The labor market importance of health in the Russian Federation[1]

Yevgeniy Goryakin

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Introduction and policy rationale

From policy perspective, it's important to know if there is a relationship between health and earned income, as well as its direction and magnitude. If families and individuals fail to smooth their income stream as a result of the health shocks, this may have severe welfare implications to them, especially if insurance markets are imperfect. In this case, there is a strong rationale to invest resources in improving people's health not only because good health is important for people's welfare, but also because of its economic benefits (Deolalikar 1988; Bloom and Canning 2000)[2]. Furthermore, policy making could benefit from knowing whether this relationship is driven by the effect of health on labor supply. Thus if worse health is a significant determinant of fewer hours worked, dropping out of the labor force or early retirement, then a policymaker could consider remedial measures such as accommodating workers with impaired health, including social insurance mechanisms (Riphahn 1999). Conversely, if worse health more strongly affects hourly wages, the next logical step would be to consider if this relationship is a reflection of lower productivity of unhealthy workers, or of their discrimination.

[1] Comments from Professors Ray Catalano, William Dow, David Levine, Richard Scheffler, and students Jennifer Liu, Sepideh Modrek and Ha Nguyen are gratefully acknowledged

[2] Or the benefits of heath as an "investment good" in Grossman model's sense (Grossman, 1972)

If the evidence of the effect of health on earned income is significant, the policy makers can then move to the next level issues of choosing whether to invest resources into prevention or treatment driven approaches. In addition, the evidence on the impact of health on income, labor market and consumption outcomes can be useful for the design of the social safety nets. For example, if the effect of health on medical expenditure is small, while on earned income and non-medical consumption (i.e. from the loss of productivity or reduction in labor hours worked) is significant, or if people use some costly strategies[3] to cope with the health shocks, the rationale for disability and other social insurance protection is more compelling than for the medical insurance. On the other hand, if medical spending responds strongly to large health shocks, and the effect of small health shocks on income is small in magnitude, there is a need for appropriate health insurance design[4] (Gertler and Gruber 2002).

In the next part, I will briefly review the context relevant to understanding my research. I will follow with the literature review and then discuss the conceptual framework relevant to my study. After that, I will describe the dataset and measures I intend to use in more detail, together with the discussion of specific empirical strategies required for identification of the parameters of interest. Finally, I will present my results and discuss them.

[3] E.g. selling assets.
[4] In such cases, the focus on catastrophic insurance with some deductible may be more appropriate than coverage without deductibles, but with some relatively low total spending cap.

Russian context

In the past two decades, Russia has been experiencing steady transformation from socialist to market economy. In addition to creating economic opportunities for a large number of people, this process has put a heavy toll on the society, contributing to the deterioration of various human development indicators (UNDP 2005).

Several major economic crises occurred in Russia during this period. By 1997, its economy shrank by more than 75% compared to early 1990s (Stillman 2006). Compared with other Easter European and Former Soviet Union countries, Russia had the largest baseline real GDP per capita but suffered the greatest collapse of the output (Stillman 2006), also see Figure 1). Unemployment kept growing throughout the whole 1990s decade, then started to fall only in around 2000 (Figure 1). During this period, the Russian population also experienced large declines in health outcomes. For example, life expectancy at birth decreased by 6 years between 1990 and 1994, recovering from 1994 to 1998 by 3 years, and then declining again after a large financial crisis occurring in 1998 (Stillman 2006), also see Figure 1). Crude death rate in Russia increased from about 11/1000 to 16/1000 from 1990 till 1994, falling back to 13/1000 by 1998, then increased again, concurrent with the financial crisis of 1998.

For comparable levels of percapita GDP, Russia has one of the highest mortality rates, and even does worse than many significantly poorer countries (Suhrcke 2007). In 1990s, the rates of mortality from avoidable causes increased in Russia, reaching a peak in 1994 and then growing again from 1998 on. For comparison, deaths from preventable causes in the UK were higher than in Russia in 1965, but steadily decreased ever since (Andreev, Nolte et al. 2003). Some shocking statistics shows that for Russian males in

2000-2001, the probability of dying between ages 15 and 60 was 42.4 %. For comparison, in Japan this figure was 9.8%, in the US- 14.1%, in Germany- 12.6% and in Turkey- 21.8% (Suhrcke 2007).

In contrast to most developing countries, this deterioration in health was mostly attributable to the increase in non-communicable diseases and injuries (e.g., see Figure 1), and not infectious diseases (Bloom and Canning 2000; Suhrcke 2007)[5]. In addition, it appears from past research that medical care inputs played a smaller role in the deteriorating health of the Russian population than the behavioral factors (Stillman 2006). For example, deteriorating diet, smoking, alcohol consumption and mental stress (also see Figures 8-10) were all implicated in past research (Bloom and Canning 2000). Brainerd and Cutler (2004) failed to find evidence that material deprivation could explain variation in mortality rates in Russia. Their conclusion was that the most significant predictors of mortality were alcohol consumption and stress (Brainerd and Cutler 2005). In addition, the gender gradient in life expectancy continuously increased during the whole period (see Figure 1), which also suggests that stress and behavior-related factors may have played an important role in declining health of the population in Russia. At the same time, there is a notable absence of ecological association between rising income and health after the year 2000, since various measures of health continued deteriorating even during the period of economic recovery (compare the trends between per capita GDP and life expectancy in Figure 1).

It is notable that considerable burden of disease appears to occur among those aged between 40 and 55 (Stillman 2006; Suhrcke 2007), thus the economic cost of ill

[5] Although these, and HIV/AIDS and tuberculosis in particular, have also been growing at an alarming rate in Russia.

health can be considerable. For example, ten days of productive work per employee per year are lost on average due to illness in Russia, while in the EU the comparable figure is less than 8 days. This amounts to the loss of 0.55%-1.37 percent of GDP, depending on calculation assumptions (Suhrcke 2007).

In Russia, the Constitution guarantees free medical care, but in practice this is not the case. For example, household spending on drugs amounts to as much as 30 percent of total healthcare spending in Russia, compared to an average of around 12 percent in OECD countries (Tompson 2007). Therefore, one can expect the extent of a disease to be related to out of pocket medical expenditures (and thus reduced non-medical consumption), even in the presence of medical insurance. The cost of disease may thus considerably go beyond productive time lost in Russia.

Literature review

Health and total income

Although the association between various dimensions of socioeconomic status (SES) and health has been studied rather extensively before, and the causality between health and income is generally acknowledged to run in both directions (Thomas and Frankenberg 2002), there is still considerable debate on the relative contribution to the observed association between variables (Adda, Chandola et al. 2003). Recently, more methodologically rigorous studies attempting to estimate causal association running from health to income have begun to appear. The available evidence shows that nutritional status and other dimensions of health indeed seem to play a very important causal role not only on the micro, but also on the macroeconomic level (Thomas and Frankenberg 2002)[6].

Although conducting experimental studies in this area is obviously a challenge, a few researchers managed to shed light on the link between nutrition and labor market outcomes from an experimental point of view. For example, there is evidence on the significant biological-level link between fatigue caused by iron deficiency and general work capacity (Thomas and Frankenberg 2002). On the other hand, experimental studies focusing on the effect of food supplementation provide less clear results (Thomas and Frankenberg 2002). For example, effect of calorie supplementation on road digging in Kenya showed a significant positive effect (Wolgemuth, Latham et al. 1982; Thomas and Frankenberg 2002), while the results of a similar experiment in Guatemala didn't show any productivity benefits of additional calorie supplementation (Immink, Flores et al. 1987).

A sizeable health shock can potentially affect individual and family earnings through adjustments in labor force participation and smaller productivity, as well as through smaller accumulation of human capital, especially for children. There were a few experimental studies in this last area. Chavez and Martinez showed that children in Mexico who received food supplementation generally performed better on tests (Scrimshaw 1998). In Guatemala a similar effect was observed (Martorell 1993). So this shows that nutrition (and its BMI proxy) can play an important role not only in raising

[6] For example, Bloom and Canning (2000) estimated that two countries, identical otherwise, will have a differential rates of growth: one with 5 year advantage in life expectancy will grow 0.5 percent faster in a year, with significant growth in total factor productivity related to investment in human capital.

productivity, but also in helping accumulate human capital for productive activity later in life, thus possibly contributing to higher income through this channel. Consistent with this long-term outlook, and using community-level instruments for health shocks, Li Gan et al (2006) found that after a major health shock (defined as requiring hospitalization or an expenditure of around 633 dollars), households saw their income reduced on average by 11.8% in the following 15 years (Gan, Xu et al. 2006).

Using anthropometric dimensions of health, Skoufias (1998) showed that income was correlated with height for girls in rural areas in Romania, while in urban areas it was uncorrelated. This suggests that causality probably runs from health to income, since healthier girls in rural areas are more likely to contribute to household income (Skoufias 1998). In addition, wage effect of height and BMI was found substantially larger when treated as endogenous: a unit gain in BMI was associated with a 9 per cent growth in wages in Cote d'Ivoire and Ghana (Schultz 2003).

Bartel and Taubman (1979) looked at the effect of specific physician-diagnosed diseases on wages. They found strong negative effects for heart disease (22 percent reduction in earnings after a new diagnosis), psychosis, neurosis (about 45 percent reduction in earnings), arthritis, bronchitis. Some diseases led to the reduction in weekly hours (e.g., heart disease), or weeks worked (e.g., arthritis). More recent diagnoses were found to have much stronger effect, while it diminished with time either because people were treated, or managed to adjust. Additional diagnosis in multi-disease cases decreased individual earnings by around 1.3 percent (Bartel and Taubman 1979).

Measuring health with self-assessment indicators, Liu, Dow et al (2008) found that household income per capita was strongly influenced by health of the individual household members. They also found stronger effect in rural areas and little evidence for men-women differential in effect. Their results were probably a lower bound for the effect of health on individual income, since other able-bodied family members may have increased their labor supply in order to compensate for the loss in family income[7].

Other prominent dimensions of health investigated by researchers included various mental conditions. Westergaard et al. (2003) conducted a case-control investigation, showing that labor market participation, earnings, unemployment and marital status were all affected for those becoming schizophrenia patients between 5 and 13 years before hospital admission (Westergaard-Nielsen, Agerbo et al. 2003). Other researchers also found that mental illness significantly reduced individual's earnings, with effect lasting up to 15 years for some diseases (i.e. in the cases of psychoses), and with the effect of neuroses diminishing faster (Bartel and Taubman 1986).

Some researchers emphasized the importance of making a distinction between the effect on income of diagnosed health and actual health, arguing that not everyone appearing as undiagnosed in surveys are healthy[8] (Frank and Gertler 1991). Using population-based measure of mental health and not relying on diagnosis (i.e. contact with medical care providers), they found that mental distress was associated with the reduction of earnings by 21 percent with population based measure, while it was slightly lower if the diagnosis-based measure was used, suggesting the bias is probably small (Frank and Gertler 1991).

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[7] However, it is also possible that other members actually *decreased* their labor supply to take care of the sick, in which case the individual effect was probably smaller, not higher, than estimated.

[8] This is a classification issue, and if the error is unsystematically correlated with mental health measure, there will be downward bias.

Reported disability is another important dimension of health that may have an effect on a range of labor market outcomes. Walker and Thompson (1996) found that disability reduced both hourly wages and probability of labor force participation, while the effect was stronger on labor force participation (Walker, Thompson et al. 1996). Madden (2004) found that discrimination was an insignificant component of the wage differential between healthy and unhealthy people, so that the main effect seemed to be caused by the productivity changes (Madden 2004).

Health and wages

A common conclusion for many studies exploring the link between health and productivity is that health unambiguously matters. For example, Strauss and Thomas (1998) estimated the elasticity of wages with respect to height in prime age males to be equal to unity. Haveman (2004) and Sundberg (1996) in (Contoyannis and Rice 2001) found that health (both lagged and contemporaneous) significantly affected wages. Martorell and Arroyave (1988) found that body size was a significant determinant of productivity. Some other studies (Behrman and Deolalikar 1988) also found an effect, especially of male BMI or male body weight. Deolalikar (1988) found significant positive effect from weight for height on farm output and wages, with nutritional status treated endogenously, but no effect from daily energy intake (Deolalikar 1988). This suggests that people may adapt better to short-term fluctuations in energy input, but not in nutritional status. In Ethiopia, market wage rate was found to be very responsive to the weight-for-height as well as the BMI and height (Croppenstedt and Muller 2000).

Overall, in developing counties the effect appears to be stronger than in developed ones. When the health status was treated as endogenous, e.g. instrumenting for anthropometric indicators with community-level inputs, several studies found a positive relationship between health and wages and income (Currie and Madrian 1999). Effects are usually non-linear and stronger for men and certain occupations. Also, in agricultural societies, extent of the loss of productivity and income in case of illness depends on whether the season is slack or peak[9], especially for males. This increases borrowing, a costly coping strategy on many occasions (Kochar 1995).

Although most researchers found a stronger association in agricultural areas of developing countries, Thomas and Strauss (1997) estimated a strong link between BMI in wages in urban Brazil, instrumenting for BMI with a relative food price. The effect was the largest among those with low education. Per capita calorie and protein consumption was also found to be significantly associated with wages (independent of BMI and height). Effect of proteins stayed while of calories disappears rapidly (Thomas and Strauss 1997).

In Pakistan, BMI was associated with wages of time-rate (but not piece-rate) workers (Thomas and Frankenberg 2002). This was probably a reflection of BMI being primarily a signal for health to the employers, rather than a factor affecting the ability set of workers. There was little evidence for the effect of BMI on labor supply in that study (Thomas and Frankenberg 2002).

Schultz (2005) found that an additional centimeter of height was associated with 1.4 percent higher wage for men in Brazil. Instrumental variable estimates were 5-7 times

[9] For example, it was greater in peak season in India (Kochar, 1995)

larger than OLS estimates. In Cote D'Ivoire, estimated effect of BMI with IV was different from OLS, implying unobserved heterogeneity or simultaneity bias (Schultz 2005). For policy purposes, instrumental variable estimates are also more interesting, since they may be more related to behavioral rather than genetic portion of the variation in height (Schultz 2002; Schultz 2005). Studies in Peru, Mexico and Colombia showed similar patterns: health status indicators instrumented with health infrastructure and other community characteristics had a greater effect on wages that the OLS. Results for males were usually stronger and more significant than for females (Schultz 2005).

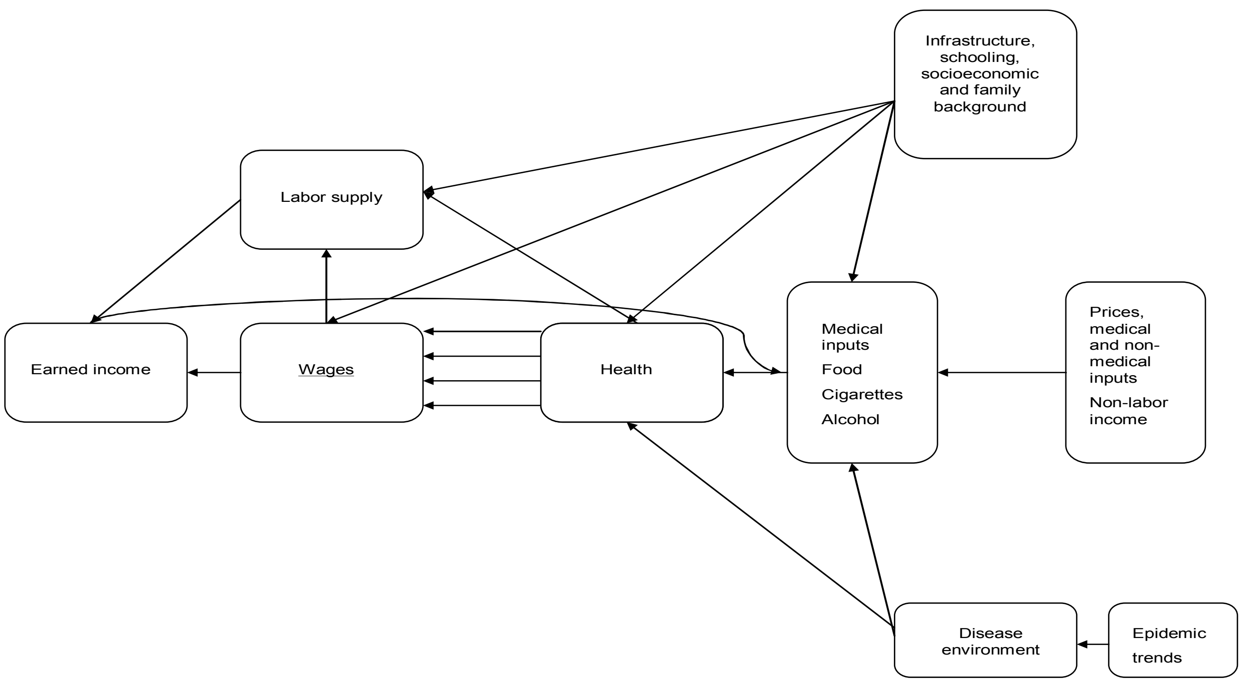
With the data from the Health and retirement Study (HRS), Pelkowski and Berger (2004) found permanent health conditions to have a negative effect on labor force participation, hours worked and wages. Women had larger reduction in wages, while men- in hours worked. Largest negative effect on health was for men in their 40s, for women- in their 30s. Fixed effects estimates were larger, pointing to the existence of omitted variable bias in studies that do not control for them. Temporary health problems had little to no effect. This can be due to people adjusting to their problems, or firms making accommodations (Pelkowski and Berger 2004). Gustman and Steinmeier (1986) found with PSID data (1969-1975) that effect of long-term illness on wages (but not total income) was considerably larger for workers older than 55.

Mitchell and Burkhauser (1990) found arthritis to have a significant effect on labor market behavior of the affected workers. Specifically, total wage earnings of those with arthritis were substantially below those of healthy workers, and hours worked were affected even more than the wage rates. The effect was stronger for men and younger women.

Conceptual Model and hypotheses

On Diagram 1, we can see that health is linked to earned income via several different pathways, for example through the effect of health on wages (for example, through the pathways of capabilities, human capital investments, savings rate and discrimination), and through the effect of health on labor supply.

Diagram 1. Conceptual model for health and earned income



However, health is also potentially driven by factors that are also linked to earned income and therefore should be controlled for if the effect of health on earned income is to be estimated without bias. These factors may include education, socioeconomic and family background variables (e.g. assets, ability), as well as infrastructure.

Based on the literature review, as well as on more formal treatment that can be found elsewhere[10], several testable hypotheses can be specified.

H1. Health is positively related to monthly wages of individuals.

As discussed above, health is expected to affect productivity and thus hourly wages in unambiguously positive direction. Also, although labor supply response to health is theoretically ambiguous, most researchers have so far found positive effect. Thus overall, I expect to find positive relationship.[11]

H2. Returns to health will be greater for males, heads of household, those working in manual occupations, as well as for rural dwellers. This will be especially true for those measures of health that are important in physically strenuous jobs.

The explanation for this is that males, heads of household, unskilled workers and those from rural areas are more likely to work in occupations where physical stamina (positively correlated with health) is at premium. For example, better physical health is expected to be more important for wages of an agrarian or steel mill worker than for wages of a computer programmer or an accountant.

H3. The gradient predicted in hypothesis 2 will vary depending on specific health measure used.

Health is a multidimentional concept, and some of its indicators may matter more than others, depending on how physically demanding an occupation is. For ease of exposition, let's suppose that jobs can be divided into physically demanding, which can be both skilled (e.g. managerial positions) and unskilled (e.g. still mill workers), but tend

[10] I did not include the more formal theoretical section in this paper. However, it will be part of my final dissertation.

[11] I will discuss finding for labor supply response in more detail in the next chapter

to be unskilled, and not physically demanding (which tend to be skilled, e.g. being a teacher or a doctor). Let’s also divide various measures of health according to how important they are in these types of jobs (see table below).

	Physically demanding jobs-important	**Physically demanding jobs-not important**
Not physically demanding jobs-important	General health, chronic diseases, disability, ADL, heart attacks, strokes (1)	Depression (2)
Not physically demanding jobs-not important	BMI, Height, Temporary health problem (3)	Bad hearing, bad eyesight (4)

If one makes a plausible assumption that men, heads of households, rural dwellers and unskilled workers are more likely to engage in physically demanding jobs, then one can expect that for them the economic returns from BMI, height, and temporary health problems (cell 3) -those health measures that are important in physically demanding occupations, and less in other jobs-should be greater than for their reference groups. On the other hand, it is possible that this gradient disappears (or that the reverse is true) for such health measures as depression, since depression is unlikely to matter more for an agrarian worker than for a teacher (cell 2). Moreover, if self-evaluated general health, good eyesight, acute health shocks such as heart attacks, chronic diseases and disability status are important in all jobs, there should be little difference in estimated effect by population subgroups- they should be considerable for all (cell 1). The only reason why this may not be the case will be discussed in hypothesis 4. Finally, such measures of health as bad hearing are unlikely to be important in most occupations, and therefore its effect on earned income should be small for all population subgroups (cell 4). The important point here is that health is a multidimensional concept, and that the returns may differ not only by populations, but also with a specific measure used.

H4. The gradients mentioned in my second hypothesis will weaken for those diseases whose diagnosis depends on certain characteristics (e.g. living in rural areas, occupation and gender).

This is because the returns to health to those having such characteristics can be underestimated because of potential misclassification of the disease status. To make matters more clear, consider table 1. We see that women are considerably more likely to be diagnosed with both high blood pressure and with at least one chronic disease than men. This difference is unlikely to be a reflection of a higher propensity of women to be sicker than men, but rather higher likelihood of them contacting the medical care system. Indeed from column 3 we see they are about 3% more likely to have visited a medical worker in the last months than men. Moreover, we see an unlikely propensity of those living in urban areas to be sicker than those from rural areas. Again, this seems to be a reflection of higher probability of those living in the cities to contact a medical system, which indeed is supported by the estimates reported in column 3 for urban dwellers. Taken together, this evidence suggests that because of the possible misclassification bias, the effect of health may be underestimated for those population groups that are less likely to contact a medical care system. Please note that prediction of this hypothesis contradicts with the prediction of hypothesis 2 for such outcome as being diagnosed with having a chronic disease. Therefore, estimating the subpopulation interactions is an opportunity to test which hypothesis is more defensible for this particular health measure.

H5. When the outcome is unearned, rather than earned income, there will be no relationship between health and income.

Testing this relationship will provide a robustness check for the above-mentioned first two hypotheses. Indeed, if there is a considerable reverse feedback form income to health, there should be little difference in the direction and size of association between earned and unearned income on the one side and heath on the other (Wagstaff, 2005). If anything, the effect of unearned income on health should be even stronger, since (according to Grossman model) increase in wage rate may lead to the reduction in the demand for health, while the effect of unearned income should be unambiguously positive. However, if I find that unearned income is *negatively* associated with good health, or if the association is much weaker than for the earned income, which would suggest that poor health drives earned (and unearned) income, rather than the other way around.

H6. The relationship between earned income and health will weaken as income increases.

To understand the logic of this hypothesis, one needs to remind oneself that wages have both income and substitution effect on labor supply. Thus as health improves, this is likely to be translated into higher wages, and eventually into higher labor supply due to substitution from leisure to working. However, assuming that leisure is a normal good, this will be counterbalanced by greater demand for leisure and therefore the partial reduction in labor supply. If one assumes that the wage elasticity of labor supply gets smaller for higher income people (with the possibility of the labor supply curve eventually becoming backward-bending), then the link between health and earned income is also likely to get progressively smaller as income increases. If this hypothesis is true, the policy implication is that adverse health status may have a particularly negative effect on the welfare of the poorer people.

Data

In this paper, I use individual, household and community-level data from rounds 6-16 of Russia Longitudinal Monitoring Survey (RLMS) dataset collected in 1996-2007 by the UNC population center. RLMS is a household-based, nationally representative survey. Data has been collected in a repeated survey of household dwelling units at regular intervals since 1992, using multistage probability sampling, with primary sampling units (PSU) selected from geographically-determined strata. The minimum number of respondents per round for the whole sample was 9,816, and the maximum was 13,547. For some specifications, I matched RLMS dataset with region-level data collected by the Statistical Committee of Russia, using community-level identifiers.

Within each selected PSU, population is further stratified, and the target sample size is allocated in proportion to the strata (CPC website). To correct for the non-independence in the data collection, I adjusted the estimated standard errors for the effect of clustering at the commune level[12].

[12] Unfortunately, as far as the author knows, it is not possible to adjust for probability weights in the analysis except for descriptive statistics. This is because Stata xtreg routine requires that individual-level weights stay constant from round to round, which was not the case in RLMS dataset.

My main dependent variable of interest is log real monthly wages, measured on the individual level. For log real monthly wages, I used the survey answers to the following question for primary and secondary places of employment for each individual:

> "How much money in the last 30 days did you receive from your primary [secondary] workplace after taxes? If you received all or part of the money in foreign currency, please convert all into rubles and name the total sum."

In some cases, there were wage arrears, and only the information on contractually agreed wages was provided. In those situations, rather than assume that the paid wages were zero, I used contractual wages in my monthly wages variable.

After summing the reported monthly wages for primary and secondary places of employment, I divided them by the national-level yearly consumer price index (CPI) reported by the State Statistical Committee of Russia (Goskomstat 2008), and then took the natural log of the variable. When the reported monthly wage was zero, I did not adjust it by converting it into one, i.e. it was then transformed into a missing value in the log wages variables.

In addition, to test my fifth hypothesis, I created a variable measuring per capita household real unearned income, by summing various real benefits and transfer income components (e.g. rental subsidies, pensions, alimony, stipends) on the household level, and then dividing this by the number of adults in the household.

Finally, in order to explore the effect of changes in health on the household income stream, I created another dependent variable – log of percapita total real family wages. For each round and household, I added the earned monthly wages of each adult, and divided this number by the number of adults in the household. If individual health only affects the income stream of the individual but not the household as a whole (for example, another household member may readjust their labor supply to compensate for the loss of income), then there should be little effect of health on the household earned income. On the other hand, the effect of health on family earned income can be magnified if other household members take care of the sick. It is likely to be the case for more acute conditions, like strokes and heart attacks.

I will use various definitions of health in my specifications, since health is obviously a multidimensional concept. More useful indicators should reflect the ability to work (Currie and Madrian 1999). More specifically, I will consider the following measures of health:

1) Self-reported health. Respondents answered the question asking them to evaluate their health with five categories, ranging from very good to very bad. This measure may suffer from subjectivity: for example, pessimistic people may underestimate their health, and may also have lower wages. However, including fixed effect should eliminate this source of this bias, as long as it is time-invariant. Another challenging issue is reverse causality running from income to health. This may happen in the context of the so-called justification hypothesis, when a person explains lower wages and/or reduction in labor force participation by reporting worse health status (Haveman, Wolfe et al. 1994; Kerkhofs, Lindeboom et al. 1999). This may be partly addressed by testing the effect of lags of self-evaluated health on earned income, as well as by using instrumental variables. Another indicator asking the respondents to indicate whether they had a health problem in the last 30 days will also be used in this paper. This measure is particularly useful, since respondents are asked to elaborate on the nature of health

problem in the follow up question (answer not available to general audience), and therefore it potentially suffers less from subjectivity and justification bias.

2) I will also use two anthropometric indicators as proxies for health. Anthropometric measures are popular because of their ease of collection and apparent objectivity (Gruber and Hanratty 1995), and they are also more likely to be responsive to changes in the prices of health and food inputs than other measures of health. Specifically, I will use the body mass index (BMI) defined as a body weight in kilograms divided by the height in meters squared. Changes in BMI scores were used previously to proxy for health status and as a measure of not only morbidity (Wagstaff 2005), but also mortality (Behrman and Deolalikar 1988). BMI is expected to be significantly related to the productivity of workers in manual occupations, where physical strength is at premium. In addition, I will use height as a measure of health less likely to be affected by fluctuation in resources and thus less likely to suffer from endogeneity[13].

3) Functional limitations indicators, such as measures of instrumental activities of daily living index (IADL) as well as activities of daily living index (ADL), were found to be reliable indicators of unanticipated major health shock in previous research (Gertler and Gruber 2002; Gertler, Levine et al. 2006), with ADL being particularly promising for distinguish serious exogenous health problems. I created both indicators in two steps[14]. First, I selected several variables measuring the ability of people 55 years of age and older to perform a number of activities, both basic (e.g., ability to take a bath and walk across the room) and intermediate in difficulty (e.g. ability to walk 1 km and to go

[13] It is true that height may reflect household resources in early childhood rather than genetically determined health, however most adults in this sample were born in the relatively egalitarian society, with little intrahousehold variation in resources. Therefore, most variation in height in the sample is likely to be a reflection of genetic endowment.

[14] In my analysis, I only reported results for ADL score, since results for IADL score were largely insignificant.

shopping), and summed them up. Finally, I adjusted this score according to the following Rand Medical Outcome Study formula (taken from Gertler et al, 2006):

(I)ADL Index_i = (Score_i – Minimum Score)/(Maximum Score – Minimum Score)

Defined this way, the index will range from 0 to 1, with 1 indicating the least functionally independent person. Functional status indicators were extensively reviewed in the literature (e.g. Wagstaff 2005, Gertler and Gruber, 2002), and are believed to be reliable measures of health status. In addition, I will use indicators for whether a person had bad vision or bad hearing as another functional limitation indicator.

4) The RLMS dataset contains a number of indicators for the specific diagnosed medical conditions, including chronic (e.g. high blood pressure, heart, lung liver and kidney disease, diabetes), as well acute ones (heart attack and stroke). My forth hypothesis predicts that chronic diseases diagnosed in the medical care system are likely to be measured with error, especially for some population subgroups, therefore these indicators are important for testing this prediction. In addition, I will include a dummy for whether a person suffered from serious nervous disorder or depression in the last 12 months as a measure of psychological health.

5) Finally, I will test for the effect of being assigned a disability qualification on the outcomes of interest. Since the probability of being given a disability status is likely to depend not only on health but also on a range of characteristics (both observable and unobservable), including ability to deal with the medical care system, it is particularly important to control for possible confounders in this case. I will discuss possible approaches to dealing with possible endogeneity in the empirical strategy section.

I will also use community-level variation in the prices of food, cigarettes and alcohol as instruments for health in the wage equation (Thomas and Strauss 1997). Even though there is overcapacity of hospital beds in Russia (Thompson 2006), closing them, especially in rural and remote areas, without providing viable alternatives, can be harmful to the local communities (Tompson 2007). Therefore, under certain assumptions, changes in the number of hospitals in a community may also provide a valid instrument for health, both in the hourly wage and monthly earnings equation. In addition, I can use the State Statistical Committee of Russia dataset containing information on the regional-level variation in the disease environment to instrument for health in all equations. It is also important to keep in mind that prices and infrastructure availability may explain a small portion of the variation in health, therefore it's possible I won't be estimate the effect with a required precision, even if it really exists. In addition, I will use certain objective measures of health (including prolonged chest pain, heart attacks, strokes, some infectious diseases) as objective instruments designed to address both endogeneity and measurement error concerns for certain health measures of interest.

I will include a number of theoretically-relevant control variables in the model, including individual's age, dummies for living in the urban area, for being married, for having a high school diploma, for university degree, a proxy for wealth, the family size, as well as regional dummies. The full list of variables and their description is provided in Table 2.

Descriptive statistics

I present descriptive statistics for the pooled sample of respondents 16 years of age and older (the age at which many Russian begin to enter labor force) in Table 2. It's interesting to note that just 2% have reported having "very good health", and as many as 18%- "poor health" or "very poor health". Compared to many other countries, very few people self-report very good health and a lot- bad health in Russia (see for example, (Liu, Dow et al. 2008)). Thus it appears self-perception of health indeed may be considerably driven by pessimism (which may in turn be related to labor market outcomes).

Moreover, about 55% of all adult respondents have reported having at least one chronic disease, and 42% answered that they had a health problem in the last 30 days. The average BMI or the whole sample in all rounds was 25.9, and 20% of the respondents were obese. The average age for the sample which excluded respondents 16 years of age and younger was about 45.5 years, about 60% of the respondents were married (or living together with a partner), females comprised about 58% of the sample, and just over 72% lived in urban areas. Reflecting a relatively high level of education in the country, about 18% had a university degree, and 43% of the population had a high school diploma as their highest educational attainment. 30% of all households had a car, and most respondents (60%) lived in households of 3-5 persons in size.

In addition to a static picture provided by a table 2, it is also interesting to see how main variables of interest have been changing over time. In figure 2, we see that the mean age of the population of Russia[15] has been steadily increasing over time, a reflection of the generally ageing population. We also see that the proportion of males has been

[15] In this case, it's more informative to report mean age for the whole sample, rather than only for adults.

steadily declining over time another indication at the growing health gap between males and females.

The unemployment rate among the surveyed increased during the time of the financial crisis of 1999, then steadily decreased as the economic growth started to pick up. The number of people working for public enterprises considerably decreased over the last years. We can also observe that average real monthly earnings of Russians dropped at around the time of the financial crisis (round 8, corresponding to year 1998), but then steadily increased over time.

An interesting comparison is between mean BMI, and mean log monthly wages. If one believes that average monthly earnings are set exogenously, one can see little evidence that BMI is driven by income. Another curious comparison is between changes in the proportions of people reporting a chronic condition and having bad health. We see that although the proportion of people reporting having bad health has been steadily declining over time, the proportion of those reporting at least one chronic illness has been increasing. This apparent contradiction could be tentatively explained by the fact that the number of reported chronic diseases has been increasing not because of the worsening health of the population, but rather because of earlier diagnostics of illnesses in more recent years. This brings us back to the forth hypothesis. One can argue, for example, that if those who underutilized medical care system in the past are more likely to visit it as time goes by, then misclassification bias mentioned in the context of fourth hypothesis should be smaller in later rounds. However, it appears that the propensity to visit medical care system increased both for women and men, at relatively equal pace (estimated not shown), but men still continue to use medical care system much less. Therefore, this misclassification bias is expected to continue in later rounds, too.

It is also informative to compare the distribution of monthly wages and BMI over time. On figure 3, we see there was little change in the distribution of log BMI from 1995 to 2007, except that the most recent distribution is now a bit thicker at the tails, reflecting more spread around the mean. The picture is different for the change in the distribution of log monthly real wages. Expectedly, the mean shifted to the right. There also appears to be a slight reduction in income inequality[16].

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[16] It should be remembered that year 1995 was at the peak of shock therapy economic transition

Estimation

Generally speaking, we are interested in estimating parameters in the following model:

(1) $Y_{iht} = \alpha_i + \delta_t + \beta_1 H_{iht} + \beta_2 X_{iht} + \varepsilon_{iht}$

Where Y_{iht} is the variable measuring real monthly earnings, for person i in household h at time t; H_{iht} is a variable measuring health; X_{iht} is a vector of exogenous sociodemographic variables likely to be correlated with both health and income, such as age, education, marital status, wealth[17], urban/rural residence; α_i is a time-invariant endowment of person i possibly correlated with health (e.g., ability); δ_t is the time effect, and ε_{iht} is an iid error term.

In general, two major issues are likely to plague the validity of estimating model 1. First, as described in my conceptual model part, health may be correlated with the error term, consisting of α_i, δ_t and ε_{iht}. Secondly, health may also be simultaneously determined by the reverse feedback from income. In this section, I will describe the general estimation approaches to dealing with these issues. In the next section, I will describe estimation challenges for more specific measures of health, and the specific solutions I will propose.

Several approaches to estimating model 1 can be taken. Under the most restrictive assumption, once conditioned on the set of observable controls $X_{iht,}$ health variable H_{iht} is not correlated with the error term consisting of $\varepsilon_{iht,}$ α_i and $\delta_{t,}$ and therefore the parameter

[17] For wealth variable, I will use a dummy indicating whether a family has a car or not. This variable has a significant variation (e.g., average car ownership is around 30% in the sample) compared to other alternatives, and seems to be a good proxy for wealth with very small measurement error.

of interest β_1 can be consistently estimated by OLS, taking appropriate account of possible heteroscedastic nature of disturbances, as well as of survey nature of the data. Since I have a number of control variables, I can try and condition on them to rule out possible confounders, which is the approach taken in some recent work (Heckman, Ichimura et al. 1997; Gomez and Nicolas 2006; Suhrcke 2007). Moreover, treating certain health variables (such as height) as exogenous to labor market outcomes may not be totally unrealistic (Currie and Madrian 1999).

However, since the above assumption seems to be very restrictive for most health measures, I may relax it by allowing health to be correlated with the time-invariant and unobservable component α_i. Specifically, I may take advantage of the panel nature of the data by including individual fixed effects to the econometric specification. This may allow me to control for the important source of unobserved heterogeneity in health, possibly at the expense of the loss of precision, especially if health is substantially serially correlated. If appropriate tests indicate that health is not correlated with the time-invariant α_i, I may include random effects to improve estimation efficiency.

In addition, for additional robustness check, I will estimate parameters in the following specification:

(2) $\Delta Y_{it} = \delta_t + \gamma_c + \beta \Delta H_{it} + \Delta u_{it}$

This is essentially a first-differenced model (due to (Gertler and Gruber 2002) to eliminate time-invariant individual unobservables, with the addition of community dummies to control for the omitted community-level factors that may be associated with the changes in individual health over time.

Next, I will test for the lagged effect of health with the following specifications:

(3) $Y_{it} = \alpha + \delta_t + \beta_1 H_{it} + \beta_2 H_{it-1} + \beta_3 H_{it-2} + \beta_4 X_{it} + \varepsilon_{it}$

(4) $Y_{it} = \alpha + \delta_t + \beta_1 \Delta H_{it-1} + \beta_2 \Delta H_{it-2} + \beta_3 \Delta H_{it-3} + \beta_4 X_{it} + \varepsilon_{it}$

(5) $\Delta Y_{it} = \alpha + \delta_t + \beta_1 \Delta H_{it-1} + \beta_2 \Delta H_{it-2} + \beta_3 \Delta H_{it-3} + X_{it-3} + \varepsilon_{it}$

Specification 3 is the most basic one, looking at how contemporaneous and lagged health measures affect income measures in the current period. Note that specification 4, taken from (Gan, Xu et al. 2006), is a test of how changes in the lags of health (i.e., from period t-1 to period t; from t-2 to t-1 and from t-3 to t-2) are related to the variation of *levels* of earnings in the current period. On the other hand, in specification 5 (taken from (Smith 2003)), we test how changes in the lags of health affect changes in the outcome variable from period t-1 to current period. Although similar on the surface, these models give different information, as specification 4 looks at how "health shocks" affect the distribution of outcomes of interest in the current period, while specification 5 gives information on whether those experiencing the shocks are more likely to experience convergence or divergence of earned income over time. It is feasible, for example, that those having adverse health shocks in the prior period will be more likely to have lower income than their counterparts (thus having negative $\beta 1_{,}$ β_2 and β_3 in model 2), but at the same time will be converging in their earnings with time (thus having at least some positive parameters $\beta 1_{,}$ β_2 and β_3 in model 3).

Finally, I will estimate a growth model of the following form:

(6) $\Delta Y_{it} = \alpha + \delta_t + \beta_1 H_{it-1} + X_{it} + \varepsilon_{it}$

This specification also looks at the convergence/divergence of income among individuals over time, but uses a lag in the level of health variable, rather than its first difference.

The major potential benefit of estimating regressions 3-6 is the possibility to reduce the potential for reverse feedback from earned income to health. However, the possible challenge with approaches 3-5 is that health is likely to exhibit strong serial correlation, thus precision may be lost (Wooldridge 2006). In addition, wages may also exhibit serial correlation and thus at least partly drive the relationship between lagged health and contemporaneous wages.

In addition, to reduce the possibility that the association between health and earned income is driven by reverse causality, I can estimate certain specifications where the direction of relationship between health and labor market outcomes can be clearer. As I mentioned previously, if I separate my sample into males and females, heads/not heads of households, and those living in urban/rural areas, then I theoretically shouldn't expect to see much difference in the estimated parameters if the direction of the relationship is from income to health (Wagstaff, 2005; Liu, Dow et al, 2008). On the other hand, if it is health that affects income, I may expect to find greater returns to better health to the males, rural dwellers and heads of households, since they are more likely to translate better health into higher income. Likewise, I can expect to find higher returns to better health for unskilled occupational categories. In addition, if I find greater returns to health for those in the lower part of income distribution (by running a series of quantile regressions), this may support the proposition that the direction of causality runs from health to income, since we may theoretically expect greater returns to health for those in low-paying jobs. Finally as discussed in my hypothesis 5, if it is health that affects income rather than the other way around, I should expect to find stronger relationship between measures of health and earned rather than unearned income.

Furthermore, to take into account possible correlation of health with time-varying unobservables, to reduce measurement error, and to rule out simultaneous feedback from earned income to health, I can try and instrument for health with appropriate variables. These variables may include both community-level data on health resources and on prices of health inputs, as well as individual-level objective indicators of health (Strauss and Thomas 1998). The success of this identification approach will depend on the first stage predictive power of the instruments, as well as on the validity of the exclusion restrictions. I will discuss potential instruments in the next section.

Finally, in order to explore the effect of changes in health on the household income stream, I created another dependent variable – log of percapita total real family wages. If individual health only affects the income stream of the individual but not the household as a whole (for example, another household member may readjust their labor supply to compensate for the loss of income), then there should be little effect of health on the household earned income. On the other hand, the effect of health on family earned income can be magnified if other household members take care of the sick. The latter is likely to be the case for more acute conditions, like strokes and heart attacks.

In most cases the variables will be defined on the individual level except for the percapita family income, which I will define for each member of the household as total real household income (not only monetary) divided by the number of people older than

18 in the household in a respective round, and therefore it will vary on the household level.

Results

I have broken my analysis of the effect of health on monthly earnings into the following parts. First, I will consider the association between anthropometric measures of health- body mass index (BMI) and height- and log real monthly wages. As mentioned before, these metrics may reflect strength and stamina required in some physically-taxing jobs, and therefore higher BMI is expected to be at premium in those occupations.

However, these measures may say nothing about the dimensions of health valuable in other occupations; therefore my next step will be to consider the effect of a more general variable, namely the effect of the self-evaluated health. Although this measure is widely believed to be somewhat subjective, the fact that I will account for the fixed unobservables possibly driving self-perception of health (e.g., pessimism about life) with fixed (or random effects, as appropriate) should lessen those concerns. Next, I will use even more specific measure of health, whereby respondents were asked if they had a health problem in the last 30 days (and then asked to elaborate on the nature of the problem).

The effect of psychological health on labor market outcomes has been relatively little studied so far. RLMS contains two rounds of information on the psychological health of the respondents, thus allowing me to estimate fixed or random effects models.

My next step will be to consider the effect of disability status as well as other functional limitations on monthly earnings. While disability measure is likely to suffer from a range of biases, ADL score deals with those dimensions of health that are less likely to be driven by subjective perception as well as by reverse feedback from earned income, and therefore can be considered an exogenous change in health. The main limitation of this metric is that it is only measured for adults 55 years and more in RLMS dataset, and since a large number of people start to leave labor force at around this age in Russia, the sample may be too small, and sample selection issues may also be more prominent. For this reason, I will also look at the effect of two other functional limitation scores that are measured for all age groups- self-assessed vision and hearing ability.

My next group of variables of interest is those whose diagnosis relies on the contact with the medical care system. As mentioned above, I expect them to be measured with considerable error, especially for certain population groups. Specifically, I will look at the effect of high blood pressure (controlling for obesity) as well as at the effect of a set of chronic and other diseases which are diagnosed after contacting medical care workers (conditional on high blood pressure and obesity).

Finally, I will measure the effect of acute diseases (e.g. of heart attacks and strokes) on monthly earnings. While their association with labor supply measures is undoubtedly expected to be strong and negative, it is interesting to see if the same association is observed with monthly earnings, especially in the short run. One can argue, for example, that it is much more controversial to cut wages for a person who has recently suffered a heart attack, as opposed to a person who had a loss in productivity due to a milder health condition.

Finally, I will conduct subpopulation analysis, trying to see how effect of varies health measures varies between different people, and whether predictions of hypothesis 3 hold.

However, before moving to the main analysis, I present results for the control variables of interest in Table 3 (I will omit the estimates for control variables from all subsequent tables). We see that all variables have the expected signs. Thus, age has a quadratic association with log monthly earnings; males have approximately 43% higher wages than females; those living in urban areas earn about 50% higher wages, and that those with university degree have a considerably higher earnings that those with only a high school diploma (or no degree at all). As the household size increases, individual monthly earnings also drop. People who have cars (a proxy for wealth and assets) also have considerably higher monthly earnings than the reference group. Those living in the capital city of Moscow and in Saint Petersburg (omitted region) have significantly higher wages than those living in all other regions.

In table 4, I present my results for the effect of my first main variable of interest-log BMI on log monthly earnings. In the baseline OLS specification 1 for the pooled sample, we see that the elasticity of BMI with respect to monthly earnings is about 0.29%, and that it is strongly statistically significant (please note that all models also include time dummies to account for nation-wide omitted covariates, as well as regional dummies).

In specification 2, I regress log monthly wages on contemporaneous and lagged (for 1 and periods) BMI. Although the estimates in this specification can possibly suffer from serial correlation in wages and/or BMI and time-invariant heterogeneity affecting even lagged health, this is still a useful first step. We see that conditional on current period health, lags of log BMI have no effect on wages. This could be either because BMI genuinely has no lagged effect on earnings, or because their effect is "absorbed" by contemporaneous health (this seems to be the case: when current period log BMI is not controlled for, the effect of log BMI lagged 1 period becomes significant, results not shown). Next, in specification 3, I regress log of monthly wages on *changes* in log BMI, both current period and lagged ones. As mentioned above, this specification looks at how "shocks" to health affect the levels of income in current and future periods. A priori, we should expect to find a positive relationship between changes in log BMI (a positive "health shock") which diminishes in time. Indeed, we see that both current and lagged changes in log BMI are positively associated with the level of earnings in the current period, and that the strength of the relationship diminishes with time.

In specification 4, I look at how changes in the lags of BMI affect *changes* in log monthly earnings from prior to the current period. It is difficult to expect a particular sign a priori, since those affected by baseline "health shocks" may experience either convergence or divergence of incomes with those unaffected by changes in health (although, as mentioned above, adverse health shocks are likely to be negatively associated with *levels* of health). In this case, we see that increases in BMI from the previous to the current period, when controlled for similar changes in the prior 2 periods, have no effect on changes in real monthly wages from the previous to current period. On the other hand, changes in log BMI from second to first lag have *negative* effect on changes in log real monthly wages from previous to current period. This possibly suggests that those people who experienced "health shocks" as measured by decreases in log BMI from one period to the next, (although having lower earnings in the following periods), are also more likely to catch up with those who were unaffected by such changes. This therefore may imply that this measure of health is not indicative of a long-term term damage to health, as earnings of the people converge in time, regardless of their baseline changes in log BMI.

In the next specification (5), I estimate a growth regression whereby I look at the effect of health lagged 1 period on change in log monthly wages from prior to current period. Again, I see some evidence of earnings convergence over time, this time for people with lower baseline log BMI (rather than changes in log BMI).

Next, in specification 6, I control for the presence of time-invariant unobservables (e.g., ability) by including individual fixed effects to the model (random effects were not appropriate, test results not shown). As expected, the association between the main variables of interest somewhat weakened, although it remains highly statistically significant, implying a short-run elasticity of monthly wages with respect to BMI of around 0.12%. The effect of age, education and car ownership also somewhat weakened, but it still remains highly significant (not shown in the table).

Finally, in column 7, I estimated a first differenced model suggested by Gertler and Gruber (2002) and Wagstaff (2005). Specifically, I regressed change in log monthly earnings on change in log BMI between adjoining rounds, together with adding dummies for all communities. Including community dummies helps to control for community-level variables that influence both changes in log individual earnings and changes in health between periods. This is a very data-demanding specification, but still the estimated effect is roughly similar to the one shown in column 6.

In column 8, I estimate the effect of individual log BMI on percapita family income. As argued previously, presence or lack of significant relationship here may be indicative of labor supply responses from family members. Here, we see that the effect is strong and significant, suggesting that other family members generally fail to compensate for weakening earning ability of those whose BMI gets smaller. Finally, from column 9 we see that there is no association between unearned income and log BMI, suggesting that reverse feedback from income measure of health to log BMI is unlikely to be of serious concern, at least in the short run.

Finally, although I took a natural log of my main variables of interest, I may still be worried about the non-linearities in the observed relationship. Indeed, the nonparametric lowess regression (figure 5) indicates inverted U-curve association between log BMI and log monthly wages. For this reason, I used dummies for my BMI variable, splitting it into 8 categories (table 6). Using OLS specification, I found that those whose BMI was between 25 and 28 had increasingly higher monthly earnings than those in the lower weight categories, and that, somewhat surprisingly, they had lower wages than those BMI was between 28 and 35 (although the effect was diminishing as weight increased). The two categories that had a BMI of 35-40 and 40 and up were not likely to have greater wages. Therefore, it does appear that the effect is strongest at lower level of BMI and weakest at the higher one.

Next, in table 6, I consider the effect of another, supposedly less endogenous health measure (at least in the context of Russia, see note 15 above) - log height on the variable of interest. Since it doesn't really make sense to estimate the effect of changes in height from one period to the next, the presentation is shortened compared to other tables.

Specification 1 indicates even stronger effect than log BMI variable: 1% greater height is associated with about 1.2% increase in log wages. Specification 2 does not imply any convergence/divergence of earned income for those with lower or higher height. Random effect specification (column 3) gives very similar results to the OLS model. The effect on family per capita income is significant although smaller, implying some compensating labor supply response from other family members. Finally, as expected, unearned income is not associated with this measure of health.

Next, I consider the effect of a more general, although also possibly more subjective measure of health – the self-perception of health coded from a 5-category variable into a dummy variable for the "bad health". Specification 1, Table 7 indicates that being in bad health is associated with a loss of about 15% of monthly earnings. However, we may be worried that this relationship can be driven by such factors as an outlook towards life, ability, and/or reverse feedback from health. Before tackling these issues, observe from specification 2 that in distinction from the case when the main variable of interest was log BMI, now it is lagged and not contemporaneous measures of bad health that have an effect on log monthly wages. This suggests a more serious lasting impact from worse health than was the case for the BMI variable. On the other hand, when the main variable of interest are changes (rather than levels) of bad health variable, "shocks to health" as measured by changes from prior period to the next are only significant for the shocks from the prior to current period (column 3), and are surprisingly positive in sign when other period shocks are controlled for (this is not the case when these controls are not included). However, the same specification where the outcome variable is total hours worked in the last 30 days demonstrates a strong negative effect for health shocks from changes in all lagged periods (results shown in the next chapter), suggesting that this measure of health more strongly affects labor supply than monthly earnings (thus placing a greater financial burden on the employer). In addition, although specification 4 does not indicate any convergence/divergence of the effects for those affected and unaffected by the shocks, specification 5 indeed suggests convergence, a finding similar to the one reported for log BMI growth regression. The difference could be due to the fact that health is likely to exhibit strong serial correlation, thus making estimating the effect of its first difference more difficult because of great loss in precision.

In specification 5, I include individual fixed effects to control for the above mentioned time-invariant unobservables that may be correlated with both bad health variable and the error term (random effects were not appropriate, Hausman test results not shown). The effect is now considerably smaller than in column 1, although still significant. In column 7 I present results for the most data-demanding specification where I add community dummies to the first-differenced equation, and although the effect is in the predicted direction, it is not significant. The effect on family earned income is similar to the individual one, suggesting lack of labor supply readjustment. Finally, as expected, there is no association between unearned income and bad health.

Next, I consider a measure of health that although reflecting possibly smaller shocks than the "bad health" variable, also likely suffers from a smaller subjectivity bias due to the follow-up clarifying question on exact nature of a health problem. In column 1 of Table 8, we see that having a health problem in the last 30 days implied a loss of about 3.9% of real monthly individual earnings. As expected, this measure only seems to have contemporaneous effect on monthly wages (column 2). From columns 3 and 4, we see that lagged changes in health had no effect on the current levels and changes in log monthly earnings when controlled for the difference in health from prior to current periods. However, when I restrict my health shocks only to the negative ones (i.e., I only consider those cases when there was a negative change in health from prior to current period), I find that changes in health from period t-2 to t-1 and t-3 to t-2 have a significant negative effect on changes in earnings from period t-1 to period t (results not shown). Therefore, for this particular measure of health shock, there is a divergent effect from negative changes in health on changes in monthly wages. Also, change from prior to current period, even controlling for prior period shocks (column 4) has a negative association with changes in the log monthly wages, indicating particularly strong contemporaneous effect.

In line with my prior reasoning that reported temporary measured of health are less likely to suffer from subjectivity bias, I did not reject the random effects model (test results not shown). In column 6 of table 8, we see that the estimated effect decreased a bit from the one reported in column 1, but still remains highly significant. However, in column 7, when community dummies are added to the first differenced model, the estimated effect is in the predicted direction but no longer significant. This is hardly surprising given the previously mentioned point concerning potentially strong serial correlation in health and thus difficulty of estimating first differenced model with it. Finally, there is no effect on family earned income (column 8), suggesting that labor supply of other family members usually successfully readjusts to short-term health changes. There is also a rather strong positive effect on unearned income (column 9), which supports the notion that it is health that drives income in the short run (in this case, deteriorating health probably drives transfer payments), rather than the other way around.

A yet more objective measure of health is a previously-discussed ADL index. I present the results for this indicator in table 9. Interestingly, the ADL index in the OLS specification is highly significant only when the self-reported health (converted to a bad health dummy) is not included. When both are in the same model, ADL score, although with a right sign, is no longer significant. Since it is customary to control for self-reported health when estimating the effect of the functional limitation scores, I will do this for all remaining specifications.

In column 2 of the same table, we see that the lags of ADL have no effect on the outcome of interest when the current ADL score is controlled for. The change in ADL score from previous to current period is also not significantly associated with the level of earned monthly wages. At the same time, the changes in ADL scores have a strong negative effect on the *changes* in wages from previous to current period (without controls for changes in ADL in the prior periods, this is in essence a first difference model, results not shown)[18]. On the other hand, the convergence hypothesis seems to be supported here as well, as both changes in ADL score from second to first period lags, as well as the first lag of ADL score have a positive effect on change in the outcome variable from prior to current periods (columns 4 and 5).

In column 6, we see that the short-term effect of ADL score on monthly wages, when controlling for individual effects, is surprisingly strong and in the expected direction, suggesting the existence of important time-invariant unobservables in the OLS

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[18] Since the data on functional limitations was only collected for round 6-9 and 11, it was not possible to estimate changes in lags of more than 1 period

specification. Moving from having no functional limitations to a maximum number of limitations is related to about 91% loss in monthly earnings. When community dummies are added to a first differenced model (specification 5), the effect becomes even stronger, although the sample size also drops to just 364. Finally, no effect on family earned income is found, suggesting other family members successfully readjust their labor supply to compensate for the loss of income of the sick members in such cases (column 8). Since ADL scores were available only for those older than 55, this could be because their share in family income[19] is usually relatively small.

Moving on to another set of functional limitations measures that were collected for all adults in rounds 6-11, we see in table 10,, column 1 that both having a bad vision and bad hearing was associated with the loss of monthly wages of up to around 10% in the bad hearing case. Specifications 2 -4 do not suggest any lasting effect of the lags of both of these measures, at least when the contemporaneous changes are controlled for. At the same time, growth model (column 5) does indicate some convergence. In addition, as random effects specification in column 4 shows (I did not reject its appropriateness with the Hausman test), the contemporaneous effect is sizable and significant for both of these measures. There is no effect of these measures on family earned income (column 8), and some *positive* association between poor vision and unearned income, possibly reflecting the increase in benefits for the handicapped people.

Next, in table 11, I consider the effect of being classified as disabled. As expected, OLS estimate (column 1) is large and statistically significant. This result should be considered with caution, however, since disability status can be determined not only

[19] Many elderly live within extended families in Russia

by health, but also other characteristics of a person (e.g. ability to pass bureaucratic hurdles, which may create an upward bias in estimated effect). But first we see that there are no lag effects of this status on earned income, nor any evidence of convergence or divergence of income with time (columns 2-5). However, since disability status exhibits strong serial correlation, these results are probably not very informative because of a lack of precision. The same applies to the fixed effects estimates reported in column 6. For this reason, a more interesting approach is to estimate the effect of disability status by instrumental variable method, instrumenting it with objective health indicators. I will do this later in the paper.

In table 12 I consider the effect of psychological health. The effect is strong when OLS method is used (column 1), implying a loss of around 9% of monthly wages when a person reports having a serious psychological problem or depression in the last 12 months. We may wonder, however, if this result is at least partly driven by reverse feedback from labor market outcomes, the question I'll attempt to address with instrumental variable method later on. Please also note lack of evidence that the lags of depression affect monthly wages net of their effect on depression in current period, nor any evidence of convergence/divergence of wages over time. Finally, note that fixed effect estimates, although half the size, are still significant (columns 6 and 7), and that there is no effect on family per capita income, suggesting that other members easily readjust their labor supply in such cases.

My next health variable of interest is diagnosed high blood pressure (table 13). We see from table 13 that even after controlling for obesity, being diagnosed with having a high blood pressure is negatively and significantly associated with monthly earnings (specification 1). However, there are no lag effects of this variable, when controlling for contemporaneous changes in diagnose status (specifications 2 and 3), therefore it appears that adjustment to changes in wages happens rather quickly (or that strong serial correlation in this variable prevents from finding an effect of lags). The random effects result (column 6) indicates that having high blood pressure is associated with the loss of about 2.3% of monthly wages, while first-differenced results with community dummies are not significant (column 7). There is also no effect on family income, and surprisingly strong positive effect on unearned income, indicating that many people with high blood pressure receive transfer payments[20]. However, note (as discussed in my hypothesis 4) that this measure of health may suffer from considerable misclassification bias, and therefore the effect may be underestimated.

Next, I show results for another set of diseases whose diagnosis depends on the contact with the medical care system. In table 14, I only present estimates for the main variables of interest and only for the three main specifications, to avoid clutter with too much information[21]. In OLS specification (column 1), we see that only kidney disease and anemia have a statistically significant and negative association with individual monthly wages. After including fixed effects (random effects model was not appropriate), only anemia and liver disease remained significant (the latter with the wrong sign). Finally, in the first-differenced model with community dummies no disease was significant. Again, the fact that so few diseases have significant association with the loss

[20] This is also true when the sample is restricted to those younger than 55 years, the official pension age in Russia

[21] VIF test for multicollinearity suggested that including all disease variables in this specification was appropriate

of wages may suggest misclassification problems linked with the lack of proper medical diagnosis in Russia, as predicted by hypothesis 4.

Finally, I look at the effect of the most acute diseases- heart attack and stroke. From table 15, column 1 we can see that only stroke has a contemporaneous effect on monthly wages, implying about 15% loss. The measurement error explanation is unlikely to be satisfactory here, so one possibility is that employers find it harder to cut wages to the people affected by such serious health events, even if hours worked are significantly reduced. However, in time an adjustment in wages may happen.

For heart attacks, this is exactly what seems to happen. In columns 3 and 4 we can see that in the third year after the heart attack, wages adjust by more than 24%. This is not the case for strokes, however, since most adjustment seems to occur within the first year. The growth model (column 5) indicates a similar story: after a heart attack, the monthly wages start to diverge between those affected and unaffected. This is in strong contrast to those affected by less serious health events, where a short term reduction in wages after a health shock is usually followed by the convergence of earned income.

The random effects specification tells a similar story (column 6). Interestingly, when the dependent variable is family earned income, there is a much larger wage response (column 8), possibly indicating that other household members take care of the sick and therefore reduce their labor supply. Moreover, when the dependent variable is hours worked in the last 30 days (not shown here, to be reported in the next chapter), there are very large losses of hours worked for those affected, which implies that after seriously adverse health events employers tend not to adjust wages rapidly and thus bear the main financial brunt. Therefore, the cost of acute health events may be seriously understated if only the wages of the sick are considered in the analysis

Next, I move on to subgroup analysis for the same variables of interest (table 16). I will see how the effect of health differs for the following populations: males vs females, household heads vs the rest, those living in urban vs rural areas, those working in unskilled vs skilled and service occupations. However, rather than report results for these groups separately, I will show the estimates for males, heads of households, those living in urban areas and those working in unskilled occupations (unshaded cells), and then report the difference in estimated effects between them and the omitted categories, using fully interacted models. In all cases, I used either fixed or random effects estimator, based on what was appropriate in my previously reported analysis.

I start with log BMI and find that for males, heads of households and unskilled workers, the association of this measure of health with monthly individual wages was considerably stronger than for the omitted groups (for heads of household and those working in unskilled occupations the difference was also statistically significant). This is in line with my second hypothesis: anthropometric measures of health are more important for people in less-skilled and/or more physically demanding occupations. One exception in this table is the results for rural dwellers only, who have a lower association of log BMI with earned income (although this difference is not significant). One possible explanation for this is that they have a greater measurement error for this metric.

Although these results are tempting to treat as a robustness check on the assumption that the main effect comes from health to earnings, rather than vice versa (since one can argue that the effect of income on health should not be stronger for males, those in unskilled occupations and with lower level of education), one can also counter that these groups are more likely to invest greater earnings into increases in body mass. Therefore, it's also important to consider the estimates for the metrics which are less likely to suffer from endogeneity concerns. Indeed we see that when height is the main variable of interest, a similar story emerges: males and heads of household seem to have a higher return to height. Less expectedly, those working in unskilled occupation have a lower return to height, which may be due to the fact that it's not height per se, but rather physical strength (measured by muscles and BMI) which is important in unskilled occupations- that's why we observe higher returns to BMI than to height in unskilled occupations. On the other hand, height may reflect those features of health (e.g. ability) that are more important in productive work in skilled occupations.

Next, I consider the effect of depression by population subgroups. As I speculated in my conceptual model section, this measure of health may be less important in physically demanding jobs, and more important in skilled jobs. Therefore, one can expect the wage returns to this health measure to be considerably less in manual occupations, rural areas, for males and household heads. Indeed, we see this seems to be the case: for males, those living in urban areas and working in unskilled occupations, the association for this measure with health outcomes is not statistically different from the one for the reference groups. For household heads, the difference is actually *positive* and statistically significant, indicative of weaker effects than for other household members, possibly a reflection of their propensity not to reveal their true psychological status.

Similarly, we can also see that there is no difference in the estimated effects between various subpopulation subgroups when the health measures are bad eyesight and hearing, also one of the predictions made in my third hypothesis. When the variable of interest is disability status, there is little difference in effects by subpopulation groups, also a prediction of the third hypothesis. It should be remembered, however, that this measure of health is particularly problematic in countries where it is determined by factors other than health (which is likely to be the case in Russia)

My next variable of interest is a dummy for bad health. Although the effect of bad health is stronger for males, rural dwellers, unskilled workers and household heads, the difference is not statistically different from zero. This may be either because this particular measure of health is equally important for all population subgroups (a prediction of my third hypothesis), because it is so general and all-encompassing, or because of its considerable subjectivity. For example, males are much less likely to rate their health as bad than females, even though they have worse life expectancy and generally have worse objective measures of health. Thus, there is probably considerable misclassification of males in this variable, and therefore the effect of bad health for them is understated.

On the other hand, when a more specific health measure- whether a health problem in the last 30 days occurred is used, a different picture emerges. There is a very strong difference in effect for all subgroups (except for urban dwellers), all in the predicted direction. Indeed, it is possible that these subgroups are more likely to justify their lower wages with self-reported health problems, but since they were also asked to be more specific about their health problems in the follow-up question, it is likely that their answers didn't significantly suffer from the subjectivity bias. Again, this result is in line with my third hypothesis, which predicts that temporary health problems are likely to be more important in physically demanding than in skilled jobs.

One must be careful in interpreting the estimation results for various subsamples when the variable of interest is ADL score. As already mentioned, the working sample for this measure is relatively small, with data being collected in only 5 rounds, and with only working adults 55 years and older answering the relevant questions. At any rate, the reported results are stronger for males and household heads. On the other hand, there is no difference in the estimates between skilled/unskilled workers. Surprisingly, the difference in effects is positive and significant for those living in urban areas, but the sample size is extremely small (n=173).

Next, in line with my forth hypothesis, we can see that the difference in the returns to health to the conditions whose diagnosis depends on the contact with the medical care system (I specifically consider dummies for high blood pressure, or for having at least one chronic condition) is now reversed. Males, heads of households, rural dwellers and unskilled workers all have *lower* returns to health than the reference groups, or the difference is not significant. This seems highly counterintuitive unless one takes into account the point I raised earlier- all these groups are less likely to have a proper medical diagnosis in Russia, and therefore the returns to health for them are likely to suffer from a serious misclassification bias.

Finally, looking at the difference in returns to health when the variables of interest are acute health conditions such as heart attacks and stroke, we see that it is significant in only two cases. First, those living in rural areas have a *positive* effect from heart attacks, statistically different from urban dwellers. This is a somewhat surprising finding, which can be tentatively explained by the possibility that fewer people survive heart attacks in rural areas. Indeed, among respondents reporting ever having a heart attack, there are more urban than rural dwellers (estimates not shown here). But overall, no other population group has a statistically significant association of having a heart attack with the loss of income. As suggested previously, this can be a reflection of the fact that employers may be loath to reducing wages after this health event (even though the work hours may be reduced). A similar story emerges for another acute disease variable- whether a person ever had a stroke. Although the effect is negative and significant for females and not heads of household, the difference is not significant for males and heads of households (in line with my hypothesis 3). It's also notable that while skilled and unskilled groups have no short-term effect on wages from having a heart attack, the effect of having a stroke appears stronger for those in unskilled occupations (statistically significant result). This can be explained by greater importance of this health measure in manually-demanding jobs, or by the fact that employers of skilled workers are more lenient in cases of such adverse events. If this is true, the costs of adverse health shocks such as this may be underestimated for the less skilled workers if an average effect is calculated.

Next, I show the results for the set of quantile regressions (Koenker and Bassett 1978; Cameron and Trivedi 2005) between log BMI, health problems and bad health dummies on the right hand side and with monthly wages/unearned real household income as dependent variables (Figures 6 and 7)[22]. The obvious trend i**Error! Hyperlink reference not valid.**ening strength of the relationship between all 3 measures of health and earned

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[22] All specifications include main controls

income as income increases (this finding is robust to using first-differenced health data, which removes time-invariant component from it). On the other hand, the reverse is true when the outcome variable is unearned income. In my view, this evidence provides strong support to my sixth hypothesis that the return to health gets weaker for higher income categories. In addition, the lack of similar trend for the health-unearned income relationship supports the importance of the effect of health on earned income rather than the other way around, at least in the short run. Indeed, if it is income that drives health, it is not clear why the relationship between earned income and health is much stronger at the lower level of income distribution, and why the sign changes when the dependent variable is unearned income. More likely, returns to health are higher to those working in manual occupations and to those with less education (who tend to have lower income).

My final estimation approach is instrumental variable method. As I argued previously, some health variables may be ridden with both endogeneity and misclassification problems. For example, disability status in Russia may depend not only on health status of individuals, but also on their ability to deal with the bureaucratic system. Likewise, it may be possible to correct for time-invariant subjectivity bias in self-evaluated health status with fixed effects, but there may still be a reverse feedback from labor market outcomes. In addition, using fixed effects may not be very feasible in the presence of serial correlation in the health variable because of considerable loss of variation in the differenced variable, therefore I am now turning to an alternative approach.

First of all, it should be noted that most of my community-level instruments measuring health-related inputs and prices had a very weak first stage predictive power, therefore I am not reporting results for these particular instruments. In table 18, I present results from several other, more promising specifications. In order to compare robustness of findings, I used different sets of instruments for each health measure except log BMI (the dependent variable in all cases is the same- log individual monthly real wages). The first set of excluded instruments for bad health and health problems dummies contains a dummy for reporting chest pain when active, a dummy for reporting severe chest pain lasting more than 30 minutes, a dummy for having an operation in the last 30 days (all 3 in the last last 30 days), as well as poor vision and hearing. I am arguing that identifying assumption in this case is defensible: these variables are unlikely to affect labor market outcomes other than through their effect on general measures of health, and are not likely to suffer from subjectivity of justification bias. The estimated effects (table 17) are significant and greater in size than those reported in my previous analysis. Next, I compare the results for these measures using a different set of coefficients. This time, I instrument for health with the second set of excluded instruments, which includes dummies for ever having hepatitis A, tuberculosis, as well as a variable for reported days spent in the hospital in the last 30 days. Again the (reasonable) identifying assumption here is that these variables reflect those dimensions of health which are likely to be exogenous to their labor market behavior (both diseases are infectious, and people are unlikely to go to hospital as a justification for lower wages). It's remarkable how close the results from both sets are. In addition, both sets of instruments have good first stage predictive power (with F-statistics ranging from 30 to 135), and both pass overidentification tests.

In a similar vein, I try to correct for misclassification and endogeneity concerns in disability status variable. The instruments I choose for the first set are ever having a heart attack, a stroke and ever having an operation. All these conditions are serious enough to genuinely cause disability, and therefore are good candidates for being excluded instruments. The results indeed indicate substantial effect on monthly wages from being disabled, which is much larger than the effect found in my previous analysis. This can be explained by the possible positive bias arising from the fact that getting a disability status may require certain skills (e.g. persistence, general ability) which may be positively correlated with labor market outcomes, and it is possible that IV approach allows correction for this bias. When I use a second set of instruments (dummies for being diagnosed with heart, liver and spinal disease), I again get very similar results. F-statistic for 1st stage test are 11 and 15; and the models also didn't fail the overidentification tests.

I also considered IV estimation for another health variable- log BMI. Even though I tried to rule out alternative explanation for found association in my above analysis, there is still room for doubt that it may at least be partly driven by reverse feedback. The findings presented in table 32 is additional evidence that health is important in its own right. Instrumenting log BMI with changes in prices of chicken and eggs from prior to current period (excluded instruments that had the strongest first stage predictive power), I found a very large positive association, with F-statistics of 4.53 and Hansen's test P-value of 0.22. Although it looks implausibly large, it may be either an indication of lack of precision (with the result still significant), or that the effect for a particular subpopulation whose health depends on changes in the price of food is very large. Either way, the finding that the IV estimate for the effect of log BMI is in the predicted direction supports the hypothesis of significant economic returns to health from anthropometric health measures.

Finally, I also mentioned that the dummy for having a depression in the last 12 months may suffer from reverse feedback from labor market outcomes. I used to sets of instruments in order to correct for this bias. First, I used interviewer's comments about sincerity and openness of the respondent. This variable, coded into a dummy, had a reasonable first stage predictive power, with the F statistic of 4.68. Although the estimate was not significant at 10% level, it still had a predicted sign and reasonable magnitude. The second set of coefficients, containing 2 variables asking respondents to evaluate their power and respect rank on a 9 point scale was also used. To make them more "exogenous" in a sense of removing subjectivity component, I averaged these scores across families. Again, they had a good first stage predictive power (F-statistics equal 15.71), and passed overidentification test. The magnitude of the effect in this case was considerably larger.

Discussion

For most part, the main hypotheses of this paper appear to be valid. Thus for those measures of health whose diagnosis did not depend on the contact with the medical care system (e.g., BMI, height, self-assessment of health and problems reported in the last 30 days, ADL score), there was a consistent association between earned income and health, even though a considerable percentage of people still work in salaried sectors. This is either because people choose to work less in Russia after health shocks, or because they become less productive, and the employers can adjust their monthly wages despite a lot of people still working in government and salaried employment. Unfortunately it is not possible to explore the effect of health on productivity because of the lack of information on hourly wages.

What I will also show in my next chapter is that the effect of health on labor supply of people is even greater than on their earned income. Therefore, the costs of ill health go beyond the reduction of the monthly wages of the affected. This is particularly true for those suffering from acute medical conditions such as heart attacks, whose income seems to adjust over relatively long time and most effect is not observed in the short run. Also, significant related cost of serious illness, including being disabled, suffering from strokes and heart attacks is the apparent reduction in the labor supply of their family members who take care of the sick. Therefore, focusing on the short-run earned income effect of those suffering from acute medical conditions of Russia may seriously underestimate the overall economic effects of this health shocks.

On the other hand, labor supply of other family members seems to increase (rather than decrease) quickly in cases of temporary health problems, so that little per capita family earned income is lost. Obviously, much greater costs will be imposed on those living in households with just working adult. Also, there does appear to be convergence in income between affected an unaffected after most temporary illnesses. Important exception is having a serious condition such as heart attack, where growth model indicates divergence of income over time. Finally, unearned income transfers do appear to increase in most cases of having an illness.

Furthermore, my second and third hypotheses also appear to be valid, which highlights the issue of multidimensionality of health. For such measures as BMI, reported health problems in the last 30 days, heart attacks and functional limitations score, the effect on earned income was generally stronger for males, household heads, those living in rural areas and working in unskilled occupations (see table 16, p. 78-79). The cost of ill health for these population groups may be particularly severe, as they tend to change their labor supply, and employers adjust their wages more readily when a health shock to them occurs. This, however, was not the case for some measures of health (such as poor vision and eyesight), which may be less relevant in physically demanding occupations. Since returns to health are likely to differ both by population subgroups and by health measure used it is necessary to consider this multidimensionality in policy analysis.

My fourth hypothesis where I predicted that those diseases whose diagnosis depends on the contact with the medical care system may have less an effect on earned income/hourly wages, especially for those population groups who are less likely to contact the medical care system, also appears to be correct. Thus despite the fact that for more general measures of health these groups tend to have higher earned income return to health, this relationship for most part disappears or is even reversed when health was measured with chronic disease diagnosis. The lesson here is simple: in a country like Russia were a lot of people have undiagnosed medical conditions, estimating returns to health with these measures will likely seriously underestimate the effects. In addition, calculations suggest that males in particular tend to rate their health considerably higher than females, despite having worse objective health outcomes. This peculiar cultural feature may explain why there is little interaction by gender, when health is measured by health self-evaluation.

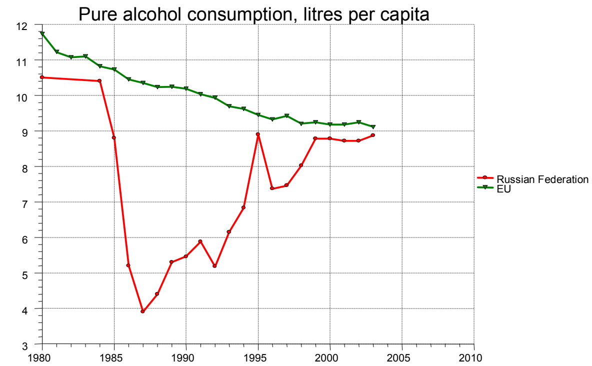
I also found extensive support for my fifth hypothesis. Indeed, there was never a positive association between good health and unearned income, which supports the assumption that health for most part drives income (especially in the short run), rather than vice versa.

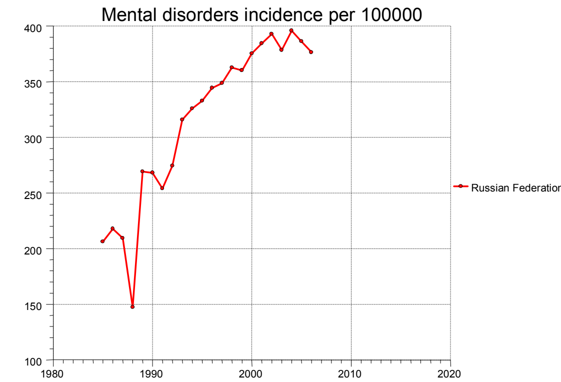
Finally, returns to health, as measured by BMI, temporary health problems and self-identified poor health, were higher for those on the lower part of income distribution (figure 6), as predicted by my sixth hypothesis.

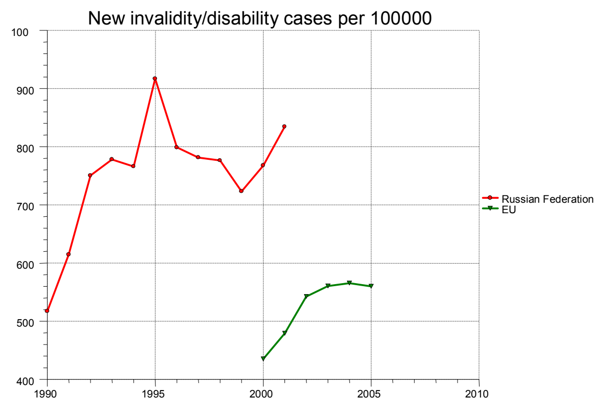
Another lesson learned is that some health measures do appear endogenous. It appears, for example, that disability status may suffer from upward bias, because this measure may be at least partly determined by such attributes as the ability to pass bureaucratic hurdles. It is also possible that some people manage to get the benefits even if they are healthy. Hopefully the instrumental variable methods presented in the paper allows to at least partly correct for this possibility.

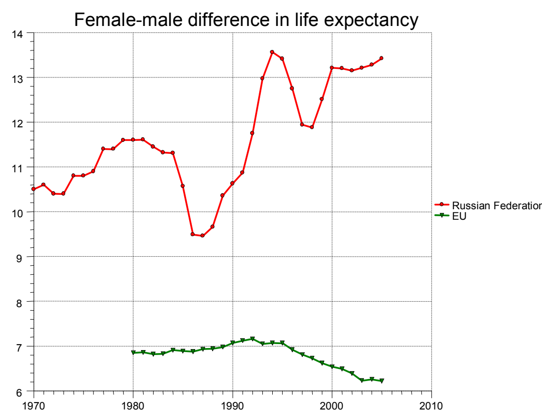
In my second chapter, I will look more closely at the effect of changes in health on labor supply, as well as on labor force participation.

Figure 1.Various country-level indicators for Russia.



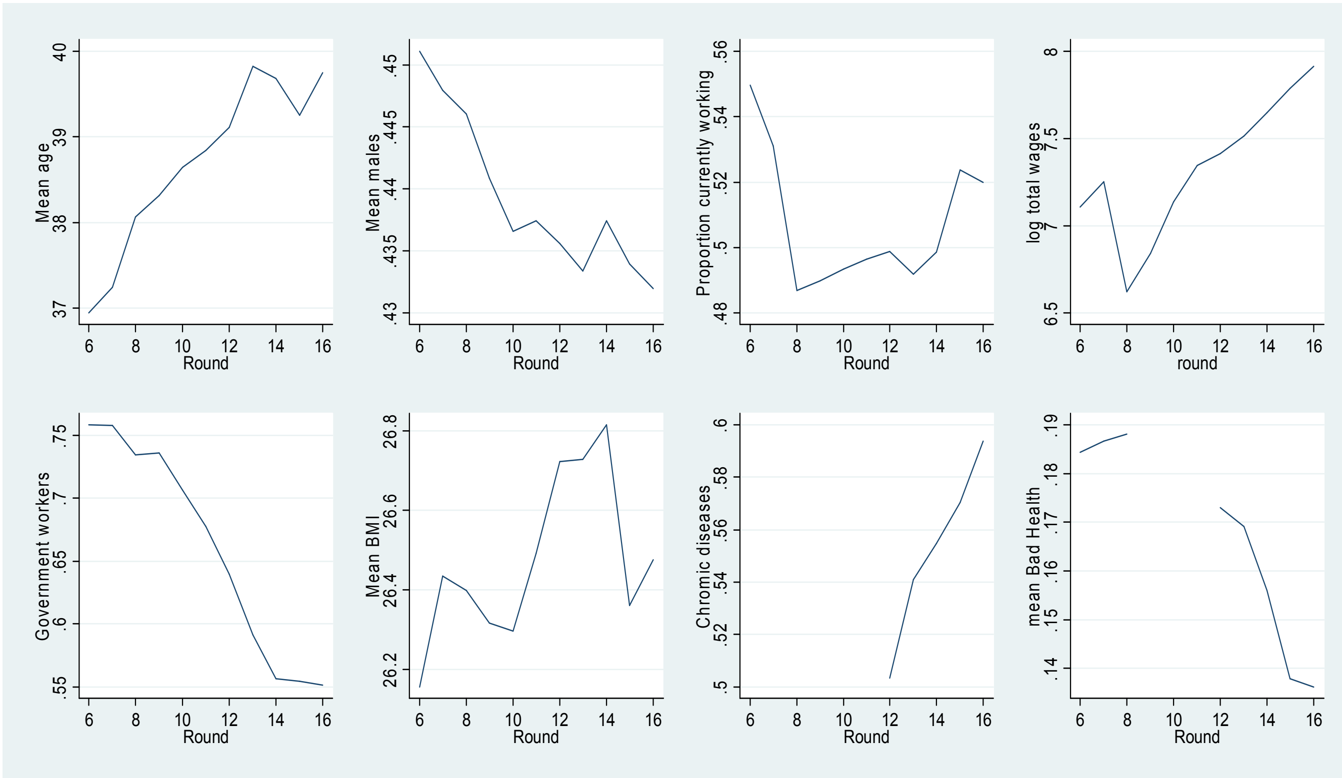






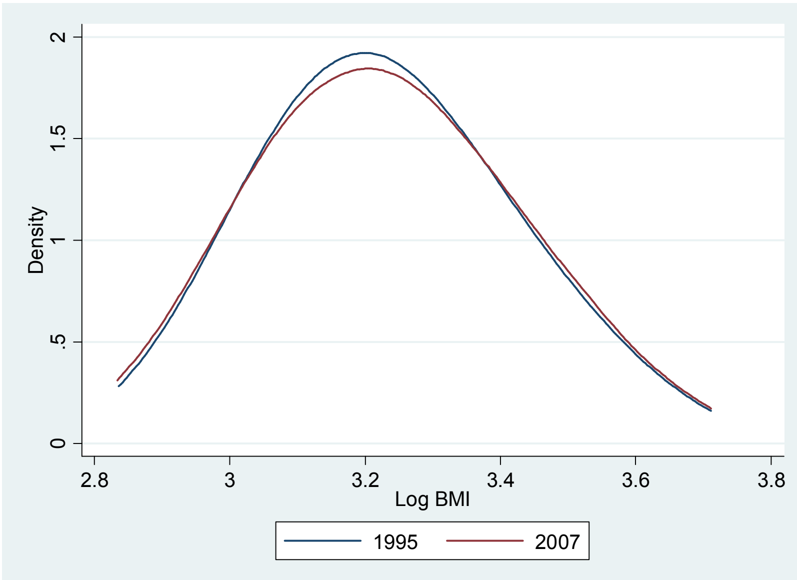
Source: WHO Health for all database

Figure 2. Change in means for various demographic, labor market and health indicators in Russian Federation, 1995-2008



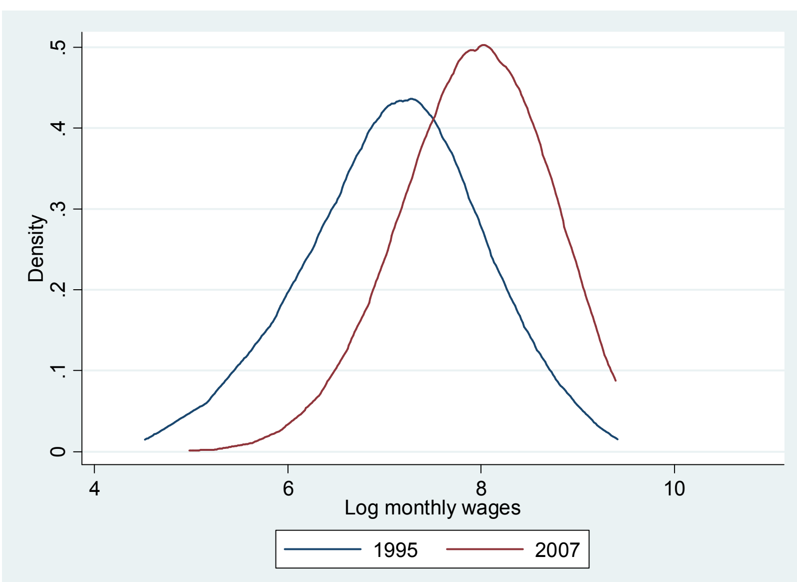
Source: RLMS dataset, rounds 6-16.

Figure 3. Density estimates for log BMI, 1995 and 2007



Notes: Epanechnikov kernel used, bandwidth 0.1

Figure 4. Density Estimates for log monthly wages, 1995 and 2007



Notes: Epanechnikov kernel used, bandwidth 0.3

Table 1. Determinants of some health measures

	(1)	(2)	(3)
Outcome	HBP	Chronic	Visited
Male	-0.0938***	-0.0493***	-0.0299***
	(0.01)	(0.00)	(0.00)
Urban	0.00121	0.0325***	0.0223***
	(0.01)	(0.01)	(0.01)

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Each row provides coefficients for the main independent variable of interest (located in the leftmost cell of the row).
All specifications estimated with OLS. All specifications contain round dummies, as well as contemporaneous control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5), regional dummies

Table 2. Descriptive statistics (respondents 16 years of age and older)

Variable	Description	Mean	Standard deviation
Ln real hourly wage	Log of the ratio of individual real wages received in last 30 days, divided by the number of hours worked in the last 30 days	2.244	0.92
Ln real monthly wage	Log of the individual real wages received in last 30 days	7.33	0.92
Ln per capita family earned income	Log monthly total real earnings for all family members in rubles, divided by the number of people older than 18	6.88	0.98
Ln per capita family unearned income	Log monthly total real benefits, pensions and other unearned payments for all family members in rubles, divided by the number of people older than 18	6.5	1.1
Very good health	Proportion reporting very good health (rounds 6-8 and 12-16)	0.02	0.13
Good health	Proportion reporting good health (rounds 6-8 and 12-16)	0.27	0.44
Average health	Proportion reporting average health (rounds 6-8 and 12-16)	0.54	0.5
Poor health	Proportion reporting poor health (rounds 6-8 and 12-16)	0.15	0.36
Very poor health	Proportion reporting very poor health (rounds 6-8 and 12-16)	0.03	0.16
Bad health	Proportion reporting poor health and very poor health (rounds 6-8 and 12-16)	0.18	0.38
Health problem	Proportion reporting any health problem in the last 30 days (rounds 6-8 and 12-16)	0.42	0.49
Chronic	Proportion reporting at least one chronic disease (rounds 12-16)	0.55	0.5
Lungs	Proportion reporting ever being diagnosed with chronic lung disease (rounds 12-16)	0.06	0.23
Heart	Proportion reporting being diagnosed with chronic heart disease (rounds 12-16)	0.18	0.38
Kidney	Proportion reporting being diagnosed with chronic kidney disease (rounds 12-16)	0.09	0.28
Stomach	Proportion reporting being diagnosed with chronic gastointestinal disease (rounds 12-16)	0.17	0.38
Liver	Proportion reporting being diagnosed with chronic liver disease (rounds 12-16)	0.1	0.3
Spine	Proportion reporting being diagnosed with chronic spine disease (rounds 12-16)	0.17	0.38
Diabetes	Proportion reporting being diagnosed with diabetes (rounds 12-16)	0.05	0.22
Anemia	Proportion reporting being diagnosed with anemia, last 12 month	0.04	0.19
IADL	IADL score (rounds 6-11)	0.35	0.28
ADL	ADL score (rounds 6-11)	0.19	0.2
BMI	Body Mass Index	25.9	4.88
HBP	Proportion reporting ever being diagnosed with high blood pressure (rounds 12-16)	0.4	0.49

Table 2. Descriptive statistics (respondents 16 years of age and older), continued

Variable	Description	Mean	Standard deviation
Lnheight	Log of height, cm	5.1	0.06
Depression	Proportion reporting serious nervous disorder or depression	0.19	0.4
Disabled	Proportion assigned disability classification (round 12-16)	0.11	0.31
Badvision	Proportion reporting poor vision and very poor vision	0.21	0.41
Badhearing	Proportion reporting poor hearing and very poor hearing	0.06	0.24
Obese	Proportion having BMI>30	0.2	0.4
Age	Age	45.5	18.5
Married	Proportion in registered marriage, or living together as partners	0.6	0.48
Male	Proportion of males	0.42	0.49
Urban	Proportion living in urban areas	0.72	0.45
Hsdiploma	Proportion having high school diploma as highest degree	0.54	0.5
University	Proportion having university diploma as highest degree	0.18	0.38
Car	Proportion having a car	0.3	0.46
HH size (1)	Proportion living in families size of 1 person	0.09	0.28
HH size (2)	Proportion living in families size of 2 people	0.23	0.42
HH size (3-5)	Proportion living in families size of 3-5 people	0.6	0.49
HH size (6-8)	Proportion living in families size of 6-8 people	0.07	0.25
HH size (9-13)	Proportion living in families size of 9-13 people	0.01	0.1

All the statistics are adjusted for the sampling weights and clustering at PSU level

Table 3. Effect of control variables on individual real monthly wages

Round 7	0.134***
Round 8	-0.402***
Round 9	-0.164***
Round 10	0.0431
Round 11	0.228***
Round 12	0.321***
Round 13	0.428***
Round 14	0.555***
Round 15	0.711***
Round 16	0.852***
Age	0.0547***
Age squared	-0.000711***
Male	0.425***
Married	0.00924
Urban	0.504***
Hsdiploma	0.0511***
University	0.362***
Car	0.147***
HH size (2)	-0.045
HH size (3-5)	-0.0653**
HH size (6-8)	-0.101***
HH size (9-13)	-0.104
Regions 2	-0.104
Regions 3	-0.461***
Regions 4	-0.708***
Regions 5	-0.527***
Regions 6	-0.526***
Regions 7	-0.477***
Regions 8	-0.405***
Constant	5.862***
Observations	46627

Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Effect of Log BMI on individual log real monthly wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	FE	FD-CE	FE	FE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Log BMI	0.293***	0.343***				0.120*		0.252***	0.03
	(0.0382)	(0.0801)				(0.0616)		(0.0523)	(0.0553)
ΔLog BMI_{0-1}			0.328***	-0.0520			0.124*		
			(0.09)	(0.08)			(0.07)		
ΔLog BMI_{1-2}			0.296***	- 0.228**					
			(0.11)	(0.09)					
ΔLog BMI_{2-3}			0.203**	-0.12					
			(0.08)	(0.09)					
Log BMI_{-1}		-0.0047			- 0.0414**				
		(0.08)			(0.02)				
Log BMI_{-2}		-0.0648							
		(0.07)							
Observations	45382	25418	19545	17136	27991	45382	27383	66227	67290
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes
Individual random effects	No	No	No	No	No	No	No	No	No
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Figure 5. Lowess regression of log real monthly wages on log BMI

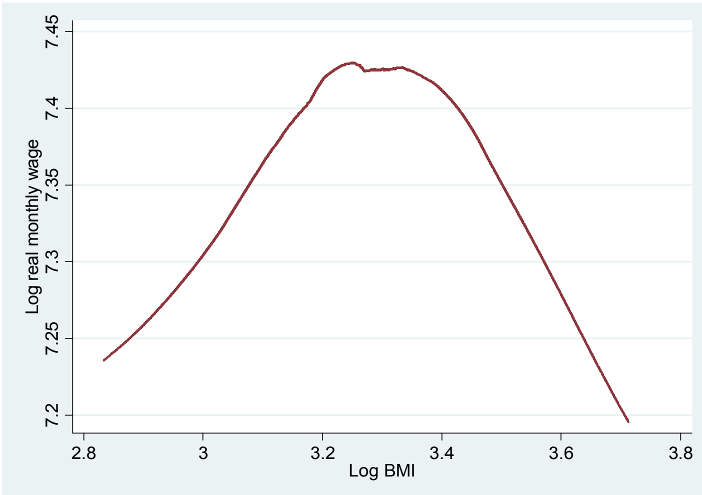


Table 5. Effect of Log BMI on individual log real monthly wages, BMI coded by categories

cat_bmi1	-0.126***
	(0.02)
cat_bmi2	-0.0847***
	(0.02)
cat_bmi3	-0.0375***
	(0.01)
cat_bmi5	0.0547***
	(0.02)
cat_bmi6	0.0425**
	(0.02)
cat_bmi7	0.02
	(0.02)
cat_bmi8	0.02
	(0.06)
Observations	40793

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
BMIs are grouped according to the following categories: (1) if bmi<20; (2) if bmi>=20 & bmi<23; (3) if bmi>=23 & bmi<25; (4) if bmi>=25 & bmi<28; (5) if bmi>=28 & bmi<30; (6) if bmi>=30 & bmi<35; (7) if bmi>=35 & x<40; (8) if bmi>=40. The omitted group is category (4). Specification also includes all usual controls mentioned in other tables, including round dummies.

Table 6. Effect of log height on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	RE	RE	RE
Outcome	y	Δy_t	y	Family earned income	Unearned income
Log Height	1.225***		1.124***	0.846***	0.11
	(0.150)		(0.164)	(0.157)	(0.191)
Log $Height_{-1}$		-0.15			
		(0.0926)			
Observations	33930	19327	33930	50469	50670
Regional dummies	Yes		No		
Time effects	Yes		Yes		
Individual fixed effects	No		No		
Individual random effects	No		Yes		
Community fixed effects	No		No		

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 7. Effect of bad health on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	FE	FD-CE	FE	FE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Badhealth	-0.148***	-0.05				-0.04**		-0.048***	0.02
	(0.0197)	(0.0304)				(0.0168)		(0.01)	(0.01)
ΔBadhealth$_{0-1}$			0.0932**	0.0126			-0.016		
			(0.04)	(0.05)			(0.02)		
ΔBadhealth$_{1-2}$			0.0272	0.00637					
			(0.05)	(0.04)					
ΔBadhealth$_{2-3}$			-0.0069	0.00676					
			(0.04)	(0.04)					
Badhealth$_{-1}$		-0.125***			0.0495*				
		(0.03)			(0.03)				
Badhealth$_{-2}$		-0.0613*							
		(0.03)							
Observations	34091	12063	5605	4946	13349	34091	16798	50898	51445
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes
Individual random effects	No	No	No	No	No	No	No	No	No
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 8. Effect of health problem in the last 30 days on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	RE	FD-CE	RE	RE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Health problem	-0.039***	-0.031*				-0.031***		-0.0107	0.0477***
	(0.0108)	(0.0175)				(0.00845)		(0.00725)	(0.01)
ΔHealth $problem_{0-1}$			-0.0181	-0.031*			-0.01		
			(0.02)	(0.02)			(0.0113)		
ΔHealth $problem_{1-2}$			-0.0205	(0.02)					
			(0.02)	(0.02)					
ΔHealth $problem_{2-3}$			0.00	0.01					
			-0.02	-0.02					
Health $problem_{-1}$		0.00			0.0366**				
		(0.02)			(0.02)				
Health $problem_{-2}$		0.00							
		(0.01)							
Observations	34187	12128	5640	4975	13374	34187	16873	51041	51583
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	No	Yes	No	No
Individual random effects	No	No	No	No	No	Yes	No	Yes	Yes
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 9. Effect of ADL on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	FE	FD-CE	FE	FE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
ADL	-0.14	0.41				-0.907**		0.20	-0.09
	(0.415)	(0.896)				(0.408)		(0.245)	(0.13)
ΔADL_{0-1}			0.30	-0.73			-1.130**		
			(0.82)	(0.71)			(0.47)		
ΔADL_{1-2}			1.16	1.738**					
			(0.86)	(0.82)					
ADL_{-1}		1.11			0.877**				
		(0.96)			(0.39)				
ADL_{-2}		-0.97							
		(0.87)							
Observations	1099	221	535	291	710	1099	364	2600	5680
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes
Individual random effects	No	No	No	No	No	No	No	No	No
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In addition, all specifications control for poor health
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 10. Effect of poor eyesight and hearing on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	RE	FD-CE	RE	RE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Badvision	-0.0479***	-0.03				-0.0305**		-0.02	0.0260**
	(0.0159)	(0.0269)				(0.02)		(0.0139)	(0.01)
ΔBadvision$_{0-1}$			-0.03	0.00			-0.03		
			(0.03)	(0.04)			(0.0203)		
ΔBadvision$_{1-2}$			-0.02	0.02					
			(0.03)	(0.03)					
ΔBadvision$_{2-3}$			-0.02	-0.01					
			(0.03)	(0.04)					
Badvision$_{-1}$		0.01			0.0240*				
		(0.03)			(0.01)				
Badvision$_{-2}$		-0.0215							
		(0.03)							
Badhearing	-0.0976**	-0.03				-0.0934**		0.01	-0.01
	(0.0419)	(0.0653)				(0.04)		(0.0285)	(0.02)
ΔBadhearing$_{0-1}$			0.0409	-0.0628			-0.07		
			(0.0647)	(0.0932)			(0.0575)		
ΔBadhearing$_{1-2}$			0.0411	-0.0191					
			(0.0906)	(0.0989)					
ΔBadhearing$_{2-3}$			0.0965	-0.123					
			(0.102)	(0.0919)					
Badhearing$_{-1}$		0.02			0.02				
		(0.0741)			(0.0357)				
Badhearing$_{-2}$		-0.0531							
		(0.08)							
Observations	21617	10324	6600	5603	14791	21617	11323	33455	35296
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	No	Yes	No	No
Individual random effects	No	No	No	No	No	Yes	No	Yes	Yes
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Notes: All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 11 Effect of being classified as disabled on individual log real monthly wage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	FE	FD-CE	FE	FE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Disabled	-0.293***	-0.03				0.00		-0.0960**	0.260***
	(0.0391)	(0.0816)				(0.0610)		(0.04)	(0.03)
ΔDisabled$_{0-1}$			0.0941	0.0197			0.07		
			(0.10)	(0.12)			(0.08)		
ΔDisabled$_{1-2}$			-0.143	-0.0881					
			(0.13)	(0.07)					
ΔDisabled$_{2-3}$			0.0336	0.115					
			(0.13)	(0.09)					
Disabled$_{-1}$		-0.11			0.05				
		(0.09)			(0.05)				
Disabled$_{-2}$		-0.12							
		(0.09)							
Observations	24946	9630	5625	4966	8291	24946	13703	36262	35560
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes
Individual random effects	No	No	No	No	No	No	No	No	No
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 12. Effect of being depressed on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	FE	FD-CE	FE	FE
Outcome	y	y	y	Δy_t	y	Δy_t	Family earned income	Unearned income
Depression	-0.0855***	-0.0938***			-0.0474**		0.00	0.01
	(0.0212)	(0.0336)			(0.0221)		(0.02)	(0.03)
$\Delta Depression_{0-1}$			-0.0141			-0.0422**		
			(0.02)			(0.02)		
$Depression_{-1}$		-0.0345		0.0232				
		(0.03)		(0.02)				
Observations	9251	3906	7758	9696	9251	6692	13652	8873
Regional dummies	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	Yes	Yes	Yes	Yes
Individual random effects	No	No	No	No	No	No	No	No
Community fixed effects	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 13. Effect of HBP on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	RE	FD-CE	RE	RE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
HBP	-0.0268*	-0.02				-0.0227*		-0.01	0.0516***
	(0.0146)	(0.0270)				(0.01)		(0.0132)	(0.02)
ΔHBP_{0-1}			-0.03	0.02			-0.02		
			(0.03)	(0.02)			(0.0191)		
ΔHBP_{1-2}			-0.01	-0.01					
			(0.04)	(0.03)					
ΔHBP_{2-3}			-0.04	0.03					
			(0.03)	(0.02)					
HBP_{-1}		-0.01			0.01				
		(0.0240)			(0.01)				
HBP_{-2}		0.00							
		(0.0243)							
Observations	36127	21687	17888	15547	23676	36127	23216	51531	16154
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	No	Yes	No	No
Individual random effects	No	No	No	No	No	Yes	No	Yes	Yes
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In addition, all specifications control for being obese
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 14. Effect of chronic diseases on individual log real monthly wage rate

	(1)	(2)	(3)
	OLS	FE	FD
Outcome	y	y	Δy_t
Lungs	-0.0169	0.0254	0.0203
	(0.03)	(0.04)	(0.04)
Heart	-0.0180	-0.0284	-0.0172
	(0.02)	(0.03)	(0.03)
Kidney	-0.0430*	-0.0244	-0.00635
	(0.02)	(0.02)	(0.03)
Stomach	0.00772	0.0111	-0.00199
	(0.01)	(0.02)	(0.01)
Liver	0.0158	0.0526***	0.0312
	(0.02)	(0.02)	(0.02)
Spine	0.02	0.00	-0.000349
	(0.02)	(0.02)	(0.02)
Diabetes	-0.00913	-0.0258	-0.0100
	(0.05)	(0.06)	(0.07)
Anemia	-0.111***	-0.0595*	-0.0294
	(0.03)	(0.03)	(0.04)
Observations	23776	23715	12691
Regional dummies	Yes	No	No
Individual fixed effects	No	Yes	Yes
Individual random effects	No	No	No
Community fixed effects	No	No	Yes

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In addition, all specifications control for being diagnosed with high blood pressure and for being obese
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Table 15. Effect of strokes and heart attacks on individual log real monthly wage rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	RE	FD-CE	RE	RE
Outcome	y	y	y	Δy_t	Δy_t	y	Δy_t	Family earned income	Unearned income
Heart attack	0.02					0.03		-0.0539*	0.0938***
	(0.0318)					(0.0408)		(0.0297)	(0.02)
ΔHeart attack$_{0-1}$		0.14	0.10	0.0302			0.0008		
		-0.10	-0.11	-0.10			-0.10		
ΔHeart attack$_{1-2}$		-0.10	-0.02	-0.0411					
		(0.142)	-0.11	-0.15					
ΔHeart attack$_{2-3}$		-0.0463	-0.240*	-0.246**					
		(0.11)	(0.13)	(0.118)					
Heart attack$_{-1}$					-0.058**				
					(0.03)				
Heart attack$_{-2}$									
Stroke	-0.145***	-0.0933				-0.100*		-0.0911**	0.109***
	(0.0455)	(0.127)				(0.06)		(0.0396)	(0.0221)
ΔStroke$_{0-1}$			-0.00754	-0.08			-0.04		
			(0.161)	(0.11)			(0.0873)		
ΔStroke$_{1-2}$			-0.0154	0.08					
			(0.143)	(0.08)					
ΔStroke$_{2-3}$			-0.0107	0.04					
			(0.153)	(0.09)					
Stroke$_{-1}$		0.0443			0.00936				
		(0.194)			(0.0375)				
Stroke$_{-2}$		-0.0952							
		(0.16)							
Observations	46591	26767	20913	18089	28634	46591	28400	69570	70987
Regional dummies	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Individual fixed effects	No	No	No	No	No	No	Yes	No	No
Individual random effects	No	No	No	No	No	Yes	No	Yes	Yes
Community fixed effects	No	No	No	No	No	No	Yes	No	No

Notes: Community cluster-robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All equations specifications contain round dummies, as well as contemporaneous and/or lagged control variables: male, married, urban, hsdiploma, university, car, hh size (1)- hhsize(5)
In specification 4, controls lagged for 3 periods are included
In all cases, the outcome variable y is individual real monthly wages, unless otherwise noted

Figure 6. Quantile regression for the association between earned income and several measures of health

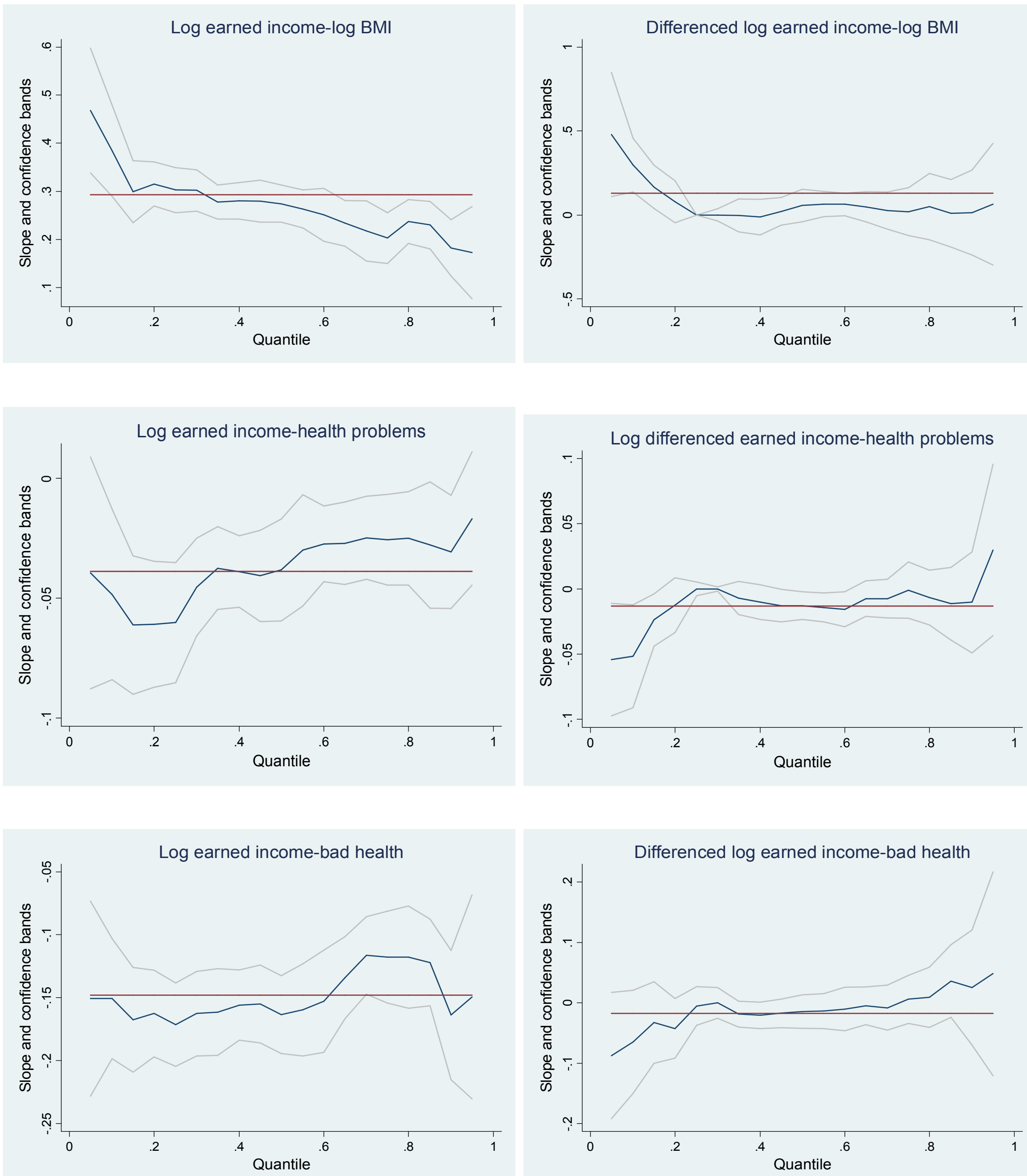


Figure 7. Quantile regression for the association between unearned income and several measures of health

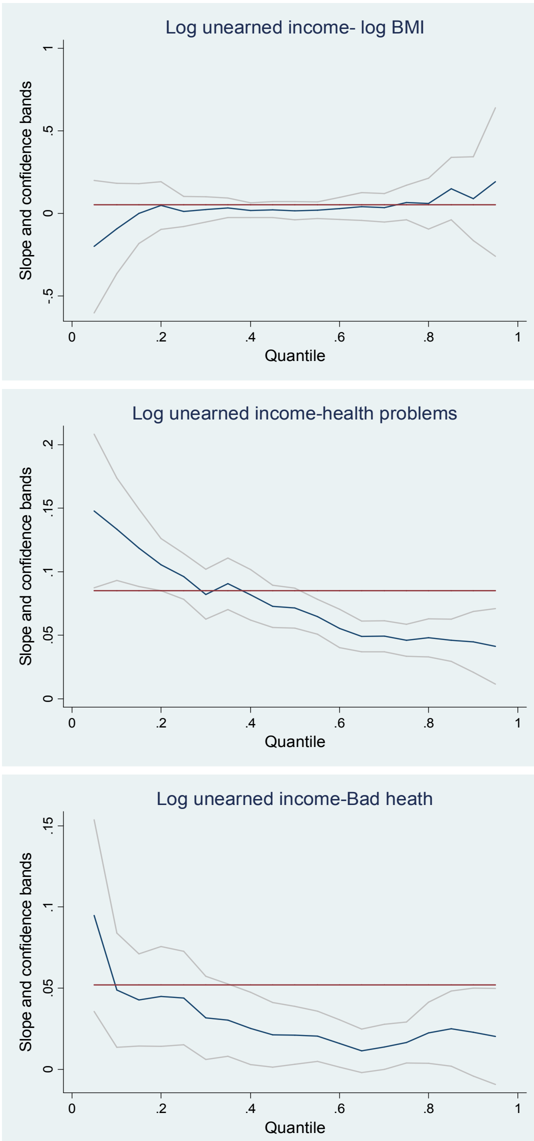


Table 16. Subgroup analysis when the outcome variable is log real monthly wages

	Males	Household heads	Urban areas	Unskilled occupations
Log BMI	0.05	0.05	-0.02	0.03
	(0.09)	(0.08)	(0.11)	(0.08)
Log BMI*interaction	**0.17**	**0.153***	**0.18**	**0.237****
	(0.12)	**(0.09)**	**(0.13)**	**(0.10)**
Log Height	0.842***	0.962***	1.077***	1.384***
	(0.22)	(0.23)	(0.35)	(0.23)
Log Height*interaction	**0.459***	**0.2340**	**0.0164**	**-0.494***
	(0.2770)	**(0.2500)**	**(0.4000)**	**(0.2750)**
Depression	-0.0659***	-0.0877***	-0.08	-0.0532**
	(0.02)	(0.03)	(0.06)	(0.02)
Depression*interaction	**0.05**	**0.0887***	**0.04**	**0.01**
	(0.05)	**(0.05)**	**(0.06)**	**(0.05)**
Bad health	-0.0359**	-0.0408**	-0.0895**	-0.03
	(0.02)	(0.02)	(0.04)	(0.03)
Bad health*interaction	**-0.01**	**0.00**	**0.07**	**-0.06**
	(0.04)	**(0.03)**	**(0.04)**	**(0.05)**
Health problem, last 30d	-0.01	-0.02	-0.02	-0.02
	(0.01)	(0.01)	(0.02)	(0.01)
Health problem, last 30d *interaction	**-0.0452*****	**-0.0338****	**-0.01**	**-0.0358****
	(0.01)	**(0.01)**	**(0.02)**	**(0.02)**
ADL	-1.04	-0.31	1.67	-0.83
	(0.68)	(0.57)	(1.08)	(0.55)
ADL*interaction	**-0.51**	**-1.368****	**-3.172*****	**-0.23**
	(0.94)	**(0.66)**	**(1.18)**	**(0.80)**
Bad vision	-0.03	-0.0496**	-0.06	-0.0314*
	(0.02)	(0.02)	(0.04)	(0.02)
Bad vision*interaction	**-0.01**	**0.04**	**0.04**	**0.00**
	(0.04)	**(0.03)**	**(0.04)**	**(0.03)**
Bad hearing	-0.110**	-0.0830*	-0.09	-0.08
	(0.04)	(0.05)	(0.08)	(0.06)
Bad hearing*interaction	**0.03**	**-0.02**	**-0.01**	**-0.02**
	(0.08)	**(0.07)**	**(0.09)**	**(0.07)**

Table 16, continued

High blood pressure	-0.0406***	-0.0439***	0.02	-0.0459***
	(0.01)	(0.01)	(0.03)	(0.01)
High blod pressure* interaction	**0.03**	**0.0383***	**-0.0601****	**0.0455***
	(0.02)	**(0.02)**	**(0.03)**	**(0.02)**
Chronic diseases	-0.02	-0.01	-0.03	-0.01
	(0.02)	(0.02)	(0.03)	-0.02
Chronic diseases* interaction	**0.03**	**0.01**	**0.03**	**0.00**
	(0.03)	**(0.02)**	**(0.03)**	**-0.03**
Heart attack	0.04	0.02	0.183**	0.05
	(0.06)	(0.06)	(0.09)	(0.07)
Heart attack*interaction	**-0.02**	**0.01**	**-0.196****	**-0.02**
	(0.08)	**(0.06)**	**(0.10)**	**(0.09)**
Stroke	-0.169**	-0.125*	-0.08	0.01
	(0.07)	(0.07)	(0.16)	(0.08)
Stroke*interaction	**0.14**	**0.03**	**-0.02**	**-0.246****
	(0.11)	**(0.11)**	**(0.17)**	**(0.13)**
Disabled	0.03	0.05	-0.211*	-0.05
	(0.09)	(0.07)	(0.12)	(0.10)
Disabled*interaction	**-0.08**	**-0.11**	**0.250***	**0.17**
	(0.13)	**(0.09)**	**(0.14)**	**(0.14)**

Notes: The dependent variable in all specifications is log real monthly wages.
The row without interaction term reports coefficients for the group which is the omitted category for respective column cell.
For example, the top left cell reports the coefficient for log BMI for females only. The interaction term (log BMI*interaction) for the same column reports the difference in coefficients between males and females.
All models are fully interacted, i.e. interactions with all independent variables (and not only with health) are included
All specifications are based on either fixed or random effects, according to results reported in previous tables
All specifications include contemporaneous controls and round dummies

Table 17. Instrumental variable estimation

	Badhealth	Health Problem	Disabled	log BMI	Depression
Coefficients, set 1	-0.491***	-0.250**	-0.655**	7.68*	-0.81
	(0.16)	(0.11)	(0.32)	(4.02)	(0.67)
Observations	5766	5791	24919	21233	9203
F-stat	30.29	55.7	11.33	4.53	4.68
Hansen P-val	0.64	0.41	0.6	0.22	-
Coefficients, set 2	-0.573***	-0.238***	-0.649*	-	-2.42***
	(0.16)	(0.07)	(0.36)	-	(0.48)
Observations	29668	29736	24867	-	9169
F-stat	42.71	131.85	14.82	-	15.7
Hansen P-val	0.89	0.78	0.39	-	0.18

Community cluster-robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: in the first set of excluded instruments for badhealth and health problems is a dummy for reporting chest pain when active, a dummy for reporting severe chest pain lasting more than 30 minutes, a dummy for having an operation in the last 30 days (all 3 in the last 30 days), as well as bad vision and bad hearing.
The first set of excluded instruments for being disabled includes dummies for ever having stroke, heart attack and for having an operation.
The first excluded instruments set for log BMI are change in the prices of chicken and eggs from prior to current periods
The excluded instrument for being depressed is a dummy for being sincere to the interviewer
In the second set of excluded instruments for badhealth and health problems are dummies for ever having hepatitis A, tuberculosis, as well as a variable for reported days spent in the hospital in the last 30 days.
The second set of excluded instruments for being disabled includes dummies for having heart disease, kidney disease and spine problems.
The second excluded instrument for being depressed are 9 point scores for self –respect and power rank, averaged on a family level.
F-stat refers to F statistics for excluded instruments in the first stage regression.
Hansen P-value refers to the Hansen's J overidentification test

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