Pfaff, Tobias

Working Paper

Income comparisons, income adaptation, and life satisfaction: How robust are estimates from survey data?

SOEPpapers on Multidisciplinary Panel Data Research, No. 555

Provided in Cooperation with:
German Institute for Economic Research (DIW Berlin)

Suggested Citation: Pfaff, Tobias (2013) : Income comparisons, income adaptation, and life satisfaction: How robust are estimates from survey data?, SOEPpapers on Multidisciplinary Panel Data Research, No. 555, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

This Version is available at:
https://hdl.handle.net/10419/74717

SOEP Das Sozio-oekonomische Panel

555 2013

SOEPpapers
on Multidisciplinary Panel Data Research

SOEP – The German Socio-Economic Panel Study at DIW Berlin 555-2013

Income Comparisons, Income Adaptation, and Life Satisfaction: How Robust Are Estimates from Survey Data?

Tobias Pfaff

DIW SOEP

SOEPpapers on Multidisciplinary Panel Data Research
at DIW Berlin

This series presents research findings based either directly on data from the German Socio-Economic Panel Study (SOEP) or using SOEP data as part of an internationally comparable data set (e.g. CNEF, ECHP, LIS, LWS, CHER/PACO). SOEP is a truly multidisciplinary household panel study covering a wide range of social and behavioral sciences: economics, sociology, psychology, survey methodology, econometrics and applied statistics, educational science, political science, public health, behavioral genetics, demography, geography, and sport science.

The decision to publish a submission in SOEPpapers is made by a board of editors chosen by the DIW Berlin to represent the wide range of disciplines covered by SOEP. There is no external referee process and papers are either accepted or rejected without revision. Papers appear in this series as works in progress and may also appear elsewhere. They often represent preliminary studies and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be requested from the author directly.

Any opinions expressed in this series are those of the author(s) and not those of DIW Berlin. Research disseminated by DIW Berlin may include views on public policy issues, but the institute itself takes no institutional policy positions.

The SOEPpapers are available at
http://www.diw.de/soeppapers

ISSN: 1864-6689 (online)

German Socio-Economic Panel Study (SOEP)
DIW Berlin
Mohrenstrasse 58
10117 Berlin, Germany

Contact: Uta Rahmann | soeppapers@diw.de

Income Comparisons, Income Adaptation, and Life Satisfaction: How Robust Are Estimates from Survey Data?

Tobias Pfaff*

University of Münster, Center for Interdisciplinary Economics, Germany

This version: May, 2013

Abstract

Theory suggests that subjective well-being is affected by income comparisons and adaptation to income. Empirical tests of the effects often rely on self-constructed measures from survey data. This paper shows that results can be highly sensitive to simple parameter changes. Using large-scale panel data from Germany and the UK, I report cases where plausible variations in the underlying income type substantially affect tests of the relationship between life satisfaction, income rank, reference income, and income adaptation. Models simultaneously controlling for income and income rank as well as models with a number of income lags are prone to imperfect multicollinearity with consequences for the precision and robustness of estimates. When testing relative-income effects, researchers should be aware that reference income constructed as average of a rather arbitrarily defined reference group and reference income predicted from Mincer-type earnings equations are two approaches that can produce inconsistent results, and that are probably not as reliable and valid as previously assumed. The analysis underlines the importance of robustness checks and regression diagnostics, two routines that are often not carried out diligently in empirical research.

Keywords: Subjective well-being, life satisfaction, relative income, income rank, adaptation

JEL classification: C23, D0, I31

* Correspondence address: University of Münster, Center for Interdisciplinary Economics, Scharnhorststrasse 100, 48151 Münster, Germany. Tel.: +49 251 83 24326. Fax: +49 251 83 28429.
E-mail address: tobias.pfaff@uni-muenster.de.

1 Introduction

Relative-income and adaptation effects play an important role in economic theory (Clark et al., 2008b). The relative-income hypothesis predicts that people's utility reacts to a change in the income of one or more others, all other things being equal. The income of others can be called reference income or comparison income. If a ceteris paribus increase in reference income leads to a decrease in utility, the phenomenon can be called comparison effect and is, from a psychological perspective, associated with negative feelings of jealousy or envy.[1] If a ceteris paribus increase in reference income leads to an increase in utility, the phenomenon can be called information effect and is associated with positive feelings of ambition (Senik, 2008).[2] Senik (2008) proposes that both the comparison and the information effect always coexist but that "the degree of mobility and uncertainty in the economic environment" (p. 496) determines which of the two is dominant. The hypothesis of adaptation to income postulates that an income shock changes the utility level of an individual temporarily, but that the effect wears off over time until the utility level reverts to its original position.[3]

For empirical tests of the two hypotheses utility is often approximated by measures of subjective well-being (Clark et al., 2008b; Kahneman and Krueger, 2006). One of the most famous studies of income and subjective well-being is Easterlin (1974). He observes in certain time-series data that national income grows while average subjective well-being remains largely flat. From a theoretical perspective, both the relative-income effect and the adaptation effect can be used to explain this finding. Consequently, a number of empirical studies have endeavored to test for the existence of the effects or even measure the effect sizes. Clark et al. (2008b) give a comprehensive overview and most studies suggest that the two effects indeed affect the utility evaluation of individuals. In recent years, a considerable number of studies specifically focused on testing the relative-income hypothesis, employing a number of different methodologies. Table 1 gives an overview of methodologies with an incomplete list of studies for each branch.[4]

[Table 1 about here]

A small number of recent studies have studied the relative-income hypothesis with experimental data, which is probably the gold standard in empirical research. All of the experimental studies detect some

[1] Similar concepts to the comparison effect are relative deprivation, relative status, or social frame of reference.
[2] Hirshman and Rothschild (1973) call this phenomenon "tunnel effect" referring to a traffic-jam situation in a tunnel where the spirit of individuals is lifted by a signal that indicates that things will get moving soon.
[3] Van Praag (1971) refers to a "preference drift" over time. The psychologists Brickman and Campbell (1971) coined the term "hedonic treadmill" for the phenomenon of adaptation. Adaptation (or habituation) has also been discussed in relation to other life events. See Frederick and Loewenstein (1999) and Clark et al. (2008a) for reviews.
[4] The task of a complete list of studies could be realized in an update of Clark et al. (2008b), which is beyond the scope of this article. It would also be interesting to distinguish studies by origin country of the data and for some studies by type of subjective well-being used as dependent variable (financial satisfaction, job satisfaction, life satisfaction, etc.).

form of cognitive or behavioral reaction to changes in the relative-income position. Another branch of studies relies on direct evidence from survey data. This research for example identified colleagues (Clark and Senik, 2010, with European data), people in your occupation (Goerke and Pannenberg, 2013, with German data) and friends (Yamada and Sato, 2013, with Japanese data) as the most relevant reference groups for income comparisons.[5] While experimental data and direct evidence are still scarce, the bulk of studies construct measures of reference income or income rank from within-sample or out-of-sample income data. Most of these studies suggest a negative relative-income effect (e.g., Ferrer-i-Carbonell, 2005, for Germany), while others suggest a positive relative-income effect (e.g., Senik, 2004, for a transition country).

In this study, I show that results based on measures constructed by the researcher from within the sample can depend heavily on rather simple parameter changes. I also confirm the finding of de la Garza et al. (2012) that results based on group-average reference income can be inconsistent with results based on predicted reference income using Mincer-type earnings equations (the approaches are explained in more detail in Section 2). Beyond questioning the reliability of results, my findings even cast some doubt on the validity of using self-constructed measures for reference income when the definition of the reference group is based on strong assumptions. Furthermore, I point to multicollinearity issues in regression equations with income and income rank, which have not been properly addressed by previous studies. Lastly, I show that tests of income adaptation with an arbitrary number of income lags are also highly sensitive to the type of income variable used, and that these tests can also be affected by imperfect multicollinearity. I speculate that robustness checks with different income types and with alternative approaches for constructing reference income could possibly undermine the results of some previous studies.

After discussing popular identification strategies for relative-income effects and adaptation to income in Section 2, I explain my empirical framework and I show some basic descriptive statistics of my samples in Section 3. The results of extensive sensitivity analyses regarding income rank, reference income, and income adaptation are discussed in Section 4. Section 5 concludes.

2 Identification strategies for relative-income effects and income adaptation using measures constructed by the researcher

Probably the most widely used strategy for identifying relative-income effects is to approximate "true" reference income of an individual by the average income of a reference group. The reference group of an individual is typically defined as the group of people in a data set that share some important characteristics, such as age, sex, and education.[6] However, the available information in the data set often urges

[5] Knight et al. (2009) use rural data from China and report "people in the same village" as main comparator group. Friends and colleagues did not appear as options in their questionnaire.
[6] See de la Garza et al. (2012) for an overview of different reference-group definitions.

the researcher to make strong assumptions and to rather arbitrarily determine the reference group. Reference groups usually do not come close to what direct evidence suggests as relevant categories such as colleagues or friends. Nonetheless, results obtained with rather arbitrary reference groups often seem plausible (e.g., significantly negative coefficients), which leads to an implicit justification of the strong assumptions. Subsection 4.2 shows that it is important to scrutinize such seemingly plausible results based on strong assumptions.[7] Other studies, using mostly out-of-sample data for determining the reference group, have to impose somewhat weaker assumptions regarding the reference group. An example is Clark et al. (2009b), who use linked employer-employee panel data from Denmark. The data structure allows them to calculate the average income of colleagues within the actual firm of the individual.

Apart from the group-average approach, a second approach for constructing reference income is to predict reference income with a Mincer-type earnings equation. The approach is also called two-stage estimation strategy, because the predicted reference income of the first-stage estimation is plugged into a well-being model with further controls in the second stage. The two-stage estimation approach appears less often in the literature compared to the group-average approach, possibly because the researcher is faced with more demanding identification problems.[8] Like instrumental-variables regressions with 2SLS, the two-stage estimation strategy needs valid exclusion restrictions for robust identification, i.e., the "claim that an instrument operates through a single known causal channel" (Angrist and Pischke, 2009, p. 153).[9] In this context, instruments are exogenous variables that influence subjective well-being only through the channel of reference income. Finding instruments is generally a challenge, and more so in the context of subjective well-being, which is naturally related to a plethora of phenomena. Nonetheless, Senik (2004, 2008) employs the two-stage estimation approach and argues that the professional variables she includes in the first-stage equation and excludes in the well-being model (e.g., occupation or industry) only influence well-being through actual and predicted reference income. Some of the variables are used in both equations (age, gender, education) with the remark that they influence both (reference) income and well-being, "but for different reasons" (Senik, 2008, p. 500). In contrast, de la Garza et al. (2012) do not trust their own, highly unstable two-stage estimation results. They attribute such inconsistent results to exclusion restrictions that are "frequently unjustified and easily refutable"

[7] Note also that regression models with one regressor being the average of another regressor can cause further identification problems (Angrist and Pischke, 2009, chapter 4.6.2).

[8] Another data-driven reason could be that estimating the earnings equation requires individual income data, which are typically less available than household income data.

[9] In the instrumental variables context, the exclusion restriction formally says that $y_i(d,0) = y_i(d,1)$ for $d = 0,1$, where $y_i(d,z)$ is the potential outcome of individual i for instrument value $z_i = z$ and treatment status $d_i = d$ (Angrist and Pischke, 2009, pp. 151–153).

(de la Garza et al., 2012, p. 1).[10] This study confirms that the two-stage estimation strategy can produce results that are inconsistent with results from the group-average approach.

More recently, a number of studies have focused on income rank (see Table 1 for references). Derived from psychology, and specifically from Parducci's (1965) Range Frequency Theory, the rationale is that utility is influenced by the ordinal rank position within an income distribution that is relevant to the individual. Brown et al. (2008) underline that comparison income and income rank are different concepts. While a certain income value can have the same distance from mean, midpoint and end points in two different income distributions, the ordinal rank position can differ notably. The empirical results of Boyce et al. (2010) even suggest that the influence of the rank position on life satisfaction is stronger than both the influence of changes in absolute income and the influence of comparing one's income to the average income of a reference group. The rank variable is usually calculated as the ranked ordinal position (or frequency value in the language of Parducci) normalized between 0 and 1:[11]

$$F_{ij} = \frac{r_{ij}-1}{n_j-1}\ , \tag{1}$$

with *F* as the frequency value of individual *i* in reference group *j*, the rank *r* of the individual's income within the reference group, and *n* as the number of observations of the reference group. What is usually not mentioned in studies advocating for income rank is that the above mentioned problem of defining the appropriate reference group remains. Unless out-of-sample data with possibly more precise information are used, the definition of the reference group mostly depends on the available information within the data set. For example, Boyce et al. (2010) calculate income rank in relation to the whole sample for each year, and Clark et al. (2010) use income rank in rather broad reference groups based on country, gender, education, and age. While the effect of income rank on well-being appears to be fairly robust in previous studies, I show in Subsection 4.1 that results can strongly depend on the income type chosen by the researcher. Given the fact that income and income rank are often highly correlated variables, multicollinearity issues should also be taken into account when interpreting results with both variables in the equation.

The usual strategy for identifying adaptation to income is comparatively more straightforward. Paul and Guilbert (2013) extend the notation of Layard (2005, p. 252) and describe a generalized adaptation function *A* as follows:

$$A(\lambda, y_i, K) = \beta\left(\ln y_{it} - \sum_{k=1}^{K} \lambda_k \ln y_{i,t-k}\right), \tag{2}$$

[10] Clark et al. (2008b) note that the exclusion restriction for the group-average approach is more subtle because individuals relate only to the mean income within each group.
[11] For other rank-related specifications such as range, see Brown et al. (2008).

where y_{it} is income of individual i at time t, λ is a vector of adaptation parameters, and K is the number of periods the adaptation process takes place. Adaptation to income is then typically modeled in a regression equation by including a rather arbitrary number of income lags.[12] Now, a model of subjective well-being, income adaptation, and reference income can be written as

$$SWB_{it} = \alpha + \beta \ln y_{it} + \sum_{k=1}^{K} \beta_k \ln y_{i,t-k} + \gamma \ln y_{it}^{*} + \delta' X_{it} + \varepsilon_{it}, \quad (3)$$

where SWB_{it} is subjective well-being of individual i at time t, $\beta_k = -\beta\lambda_k$ ($k = 1, 2, \ldots, K$), y^*_{it} is reference income, the vector X_{it} refers to a set of further control variables, and ε_{it} is an error term. Following Di Tella et al. (2010) and Paul and Guilbert (2013), the hypothesis of no adaptation can be tested with

$$H_0\text{: } \sum_{k=1}^{K} \beta_k = 0 \text{ versus } H_1\text{: } \sum_{k=1}^{K} \beta_k \neq 0, \quad (4)$$

and the long-run effect (full adaptation) can be tested with

$$H_0\text{: } \beta + \sum_{k=1}^{K} \beta_k = 0 \text{ versus } H_1\text{: } \beta + \sum_{k=1}^{K} \beta_k \neq 0. \quad (5)$$

Subsection 4.3 shows that the choice of the income variable can have a substantial impact on results of the hypothesis tests in (4) and (5). More specifically, my results suggest that the hypothesis tests are more likely rejected when the researcher uses raw household income instead of equivalized household income.

3 Empirical framework and descriptive statistics

3.1 Data sets

Like other prominent studies in the field, I use data from the German Socio-Economic Panel (SOEP, 2011), and from the British Household Panel Survey (BHPS, 2012). The SOEP is the world's longest-running socio-economic panel study with the first wave in 1984 (Wagner et al., 2007). I choose life satisfaction as dependent well-being variable. Life satisfaction in the SOEP is derived from the question *"How satisfied are you with your life, all things considered?"*, with answers ranging from 0 (*"completely dissatisfied"*) to 10 (*"completely satisfied"*). From a theoretical perspective, Senik (2008) proposes that the degree of mobility and stability in the economic environment determines if either the positive information effect or the negative comparison effect is dominant. Given that re-unified Germany now has a developed economy with a comparatively high income level, I expect the comparison effect to dominate the information effect, resulting in a negative relative-income effect. However, Eastern Germany went through a turbulent transition period after the German re-unification, which gives rise to expect a somewhat stronger influence of the information effect on Eastern Germans than on Western Germans. It can thus be conjectured with some reason that the size of the relative-income effect

[12] Di Tella et al. (2010) use four lags, Layard et al. (2010) use three lags. Ferrer-i-Carbonell and van Praag (2008) suggest an alternative way to measure adaptation, but I concentrate on the mainstream approach in this paper.

in Eastern Germany is less negative (or more positive) compared to Western Germany. In order to test this hypothesis in passing, I distinguish between two samples: Western Germany (1992–2010), and Eastern Germany (1992–2010).[13]

The BHPS was started in 1991 and asks for life satisfaction on a 7-point scale: *"How dissatisfied or satisfied are you with your life as a whole?"*. The question was introduced in wave 6, but not asked in wave 11. This allows me to use waves 6–10 and 12–18, covering 12 waves or the years 1996–2008 (without 2001).

3.2 Type of income

Often, (panel) survey data sets offer more than one income variable. The researcher can then choose among categories such as gross/net, nominal/real, household/individual, etc. While the choice within some categories is closely linked to the research question, the choice within other categories is more open. For example, both the SOEP and the BHPS offer a variable with household income from the current year, and another variable with household income from the previous year. When SOEP data are used, household income of the previous year is often preferred, most likely because the variable has fewer missing values than current household income.[14] However, one rarely sees research articles that run robustness checks with different income variables when the choice was not theory driven, but rather data driven. This paper shows that the choice of the income variable can significantly affect tests of relative income and income adaptation.

I also make a case for using equivalized household income, while many (if not most) studies in the field have used raw household income. Mainstream economic theory assumes that utility is generated by fulfilling preferences. Consumption possibilities enable individuals to fulfill these preferences, and income, in turn, can be seen as a measure for consumption possibilities. Thus, when *individual* utility is approximated by a measure of well-being, such as life satisfaction, the model naturally assumes that income is linked with life satisfaction through consumption possibilities. However, consumption possibilities represented by *household* income strongly depend on the size and composition of the household. Not taking the size and composition of the household into account potentially leads to biased estimates of the relationship between household income as a proxy for consumption possibilities and individual well-being. The literature shows two general approaches for avoiding the bias. The first approach is to add control variables for household size and household composition to the equation (e.g.,

[13] The SOEP sample was extended to Eastern Germany by 1990. Income variables are available for Eastern Germany only from 1992. Therefore, the analysis with models including four income lags in Subsections 4.2 and 4.3 can start only in 1996. For comparison reasons, I choose the same period for the Western German sample. The conclusions drawn in this paper would have been the same if I had used a combined sample of re-unified Germany (estimation results are available from the author).

[14] Note that it is generally more plausible to assume that individual well-being is affected by comparisons to other's *current* income instead of being affected by comparisons to other's income of the *previous* year. I thank Jan Goebel for hinting at this point.

the number of adults and children). Another, more fine-tuned approach is to use equivalized household income, i.e., household income divided by an equivalence scale.[15] The estimations in Section 4 show that the two approaches can produce significantly different results, especially regarding tests of income adaptation.[16] I conclude that the plausibly more accurate approach of using equivalized income should be standard in studies of well-being when household income is used as a proxy for individual income, unless there is a good theoretical justification for the approach with raw household income and respective control variables.

The income variables available in the SOEP and the BHPS that are adequate for my models are net household income of the previous year, current net household income, and individual gross labor income. All income variables are described in detail in Appendix A.

3.3 Self-constructed measures from income variables

The focus of this study are robustness checks for estimations with self-constructed measures for group-average reference income, predicted reference income, income rank, and lastly income lags for testing income adaptation.

From studies using the group-average approach for constructing reference income, I choose three different methods. The first method, proposed by McBride (2001), is a simple calculation of average income for age cohorts, i.e., the average income of everyone from five years younger to five years older than the individual. While McBride (2001) uses cross-section data, I calculate cohort averages separately for every year in my panel data. The second group-average method I choose is used in Ferrer-i-Carbonell (2005). She defines a reference group according to five education groups, five age brackets, and region. The third method was proposed by Layard et al. (2010), who calculate average income for every year based on the age cohort (± 5 years), four education groups, and gender.[17] Before calculating group averages, I treat outliers of the income variable by dropping the first percentile with implausibly low values.[18] For the SOEP samples, I use weights to calculate average income of a reference group in order to avoid bias due to sampling artifacts. In the BHPS sample, two-thirds of the respondent weights are zero. In order to avoid too many missing values, I do not use weights, but I drop all individuals from the rather small ECHP sample, where individuals with low income are overrepre-

[15] The equivalence scale can be defined differently, for example the International Experts' Scale (Buhmann et al., 1988) or the now widely used modified-OECD scale (De Vos and Zaidi, 1997).

[16] My motivation to investigate the difference between the approaches came from attempts to replicate the results of Ferrer-i-Carbonell (2005) and Di Tella et al. (2010). Using very similar samples and models, my replication suggested that using equivalized income leads to different results than the original approaches with raw income and control variables for household size and household composition. Results of the replications attempts are not shown here, but are available on request.

[17] For further details on the construction of the education groups and age brackets, I refer the reader to the original papers.

[18] Clark et al. (2005) exclude the first and the last percentile of household income. However, values in the last percentile still seem plausible in my samples (see Table 2 and Tables B.1a–d of Appendix B).

sented. Some reference groups are very small so that extremely high or low incomes can exert a considerable influence on average income. In order to mitigate the influence of extreme income values, I exclude all observations from the estimations where average income of the reference group is based on less than 10 individuals.

From studies using Mincer-type earnings equations for predicting reference income, I use equations similar to Senik (2008), and I follow her remark to only use *individual* income for the two-stage estimation approach. In order to avoid biased estimates, I change the first percentile of the individual labor income variable with implausibly low values to missing. For the SOEP samples, I use OLS to predict log individual labor income for each year based on age, age squared, gender, years of education, industry, occupation, employment status (full-time, part-time, etc.), tenure, and region.[19] For the BHPS sample, I replace years of education with education level, and I have to leave industry and tenure out of the earnings equation.[20] The estimations of the earnings equations and the predictions are restricted to working individuals. From the variables used in the first-stage estimation, the well-being model of the second stage includes age squared and region, as well as implicitly gender through individual fixed effects. Due to the requirement of valid exclusion restrictions, I need to assume for the other variables that they influence life satisfaction only through actual and predicted income (see Section 2 for a critical view on this assumption).

Income rank is calculated using formula (1), with reference groups defined as in Ferrer-i-Carbonell (2005). This resembles the approaches for testing income rank in Clark et al. (2010) and in Budria and Ferrer-i-Carbonell (2012).

For measuring adaptation to income, I use four income lags so that results are comparable to Di Tella et al. (2010). For estimations with models including income lags, I exclude all individuals with gaps in the interview sequence so that a lag of t-1 always refers to the previous year, a lag of t-2 refers to the second to last year, etc.

3.4 Control variables and estimation method

The estimated models are similar to equation (3): I always control for the logarithm of the respective income variable, and I always use a set of further personal control variables that are described in Appendix A.[21]

[19] I use the natural logarithm throughout this study.

[20] The BHPS data do not provide enough information for constructing years of education consistently (Dickson, 2012). Tenure and a consistent variable for industry are also not available for my period of analysis.

[21] In contrast to many other studies in the field, I do not control for education. As Dolan et al. (2008) convincingly argue, "most adult survey respondents are unlikely to change their education level during their time in a panel survey, and consequently fixed effects models are unlikely to find any significant effect for education" (p. 100). I tested dummies for the education level in all of my models with reference income. The education dummies were in the vast majority of cases insignificant and did not have a sizeable effect on the coefficients of the key regressors.

I choose fixed-effects OLS for the estimations.[22] Results from OLS can be easily interpreted, while individual fixed-effects have the advantage that all unobservable time-constant characteristics are controlled for. Another advantage is that the possibility of endogeneity bias is somewhat reduced.[23] The OLS approach requires the assumption that the life-satisfaction variable is cardinal, which should be unproblematic since ordinal approaches usually lead to qualitatively very similar results (Ferrer-i-Carbonell and Frijters, 2004).

In order to better assess if standard errors behave normally, I report heteroskedasticity-robust standard errors as well as standard errors that are robust to clustering at the individual level in some of my tables. Clustering at the level of the panel identifier relaxes the assumption that observations are independent within the cluster, i.e., estimates are also robust to serial correlation, which is an advantage for analyses with panel data where serial correlation is a likely phenomenon. As in Senik (2004, 2008), bootstrapped standard errors are systematically reported when the reference-income variable was estimated in a first-stage regression. Note that multicollinearity could be a problem for models with predicted reference income because age squared and region are included in both the first-stage and in the second-stage regression. However, variance inflation factors calculated for the second-stage model do not point to alarming multicollinearity problems. Regression diagnostics are discussed in detail in Appendix C.

3.5 Descriptive statistics

I generate a separate data file for each combination of the three samples (Western Germany, Eastern Germany, United Kingdom) and five different income types used for constructing group-average reference income (previous year's equivalized household income, current equivalized household income, previous year's raw household income, current raw household income, and individual labor income). This results in fifteen different data sets. Table 2 shows descriptive statistics for the primary variables of interest for group averages calculated with previous year's equivalized household income.[24]

[Table 2 about here]

The descriptive statistics do not suggest that any of the approaches to construct reference income dominates the other methods. I only observe that reference income predicted with the earnings equation has a higher variation than reference income from the group-averages approach, while higher variation implies higher statistical power of the tests.

[22] I use the Stata command -xtivreg2- (Schaffer, 2010) because the command excludes singletons from the estimation, while the standard command -xtreg- includes singletons, which is odd considering the within transformation of fixed effects. I do not show the coefficient for the constant in the tables because it is not reported by -xtivreg2-.

[23] Advantages of fixed-effects regressions for models of life satisfaction are explained in Pfaff and Hirata (2013) and in Vendrik and Woltjer (2007).

[24] Descriptive statistics for the data sets with group averages based on other income types are shown in Tables B.1a–d of Appendix B. I do not use weights here, because the focus is not on representative statistics.

4 Sensitivity analyses

4.1 Income rank

In order to test the sensitivity of estimations with income rank, I estimate three models for each combination of sample and income type. The key regressors are log income and income rank. The first and the second model include the key regressors separately. The third model includes both regressors. All models include a set of further personal control variables, as well as year fixed effects and region fixed effects. Note that the size of the coefficients cannot be readily compared between the SOEP samples and the BHPS sample because the life satisfaction scale is 0–10 in the former, and 1–7 in the latter. I do not standardize the life-satisfaction variables because my focus is not on comparing the magnitude of the coefficients between samples. Here, the possibility to compare the sign and significance is sufficient. Table 3 shows the results.

[Table 3 about here]

When the variables are entered separately, the coefficients are all positive and highly significant (log individual labor income in the UK is only significant at the 5 percent level). As demonstrated for example in Boyce et al. (2010), the picture changes when both variables are entered simultaneously.[25] Boyce et al. (2010) observe a dominant income-rank coefficient, while the coefficient for household income shrinks dramatically. The results presented in Table 3 suggest that this phenomenon is not consistent when the underlying income type is exchanged. Various constellations appear in columns 3, 6, and 9 of Table 3: both variables significant, both variables insignificant, income dominant, income rank dominant. A specific pattern of results dependent on the income type does not become apparent.

What should be discussed in light of the inconsistent results are potential effects of imperfect multicollinearity. To the best of my knowledge, this issue has not been thoroughly discussed in previous studies.[26] Recall that imperfect multicollinearity among regressors does not lead to biased coefficients, provided that other OLS assumptions hold.[27] Nonetheless, likely consequences of high multicollinearity are imprecise estimation (large standard errors) and unreliable tests of at least one regressor, as well as sensitivity of coefficients and standard errors to minor changes in the data. While there is no proper test for multicollinearity, I can only speculate about the degree of multicollinearity in my data and I use correlation coefficients and variance inflation factors (VIF) as rules of thumb. On the one hand, the correlation coefficients between log income and income rank are all above 0.80 (except for individual

[25] Note that Boyce et al. (2010) use a different reference group for calculating income rank (all individuals in a given year).

[26] For example, Brown et al. (2008, p. 372) simply argue: "These different measures of pay are, of course, somewhat correlated. Nevertheless, the large number of observations makes it possible, in practice, to estimate the separate variables' effects."

[27] For this and the rest of my discussion on multicollinearity, I refer to the elaborate chapter on multicollinearity in Gujarati and Porter (2009).

income in Eastern Germany and the UK), which points to high correlation between the variables. On the other hand, a VIF of 10 and higher is usually interpreted as an alarming sign for multicollinearity problems. None of the VIFs shown in Table 3 are as high as 10. Note, however, that a large VIF is neither a necessary nor a sufficient condition for biased standard errors.

The fact that the dominant variable switches in some of my estimations when the underlying income type is exchanged could be interpreted as sensitivity to small changes in the data. Together with the high correlation coefficients, my interpretation of the evidence presented in Table 3 is that income and income rank are in some of my data sets too highly correlated for isolating the individual influence on life satisfaction. In light of my results, I find it hard to generally believe that income rank is a better predictor of life satisfaction than income, which is claimed by Boyce et al. (2010). Comparing the amount of variation in life satisfaction explained by the models with either income or income rank individually, the differences in R^2 shown in Table 3 are minor, if not close to zero. Also, a larger coefficient of income rank does not necessarily mean that the variable is more important.[28] Still, the researcher can decide if one of the variables is more apt for the specific research context. The researcher can also test if one of the variables better fits the data or if one variable is dominant when both are included in the model. In the latter case, the caveats discussed here should be kept in mind.

4.2 Reference income

In this subsection, I conduct extensive sensitivity analyses for different self-constructed reference-income variables: three versions of group-average reference income and reference income predicted with an earnings equation (two-stage estimation). De la Garza et al. (2012) is the only other study I am aware of that compares results of group-average reference income and predicted reference income in the same sample. My robustness checks go much further: I run estimations for the three samples of Western Germany, Eastern Germany, and the UK, and I change the underlying income type for each combination of sample and type of reference income. Using individual labor income practically restricts the sample to working individuals. In order to determine if any difference between results using individual labor income and results using household income is due to the restriction to the working population, I repeat estimations for the household income variables with likewise restricted samples. In all estimations, I control for the log of the respective income variable, for a set of personal characteristics, and for year and region. The models needed for testing income adaptation in Subsection 4.3 are very similar. I use the opportunity and repeat the whole analysis with models that additionally include four income lags.

[28] The income-rank coefficient can be interpreted as an increase in life satisfaction if the individual climbs up from the lowest to the highest position in the income ranking of the reference group. On the other hand, the coefficient of (natural) log income should be interpreted as the change in life satisfaction if income increases by a factor of approximately 2.7 (Euler's number), rather than by the factor 2 as is often incorrectly stated.

This procedure allows me to analyze the sensitivity of results when changing the following parameters: reference group, approach for constructing reference income (group average or prediction), income type, sample, restriction of the sample to working individuals, models with or without income lags. Table 4 only reports coefficients for reference income. The respective results for the models with income lags are shown in Table B.2 of Appendix B. Results for all control variables for rows 2–5 of Table 4 (Table B.2) are shown in Tables B.3–7 (Tables B.8–12) of Appendix B. Full results for rows 6–9 of Table 4 and Table B.2 are not shown, but are available on request from the author. Note again that the size of the coefficients cannot be compared between the German samples and the UK sample. Tables B.8–12 show heteroskedasticity-robust standard errors as well as standard errors clustered at the individual level. Cluster-robust standard errors of the reference-income coefficients are in most cases only slightly larger than heteroskedasticity-robust standard errors. This suggests that serial correlation is not much of an issue in my data. At the same time, not much efficiency is lost when accounting for serial correlation, and I will use cluster-robust standard errors for inference in the remainder of the analysis.

[Table 4 about here]

In the following, I describe my observations when the respective parameter is changed.

Reference group

It might not be surprising that results using group-average reference income can depend on the reference group chosen. However, two issues are noteworthy. The first is that the method of McBride (2001) produces highly significant negative coefficients with unusually large magnitudes when the samples are not restricted to the working population. The results imply that on average a 2.7-fold increase in the average income of one's age cohort has a much more negative impact on life satisfaction than for example becoming unemployed, which seems implausible (see results for all control variables in Tables B.3–7 of Appendix B). Further, we know from direct evidence that the most important reference groups are usually colleagues and friends. Reference groups as defined by Ferrer-i-Carbonell (2005) and Layard et al. (2010) come arguably closer to colleagues and friends than just taking the age cohort as reference group as in McBride (2001). Thus, one would expect the magnitude and size of coefficients for reference income obtained with the method of McBride (2001) to be smaller than the magnitude and size of coefficients obtained with the other two methods. However, the opposite is the case in my estimations. I interpret this as a warning that coefficients with the expected sign and significance cannot be readily taken as a justification for strong assumptions regarding the reference group. This issue even undermines the validity of the group-average approach with rather arbitrarily defined reference groups to a certain extent. The second issue is that the methods of Ferrer-i-Carbonell (2005) and Layard et al. (2010) produce coefficients with the same sign in almost all estimations, but I observe cases where even such similarly defined reference groups lead to different inference (e.g., row 3 of columns 10 and 11 in Table 4).

Approach for constructing reference income

Results between the group-average approach and the two-stage estimation strategy can only be directly compared when the sample is restricted to working individuals (bottom panel of Table 4). Coefficients obtained with group-average reference income have both positive and negative signs, while significant coefficients are only produced with the method of McBride (2001), and these are always negative. In contrast, the two-stage estimation strategy produces positive coefficients throughout. The coefficients are highly significant in the German samples (except for the estimation based on individual income in Western Germany), and mostly significant in the UK sample. This observation of predominantly inconsistent results between the two approaches is similar to the findings of de la Garza et al. (2012) with Japanese data. They compare the performance of self-constructed measures with a benchmark of self-reported reference wages and conclude that the group-average approach performs better than the two-stage estimation strategy, possibly due to invalid exclusion restrictions. In Appendix D, I show for a number of European countries that the two-stage estimation strategy produces results that are inconsistent with direct evidence, provided that one accepts to use data on comparison intensity for predicting the sign of the relative-income effect.

Income type

As Table 4 shows, the underlying income type has a dramatic impact on the magnitude of coefficients in some cases. For example, the coefficient based on equivalized household income of the previous year in column 7, row 1 is reduced by more than half when current equivalized household income is used (column 7, row 2). Although important, such robustness checks are often neglected in studies using survey data that offer several reasonable income variables. I further observe that the choice between the approach of using equivalized household income and the approach of using raw household income with control variables for household size and household composition can also influence inference. The differences are especially pronounced in some of my estimations with models that include income lags (see, e.g., rows 1 and 3 of column 11 in Table B.2 of Appendix B). As argued above, equivalized household income should be preferred, unless there are good reasons for using raw household income. Concerning results based on individual labor income, I do not see that differences compared to results based on household income variables follow a specific pattern. The bottom line is that the choice of the income variable can strongly influence tests of relative-income effects with self-constructed measures.

Sample

Some patterns can be identified when comparing results across samples. In the upper panel of Table 4 with coefficients from unrestricted samples, all coefficients from the Eastern German data are more negative than the respective coefficients from the Western German data. This is contrary to my expectations based on the hypothesis of a stronger information effect in Eastern Germany compared to

Western Germany due to the Eastern German transition period (see Subsection 3.1).[29] However, this uniform pattern disappears once the samples are restricted to working individuals. For example, the coefficients of group-average reference income based on reference groups defined as in Layard et al. (2010) and the coefficients from predicted reference income are all more positive in the Eastern German data compared to the Western German data. While the evidence from unrestricted samples points to a rejection of the hypothesis of a stronger information effect in Eastern Germany compared to Western Germany, the evidence is inconclusive once the samples are restricted to the working population. I infer that the hypothesis should be better tested with other data, such as direct evidence.

Regarding differences between the German samples and the UK sample, the UK results seem to resemble more the Eastern German results than the Western German results. In light of the sensitivity of results to parameter changes, I am reluctant to further interpret differences between the countries.

Restriction of the sample to working individuals

It is striking that most of the negatively significant coefficients for group-average reference income are insignificant (or much less significant) once the samples are restricted to working individuals. A possible interpretation of this phenomenon is that the income level in the samples restricted to working individuals is higher and the relative-income effect seems to affect richer individuals less negatively, as shown with direct evidence in Clark and Senik (2010).[30] If the self-constructed group-average measures were indeed reliable and valid instruments for testing relative-income effects, then my results would suggest that working individuals in Germany and the UK are not affected by comparisons to the average income of a reference group. Otherwise, if the two-stage estimation approach would be a reliable and valid instrument, then my results would suggest that the life satisfaction of working individuals increases with rising reference income in both countries. Both propositions are somewhat daring given that experimental data suggest a *negative* relative-income effect for German subjects (Dohmen et al., 2011), and direct evidence suggests a *negative* relative-income effect for Germany and the UK (Clark and Senik, 2010, see also Table D.1 in Appendix D). From this, together with the fact that some of the above discussed results are inconsistent or implausible, I conclude that results obtained with self-constructed reference income should be interpreted with care. Unless reference income can be exactly determined for a plausible reference group, such as colleagues within the firm of the individual as in Clark et al. (2009b), I would generally prefer results from experiments or direct evidence.

[29] In a personal communication, Ada Ferrer-i-Carbonell suggested the counter-hypothesis that, after the fall of the Berlin wall, Eastern Germans compared themselves with the richer West Germans, which could have made them more vulnerable for negative comparison effects. This hypothesis would fit to the pattern of the coefficients in the unrestricted samples.

[30] The restriction to working individuals should lead on average to a smaller fraction of transfer income within household income so that the fraction of labor income increases. Together with the insight that labor income is much more likely related to the positive information effect than transfer income, this would be another explanation for the more positive coefficients. I thank Heinz Welsch for pointing this out to me.

Models with or without income lags

Results based on models with four income lags are shown in Table B.2 of Appendix B. Note that the period of analysis changes from 1992–2010 to 1996–2010 for the German samples, so that any difference in results compared to Table 4 could also be due to this parameter change rather than only the difference in the underlying equations. For example, it is obvious that the significance level of some coefficients in Table 4 differs strongly from the significance level of the respective coefficients in Table B.2. While the focus here is not on disentangling the effects of changing the model or the period of analysis, the comparison of the two tables illustrates once more the sensitivity of results using self-constructed reference income.

4.3 Income adaptation

Finally, I evaluate the sensitivity of tests for adaptation to income. I use models that include four lags of the (log) income variable, as well as a term for reference income so that the estimations can be used for testing sensitivity of both relative-income effects and adaptation to income (for sensitivity tests on the former, see Subsection 4.2). I have made sure that the conclusions drawn in this subsection are robust to using models without controlling for reference income (results not shown, but available from the author). Full results on the lag coefficients and on hypothesis tests of no adaptation and no full adaptation are reported in Tables B.8–12. Table 5 shows the influence of changing the underlying income type on hypothesis tests of adaptation to income (consolidating Tables B.8–12).

[Table 5 about here]

It is obvious that results regarding adaptation to income after four years strongly depend on the underlying income type. The pattern in Table 5 clearly suggests that the hypothesis of no adaptation to income is more likely rejected if raw household income and control variables for household size and household composition are used, whereas the hypothesis is in most cases not rejected when either equivalized household income or individual income are used. This pattern does not appear across all three samples when the hypothesis of no full adaptation is tested. But it is nonetheless hard to fully deny an influence of the income type chosen on tests of no full adaptation.[31] Following my above argument, I would prefer results based on equivalized household income or individual income over results from raw household income. Thus, I do not find any evidence for adaptation to income after four years in Western Germany, which is in contrast to the results presented in Di Tella et al. (2010), who use a similar data set, but raw household income and a control variable for the number of children.

Note that imperfect multicollinearity could compromise the results of the hypothesis tests for adaptation to income, too. VIFs of the income lags do not exceed the conventional limit of 10, but some of the VIFs

[31] A closer look at Tables B.8–12 reveals that the type of reference income used in the model does not affect tests for income adaptation.

are as high as 9.25. Correlation coefficients between the log of the respective income variable and its four lags reach a maximum of 0.91 with an average of 0.74 in my fifteen data sets. Correlation coefficients between the income lags have a similar magnitude. These rules of thumb point to some degree of imperfect multicollinearity, which potentially affects the standard errors of the income coefficients and the lagged income coefficients. In consequence, the hypothesis tests of the sums of the coefficients could also be biased. In this case, other approaches to measure adaptation to income could be more promising, for example experimental data.

5 Conclusion

A number of recent studies have tested the relative-income hypothesis with self-constructed measures for income rank and reference income. Related studies have tested the hypothesis of adaptation to income with an arbitrary number of income lags. The analysis in this paper has shown that these test results—if based on survey data and strong assumptions—can be highly vulnerable to rather simple parameter changes, such as varying the underlying income variable.

Most of the relevant studies on the relative-income effect mention the difficulty of appropriately defining the reference group. Some studies proceed to define the reference group under strong assumptions, such as simple age cohorts or reference groups based on a few personal characteristics. My finding of sensitive or even implausible results can be interpreted as evidence for assumptions that are too far away from the true cognitive mechanisms of income comparisons. So far, direct evidence from a few countries suggests that colleagues and friends are the most relevant reference groups. Therefore, reference income that comes closest to these groups ought to be the most promising instruments for measuring the size of relative-income effects. This would of course not supersede the other strong assumption that individuals actually know the income of their peers. If it turns out that this assumption is also unrealistic, the researcher should rather rely on experimental data or direct evidence.

I confirm the finding of de la Garza et al. (2012) that reference income predicted with a Mincer-type earnings equation can produce inconsistent results. The researcher should be aware that such a two-stage estimation strategy is comparatively demanding from an econometrics perspective and requires due diligence. This paper also raises the issue that models simultaneously controlling for income and income rank are prone to imperfect multicollinearity with consequences for the precision and robustness of estimates. Regarding adaptation to income, I show that hypothesis tests based on models with lags of equivalized household income can lead to different results than the same hypothesis tests based on models with lags of raw household income and controlling for household size and household composition. Due to my preference for equivalized household income, my results suggest that the hypothesis of no adaptation to income cannot be rejected for Western Germany, which is in contrast to the findings of Di Tella et al. (2010). Given the sensitivity of results together with potential issues of imperfect mul-

ticollinearity, future research should discuss if a rather arbitrary number of income lags is a valid approach for measuring adaptation to income or if other, better performing approaches should be used.

This paper is relevant beyond the field of income comparisons and income adaptation. Survey data often offer more than one income variable and researchers should be aware of how the choice influences results. The analysis underlines the importance of robustness checks and regression diagnostics, two routines that are still not applied diligently in all empirical studies.

Acknowledgments

The data used in this publication were made available by the German Socio-Economic Panel Study (SOEP) at the German Institute for Economic Research (DIW Berlin) in Berlin, the Institute for Social & Economic Research at the University of Essex, and the Norwegian Social Science Data Services. I am grateful for valuable comments and suggestions from Ada Ferrer-i-Carbonell, Johannes Hirata, Jan Goebel, and seminar participants at the University of Münster. I thank Ada Ferrer-i-Carbonell and Claudia Senik for help on replicating some of their earlier results. All remaining errors are mine.

Appendix A

Description of control variables

Household income: Net household income calculated at price levels of 2005 in Euros for Germany, and calculated at price levels of 2010 in GBP for the UK. I use the modified-OECD scale for equivalization (De Vos and Zaidi, 1997). The SOEP variable *i11102* (Cross-National Equivalent File) is used for household income of the previous year, and the variable *hghinc* is used for current household income. The variable *i11102* refers to yearly income, while *hghinc* refers to monthly income. In order to make results comparable on a monthly level, the variable *i11102* is divided by 12. The BHPS variable *hhnyrde2* is equivalized household income of the 12 months interval up to September 1 of the year of the respective wave. The BHPS variable *hhnetde2* is current weekly equivalized household income. In order to make results comparable on a monthly level, the variable *hhnyrde2* is divided by 12, and the variable *hhnetde2* is multiplied by 52 and divided by 12. In order to obtain raw household income, the BHPS variables with equivalized household income are multiplied with the respective value of the equivalence scale.

Individual income: Current monthly gross labor income calculated at price levels of 2005 in Euros for Germany (*pglabgro*), and calculated at price levels of 2010 in GBP for the UK (*fimnl*).

Health satisfaction: Subjective health satisfaction, ranging from 0 *"totally unsatisfied"* to 10 *"totally satisfied"* in the SOEP (*p0080*), and from 1 *"not satisfied at all"* to 7 *"completely satisfied"* in the BHPS (*lfsat1*).

Age squared: The square of the respondent's age in years.

Marital status: The variables *pgfamstd* (SOEP) and *mlstat* (BHPS) are recoded into the categories *"married"*, *"separated/divorced"*, *"single"*, *"widowed"*. In the SOEP samples, married couples living separately appear in the category *"separated/divorced"*.

Number of children in household: Number of household members below the age of 18 at the time of the interview in the SOEP (*d11107*). Number of own children in household in the BHPS (*nchild*).

Number of adults in household: The variable is generated by subtracting the number of children from household size (*d11106* in the SOEP; *hhsize* in the BHPS).

Labor force status: The variables *pglfs* (SOEP) and *jbstat* (BHPS) are recoded into the categories *"working"*, *"non-working"*, and *"unemployed"*.

House owner: Dummy variable indicating whether a person owns a home, generated from the variables *hgowner* (SOEP) and *tenure* (BHPS). The variable serves as a proxy for personal wealth.

Self-administered interview: The dummy variable indicates whether the interview was executed self-administered in contrast to a face-to-face or telephone interview. The dummy is generated from the SOEP variable *hghmode*. Chadi (2012) and Conti and Pudney (2011) show that the interview mode can have a significant influence on the answering behavior for satisfaction questions, which is confirmed by this study. In the BHPS, all respondents answer the life-satisfaction question in a self-completion questionnaire.

Variables used for the earnings equation: The following variables are used for the earnings equation in order to predict reference income. If ambiguous, the first variable in brackets refers to the SOEP and the second variable refers to the BHPS: Female, age, age squared, years of education (*pgbilzt*; not available in the BHPS), industry (*pgnace*; no variable in the BHPS that is consistent over my period of analysis), occupation (*pgstib*; *jbiscon*) employment status (*p0195*; *jbft*), tenure (*pgerwzt*; not available in the BHPS).

Appendix B

Please see Tables B.1–B.12.

Appendix C

Regression diagnostics

I performed a series of diagnostic tests in order to determine compliance with assumptions of OLS regression and hypothesis testing. Concerning unusual observations, I identified "multivariate outliers"

with added-variable plots. In order to exclude that unusual observations influence the results, I re-estimated every model without the 50 most unusually low, and the 50 most unusually high values of the respective reference-income variable given all other independent variables. I found that dropping these unusual observations did not have a sizeable impact on the coefficients for reference income so that none of the conclusions was affected. The normality assumption should not be a problem in such large samples. Residual-versus-fitted plots do not show signs of strong heteroskedasticity, and the cluster-robust standard errors used for inference are also robust to heteroskedasticity. The issue of imperfect multicollinearity is discussed in Subsection 4.1 regarding models with income rank, and in Subsection 4.3 regarding models with lags of the income variables. For reference income and coefficients of other control variables, I again look at variance inflation factors (VIF). VIFs above 10.0 are conventionally considered to be problematic. The largest VIF of the main control variables (except income lags and year and region dummies) is smaller than 7.5. The correlation coefficients between the log of the respective income variable and reference income do not exceed 0.61, and the average in my fifteen data sets is 0.39. My interpretation of the VIFs and the correlation coefficients is that imperfect multicollinearity and the consequence of imprecise estimation should not be major issues regarding the reference-income coefficients (and the other main control variables). Augmented component-plus-residual plots confirm the approximate linear relationship between life satisfaction and each of the independent variables. These plots and theoretical considerations corroborate the model specifications I have chosen.

Appendix D

Comparing results from the two-stage estimation strategy with direct evidence

My aim is to compare results of the sign of the relative-income effect obtained with the two-stage estimation strategy with results from direct evidence. According to Clark and Senik (2010), direct evidence on the intensity of income comparisons provide empirical indications on the sign of the relative-income effect. They use data from Wave 3 of the European Social Survey (ESS, 2006). The relevant question in the ESS is *"How important is it for you to compare your income with other people's incomes?"*, and individuals answered on a scale from 0 (*"not at all important"*) to 6 (*"very important"*). Clark and Senik (2010) show results from a regression of subjective well-being on comparison intensity for the complete data set (their Table 7, columns 1 and 2). I replicate their empirical strategy, but I run separate regressions for each country. The list of countries overlaps with the countries analyzed in Senik (2008). She interprets a positive (negative) coefficient obtained with two-stage estimation as evidence that the information effect dominates (is dominated by) the comparison effect. In the same manner, Clark and Senik (2010) interpret a positive (negative) coefficient from direct evidence on comparison intensity in the ESS as evidence that the comparison effect dominates (is dominated by) the information effect. Table D.1 compares the results.

[Table D.1 about here]

For the overlapping countries, sign and indication of significance match only in 6 out of 15 cases. Note that the pattern in column 1 is robust to using happiness as dependent variable, to using ordered probit, and to variations with control variables, such as replacing occupation with activity status, which removes the restriction to working individuals (results are not shown, but are available from the author). While the direct evidence in the ESS points to a significantly *negative* relative-income effect in the majority of European countries (column 1), the evidence in Senik (2008) suggests a *positive* effect for most of the countries (column 2). This inconsistency can be interpreted in two ways. The first interpretation, assuming that direct evidence is the more reliable data source, is that the evidence adds to the conjecture that the two-stage estimation strategy produces unreliable results (see Subsection 4.2). The alternative interpretation is—if one trusts that the estimates in Senik (2008) are valid and representative for the countries—that the coefficients from column 1 and column 2 cannot be compared, which would imply that it is invalid to use questions of comparison intensity for drawing conclusions on the sign of the relative-income effect.

Tables

Table 1: Methodologies for the empirical analysis of the relative-income hypothesis (with selected studies for each branch)

Self-constructed measures					Direct evidence from surveys				Experiments	
Group-average reference income		Predicted reference income from earnings equation	Income rank within reference group		Self-reported reference income	Perceived relative-income position	Reference group	Comparison intensity	Brain images	Other (lab) experiments
Within-sample data	Out-of-sample data	Within-sample data	Within-sample data	Out-of-sample data						
Ferrer-i-Carbonell (2005) Brown et al. Clark et al. (2010) Layard et al. FitzRoy et al. (2011) Akay et al. (2012) de la Garza et al. (2012) Paul and Guilbert (2013) Clark et al. (2013)	McBride (2001) Luttmer (2005) Clark et al. (2009a) Clark et al. (2009b) de la Garza et al. (2012) Clark et al. (2013)	Clark and Oswald (1996) Sloane and Williams (2000) Senik (2004) Senik (2008) de la Garza et al. (2012)	Brown et al. (2008) Boes et al. (2010) Boyce et al. (2010) Clark et al. (2010) Budria and Ferrer-i-Carbonell (2012) Clark and Senik (2012)	Clark et al. (2009a)	de la Garza et al. (2012) Clark et al. (2013)	Knight et al. (2009) Senik (2009) Goerke and Pannenberg (2013)	Knight et al. (2009) Clark and Senik (2010) Clark et al. (2013) Yamamoto and Sato (2013)	Clark and Senik (2010) Yamamoto and Sato (2013) Goerke and Pannenberg (2013) Clark et al. (2013)	Fliessbach et al. (2007) Dohmen et al. (2011)	Brown et al. Clark et al. (2010) McBride (2010) Card et al. (2012) Mujcic and Frijters (2013) Yamamoto and Sato (2013)

Table 2: Descriptive statistics for key variables in samples where group-average reference income is based on previous year's equivalized household income

Variable	Approach used for constructing reference income	Reference income constructed similar to …	Income type used for construction of reference income	Obser-vations	Mean	Standard deviation	Min.	Max.	Min. observations per reference	Max. observations per reference
Western Germany, 1992–2010										
Household income	—	—	—	253,514	1,815	1,695	404	237,916	—	—
Individual income	—	—	—	148,472	2,560	2,169	165	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	253,501	1,708	181	1,070	2,082	10	4,527
		Ferrer-i-Carbonell		243,437	1,675	382	1,111	2,547	2,031	32,895
		Layard et al. (2010)		253,047	1,720	412	800	3,946	10	930
Reference income	Two-stage estimation	Senik (2008)	Individual income	138,174	2,402	1,381	102	12,916	—	—
Eastern Germany, 1992–2010										
Household income	—	—	—	85,552	1,430	756	404	31,524	—	—
Individual income	—	—	—	47,371	1,924	1,457	150	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	85,535	1,356	123	784	1,646	10	1,340
		Ferrer-i-Carbonell		82,914	1,362	230	891	1,823	224	10,007
		Layard et al. (2010)		84,406	1,371	255	706	2,279	10	401
Reference income	Two-stage estimation	Senik (2008)	Individual income	44,446	1,818	876	110	16,570	—	—
United Kingdom, 1996–2008										
Household income	—	—	—	127,213	1,369	853	147	44,149	—	—
Individual income	—	—	—	78,336	1,792	1,611	10	93,627	—	—
Reference income	Group averages	McBride (2001)	Household income	127,207	1,372	167	790	1,630	11	2,968
		Ferrer-i-Carbonell		125,224	1,370	325	557	2,865	11	6,528
		Layard et al. (2010)		124,290	1,374	330	573	3,587	10	466
Reference income	Two-stage estimation	Senik (2008)	Individual income	68,696	1,672	885	17	40,515	—	—

Notes: Previous year's monthly household income is net and equivalized. Current monthly individual labor income is gross. All income variables are in real terms (price levels of 2005 in Euro for the German samples and price levels of 2010 in GBP for the UK sample). Data are from SOEP (2011) and BHPS (2012).

Table 3: Fixed-effects OLS regressions of life satisfaction on income and income rank

	Western Germany, 1992–2010			Eastern Germany, 1992–2010			United Kingdom, 1996–2008		
Income type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Equivalized household income, previous year									
ln(Income)	0.225***		0.203***	0.300***		0.195***	0.038***		0.012
	(0.013)		(0.027)	(0.026)		(0.055)	(0.010)		(0.021)
Income rank		0.297***	0.037		0.375***	0.159**		0.071***	0.054
		(0.020)	(0.040)		(0.034)	(0.071)		(0.017)	(0.035)
Correlation coefficient			0.842			0.861			0.856
VIF ln(Income)	1.312		4.059	1.291		4.524	1.372		4.642
VIF Income rank		1.201	3.709		1.170	4.077		1.204	4.074
R^2	0.126	0.127	0.127	0.101	0.102	0.102	0.110	0.110	0.110
Observations	246,394	237,004	237,004	83,664	81,140	81,140	122,611	120,783	120,783
Equivalized household income, current year									
ln(Income)	0.289***		0.259***	0.501***		0.455***	0.057***		0.012
	(0.014)		(0.032)	(0.026)		(0.062)	(0.010)		(0.021)
Income rank		0.381***	0.054		0.591***	0.083		0.104***	0.087**
		(0.020)	(0.045)		(0.033)	(0.078)		(0.016)	(0.035)
Correlation coefficient			0.850			0.879			0.853
VIF ln(Income)	1.278		4.255	1.266		5.032	1.413		4.903
VIF Income rank		1.179	3.917		1.173	4.633		1.209	4.194
R^2	0.127	0.127	0.128	0.106	0.106	0.107	0.109	0.109	0.109
Observations	232,221	223,482	223,482	80,456	78,067	78,067	122,044	120,218	120,218
Raw household income, previous year									
ln(Income)	0.232***		0.193***	0.300***		0.219***	0.040***		0.041**
	(0.013)		(0.023)	(0.026)		(0.046)	(0.010)		(0.019)
Income rank		0.338***	0.080**		0.430***	0.165**		0.068***	0.002
		(0.022)	(0.038)		(0.039)	(0.068)		(0.018)	(0.035)
Correlation coefficient			0.855			0.853			0.838
VIF ln(Income)	1.732		4.973	2.047		5.664	1.812		5.811
VIF Income rank		1.525	4.382		1.620	4.458		1.443	4.626
R^2	0.127	0.127	0.127	0.101	0.102	0.102	0.110	0.110	0.110
Observations	246,376	236,953	236,953	83,586	81,057	81,057	122,582	120,752	120,752
Raw household income, current year									
ln(Income)	0.299***		0.276***	0.489***		0.386***	0.058***		0.026
	(0.014)		(0.028)	(0.026)		(0.054)	(0.009)		(0.019)
Income rank		0.412***	0.049		0.668***	0.192**		0.113***	0.070*
		(0.021)	(0.042)		(0.037)	(0.076)		(0.018)	(0.036)
Correlation coefficient			0.866			0.875			0.830
VIF ln(Income)	1.579		5.094	1.739		5.926	1.914		6.323
VIF Income rank		1.411	4.551		1.473	4.974		1.460	4.823
R^2	0.127	0.127	0.128	0.106	0.106	0.107	0.109	0.109	0.109
Observations	232,138	223,383	223,383	80,364	77,958	77,958	122,019	120,195	120,195
Individual labor income									
ln(Income)	0.136***		0.081***	0.255***		0.226***	0.008**		0.001
	(0.011)		(0.018)	(0.021)		(0.034)	(0.004)		(0.004)
Income rank		0.326***	0.172***		0.443***	0.079		0.093***	0.104***
		(0.028)	(0.042)		(0.045)	(0.072)		(0.025)	(0.029)
Correlation coefficient			0.825			0.768			0.517
VIF ln(Income)	1.054		3.480	1.125		3.013	1.029		1.446
VIF Income rank		1.018	3.382		1.021	2.763		1.043	1.472
R^2	0.106	0.106	0.106	0.082	0.081	0.082	0.097	0.097	0.097
Observations	144,170	140,493	140,493	45,961	45,176	45,176	71,919	71,589	70,793

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. When equivalized household income or individual income are used, further control variables are health satisfaction, age squared, marital status, number of children, labor force status, house owner, self-administered interview (only for German data), year dummies, and region dummies. When raw household income is used, the model also includes the number of adults in the household. VIF is variance inflaction factor. Income rank refers to reference groups defined as in Ferrer-i-Carbonell (2005). The samples are restricted to working individuals when individual income is used. Data are from SOEP (2011) and BHPS (2012).

Table 4: Comparison of reference-income coefficients across samples, across income types, and between unrestricted samples and samples restricted to working individuals

	Western Germany, 1992–2010				Eastern Germany, 1992–2010				United Kingdom, 1996–2008			
	Group averages			Two-stage estimation	Group averages			Two-stage estimation	Group averages			Two-stage estimation
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)
Income type used for group averages	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Coefficients for ln(Reference income) from unrestricted samples												
Equivalized household income, previous year	-0.747***	-0.046	-0.007		-1.535***	-0.371***	-0.490***		-1.005***	-0.089*	-0.173***	
	(0.128)	(0.054)	(0.048)		(0.160)	(0.129)	(0.089)		(0.118)	(0.048)	(0.045)	
Equivalized household income, current year	-1.142***	-0.035	0.012		-1.494***	-0.423***	-0.218**		-1.097***	-0.105**	-0.178***	
	(0.164)	(0.066)	(0.052)		(0.197)	(0.159)	(0.091)		(0.123)	(0.048)	(0.043)	
Raw household income, previous year	-0.303***	-0.028	-0.060		-1.085***	-0.158**	-0.471***		-0.892***	-0.064	-0.225***	
	(0.074)	(0.036)	(0.043)		(0.121)	(0.076)	(0.074)		(0.092)	(0.040)	(0.045)	
Raw household income, current year	-0.422***	-0.035	-0.068		-1.239***	-0.264***	-0.343***		-0.789***	-0.064*	-0.217***	
	(0.088)	(0.044)	(0.048)		(0.146)	(0.101)	(0.080)		(0.085)	(0.037)	(0.043)	
Coefficients for ln(Reference income) from samples restricted to working individuals												
Individual labor income	-0.137	-0.010	-0.032	0.042**	-0.140	0.098	0.039	0.132***	-0.005	-0.003	0.009	0.033**
	(0.111)	(0.038)	(0.039)	[0.016]	(0.180)	(0.072)	(0.069)	[0.034]	(0.047)	(0.014)	(0.019)	[0.014]
Equivalized household income, previous year	-0.464**	0.012	0.018	0.102***	-0.516**	-0.063	0.071	0.238***	-0.069	0.085	0.011	0.030**
	(0.181)	(0.072)	(0.061)	[0.013]	(0.246)	(0.182)	(0.115)	[0.027]	(0.172)	(0.057)	(0.055)	[0.013]
Equivalized household income, current year	-0.400*	0.028	0.084	0.092***	-0.381	-0.123	0.160	0.200***	-0.128	0.067	0.035	0.024*
	(0.236)	(0.081)	(0.067)	[0.014]	(0.315)	(0.214)	(0.121)	[0.028]	(0.182)	(0.061)	(0.054)	[0.014]
Raw household income, previous year	-0.114	0.039	-0.020	0.103***	-0.373**	-0.027	0.008	0.240***	-0.240*	0.014	-0.030	0.028**
	(0.095)	(0.057)	(0.055)	[0.013]	(0.167)	(0.116)	(0.097)	[0.028]	(0.127)	(0.059)	(0.056)	[0.013]
Raw household income, current year	-0.065	0.031	0.005	0.093***	-0.553***	-0.121	0.052	0.213***	-0.223*	-0.012	-0.007	0.022
	(0.113)	(0.066)	(0.061)	[0.014]	(0.203)	(0.140)	(0.105)	[0.027]	(0.114)	(0.056)	(0.053)	[0.014]

Notes: The table shows coefficients of fixed-effects OLS regressions of life satisfaction on reference income. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. Bootstrapped cluster-robust standard errors are shown in brackets (1000 replications). When equivalized household income or individual income are used, further control variables are ln(income), health satisfaction, age squared, marital status, number of children, labor force status, house owner, self-administered interview (only for German data), year dummies, and region dummies. When raw household income is used, the model also includes the number of adults in the household. Predicted reference income used for the estimations in columns 4, 8, and 12 is always based on individual labor income. Data are from SOEP (2011) and BHPS (2012).

Table 5: Sensitivity of income-adaptation tests with respect to the underlying income type

Underlying income type	Western Germany, 1996–2010	Eastern Germany, 1996–2010	United Kingdom, 1996–2008
Hypothesis of no adaptation (Σ Income lags not significant) rejected			
Equivalized household income, previous year	No	Yes	No
Equivalized household income, current year	No	No	No
Raw household income, previous year	Yes	Yes	Yes
Raw household income, current year	Yes	Yes	Yes
Individual labor income	No	No	No
Hypothesis of no full adaptation (Σ Current and lagged income positive and significant) rejected			
Equivalized household income, previous year	No	No	No
Equivalized household income, current year	No	No	No
Raw household income, previous year	No	Yes	Yes
Raw household income, current year	No	No	Yes
Individual labor income	No	No	Yes

Notes: Detailed results are shown in Tables B.8–12. The threshold for rejection is the 10 percent level.

Table B.1a: Descriptive statistics for key variables in samples where group-average reference income is based on current equivalized household income

Variable	Approach used for constructing reference income	Reference income constructed similar to …	Income type used for construction of reference income	Obser-vations	Mean	Standard deviation	Min.	Max.	Min. observations per reference	Max. observations per reference
Western Germany, 1992–2010										
Household income	—	—	—	239,087	1,592	1,074	395	68,799	—	—
Individual income	—	—	—	140,127	2,554	2,160	165	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	239,074	1,501	120	1,079	1,775	10	4,210
		Ferrer-i-Carbonell		229,731	1,486	316	1,070	2,199	1,923	30,985
		Layard et al. (2010)		238,615	1,512	335	806	3,041	10	859
Reference income	Two-stage estimation	Senik (2008)	Individual income	130,676	2,404	1,389	115	12,892	—	—
Eastern Germany, 1992–2010										
Household income	—	—	—	82,298	1,252	577	395	13,939	—	—
Individual income	—	—	—	45,446	1,927	1,456	150	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	82,280	1,196	77	859	1,377	10	1,253
		Ferrer-i-Carbonell		79,807	1,204	174	750	1,528	218	9,653
		Layard et al. (2010)		81,086	1,208	198	595	2,642	10	371
Reference income	Two-stage estimation	Senik (2008)	Individual income	42,694	1,825	876	122	19,256	—	—
United Kingdom, 1996–2008										
Household income	—	—	—	126,691	1,377	868	202	30,851	—	—
Individual income	—	—	—	78,381	1,794	1,610	16	93,627	—	—
Reference income	Group averages	McBride (2001)	Household income	126,685	1,380	182	760	1,644	10	2,942
		Ferrer-i-Carbonell		124,705	1,378	342	508	2,743	11	6,501
		Layard et al. (2010)		123,763	1,382	346	564	3,481	10	460
Reference income	Two-stage estimation	Senik (2008)	Individual income	68,633	1,676	885	17	40,515	—	—

Notes: Current monthly household income is net and equivalized. Current monthly individual labor income is gross. All income variables are in real terms (price levels of 2005 in Euro for the German samples and price levels of 2010 in GBP for the UK sample). Data are from SOEP (2011) and BHPS (2012).

Table B.1b: Descriptive statistics for key variables in samples where group-average reference income is based on previous year's raw household income

Variable	Approach used for constructing reference income	Reference income constructed similar to …	Income type used for construction of reference income	Obser-vations	Mean	Standard deviation	Min.	Max.	Min. observations per reference	Max. observations per reference
Western Germany, 1992–2010										
Household income	–	–	–	253,521	3,265	2,826	509	356,874	–	–
Individual income	–	–	–	148,432	2,561	2,169	165	105,819	–	–
Reference income	Group averages	McBride (2001)	Household income	253,508	2,918	455	1,259	3,672	10	4,528
		Ferrer-i-Carbonell		243,410	2,886	680	1,551	4,299	2,014	32,924
		Layard et al. (2010)		253,053	2,944	721	897	6,794	10	932
Reference income	Two-stage estimation	Senik (2008)	Individual income	138,140	2,403	1,381	99	12,903	–	–
Eastern Germany, 1992–2010										
Household income	–	–	–	85,481	2,573	1,521	509	55,548	–	–
Individual income	–	–	–	47,330	1,925	1,457	150	105,819	–	–
Reference income	Group averages	McBride (2001)	Household income	85,464	2,321	378	1,077	2,929	10	1,341
		Ferrer-i-Carbonell		82,840	2,324	506	1,391	3,230	226	9,994
		Layard et al. (2010)		84,327	2,355	554	950	4,141	10	401
Reference income	Two-stage estimation	Senik (2008)	Individual income	44,414	1,819	876	110	16,589	–	–
United Kingdom, 1996–2008										
Household income	–	–	–	127,212	2,399	1,587	208	73,025	–	–
Individual income	–	–	–	78,348	1,792	1,611	10	93,627	–	–
Reference income	Group averages	McBride (2001)	Household income	127,206	2,400	479	922	3,010	11	2,968
		Ferrer-i-Carbonell		125,223	2,398	630	703	4,248	11	6,523
		Layard et al. (2010)		124,292	2,410	651	712	5,273	10	465
Reference income	Two-stage estimation	Senik (2008)	Individual income	68,697	1,672	886	17	40,515	–	–

Notes: Household income of the previous year is net. Current individual labor income is gross. All income variables are in real terms (price levels of 2005 in Euro for the German samples and price levels of 2010 in GBP for the UK sample). Data are from SOEP (2011) and BHPS (2012).

Table B.1c: Descriptive statistics for key variables in samples where group-average reference income is based on current raw household income

Variable	Approach used for constructing reference income	Reference income constructed similar to …	Income type used for construction of reference income	Obser-vations	Mean	Standard deviation	Min.	Max.	Min. observations per reference	Max. observations per reference
Western Germany, 1992–2010										
Household income	—	—	—	239,022	2,831	1,870	551	103,198	—	—
Individual income	—	—	—	140,161	2,554	2,159	165	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	239,009	2,532	326	1,215	3,114	10	4,222
		Ferrer-i-Carbonell		229,643	2,533	543	1,501	3,697	1,918	30,972
		Layard et al. (2010)		238,552	2,556	569	951	4,682	10	861
Reference income	Two-stage estimation	Senik (2008)	Individual income	130,725	2,404	1,388	101	12,905	—	—
Eastern Germany, 1992–2010										
Household income	—	—	—	82,220	2,225	1,150	551	18,762	—	—
Individual income	—	—	—	45,519	1,927	1,456	151	105,819	—	—
Reference income	Group averages	McBride (2001)	Household income	82,202	2,021	255	1,055	2,454	10	1,255
		Ferrer-i-Carbonell		79,718	2,028	370	1,373	2,772	216	9,647
		Layard et al. (2010)		81,011	2,048	410	985	3,915	10	373
Reference income	Two-stage estimation	Senik (2008)	Individual income	42,765	1,824	876	122	19,312	—	—
United Kingdom, 1996–2008										
Household income	—	—	—	126,665	2,433	1,657	276	55,748	—	—
Individual income	—	—	—	78,415	1,793	1,609	16	93,627	—	—
Reference income	Group averages	McBride (2001)	Household income	126,659	2,434	529	870	3,068	10	2,946
		Ferrer-i-Carbonell		124,680	2,432	678	644	4,095	11	6,490
		Layard et al. (2010)		123,725	2,444	698	681	5,406	10	461
Reference income	Two-stage estimation	Senik (2008)	Individual income	68,684	1,675	885	17	40,515	—	—

Notes: Current monthly household income is net. Current monthly individual labor income is gross. All income variables are in real terms (price levels of 2005 in Euro for the German samples and price levels of 2010 in GBP for the UK sample). Data are from SOEP (2011) and BHPS (2012).

Table B.1d: Descriptive statistics for key variables where group-average reference income is based on individual labor income

Variable	Approach used for constructing reference income	Reference income constructed similar to …	Income type used for construction of reference income	Obser-vations	Mean	Standard deviation	Min.	Max.	Min. observations per reference	Max. observations per reference
Western Germany, 1992–2010										
Individual income	—	—	—	148,182	2,568	2,166	214	105,819	—	—
Reference income	Group averages	McBride (2001)	Individual income	149,796	2,474	446	818	3,488	10	3,587
		Ferrer-i-Carbonell		145,765	2,493	811	926	4,161	137	19,907
		Layard et al. (2010)		149,314	2,497	1,079	339	10,960	10	689
Reference income	Two-stage estimation	Senik (2008)	Individual income	137,577	2,411	1,373	152	12,849	—	—
Eastern Germany, 1992–2010										
Individual income	—	—	—	47,166	1,934	1,454	189	105,819	—	—
Reference income	Group averages	McBride (2001)	Individual income	47,612	1,852	336	529	3,087	10	1,103
		Ferrer-i-Carbonell		46,761	1,875	505	628	2,624	18	7,579
		Layard et al. (2010)		46,538	1,877	599	383	3,951	10	353
Reference income	Two-stage estimation	Senik (2008)	Individual income	44,147	1,829	864	149	16,538	—	—
United Kingdom, 1996–2008										
Individual income	—	—	—	74,342	1,855	1,621	3	93,627	—	—
Reference income	Group averages	McBride (2001)	Individual income	75,962	1,401	359	0	1,826	214	2,991
		Ferrer-i-Carbonell		74,725	1,431	627	1	3,248	11	6,554
		Layard et al. (2010)		74,882	1,505	788	0	5,862	10	470
Reference income	Two-stage estimation	Senik (2008)	Individual income	68,942	1,666	886	12	40,515	—	—

Notes: Current monthly individual labor income is gross. All income variables are in real terms (price levels of 2005 in Euro for the German samples and price levels of 2010 in GBP for the UK sample). Data are from SOEP (2011) and BHPS (2012).

Table B.2: Comparison of reference-income coefficients across samples, across income types, and between unrestricted samples and samples restricted to working individuals (all models with income lags)

	Western Germany, 1996–2010				Eastern Germany, 1996–2010				United Kingdom, 1996–2008			
	Group averages			Two-stage estimation	Group averages			Two-stage estimation	Group averages			Two-stage estimation
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)
Income type used for group averages	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Coefficients for ln(Reference income) from unrestricted samples												
Equivalized household income, previous year	-1.146***	-0.172**	-0.104		-1.624***	-0.521***	-0.471***		-0.876***	-0.101	-0.085	
	(0.190)	(0.073)	(0.067)		(0.232)	(0.165)	(0.123)		(0.157)	(0.067)	(0.060)	
Equivalized household income, current year	-1.453***	-0.201**	-0.088		-1.427***	-0.537**	-0.229*		-0.946***	-0.083	-0.122**	
	(0.243)	(0.091)	(0.077)		(0.280)	(0.219)	(0.128)		(0.154)	(0.065)	(0.058)	
Raw household income, previous year	-0.482***	-0.056	-0.120*		-1.219***	-0.220**	-0.524***		-0.919***	-0.048	-0.180***	
	(0.129)	(0.050)	(0.066)		(0.177)	(0.096)	(0.106)		(0.118)	(0.050)	(0.059)	
Raw household income, current year	-0.559***	-0.069	-0.145*		-1.296***	-0.355***	-0.328***		-0.805***	-0.027	-0.184***	
	(0.155)	(0.064)	(0.076)		(0.223)	(0.132)	(0.116)		(0.108)	(0.046)	(0.056)	
Coefficients for ln(Reference income) from samples restricted to working individuals												
Individual labor income	-0.004	-0.126	-0.110	0.058*	0.544	0.237	0.196	0.234***	0.119*	0.014	0.045*	0.014
	(0.217)	(0.079)	(0.074)	[0.032]	(0.422)	(0.169)	(0.149)	[0.065]	(0.065)	(0.020)	(0.027)	[0.019]
Equivalized household income, previous year	-0.395	-0.059	-0.070	0.105***	-0.579*	-0.372	-0.022	0.284***	-0.023	0.048	0.043	0.021
	(0.267)	(0.101)	(0.089)	[0.021]	(0.339)	(0.238)	(0.152)	[0.040]	(0.230)	(0.082)	(0.075)	[0.017]
Equivalized household income, current year	-0.425	-0.144	-0.101	0.106***	-0.708*	-0.582**	0.002	0.265***	-0.086	0.076	0.048	0.013
	(0.353)	(0.118)	(0.100)	[0.023]	(0.427)	(0.288)	(0.169)	[0.040]	(0.235)	(0.086)	(0.073)	[0.018]
Raw household income, previous year	0.197	0.141*	0.021	0.111***	-0.481*	-0.059	-0.032	0.285***	-0.359**	0.033	-0.025	0.019
	(0.169)	(0.085)	(0.086)	[0.022]	(0.259)	(0.160)	(0.135)	[0.039]	(0.174)	(0.079)	(0.075)	[0.016]
Raw household income, current year	0.400*	0.077	-0.041	0.109***	-0.786**	-0.137	0.025	0.279***	-0.308**	0.058	-0.011	0.015
	(0.214)	(0.098)	(0.099)	[0.022]	(0.337)	(0.195)	(0.154)	[0.041]	(0.155)	(0.075)	(0.070)	[0.017]

Notes: The table shows coefficients of fixed-effects OLS regressions of life satisfaction on reference income. In contrast to Table 4, all models include four lags of ln(income). The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. Bootstrapped cluster-robust standard errors are shown in brackets (1000 replications). Predicted reference income used for the estimations in columns 4, 8, and 12 is always based on individual labor income. See the notes of Table 4 for details on further control variables and data sources.

Table B.3: Fixed-effects OLS regressions of life satisfaction on previous year's monthly equivalized household income and reference income

	Western Germany, 1992–2010			Eastern Germany, 1992–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.230***	0.225***	0.225***	0.332***	0.312***	0.313***	0.045***	0.040***	0.041***
	(0.013)	(0.014)	(0.013)	(0.026)	(0.027)	(0.026)	(0.010)	(0.010)	(0.010)
ln(Reference income)	-0.747***	-0.046	-0.007	-1.535***	-0.371***	-0.490***	-1.005***	-0.089*	-0.173***
	(0.128)	(0.054)	(0.048)	(0.160)	(0.129)	(0.089)	(0.118)	(0.048)	(0.045)
Age squared/1000	-0.224***	-0.123***	-0.074**	-0.229***	-0.194***	-0.149**	-0.176***	-0.042	-0.022
	(0.044)	(0.038)	(0.036)	(0.061)	(0.066)	(0.062)	(0.038)	(0.035)	(0.034)
Marital status (Base category: Married)									
Separated/divorced	-0.197***	-0.213***	-0.199***	-0.047	-0.073	-0.058	-0.096***	-0.092***	-0.097***
	(0.029)	(0.029)	(0.028)	(0.052)	(0.053)	(0.053)	(0.025)	(0.025)	(0.025)
Single	-0.125***	-0.126***	-0.129***	-0.037	-0.006	-0.020	-0.068***	-0.051**	-0.054***
	(0.024)	(0.024)	(0.024)	(0.046)	(0.047)	(0.046)	(0.020)	(0.020)	(0.020)
Widowed	-0.380***	-0.373***	-0.386***	-0.071	-0.085	-0.112	-0.278***	-0.292***	-0.295***
	(0.050)	(0.050)	(0.050)	(0.073)	(0.074)	(0.075)	(0.044)	(0.044)	(0.045)
Number of children in household	0.014**	0.015**	0.018**	0.064***	0.074***	0.072***	-0.007	-0.009	-0.006
	(0.007)	(0.007)	(0.007)	(0.014)	(0.014)	(0.014)	(0.008)	(0.008)	(0.008)
Health satisfaction	0.254***	0.254***	0.254***	0.230***	0.232***	0.231***	0.261***	0.262***	0.262***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Labor force status (Base category: Working									
Non-working	-0.066***	-0.062***	-0.059***	-0.146***	-0.105***	-0.118***	-0.016	-0.000	-0.008
	(0.012)	(0.013)	(0.012)	(0.023)	(0.024)	(0.023)	(0.013)	(0.013)	(0.013)
Unemployed	-0.591***	-0.594***	-0.591***	-0.635***	-0.627***	-0.632***	-0.273***	-0.271***	-0.274***
	(0.023)	(0.024)	(0.023)	(0.026)	(0.026)	(0.026)	(0.024)	(0.025)	(0.025)
House owner	0.049***	0.045***	0.044***	0.047*	0.040	0.034	0.006	0.009	0.008
	(0.015)	(0.015)	(0.015)	(0.027)	(0.027)	(0.027)	(0.017)	(0.017)	(0.017)
Self-administered interview	-0.168***	-0.165***	-0.168***	-0.057***	-0.056***	-0.057***			
	(0.012)	(0.012)	(0.012)	(0.018)	(0.018)	(0.018)			
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.127	0.127	0.126	0.103	0.102	0.101	0.110	0.110	0.109
Individuals	29,101	27,878	29,048	9,049	8,712	8,959	17,833	17,521	17,467
Observations	246,380	237,004	245,939	83,649	81,140	82,564	122,604	120,709	119,777

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with previous year's monthly net household income equivalized according to the modified-OECD scale. See the notes of Tables 4 for details on data sources.

Table B.4: Fixed-effects OLS regressions of life satisfaction on current monthly equivalized household income and reference income

	Western Germany, 1992–2010			Eastern Germany, 1992–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.292***	0.293***	0.289***	0.518***	0.518***	0.503***	0.061***	0.057***	0.059***
	(0.014)	(0.015)	(0.014)	(0.026)	(0.027)	(0.027)	(0.010)	(0.010)	(0.010)
ln(Reference income)	-1.142***	-0.035	0.012	-1.494***	-0.423***	-0.218**	-1.097***	-0.105**	-0.178***
	(0.164)	(0.066)	(0.052)	(0.197)	(0.159)	(0.091)	(0.123)	(0.048)	(0.043)
Age squared/1000	-0.257***	-0.128***	-0.087**	-0.168***	-0.161**	-0.101	-0.198***	-0.046	-0.023
	(0.044)	(0.038)	(0.036)	(0.061)	(0.064)	(0.062)	(0.039)	(0.035)	(0.035)
Marital status (Base category: Married)									
Separated/divorced	-0.198***	-0.215***	-0.198***	-0.037	-0.056	-0.043	-0.096***	-0.092***	-0.097***
	(0.029)	(0.030)	(0.029)	(0.053)	(0.053)	(0.053)	(0.025)	(0.025)	(0.025)
Single	-0.134***	-0.126***	-0.126***	-0.031	-0.001	-0.010	-0.068***	-0.051**	-0.054***
	(0.024)	(0.025)	(0.024)	(0.046)	(0.047)	(0.047)	(0.020)	(0.020)	(0.020)
Widowed	-0.414***	-0.416***	-0.425***	-0.126*	-0.139*	-0.166**	-0.273***	-0.289***	-0.292***
	(0.050)	(0.051)	(0.051)	(0.074)	(0.076)	(0.076)	(0.044)	(0.044)	(0.045)
Number of children in household	0.017**	0.015**	0.018**	0.083***	0.081***	0.083***	-0.008	-0.007	-0.005
	(0.007)	(0.008)	(0.007)	(0.014)	(0.015)	(0.014)	(0.008)	(0.008)	(0.008)
Health satisfaction	0.253***	0.254***	0.253***	0.231***	0.232***	0.230***	0.260***	0.261***	0.261***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Labor force status (Base category: Working									
Non-working	-0.047***	-0.040***	-0.037***	-0.099***	-0.069***	-0.077***	-0.007	0.010	0.002
	(0.012)	(0.013)	(0.012)	(0.023)	(0.024)	(0.023)	(0.013)	(0.014)	(0.014)
Unemployed	-0.542***	-0.544***	-0.542***	-0.568***	-0.560***	-0.563***	-0.251***	-0.249***	-0.252***
	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)
House owner	0.046***	0.047***	0.046***	0.039	0.041	0.036	0.008	0.011	0.010
	(0.015)	(0.015)	(0.015)	(0.027)	(0.028)	(0.027)	(0.017)	(0.017)	(0.017)
Self-administered interview	-0.161***	-0.159***	-0.161***	-0.048***	-0.049***	-0.052***			
	(0.012)	(0.012)	(0.012)	(0.018)	(0.018)	(0.018)			
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.127	0.128	0.127	0.107	0.107	0.105	0.110	0.109	0.109
Individuals	27,887	26,724	27,832	8,834	8,511	8,746	17,849	17,537	17,476
Observations	232,207	223,482	231,754	80,439	78,067	79,296	122,037	120,146	119,199

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with current monthly net household income equivalized according to the modified-OECD scale. See the notes of Tables 4 for details on data sources.

Table B.5: Fixed-effects OLS regressions of life satisfaction on previous year's monthly raw household income and reference income

	Western Germany, 1992–2010			Eastern Germany, 1992–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.236***	0.233***	0.233***	0.320***	0.312***	0.311***	0.043***	0.042***	0.043***
	(0.013)	(0.013)	(0.013)	(0.026)	(0.027)	(0.026)	(0.010)	(0.010)	(0.010)
ln(Reference income)	-0.303***	-0.028	-0.060	-1.085***	-0.158**	-0.471***	-0.892***	-0.064	-0.225***
	(0.074)	(0.036)	(0.043)	(0.121)	(0.076)	(0.074)	(0.092)	(0.040)	(0.045)
Age squared/1000	-0.151***	-0.113***	-0.081**	-0.219***	-0.160**	-0.147**	-0.234***	-0.035	-0.049
	(0.040)	(0.037)	(0.036)	(0.061)	(0.065)	(0.062)	(0.040)	(0.035)	(0.036)
Marital status (Base category: Married)									
Separated/divorced	-0.181***	-0.203***	-0.188***	-0.024	-0.072	-0.047	-0.095***	-0.102***	-0.104***
	(0.029)	(0.029)	(0.029)	(0.052)	(0.053)	(0.053)	(0.025)	(0.025)	(0.025)
Single	-0.119***	-0.124***	-0.127***	-0.033	-0.008	-0.024	-0.056***	-0.050**	-0.052***
	(0.024)	(0.025)	(0.024)	(0.046)	(0.046)	(0.046)	(0.020)	(0.020)	(0.020)
Widowed	-0.337***	-0.338***	-0.349***	-0.054	-0.094	-0.109	-0.272***	-0.298***	-0.298***
	(0.050)	(0.051)	(0.051)	(0.074)	(0.075)	(0.076)	(0.044)	(0.044)	(0.045)
Number of children in household	-0.023***	-0.027***	-0.024***	0.011	0.007	0.010	-0.017**	-0.021***	-0.018**
	(0.008)	(0.008)	(0.008)	(0.015)	(0.016)	(0.015)	(0.008)	(0.008)	(0.008)
Number of adults in household	-0.059***	-0.066***	-0.064***	-0.095***	-0.116***	-0.106***	-0.015**	-0.026***	-0.024***
	(0.008)	(0.008)	(0.008)	(0.015)	(0.015)	(0.015)	(0.007)	(0.007)	(0.007)
Health satisfaction	0.254***	0.254***	0.254***	0.230***	0.232***	0.230***	0.261***	0.262***	0.262***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Labor force status (Base category: Working									
Non-working	-0.063***	-0.061***	-0.059***	-0.136***	-0.100***	-0.116***	-0.017	0.001	-0.007
	(0.012)	(0.013)	(0.012)	(0.023)	(0.024)	(0.023)	(0.013)	(0.013)	(0.013)
Unemployed	-0.589***	-0.592***	-0.589***	-0.636***	-0.626***	-0.634***	-0.270***	-0.269***	-0.273***
	(0.023)	(0.024)	(0.023)	(0.026)	(0.026)	(0.026)	(0.024)	(0.025)	(0.025)
House owner	0.048***	0.045***	0.044***	0.064**	0.055**	0.053*	0.010	0.014	0.013
	(0.015)	(0.015)	(0.015)	(0.027)	(0.028)	(0.027)	(0.017)	(0.017)	(0.017)
Self-administered interview	-0.168***	-0.167***	-0.168***	-0.057***	-0.056***	-0.057***			
	(0.012)	(0.012)	(0.012)	(0.018)	(0.018)	(0.018)			
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.127	0.127	0.126	0.103	0.102	0.102	0.111	0.110	0.110
Individuals	29,091	27,865	29,038	9,047	8,705	8,958	17,836	17,524	17,470
Observations	246,362	236,953	245,918	83,571	81,057	82,478	122,575	120,679	119,751

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with previous year's monthly net household income that is not equivalized ('raw'). See the notes of Tables 4 for details on data sources.

Table B.6: Fixed-effects OLS regressions of life satisfaction on current monthly raw household income and reference income

	Western Germany, 1992–2010			Eastern Germany, 1992–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.303***	0.304***	0.301***	0.505***	0.505***	0.494***	0.059***	0.058***	0.059***
	(0.014)	(0.014)	(0.014)	(0.026)	(0.026)	(0.026)	(0.009)	(0.009)	(0.009)
ln(Reference income)	-0.422***	-0.035	-0.068	-1.239***	-0.264***	-0.343***	-0.789***	-0.064*	-0.217***
	(0.088)	(0.044)	(0.048)	(0.146)	(0.101)	(0.080)	(0.085)	(0.037)	(0.043)
Age squared/1000	-0.176***	-0.126***	-0.099***	-0.175***	-0.153**	-0.104*	-0.211***	-0.036	-0.047
	(0.040)	(0.038)	(0.037)	(0.061)	(0.065)	(0.062)	(0.039)	(0.034)	(0.036)
Marital status (Base category: Married)									
Separated/divorced	-0.166***	-0.192***	-0.175***	0.005	-0.038	-0.025	-0.092***	-0.099***	-0.101***
	(0.029)	(0.030)	(0.029)	(0.053)	(0.053)	(0.053)	(0.025)	(0.025)	(0.025)
Single	-0.115***	-0.120***	-0.122***	-0.031	0.001	-0.014	-0.055***	-0.050**	-0.052***
	(0.024)	(0.025)	(0.024)	(0.046)	(0.047)	(0.047)	(0.020)	(0.020)	(0.020)
Widowed	-0.368***	-0.374***	-0.384***	-0.058	-0.096	-0.117	-0.271***	-0.296***	-0.295***
	(0.051)	(0.052)	(0.051)	(0.075)	(0.077)	(0.077)	(0.044)	(0.044)	(0.046)
Number of children in household	-0.026***	-0.034***	-0.030***	-0.002	-0.015	-0.011	-0.021***	-0.023***	-0.020***
	(0.008)	(0.008)	(0.008)	(0.015)	(0.016)	(0.015)	(0.008)	(0.008)	(0.008)
Number of adults in household	-0.062***	-0.071***	-0.069***	-0.120***	-0.140***	-0.134***	-0.020***	-0.031***	-0.029***
	(0.008)	(0.008)	(0.007)	(0.014)	(0.014)	(0.014)	(0.007)	(0.007)	(0.007)
Health satisfaction	0.253***	0.253***	0.252***	0.230***	0.231***	0.230***	0.259***	0.261***	0.260***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Labor force status (Base category: Working									
Non-working	-0.045***	-0.041***	-0.039***	-0.106***	-0.074***	-0.085***	-0.003	0.014	0.005
	(0.012)	(0.013)	(0.012)	(0.023)	(0.024)	(0.023)	(0.013)	(0.014)	(0.014)
Unemployed	-0.543***	-0.543***	-0.542***	-0.576***	-0.563***	-0.570***	-0.243***	-0.242***	-0.247***
	(0.024)	(0.024)	(0.024)	(0.026)	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)
House owner	0.044***	0.040***	0.040***	0.051*	0.049*	0.042	0.012	0.017	0.016
	(0.015)	(0.016)	(0.015)	(0.027)	(0.028)	(0.028)	(0.017)	(0.017)	(0.017)
Self-administered interview	-0.161***	-0.159***	-0.161***	-0.052***	-0.052***	-0.054***			
	(0.012)	(0.012)	(0.012)	(0.018)	(0.018)	(0.018)			
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.127	0.128	0.127	0.108	0.107	0.105	0.110	0.109	0.109
Individuals	27,896	26,728	27,841	8,823	8,491	8,734	17,844	17,531	17,472
Observations	232,124	223,383	231,673	80,347	77,958	79,207	122,012	120,121	119,161

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with current monthly net household income that is not equivalized ('raw'). See the notes of Tables 4 for details on data sources.

Table B.7: Fixed-effects OLS regressions of life satisfaction on monthly individual labor income and reference income

	Western Germany, 1992–2010				Eastern Germany, 1992–2010				United Kingdom, 1996–2008			
	Group averages			Two-stage estimation	Group averages			Two-stage estimation	Group averages			Two-stage estimation
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ln(Individual income)	0.138***	0.135***	0.139***	0.123***	0.256***	0.251***	0.254***	0.210***	0.008**	0.009**	0.008**	0.006
	(0.011)	(0.012)	(0.011)	(0.014)	(0.022)	(0.022)	(0.022)	(0.027)	(0.004)	(0.004)	(0.004)	(0.004)
ln(Reference income)	-0.137	-0.010	-0.032	0.042**	-0.140	0.098	0.039	0.132***	-0.005	-0.003	0.009	0.033**
	(0.111)	(0.038)	(0.039)	[0.017]	(0.180)	(0.072)	(0.069)	[0.034]	(0.047)	(0.014)	(0.019)	[0.014]
Age squared/1000	0.241***	0.279***	0.303***	0.295***	0.519***	0.678***	0.625***	0.668***	0.399***	0.399***	0.436***	0.449***
	(0.091)	(0.070)	(0.069)	(0.067)	(0.161)	(0.130)	(0.129)	(0.126)	(0.103)	(0.057)	(0.065)	(0.057)
Marital status (Base category: Married)												
Separated/divorced	-0.192***	-0.203***	-0.190***	-0.196***	-0.032	-0.040	-0.035	-0.037	-0.067**	-0.060**	-0.066**	-0.056**
	(0.031)	(0.032)	(0.031)	(0.033)	(0.061)	(0.060)	(0.061)	(0.064)	(0.028)	(0.028)	(0.028)	(0.029)
Single	-0.134***	-0.132***	-0.132***	-0.142***	-0.128**	-0.128**	-0.126**	-0.138**	-0.066***	-0.062***	-0.065***	-0.060***
	(0.026)	(0.026)	(0.026)	(0.027)	(0.052)	(0.053)	(0.053)	(0.056)	(0.021)	(0.021)	(0.021)	(0.022)
Widowed	-0.508***	-0.461***	-0.524***	-0.505***	-0.020	-0.040	-0.063	-0.018	-0.250***	-0.252***	-0.220**	-0.246***
	(0.101)	(0.101)	(0.102)	(0.104)	(0.153)	(0.160)	(0.168)	(0.174)	(0.088)	(0.089)	(0.087)	(0.092)
Number of children in household	0.014*	0.011	0.015*	0.014*	0.073***	0.067***	0.069***	0.074***	-0.005	-0.006	-0.004	-0.004
	(0.008)	(0.008)	(0.008)	(0.009)	(0.016)	(0.016)	(0.016)	(0.017)	(0.008)	(0.008)	(0.008)	(0.008)
Health satisfaction	0.235***	0.234***	0.235***	0.233***	0.212***	0.213***	0.212***	0.214***	0.243***	0.243***	0.243***	0.244***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.006)	(0.006)	(0.004)	(0.004)	(0.004)	(0.005)
House owner	0.078***	0.076***	0.079***	0.080***	0.074**	0.079**	0.076**	0.089***	0.021	0.024	0.023	0.028
	(0.017)	(0.017)	(0.017)	(0.017)	(0.031)	(0.032)	(0.032)	(0.033)	(0.019)	(0.019)	(0.019)	(0.020)
Self-administered interview	-0.184***	-0.182***	-0.185***	-0.187***	-0.076***	-0.074***	-0.078***	-0.067***				
	(0.013)	(0.014)	(0.013)	(0.014)	(0.020)	(0.020)	(0.020)	(0.021)				
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.106	0.106	0.106	0.107	0.082	0.082	0.082	0.083	0.097	0.097	0.096	0.098
Individuals	19,813	19,277	19,749	18,634	5,991	5,845	5,872	5,646	11,659	11,453	11,501	10,849
Observations	144,123	140,493	143,683	132,801	45,944	45,176	44,912	42,672	71,919	70,757	70,861	65,517

Notes: Asterisks denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. The standard errors in parentheses are adjusted for clustering on the individual level. Bootstrapped cluster-robust standard errors are shown in brackets (1000 replications). The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with monthly individual gross labor income. All samples are restricted to working individuals. See the notes of Tables 4 for details on data sources.

Table B.8: Fixed-effects OLS regressions of life satisfaction on previous year's monthly equivalized household income, reference income, and income lags

	Western Germany, 1996–2010			Eastern Germany, 1996–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.226	0.225	0.224	0.315	0.295	0.306	0.037	0.035	0.034
	(0.019)	(0.019)	(0.019)	(0.035)	(0.035)	(0.035)	(0.013)	(0.013)	(0.013)
	[0.021]	[0.021]	[0.021]	[0.038]	[0.038]	[0.038]	[0.013]	[0.014]	[0.014]
ln(Reference income)	-1.146	-0.172	-0.104	-1.624	-0.521	-0.471	-0.876	-0.101	-0.085
	(0.159)	(0.062)	(0.057)	(0.189)	(0.138)	(0.103)	(0.137)	(0.060)	(0.053)
	[0.190]	[0.073]	[0.067]	[0.232]	[0.165]	[0.123]	[0.157]	[0.067]	[0.060]
ln(Household income, *t*-1)	0.009	0.003	0.007	0.001	-0.010	-0.013	0.004	-0.000	0.001
	(0.019)	(0.019)	(0.019)	(0.035)	(0.036)	(0.035)	(0.013)	(0.013)	(0.013)
	[0.019]	[0.019]	[0.019]	[0.035]	[0.036]	[0.035]	[0.013]	[0.013]	[0.013]
ln(Household income, *t*-2)	-0.005	-0.011	-0.008	-0.018	-0.025	-0.025	0.006	0.005	0.003
	(0.017)	(0.017)	(0.017)	(0.031)	(0.032)	(0.032)	(0.010)	(0.010)	(0.010)
	[0.017]	[0.017]	[0.017]	[0.031]	[0.031]	[0.031]	[0.011]	[0.011]	[0.011]
ln(Household income, *t*-3)	-0.007	-0.012	-0.010	-0.041	-0.049	-0.047	0.001	-0.000	0.002
	(0.016)	(0.016)	(0.016)	(0.030)	(0.031)	(0.030)	(0.010)	(0.010)	(0.010)
	[0.016]	[0.016]	[0.016]	[0.030]	[0.031]	[0.030]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-4)	0.021	0.019	0.017	-0.034	-0.047	-0.039	0.004	0.001	0.001
	(0.015)	(0.015)	(0.015)	(0.028)	(0.028)	(0.028)	(0.010)	(0.010)	(0.010)
	[0.016]	[0.016]	[0.016]	[0.029]	[0.029]	[0.029]	[0.010]	[0.010]	[0.010]
Results of F-tests (using cluster-robust standard errors)									
Σ Income lags	0.017	-0.000	0.007	-0.092	-0.131	-0.124	0.015	0.006	0.008
Prob(Σ Income lags > *F*)	0.570	0.988	0.828	0.097	0.019	0.026	0.440	0.758	0.695
Σ Current and lagged income	0.243	0.224	0.230	0.223	0.164	0.182	0.053	0.041	0.042
Prob(Σ Current and lagged income > *F*)	0.000	0.000	0.000	0.000	0.008	0.003	0.025	0.078	0.071
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further personal control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.113	0.113	0.112	0.107	0.106	0.105	0.109	0.108	0.108
Individuals	15,230	14,991	15,205	5,144	5,070	5,106	11,236	11,080	10,995
Observations	118,694	116,833	118,508	43,505	42,994	43,038	74,377	73,531	72,694

Notes: Robust standard errors are shown in parentheses. The standard errors in brackets are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with previous year's monthly net household income equivalized according to the modified-OECD scale. See the notes of Tables 4 for details on further control variables and data sources.

Table B.9: Fixed-effects OLS regressions of life satisfaction on current monthly equivalized household income, reference income, and income lags

	Western Germany, 1996–2010			Eastern Germany, 1996–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.310	0.313	0.308	0.517	0.508	0.508	0.062	0.060	0.063
	(0.021)	(0.021)	(0.021)	(0.036)	(0.036)	(0.036)	(0.012)	(0.012)	(0.012)
	[0.023]	[0.023]	[0.023]	[0.038]	[0.038]	[0.038]	[0.013]	[0.013]	[0.013]
ln(Reference income)	-1.453	-0.201	-0.088	-1.427	-0.537	-0.229	-0.946	-0.083	-0.122
	(0.210)	(0.078)	(0.067)	(0.232)	(0.184)	(0.108)	(0.136)	(0.058)	(0.052)
	[0.243]	[0.091]	[0.077]	[0.280]	[0.219]	[0.128]	[0.154]	[0.065]	[0.058]
ln(Household income, *t*-1)	0.058	0.056	0.056	-0.003	-0.008	-0.005	0.002	-0.001	-0.000
	(0.020)	(0.020)	(0.020)	(0.035)	(0.036)	(0.036)	(0.012)	(0.012)	(0.012)
	[0.020]	[0.020]	[0.020]	[0.036]	[0.036]	[0.036]	[0.012]	[0.012]	[0.012]
ln(Household income, *t*-2)	-0.013	-0.017	-0.015	0.073	0.069	0.065	0.007	0.005	0.002
	(0.019)	(0.019)	(0.019)	(0.034)	(0.034)	(0.034)	(0.010)	(0.010)	(0.010)
	[0.019]	[0.019]	[0.019]	[0.033]	[0.033]	[0.033]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-3)	0.033	0.032	0.032	-0.035	-0.039	-0.041	-0.005	-0.007	-0.004
	(0.019)	(0.019)	(0.019)	(0.031)	(0.031)	(0.031)	(0.010)	(0.010)	(0.010)
	[0.019]	[0.019]	[0.019]	[0.030]	[0.031]	[0.031]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-4)	-0.018	-0.021	-0.020	-0.006	-0.019	-0.009	0.003	-0.001	-0.001
	(0.018)	(0.018)	(0.018)	(0.030)	(0.030)	(0.030)	(0.009)	(0.009)	(0.009)
	[0.019]	[0.019]	[0.019]	[0.031]	[0.032]	[0.032]	[0.010]	[0.010]	[0.010]
Results of F-tests (using cluster-robust standard errors)									
Σ Income lags	0.061	0.049	0.053	0.029	0.004	0.009	0.007	-0.004	-0.003
Prob(Σ Income lags > *F*)	0.085	0.163	0.130	0.619	0.949	0.875	0.735	0.840	0.892
Σ Current and lagged income	0.371	0.362	0.362	0.546	0.512	0.517	0.069	0.056	0.060
Prob(Σ Current and lagged income > *F*)	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.016	0.010
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further personal control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.115	0.115	0.114	0.110	0.109	0.108	0.109	0.108	0.108
Individuals	14,044	13,819	14,019	4,903	4,834	4,866	11,165	11,011	10,924
Observations	105,150	103,631	104,969	39,943	39,497	39,462	73,334	72,498	71,664

Notes: Robust standard errors are shown in parentheses. The standard errors in brackets are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with current monthly net household income equivalized according to the modified-OECD scale. See the notes of Tables 4 for details on further control variables and data sources.

Table B.10: Fixed-effects OLS regressions of life satisfaction on previous year's monthly raw household income, reference income, and income lags

	Western Germany, 1996–2010			Eastern Germany, 1996–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.254	0.255	0.254	0.331	0.317	0.329	0.053	0.051	0.052
	(0.018)	(0.018)	(0.018)	(0.034)	(0.035)	(0.034)	(0.013)	(0.013)	(0.013)
	[0.020]	[0.020]	[0.020]	[0.038]	[0.038]	[0.038]	[0.013]	[0.013]	[0.013]
ln(Reference income)	-0.482	-0.056	-0.120	-1.219	-0.220	-0.524	-0.919	-0.048	-0.180
	(0.105)	(0.042)	(0.056)	(0.140)	(0.081)	(0.089)	(0.102)	(0.044)	(0.053)
	[0.129]	[0.050]	[0.066]	[0.177]	[0.096]	[0.106]	[0.118]	[0.050]	[0.059]
ln(Household income, *t*-1)	-0.055	-0.060	-0.056	-0.068	-0.080	-0.079	-0.023	-0.029	-0.028
	(0.017)	(0.017)	(0.017)	(0.032)	(0.032)	(0.032)	(0.012)	(0.012)	(0.012)
	[0.017]	[0.017]	[0.017]	[0.031]	[0.032]	[0.031]	[0.012]	[0.012]	[0.012]
ln(Household income, *t*-2)	-0.048	-0.053	-0.051	-0.058	-0.065	-0.060	-0.012	-0.014	-0.015
	(0.015)	(0.015)	(0.015)	(0.028)	(0.028)	(0.028)	(0.010)	(0.010)	(0.010)
	[0.015]	[0.015]	[0.015]	[0.027]	[0.027]	[0.027]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-3)	-0.035	-0.038	-0.037	-0.047	-0.055	-0.052	-0.015	-0.017	-0.014
	(0.014)	(0.014)	(0.014)	(0.027)	(0.027)	(0.027)	(0.009)	(0.010)	(0.010)
	[0.014]	[0.015]	[0.014]	[0.027]	[0.027]	[0.027]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-4)	-0.013	-0.016	-0.016	-0.077	-0.093	-0.082	-0.007	-0.012	-0.011
	(0.013)	(0.013)	(0.013)	(0.025)	(0.025)	(0.025)	(0.009)	(0.009)	(0.009)
	[0.014]	[0.014]	[0.014]	[0.026]	[0.026]	[0.026]	[0.009]	[0.009]	[0.009]
Results of F-tests (using cluster-robust standard errors)									
Σ Income lags	-0.151	-0.168	-0.160	-0.250	-0.293	-0.273	-0.056	-0.073	-0.068
Prob(Σ Income lags > *F*)	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000
Σ Current and lagged income	0.103	0.088	0.095	0.080	0.024	0.056	-0.003	-0.021	-0.015
Prob(Σ Current and lagged income > *F*)	0.001	0.006	0.003	0.141	0.660	0.310	0.906	0.329	0.485
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further personal control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.113	0.113	0.113	0.108	0.106	0.106	0.110	0.109	0.109
Individuals	15,203	14,963	15,178	5,140	5,066	5,101	11,234	11,078	10,992
Observations	118,646	116,774	118,459	43,472	42,963	42,997	74,368	73,523	72,686

Notes: Robust standard errors are shown in parentheses. The standard errors in brackets are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with previous year's monthly net household income that is not equivalized ('raw'). See the notes of Tables 4 for details on further control variables and data sources.

Table B.11: Fixed-effects OLS regressions of life satisfaction on current monthly raw household income, reference income, and income lags

	Western Germany, 1996–2010			Eastern Germany, 1996–2010			United Kingdom, 1996–2008		
	Group averages			Group averages			Group averages		
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(Household income)	0.352	0.357	0.352	0.562	0.555	0.556	0.068	0.066	0.069
	(0.021)	(0.021)	(0.021)	(0.035)	(0.036)	(0.035)	(0.012)	(0.012)	(0.012)
	[0.022]	[0.023]	[0.023]	[0.038]	[0.038]	[0.038]	[0.012]	[0.012]	[0.013]
ln(Reference income)	-0.559	-0.069	-0.145	-1.296	-0.355	-0.328	-0.805	-0.027	-0.184
	(0.129)	(0.054)	(0.066)	(0.176)	(0.112)	(0.098)	(0.093)	(0.041)	(0.050)
	[0.155]	[0.064]	[0.076]	[0.223]	[0.132]	[0.116]	[0.108]	[0.046]	[0.056]
ln(Household income, *t*-1)	-0.033	-0.038	-0.035	-0.083	-0.087	-0.083	-0.020	-0.025	-0.024
	(0.019)	(0.019)	(0.019)	(0.033)	(0.034)	(0.033)	(0.011)	(0.011)	(0.011)
	[0.019]	[0.019]	[0.019]	[0.033]	[0.033]	[0.033]	[0.011]	[0.011]	[0.011]
ln(Household income, *t*-2)	-0.069	-0.071	-0.071	0.008	-0.000	0.003	-0.007	-0.011	-0.012
	(0.018)	(0.018)	(0.018)	(0.031)	(0.031)	(0.031)	(0.010)	(0.010)	(0.010)
	[0.017]	[0.018]	[0.017]	[0.030]	[0.030]	[0.030]	[0.010]	[0.010]	[0.010]
ln(Household income, *t*-3)	-0.004	-0.006	-0.006	-0.062	-0.070	-0.070	-0.017	-0.021	-0.016
	(0.017)	(0.018)	(0.017)	(0.030)	(0.030)	(0.030)	(0.009)	(0.009)	(0.009)
	[0.018]	[0.018]	[0.018]	[0.029]	[0.029]	[0.029]	[0.009]	[0.009]	[0.009]
ln(Household income, *t*-4)	-0.047	-0.051	-0.050	-0.069	-0.085	-0.076	-0.007	-0.013	-0.012
	(0.016)	(0.016)	(0.016)	(0.028)	(0.028)	(0.028)	(0.009)	(0.009)	(0.009)
	[0.017]	[0.018]	[0.018]	[0.029]	[0.029]	[0.029]	[0.009]	[0.009]	[0.009]
Results of F-tests (using cluster-robust standard errors)									
Σ Income lags	-0.153	-0.167	-0.162	-0.205	-0.243	-0.226	-0.051	-0.069	-0.064
Prob(Σ Income lags > *F*)	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.001
Σ Current and lagged income	0.199	0.189	0.190	0.356	0.312	0.330	0.017	-0.003	0.005
Prob(Σ Current and lagged income > *F*)	0.000	0.000	0.000	0.000	0.000	0.000	0.441	0.884	0.826
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further personal control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.114	0.115	0.114	0.111	0.110	0.109	0.109	0.108	0.108
Individuals	14,035	13,812	14,011	4,898	4,827	4,861	11,159	11,005	10,920
Observations	105,032	103,521	104,853	39,935	39,499	39,452	73,354	72,521	71,678

Notes: Robust standard errors are shown in parentheses. The standard errors in brackets are adjusted for clustering on the individual level. The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with current monthly net household income that is not equivalized ('raw'). See the notes of Tables 4 for details on further control variables and data sources.

Table B.12: Fixed-effects OLS regressions of life satisfaction on individual labor income, reference income, and income lags

	Western Germany, 1996–2010				Eastern Germany, 1996–2010				United Kingdom, 1996–2008			
	Group averages			Two-stage estimation	Group averages			Two-stage estimation	Group averages			Two-stage estimation
Reference income constructed similar to …	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)	McBride (2001)	Ferrer-i-Carbonell (2005)	Layard et al. (2010)	Senik (2008)
Dependent variable: life satisfaction	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ln(Individual income)	0.142	0.141	0.143	0.137	0.298	0.297	0.297	0.251	0.012	0.012	0.012	0.010
	(0.023)	(0.023)	(0.023)	(0.024)	(0.043)	(0.043)	(0.043)	(0.046)	(0.005)	(0.005)	(0.005)	(0.006)
	[0.024]	[0.024]	[0.024]	[0.026]	[0.046]	[0.046]	[0.047]	[0.050]	[0.005]	[0.006]	[0.006]	[0.006]
ln(Reference income)	-0.004	-0.126	-0.110	0.058	0.544	0.237	0.196	0.234	0.119	0.014	0.045	0.014
	(0.192)	(0.068)	(0.066)	{0.032}	(0.375)	(0.150)	(0.132)	{0.065}	(0.058)	(0.018)	(0.024)	{0.019}
	[0.217]	[0.079]	[0.074]	<0.032>	[0.422]	[0.169]	[0.149]	<0.065>	[0.065]	[0.020]	[0.027]	<0.019>
ln(Individual income, *t*-1)	0.003	0.004	0.003	0.002	0.008	0.007	0.002	0.006	0.005	0.005	0.006	0.006
	(0.022)	(0.022)	(0.022)	(0.023)	(0.045)	(0.045)	(0.045)	(0.045)	(0.006)	(0.006)	(0.006)	(0.006)
	[0.022]	[0.022]	[0.022]	[0.022]	[0.048]	[0.049]	[0.049]	[0.048]	[0.005]	[0.005]	[0.006]	[0.006]
ln(Individual income, *t*-2)	-0.005	-0.003	-0.005	-0.009	-0.004	-0.002	-0.001	-0.013	-0.011	-0.010	-0.011	-0.008
	(0.020)	(0.021)	(0.021)	(0.021)	(0.042)	(0.043)	(0.042)	(0.043)	(0.005)	(0.006)	(0.006)	(0.006)
	[0.020]	[0.020]	[0.020]	[0.021]	[0.044]	[0.044]	[0.044]	[0.044]	[0.006]	[0.006]	[0.006]	[0.006]
ln(Individual income, *t*-3)	-0.048	-0.043	-0.046	-0.048	-0.055	-0.052	-0.049	-0.046	-0.002	-0.002	-0.002	-0.003
	(0.020)	(0.020)	(0.020)	(0.021)	(0.039)	(0.039)	(0.039)	(0.040)	(0.006)	(0.006)	(0.006)	(0.006)
	[0.021]	[0.021]	[0.021]	[0.022]	[0.038]	[0.039]	[0.039]	[0.039]	[0.006]	[0.006]	[0.006]	[0.006]
ln(Individual income, *t*-4)	-0.000	0.001	0.001	-0.005	-0.034	-0.031	-0.031	-0.044	0.002	0.001	0.002	0.001
	(0.018)	(0.019)	(0.018)	(0.019)	(0.038)	(0.038)	(0.038)	(0.039)	(0.006)	(0.006)	(0.006)	(0.006)
	[0.019]	[0.019]	[0.019]	[0.019]	[0.040]	[0.040]	[0.041]	[0.041]	[0.006]	[0.006]	[0.006]	[0.006]
Results of F-tests (using cluster-robust standard errors)												
Σ Income lags	-0.049	-0.041	-0.047	-0.060	-0.085	-0.079	-0.078	-0.098	-0.005	-0.005	-0.005	-0.004
Prob(Σ Income lags > *F*)	0.189	0.279	0.208	0.115	0.293	0.326	0.343	0.223	0.610	0.620	0.620	0.719
Σ Current and lagged income	0.093	0.100	0.096	0.077	0.214	0.218	0.218	0.154	0.006	0.006	0.007	0.006
Prob(Σ Current and lagged income > *F*)	0.028	0.019	0.023	0.081	0.021	0.018	0.020	0.105	0.594	0.587	0.574	0.616
Region and year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Further personal control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.089	0.089	0.089	0.090	0.083	0.084	0.084	0.085	0.093	0.093	0.093	0.092
Individuals	8,151	8,069	8,129	7,969	2,475	2,458	2,448	2,435	6,195	6,110	6,126	5,994
Observations	54,177	53,699	54,077	52,438	17,386	17,310	17,103	16,846	36,497	36,047	36,039	34,909

Notes: Robust standard errors are shown in parentheses. The standard errors in brackets are adjusted for clustering on the individual level. Bootstrapped robust standard errors are shown in braces and bootstrapped cluster-robust standard errors are shown in angle brackets (1000 replications, respectively). The life-satisfaction scale is 0–10 in the German data, and the scale is 1–7 in the UK data. Reference income is calculated with monthly individual gross labor income. All samples are restricted to working individuals. See the notes of Tables 4 for details on further control variables and data sources.

Table D.1: Evidence of the sign of the reference-income effect in European countries

Country	Direct evidence from the ESS		Two-stage estimation results reported in Senik (2008)	
	(1)		(2)	
Austria	**-0.234*** **	**(0.038)**	**-0.013** **	**[0.006]**
Belgium	**-0.062***	**(0.034)**	**-0.006*** **	**[0.002]**
Bulgaria	-0.083	(0.060)		
Switzerland	-0.154***	(0.033)		
Germany	-0.189***	(0.035)	0.027***	[0.009]
Denmark	**-0.081** **	**(0.034)**	**-0.004***	**[0.002]**
Estonia	-0.164***	(0.052)	0.364***	[0.065]
Spain	-0.089***	(0.030)	0.025***	[0.005]
Finland	**-0.094*** **	**(0.032)**	**-0.041*** **	**[0.002]**
France	-0.235***	(0.038)	0.008	[0.005]
United Kingdom	**-0.158*** **	**(0.031)**	**-0.011*** **	**[0.002]**
Hungary	-0.081	(0.052)	0.118***	[0.007]
Ireland	-0.122***	(0.041)	0.026***	[0.007]
Netherlands	-0.045*	(0.027)	0.010***	[0.002]
Norway	-0.040	(0.027)		
Poland	-0.115**	(0.049)	0.532***	[0.182]
Portugal	**0.017**	**(0.054)**	**0.005**	**[0.005]**
Russia	-0.115***	(0.042)	0.186***	[0.035]
Sweden	-0.114***	(0.028)		
Slovenia	-0.143***	(0.044)		
Slovakia	-0.108**	(0.054)		
Ukraine	-0.001	(0.059)		

Notes: Asterisks next to the reported OLS coefficients denote statistical significance lower than or equal to the * 10 percent, ** 5 percent, and *** 1 percent level. Coefficients with the same sign in columns 1 and 2 are in bold. Robust standard errors are reported in parentheses. Bootstrapped standard errors are reported in brackets. The dependent variable in column 1 is life satisfaction. Column 1 shows coefficients from own estimations with ESS (2006) data based on a model proposed by Clark and Senik (2010), i.e., regressions of life satisfaction on the question *"How important is it for you to compare your income with other people's incomes?"* (scale 0–6; Denmark: scale 1–6). The samples are restricted to individuals in paid work, aged between 16 and 65. Further controls are household income, gender, 10 occupation dummies, self-employed, 3 age categories, 3 education categories, 5 marital status categories, and a dummy for those who ever had a child. Column 2 shows coefficients reported in Senik (2008), i.e., regressions of a satisfaction variable (life satisfaction, income satisfaction, financial satisfaction, etc.) on reference income that has been previously estimated with an earnings equation.

References

Akay, A., Bargain, O., Zimmermann, K.F., 2012. Relative concerns of rural-to-urban migrants in China. Journal of Economic Behavior & Organization, 81(2), 421-441.

Angrist, J.D., Pischke, J.-S., 2009, Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press, Princeton and Oxford.

BHPS, 2012, Britisch Household Panel Survey. Institute for Social & Economic Research, University of Essex.

Boes, S., Staub, K., Winkelmann, R., 2010. Relative status and satisfaction. Economics Letters, 109(3), 168-170.

Boyce, C.J., Brown, G.D., Moore, S.C., 2010. Money and happiness: rank of income, not income, affects life satisfaction. Psychological science, 21(4), 471-475.

Brickman, P., Campbell, D.T., 1971, Hedonic Relativism and Planning the Good Society. In: M.H. Appley (Ed.). Adaptation-level Theory: A Symposium. Academic Press, New York, pp. 287-302.

Brown, G.D.A., Gardner, J., Oswald, A.J., Qian, J., 2008. Does Wage Rank Affect Employees' Well-being? Industrial Relations, 47(3), 355-389.

Budria, S., Ferrer-i-Carbonell, A., 2012, Income Comparisons and Non-cognitive Skills. SOEPpaper No. 441 on Multidisciplinary Panel Data Research. DIW Berlin.

Buhmann, B., Rainwater, L., Schmaus, G., Smeeding, T.M., 1988. Equivalence Scales, Well-Being, Inequality, and Poverty: Sensitivity Estimates across Ten Countries Using the Luxembourg Income Study (LIS) Database. Review of Income and Wealth, 34(2), 115-142.

Card, D., Mas, A., Moretti, E., Saez, E., 2012. Inequality at Work: The Effect of Peer Salaries on Job Satisfaction. American Economic Review, 102(6), 2981-3003.

Chadi, A., 2012. I Would Really Love to Participate in Your Survey! Bias Problems in the Measurement of Well-being. Economics Bulletin, 32(4), 3111-3119.

Clark, A.E., Diener, E., Georgellis, Y., Lucas, R.E., 2008a. Lags and Leads in Life Satisfaction: A Test of the Baseline Hypothesis. The Economic Journal, 118(529), F222-F243.

Clark, A.E., Etilé, F., Postel-Vinay, F., Senik, C., Van der Straeten, K., 2005. Heterogeneity in Reported Well-Being: Evidence from Twelve European Countries. The Economic Journal, 115(502), C118-C132.

Clark, A.E., Frijters, P., Shields, M.A., 2008b. Relative Income, Happiness, and Utility: An Explanation for the Easterlin Paradox and Other Puzzles. Journal of Economic Literature, 46(1), 95-144.

Clark, A.E., Kristensen, N., Westergard-Nielsen, N., 2009a. Economic Satisfaction and Income Rank in Small Neighbourhoods. Journal of the European Economic Association, 7(2-3), 519-527.

Clark, A.E., Kristensen, N., Westergard-Nielsen, N., 2009b. Job Satisfaction and Co-worker Wages: Status or Signal? The Economic Journal, 119(536), 430-447.

Clark, A.E., Masclet, D., Villeval, M.C., 2010. Effort and Comparison Income: Experimental and Survey Evidence. Industrial and Labor Relations Review, 63(3), 407-426.

Clark, A.E., Oswald, A.J., 1996. Satisfaction and Comparison Income. Journal of Public Economics, 61(3), 359-381.

Clark, A.E., Senik, C., 2010. Who Compares to Whom? The Anatomy of Income Comparisons in Europe. The Economic Journal, 120(544), 573-594.

Clark, A.E., Senik, C., 2012, Income Comparisons in Chinese Villages. Discussion Paper. Paris School of Economics.

Clark, A.E., Senik, C., Yamada, K., 2013, The Joneses in Japan: Income Comparisons and Financial Satisfaction. ISER Discussion Paper No. 866. Institute of Social and Economic Research, Osaka University.

Conti, G., Pudney, S., 2011. Survey Design and the Analysis of Satisfaction. The Review of Economics and Statistics, 93(3), 1087-1093.

de la Garza, A., Mastrobuoni, G., Sannabe, A., Yamada, K., 2012, The Relative Utility Hypothesis with and without Self-reported Reference Wages. ISER Discussion Paper No. 798. The Institute of Social and Economic Research, Osaka University.

De Vos, K., Zaidi, M.A., 1997. Equivalence Scale Sensitivity of Poverty Statistics for the Member States of the European Community. Review of Income and Wealth, 43(3), 319-333.

Di Tella, R., Haisken-DeNew, J.P., MacCulloch, R., 2010. Happiness Adaptation to Income and to Status in an Individual Panel. Journal of Economic Behavior & Organization, 76(3), 834-852.

Dickson, M., 2012. The Causal Effect of Education on Wages Revisited. Oxford Bulletin of Economics and Statistics.

Dohmen, T., Falk, A., Fliessbach, K., Sunde, U., Weber, B., 2011. Relative versus absolute income, joy of winning, and gender: Brain imaging evidence. Journal of Public Economics, 95(3-4), 279-285.

Dolan, P., Peasgood, T., White, M., 2008. Do We Really Know What Makes Us Happy? A Review of the Economic Literature on the Factors Associated with Subjective Well-Being. Journal of Economic Psychology, 29(1), 94-122.

Easterlin, R.A., 1974, Does Economic Growth Improve the Human Lot? Some Empirical Evidence. In: P.A. David, M.W. Reder (Eds.). Nations and Households in Economic Growth: Essays in Honor of Moses Abramowitz. Academic Press, New York, pp. 88-125.

ESS, 2006, European Social Survey Round 3 Data. Data file edition 3.4. Norwegian Social Science Data Services, Norway.

Ferrer-i-Carbonell, A., 2005. Income and Well-Being: An Empirical Analysis of the Comparison Income Effect. Journal of Public Economics, 89(5-6), 997-1019.

Ferrer-i-Carbonell, A., Frijters, P., 2004. How Important Is Methodology for the Estimates of the Determinants of Happiness? The Economic Journal, 114(497), 641-659.

Ferrer-i-Carbonell, A., Van Praag, B.M.S., 2008, Do People Adapt to Changes in Income and other Circumstances? The Discussion Is not Finished Yet. Mimeo.

FitzRoy, F.R., Nolan, M.A., Steinhardt, M.F., Ulph, D., 2011, So Far so Good: Age, Happiness, and Relative Income. SOEPpaper No. 415 on Multidisciplinary Panel Data Research. DIW Berlin.

Fliessbach, K., Weber, B., Trautner, P., Dohmen, T., Sunde, U., Elger, C.E., Falk, A., 2007. Social Comparison Affects Reward-Related Brain Activity in the Human Ventral Striatum. Science, 318(5854), 1305-1308.

Frederick, S., Loewenstein, G.F., 1999, Hedonic Adaptation. In: D. Kahneman, E. Diener, N. Schwarz (Eds.). Well-Being: The Foundations of Hedonic Psychology. Russel Sage Foundation, New York, pp. 302-329.

Goerke, L., Pannenberg, M., 2013, Direct Evidence on Income Comparisons and Subjective Well-Being. IAAEU Discussion Paper No. 03/2013. Institut für Arbeitsrecht und Arbeitsbeziehungen in der Europäischen Union.

Gujarati, D.N., Porter, D.N., 2009, Basic Econometrics, vol. 5. McGraw Hill, New York.

Hirshman, A.O., Rothschild, M., 1973. The Changing Tolerance for Income Inequality in the Course of Economic Development. The Quarterly Journal of Economics, 87(4), 544-566.

Kahneman, D., Krueger, A.B., 2006. Developments in the Measurement of Subjective Well-Being. Journal of Economic Perspectives, 20(1), 3-24.

Knight, J., Song, L., Gunatilaka, R., 2009. Subjective well-being and its determinants in rural China. China Economic Review, 20(4), 635-649.

Layard, R., 2005, Happiness: Lessons from a New Science. Penguin Books, London.

Layard, R., Mayraz, G., Nickell, S., 2010, Does Relative Income Matter? Are the Critics Right? In: E. Diener, J.F. Helliwell, D. Kahneman (Eds.). International Differences in Well-Being. Oxford University Press, Oxford and New York, pp. 139-165.

Luttmer, E.F.P., 2005. Neighbors as Negatives: Relative Earnings and Well-being. The Quarterly Journal of Economics, 120(3), 963-1002.

McBride, M., 2001. Relative-income Effects on Subjective Well-being in the Cross-section. Journal of Economic Behavior & Organization, 45(3), 251-278.

Mujcic, R., Frijters, P., 2013. Economic choices and status: measuring preferences for income rank. Oxford Economic Papers, 65(1), 47-73.

Parducci, A., 1965. Category Judgment: A Range-frequency Model. Psychological Review, 72, 407-418.

Paul, S., Guilbert, D., 2013. Income–happiness paradox in Australia: Testing the theories of adaptation and social comparison. Economic Modelling, 30, 900-910.

Pfaff, T., Hirata, J., 2013, Testing the Easterlin Hypothesis with Panel Data: The Dynamic Relationship Between Life Satisfaction and Economic Growth in Germany and in the UK. SOEPpaper No. 554 on Multidisciplinary Panel Data Research. DIW Berlin.

Schaffer, M.E., 2010, xtivreg2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models. http://ideas.repec.org/c/boc/bocode/s456501.html.

Senik, C., 2004. When Information Dominates Comparison: Learning from Russian Subjective Panel Data. Journal of Public Economics, 88(9-10), 2099-2123.

Senik, C., 2008. Ambition and Jealousy: Income Interactions in the 'Old' Europe versus the 'New' Europe and the United States. Economica, 75(299), 495-513.

Senik, C., 2009. Direct Evidence on Income Comparisons and their Welfare Effects. Journal of Economic Behavior & Organization, 72(1), 408-424.

Sloane, P.J., Williams, H., 2000. Job Satisfaction, Comparison Earnings, and Gender. LABOUR, 14(3), 473-502.
SOEP, 2011, Socio-Economic Panel Study, Data for years 1984–2010, Version 27, beta version of SOEPlong. DIW Berlin, SOEP.
Van Praag, B.M.S., 1971. The Welfare Function of Income in Belgium: An Empirical Investigation. European Economic Review, 2(3), 337-369.
Vendrik, M.C.M., Woltjer, G.B., 2007. Happiness and loss aversion: Is utility concave or convex in relative income? Journal of Public Economics, 91(7-8), 1423-1448.
Wagner, G.G., Frick, J.R., Schupp, J., 2007. The German Socio-Economic Panel Study (SOEP) – Scope, Evolution and Enhancements. Schmollers Jahrbuch, 127, 139-169.
Yamada, K., Sato, M., 2013. Another avenue for anatomy of income comparisons: Evidence from hypothetical choice experiments. Journal of Economic Behavior & Organization, 89, 35-57.