Adaptation to income over time: A weak point of subjective well-being

Christoph Wunder

University of Bamberg

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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 judgement are unaltered. This is a weak point of such measures. The study investigates the change in the satisfaction judgements resulting from adaptation to income over time. Adaptation is understood as 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).

Keywords: adaptation, financial satisfaction, subjective well-being, standards of judgement

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Corresponding author:
Christoph Wunder
University of Bamberg
Department of Economics
Feldkirchenstraße 21
D-96045 Bamberg
E-Mail: christoph.wunder@uni-bamberg.de

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 produced some insightful studies that demonstrated 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 and Stutzer 2002). This is a strong point of subjective well being measures.

Self reported satisfaction measures are approved to represent a judgement people make about their life or, in the case of domain satisfactions, on specific areas of their life. A prerequisite for using survey data on subjective well-being as a complementary indicator of the life situation is that people evaluate their lives and living conditions with respect to a standard of judgement. Without such a standard, the judgement would be more or less arbitrary and hence meaningless. The standard of judgement is, however, not independent of the life to be judged. It rather 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 judgements given at different points in time will not be comparable. This could be a weak point of subjective well-being measures.

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

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). Current empirical studies typically model adaptation to income as an intrapersonal income comparison (e.g., Stutzer 2004; Clark et al. 2007; Di Tella et al. 2007). This approach assumes that adaptation occurs as a shifting of adaptation levels: The level of income that is experienced as hedonically neutral is altered, since people become habituated to changes in their financial situation. Modeling adaptation as shifting adaptation levels has two important implications: First, information on the individuals' income history is required to calculate a comparison income. Second, the sensitivity to deviations from the new (i.e., shifted) comparison income increases (or remains constant) (cf. Frederick and Loewenstein 1999).

This study applies an alternative approach: Adaptation is modeled as desensitization (sensitization) to the hedonic effect of income. The starting point is the premiss that an individual derives a decreasing (increasing) utility from a given amount of income over time when he/she expects an improvement (worsening) of the financial situation. The reasons for that is that an increase (decrease) in income leads to an upward (downward) adjustment of the individuals' standards of judgement. Hence, adaptation to income is seen as an adjustment of the standards to the living conditions.

Modeling adaptation as a desensitizing process has two distinctive characteristics: First, information about the respondents' income history is not necessary, because the approach does not require the numerical calculation of an adaptation level. Second, the sensitivity to deviations from the status quo decreases due to the desensitization. This is also the decisive difference with respect to shifting adaptation levels. To the best of my knowledge, this study is the first attempt to apply the framework of desensitization to the adaptation of income.

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:

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

Utility u is determined by (the natural logarithm of) income y and further socio economic variables in the vector $\mathbf{x}$. The parameter α denotes the effect of income on well-being that would be realized if there was 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:

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

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

Evidently, an individual benefits less (in terms of utility experienced) from 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:

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

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

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) the 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:

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

First differencing provides also the possibility to control 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 $t = 3, ..., T$ in the $(T-2) \times 1$-vector **d** yields the complete econometric model:

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

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

3   Data

The study uses data from the German Socio-Economic Panel Study (SOEP) (cf. Wagner et al. 2007). 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 as well as income losers who gave the minimum value on the satisfaction scale, are excluded from the sample in a part of the analysis. These individuals are not able to upward (respectively downward) adjust their judgement in the presence of an increase (or decrease) in income. For example, when the income of a very contended person, who reports already the maximum value on the satisfaction scale, further rises, then he/she has not the possibility

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[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 and Hahn (2006) describe PanelWhiz in detail.

to upward adjust his/her assessment 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 was 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 the 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 a 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' socio-economic status.

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[2] I thank Andrew Clark for this point.

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)
non working	-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.

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 calculated 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 a growth in real income at a rate of lower equal 2% is fully offset by the adjustment of standard of judgement. 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]

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 suffered from a loss of income (losers). However, considering the prospect theory which states that gains are evaluated higher than losses, adaptation to income is expected to differ for winners and losers (cf. Kahneman and 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 judgement 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-

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

losers lower their standard of judgement. 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 re-estimated 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 the winners adapt more strongly to the increase in income than the losers to the decrease in income. Or to put it differently, this results suggests that, on the one hand, individuals push up their aspirations in the case of an improvement of their financial situation, and, on the other hand, they adapt to losses with a relatively lower rate of adjustment. This leads to a situation in which the benefits from an improved financial situation are fizzled out rather quickly, whereas people seem to persist longer in their aspirations in the case of a loss of income. In 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 an asymmetrical adaptation.

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[4] The per capita income was used for the dividing up of the sample in order to control for a change in the household composition. That is, an individual may in fact be a winner in spite of a reduction in the household income due to a decrease in the household size.

Table 2
Adaptation 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***	-09.27***
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 numbers of years of education. The bottom and the second quartile were put together in the low category. The 3rd and the top quartile represent the middle and 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 the 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 high educated persons have the lowest, 5.5% compared to 3.3%. This means that the financial satisfaction of a given income diminishes more slowly for higher educated persons over time than for low educated ones.

The separate estimations for winners and losers point out the basis of this result. The relative retention of the standards of the higher educated persons seems to be a consequence from their pushing up aspirations to a smaller extent in the presence of an increase in income compared to the low 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 low and the high educated persons are characterized by a rate of adaptation of a similar magnitude whereas those with a middle educational attainment seem to

downward adjust their standards more slowly. All in all, this finding gives rise to the supposition that the lower overall adaptation of higher educated persons is first and foremost a consequence of their lower upward adaptation that may lead to a more sustainable financial well-being.

5   Conclusion

Finding clear evidence for adaptation to income, the primary conclusion from the analysis is that the meaningfulness of an intertemporal comparison of subjective well-being measures is clearly limited. Observing a change in the financial contentment, it is indistinct whether this change is a result from a variation in the living conditions or an adaptation of the standards of judgement. This means that the inference to be made from an intertemporal analysis of satisfaction measures is only meaningful to the extent it is plausible to assume that the latent standards are approximately unaltered. The longer the period under consideration, the lesser this condition appears to be fulfilled. This is why adaption to income is a weak point of subjective well-being.

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