Health and Social comparison - Does envy make you sick?*

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Abstract

This paper investigates the relationship between health and the economic status among one's circle of acquaintances. Using unique information from a representative household survey of the Dutch population that circumvents the need to define the social circle I find robust effects of social comparison on self rated health. People that consider themselves poorer than their peers have significant worse health.Using these self-related relative income measures and controlling for demographic characteristics and absolute econonmic position I find significant effect of relative deprivation on health. I further show that this effect exhibits asymmetries, i.e. lower income groups are stronger affected than high income groups and that being worse off than your circle of acquaintances have a strong effect whereas being better off show only mild positive effects. In this paper I also show that compared to the traditional approach of using a reference group based on demographic characteristics the approach based on self reported groups reports stronger results.

JEL Classification: I14.

Keywords: Health Economics, Inequality, Relative Deprivation

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Introduction and Background

Health is highly correlated with economic performance. In terms of absolute income this holds true both for cross country studies where poorer countries have a worse population health and for micro studies where rich people experience better health as well as a longer life span. A more disputed socioeconomic pattern in health is the positive correlation between good health and relative measures of economic outcome. These relative measures implicitly assume that not only one's absolute material resources that matter for physical and mental well-being but also the level or distribution of economic resources in one's reference group. There are two different approaches followed by the literature. Studies that use population income inequality in cross country regression as a determinant of bad population health exhibit mixed results. While for example **?**) find evidence for a clear correlation between population inequality and health others as **?**) have questioned these association by arguing the correlation naturally results from a nonlinearity in the production function of health**.**

The other strand of literature focusing on relative position of individuals argues that low socioeconomic position within a reference group is associated with perceptions of inferiority, depression isolation insecurity and trigger stress and anxious feelings. Chronic stress put the body permanently in a 'fight and flight' situation and channels the body energy to the physiological processes essential for producing fast responds to an immediate danger and put other for example recreational processes on hold. Whereas this 'fight and flight' is beneficial in a short term dangerous situation it increases the general vulnerability of the body in the long run. Stress and anxiety are also often linked to behavior that is detrimental to health. So may smoking reduce acute stress symptoms, heavy and permanent alcohol consumption may drown ones frustrations and eating for comfort mitigate bad mood as smoking alcohol drinking and comfort eating, cf. **?**). A good overview of potential other mechanisms of relative deprivation on health is done by **?**). Using an inequality as a proxy for personal deprivation is not useful as **?**) point out that two individual might experience the same level of inequality because they live in the same community but their relative position might be very different. So most of the recent literature focuses on individual level measures of relative deprivation. Relative measures necessarily need a reference point. In most of the studies these reference point/group is assigned according to demographic (gender, race, education, age) and geographic (country, state, zip code) characteristics. Cross section studies based on this approach find mixed results. Where some papers indicate there is an effect, cf. **?**), **?**), **?**), **?**), **?**). Other found that the effect if anything weak and not significant cf. **?**). A good survey of the existing literature give **?**)

However, constructing reference groups on demographic characteristics is questionable, since sociological evidence show that reference groups tend to be more localized and

are mostly limited to family, friends, neighbors and work colleagues. **?**) show that the personal reference point differs based on personal characteristics. So men compare less to family members than women do or employees in more professional occupations compare more to their colleagues than do those in elementary occupations. So as households reference group are heterogeneous and very likely not just determined by age and education a more natural approach would be to directly ask household to compare their own income to the reference group they think they should compare themselves. **?**) is one of the few papers that follow this direct approach to determine the reference group. Using the National Social Life, Health, and Aging Project (NSHAP) data set that reports individuals' income positions within their self-defined social networks, she examines whether there is an association between relative position and health in the US. She finds significant results for lower rank deprivation with self-reported health and cardiovascular disease.

In this paper I use a similar approach. Using the Dutch National Bank Household Survey (DNBHS) has the additional advantage of providing panel data structure about the relative position and economic performance of households. Furthermore the DNBHS has a complete age structure to separate and analyze life cycle effects and because it is a central bank questionnaire it has a rich income and assets sections. Using these self-related relative income measures and controlling for demographic characteristics and absolute economic position I find significant effect of relative deprivation on health. I further show that this effect exhibits asymmetries, i.e. lower income groups are stronger affected than high income groups and that being worse off than your circle of acquaintances have a strong effect whereas being better off show only mild positive effects. In this paper I also show that compared to the traditional approach of using a reference group based on demographic characteristics the approach based on self-reported groups reports stronger results.

My analysis proceeds as follows. Section 2 presents the data set and highlights the important feature this study exploits. In section 3 I show the results for a pooled cross section study. Section 4 presents results for a panel survey. In section 5 I discussed endogeneity problems and conclude. Additional material is contained in an appendix.

Data and methods

Data

The DNBHS is a Dutch online household survey, based on annual information from $2,000$ units, beginning in 1993. The DNBHS covers work, pensions, housing, mortgages, income, assets, debts, health, economic and psychological concepts and other variables. It thus allows the study of the consequences on health for both the absolute material resources and the perception of relative economic status. The initial survey was administered to around

2,790 Dutch households oversampled from the top 10% of the income distribution and weighted to be representative of the Dutch-speaking population. Since then, households have been re-interviewed annually, with new households added each year to counteract the non-negligible attrition and keep the cross-sectional sample representative. [1] The survey underwent a major refreshing in 2001, resulting in a sample of 1861 households. Unfortunately not all of the observations of the DNBHS could be used for this analysis.

Table 1: Descriptive statistics

Variable	Weighted mean or proportion (standard deviation)		
Sample	Complete	no response to controls	Final
Age	47.2	50.1	50.4
% Male	50.5	55.2	56.0
% Married	69.5	71.7	71.8
Household size	2.8	2.6	2.6
% Urban	60.3	60.8	60.4
% Less high school	14.4	13.8	13.0
% High school	39.5	37.0	37.0
% College	44.4	47.4	48.3
% Employed	56.6	52.8	54.1
% Unemployed	1.8	1.8	1.8
% Retired	14.0	18.1	18.3
% Students	3.8	1.7	1.0
% Others	23.7	25.6	24.9
Household assets	93.6(142.7)	97.1(141.3)	100.6(146.2)
Household income	40.4(35.8)	35.7(17.3)	35.6(17.3)
Observation	55,180	23,346	20,513

Summary statistics of the pooled 18 waves of DNBHS without 1993/1994/2008/10/12 and only respondents with $age >= 21$. Assets and income are reported in 1,000

First I drop all observations of respondents of respondents younger than 21. Second, as with many surveys that include questions on financial status, the biggest constraints on sample size were the response rates for the income and assets' questions. In the DNBHS survey, the response rate for the section " economic and psychological concepts" which is central to in this paper was 42.4%. Excluding those observations that at least have one non-response among all variable of interest reduces the sample to a number of 19727 observations. There could be a potential bias for my results from nonrespondents. Table

[1]The DNBHS is based on the CentERpanel which is representive along for the dutch population, exceptions are underrepresentation of the middle level educated, single households and people living in a highly urbanized area, cf. **?**). A comparison to Netherlands Official Statistics is provided in the Appendix.

(**??**) presents the summary statistics. It shows that the main demographic characteristics between the complete sample and the persons who answered the relative income section were almost identical. It seems that less students answered and the sample is older, less educated and include more men. With respect to economic performance both sample seems to be almost identical. [**TBC** - Robustness - Reweight the sample]

Measures of relative situation

The key feature of the DNBHS I exploit to answer whether there is a connection between low social status and health is are question to a self determined circle of acquaintances. This circle is explained to the respondents as "people with whom [they] associate frequently, such as friends, neighbors, acquaintances, or maybe people at work". The DNBHS also provides rich information about the characteristics of these acquaintances. So the respondents also report the age category most of them belong to, the (perceived) average household income (in brackets), average household size, average education, the most prevalent kind of employment (i.e. whether they are employed, self-employed or in other conditions) and the average hours of work per week,distinguished by gender.

Direct Question to Position among Acquaintances The respondents have to indicate to what extent they agree or disagree to certain statements on a coded on a seven-point ordinal scale from "strongly disagree" to "strongly agree". The exact statements are provided in table **??**. So the respondent has to indicate how he sees himself

Table 2: Relative position among aquaintances

General	Compared to others in my environment, I am better off.
Assets	I think my household has more assets than others in my environment.
Spending	Other people in my environment have more money to spend than I do.
Financial	If I compare myself with my friends, I think in general I am financially better off.
Durable goods consumption	I can spend more money on durable consumer goods than others in my environment.

Note that spending has an opposing formulation so the coefficient sign has also to be opposing.

in terms of asset, consumption durable goods consumption and overall situation.[2] Despite the ex ante suspicion that there might be very little variation in the responses to these questions – perhaps everyone considers himself to be average – table **??** show the responses to the first statement have a reasonable distribution. Furthermore it shows that even though relative income position is naturally positively correlated with absolute income and assets, there is distribution of the perception of being above or below the average of my acquaintances in each reported income band. Strikingly feature of this table is that almost 17% of the lowest income band feel them relatively better then there environment where as just 46% feel that they are worse of.

Table 3: Absolute income versus local position

Compared to other better off	<10	10-14	14-22	22-40	40-75	>75	Total
Totally disagree	16.04	7.63	4.73	2.80	1.76	1.32	4.47
2	13.50	9.62	6.48	4.39	2.37	1.32	5.83
3	16.70	14.41	10.73	9.55	5.37	0.66	10.25
4	36.84	47.24	46.96	45.99	39.49	24.34	45.04
5	10.62	14.04	19.41	22.28	28.75	30.26	20.71
6	4.31	5.15	9.18	11.81	16.84	28.29	10.58
Totally agree	1.99	1.91	2.50	3.17	5.41	13.82	3.12
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Entries in percent. Income bands measured in 1000 €.

Indirect Answer to Relative Position Other than using the direct question of position I use the statement about the concrete income statement of the circle of acquaintances to compute an additional measure for relative position. I compute the distance between the income band of the circle of acquaintances to the income band of the household and use this as the covariate in the regression. For this measure it is however not possible to compute exact household equivalent income measure and as I have no information about the asset situation I have to restrict this research on income. But most of the argumentation of the relative deprivation hypothesis is about perception of inferiority and so it is more natural to use subjective other than objective measure. [Results given in the Appendix show less quality]

[2]Figure **??** in Appendix show that question the question to general situation, assets, financial situation, and durable good consumption are highly correlated. Only spending is less correlated to the other variables.

Measures of health status

In the DNBHS the respondents report the standard survey measure of self-rated physical health on a 5 point scale ("excellent" "good" "fair"not so good" "poor"). In the benchmark case I collapse this multidimensional answer to a binary variable of being in good ("excellent " "good") or poor (textquotedblleft fair"not so good"textquotedblleft poor") health. *Besides capturing an individual's subjective well-being, poor self-rated health has been shown tobe a robust predictor of mortality and correlates highly with other objective health indicators, especially in the context working age population and developed countries*,cf. **?**), **?**). Additionally to this general statement about health situation I have information about health related behavior such as smoking, drinking alcohol. Finally, I use an more objective indicator based on anthropometric measurements The DNBHS reports the respondent's height and weight Height and weight are use to compute the respondents body mass index. I classify someone to be obese according to the criteria established by the World Health Organization.

Table 4: Summary Health Statistics

Variable	Mean or proportion (standard deviation)	
Sample	Complete	Final
% Good Health	79.28	79.08
% Smoking	21.98	21.14
% Alcohol (>4) drinks	7.40	7.73
BMI average	25.28(4.29)	25.36(4.19)
% obese (BMI>30)	10.27	10.12
% long illness	25.40	26.17
Observation	34839	20513

Summary health statistics of the pooled 18 waves of DNBHS without 1993/1994/2008/10/12 and age>20

Omitted variable bias

The omitted variable bias is a potential problem for causal analysis. The most important is surely absolute level of income but there are certainly more variable that potentially bias the findings.

The omitted-variable issue can be addressed by certain general strategies: (a) introduce the omitted measure explicitly into the analysis and gauge the adjusted degree of association between relative position and health; and (b) estimate fixed effects" models, in which changes in relative position of an household are related to changes of this household. Fixed effect models difference out effects of persistent characteristics (both measurable and not) of the household (cf. **?***)*).

Absolute income and wealth [3] Absolute income is best example of how omitted variables may bias the results for a causal analysis. It has both a negative association with relative income position and a positive association with health. So suppose there would be no connection between local position and health a OLS regression omitting absolute income would find a positive relation. To encounter this I include the absolute income level reported by the household as a control variable.[4]
The same logic applies to the level of total wealth. This central bank survey provides detail information for personal assets and liabilities I construct a proxy for total wealth consisting of real and financial assets and liabilities (including mortgages). Out of this I group the respondents in wealth deciles.[5]

Measure of self esteem [**TBC** - There is maybe a problem from an omitted variable bias. If the respondent is an optimist or have a high self esteem he would possibly overstate his answer both to the question of health condition and to the question about relative economic position To counteract I try to ... Panel fixed effects???]

Model estimation

In the first approach I consider the pooled data of all waves from 1993 to 2012.

Pooled data For most of the health measure I use a probit model to estimate the results. The baseline model equation for this approach is

$$\Pr\left(Health_i = H\right) = \Phi\left(\alpha + RP_i\beta + \gamma\ logIncome_i + \delta logAssets_i + Demographic_i\theta\right) \tag{1}$$

where $Health_i$ is the health status of an individual i, RP_i is the relative position variable, $logincome_i$ is the natural logarithm of the adjusted per capita household income, $logassets_i$ is the natural logarithm of the adjusted per capita household assets and $Demographic_i$ is a vector of demographic characteristics (age, age^2, gender, education, employment status, marital status, household size, degree of urbanity, year). For BMI and Health condition is use also a simple OLS regression. The baseline regression equation is

$$HealthCondition_i = \alpha + RP_i\beta + \gamma logIncome_i + \delta logAssets_i + Demographic_i\theta + \eta \tag{2}$$

[3]Research on relative deprivation has to circumvent the problem that lower income is perfectly correlated with lower relative position within a given society.

[4]To capture also nonlinear effects of absolute income on health I include also the square income as a control in a robustness check. But as this makes both income and income square statistically insignificant I omit it in the main findings as this do not alter the qualitative findings on the relative income measures.

[5]Both variables adjust to household size according to the OECD household factor.

Panel [**TBC** In the second section I used a logit panel fixed effect model.]

Pooled Data

Self reported health (SRH)

General Results In Table **??**, I report the baseline results estimated from equation (**??**) for the probit model for several relative position measures. In accordance with the literature the probability of good health is decreasing with age and increasing in education. The results also show positive effects both for absolute household income and absolute assets as predicted by the literature.
According to the Probis model a high relative position is positively associated with the probability to report good health. This holds for all measures of relative position with the strongest impact of general condition and the lowest coefficient for financial position. All the coefficient are highly significant. Table **??** shows marginal effects as opposed to

Table 5: Probit results for subjectiv evaluation of own position

Self-reported Health Condition	(1)	(2)	(3)	(4)	(5)
log income	.0909***	.1044***	.0906***	.1069***	.0865***
	(.0284)	(.0285)	(.0289)	(.0281)	(.0293)
log assets	.0706***	.0718***	.0779***	.0781***	.0681***
	(.0223)	(.0225)	(.0224)	(.0222)	(.0225)
General	.0691***				
	(.0113)				
Assets		.0416***			
		(.0107)			
Spending			-.0540***		
			(.0100)		
Financial				.0405***	
				(.0107)	
Durable Goods consumption					.0461***
					(.0113)

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All regressions include age, age^2, gender, maritial status, household size, degree of urbanization of place of living, education dummies, dummies for occupation status and year dummies. Standard error clustered.

regression coefficients. The results indicate that increasing the relative position by one degree is associated with a higher probability to report good health by .6 to point 1.4 percent. Taken to the extreme being in the highest (7) instead in the lowest (1) relative position raises the odds to report good health by something between 6.54 percent to 11.16

Table 6: Marginal effects of relative measures

SRH	General	Assets	Consump.	Financial	Dur. Goods
dx/dy	.0186	.0112	-.0145	.0109	.0124

Marginal effect of variables of above probit estimation.

percent.

Nonlinear effect of relative position The effect of relative position seems to be highly nonlinear. By using dummies for either below or above your relevant peer group the results indicates strong asymmetries in the effect. The absolute magnitude of the negative effect of being in a relative poor position is higher than the magnitude of the positive effect of being in a relatively high position. The average marginal effect for being in low position is $-.0567$, i.e. feeling deprived compared to your circle of acquaintances does lower your probability of being in good health by 5.7 percent whereas the marginal effect of being in a better position than my acquaintances is .0233, i.e. the chance of being in good health is heightened by .2.3 percent. This result holds also for a finer distinction of being in lower and upper position but due to few observations in the boundary the effects are non statistically significant. This result is in line with results of the literature like XXXX.
This result also implies that on average a reduction of inequality between those peer groups may improve overall health.

Age groups Running the regression for different age groups such as young working $(25-45)$ older working $(45-65)$ and retired (>65) the results for $(1,2,4,5)$ are all significant and the coefficient is almost the same in all probit regressions. For the variable situat_spending the magnitude of the coefficient is age depend. I found significant results for young $(-.0950)$ and old workers$(-.0637)$ but small $(-.0142)$ and insignificant effects for the retired. This could indicate that the comparison is more important for younger household and as one gets older and older he become more even-tempered.

Gender It is also remarkable that there are gender differences. In both subsamples the effect still persist, but it seems to be stronger in the male subsample

Different income groups I also examine wether the effect are the same for different income groups. The results from the probit model show that also here an asymmetry is found. The effect seems strongest for the lowest income quintile whereas it is almost not existing in the upper range of the income distribution. So the marginal effect for the low income group is 2.7 percent whereas in the

Health Behavior

Smoking Running the same probit regression for the probability of regularly smoking indicates that also being in a low position is related to a higher prevalence of smoking. But there is a discrepancy that the sign of the coefficient of regression CONSUMPTION is different as in the other regressions. [**TBC-** Why -This could maybe explained because spending money may signal by buying cigarettes???]

Alcohol The coefficient of the probit models indicate that people who are better of than there circle of acquaintances are more likely to drink more than 4 drinks a day. This holds true for all 5 measures.

Obesity I find no significant results for relative deprivation on BMI or obesity. Even the signs change between the measures.

Logit (panel)

As a beneficial feature of the data set is the panel structure I employ a logit panel model with fixed effects. these fixed effects should account for possible time invariant characteristics of the household as his self esteem that would potentially effect both his self reported health as well as his relative social position.

Relative position and causality

As I have carefully tested that the correlation between health and relative position is not due to an omitted variable bias I cannot account for whether the effect of health goes from health to relative position or vice versa.

Comparison to Traditional Approach

As the DNBHS also have information about the characteristics of the respondents I construct for each individual the income y^R of its reference group based on sex, education, region and age. I use the same equation for the regression but instead of using the relative position to circle of acquaintances I take the difference between own income and the income of the reference group $y - y^R$ The results are shown in table **??**.

Discussion

Endogeneity problem of circle of acquaintances [**TBC** the group endogeneity problem what if agents according to there characteristics self select into reference group.

Table 7: Traditional approach regression

Self-reported Health	(1)	(2)
Log Income		
Log assets		
$\log(y - y^R)$		

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
First regression same respondents as in above regression. Second Regression total sample.All regressions include age, age^2, gender, education dummies, maritial status, degree of urbanization of place of living, dummies for occupation status. Income is household size adjusted according to the OECD scale. All results are from probit regressions. Standard error clustered.

or the question why do rational people not choose other environments if having richer friends is bad for their health. Possible answer: Cannot choose there families and school friends. work colleagues. long process.

What do these results mean for the relative deprivation hypothesis?

Appendix

Appendix A Survey

DNBHS is a good approximation for the Dutch population with a slight underrepresentation of urban people and overrepresentation of married people. This could be due to a large nonrespondent rate to marital status question.

Table 8: Comparison CBS DNBHS

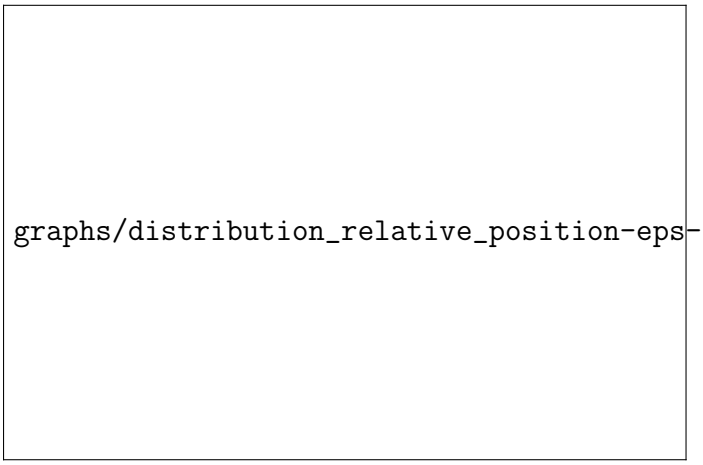
Variable	Weighted mean or proportion	
	CBS	DNBHS
Age	39	40
% Male	49	50
% Married	43	64
% Urban	45	38
% less high school	9	8
% Master, Doctoral	9	10
% Unemployed	5	3

Summary statistics of the pooled 12 waves of DNBHS 2001-2012 compared to official CBS data.

Appendix B Relative Measure

The correlation between the relative measures are strong but not perfect. Especially the spending variable is less related. This could be due to the reverse formulation of the question.

Figure 1: Relative income



Distribution of perceived local relative position

Table 9: prepared sample

Variable	Weighted mean or proportion (standard deviation)					
	age>17		age>25		>17, no students	
	whole sample	Only who answered situat1	whole sample	Only who answered situat1	whole sample	Only who answered situat1
Age	45.6	49.2	48	49,7	47,1	49,6
% Male	50.7	54,4	51	55	50,7	54,5
% Married	67.5	70	71	71	70,8	71,0
% less high school	17.4	12,1	17	12	14,2	12,1
% high school	37.2	38,6	37	39	39,2	38,8
% college	43.6	47,8	43	47	44,5	47,5
% employed	53.5	56,0	55	56	58,7	56,9
% unemployed	1.8	1,8	2	2	2,0	1,8
% retired	12.5	17,0	13	17	13,7	17,28
% students	9.0	1,6	4.7	1		
% others	23.2	23,6	24	24	25,5	24,0
% Urban	61.0	59,9	61	60	60,7	60,0
Household assets	173 (248)	177 (249)	174 (248)	178 (249)	174 (248)	178 (249)
Household income	18.2(10.5)	18.6(10.5)	18.2(10.5)	18.7(10.5)	18.2(10.5)	18.7(10.5)
Observation	70335	28878	64833	28320	64097	28407

Summary statistics of the pooled 20 waves of DNBHS without 2008/10/12

Appendix C Additional Results

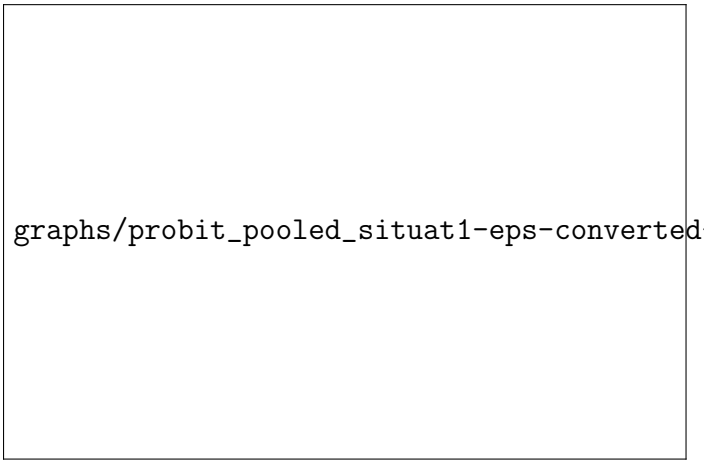
In Table **??**, I report the baseline results estimated from Equation (**??**) for a simple OLS regression for all relative position measures on the health condition which is a cardinal measure from 1 *good* to 5 *bad* . The range of the coefficient between The results indicate that an increased relative position is associated with an better self assesed health condition. All results are statistically significant. Taken to the extreme between being in the lowest position to being in the highest position is a different in reporting good health of something between 4.2 percent to 9.8 percent. According to the probit model estimates in table **??** , relative position is significantly related to SRH. This association holds for all four measures of relative position.

Table 10: Correlation between statements

	general	Assets	Spending	Financial	Durable Goods
General	1				
Assets	0,65	1			
Spending	-0,22	-0,19	1		
Financial	0,68	065	-0,25	1	
Durable Goods	0,62	0,67	-0,27	0,70	1

Correlation between the several measures of relative position

Figure 2: Rectilinear Grid



Result for the benchmark case of the pooled OLS regression

Table 11: Regression results for subjectiv evaluation of own position

Self-reported Health Condition	(1)	(2)	(3)	(4)	(5)
log income	-.0337**	-.0454***	-.0352**	-.0441***	-.0396**
	(.0160)	(.0161)	(.01608)	(.0158)	(.0165)
log assets	-.0347***	-.0231***	-.0233***	-.0245***	-.0233***
	(.0061)	(.0063)	(.0062)	(.0061)	(.0063)
General	-.0400***				
	(.0061)				
Assets		-.0206***			
		(.0055)			
Spending			.0326***		
			(.0052)		
Financial				-.0248***	
				(.0055)	
Durable Goods consumption					-.0225***
					(.0057)

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
All regressions include age, age^2, gender, education dummies, maritial status, degree of urbanization of place of living, dummies for occupation status. Income is household size adjusted according to the OECD scale. All results are from probit regressions. Standard error clustered.

Table 12: Results for all variables

Self-reported Health	(1)	(2)	(3)	(4)	(5)
log Income	.05648**	.06616**	.05937**	.07833***	.05747*
	(.0077)	(.0294)	(.0297)	(.0291)	(.02974)
log assets	.13124***	.13520***	.13202***	.1383***	.13783***
	(.0043)	()	(.0167)	(.0160)	(.0164)
General	.05430***				
	(.0031)				
Assets		.0345***			
		(.0110)			
Spending			-.0360***		
			(.0106)		
Financial				.0233***	
				(.0112)	
Durable Goods					.0234**
					(.0118)

Robust standard errors in parentheses; *** p>0.01, ** >0.05, * p>0.1
All regressions include age, age^2, gender, education dummies, maritial status, degree of urbanization of place of living, dummies for occupation status. Income is household size adjusted according to the OECD scale. All results are from probit regressions. Standard error clustered.