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**Working Paper**

## Monitoring subjective well-being: Some new empirical evidence for Germany

SOEPpapers on Multidisciplinary Panel Data Research, No. 696

**Provided in Cooperation with:**

German Institute for Economic Research (DIW Berlin)

*Suggested Citation:* Oltmanns, Erich; Braakmann, Albert; Schmidt, Joachim (2014) : Monitoring subjective well-being: Some new empirical evidence for Germany, SOEPpapers on Multidisciplinary Panel Data Research, No. 696, Deutsches Institut für Wirtschaftsforschung (DIW), Berlin

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**SOEPpapers**  
on Multidisciplinary Panel Data Research

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

696-2014

**Monitoring Subjective Well-Being:  
Some New Empirical Evidence for  
Germany**

Erich Oltmanns, Albert Braakman, Joachim Schmidt

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ISSN: 1864-6689 (online)

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**Paper Prepared for the 33<sup>rd</sup> General Conference of  
The International Association for Research in Income and Wealth  
Rotterdam, Netherlands, August 24–30, 2014**

## **Monitoring Subjective Well-Being: Some New Empirical Evidence for Germany**

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(The views expressed in this paper are those of the authors. They do not necessarily reflect the views of the German Federal Statistical Office.)

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## **Abstract**

What is subjective well-being influenced by? Since the Report by the Commission on the Measurement of Economic Performance and Social Progress by Stiglitz, Sen and Fitoussi a huge number of studies has raised this question – with partly different findings. In addition, international organizations are increasingly addressing subjective well-being issues. The post-2015 development agenda of the United Nations as well as the inclusive growth strategy of the OECD may be quoted as examples. Facing the current state of national and international discussion, this paper analyses appropriate indicators for the mostly named factors influencing subjective well-being.

The goal of the empirical study for Germany is twofold: First of all, the indicators discussed prominently are analysed with regard to the relevance for explaining the degree of subjective well-being (micro level). Secondly, it is examined, whether the relevance of these indicators changes over time. The empirical results presented in this paper are mainly based on yearly longitudinal data of private households in Germany. Currently, the data set covers about 21,000 individuals living in more than 12,000 private households. The data set provides information on various indicators for subjective well-being mentioned by most of the recent studies, like for instance people's life-circumstances and individual assessments. Concluding remarks concern on one hand the question if data from EU-SILC (because of its Europe-wide coverage) are useful in this context. On the other hand the combination of data at the micro level with indicators at the aggregate level is discussed as well.

**Keywords:** Gross domestic product, Stiglitz-Sen-Fitoussi-Report, quality of life, Socio-economic panel (SOEP), Germany

**JEL classification:** C2, D6, I31

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# 1 Introduction

The “Report by the Commission on the Measurement of Economic Performance and Social Progress” by Stiglitz, Sen and Fitoussi has initiated a wide range of papers concerning the measurement of well-being.<sup>1</sup> The central issue of these contributions is the search for indicators that could supplement the gross domestic product, i. e. to derive additional factors explaining well-being and quality of life.

Progress in economics often can be regarded as circular. Paradigms, ideas and methods arise, vanish and arise again, reflecting the change in the problems of society and economy. It seems that this statement can also be applied to the statistical measurement of well-being.

Indeed, criticism on the gross domestic product and discussions about alternative measures of well-being are not new. For instance, in the 1990s the United Nations created the “human development index (HDI)” that combined the GDP with measures of health and educational achievement. In 1992 the UN Summit in Rio de Janeiro brought the notion of Sustainable Development into the policy debate (“Agenda 21”). In the 1970s Nordhaus and Tobin (1973) attempted to develop a measure of economic welfare (MEW), based on GDP, but correcting GDP for its most evident limitations.<sup>2</sup> And in the year 1972 the “Club of Rome” raised considerable attention with the report “The Limits to Growth”.

Already at that time when the concepts of the national accounts were founded, the psychologist and humanistic philosopher Erich Fromm criticised the modern society with its focus set on material wealth: “We consume, as we produce, without any concrete relatedness to the objects with which we deal; we live in a world of things, and our only connection with them is that we know how to manipulate or to consume them. (Fromm, E., 1959, p. 134). And in the 1960 he came to the *credo* “... that love is the main key to open the doors to the ‘growth’ of man. Love and union with someone or something outside of oneself, union that allows one to put oneself into relationship with others, to feel one with others, without limiting the sense of integrity and independence.” (Fromm, E., 1994)

Expressing it in his words from the mid of the last century Fromm has just dealt with the topic of this paper: it is the search for components or variables that determine the “growth of man”, or in modern words: the quality of life of human beings.

Hereunto, the paper is organised as follows: Following this introduction section 2 deals in general with the framework of measuring the quality of life. In section 3 the data to be used for the econometric estimates later in this paper are explained. Section 4 discusses the basic set of variables and the (possible) methods for the estimates. In section 5 the empirical results are presented and the paper ends with some concluding remarks in section 6.

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<sup>1</sup> In the following this report is called by its authors “Stiglitz-Sen-Fitoussi-Report”.

<sup>2</sup> Commission on the Measurement of Economic Performance and Social Progress (2008), p. 1.

## 2 Measuring the quality of life: Background

### 2.1 The Stiglitz-Sen-Fitoussi-Commission and the initiative “GDP and beyond”

“A discussion on adequate well-being indicators is anything but new. An important academic debate on social and well-being indicators has been going on since the early 70s. The novelty of the current debate is that the discussion has fully reached and has been forcefully appropriated by the political sphere for the first time.” (García Díez, S., 2012, p. 2)

For this new debate two reports are very influential. First of all, it is the “Report of the Commission on the Measurement of Economic Performance and Social Progress” (or “Stiglitz-Sen-Fitoussi-Report”). And on the other side, with the focus set on Europe it is the “Communication from the Commission to the Council and the European Parliament. GDP and beyond. Measuring progress in a changing world” by the European Commission.<sup>1</sup> These reports discuss the informational value and the shortcomings of the gross domestic product (GDP). They both acknowledge the usefulness of the GDP as an approved economic indicator. But they propose to supplement the GDP by other indicators concerning economic, social and ecological topics.

As one of the reasons for supplementing the GDP by other indicators the Stiglitz-Sen-Fitoussi-Commission considers the concept of the quality of life. To measure the quality of life it is not sufficient to measure the availability of goods and services. It is rather necessary to go beyond the concept of material standard of living and to investigate the determinants of the quality of life. For this purpose the objective features that shape the quality of life have to be identified. According to the Stiglitz-Sen-Fitoussi-Commission seven features indicate the dimensions of the quality of life in addition to the economic conditions:

- Health,
- Education,
- Personal activities,
- Political voice and governance,
- Social connections,
- Environmental conditions
- Personal and economic insecurity.

It is common practice to measure these features in different ways. For instance, health can be measured by the life expectancy at birth, the absence of diseases or healthy live years. Therefore, it is the prior task to identify indicators that predominantly determine these features and the quality of life. And a second and possibly more important question is how to determine factors influencing quality of life. Can experts’ proposals be accepted or should they be substantiated by empirical evidence? Do such factors change across countries and/or over time?

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<sup>1</sup> For an overview see Braakmann, A. (2010).



## 2.2 Approaches to measure the quality of life

Apart from the traditional GDP approach there are four approaches to measure well-being and quality of life respectively.<sup>1</sup>

- Corrected GDP and extended national accounts,
- Composite indexes,
- Subjective approaches and
- Dashboards or sets of indicators.

One of the early attempts to calculate a corrected GDP was done by Nordhaus, W./Tobin, J. (1972). They derive a Measure of Economic Welfare (MEW) by subtracting from total private consumption a number of components that do not contribute positively to welfare (such as commuting or legal services) and by adding monetary estimates of activities that contribute positively to welfare (such as leisure or work at home). Then they convert the MEW in a “sustainable measure of economic welfare” (SMEW) that takes into account changes in total wealth.

The so-called “composite indicators approach” consists in aggregating several elementary indexes to encompass a broad spectrum of dimensions affecting what the indicator wants to measure (human development, well-being, environmental sustainability, etc.). Unlike the “corrected GDP” indicators, this approach does not provide a unified way of measuring heterogeneous dimensions of well-being. The distinctive features of these indicators relate to the domains covered, the normalisation methodology used, and the weights used for aggregation. The most well-known composite indicator is the Human Development Index (HDI) proposed by the United Nation Development Programme (UNDP) in 1990. The HDI consists of a weighted average of GDP, life expectancy and education measures (adult literacy rate and school entry rates).

A third group of approaches consists of measures of subjective well-being. Subjective approaches are based on the idea that individuals themselves are the best judges of their quality of life. So, it is the best way to ask them directly about their well-being, which in practice can be done by using different methods. Meanwhile, there are several surveys that include questions about well-being. For instance, EU-SILC, the European “Statistics on income, social inclusion and living conditions“, which started in 2003 and is conducted in the member states of the European Union, in Switzerland, Norway, Island, Turkey, Croatia, Serbia and Macedonia, includes questions about poverty, social exclusion, education and health.<sup>2</sup>

The fourth approach to measure quality of life is to apply dashboards or sets of indicators. Sets of indicators have a long tradition. In the 1970s the OECD initiated an ambitious statistical program on social indicators. In the midst of the 1980s their influence decreased, but they have come back to life in the 1990s, represented by the “Sustainable Development In-

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<sup>1</sup> For a synopsis of these approaches see Commission on the Measurement of Economic Performance and Social Progress (2008). The survey is also the basis for this section.

<sup>2</sup> See Eurostat (2010).

dicators of the United Nations. And in 2011 the OECD launched its “Better Life Index” that covers 11 dimensions of the OECD well-being framework.<sup>1</sup>

Sets of indicators “typically refer to descriptive measures of *average* conditions of people living in different countries, with indicators covering a large number of domains. Recent initiatives on indicator sets share some specific characteristics that differentiate them from earlier developments. First, these initiatives have often a strong environmental focus, within the broader agenda of sustainable development. Second, these developments are often more participatory, developed at the local level by groups that use indicators as part of a strategy aimed to mobilize action on specific issues. Third, these indicator sets are often specifically tailored to the needs of policy makers.” (Commission on the Measurement of Economic Performance and social Progress ..., 2008, p. 8)

### 2.3 Selection of indicators

As there are several very different approaches to measure the quality of life this leads to the question which approach should be preferred. It is not straightforward to find an answer. Every approach has its pros and cons. But an answer can be found on a very pragmatic level: Currently, the political discussion is focussing on sets of indicators. Not only the Stiglitz-Sen-Fitoussi-Report, but also the Commission of the European Communities (2009) or the German Council of Economic Experts and Conseil d’Analyse Economique (2010) discuss or propose respectively dashboards or set of indicators.<sup>2</sup> And in 2013 the “Study Commission on Growth, Well-being and Quality of Life” of the German Bundestag proposed the so-called set of “W<sup>3</sup>” – Indicators comprising ten key indicators and ten additional indicators.<sup>3</sup>

To contribute to this discussion it would be very useful to investigate the question which indicators predominantly determine the quality of life. One approach for Germany was proposed by Kassenboehmer and Schmidt (2011): They analyse data at the macro level from the German Federal Statistical Office combined with micro level data from the German SOEP (1991–2008) on the personal work situation and subjective feelings concerning several aspects of life. Employing the indicators suggested by the Stiglitz-Sen-Fitoussi-Report, they come to the result that much of the variation in many well-being measures can be captured well by the hard economic indicators as used in the literature, especially by GDP and the unemployment rate. But they also see that these correlations are far from perfect, thus giving considerable hope that there is room for a broader statistical reporting.

Following and discussing the approach of Kassenboehmer and Schmidt (2011) in the next section it is tried to discuss indicators that predominantly determine the quality of life. As this is also done in Oltmanns, Braakmann and Schmidt (2012), the focus is set on analysing the differences that result from the enlarged database.

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<sup>1</sup> See OECD (2013), p. 20.

<sup>2</sup> The Conseil d’Analyse Economique is the French counterpart to the German Council of Economic Experts.

<sup>3</sup> See Study Commission on Growth, Well-being and Quality of Life (2013).

### 3 Data: German Socio-Economic Panel (SOEP)

The first step to search for indicators that determine the satisfaction with life is to find an appropriate data base. For instance, results from EU-SILC could be used. The advantage of this survey is that it covers many European countries.<sup>1</sup> On the other side, it is the aim of this study to begin with the results of Kassenboehmer and Schmidt (2011). As they use data from the German Socio-Economic Panel (SOEP), it is self-evident also to use these data.

**Table 1: Subsamples of the SOEP 2011<sup>2</sup>**

Sample	Start-Year	Households	Persons	Description
A West-German residents	1984			Head is either German or other nationality than those in Sample B
B Foreigners	1984	2,539	4,451	Head is either Turkish, Italian, Spanish, Greek or from the former Yugoslavia
C East-Germans	1990	1,355	2,392	Head was a citizen of the GDR (expansion of survey territory)
D Immigrants	1994 / 1995	266	461	At least one household member has moved to Germany after 1989 (expansion of survey population)
E Refreshment	1998	545	961	Random sample covering all existing subsamples (total population)
F Innovation	2000	2,885	4,984	Random sample covering all existing subsamples (total population)
G High Income	2002	706	1,358	Monthly net household income is more than 4.500 Euro (7.500 DM)
H Refreshment	2006	858	1,478	Random sample covering all existing subsamples (total population)
I Incentive	2009	-	-	Random sample covering all existing subsamples (total population); since 2011 part of the SOEP Innovation Sample (SOEP-IS) <sup>3</sup>
J Refreshment	2011	3136	5161	Random sample covering all existing subsamples (total population) <sup>4</sup>

The SOEP is a longitudinal panel dataset of the population in Germany that started in 1984.<sup>5</sup> It is a household based study which re-interviews adult household members annually. Altogether, the panel consists of nine subsamples: The survey began in 1984 with two subsam-

<sup>1</sup> Frick, J and K. Krell (2011) compare EU-SILC and the SOEP concerning income analysis for Germany.

<sup>2</sup> The figures concern to the number of successful interviews in 2011. See Kroh, M. (2014), p. 6 – 12.

<sup>3</sup> See Frick, J. and I. Sieber (2012), p.3

<sup>4</sup> See [http://www.diw.de/en/diw\\_01.c.390440.en/soep\\_is.html](http://www.diw.de/en/diw_01.c.390440.en/soep_is.html).

<sup>5</sup> For a description of the SOEP see Haisken-DeNew, J. P. and J. Frick (2005), Wagner, Gert G., Joachim R. Frick and Jürgen Schupp (2007) and [http://en.wikipedia.org/wiki/Socio-Economic\\_Panel](http://en.wikipedia.org/wiki/Socio-Economic_Panel).

ples: West German residents (subsample “A”) and the subsample “B” of households with a head from a foreign country. After the German reunification they were supplemented by the subsample “C” with East German residents. In the following years these were supplemented by the subsamples “D” to “H” to consider the role of immigrants in Germany or to refresh the samples. The last subsamples “J” and “K” were introduced in 2011 and 2012.<sup>1</sup> The subsamples are described in Table 1. In 2011, there were about 12,000 households, and more than 21,000 adult persons inquired.

**Table 2: Variables of the estimated models<sup>2</sup>**

Variable	Description	Unit/Code/Remarks
SATLIFE	Satisfaction with life at today	0-low to 10-high
SATHEALTH	Satisfaction with health	
SATWORK	Satisfaction with work	
WORRYECON	Worried about economic development	1 Very concerned
WORRYECSIT	Worried about finances	2 Somewhat concerned
WORRYENV	Worried about environment	3 Not concerned
WORRYJOB	Worried about job security	
WORRYPEACE	Worried about peacekeeping	
LABNET	Current net labour income	Euro ; generated variable
OVERTIME	Hours of overtime last month	Hours
UNEMPLYD	Registered unemployed	1 yes ; 2 no
EDUCATION	Amount of education or training in years	Number of years
YEARBIRTH	Year of birth	Year
MARITALSTATUS	Marital status in survey year	Nominal
NATION	Nationality	Nominal ; generated var.

The topics surveyed by the SOEP include questions concerning<sup>3</sup>

- Demography and housing,
- Personality traits und basic attitudes,
- Social capital and leisure time,
- Education,
- Labour market and employment
- Income, wealth and social security
- Health,
- Subjective indicators on social inclusion/exclusion (worries, satisfaction with life).

<sup>1</sup> Subsample K is neglected here, because only data until 2011 are used for the estimations.

<sup>2</sup> See Goebel, J. (2014a) and Goebel, J. (2014b).

<sup>3</sup> See Gert G.Wagner, Jan Goebel, Peter Krause, Rainer Pischner and Ingo Sieber (2008), p. 305.

SOEP data are integrated into the Cross National Equivalent File (CNEF) which contains panel data from Australia, Canada, Germany, Great Britain and the United States. The data distribution of the SOEP for researchers outside of Germany is supplied with the CNEF by a group at Cornell University.

## 4 Method

### 4.1 The basic set of indicators

As it is an intention of this paper to discuss the results of Kassenboehmer and Schmidt (2011) the selection of indicators used for the estimated models is widely determined by their approach. All in all they have twelve variables for their investigation on the micro-level. These are shown in Table 2 on page 9.<sup>1</sup>

The variable SATLIFE represents general satisfaction with life. It is measured on a scale from 0 ("low") to 10 ("high"). On the same scale the variables SATHEALTH ("Satisfaction with health") and SATWORK ("Satisfaction with work") are measured. These variables represent so-called areas of satisfaction.

Five indicators describe special worries, ranging from individual worry about own finances and job security to rather general worries about environment and peace. These indicators are measured on a scale from 1 ("very concerned") to 3 ("not concerned").

The indicator LABNET represents the current net labour income. It is a so-called generated variable.<sup>2</sup> This variable is measured in Euro. The further variables used by Kassenboehmer and Schmidt (2011) are OVERTIME, UNEMPLYD and EDUCATION.

The variable YEARBIRTH is no part of the investigation of Kassenboehmer and Schmidt (2011). In this study the meaning of this variable is twofold. First of all, it is used to include only adults into the dataset. Secondly, YEARBIRTH serves as a control variable for some models to be estimated later. The other control variables are MARITALSTATUS and NATION. MARITALSTATUS is a variable empirically measured and NATION is a generated variable.

### 4.2 Estimation technique

There are several methodological approaches to investigate the question what kind of indicators determines the quality of live.

Kassenboehmer and Schmidt (2011) carry out their analysis using principal component factor analysis. It is the aim of the factor analysis to reduce the number of variables to a set of hypothetical variables, the so-called *factors*. Especially, in their paper the observed variables income, unemployment etc. is supposed to be presented by a smaller number of variables.

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<sup>1</sup> Kassenboehmer and Schmidt (2011) have also an approach based on macro-data with partly different variables. For instance, they use GDP instead of (monthly) labour income, unemployment rate instead of the dummy for unemployment. But this approach on the macro-level is not investigated here.

<sup>2</sup> Generated variables are no part of the SOEP-survey. They supplement the survey data to facilitate the analysis.

Then, applying statistical measures it would be possible to select observed variables that are appropriate to represent the *dimensions* of wealth.

Factor analysis serves as a tool to reduce dimensions (of the data). It is a linear model between factors and variables. Because of the high number of unknown parameters the general model of factor analysis is not without ambiguity and problems of identification concerning the problem of communalities, the problem of rotation or the number of variables to be extracted. These problems are an integral part of the factor analysis and they only can be solved by introducing very restrictive assumptions. For this reason, the factors found by the factor analysis should not be interpreted as determining variables, but rather as variables that condense the information contained in the data. To find causalities between variables it would be useful to apply other methods.

First of all, it is possible to use the classical multiple linear regression model. The advantage of the multiple regression model can be described as follows: "The linear regression model is the single most useful tool in the econometrician kit. Although to an increasing degree in contemporary research it is often only the departure point for the full analysis, it remains the device used to begin all empirical research. And, it is the lens through which relationships among variables are usually viewed." (Greene, W., 2012, p. 52) The linear regression model can be estimated with the pooled data from 1991 to 2009 or with data for single years.

One of the assumptions of the linear regression model are normal distributed residuals and homoscedasticity of the residuals. This implies that the variables of the model, especially the dependent variable, are also normally distributed and of a quantitative nature. But almost all variables described above do not hold this assumption. They are the result of an ordered choice measured on different scales. "The numerical values are only a ranking, not a quantitative measure. Thus a "1" is greater than a "0" in a qualitative sense, but not by one unit, and the difference between a "2" and a "1" is not the same as that between a "1" and a "0"." (Greene, W., 2012, p. 722). To consider the shortcomings of the linear regression model it would be useful to apply logit or probit models. On the other hand, SATLIFE, the variable to be predicted, is measured on a scale from "0" to "10", which implies a binomial distribution for the sample. The discrete binomial distribution converges to the normal distribution for big samples. So, the assumptions of the linear regression model may be fulfilled asymptotically and the linear regression model could lead to useful results. Hajek, A. (2011) argues that the question if the satisfaction with life should be measured on an ordered scale or on an continuous scale has no clear answer. Psychologist and sociologist would treat satisfaction with life as continuous using OLS-regressions (Kahneman, Diener and Schwarz, 1999) whereas economists would apply ordered response models based on the assumption of an ordinal variable (for instance, Ferrer-i-Carbonell and Fritjers, 2004). Furthermore, Ferrer-i-Carbonell and Fritjers (2004) and Blanchflower (2009) would argue, that it does not matter if satisfaction with life is treated as ordinal or continuous.

In this paper the analysis predominantly uses OLS regressions. First of all, a detailed analysis is done for 2011. Then, the results of 2011 are compared with the results for the years 1991 and 2001. Hereafter, the regression is carried out with the pooled data from 1991 to 2011.

**Table 3: Descriptive statistics. Data for 2011**

Variable	N	Arithmetic mean	Standard deviation	Minimum	Maximum
SATLIFE	18182	6.91	1.77	0.00	10.00
SATHEALTH	18206	6.51	2.20	0.00	10.00
SATWORK	10919	6.83	2.18	0.00	10.00
WORRYECON	18170	1.62	0.59	1.00	3.00
WORRYECSIT	18158	2.02	0.69	1.00	3.00
WORRYENV	18160	1.88	0.62	1.00	3.00
WORRYJOB	10450	2.31	0.71	1.00	3.00
WORRYPEACE	18170	1.86	0.67	1.00	3.00
LABNET	18237	917.58	1262.84	0.00	20000.00
OVERTIME	4301	18.97	17.32	1.00	99.00
UNEMPLOYD	18237	1.94	0.24	-1.00	2.00
EDUCATION	17046	12.26	2.71	7.00	18
YEARBIRTH (Age)	18237	51,89	17.65	18	99
		Value		N	%
MARITALSTATUS	Married, live together			12413	58.92
	Married, live separated			380	1.80
	Single			4933	23.41
	Divorced			1783	8.46
	Widowed			1512	7.18
	Total			21021	100.00
NATION	Germany			20262	94.97
	Turkey			256	1.20
	Italy			165	0.77
	Greece			79	0.37
	Croatia			70	0.33
	Austria			40	0.19
	Spain			34	0.16
	Others			430	2.02
	Total			21336	100.00

## 5 Empirical results

### 5.1 Descriptive Analysis of the indicators

Table 3 shows some descriptive information about the indicators used for the estimates of the models for 2011. MARITALSTATUS and NATION are nominal variables. Therefore, only absolute and relative frequencies are calculated. Both variables are shown here divided by subcategories. All subcategories for MARITALSTATUS are listed, but for NATION only the most frequently categories. For the purpose of regression estimates both variables are transformed to dummy variables with “Married, live together” = 1/“Otherwise” = 0 and “Germany” = 1/“Otherwise” = 0. The results differ slightly from those of Oltmanns, Braakmann and

Schmidt (2012). But the differences are far away from yielding substantial opportunities for interpretation.

**Table 4: Correlation coefficients of the variables (Bravais-Pearson) 2011**

	SATLIFE	SATHEALTH	SATWORK	WORRYECON	WORRYECSIT	WORRYENV	WORRYJOB	WORRYPEACE	LABNET	OVERTIME	UNEMPLYD	EDUCATION	YEARBIRTH
SATLIFE	1.000	0.504	0.455	0.131	0.362	0.020	0.043	0.269	0.017	-0.008	0.176	0.028	0.053
SATHEALTH	0.504	1.000	0.396	0.104	0.161	0.070	0.085	0.140	0.017	-0.002	0.056	0.028	0.325
SATWORK	0.455	0.396	1.000	0.105	0.289	0.018	0.036	0.294	0.018	-0.027	0.214	0.028	0.068
WORRYECON	0.131	0.104	0.105	1.000	0.347	0.260	0.267	0.224	0.001	-0.012	0.026	0.007	0.094
WORRYECSIT	0.362	0.161	0.289	0.347	1.000	0.095	0.188	0.512	0.033	0.018	0.195	0.049	-0.155
WORRYENV	0.020	0.070	0.018	0.260	0.095	1.000	0.473	0.047	-0.005	0.025	-0.003	-0.005	0.078
WORRYJOB	0.043	0.085	0.036	0.267	0.188	0.473	1.000	0.128	0.017	0.049	0.022	0.008	0.091
WORRYPEACE	0.269	0.140	0.294	0.224	0.512	0.047	0.128	1.000	0.027	0.005	0.099	0.041	-0.098
LABNET	0.017	0.017	0.018	0.001	0.033	-0.005	0.017	0.027	1.000	0.011	0.022	0.357	0.002
OVERTIME	-0.008	-0.002	-0.027	-0.012	0.018	0.025	0.049	0.005	0.011	1.000	0.034	0.015	-0.059
UNEMPLYD	0.176	0.056	0.214	0.026	0.195	-0.003	0.022	0.099	0.022	0.034	1.000	0.009	-0.110
EDUCATION	0.028	0.028	0.028	0.007	0.049	-0.005	0.008	0.041	0.357	0.015	0.009	1.000	-0.013
YEARBIRTH	0.053	0.325	0.068	0.094	-0.155	0.078	0.091	-0.098	0.002	-0.059	-0.110	-0.013	1.000

## 5.2 Correlation of indicators

In Table 4 the correlation between the variables for 2011 is shown. All variables are treated as numeric. Therefore the correlation coefficient of Bravais-Pearson was pairwise calculated. The calculation of the correlation coefficient of Spearman that would be more appropriate for ordered data led to similar results. Compared to Oltmanns, Braakmann and Schmidt (2012) the interpretation of results has not changed.

Altogether, the correlations between the variables are not very strong. None of the values exceeds 0.6 and only a few are higher than 0.4. For the purpose of regression analysis this result has its advantage. Poor correlation between the variables can mean that the variables are appropriate to explain the behaviour (or deviation) of the dependent variable.

Only some of the variables show a correlation that should be expected. There is a pairwise correlation between SATLIFE, SATHEALTH, SATWORK and WORRYECSIT and also a correlation between EDUCATION and LABNET. On the other side, the lack of correlation between



some variables is far from intuition. For instance, it should be clear that there is a strong relationship between the year of birth and income or between income and the hours of overtime. But both parameters are near zero.

### 5.3 Cross-sectional evidence

In general, the investigation of cross-sectional evidence starts with all variables used by Kassenboehmer and Schmidt (2011). But including the variable UNEMPLYD makes it necessary to group the regression equations. If the status of UNEMPLYD is "YES", it is not very useful to include the variables LABNET, WORRYJOB and OVERTIME. Therefore, the estimates are grouped by UNEMPLYD and the variables mentioned are skipped for UNEMPLYD = "Yes".

The results of the grouped regressions are shown in Table a and b. Model 1 includes all variables of Kassenboehmer and Schmidt (2011) for the employed and the reduced set for the unemployed respectively. First of all, the groups have a lot in common. As shown by the F-value the models for both groups are significant. Satisfaction with health and work and the (absence of) worry about the own economic situation have a significant influence on the satisfaction with life, as well as the variable WORRYJOB for the group of the employed. For both groups the other variables have no significant influence on the satisfaction of life.

**Table 5a: Estimation results for grouped regression 2011**

Variable	Model 1: Full model		Model 2: Forward selection		Model 3: Backward selection		Model 4: Free-hand-selection	
	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
	Regression on SATLIFE ; UNEMPLYD = No							
Intercept	2.32452	<.0001	2.64654	<.0001	2.72356	<.0001	2.58885	<.0001
SATHEALTH	0.27829	<.0001	0.28375	<.0001	0.28913	<.0001	0.28766	<.0001
SATWORK	0.21469	<.0001	0.20027	<.0001	0.19166	<.0001	0.19241	<.0001
WORRYECON	-0.02423	0.5282						
WORRYECSIT	0.47314	<.0001	0.49289	<.0001	0.56989	<.0001	0.56621	<.0001
WORRYENV	-0.03647	0.3356	-0.09192	<.0001	-0.07716	0.0002		
WORRYJOB	0.14098	<.0001	0.10725	<.0001				
WORRYPEACE	-0.01735	0.6266						
LABNET	-0.00001	0.7624						
OVERTIME	0.00018	0.8746						
EDUCATION	0.01362	0.0853	-0.00065	0.8965				
F-Value (model)	231.94	<.0001	879.58	<.0001	1490.73	<.0001	1985.91	<.0001
Observations	3918		9128		10503		10513	

All in all, the results for Model 1 are unambiguous. But they differ substantially from the results for the year 2008 presented in Oltmanns, Braakmann and Schmidt (2012). For 2008 also the variables WORRYENV, WORRYPEACE and LABNET had a significant influence on satisfaction with life for the employed. And WORRYENV was significant for the group of the unemployed. To find an explanation for this change of parameters for these models is not straightforward. One could expect that changes in the explaining model occur stepwise. But

on the other hand, 2008 the bankruptcy of the *Lehman Brothers* took place and the great depression began.<sup>1</sup> And it is quite understandable that in the following years, including 2011, the focus is set on worries about the own economic situation.

**Table 5b: Estimation results for grouped regression 2011**

Variable	Model 1: Full model		Model 2: Forward selection		Model 3: Backward selection		Model 4: Free-hand-selection	
	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
	Regression on SATLIFE ; UNEMPLYD = Yes							
Intercept	2.51566	0.0001	2.76082	0.0001	2.23116	<.0001	2.23116	<.0001
SATHEALTH	0.25401	<.0001	0.23323	0.0004	0.24903	<.0001	0.24903	<.0001
SATWORK	0.15656	<.0001	0.16061	0.0015	0.15793	<.0001	0.15793	<.0001
WORRYECON	0.15183	0.4371	0.19420	0.4803				
WORRYECSIT	0.79793	<.0001	1.08200	<.0001	0.83755	<.0001	0.83755	<.0001
WORRYENV	-0.19860	0.3371	-0.20498	0.4698				
WORRYPEACE	-0.14711	0.4221	-0.18276	0.3459				
EDUCATION	0.01019	0.7729	-0.24350	0.3272				
F-Value (model)	16.98	<.0001	9.24	<.0001	43.32	<.0001	43.32	<.0001
Observations	319		1088		344		344	

Model 2 and Model 3 are the result of automated model selection: forward selection and backward selection based on all variables of Model 1.<sup>2</sup> The model specifications are similar to the specification of Model 1, what means that SATHEALTH, SATWORK and WORRYECSIT have a significant influence. For the group of the unemployed the results of forward selection and backward selection are identical with Model 1. For the group of the employed the variable WORRYENV is included but has the wrong sign for both models (2 and 3). Additionally, Model 2 and Model 3 for the group of the employed differ by the variable WORRYJOB. This may be a result of the different techniques of model selection that are both based on the F-value of the model. Model 4 is the result of freehand selection. For both groups the same set of indicators was selected: SATHEALTH, SATWORK and WORRYECSIT.

Altogether, the results of the four models lead to a unique selection of variables. In all cases satisfaction with health, satisfaction with work and worries about the own economic situation seem to be important for satisfaction with life. As this result differs from the outcome of Oltmanns, Braakmann and Schmidt (2012), in the next chapter the reasons for these differences have to be discussed.

<sup>1</sup> Strictly spoken the great depression was sparked in 2007 by the U.S. Subprime mortgage crisis. But the exact point of time is not important here.

<sup>2</sup> The criterion to select or drop variables was the p-value of the F-statistics of the model. As a third automated method Stepwise selection was applied. Stepwise selection is not reported in Table , because it led to the same results as the backward selection. For a discussion of the problem of model selection see for instance Greene, W. (2012), p. 178 – 181.

## 5.4 Longitudinal results

To get longitudinal results, the estimates were repeated with data for 1992, 2001 and for the pooled data from 1992 to 2011.<sup>1</sup>

First of all, the approach of Oltmanns, Braakmann and Schmidt (2012) was kept. That means, that several control variables are added now: Age, marital status and nationality. Even, if these variables may have an influence on the quality of life they were not included before, because it was the intention to investigate the impact of the variables of Kassenboehmer and Schmidt (2011) exclusively. Now, in the following step it is not only the intention to investigate the longitudinal aspect of the estimates but also to try to improve the model specifications.

With these modifications in mind the results confirm the estimates of the previous chapter. For 1992, 2001 and 2011 as well as for the pooled data for 1992 to 2011 SATHEALTH, SATWORK, WORRYECSIT and WORRYJOB have a significant influence on the satisfaction with life. The influence of some other variables is ambiguous. For instance, WORRYECON is significant for 2001 and for the pooled data set, LABNET for 1992 and the pooled data.

**Table 6: Estimation results for 1992, 2001, 2011 and 1992 to 2011**

	Model 5: 1992		Model 6: 2001		Model 7: 2011		Model 8: 1992 – 2011 (pooled data)	
	Regression on SATLIFE ; UNEMPLYD = No							
Variable	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
Intercept	2.39347	<.0001	2.68566	<.0001	2.52446	<.0001	2.52046	<.0001
SATHEALTH	0.23888	<.0001	0.25313	<.0001	0.28522	<.0001	0.26597	<.0001
SATWORK	0.24454	<.0001	0.20513	<.0001	0.19919	<.0001	0.21073	<.0001
WORRYECON	-0.00736	0.7949	0.07349	0.0010	0.02096	0.4042	0.03864	<.0001
WORRYECSIT	0.48132	<.0001	0.50505	<.0001	0.50480	<.0001	0.50575	<.0001
WORRYENV	-0.02287	0.4530	-0.04751	0.0378	-0.04670	0.0569	-0.00814	0.0004
WORRYJOB	0.16800	<.0001	0.06485	0.0012	0.10847	<.0001	0.09409	<.0001
WORRYPEACE	-0.05595	0.0328	-0.06743	0.0012	-0.07543	0.0011	-0.08158	<.0001
LABNET	0.00011	<.0001	0.00002	0.1166	> -0.00001	0.8563	0.00002	<.0001
MARITALSTATUS	0.06943	0.0532	0.20830	<.0001	0.24813	<.0001	0.19216	<.0001
NATION	-0.30230	<.0001	-0.07000	0.0899	-0.04925	0.3855	-0.09452	<.0001
F-Value (model)	444.11	<.0001	643.13	<.0001	580.02	<.0001	10715.8	<.0001
Observations	7606		11984		9958		189551	

Additionally, there are some anomalies: WORRYPEACE is significant for all models but it has the wrong sign. And for the pooled data every variable is significant. As this is valid not only for the variables chosen for Model 8 but also for the variables that were investigated but skipped, this leads to the assumption that simple linear regression provides no appropriate

<sup>1</sup> 1992 instead of 1991 was chosen to avoid outliers due to the German unification.

model to fit the data. To clarify this issue, the regression estimates were supplemented by some fixed effects models. And to get an answer for the question what has happened from 2008 to 2011, the model for 2008 presented in Oltmanns, Braakmann and Schmidt (2012) was applied for the single years. But the results for both investigations were ambiguous and are not reported here.

## 5.5 Evaluation of results

The models presented in the previous chapter have identified several variables that predominantly determine the satisfaction with life. These variables show a significant influence on the satisfaction with life. The results hold for regression grouped by the status of employment, in the course of time and for the pooled data from 1992 to 2011.

The role of other variables is far away from a clear interpretation. For instance, the variable WORRYECON (worry about the economic development) is only significant for 2001 and for the pooled data. On the other hand, it has had a significant influence on satisfaction with life in 2008, as reported by Oltmanns, Braakmann and Schmidt (2012). The variable WORRYENV is significant in some cases and in other cases not. But in every estimate it has the wrong sign.

## 6 Conclusion

In this paper it was investigated which factors determine the satisfaction with life. A set of selected indicators was used to construct single equation regression models. The estimated models identified soft factors like satisfaction with health or satisfaction with work as well as the (absence of) worries about the own economic situation that predominantly determine the satisfaction with life.

Even if the results were unambiguous according to the selected variables it seems necessary to broaden the investigation. The longitudinal results show significant differences in the course of time, maybe due to the business cycle. Therefore, it would be useful to supplement the regression models by appropriate panel data models and to include variables reflecting the general economic situation. Also, the analysis should be broadened by including additional variables from the SOEP like "Satisfaction with friends and acquaintances" or "spare time activities" into the models.

The data from the SOEP refer to Germany only. The results achieved are not valid for other countries. Therefore, it would be useful to repeat the estimates with other data. Cause of its international coverage, the data from EU-SILC seem to be very useful here.

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