of material prosperity. Age is found to be strongly related to the probability of reporting bad health. Women are found to report poor health more often than men. The effect of marital status on health is not significant. The interesting finding is that good family relations are associated with better self-rated health irrespectively of material prosperity.

However, logistic regression, as any other approach based on the estimation of a single equation, does not account for the potential reverse causality between health and material prosperity. To do that one needs a simultaneous equation model that allows for their mutual interdependence. To our knowledge, up to date there is no single study that applies a simultaneous equation model framework to investigate the relationship between incomes and health in transition economies. That is what we do in this paper.

III. The Model

The model consists of two structural equations with health status and market income being jointly dependent. The setup of the model is very similar to one used by Lee (1982), and has the following structure:

$$H = \hat{a}_0 + \hat{a}_1 * Y + \hat{a}_2 * X_1 + e_1; (1)$$

$$Y = \hat{a}_0 + \hat{a}_1 * H + \hat{a}_2 * X_2 + e_2; (2)$$

where the negative effect of a big city on health comes from. Probably it is a hasty life pace in big cities that matters.

⁵ The self-assessed health status on a five-point scale has been dichotomized in this study into "good" and "poor". This approach wipes out a lot of information and increases measurement error.

where H is the individual's health status, Y is the individual's market income, X_1 and X_2 are vectors of personal characteristics (that are allowed to differ across equations), e_1 and e_2 are disturbance terms.

We adopt the approach of Wagstaff and van Doorslaer (1994) in assuming health to be a continuous latent variable that underlies the self-assessed health categorical variable.⁶ This latent variable is constructed as follows. Suppose that the self-assessed health variable, H_S , has J categories, where 1 represents very bad health and J very good health. Then the relationship between the categorical variable H_S and a continuous latent health H_L can be expressed in the following way:

$$\begin{aligned} H_S = 1 & \text{ if } -\infty < H_L < \alpha_1; \\ H_S = 2 & \text{ if } \alpha_1 < H_L < \alpha_2; \\ H_S = 3 & \text{ if } \alpha_2 < H_L < \alpha_3; \\ & \dots \\ H_S = J & \text{ if } \alpha_{J-1} < H_L < +\infty; \end{aligned}$$

where α_{J-1} represents $(J-1)^{\text{th}}$ threshold.

To estimate the numerical values for thresholds, H_L is assumed to have a standard normal distribution. Then $(J-1)^{\text{th}}$ threshold can be computed as:

$$\hat{\alpha}_j = \Phi^{-1} \left(\sum_{i=1}^j n_i / N \right), \quad j = 1, 2, \dots, J-1;$$

where Φ^{-1} is the inverse standard normal cumulative distribution function, n_j the number of individuals belonging to category j , and N the total sample size. In fact, the area under the standard normal distribution is divided proportionally to the number of individuals in each category.

We then estimate the mean value of H_L for each interval using the formula for the mean of the truncated normal distribution (Maddala, 1983).

If the truncation is from above, so that we consider the distribution $H_L < \alpha_1$ (i.e. the first interval), then:

⁶ For the application of this approach to Swedish data see Sundberg (1996).

$$E(H_L) = \frac{-f(\mathbf{a}_1)}{\Phi(\mathbf{a}_1)} = \hat{Z}_1;$$

For the truncation from below, that is when $H_L > \alpha_{J-1}$, we have:

$$E(H_L) = \frac{f(\mathbf{a}_{J-1})}{1 - \Phi(\mathbf{a}_{J-1})} = \hat{Z}_J;$$

Finally, if the distribution is truncated from both sides, so that $\alpha_j < H_L < \alpha_{j+1}$ (for $j = 1, 2, \dots, J-2$), then:

$$E(H_L) = \frac{f(\mathbf{a}_j) - f(\mathbf{a}_{j+1})}{\Phi(\mathbf{a}_{j+1}) - \Phi(\mathbf{a}_j)} = \hat{Z}_j;$$

where $\Phi(\cdot)$ denotes the cumulative distribution function and $f(\cdot)$ the density function of the standard normal distribution, and \hat{Z}_j ($j = 1, 2, \dots, J$) are calculated mean values.

To take into account the skewed nature of the self-reported health status⁷ and to avoid the negative values of the latent health variable, we assume that $\hat{Z}_j = -\ln(H_{L(j)})$, so that $H_{L(j)} = \exp(-\hat{Z}_j)$, where $H_{L(j)}$ are the values in a standard lognormal distribution that correspond to the values \hat{Z}_j in a standard normal distribution.⁸ The estimated values of the latent health variable based on the assumption that H_L has a standard lognormal distribution are presented in Table 1.

Table 1. Calculated values of the latent health variable

Categorical health variable	Frequency (%)			Latent health		
	All sample	Men	Women	All sample	Men	Women
1 (very bad)	8.31	5.52	10.41	6.306	16.013	4.352
2 (bad)	22.26	17.28	26.00	2.430	3.139	2.139
3 (satisfactory)	44.54	43.06	45.65	0.927	0.925	0.929
4 (good)	23.30	31.46	17.18	0.304	0.414	0.199
5 (very good)	1.59	2.68	0.77	0.082	0.226	0.006

Source: Author's calculations.

⁷ In our case the distribution is skewed toward bad health outcomes. That can be a specific feature of transition (or low-income) economies, because for industrialized countries the opposite (i.e. the distribution is skewed toward good health outcomes) is generally true.

⁸ By performing this transformation we obtain health variable that is increasing in *ill* health.

A simultaneous equation model consisting of equations (1) and (2) is estimated using a three-stage least squares (3SLS) procedure (Zellner and Theil, 1962). Since the endogenous health variable enters as explanatory variable into the income equation, and the endogenous income appears as a regressor in the health equation, the disturbances are correlated with the endogenous variables violating the assumptions of OLS. Furthermore, the disturbance terms between the equations are expected to be correlated. 3SLS procedure involves an instrumental variable approach to produce consistent estimates and GLS technique to account for the correlation structure in the error terms between the equations.⁹ The data and variables that we use in the estimation are described in the next section.

IV. The Data

We use data from the 1995 Living Standards Measurement Survey (LSMS) conducted in Ukraine by the Kiev International Institute of Sociology (KIIS) and the World Bank. The sample was drawn in a way that ensures its randomness, with an equal probability for each household to be selected. The response rate was equal to 84 percent. The sample is nationally representative and it consists of 4,567 respondents in 2,024 households.¹⁰ The sample used in the analysis comprises 1,836 individuals since for the purpose of our analysis we include only those people who reported to be employed in market work and to have positive work-hours and positive incomes during the month preceding an interview.¹¹ However, the fact that we do not consider in our analysis people outside of the labor market has an important limitation. It may well be that someone is not involved in market work due to severe health problems. If this is the case, then by not including such individuals in the analysis we would underestimate the effect of health on market income. The survey's design, however, does not allow us to identify with certainty all

⁹ Although the use of OLS under violated assumptions will result in biased and inconsistent estimates, the use of 3SLS procedure is not free from a caveat either. The use of the covariance matrix of the equation disturbances improves the efficiency of the three-stage estimator. However, in the case when at least one equation in the system is misspecified, the resulting parameter estimates would be biased and inconsistent (Green, 1997).

¹⁰ To acquire more detailed information on the sample design and data collection one can consult Technical Report on the Project "Household Income and Expenditures in Ukraine, Ukraine-95" prepared by KIIS and the World Bank, which is available on request from either of them.

¹¹ In our analysis we focus on the relationship between *market* income and health because it is only market income that directly depends on individual health capital. Although disability allowances are also determined by health, other social transfers, such as pensions, stipends, etc., are a function of one's social assistance status rather than health.

those cases in which unemployment was due to health limitations.¹² Even if that was possible, another problem would emerge. The inclusion of those individuals who do not participate in the labor market because of health problems, and hence do not earn any market incomes, would bias downward the parameter estimates on other (except health) determinants of incomes (such as work experience, education, etc.). That is why in our study we prefer to focus on those people who are employed in market work. However, the estimated market income equation is corrected for potential sample selection biases following the approach developed by Heckman (1979). We first estimate the sample correction term (also known as the inverse of Mills' ratio) using probit equation of labor market participation. This term is then used as a regressor in the market income equation to get consistent estimates of the coefficients. The estimation procedure and regression results are described in detail later in the paper.

The individual health status is represented in the survey by self-rated health according to a five-point scale.¹³ Although it is argued that self-assessed health includes some element of subjectivity, a number of studies suggest that it represents a reliable measure of health capital (Grossman, 1972; Kemna, 1987). Humphries and van Doorslaer (2000) find that health status measured by (subjective) self-rated health is not significantly different from that obtained using (objective) Health Utility Index score, which is based on functional status estimated in eight domains.

In the estimations we utilize the latent health variable constructed in the previous section. Explanatory variables in the health equation include individual market income, age, education, and dummies for marital status, living alone (i.e., in a single-person household), residence in a big city, administrative region, and being overworked. The choice of variables is guided by the following considerations. The individual's market income (income from any kind of work) during the previous month is used as a measure of economic prosperity. Higher income is expected to lead to better health through improved nutrition, health care and, probably, richer social life. It is also suggested by Grossman (1972b) and Lee (1982) that larger income induces a person to invest more in health.

Aging reflects the process of natural deterioration of personal health.

¹² The respondents were not directly asked why they were, if at all, unemployed during the previous week/month. It is only in the case if the respondent was unemployed and not looking for employment over the previous week that he/she was asked about the reason for not *seeking* employment. Among possible answers was a sick leave over the past week. That is not likely to be a very reliable source of information since even otherwise generally healthy people could be sick over a short period.

Being married is thought to have a positive impact on one's health for a variety of reasons. It could be that married people have better health than singles because they support each other, share their knowledge of health care facilities, and have less volatile incomes. It has been argued that family support has a strong positive effect on individual's health. Good family relations are found, irrespectively of material prosperity, to substantially decrease the probability of having a bad health (Carlson, 2000). It is probably for the reason of absent family support that the same study finds that individuals from one-person households are more likely to report bad health. Since the importance of family support could be especially profound in times of economic hardship¹⁴ we include a single-person household dummy in our model to test whether this factor is a significant determinant of health in Ukraine.

Education is expected to be positively associated with health because better educated people tend to be better aware of their health problems and hence to take due measures to prevent them.¹⁵ However, due to almost universal adult literacy and generally high level of education among Ukrainians the majority of the population is likely to respond more or less adequately to their health problems. It is rather the lack of financial resources than low awareness that is expected to prevent people from going to the hospital or from purchasing necessary medicine.

Living in a big city can be detrimental to health because of high pollution and generally more stressful working environment than in rural areas. At the same time, city dwellers may be thought to enjoy the access to better health care services, which should have positive impact on health. However, when health care services are no longer free, as it was in the socialist past, the prices of medicine are high, and the practice of requiring "under-the-table" payments by health care workers for providing services is widespread (the World Bank, 2000), this advantage of living in a big city can be seriously questioned.

We also include dummies for administrative regions to capture regional differences in environmental conditions. The use of the dummy for working long hours is motivated by the fact that a sharp decline in real incomes during the transition makes many people take additional job and/or work extra hours. Although longer work-hours provide higher incomes and hence can indirectly affect health in a positive way through, for example, better nutrition,

¹³ The respondent has been asked the question "What do you think your health is? Is it very bad, bad, satisfactory, good or very good?"

¹⁴ In Ukraine real incomes declined by three times since the beginning of transition, and unemployment rate is estimated to be about 10-20 percent.

¹⁵ The better awareness, on the other hand, may result in reporting poorer health for a given objective health status by more educated. However, we do not believe this effect to be significant.

it is very likely that overworked people jeopardize their health by having insufficient leisure time to rest.

The specification of the income generating function is very similar to that used in the literature on returns to education. The only difference is that the health variable is included in the income equation to directly measure the effect of health capital on income. Better health is expected to be positively related to the market income through increased productivity and/or work-hours. The positive effect of health on income may also come from the fact that for a given level of education healthier people may undertake jobs requiring higher efforts. Age enters the wage equation as a proxy for market experience. The squared value of age is included to account for the commonly found inverted U-shape relationship between age and income. The investment in formal schooling, measured by years of education, provides better job opportunities and hence is expected to generate higher incomes. Income-generating capacity also depends much on one's location. In Ukraine there are profound inequalities in job prospects across cities, towns and villages, and to account for these we include the respective dummies in our income equation. We also include dummies for administrative regions to capture geographical heterogeneity in labor market conditions. The definitions of all variables used in the model and their descriptive statistics are provided respectively in tables A1 and A2 in the Appendix.

V. Empirical results

We first present the regression results from the estimation of the (ill) health and market income equations that does not correct for the potential selection bias in the estimation of the income equation.¹⁶ The model is estimated by using 2SLS and 3SLS procedures.¹⁷ These results are presented in Table 2 (see *Regression Results*).

We start the discussion of the results with noting that 3SLS estimates are generally very similar to 2SLS estimates. The only major difference is that living in a single-person household appears to be negatively (positively) associated with health (ill health) when we

¹⁶ Since the variable “ill health” is increasing in *bad* health the negative coefficient on the determinant of health implies *positive* effect on health, and vice-versa.

¹⁷ It is well known that, relative to 2SLS procedure, 3SLS estimation is expected to produce, given the validity of our specification, more precise parameter estimates since it takes into consideration the covariance between the parameters of the equations. However, with 2SLS, as no covariance is calculated between the estimates of the equations, the misspecification of one equation will not affect the parameter estimates of another equation. That is why we report the results obtained from using both procedures. Another substantial reason for reporting 2SLS results is that they give a basis for comparison with those results that we get when correcting for potential selectivity bias.

use 2SLS, but does not seem to matter when we deploy 3SLS procedure. In the market income equation the parameter estimate on health is more significant when 3SLS is used, while gender dummy becomes marginally significant with the use of 2SLS. The other results, however, are very similar, and we take 3SLS estimates as a reference for the description of the results (from Table 2) that follows below.

In the health equation, the parameter estimate on income suggests that health increases with income. The estimated coefficient implies that a 10 percent increase in market income would raise health at the mean by 6 %. At this income elasticity of health a doubling of income is needed to improve one's health from satisfactory to good. Alternatively, more than a triple contraction in market income is required to impose a shift in the health status from satisfactory to bad.¹⁸ An observed causal link from income to health is expected to work through different ways. A decline in income is likely to worsen nutrition and lower medical care and recreation expenses. A sharp decline in real incomes for many people in Ukraine has led to increased impoverishment. It is estimated that the incidence of absolute poverty has risen from about 9 percent in 1991 to 31 percent in 1995.¹⁹ That has undoubtedly led to the increased prevalence of malnutrition. The real value of public health spending per capita has decreased in Ukraine by more than twice during the transition. If not officially, then unofficially medical care facilities were no longer free. Hence, in the absence of the effective medial insurance system, medical treatment became available to those only who could pay for it out-of-the-pocket. As a number of studies indicate (e.g., Case, 2001) a decline in income could also negatively affect health through the increase of psychosocial stress.

As indicated by insignificance of the gender dummy in the health equation, the health status of men does not appear to be considerably different from that of women. As expected, age, a proxy for the natural process of health deterioration, is associated negatively with health. An extra year of living at the mean would deteriorate health at the mean by 2.1 percent. In the alternative specification we also included the quadratic term for age in the health equation to capture potential non-linearity in the relationship between health and age, but it was not found to be significant. It could be that the found strong *linear*

¹⁸ These calculations, however, do not take into account that income elasticity of health is likely to differ at various income levels.

¹⁹ The latter estimate is based on the same survey as the one used for the analysis presented in this paper.

relationship between health and age is driven by the fact that only able to work individuals (i.e., those having positive market incomes) are included in the analyzed sample.

Being married has turned out to have no significant effect on health. However, the 2SLS parameter estimate on the marital status is marginally significant and it suggests, rather surprisingly, that married people tend to have worse health.

Living in a single-person household does not appear to be a crucial determinant of health when the model is estimated by 3SLS. The respective parameter estimate is significant, though, when 2SLS is used, and suggests a strong negative effect of this factor on personal health.

Education is not found to affect health. It could be that, as was argued, the overall high level of education of Ukrainian people makes them more or less equally aware of their health problems. We have also estimated the model with dummies for different levels of education instead of years of education. The results (not shown for the sake of brevity) indicate that, controlling for other factors, people with above primary education tend to have better health than people with no or below primary education.

The empirical evidence does not support the hypothesis that working long hours negatively affects health. On the contrary, there is even a weak evidence that extra hours of work may be positively associated with health. This may be due to the fact that the adverse effect of long work hours on individual health is counterbalanced (or even over-compensated) by the positive effect of extra income from additional hours of work.²⁰

People living in big cities are not found to have poorer health than people living elsewhere. We do, however, find a strong effect of living in certain geographical regions (as compared to living in the capital city of Kiev) on health. For instance, individuals living in Kiev suburbs and highly industrialized region of Kharkov tend to report poorer health than Kiev residents. At the same time, the residents of Trans-Carpathian, Lvov and Khmelnytsky – the western regions of Ukraine adjacent to Carpathian Mountains and known for their better, relative to other regions, environmental conditions (in fact, a lot of recreational facilities are located there) – tend to have better health.

In the income equation, we find some evidence that healthier individuals tend to have higher market incomes, although the parameter estimate is highly statistically significant using the 3SLS only. The parameter estimate indicates that a 10 percent worsening in health at the

²⁰ We cannot rule out, however, that it is mostly healthier individuals who may choose to work long hours in the first place. Empirical results (not reported here) also show that there may exist a threshold level above which extra working hours indeed become detrimental to health.

mean would lower market income by 6.2 %. A significant casual link from better personal health to higher individual income was also found in many studies of both industrialized (Lee, 1982; Wagstaff, 1986; Sundberg, 1996) and developing (Murrugarra, 1999; Parker, 1999) countries.

Somewhat surprisingly, we do not find any evidence, as indicated by the parameter estimate from the 3SLS estimation, that women are discriminated in the Ukrainian labor market, although the marginally significant coefficient from the 2SLS estimation indeed suggests that.

Years of education and age (a proxy for working experience) are positively and significantly associated with market incomes. An extra year of education at the mean would increase market income by 4.1 percent. At the same time, an additional year of market experience would raise income by 3.8 percent. The negative coefficient on age squared confirms to a common finding that years of experience have a diminishing marginal return. The parameter estimates on age and age squared suggest that market incomes tend to increase until the age of 57, and then start to decline.

Married people are found to have on average 14 percent higher market incomes than single people. City dwellers and individuals living in towns are not found to enjoy higher incomes than people living in villages. However, when we estimated the same model, but without dummies for administrative regions, the city dummy coefficient was significant and implied that city residents get on average 12 percent higher incomes than villagers. Hence, it seems that regional dummies tend to capture some effect that is otherwise attributable to the city residence dummy.

Dummies for geographical regions indicate that there is a substantial heterogeneity in the labor market conditions across Ukraine. The picture that clearly emerges is that income-generating opportunities in the western parts of Ukraine are much worse than in the city of Kiev, while Kharkov region is doing relatively well in this respect. To consider two extremes, we find that in Volyn region market incomes are on average 84% lower than in Kiev, while in Kharkov region they are twice as high.

Estimation with correction for sample selection bias

This section addresses the possible importance of sample selection bias that can result from using a sample of only those individuals who participate in the labor market. We estimate the probability of participating in the labor market to obtain a sample correction term, which is then used to correct the reduced-form market income equation. The fitted

values of the market income that we get from the reduced-form market income equation are then used as an instrument for market income in the estimation of the structural-form health equation. Conversely, we estimate the reduced-form health equation to obtain fitted values of health that are then used as instruments in the estimation of the structural-form market income equation. This is a two-stage estimation method proposed by Lee (1981), which is analogous to the 2SLS that takes into account the necessary selection correction.

The results of the probit model of labor market participation are reported in Table 3 (see *Regression Results*). The model is estimated for the whole sample, and also for separate samples of men and women. The results indicate that the likelihood of participation increases until some age, and then decreases. This threshold level of age is estimated to be 42 years for women and 40 years for men. The parameter estimate on the gender dummy suggests that men have better chances of labor force participation. We find that people with vocational school and complete university education are more likely to participate in the labor market than people with primary education. Being married is associated with higher probability of entering the labor force for men, but not for women. The coefficient on the dependency ratio, which we define as the number of children at home divided by the number of adults, although being positive, is not significant. Finally, we find that availability of the non-market income (pensions, social assistance, stipends) makes one less likely to enter the labor force.

Based on the estimation of the probit equation for the whole sample and for separate samples of men and women we derived the inverse of the Mill's ratio (Heckman, 1979) that was then used in the respective reduced-form market income equations to obtain fitted values of income. The results from the estimation of the reduced-form equations (not reported here for brevity) suggest, though, that sample selection bias does not represent a problem, since the parameter estimates on sample correction terms are not statistically significant at any conventional level.

Nevertheless, in what follows we report the results of the estimation of structural equations for health and market income that we obtain with and without sample selection correction. The results of the 2SLS estimation of the health and market income equations with correction for sample selection bias are reported in Table 4 (see *Regression Results*). In the same table we report the previously obtained results of the 2SLS estimation of the same model with no correction for possible sample selection bias.

The results presented in Table 4 show that results obtained with and without correction for sample selection bias are very similar. The only substantial difference we note is that the parameter estimate on the gender dummy is larger in magnitude and significance in the estimation with correction. The coefficient suggests that market incomes of *women* tend to be, other factors being equal, 29 percent lower than those of men. The parameter estimate on education also appears to be higher in the case with correction, suggesting that an additional year of education at the mean would increase market income by 5.9 percent. The parameter estimate on market income in the health equation is robust to the estimation of the model with correction for sample selection bias, and it is very similar to the parameter estimate from the 3SLS estimation discussed above. The same cannot be said, however, about the coefficient on health in the market income equation, which turns to be insignificant.

We next estimate the model separately for men and women using the same estimation procedure. For comparative purposes, we report the estimation results from the 2SLS estimation with correction for sample selection bias alongside with those 2SLS results where such correction was not made. The estimation results for women and men are shown in respectively Tables 5 and 6 (see *Regression Results*).

In the health equation, market incomes are found to be negatively associated with health for both women and men, although the effect for women is only marginally significant. The parameter estimates on market income suggest that a 10 percent decline in market income would be associated with 5.1 and 6.6 percent deterioration in health respectively for men and women.²¹ Age is strongly and negatively related to the health status, and the effects of age on health seem to differ for men and women. The estimated age coefficients imply that an increase in age at the mean by 1 year would undermine health at the mean by 2.6 and 1.9 percent for respectively women and men. Education is not found to affect the health of neither women nor men. Living in a single-person household is negatively associated with health for women, but not for men. Marital status and big city residence are not significant determinants of health for both women and men.

In the income equation for women, market income is indicated to increase in age at a diminishing rate. The estimated threshold level of age after market income begins to decline is 42.7 years. Education has a strong positive effect on incomes of women. An extra year of education at the mean is associated with 5.1 percent increase in market income. Being

²¹ The trends in life expectancy for transition economies also suggest that life expectancy for men is more responsive to economic and social conditions than life expectancy for women.

married is found to be positively associated with incomes, but the coefficient is only marginally significant. It suggests, nevertheless, that market incomes of married women are on average 13.8 percent higher than those of single women. Dummies for city and town residence versus village residence are not found to be significant. However, when the model is estimated without dummies for administrative regions (the results are not shown) women living in towns are found to be 22 percent worse off in monetary terms than women living in villages. As before, dummies for geographical areas indicate that residence in certain parts of Ukraine is associated with significant income limitations of women.

In the income equation for men bad health is found to have a negative effect on market incomes, although the parameter estimate is only marginally significant. Age, a proxy for market experience, also appears to affect the market incomes of men, although the parameter estimate is significant only if the model is estimated with correction for sample selection bias. In contrast to the case of women, there is no evidence whatsoever of an inverted relationship between incomes and market experience for men. That market experience is a poor predictor of market incomes for men could probably be explained by the fact that many men have changed jobs and/or moved from the state to the private sector in search of higher wages during the period of economic transition.²² This is likely to have resulted in the destruction of the job-specific capital. Another possible explanation is that due to rising unemployment and poor labor market prospects a lot of skillful people had to assume jobs that, despite paying decent wages, did not remunerate previous experience.²³ The same argument could be applied to explain the insignificance of the education coefficient. It may also be that education is not a significant determinant of market incomes for men because individuals with low levels of education who work in hard manual jobs are expected to be compensated by higher wages. For women, the engagement in jobs requiring manual labor is limited, and hence education for them may be more important determinant of income than for men.²⁴ Similar to the case of women there were found significant geographical differences in market incomes for men, although a set of regional dummies for men is slightly different from that of women.

²² For women, labor mobility has been generally limited by discrimination in the labor market. It is a common practice that women are refused to be given jobs (especially in the private sector) because employers are reluctant to pay maternity leaves.

²³ Among such jobs are commercial trips, retail trade, flats' repairs, private taxi, etc.

²⁴ A significant effect of education on market income for women can also stem from the fact most of the women are employed in the public sector where educational premium is higher than that in the private sector.

The regression results on the determinants of market incomes, however, seem to indicate the need of the further research on this issue for transition economies.

VI. Conclusions

In this study, we have estimated a two-equation simultaneous equation model of joint determination of health and market income using individual-level data from the household survey conducted in Ukraine. The main research objective has been to investigate the effect of incomes on health. The health capital variable used in the estimations was obtained by transforming a discrete self-rated health variable into a latent variable. This allowed us to estimate the model by the least squares approach.

The model was estimated by using the two-stage least squares (2SLS) and three-stage least squares (3SLS) procedures. A simultaneous equation model approach allowed us to address the issue of potential reverse causality between health and market incomes. This approach has not been employed yet in studies of the relationship between health and incomes in transition countries. We have also used the estimation technique that allowed us to correct for the potential sample selection bias.

The results from the estimation of the health equation indicate that incomes have a strong positive effect on health. In other words, individuals with higher incomes tend to be healthier. We have found that a 10 percent decline in market income is associated with 6 percent deterioration in individual health. Therefore, a profound decline in real incomes during the transition is expected to have serious implications for human capital by undermining the health status of the population. The found relationship between health and market incomes suggests, on the other hand, that the restoration of economic growth and the creation of new jobs in Ukraine could be very effective in raising population's health. A withered provision of public health care and increased out-of-pocket medical expenses in Ukraine and other transition economies indicate an increasing role of private incomes in maintaining good health.

Age is found to significantly affect the health of both men and women, although the affect for women appears to be stronger.

Women living in single-person households are found to report poorer health than those residing with other family members. That suggests that family support can be an important determinant of personal health. Being overworked does not appear to affect health. We argue that the expected negative effect of working long hours on health could be counterbalanced by extra incomes earned during these hours. Years of schooling were not found to affect health. There appears to be a strong evidence for substantial geographical heterogeneity of the health status in Ukraine.

The results from the estimation of the income equation are generally in line with those found in studies on the returns to human capital. We have found that incomes increase with age (a proxy for experience) at a diminishing rate, although this result is supported for women only when the model is estimated separately for men and women. Most of the regression results indicate that women are discriminated in the labor market. Education is strongly and positively associated with incomes for women only. An extra year of education at the mean is expected to increase market income by 5.1 percent. Married women tend to have higher incomes than singles. Geographical factor appeared to play a substantial role in income-generating opportunities for both men and women. As some conventional factors explaining market incomes were found to be less significant for men than for women, we have advanced several arguments of why that could be the case in Ukraine.

Health has not been found to strongly affect market incomes of employed individuals. Although there is some evidence that health limitations are associated with lower market incomes for men, this evidence is not very strong. We argue that the absence of a strong causality from health to market incomes could probably be explained by weak social protection during the transition, which made even people with health limitations to work. Another possible explanation is that depressed labor markets put an upper bound on incomes even for healthier people.

The results reported in the paper are found to be fairly robust to the choice of the estimation methodology. Sample selection bias has not been found to represent a substantial problem. The parameter estimates obtained using correction for sample selection bias were largely very similar to those when no such correction has been made.

REGRESSION RESULTS

Table 2: Estimates from the two-equation simultaneous model of health status and market incomes

Explanatory variable	Three-stage least squares		Two-stage least squares	
	Dependent variable		Dependent variable	
	Ill health	Log (market income)	Ill health	Log (market income)
Intercept	5.626*** (.136)	7.362*** (.379)	5.336*** (1.589)	7.143*** (.407)
Ill health	-	-.564** (.247)	-	-.429* (.264)
Log (market income)	-.663*** (.209)	-	-.624*** (.215)	-
Sex	-.107 (.082)	.138 (.093)	-.119 (.083)	.184* (.098)
Age	.024*** (.002)	.038*** (.010)	.023*** (.002)	.044*** (.011)
Age squared / 100	-	-.033** (.013)	-	-.044*** (.015)
Married	.126 (.077)	.131** (.060)	.145* (.078)	.116* (.065)
Single-person household	.161 (.117)	-	.390** (.154)	-
Overworked	-.091* (.054)	-	-.030 (.067)	-
Education	-.004 (.022)	.041** (.016)	-.007 (.022)	.048*** (.017)
Big city	.072 (.060)	-	.060 (.085)	
City ^a	-	.063 (.047)	-	.015 (.062)
Town ^a	-	-.032 (.047)	-	-.032 (.078)
<i>Regional dummies^b:</i>				
Kiev Region	.395** (.186)		.378* (.195)	
Vinnitsa	-.519** (.241)	-.336** (.159)		-.378** (.162)
Volyn		-.614*** (.208)	-.511** (.247)	-.602*** (.211)
Trans-Carpathian	-.498** (.208)	-.499** (.201)	-.505** (.214)	-.479** (.203)
Ivano-Frankovsk	.333* (.202)			
Lugansk		-.426*** (.151)		-.442*** (.153)
Lvov	-.311* (.163)	-.289* (.160)	-.319* (.169)	-.285* (.161)
Nikolaev	-.374** (.174)		-.379** (.180)	
Odessa		-.253* (.147)		-.291* (.150)
Poltava				-.326* (.195)
Ternopol		-.545* (.303)		-.546* (.307)
Kharkov	.582*** (.202)	.742*** (.142)	.542** (.212)	.712*** (.145)
Khmelnytsky	-.480** (.211)	-.593*** (.169)	-.479** (.216)	-.595*** (.171)
Chi2 (3SLS)	432.9	314.1	-	-
Prob. > Chi2	0.0000	0.0000	-	-

F-value (2SLS)	-	-	12.65	9.30
Prob. > F	-	-	0.0000	0.0000
N. of observations	1836	1836	1836	1836

Note: The standard errors are given in parentheses. ^a – village dummy is the omitted category. ^b – Kiev city is the omitted category. For regional dummies we report only those that are significant.
*, **, *** - indicate significance at respectively 10, 5 and 1% level;

Table 3: Probit estimates of probability of labor force participation (i.e., of having positive market income)

Explanatory variable	All Sample	Women	Men
Intercept	-1.962*** (.160)	-2.118*** (.213)	-1.558*** (.239)
Age	.105*** (.008)	.121*** (.010)	.080*** (.012)
Age squared / 100	-.126*** (.009)	-.144*** (.012)	-.100*** (.013)
Sex	.105** (.042)	-	-
<i>Educational dummies</i> ^a :			
No education	.080 (.212)	.077 (.233)	.263 (.589)
Incomplete Secondary	-.149* (.088)	-.148 (.115)	-.131 (.136)
Complete Secondary	.078 (.085)	.062 (.112)	.111 (.132)
Vocational (Specialized) School	.198** (.082)	.182* (.108)	.219* (.127)
Incomplete University	.208 (.155)	.083 (.219)	.360 (.224)
Complete University	.340*** (.092)	.271** (.121)	.420*** (.143)
Married	.080 (.050)	-.069 (.062)	.372*** (.093)
No. of children / No. of adults at home	.033 (.063)	.023 (.083)	-.030 (.100)
Non-market income dummy (1 if yes)	-.420*** (.051)	-.408*** (.065)	-.447*** (.083)
Log likelihood	-2601.20	-1444.39	-1147.10
LR Chi2(12)	1015.87	612.47	388.25
Prob. > Chi2	0.0000	0.0000	0.0000
Pseudo R ₂	0.1634	0.1749	0.1447
N. of observations	4521	2586	1935

Note: The standard errors are given in parentheses. ^a – primary education is the omitted category.
*, **, *** - indicate significance at respectively 10, 5 and 1% level;

Table 4: Estimates from the two-equation simultaneous model of health status and market incomes (2SLS with correction for sample selection bias)

Explanatory variable	2SLS (with correction)		2SLS (without correction)	
	Dependent variable		Dependent variable	
	Ill health	Log (market income)	Ill health	Log (market income)
Intercept	5.521*** (1.352)	6.857*** (.332)	5.336*** (1.589)	7.143*** (.407)
Ill health	-	-.212 (.211)	-	-.429* (.264)
Log (market income)	-.649*** (.183)	-	-.624*** (.215)	-
Sex	-.112 (.071)	.255*** (.081)	-.119 (.083)	.184* (.098)
Age	.023*** (.002)	.046*** (.010)	.023*** (.002)	.044*** (.011)
Age squared / 100	-	-.053*** (.013)	-	-.044*** (.015)
Married	.150** (.067)	.090 (.063)	.145* (.078)	.116* (.065)
Single-person household	.391*** (.132)	-	.390** (.154)	-
Overworked	-.026 (.057)	-	-.030 (.067)	-
Education	-.005 (.019)	.059** (.014)	-.007 (.022)	.048*** (.017)
Big city	.060 (.072)	-	.060 (.085)	
City ^a	-	.010 (.047)	-	.015 (.062)
Town ^a	-	-.061 (.073)	-	-.032 (.078)
<i>Regional dummies^b:</i>				
Kiev Region	.376** (.167)		.378* (.195)	
Vinnitsa	-.519** (.241)	-.395*** (.152)		-.378** (.162)
Volyn	-.523** (.211)	-.538*** (.192)	-.511** (.247)	-.602*** (.211)
Trans-Carpathian	-.513*** (.183)	-.438** (.205)	-.505** (.214)	-.479** (.203)
Ivano-Frankovsk	.306* (.177)			
Lugansk	-.311* (.166)	-.408*** (.140)		-.442*** (.153)
Lvov	-.324** (.144)		-.319* (.169)	-.285* (.161)
Nikolaev	-.383** (.154)		-.379** (.180)	
Odessa		-.321** (.138)		-.291* (.150)
Poltava		-.341* (.182)		-.326* (.195)
Ternopol		-.483* (.282)		-.546* (.307)
Kharkov	.558*** (.181)	.704*** (.136)	.542** (.212)	.712*** (.145)
Khmelnytsky	-.492** (.184)	-.520*** (.150)	-.479** (.216)	-.595*** (.171)
Chi2 (3SLS)			-	-
Prob. > Chi2			-	-

F-value (2SLS)	17.37	10.69	12.65	9.30
Prob. > F	0.0000	0.0000	0.0000	0.0000
Adj. R ²	0.2274	0.1484		
N. of observations	1836	1836	1836	1836

Note: The standard errors are given in parentheses. ^a – village dummy is the omitted category. ^b – Kiev city is the omitted category. For regional dummies we report only those that are significant.

*, **, *** - indicate significance at respectively 10, 5 and 1% level;

Table 5: Estimates from the two-equation simultaneous model of health status and market incomes **for women** (2SLS with correction for sample selection bias)

	2SLS (with correction)		2SLS (without correction)	
	Dependent variable		Dependent variable	
Explanatory variable	Ill health	Log (market income)	Ill health	Log (market income)
Intercept	3.801** (1.927)	6.805*** (.366)	3.639* (2.075)	6.840*** (.380)
Ill health	-	-.098 (.209)	-	-.150 (.255)
Log (market income)	-.462* (.255)	-	-.440 (.275)	-
Age	.029*** (.003)	.053*** (.013)	.029*** (.003)	.053*** (.013)
Age squared / 100	-	-.062*** (.017)	-	-.060*** (.018)
Married	.140 (.096)	.129* (.077)	.136 (.104)	.139* (.074)
Single-person household	.464*** (.179)	-	.466** (.193)	-
Overworked	-.103 (.085)	-	-.106 (.091)	-
Education	-.017 (.024)	.051*** (.014)	-.019 (.025)	.050*** (.017)
Big city	.092 (.112)	-	.093 (.120)	
City ^a	-	-.063 (.080)	-	-.060 (.079)
Town ^a	-	-.137 (.102)	-	-.123 (.103)
<i>Regional dummies^b:</i>				
Kiev Region	.480* (.255)		.479* (.274)	
Vinnitsa		-.448** (.218)		-.416* (.234)
Volyn		-.675*** (.250)		-.688*** (.255)
Donetsk	.373* (.214)		.377* (.230)	
Trans-Carpathian		-.406* (.244)		-.396* (.230)
Lugansk		-.519*** (.196)		-.530*** (.198)
Odessa		-.444** (.186)		-.422** (.194)

Poltava	.531* (.304)		.541* (.326)	
Kharkov	.487** (.244)	.517*** (.187)	.476* (.263)	.526*** (.191)
Kherson		-.380* (.229)		
Khmelnytsky		-.877*** (.203)		-.895*** (.207)
F-value (2SLS)	8.96	5.47	7.76	5.36
Prob. > F	0.0000	0.0000	0.0000	0.0000
Adj. R ²	0.2096	0.1297		
N. of observations	961	961	961	961

Note: The standard errors are given in parentheses. ^a – village dummy is the omitted category. ^b – Kiev city is the omitted category. For regional dummies we report only those that are significant.

*, **, *** - indicate significance at respectively 10, 5 and 1% level;

Table 6: Estimates from the two-equation simultaneous model of health status and market incomes **for men** (2SLS with correction for sample selection bias)

	2SLS (with correction)		2SLS (without correction)	
	Dependent variable		Dependent variable	
Explanatory variable	Ill health	Log (market income)	Ill health	Log (market income)
Intercept	5.302*** (1.631)	8.001*** (.826)	5.760*** (2.021)	8.810*** (1.403)
Ill health	-	-1.233* (.733)	-	-1.550* (.964)
Log (market income)	-.596*** (.218)	-	-.658** (.270)	-
Age	.018*** (.003)	.048*** (.016)	.017*** (.004)	.030 (.025)
Age squared / 100	-	-.029 (.024)	-	-.003 (.042)
Married	.134 (.090)	.022 (.102)	.144 (.111)	.201 (.179)
Single-person household	.060 (.211)	-	.067 (.259)	-
Overworked	.024 (.075)	-	.035 (.092)	-
Education	-.007 (.027)	.028 (.038)	-.001 (.033)	.050*** (.017)
Big city	.030 (.092)	-	.033 (.113)	
City ^a	-	-.061 (.141)	-	-.004 (.160)
Town ^a	-	.002 (.109)	-	.093 (.170)
<i>Regional dummies^b:</i>				
Vinnitsa	-.511** (.211)	-.818** (.393)	-.531** (.260)	-.890* (.523)
Volyn		-.647* (.343)		
Trans-Carpathian	-.689*** (.239)	-1.098** (.543)	-.707** (.294)	-1.145* (.671)
Lugansk	-.347* (.191)	-.531** (.251)		
Lvov	-.531*** (.186)	-.770** (.377)	-.547** (.229)	
Nikolaev	-.439** (.186)		-.435* (.228)	
Odessa				
Poltava	-.679*** (.263)	-.697** (.315)	-.710** (.324)	-1.174* (.642)
Kharkov	.468* (.246)	.886*** (.197)	.517* (.303)	.759** (.331)
Khmelnytsky	-.446** (.203)		-.452* (.249)	
F-value (2SLS)	8.19	5.11	5.46	1.98
Prob. > F	0.0000	0.0000	0.0000	0.0009
Adj. R ²	0.2084	0.1309		
N. of observations	875	875	875	875

Note: The standard errors are given in parentheses. ^a – village dummy is the omitted category. ^b – Kiev city is the omitted category. For regional dummies we report only those that are significant.

, **, * - indicate significance at respectively 10, 5 and 1% level;*

Appendix

Table A1. Definitions of variables used in the estimations

Variable	Definition
Health	Self-assessed health on a five-point scale: 1 – very bad, 2 – bad, 3 – average (satisfactory), 4 – good, 5 – very good
Market income (monthly)	Wage and in-kind income (monetary assessment of it) from main work, wage and in-kind income from additional work, once-only earnings and income from unofficial activities, agricultural income (either from agriculture as a main sector of employment or from using a private land plot)
Age	Respondent's age in years at the time of the interview
Age squared/100	Age squared divided by 100
Sex	A dummy variable that equals 1 for men, and 0 for women
Married	A dummy variable that equals 1 if a person is married or cohabiting, and 0 otherwise
Single-person household	A dummy variable that equals 1 if a person is living in a single-person household, and 0 otherwise
Education	Years of education (imputed value based on the completed educational grade ranging from no education to university education)
Overworked	A dummy variable that equals 1 if a person is working more than 56 hours per week, and 0 otherwise
Big city	A dummy variable that equals 1 if a person is living in a city with more than 0.5 million inhabitants, and 0 otherwise
City	A dummy variable that equals 1 if a person is living in a city, and 0 otherwise
Town	A dummy variable that equals 1 if a person is living in a town, and 0 otherwise
Village	A dummy variable that equals 1 if a person is living in a village, and 0 otherwise

Table A2. Descriptive statistics of the data used in the study

Variable	Mean	Std. Dev.	Min.	Max.
Health (categorical variable)	3.108	0.764	1	5
Health (latent variable)	1.104	1.081	0.082	6.306
Market income (monthly), thousand	6618	11724	30.14	159725
Nat. logarithm of market income	8.229	1.047	3.406	11.981
Age	41.327	13.825	15	84
Age squared/100	18.990	12.232	2.25	70.56
Sex	0.477	0.500	0	1
Married	0.764	0.425	0	1
Single-person household	0.036	0.186	0	1
Education	10.92	2.441	0	15
Overworked	0.296	0.457	0	1
Big city	0.218	0.413	0	1
City	0.467	0.499	0	1
Town	0.169	0.375	0	1
Village	0.364	0.481	0	1

Note: The minimum value of the latent health variable corresponds to the maximum value of the categorical health variable. Num. of obs. = 1836. The market income of 6,617 thousand Karbovanets (Ukrainian currency before the introduction of Hryvnia in August 1996) is equivalent to 47 USD.

Table A3. Descriptive statistics of the data used in the study: *a sample of women*

Variable	Mean	Std. Dev.	Min.	Max.
Health (categorical variable)	2.948	0.731	1	5
Health (latent variable)	1.127	0.864	0.006	4.352
Market income (monthly), thousand	5573	10477	30.57	144449
Nat. logarithm of market income	8.069	1.029	3.420	11.881
Age	41.82	13.67	15	84
Age squared/100	19.36	12.18	2.25	70.56
Married	0.709	0.455	0	1
Single-person household	0.050	0.218	0	1
Education	10.91	2.593	0	15
Overworked	0.274	0.446	0	1
Big city	0.214	0.411	0	1
City	0.468	0.499	0	1
Town	0.166	0.372	0	1
Village	0.366	0.482	0	1

Note: The minimum value of the latent health variable corresponds to the maximum value of the categorical health variable. Num. of obs. = 961.

Table A4. Descriptive statistics of the data used in the study: *a sample of men*

Variable	Mean	Std. Dev.	Min.	Max.
Health (categorical variable)	3.285	0.761	1	5
Health (latent variable)	1.201	2.054	0.226	16.013
Market income (monthly), thousand	7765	12865	30.12	159725
Nat. logarithm of market income	8.405	1.039	3.406	11.981
Age	40.79	13.98	15	81
Age squared/100	18.59	12.28	2.25	65.61
Married	0.824	0.381	0	1
Single-person household	0.021	0.142	0	1
Education	10.92	2.263	0	15
Overworked	0.320	0.467	0	1
Big city	0.223	0.416	0	1
City	0.466	0.499	0	1
Town	0.174	0.379	0	1
Village	0.360	0.480	0	1

Note: The minimum value of the latent health variable corresponds to the maximum value of the categorical health variable. Num. of obs. = 875.

REFERENCES:

- Carlson, P., "Educational differences in self-rated health during the Russian transition", in P. Carlson, *An Unhealthy Decade. A sociological study of the state of public health in Russia 1990-1999*, Stockholm, 2000.
- Case, A., "Health, Income and Economic Development", Paper prepared for the ABCDE Conference, World Bank, Washington D.C., May 1-2, 2001.
- Green, W. H. (1997), *Econometric Analysis*, 3rd edition, NJ: Prentice-Hall.
- Grossman, M. (1972a), *The Demand for Health: A Theoretical and Empirical Investigation*, New York: Columbia University Press.
- Grossman, M. (1972b), "On the Concept of Health Capital and the Demand for Health", *Journal of Political Economy*, 80, pp. 223-255.
- Haveman, R., B. Wolfe, B. Kreider, and M. Stone (1994), "Market Work, Wages, and Men's Health", *Journal of Health Economics*, 13, pp. 163-182.
- Heckman, J. (1979), "Sample Selection Bias as a Specification Error", *Econometrica*, 47 (1), pp. 153-161.
- Kemna, H.J.M.I. (1987), "Working Conditions and the Relationship Between Schooling and Health", *Journal of Health Economics*, 6, pp. 189-210.
- Kooreman, P., and S. Wunderink, *The Economics of Household Behavior*, Macmillan Press Ltd., London, 1997.
- Lee, L.-F. (1982), "Health and Wage: A Simultaneous Equation Model with Multiple Discrete Indicators", *International Economic Review*, 23, pp. 199-221.
- Lee, L.-F. (1981), "Simultaneous Equations Models with Discrete and Censored Dependent Variables", in *Structural Analysis of Discrete Data with Econometric Applications*, edited by C. F. Manski and D. McFadden, the MIT Press, 1981.
- Maddala, G. S., *Limited-dependent and Qualitative Variables in Econometrics*, Cambridge University Press, 1983.
- *Making Transition Work for Everyone: Poverty and Inequality in Europe and Central Asia*, the World Bank, Washington DC, 2000.
- Murrugarra, E. (1999), "The Returns to Health for Peruvian Urban Adults: Differentials Across Genders, the Life-Cycle and the Wage Distribution", Working Paper Series R-352, Inter-American Development Bank, Washington D.C.
- Parker, S. W. (1999), "Elderly Health and Salaries in the Mexican Labour Market", Working Paper Series R-352, Inter-American Development Bank, Washington D.C.
- Sundberg, G., "Health, Work-hours, and Wages in Sweden", *Essays on Health Economics*, Department of Economics, Uppsala University, 1996.
- Wagstaff, A., E. van Doorslaer (1994), "Measuring Inequalities in Health in the Presence of Multiple-Category Morbidity Indicators", *Health Economics*, 3, pp. 281-291.
- Wagstaff, A. (1986), "The Demand for Health. Some New Empirical Evidence", *Journal of Health Economics*, 5, pp. 195-233.
- Zellner, A., and H. Theil (1962), "Three stage least squares: simultaneous estimate of simultaneous equations", *Econometrica*, 29, pp. 63-68.