Session Number: Parallel Session 6B
Time: Thursday, August 26, PM

Paper Prepared for the 31st General Conference of
The International Association for Research in Income and Wealth

St. Gallen, Switzerland, August 22-28, 2010

What (if anything) do Satisfaction Scores Tell Us About the Intertemporal Change in Living Conditions?

Christoph Wunder and Johannes Schwarze

For additional information please contact:

Name: Christoph Wunder
Affiliation: University of Erlangen-Nuremberg,

Email Address: christoph.wunder@wiso.uni-erlangen.de

This paper is posted on the following website: http://www.iariw.org

What (if anything) do satisfaction scores tell us about the intertemporal change in living conditions?

Christoph Wunder[a,*] and Johannes Schwarze[c,d]

July 30, 2010

Abstract

This paper looks at the information content of satisfaction scores. It is argued that the information content depends on the extent to which people adapt to living conditions in general. Using data from the German Socio-Economic Panel Study (SOEP), the estimation of a dynamic panel data model provides evidence that adaptation takes place within a relatively short window of time: changes in living conditions are, for the most part, absorbed by an adjustment of the adaptation level within one year. This leads to the conclusion that the information content of satisfaction scores accentuates recent changes in living conditions. Remote changes are not captured by the according survey questions, even if these changes have long-term impact on living conditions. The usefulness of satisfaction scores as an indicator of people's living conditions is discussed.

Keywords: adaptation, dynamic panel data model, subjective well-being, satisfaction

JEL Classification: C23, I31

[a] University of Erlangen-Nuremberg
[b] University of Bamberg
[c] DIW Berlin and IZA Bonn
[*] Corresponding author: Christoph Wunder, University of Erlangen-Nuremberg, Department of Economics, Lange Gasse 20, 90403 Nuremberg, Germany. Tel.: +49 911 5302 260; Fax: +49 911 5302 178. E-mail: christoph.wunder@wiso.uni-erlangen.de

Acknowledgments: We would like to thank Barbara Hanel and Robert Orlowski for helpful discussions.

1 Introduction

In recent years, data on people's subjective well-being has received increasing interest from both social scientists and policy makers. Scientific studies worked out that measures of subjective well-being may deliver insights into people's lives and living conditions that are complementary to information provided by objective indicators, such as income or GDP (e.g., Dolan and Peasgood 2008). Policy makers have also drawn their attention to subjective indicators. In this context, French President Nicholas Sarkozy established a commission chaired by Joseph Stiglitz on the measurement of economic performance and social progress. One of the key recommendations of the final report of the commission is that "[s]tatistical offices should incorporate questions to capture people's life evaluations, hedonic experiences and priorities in their own survey" (Stiglitz et al. 2009, p. 16).

A typical way to measure people's subjective well-being is to use self-reported satisfaction scores obtained from survey questions about life satisfaction and satisfaction with specific areas of life (for an overview, cf. Frey and Stutzer 2002). An example survey question can be found in the questionnaire of the German Socio-Economic Panel Study (SOEP). The survey asks: "How satisfied are you with your life, all things considered?" The response is measured on a discrete scale that ranges from 0 (completely dissatisfied) to 10 (completely satisfied).

In order to assess the usefulness of satisfaction scores as an indicator of people's living conditions, it is necessary to clarify to what extent people adapt to their living conditions. The reason for this is that adaptation determines the substantive information content of satisfaction scores: in the presence of strong adaptation, satisfaction scores provide primarily information about recent changes in living conditions. In this case, remote changes do not influence the current evaluation, even if they have long-term impact on living conditions. Instead, they are (fully) offset by an adjustment of the adaptation level. In the contrary case of weak adaptation, satisfaction scores represent an evaluation of both the recent changes in and the long-term development of living conditions. As a result, the potential information content provided by satisfaction scores could be between a short-term snapshot based on recent changes in living conditions and a long-term picture of the development of living conditions (that considers recent changes as one part of the picture).

Adaptation is one of the core research fields in the literature on subjective well-being. However, previous studies usually analyzed adaptation to certain circumstances and life events. For example, the seminal study by Brickman et al. (1978) looked at adaptation among lottery winners and accident victims; economists developed a sustained interest in adaptation to income (e.g., Di Tella et al. 2007, Clark et al. 2008, Wunder 2009). Also, researchers investigated adaptation to major life events, such as divorce, marriage, and widowhood (e.g., Lucas et al. 2003, Lucas 2005, Wunder and Schwarze 2009).

Despite of intense research activities in specific fields, it lacks a systematic approach to the empirical analysis of to what extent people adapt to their living conditions *in general*. As a result, there is a knowledge deficit regarding the substantive information content of satisfaction scores: do satisfaction scores reflect recent changes in living conditions (in the case of strong adaptation) or do they provide information about long-term development of living conditions (in the case of weak or no adaptation)? The present paper attempts to fill in this research gap. In the next section, an approach to empirically analyze general adaptation to living conditions is introduced. The data is described in Section 3. The results are presented in Section 4. Finally, the conclusions are drawn in Section 5.

2 A model of general adaptation to living conditions

In this section, an econometric model that provides an estimate of the extent of general adaptation to living conditions is introduced in two steps. First, it is argued, in a short review of adaptation level theory, that utility depends on the difference between living conditions and the adaptation level. In the second step, a dynamic panel data model that yields a direct estimate of the extent of general adaptation is derived.

The assessment of living conditions on the basis of satisfaction scores depends on the expectations a person has about life. For example, the multiple discrepancies theory sees satisfaction as a function of the perceived gap between factual living conditions and expectations (cf. Michalos 1985). However, expectations depend in turn on the context in which the person lives in, so that current expectations of life depend on living conditions (and expectations) in the past. For example, individuals may have higher income expectations at present due to increased incomes

in the past. Thus, increasing incomes are likely to lead to an upward adjustment in expectations (cf. Diener and Biswas-Diener 2002, Solberg et al. 2002).

The context-dependence of expectations can be studied within the theoretical framework of adaptation level theory (cf. Helson 1964). Adaptation level theory hypothesizes that the hedonic experience (i.e., utility) depends on the difference between the stimulus level and the level of the stimulus that provokes no reaction in the individual. This neutral level, denoted the adaptation level, represents an individuals's expectations, so that increasing (decreasing) expectations are mirrored in an increasing (decreasing) adaptation level.

Assuming for simplicity that the utility function is linear, the utility u at time t derived from the consumption of a commodity x can be written as follows:

$$u_t = (x_t - w_t)\beta\,, \tag{1}$$

where $\beta > 0$ denotes the effect of the consumption of the commodity on utility, w is the adaptation level. Assuming that an utility index of zero denotes a threshold between dissatisfaction ($u < 0$) and satisfaction ($u > 0$), the following conclusion can be drawn: an individual is satisfied, if the quantity of x consumed is larger than the adaptation level. The individual is dissatisfied, if the quantity of x consumed is lower than the adaptation level. Hence, an individual derives (positive) utility from consumption, when the quantity consumed is larger than the neutral level.

A widely used formulation of the adaptation level that takes into account the role of time is (cf. Frederick and Loewenstein 1999):

$$w_t = \alpha x_{t-1} + (1-\alpha)w_{t-1}. \tag{2}$$

According to Equation 2, the adaptation level in period t is calculated as a function of the stimulus level in $t-1$ and the adaptation level in $t-1$. Equation 2 can also be read as: the

adaptation level of the commodity x in period t depends on the levels of x in all previous periods and the adaptation level in the initial situation.[1]

The parameter α indicates the extent to which an individual changes his or her adaptation level and adapts to living conditions represented by the stimulus level in the preceding period. It is assumed that $0 \leqslant \alpha \leqslant 1$. If $\alpha = 1$, the adaptation level is completely determined by the level of x in the previous period. If $\alpha = 0$, the level of x does not influence the current adaptation level, i.e., adaptation does not take place. In this case, a person evaluates living conditions with respect to his or her long-term beliefs and expectations. Thus, both the recent changes and the long-term development of living conditions would determine a person's utility. Therefore, large values of α indicate strong adaptive processes, whereas small values of α indicate weak (or no) adaptive processes. Rewriting Equation 2 shows that the change in adaptation levels between period $t-1$ and t is proportional to the difference between the quantity of x and the adaptation level in period $t-1$ (cf. Frederick and Loewenstein 1999):

$$w_t - w_{t-1} = \alpha(x_{t-1} - w_{t-1}). \tag{3}$$

If a constant quantity of the commodity is consumed over time, i.e., if $x_{it} = x_{t-1} = ... = x_0 = \mu_x$, then the adaptation level converges to a constant value $w = \mu_x$. As a result, the difference between x and w converges to zero, and the utility derived from consumption of constant quantities of the commodity x decreases over time. This process represents the main idea of adaptation: "[T]he essence of adaptation [is] that persistent bad things gradually become less aversive, and persistent good things gradually become progressively less pleasurable" (Frederick and Loewenstein 1999, p. 306).

[1] The dependence of w_t on the level of x in all previous periods can be seen from rewriting Equation 2 as $w_t = \alpha x_{t-1} + \sum_{\tau=0}^{t-2} \alpha(1-\alpha)^{(t-1)-\tau} x_\tau + (1-\alpha)^t w_0$, where w_0 denotes the adaptation level in the initial situation. It also follows that the calculation takes into account that the stimulus has less weight, the further it is in the past. The initial value w_0 may be seen to represent a person's long-term beliefs and expectations.

An econometric model that allows to estimate the extent of adaptation (i.e., the parameter α) can be derived by taking first differences of the utility function in Equation 1:

$$u_t - u_{t-1} = (x_t - x_{t-1})\beta - (w_t - w_{t-1})\beta. \tag{4}$$

From Equation 3 follows that one can substitute $\alpha(x_{t-1} - w_{t-1})$ for $(w_t - w_{t-1})$ in Equation 4:

$$u_t - u_{t-1} = (x_t - x_{t-1})\beta - \alpha(x_{t-1} - w_{t-1})\beta. \tag{5}$$

Considering that $(x_{t-1} - w_{t-1})\beta$ is the utility in $t-1$, it follows:

$$u_t - u_{t-1} = (x_t - x_{t-1})\beta - \alpha u_{t-1}. \tag{6}$$

Solving Equation 6 for the utility in t, u_t, leads to a dynamic model that describes the utility in t as a function of the utility in the preceding period and the change in the consumption of the commodity x.

$$u_t = (1-\alpha)u_{t-1} + \Delta x_t \beta. \tag{7}$$

The econometric model that takes into account that living conditions can be characterized by a vector $\mathbf{x}$ of K commodities is:

$$u_{it} = \beta_0 + (1-\alpha)u_{i,t-1} + \Delta \mathbf{x}'_{it}\boldsymbol{\beta} + \mathbf{d}'_t\boldsymbol{\delta} + \nu_i + \varepsilon_{it}, \tag{8}$$

where ν is an individual-specific error term and ε is the idiosyncratic error. The parameter β_0 denotes a constant term. Wave dummies are included in the vector $\mathbf{d}$, $\boldsymbol{\delta}$ is the corresponding coefficient vector. The remaining parameters are defined as above. The resulting model can be estimated as a dynamic panel data model. At first glance, it may seem surprising that the model does not include the levels of the covariates. However, it follows from the derivation of the

model that the parameters in Equation 8 have a clear counterpart in the statements of adaption level theory.[2]

3 Data

The data used in this paper is based on the German Socio-Economic Panel Study (SOEP). The SOEP is a longitudinal study of households that surveys the same respondents annually. A detailed description of the survey can be found in Wagner et al. (2007).[3]

In the SOEP life satisfaction is ascertained by the following question: "How satisfied are you with your life, all things considered?" The response is measured on an 11-point scale ranging from 0 (completely dissatisfied) to 10 (completely satisfied). The respondents report an average level of 6.9. The median is seven and the most frequent score (mode) in the sample is eight. Although satisfaction scores are collected on an ordinal scale, assuming cardinality of satisfaction scores makes little difference to the results of regression analyses (cf. Ferrer-i-Carbonell and Frijters 2004). Hence, we are able to apply econometric models designed for continuous response variables.

The sample includes a set of time invariant standard control variables that enter the model in first-differences. Summary statistics for all variables can be found in Table 1 in the Appendix. We use 25 waves from 1984 to 2008. Since our estimation strategy builds on a dynamic panel data model with differenced variables and lags of the dependent variable, observations in the years 1984-1988 are only used to calculate first differences and as lag variables. In consequence, the data set has a large number of individuals who are observed for a relatively small number of time periods.

[2] An example for a dynamic panel data model that includes levels of the covariates as well as first differences can be found in Pudney (2008). However, his approach has a different theoretical starting point.

[3] The data used in this paper were extracted using the Add-On package PanelWhiz v3.0 (Nov 2010) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). 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 our own. Haisken-DeNew and Hahn (2006) describe PanelWhiz in detail.

4 Results

This section looks at the estimation results in Tables 2 and 3 for the dynamic panel data model introduced in Equation 8. (Tables are in the Appendix.) We begin with a brief discussion of the properties and the diagnostic statistics of the estimators applied in order to assess their statistical quality. After that, we turn to an interpretation of the parameters of interest.

Table 2 reports results obtained from five different estimation strategies: Columns (1) and (2) show OLS and fixed effects estimates, respectively. Although these results are inconsistent for fixed T (e.g., Hsiao 2003), they give a first idea of the parameters involved. Since the OLS estimates are likely to be upward biased, whereas the fixed effects estimates are likely to be downward biased, these models provide informative bounds on the true parameters of interest (e.g., Bond 2002). Thus, we expect good estimates of the coefficient of the lagged dependent variable, which represents $1 - \alpha$, to be in the range between 0.11 and 0.60 which points to moderate to high adaptation.

The inconsistency problem can be solved applying Generalized Method of Moments (GMM) estimators. Columns (3) and (4) report results from difference GMM estimators: we apply the two-step Arellano-Bond estimator with Windmeijer bias-corrected standard errors (cf. Arellano and Bond 1991, Windmeijer 2005). Moreover, Column (5) shows results obtained from a system GMM estimator that makes use of additional instruments (cf. Arellano and Bover 1995, Blundell and Bond 1998). Since the Arellano-Bond test provides evidence for second order serial correlation in the first differenced residuals of the model specification in Column (3), these results are assumed to be biased. Therefore, further lags of the dependent variable were included in the specification in Columns (4) and (5) to resolve the autocorrelation problem. For the model with four lags, no evidence for autocorrelation of second or higher order is found in the Arellano-Bond difference GMM model in Column (4). However, the results from the system GMM estimator in Column (5) are supposed to still suffer from autocorrelation and should, therefore, be read with caution. Thus, we concentrate on the results in Column (4) of Table 2.

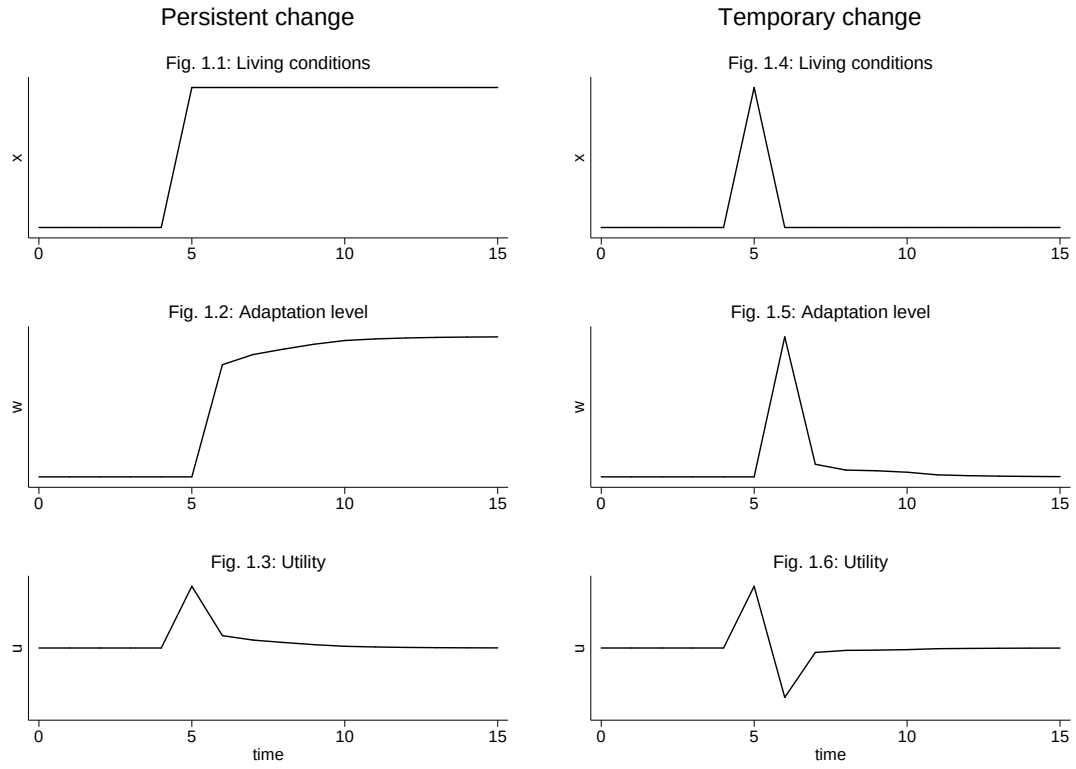
The Sargan-test of overidentifying restrictions refutes the null hypothesis that the moment conditions are valid in our preferred model. Since the test is known to be prone to weakness (cf. Roodman 2009), the rejection of the null hypothesis should not give a cause for the rejection of the model at this stage. To further investigate the issue, we re-estimated the model with restricted samples that used smaller windows of observation than the full sample in order to reduce the number of moment conditions. The estimation results obtained from these subsamples are reported in Table 3 and are of similar magnitude as those obtained from the full sample. In particular, the estimates for the coefficient of the first lag of the dependent variable are between 0.173 and 0.209, which is quite similar to the value of 0.198 reported for the full sample. Most importantly, the Sargan-test does not refute the null hypothesis for any of the estimations using the restricted samples. Thus, we regard the result reported in Column (4) of Table 2, which is in the range of these values, as credible and sufficiently accurate.

Next, we look at the estimation results for the parameters of interest. The estimates of the first-differenced control variables included in the model show the expected signs: individuals with disability report, ceteris paribus, lower satisfaction scores than those with good health; income is positively correlated with life satisfaction; full- and part-time employed persons are more satisfied than non-working individuals, whereas unemployment has a clear negative correlation; widowed people experience lower satisfaction than single, married, or divorced persons.

Our primary interest is in the coefficient of the first lag of the life satisfaction variable. This parameter reveals information about the extent to which people generally adapt to living conditions. From the estimate of approximately 0.2 follows that the adaptation parameter α takes the value 0.8. In the context of Equation 2, this value indicates that the adaptation level at present is a weighted average where living conditions in the immediately preceding period are weighted at approximately 80 percent, and the previous adaptation level is weighted at only 20 percent. It follows that a person's expectations and aspirations about life at present are shaped, for the most part, by the living conditions in the previous period $t-1$. Long-term beliefs (that would be reflected in a long-term constant adaptation level) seem to play only a minor role in the assessment of living conditions.

To look at the estimation results in an alternative way, Figure 1 provides simulations of the process of adaptation to a persistent and a temporary change in living conditions, respectively.

Figure 1
Adaptive process over time



Note: The figures simulate the reaction to a persistent and temporary change in living conditions, respectively. Figures 1.1 and 1.4 show the development of living conditions measured by a variable *x*. Figures 1.2 and 1.5 simulate the adjustment of the adaptation level. Figures 1.3 and 1.6 indicate the corresponding utility level. The simulations are based on the theoretical model introduced in Section 2 and on the estimation results in Column (4) of Table 2.

The simulations are based on the theoretical model introduced in Section 2 and on the estimation results in Column (4) of Table 2 taking into account the additional lags of the dependent variable (i.e., life satisfaction in $t-2$, $t-3$, and $t-4$). The graphs in the left of Figure 1 simulate a persistent positive shock in living conditions that occurs in $t=5$. The high degree of responsiveness to the change in living conditions leads to a considerable and immediate change in the adaptation level: Figure 1.2 depicts that most of the adaptation process is completed in the next period, $t=6$. Mirroring the adjustment of the adaptation level, the utility curve in Figure 1.3 shows a peak in the period in which the (unanticipated) shock appears. After that, utility returns quickly back to the starting level that was observed before the change in living conditions occurred. Consequently, the shock is absorbed, for the most part, by an adjustment of the adaptation level after one period has elapsed.

The graphs in the right of Figure 1 show an example of a temporary shock. The high degree of adjustment of the adaptation level leads again to a quick return of utility to its pre-shock level.

In sum, the simulations that illustrate our estimation results make clear that the utility level the individual experiences three to four periods after the change in living conditions occurred is not different from the pre-shock level. Thus, we conclude that subjective measures of well-being that are regarded as proxy information about utility do not inform us about the long-term development in living conditions. Instead, the evidence for the high degree of adaptation found in the present study leads to the conclusion that measures of utility provide first and foremost a picture of recent changes in living conditions.

5 Conclusion

In this paper, we investigated the question of to what extent people adapt to living conditions. The answer to this question is of great importance, because adaptation determines the information content of satisfaction scores. The empirical evidence pointed to relatively strong general adaptation to living conditions. Thus, we conclude that satisfaction scores first and foremost tell us something about recent changes in living conditions. They appear not to be informative about remote changes, even if those changes have long-term impact on living conditions. Hence, we learn nothing (or only very little) about the long-term development of living conditions.

Can satisfaction scores be used to inform policy and society about people's living conditions? The literature proposed to use data on subjective well-being, for example, (1) to identify specific population subgroups with problems, (2) to analyze the correlates (and causes) of well-being, or (3) detect trends (cf. Layard 2010). (The wider policy implications of data on subjective well-being are discussed, for example, in Oswald (1997), Frey and Stutzer (2000), Layard (2005), and Huschka and Wagner (2010).) In this paper, we come to the conclusion that satisfaction scores can, indeed, be used as an indicator of living conditions. However, one has to be cautious: what we can learn from satisfaction scores is of a short-term nature. Survey questions on life satisfaction tend to operate like a seismograph: they record *movements* in liv-

ing conditions (just as a seismograph records movements in the ground); they do not capture persistent shifts in circumstances (as an altimeter would measure the level above the ground.)

References

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations, *Review of Economic Studies* **58**(2): 277–97.

Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models, *Journal of Econometrics* **68**(1): 29–51.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* **87**(1): 115–143.

Bond, S. (2002). Dynamic panel data models: A guide to micro data methods and practice, *Portuguese Economic Journal* **1**(2): 141–162.

Brickman, P., Coates, D. and Bulman, R. J. (1978). Lottery winners and accident victims: Is happiness relative, *Journal of Personality and Social Psychology* **36**(8): 917–927.

Clark, A. E., Frijters, P. and Shields, M. A. (2008). Relative income, happiness, and utility: An explanation for the Easterlin paradox and other puzzles, *Journal of Economic Literature* **46**(1): 95–144.

Di Tella, R., Haisken-De New, J. and MacCulloch, R. (2007). Happiness adaptation to income and to status in an individual panel, *NBER Working Papers 13159*, National Bureau of Economic Research.

Diener, E. and Biswas-Diener, R. (2002). Will money increase subjective well-being?, *Social Indicators Research* **57**(2): 119–169.

Dolan, P. and Peasgood, T. (2008). Measuring well-being for public policy: Preferences or experiences?, *The Journal of Legal Studies* **37**(2): S5–S31.

Ferrer-i-Carbonell, A. and Frijters, P. (2004). How important is methodology for the estimates of the determinants of happiness?, *Economic Journal* **114**(497): 641–659.

Frederick, S. and Loewenstein, G. (1999). Hedonic adaptation, *in* D. Kahneman, E. Diener and N. Schwarz (eds), *Well-Being: The Foundations of Hedonic Psychology*, Russell Sage Foundation, New York.

Frey, B. S. and Stutzer, A. (2000). Happiness, economy and institutions, *Economic Journal* **110**(466): 918–38.

Frey, B. S. and Stutzer, A. (2002). What can economists learn from happiness research?, *Journal of Economic Literature* **40**(2): 402–435.

Haisken-DeNew, J. P. and Hahn, M. (2006). Panelwhiz: A flexible modularized Stata interface for accessing large scale panel data sets, mimeo.

Helson, H. (1964). *Adaptation-Level Theory. An Experimental and Systematic Approach to Behavior*, Harper & Row, New York.

Hsiao, C. (2003). *Analysis of Panel Data*, Cambridge University Press, Cambridge.

Huschka, D. and Wagner, G. G. (2010). Sind Indikatoren zur Lebensqualität und zur Lebenszufriedenheit als politische Zielgrößen sinnvoll?, *SOEPpapers 275*, DIW Berlin, The German Socio-Economic Panel (SOEP).

Layard, R. (2005). Rethinking public economics: The implications of rivalry and habit, *in* L. Bruni and P. L. Porta (eds), *Economics and Happiness. Framing the Analysis*, Oxford University Press, Oxford, pp. 147–169.

Layard, R. (2010). Measuring subjective well-being, *Science* **327**(5965): 534–535.

Lucas, R. E. (2005). Time does not heal all wounds—a longitudinal study of reaction and adaptation to divorce, *Psychological Science* **16**(12): 945–950.

Lucas, R. E., Clark, A. E., Georgellis, Y. and Diener, E. (2003). Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status, *Journal of Personality and Social Psychology* **84**(3): 527–539.

Michalos, A. C. (1985). Multiple discrepancies theory (MDT), *Social Indicators Research* **16**(4): 347–413.

Oswald, A. J. (1997). Happiness and economic performance, *Economic Journal* **107**(445): 1815–31.

Pudney, S. (2008). The dynamics of perception: modelling subjective wellbeing in a short panel, *Journal Of The Royal Statistical Society Series A* **171**(1): 21–40.

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata, *Stata Journal* **9**(1): 86–136.

Solberg, E. C., Diener, E., Wirtz, D., Lucas, R. E. and Oishi, S. (2002). Wanting, having, and satisfaction: Examining the role of desire discrepancies in satisfaction with income, *Journal of Personality and Social Psychology* **83**(3): 725–734.

Stiglitz, J. E., Sen, A. and Fitoussi, J.-P. (2009). Report by the commission on the measurement of economic performance and social progress.
URL: *http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf*

Wagner, G. G., Frick, J. R. and Schupp, J. (2007). The German Socio-Economic Panel Study (SOEP) – scope, evolution and enhancemants, *Schmollers Jahrbuch (Journal of Applied Social Science Studies)* **127**(1): 139–169.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics* **126**(1): 25–51.

Wunder, C. (2009). Adaptation to income over time: A weak point of subjective well-being, *Schmollers Jahrbuch : Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften* **129**(2): 269–281.

Wunder, C. and Schwarze, J. (2009). Is Posner right? An empirical test of the Posner argument for transferring health spending from old women to old men, *IZA Discussion Papers 4485*, Institute for the Study of Labor (IZA).

Appendix

Table 1
Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
Life satisfaction	6.888	1.785	0	10
Disability status: disabled	0.123	0.329	0	1
Years of education	11.532	2.564	7	18
Log of net household income	7.613	0.530	3.258	10.661
Log of household size	0.914	0.496	0	2.833
Full time employed	0.441	0.496	0	1
Part time employed	0.129	0.335	0	1
Unemployed	0.065	0.246	0	1
Married	0.702	0.457	0	1
Divorced	0.071	0.257	0	1
Widowed	0.072	0.259	0	1
Year: 1989	0.039	0.193	0	1
Year: 1990	0.038	0.190	0	1
Year: 1991	0.037	0.190	0	1
Year: 1992	0.037	0.189	0	1
Year: 1993	0.036	0.187	0	1
Year: 1994	0.036	0.186	0	1
Year: 1995	0.035	0.184	0	1
Year: 1996	0.050	0.217	0	1
Year: 1997	0.049	0.217	0	1
Year: 1998	0.048	0.215	0	1
Year: 1999	0.049	0.217	0	1
Year: 2000	0.049	0.216	0	1
Year: 2001	0.048	0.213	0	1
Year: 2002	0.047	0.212	0	1
Year: 2003	0.051	0.220	0	1
Year: 2004	0.050	0.218	0	1
Year: 2005	0.077	0.266	0	1
Year: 2006	0.073	0.260	0	1
Year: 2007	0.077	0.267	0	1
Year: 2008	0.073	0.261	0	1

Note: $n = 24822$, $nT = 183870$. Observations from the years 1984-1988 are only used as lag variables and to calculate first differences.
Source: SOEP 1984-2008.

Table 2
Estimation results

	(1) OLS	(2) FE	(3) AB	(4) AB	(5) BB
Life satisfaction in $t-1$	0.592***	0.106***	0.111***	0.198***	0.238***
	(0.002)	(0.004)	(0.005)	(0.007)	(0.005)
Life satisfaction in $t-2$				0.088***	0.110***
				(0.005)	(0.004)
Life satisfaction in $t-3$				0.046***	0.060***
				(0.004)	(0.004)
Life satisfaction in $t-4$				0.016***	0.025***
				(0.004)	(0.003)
First-differenced variables:					
Disability status: disabled	-0.173***	-0.137***	-0.050**	-0.058***	-0.059***
	(0.023)	(0.020)	(0.021)	(0.021)	(0.021)
Years of education	0.029***	0.001	-0.005	-0.006	-0.005
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Log of net household income	0.230***	0.161***	0.135***	0.149***	0.154***
	(0.014)	(0.012)	(0.012)	(0.012)	(0.012)
Log of household size	0.148***	0.177***	0.103***	0.101***	0.100***
	(0.023)	(0.022)	(0.023)	(0.024)	(0.023)
Full time employed	0.185***	0.126***	0.125***	0.130***	0.131***
	(0.017)	(0.015)	(0.016)	(0.016)	(0.016)
Part time employed	0.090***	0.041***	0.047***	0.054***	0.054***
	(0.016)	(0.013)	(0.014)	(0.014)	(0.014)
Unemployed	-0.280***	-0.201***	-0.183***	-0.201***	-0.210***
	(0.019)	(0.017)	(0.018)	(0.018)	(0.017)
Married	0.277***	0.198***	0.153***	0.140***	0.139***
	(0.034)	(0.032)	(0.034)	(0.035)	(0.034)
Divorced	0.187***	0.076	0.117**	0.112**	0.117**
	(0.051)	(0.047)	(0.052)	(0.053)	(0.051)
Widowed	-0.646***	-0.748***	-0.553***	-0.558***	-0.581***
	(0.083)	(0.079)	(0.087)	(0.088)	(0.086)
Constant	2.854***	6.455***	6.390***	4.623***	4.038***
	(0.025)	(0.034)	(0.041)	(0.117)	(0.092)
Sargan-test			0.000	0.000	0.000
Autocorrelation test			failed	o.k.	failed

Note: Significance levels: *<0.1, *<0.05, ***<0.01. $n = 24822$, $nT = 183870$. Dependent variable is life satisfaction in t. Standard errors in parentheses. Col. (1): ordinary least squares estimates with robust standard errors. Col. (2): fixed effects estimates. Col. (3) and (4): Arellano-Bond two-step estimates with Windmeijer bias-corrected standard errors. Col. (5): Blundell-Bover system GMM estimator. All estimations include dummy variables for the year of the survey. Sargan-test reports p-value for H0: overidentifying restrictions are valid. Autocorrelation test: Arellano-Bond test for zero autocorrelation in first-differenced errors.
Source: SOEP 1984-2008.

Table 3
Estimation results: Arellano-Bond estimates for restricted window of observation

	1988-2000	1990-2002	1992-2004	1994-2006	1996-2008
Life satisfaction in $t-1$	0.197***	0.191***	0.173***	0.179***	0.209***
	(0.013)	(0.012)	(0.013)	(0.013)	(0.013)
Life satisfaction in $t-2$	0.094***	0.092***	0.076***	0.078***	0.098***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Life satisfaction in $t-3$	0.044***	0.043***	0.034***	0.035***	0.046***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Life satisfaction in $t-4$	0.019***	0.019***	0.016**	0.016***	0.018***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
First-differenced variables:					
Disability status: disabled	-0.021	-0.041	-0.063**	-0.099***	-0.077***
	(0.036)	(0.032)	(0.032)	(0.030)	(0.028)
Years of education	0.002	-0.000	0.003	-0.001	-0.015
	(0.012)	(0.010)	(0.010)	(0.010)	(0.011)
Log of net household income	0.185***	0.191***	0.173***	0.165***	0.159***
	(0.021)	(0.020)	(0.019)	(0.018)	(0.017)
Log of household size	0.042	0.070*	0.101***	0.114***	0.153***
	(0.038)	(0.037)	(0.036)	(0.033)	(0.033)
Full time employed	0.153***	0.147***	0.122***	0.117***	0.117***
	(0.026)	(0.025)	(0.025)	(0.024)	(0.023)
Part time employed	0.074***	0.070***	0.057**	0.066***	0.066***
	(0.025)	(0.024)	(0.022)	(0.020)	(0.019)
Unemployed	-0.194***	-0.188***	-0.192***	-0.215***	-0.208***
	(0.027)	(0.025)	(0.025)	(0.025)	(0.025)
Married	0.192***	0.206***	0.130**	0.114**	0.111**
	(0.059)	(0.057)	(0.056)	(0.052)	(0.050)
Divorced	0.102	0.130	0.062	0.095	0.100
	(0.087)	(0.080)	(0.078)	(0.076)	(0.072)
Widowed	-0.398***	-0.515***	-0.694***	-0.783***	-0.749***
	(0.140)	(0.142)	(0.142)	(0.124)	(0.126)
Constant	4.561***	4.541***	4.845***	4.816***	4.507***
	(0.206)	(0.198)	(0.197)	(0.212)	(0.217)
Sargan-test	0.1502	0.1366	0.2264	0.3089	0.1392
Autocorrelation test	o.k.	o.k.	o.k.	o.k.	o.k.
n	12775	12722	13394	18352	19357
nT	64950	69125	72096	81650	91206

Note: Significance levels: *<0.1, *<0.05, ***<0.01. Dependent variable is life satisfaction in t. Arellano-Bond two-step estimates with Windmeijer bias-corrected standard errors. Four lags of the dependent variable are used as instruments. All estimations include dummy variables for the year of the survey. Sargan-test reports p-value for H0: overidentifying restrictions are valid. Autocorrelation test: Arellano-Bond test for zero autocorrelation in first-differenced errors.
Source: SOEP 1984-2008.