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Adaptation to Income Over Time: A Weak Point of Subjective Well-Being

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Abstract

This article holds the view that intertemporal comparisons of subjective well-being measures are only meaningful when the underlying standards of judgment are unaltered. This is a weak point of such measures. The study investigates the change in the satisfaction judgments resulting from adaptation to income over time. Adaptation is defined to be desensitization (sensitization) to the hedonic effect of income resulting from an upward (downward) adjustment of the standards. A framework is introduced that provides empirical estimates for the rate of adaptation using data from the Socio-Economic Panel Study (SOEP).

JEL Classification: C23, I31

1. Introduction

One of the principal aims of the research on subjective well-being is to narrow the informational gap left open by objective indicators describing individuals' welfare. Undoubtedly, objective indicators, such as the growth in incomes, convey a picture of people's living conditions, but this representation remains incomplete as long as the individuals' subjective evaluations differ from the objective measures. In this context, the literature contains some insightful studies that demonstrate how subjective well-being measures can be utilized to investigate questions for which an answer cannot be found (solely) on the basis of objective indicators (for an overview cf. Frey / Stutzer 2002). This is a strong point of subjective well-being measures.

Self-reported satisfaction measures are often used to represent judgments that people make about their life or, in the case of domain satisfactions, on

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specific areas of their life. A prerequisite for using survey data on subjective well-being as a complementary indicator of life situation is that people evaluate their lives and living conditions with respect to a standard of judgment. Without such a standard, the judgment would be more or less arbitrary and hence meaningless. The standard of judgment is, however, not independent of the life to be judged. Instead, it depends on the context in which the evaluating individual lives. For example, an increase in income in the past is supposed to result in higher income expectations at present. As a consequence, if standards change over time, then the judgments made at different points in time will not be comparable. This could be a weak point of subjective well-being measures.

This study addresses the question of whether and to what extent people change their standard of judgment over time, applying a framework of adaptation to income over time. The methodological framework is introduced in Section 2. Sections 3 and 4 establish the dataset from the German Socio-Economic Panel Study (SOEP) and provide the empirical results, respectively. Section 5 draws a conclusion.

2. A Framework for the Analysis of Adaptation

In surveys collecting data on socioeconomic living conditions, people are, among other things, asked to assess subjectively how satisfied they are with their life as a whole or specific areas of their life. In general, the standards on which these judgments are based are not observed directly, and empirical researchers have no (or only very limited) information on the underlying expectations and aspirations. However, a change in the *latent* standards of judgment is mirrored in *observed* changes in the satisfaction judgment. Given the individuals' living conditions, i.e., controlling for socioeconomic characteristics, the observed changes in the intertemporal satisfaction values can be interpreted as a symptom of the changes in the latent standards of judgment.

An approach to analyzing variations in people's satisfaction responses in the presence of a constant or repeated stimulus is available in the adaptation level theory (cf. Helson, 1964). The starting point is the idea that an individual derives decreasing (increasing) utility from a given amount of income over time because an increase (decrease) in income in the past leads to an upward (downward) adjustment of the individuals' standards of judgment. Hence, adaptation to income could be interpreted as an adjustment of the standards to the living conditions. In principle, there are two ways of modeling the process of adaptation:

The first approach assumes that people experience a certain income level, the so-called adaptation level (AL), as hedonically neutral. From this point of view, the utility of income is a function of the difference between the current income and the neutral level: if the income available is greater (lower) than the adapta-

tion level, then the individuals are supposed to be satisfied (dissatisfied). In this framework, adaptation occurs as a shifting of adaptation levels: people become less satisfied with a given income as their adaptation levels rise.

Figure 1 graphically illustrates shifting adaptation. Given that the adaptation level is y_0 in the initial situation, the income y_2 yields utility u_2 (point P). The shifting adaptation level in the successive period $t = 1$ is represented by a shift of the abscissa: the income level experienced as hedonically neutral then is y_1 and, as a consequence, income y_2 yields only utility u_1 (point Q).

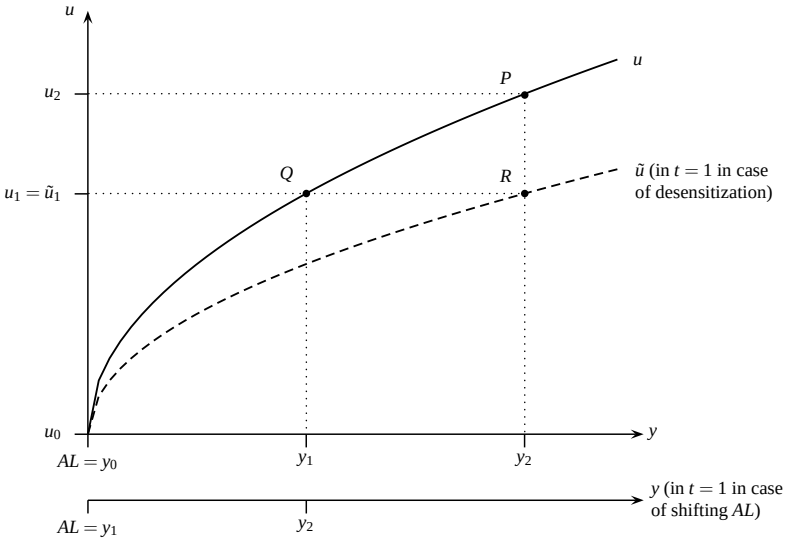

Figure 1: Shifting adaptation levels versus desensitization

The present study applies a second, alternative approach: adaptation is modeled as desensitization (sensitization) to the hedonic effect of income. To the best of my knowledge, this is the first attempt to apply the framework of desensitization to the empirical analysis of adaptation to income. The desensitizing process is embodied in figure 1 by the downward shift of the utility function. Accordingly, the resulting utility function $\tilde{u}$ indicates that income y_2 yields utility $\tilde{u}_1$ (point R) which is equal to u_1 (the utility in the case of a shifting adaptation level). Hence, both approaches are suitable to identify the reduction in the satisfaction response caused by an adjustment of the standards of judgment.

Modeling adaptation as a desensitizing process has, however, two distinct characteristics. First, the approach does not require the numerical calculation of an adaptation level. Second, the sensitivity to deviations from the status quo

decreases because of the desensitization: the slope of the utility curve (i.e., the marginal utility) in point *R* is smaller than in *P*. Compared with that, the shifting adaptation levels result in an increase in the marginal utility: the slope in *Q* is larger than in *P*.

Which of the two alternatives is appropriate for the analysis of adaptation to income over time? Current empirical research focuses exclusively on shifting adaptation levels (cf. Stutzer 2004; DiTella et al. 2007; Clark et al. 2008). However, it is questionable whether the assumption of an increasing (or just constant) sensitivity adequately depicts adaptation. Why should a higher standard (or reference point) result in an increasing marginal utility (of a given income) over time? The present study intends to initiate a discussion about the plausibility of this assumption presenting first empirical evidence derived from a framework that is based on decreasing marginal utility.

Desensitization can be modeled allowing the impact of income on utility to vary over time. Such a variation of the income effect can be incorporated in the utility function by including an intertemporal discounting factor. Hence, the econometric model can be written (for one individual at time *t*) as:

$$u = e^{-\kappa t}\alpha \ln y + \mathbf{x}'\boldsymbol{\beta} + \varepsilon\,. \tag{1}$$

Utility u is determined by (the natural logarithm of) income y and further socioeconomic variables in the vector $\mathbf{x}$. The parameter α denotes the effect of income on well-being that would be realized if there were no adaptation. κ denotes the rate of adaptation, t indicates the time period and e is the exponential function.

Starting from equation 1, the model can be set up for two periods, $t-1$ and t, as:

$$u_{t-1} = e^{-\kappa(t-1)}\alpha \ln y_{t-1} + \mathbf{x}'_{t-1}\beta + \varepsilon_{t-1}\,, \tag{2}$$

$$u_t = e^{-\kappa t}\alpha \ln y_t + \mathbf{x}'_t\boldsymbol{\beta} + \varepsilon_t\,. \tag{3}$$

Evidently, an individual benefits less (in terms of utility experienced) from a given amount of income in period t when $\kappa > 0$; i.e., in the case of an upward shift of expectations. The parameter κ is regarded as an indicator for the rate of adaptation and can be identified by first differencing equations 2 and 3:

$$u_t - u_{t-1} = e^{-\kappa t}\alpha \ln y_t - e^{-\kappa(t-1)}\alpha \ln y_{t-1} + \Delta\mathbf{x}'\boldsymbol{\beta} + \Delta\varepsilon\,, \tag{4}$$

$$\Delta u = \gamma_1 \ln y_t + \gamma_0 \ln y_{t-1} + \Delta\mathbf{x}'\boldsymbol{\beta} + \Delta\varepsilon\,. \tag{5}$$

Equation 5 can be estimated by OLS. The calculation of the adaptation rate is feasible on the basis of the coefficients of (the natural logarithm of) income

of the two time periods following each other, γ_1 and γ_0. Considering that γ_0 represents $-e^{-\kappa(t-1)}\alpha$, κ is:

$$\ln\left(-\frac{\gamma_0}{\gamma_1}\right) = \ln\left(-\frac{-e^{-\kappa(t-1)}\alpha}{e^{-\kappa t}\alpha}\right) = \ln(e^{\kappa}) = \kappa\,. \tag{6}$$

First differencing also provides the possibility of controlling for individual heterogeneity because unobserved time-invariant effects are eliminated from the model. Controlling, in addition, for fixed year effects by including an overall intercept β_0 and dummy variables indicating the time periods $t = 3, \ldots, T$ in the $(T-2) \times 1$-vector d yields the complete econometric model:

$$\Delta u_{it} = \beta_0 + \mathbf{d}_t'\theta + \gamma_1 \ln y_{it} + \gamma_0 \ln y_{i,t-1} + \Delta \mathbf{x}_{it}'\boldsymbol{\beta} + \Delta\varepsilon_{it}\,. \tag{7}$$

Robust standard errors were computed to correct for serial correlation in the idiosyncratic error $\Delta\epsilon_{it}$ (cf. Woolddridge 2002).

3. Data

This study uses data from the German Socio-Economic Panel Study (SOEP) (cf. Wagner et al. 2007). Adaptation is analyzed using the questions on self-reported financial and life satisfaction, respectively. (The life satisfaction question in the survey is: "In conclusion, we would like to ask you about your satisfaction with your life in general.") The answers are given on an eleven point ordinal scale. However, it is common in the literature to assume cardinality of happiness scores (cf. Ferrer-i-Carbonell / Frijters 2004).

The information gathered at the first interview – and therefore the entire first wave – was completely eliminated from the dataset. The reason for this is that the subjective data provided by the respondents may be affected by panel and / or learning effects, and the answers provided at the first contact may contain extreme values more often (cf. Ehrhardt et al. 2000). Hence, the sample contains information from 1985 to 2006.[1]

Furthermore, respondents 'at the corner', i.e., income winners who reported the maximum value prior to the increase in income as well as income losers who gave the minimum value on the satisfaction scale prior to the decrease in income, are excluded from the sample in part of the analysis. These indivi-

[1] The data used in this paper were extracted using the Add-On package PanelWhiz v2.0 (Nov 2007) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john @panelwhiz.eu). The following authors supplied PanelWhiz SOEP Plugins used to ensure longitudinal consistency, John P. Haisken-DeNew (6), Markus Hahn and John P. Haisken-DeNew (11). The PanelWhiz generated DO file to retrieve the SOEP data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are my own. Haisken-DeNew / Hahn (2006) describe PanelWhiz in detail.

duals are not able to adjust their judgment upward (downward) in the presence of an increase (decrease) in income. For example, when the income of a very contented person, who already reports the maximum value on the satisfaction scale, further rises, then he / she does not have the possibility of adjusting his / her assessment upward on the satisfaction scale, but the individual rather sticks 'at the corner'.[2] The model applied would interpret this response behavior as a desensitization to the higher income, although it is unknown how these respondents would have answered the question if the satisfaction scale were not truncated. Hence, the rate of adaptation could be overestimated if those observations were included in the estimation.

4. Results

4.1 The Average Rate of Adaptation

Adaptation to income is analyzed by regressing the change in financial and life satisfaction, respectively, on the natural logarithm of household incomes measured in two successive years. Table 1 shows the estimation results of the first differencing model in equation 7. As the household income is the aggregated income of all household members, its impact on subjective well-being depends on the number of persons living in the same household. Therefore, the change in the natural logarithm of the household size between two periods was included in the estimation equations to control for variation in the number of persons sharing the household income. This specification avoids the application of a particular equivalence scale (cf. Schwarze, 2003). The coefficient on the change in household size has, as expected, a negative sign. That is, an increase in the size of the household causes a decrease in financial contentment (given the household income). Further variables are included in the estimation in order to control for changes in the individuals' socioeconomic status.

The average rates of adaptation are calculated as 4.2 % (for satisfaction with household income) and 6.2 % (for life satisfaction). As the rate of adaptation κ is a function of two random variables (i.e., the estimators for γ_1 and γ_0), the standard errors are estimated using the delta method (cf. Greene, 2003). With standard errors of 0.0090 and 0.0282, respectively, the corresponding *t*-test statistics are 4.67 and 2.18 indicating that the rates of adaptation are statistically significant.

What is the interpretation of this result? First, the financial satisfaction derived from a given amount of income decreases between two successive years by approximately 4 %. This result provides clear empirical evidence for the existence of adaptation to material well-being. Second, the compensating income variation required to keep well-being constant over time can be calcu-

[2] I thank Andrew Clark for this point.

lated as follows. Using the estimation results from the financial satisfaction model in table 1 and assuming sample averages in the vector $\Delta\mathbf{x}$ and a monthly net income of $y = 2500$ euro, it follows that growth in real income at a rate of lower than or equal to 2 % is fully offset by the adjustment of standard of judgment. Interestingly enough, the annual average growth in real household income per capita in the period under consideration is about 1.4 % and 2.0 % for West and East Germany, respectively. This improvement of the financial situation is, evidently, not translated in an equal-sized increase in financial well-being because of the desensitization to the hedonic effects of income.[3]

Table 1

Estimation results

Variable	Financial satisfaction		Life satisfaction	
	Coefficient	Robust s.e.	Coefficient	Robust s.e.
Log of household income in t : γ_1	1.070***	(0.021)	0.292***	(0.016)
Log of household income in $t-1$: γ_0	–1.116***	(0.021)	–0.310***	(0.016)
East Germany	0.062***	(0.011)	0.042***	(0.009)
Yearly changes				
Log of household size	–0.370***	(0.033)	–0.064**	(0.027)
Years of education	–0.018	(0.011)	0.009	(0.009)
Home owner	–0.106***	(0.025)	0.018	(0.022)
Single: reference				
Married	0.121***	(0.047)	0.166***	(0.035)
Separated	–0.319***	(0.070)	–0.118*	(0.061)
Divorced	–0.065	(0.072)	0.161***	(0.059)
Widowed	–0.076	(0.093)	–0.672***	(0.093)
Nonworking	–0.391***	(0.026)	–0.195***	(0.022)
In training	–0.417***	(0.034)	0.018	(0.026)
Job: low	–0.113***	(0.017)	–0.061***	(0.014)
Job: middle: reference				
Job: high	0.057***	(0.021)	0.028	(0.018)
Self-employed	–0.147***	(0.040)	–0.007	(0.033)
Jobless	–0.934***	(0.026)	–0.557***	(0.021)
Pensioner	–0.284***	(0.030)	–0.104***	(0.026)
Year fixed effects	included		included	
R-squared	0.05		0.02	
No. of individuals	23757		23973	
No. of observations	184398		187277	

Note: Significance levels: * < 0.1, * < 0.05, *** < 0.01. An intercept term is included in all regressions.

Source: SOEP 1985 – 2006.

[3] The analysis of the life satisfaction model exhibits qualitatively equivalent results to the financial satisfaction model. However, the results are not discussed in detail here.

4.2 Adaptation to Gains and Losses

So far, the average rate of adaptation was calculated for the entire sample. In particular, no distinction was made between persons who experienced an increase in income (winners) and those who experienced a decrease in income (losers). However, considering prospect theory, which states that gains are evaluated higher than losses, adaptation to income is expected to differ for winners and losers (cf. Kahneman / Tversky, 1979). In this context, it can be hypothesized that an income growth experienced by winners induces an upward shift in their aspirations. The corresponding change in the standard of judgment is supposed to find its expression in the desensitization of the winners' satisfaction response function. On the contrary, a decline in the living standard may result in an adaptation of aspirations such that the then-losers lower their standard of judgment. Applying a lower standard to the evaluation of the financial situation suggests, in turn, a sensitization of the losers' satisfaction response function.

In order to test this hypothesis, the sample is divided up into two groups: the winners were defined as individuals whose per capita income rose in two successive years; the losers are, accordingly, those characterized by a decrease in income.[4] The econometric model in equation 7 is reestimated for both winners and losers with respect to the financial and the life satisfaction evaluation. The resulting rates of adaptation are summarized in table 2. The second column repeats the numbers for the entire sample calculated above.

Two important conclusions can be drawn from the results. First, adaptation to income occurs in two diametrically opposed directions. While the positive rates of adaptation suggest an upward adaptation of the winners' aspirations, the negative numbers calculated for the losers indicate a downward adjustment. Second, the intensity of adaptation is asymmetric. With respect to gains and losses, it is evident that winners adapt more strongly to the increase in income than losers adapt to the decrease in income. Or to put it differently, this result suggests that, on the one hand, individuals push up their aspirations in the case of an improvement in their financial situation, and, on the other hand, they adapt to losses with a lower rate of adjustment. This leads to a situation in which the benefits from an improved financial situation fizzle out rather quickly, whereas people seem to persist longer in their aspirations in the case of a loss of income. As a consequence, a recovery from losses is slower than habituation to gains. This finding holds for both the life and financial satisfaction and represents a clear confirmation of the hypothesis of asymmetrical adaptation.

[4] Per capita income was used to divide up the sample in order to control for a change in household composition. That is, an individual may in fact be a winner despite a reduction in household income because of a decrease in household size.

Table 2

Adaption to gains and losses

	Overall	Winner	Loser
Financial satisfaction	4.19***	18.15***	–11.27***
No. of observations	184398	92857	88554
No. of individuals	23757	21717	21725
Life satisfaction	6.15**	15.90***	–8.68
No. of observations	187277	94293	90021
No. of individuals	23973	21954	21960
Adaptation with respect to education			
Low	5.51***	23.35***	–14.37***
Middle	4.43**	18.95**	–9.27***
High	3.25**	16.14***	–13.08***

Note: Significance levels: * < 0.1, * < 0.05, *** < 0.01. The numbers of observations with respect to the winners and losers do not sum up to the number of overall observations because respondents 'at the corner' (cf. the description of the data in section 3) are excluded from the partitioned subsamples. The educational subgroups were defined with respect to the number of years of education. The bottom and the second quartile were put together in the low category. The third and the top quartile represent the middle and the high category, respectively. The estimation results for the regressions are available from the author on request.

Source: SOEP 1985 – 2006.

The remainder of this subsection focuses on financial satisfaction and analyzes adaptation with respect to education-specific subgroups of the sample (cf. table 2): those with a low educational attainment have the strongest average rate of adaptation to income, whereas highly educated persons have the lowest, 5.5 % compared with 3.3 %. This means that the financial satisfaction of a given income diminishes more slowly for highly educated persons over time than for less-educated ones.

The separate estimations for winners and losers point out the basis of this result. The relative retention of the standards of the highly educated persons seems to be a consequence of their pushing up aspirations to a smaller extent in the presence of an increase in income compared with the less-educated ones. The rate of adaptation for individuals with a high and a low educational attainment is 23.35 % and 16.14 %, respectively. However, with respect to a decrease in income, the results are ambiguous. The less-educated and the highly educated persons are characterized by a rate of adaptation of a similar magnitude, whereas those with a moderate educational attainment seem to adjust their standards downward more slowly. All in all, this finding gives rise to the supposition that the lower overall adaptation of highly educated persons is first and foremost a consequence of their lower upward adaptation, which may lead to a more sustainable financial well-being.

5. Conclusion

What conclusions can be drawn from the results presented? An often-cited inference drawn from the existence of adaptive processes is that humans are caught in a hedonic treadmill (cf. Brickman / Campbell, 1971). This view led to the paradigm of the set-point theory: changes in the life situation only cause short-term fluctuations around the baseline level of well-being. In contrast, a permanent change is considered to be impossible. The sobering conclusion that one is left with is that the external circumstances are completely irrelevant to well-being: human and political action aiming at improving living conditions does not affect well-being in the long term.

However, the set-point theory also provoked opposition (cf. Headey, 2007). Does it really not matter whether a person is rich or poor, healthy or sick? Can one conclude that a permanent change in perceived well-being is impossible? Extensive empirical evidence gives reason to doubt the paradigm because aspirations and expectations do not change equally in all areas of life: on the one hand, people adapt to changes of their material living conditions with a relatively high intensity. On the other hand, events occurring in noneconomic areas of life, such as changes in family life or social integration into working life, have a serious, long-lasting impact on people's subjective well-being. For example, Lucas et al. (2004) provide evidence for a long-term negative impact of unemployment on satisfaction. The death of a spouse also has long-term consequences (cf. Lucas et al., 2003). These findings give rise to the supposition that there are considerable differences in the intensity of adaptation depending on the area of life.

A consequence of differences in the intensity of adaptation is that people overestimate the benefits of an increase in income because they regard their desires as fixed and do not consider the adaptation to income. For that reason, a shift in activities from the economic sphere toward areas of life in which adaptation plays no essential role is recommended as a strategy that could lead to greater satisfaction (cf. Easterlin, 2005).

The present analysis shows a further way out of the hedonic treadmill: people with a high educational attainment are apparently less prone to push up their aspirations in the case of an improvement of their financial situation. The greater stability of their standards tends to find its expression in a lower rate of adaptation and a more sustainable well-being. The education system is thus a possible starting point for policy. Better educational opportunities put people in a position to examine their desires and consumption needs critically.

Finally, it must be noted that an adaptation of standards is a problem for empirical research on subjective well-being: the comparison of satisfaction scores that were reported at different points in time is clearly restricted when these judgments are based on different standards. In this case, it is unclear

whether an observed change in financial contentment is a result of a variation in the living conditions or whether it is caused by an adaptation of the standards of judgment. This means that the inference to be made from an intertemporal analysis of satisfaction measures is only meaningful to the extent that it is plausible to assume that the latent standards are approximately unaltered. The longer the period under consideration, the less this condition appears to be fulfilled. This is why adaption to income is a weak point of subjective well-being.

As a result, the attempt to narrow the informational gap left open by objective indicators using subjective measures succeeds only partially, because a new information deficit arises: the standards on which satisfaction judgments are based are generally unknown. A similar problem occurs in international and cross-sectional analyses of subjective well-being measures. In this field, the standards of judgment vary *between* individuals so that people of different nationalities, for example, use the satisfaction scales in a different way. Kapteyn et al. (2008) propose in this context to solve the problem of incomparability using vignettes. The method confronts the respondents with a hypothetical person's financial situation and asks them to assess the satisfaction of that person. The additional information can then be applied to adjust the response scales of the respondents. So far, experience with the application of vignettes is only available in a few areas; e.g., regarding the self-assessment of health (cf. Kapteyn et al., 2007). A further development of the approach and the inclusion of appropriate vignette questions in longitudinal surveys, such as the SOEP, could provide information about the adaptation of standards. Further insights can be gained when the expectations and aspirations are gathered directly in the survey. This will make subjective well-being measures a better indicator of well-being.

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Appendix: Summary Statistics

Table 3

Summary statistics for financial satisfaction regression in table 1

Variable	Mean	Std. dev.	Min.	Max.
Satisfaction with HH Income	6.302	2.230	0	10
Real HH income	2359	1355	10	65152
No. of persons in HH	2.774	1.229	1	12
East Germany	0.272	0.445	0	1
Age	46.44	15.76	18	80
Years of education	11.76	2.440	7	18
Home owner	0.511	0.500	0	1
Single	0.197	0.398	0	1
Married	0.657	0.475	0	1
Separated	0.015	0.121	0	1
Divorced	0.071	0.257	0	1
Widowed	0.060	0.238	0	1
Non working	0.096	0.294	0	1
In training	0.047	0.211	0	1
Job: low	0.147	0.354	0	1
Job: mid	0.277	0.448	0	1
Job: high	0.101	0.301	0	1
Self-employed	0.055	0.228	0	1
Jobless	0.061	0.240	0	1
Pensioner	0.216	0.411	0	1

Source: SOEP 1985 – 2006. No. of individuals: 23757. No. of observations: 184398.