1 Health and Inequality

Point of departure: there is an empirical relation between health status/mortality and economic position.

What is the causality of this relation? Health → Income or Income ⟶ Health?

1.1 Effects of Health Changes on Income and Wealth

Two costs: medical care and loss of income from work.

Smith (1999): Effect of health changes on savings and wealth accumulation.

Reasons to why savings may decrease after a decline in the general health status.

- Out-of-pocket medical expenditures. Table 2 shows surprisingly modest changes in out-of-pocket medical spending for the US.
- Marginal utility of consumption may change as a result of changes in the health status: State dependence in the utility function. Changes in the life expectancy should have an effect in the life cycle model. Identification problems to test this empirically.

Table 3 shows empirical results on wealth accumulation from HRS (Health and Retirement Survey) and AHEAD (Asset and Health Dynamics of the Oldest Old).

Between wave new onsets in chronic health problems on the between wave changes in wealth.

Substantial effects on wealth de-accumulation across different groups. Again, modest changes in OOP medical expenses.

Table 4: Effects on life expectancy, labor supply and earnings.

Puzzle: Changes in wealth are on average larger than what can be explained by changes in out-of-pocket medical expenses and income combined. Two possible explanations:

- State dependence in utility of consumption.
- Qualification rules for Medicaid. Means tested (Wealth test).

Gertler and Gruber (2002): "Insuring Consumption Against Illness"

Data from Indonesia. Has invested heavily in a government-operated health care delivery system.

Two different measures of health status: indicators of activities of daily living (ADL) and composite health index. The authors are able to measure changes in these measures and analyze how it affects labor supply and consumption.

Analysis in three steps:
First step: Effects of health changes on labor supply, out-of-pocket medical expenses, and household income.
Sam specification for all three outcome variables:

$$\Delta L_{ij} = \boldsymbol{\alpha}_j + \beta \Delta h_{ij} + \sum_k \lambda_k X_{ijk} + \varepsilon_{ij},$$

$\boldsymbol{\alpha}_j$ community fixed effects, controls for community unobserved heterogeneity, X demographic controls.
Results:
Major effect on labor supply from changes in the ADL index.
Trivial effects on medical expenses.
Large effects on household income, again only from changes in the ADL index.

Separate analysis on the labor supply of other household members. No such effects found.

Second step: Effects on consumption spending.

Theory of full insurance tells us that there should be no effects on consumption spending from changes in health status, assuming no state dependence in preferences for consumption.

Reduced form for changes in log per capita consumption spending:

$$\Delta \ln \left(\frac{C_{ij}}{n_{ij}} \right) = \boldsymbol{\alpha}_j + \beta \Delta h_{ij} + \sum_k \lambda_k X_{ijk} + \varepsilon_{ij},$$

Results:
Rejects full insurance. Again, only ADL index results significant.

Key assumption on state dependence in preferences for consumption. Different test for this assumption:

1. Consumption spending for other household members.
2. Workers v/s non-workers.
3. Self-insurance: If a household are not able to self-insure you should see a relatively large decrease in consumption from a health shock if the effect works through the budget constraint. Compares households who have a large labor supply potential of other household members to those who have not.
4. Health status of other family members.

Step 3: How large is effect?

The extent to which households are unable to insure income losses:

$$\Delta \ln \left(\frac{C_{ij}}{n_{ij}} \right) = \boldsymbol{\alpha}_j + \gamma \Delta Y_{ij} + \sum_k \lambda_k X_{ijk} + \varepsilon_{ij},$$

γ / C_{t-1} share of consumption that is not insured.
IV because:

- Income level endogenous: Risk averse households able to insure part of their income losses through labor supply responses.
- Measurement errors in the income change variable.

Health status used as instrument. Valid if:

- No state dependence in utility.
- No feedback in changes in consumption to changes in health.
- Measurement errors in health status are uncorrelated with measurement errors in the income variable.

Result shows that the household is only able to insure on average 65 percent of an income change.

1.2 The Effect of Income on Health

Hypotheses:

1. There is a separate and non-linear effect of absolute income level on individual health status.

Distinct non-linear relations in regression of health status on both income and wealth as been found in several studies. If this is a causal relation, it may be profitable for the general health status in the society to redistribute income from rich to poor. Also an effect of general economic growth.

2. There is a separate effect of income inequality.

There is a separate effect of income inequality, in addition to the non-linear effect of the level of income, on health. Additional effect of income redistributions.

$$h_{is} - \overline{h} = \alpha + \beta \left(y_{is} - \overline{y} \right) - \gamma \left(y_{is} - \overline{y} \right)^2 - \theta \upsilon_s,$$

where i is sub-index for individual s is for country, h is heath, y is income, υ_s is income inequality measured by country income variance.

Averaging over all individuals in a country

$$h_s - \overline{h} = \alpha + \beta \left(y_s - \overline{y} \right) - \gamma \left(y_s - \overline{y} \right)^2 - \left(\gamma + \theta \right) \upsilon_s.$$

Allows for diminishing effect of country mean income level.

Both γ and θ are identified. Possible to test for separate effect from income inequality.

Limitations:

- The derivative with respect to mean income is $\beta - 2\gamma \left(y_s - \overline{y} \right)$ .Since γ is positive, this implies that mean income becomes less important as income increases and income inequality, even if the direct effect (θ) is zero, becomes more important.

- Restrictive functional form and implies that health, at a certain level, will decrease with income level.

Binary specification

$$h_{is} = a + b \ln y_{is} + d\omega_s + \epsilon_{is},$$

ω_s is the variance of log incomes. If the individual ends up below a certain income level he/she dies.

Probability of dying:

$$p_{is} = p\left(death \mid y_{is}, \omega_s\right) = \Phi\left(\frac{c - a - b \ln y_{is} - d\omega_s}{\sigma}\right)$$

Extending with $b\mu_s$, we get

$$h_{is} = a + b\mu_s + d\omega_s + b\left(\ln y_{is} - \mu_s\right) + \epsilon_{is},$$

For an aggregate economy:

$$p_s = p\left(death \mid \mu_s, \omega_s\right) = \Phi\left(\frac{c - a - b\mu_s - d\omega_s}{\sigma\sqrt{1 + b^2\omega_s/\sigma^2}}\right).$$

The separate effect of income inequality is identified from aggregate data. Setting $d = 0$ it can be seen from differentiating with respect to income inequality and mean income that it can be seen that there is a diminishing effect of both these variables on mortality in absence of a direct effect of income inequality.

There is an effect of the relative income level.

There is an effect on the relative income level within reference groups. Famous Whitehall studies on British civil servants. No effects of income redistributions.

If health depends on relative income within a reference group

$$h_{is} = \overline{h} + \beta \left(y_{is} - y_s \right) + \varepsilon_{is},$$

we will observe an attenuated relation to mean income

$$E \left(h_{is} \mid y_{is} \right) = \overline{h} + \frac{\beta \sigma_w^2}{\sigma_w^2 + \sigma_b^2} y_s.$$

Fehr and Schmidt (1999) model of self centered inequality aversion:

$$u \left(y \right) = y - \beta_1 \int_y^\infty \left(x - y \right) dF \left(x \right) + \beta_2 \int_0^y \left(y - x \right) dF \left(x \right)$$

$\beta_1 > 0$, so you are definitely upset by the people in Skandia! (if they are in your reference group). β_2 captures your views on the income distribution of those who are poorer than yourself. $\beta_1 > \beta_2$, which means that you are more conserned about your own relative position.

The FS utility function can be rewritten as:

$$u \left(y \right) = y - \beta_2 \left(y - \mu \right) - \left(\beta_1 - \beta_2 \right) \times \int_y^\infty \left(x - y \right) dF \left(x \right) = y + \beta_2 \left(y - \mu \right) - \left(\beta_1 - \beta_2 \right) \mu R \left(y \right).$$

$R \left(y \right)$ in a measure of relative deprivation. It can be shown that this utility function is concave in income.

Looking at group health, by averaging the expression above we get

$$u \left(y \right) = \int_0^y u \left(y \right) dF \left(y \right) = \mu \left[1 - \left(\beta_1 - \beta_2 \right) g \right]$$

where g is the Gini coefficient. So, group utility (health) depends positively on group income level and negatively on group income inequality.

1.3 Empirical results

Cross-country Analysis

Severe measurement problems. Refers to Atkinson and Brandolini (2001) who compares Deininger and Squire (1996) with LIS data. Sweden is for example ranked as very unequal in DS but most equal in LIS.

Wilkinson (1992, 1994, 1996) bold, but apparently not very careful studies. Shows a cross country relation between income inequality an life expectancy.

Judge, Mulligan and Benzeval (1997) most convincing study according to Deaton. Negative but insignificant effect of the Gini coefficient on life expectancy. Infant mortality: harmful effect of poverty (10/90 percentile ratios).

Deaton also refers to studies on the relation between income inequality and other outcome variables such as criminality.

Within-Country Area Studies of Income Inequality and Health

Wolfson et al. (1999) finds a strong relation between income inequality and mortality across US states that cannot be made up by a non-linear relation to income.

Mellor and Milyo (2001) replicates the previous relation between income inequality and mortality. Shows that inclusion of controls for education level, urbanization and race eliminates the relation. Also shown in various studies by Deaton himself. Next question: what makes up the relation between race and mortality in the US. No unambiguous answer on that.

Gertham and Johannesson (2003):

Uses Swedish data from the ULF surveys. Rotating panel. Interviews the same people every eight year. The pool all surveys together and obtains 43,898 individuals. Tax register data on incomes matched on.

Cox proportional hazard model on survival. Dependent variable: number of years from survey to death. Right hand censoring of people who are alive in December 31, 1996.

Independent variables: Measure of individual disposable income, income difference to the mean income in the municipality, a measure of the difference between the individual's income and average income in the municipality, a measure of the Gini coefficient in the municipality calculated in the sample (varies between 0.12 and 0.51), measure of individual initial health status obtained from the survey interviews (controls for feedback effect).

Tests the absolute income hypothesis (including non-linear effect in income), relative income hypothesis and a separate effect of income inequality.

Results: Support for the absolute income hypothesis (including non-linearity in incomes); not for the relative income hypothesis, nor a separate effect of income inequality.

Effects from a "third factor".

Spurious regression effect of a third factor, such as education ("educated living") or destructive living (drug and alcohol abuse) among low-income individuals.

Credit constraints of poor people.

Poor people are restricted from taking small expenses on health, cf. the current debate on sickness insurance. Need for health insurance programs rather than income redistributions.

Effect through political inequalities.

Health has an element of public good (e.g. provision of basic health care and prevention of pollution). No direct effect of income redistributions.

Effects on health during childhood - observed correlation through intergenerational income correlation.

Differences in health status comes from differences in treatment during very early childhood. Correlation in income over generations. No direct effect (in the current generation) of income redistributions.

Case, Lubotsky and Paxton (2002)

The probability that a child is in poor health:

$$P(H \mid X) = P(H \mid C = 0, X)\, P(C = 0 \mid X) + P(H \mid C = 1, X)\, P(C = 1 \mid X)$$

C - 1 if the child suffers from chronic conditions, 0 otherwise.
H - 1 if the child suffers from bad health, 0 otherwise.

Decomposition:

$$\begin{aligned}\frac{\partial P(H)}{\partial \ln y} = & \frac{\partial P(H \mid C = 0)}{\partial \ln y} + \\ & \left[\frac{\partial P(H \mid C = 1)}{\partial \ln y} - \frac{\partial P(H \mid C = 0)}{\partial \ln y}\right] P(C = 1) + \\ & [P(H \mid C = 1) - P(H \mid C = 0)] \frac{\partial P(C = 1)}{\partial \ln y}\end{aligned}$$

Three components:

1. The marginal effect of income on bad health given that the child does not suffer from a chronic condition.
2. The additional impact of income if the child suffers from a chronic condition. "Severity effect".
3. The effect of income on poor health that works through the greater that poorer children obtain a chronic condition. "Prevalence effect".

Two different LPM models:

$$\begin{aligned} C &= \alpha_0 + \alpha_1 \ln y + X\delta^C + \varepsilon^C \\ H &= \beta_0 + \beta_1 \left(\ln y - \overline{\ln y}\right) + \beta_2 C + \beta_3 \left(\ln y - \overline{\ln y}\right) C + X\delta^H + \varepsilon^H \end{aligned}$$

Key parameters:
$\alpha_1 = \frac{\partial P(C=1)}{\partial \ln y}$.
$\beta_3 = \left[\frac{\partial P(H|C=1)}{\partial \ln y} - \frac{\partial P(H|C=0)}{\partial \ln y}\right]$
$\alpha_1\beta_2$ = Prevalence effect.
β_2- shows which chronic condition that have the most severe impact.

Results:
α_1 only positive for hay fever and sinusitis (brat diseases!).
β_3 negative throughout. Larger for older children.

Decomposition: The effect on health goes primarily through the severity effect.

Section 5: Understanding the gradient.

1. Health at birth: In general a significant relation between income and health at birth. However, adding controls for health at birth does not alter the original relation.

2. Parental health as a determinant of children's health: Separate analysis. 1. Large effect of parental health on child health. 2. Mother's health most important. 3. Does not account for the entire effect of the previous analysis although the gradients become smaller.

3. Genetic ties: Interactions with indicators on adopted children. No effect of interactions could not be rejected.

4. Health and health insurance: Investment in children's health can go through health care and access to health insurance. Not supported in the empirical analysis since interactions with access to health insurance insignificant.

5. Children's health and maternal labor supply: Parents of children with chronic conditions may work and earn less, which may make up for the observed relation. However, not supported in the empirical analysis.

6. Parent an child health-related behavior: Indicators for different behavioral differences (e.g. does the child have a regular bedtime). Some indicators are significant. Make up for some of the income relation.