

# **An investigation into the relationship between subjective well-being and (relative) wealth in Germany**

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## Executive summary

While there is a vast body of literature linking subjective well-being to income indicators, we explore the role of wealth for subjective well-being in detail and begin to address the scarcity of literature in this area of research. We therefore develop a conceptual framework of subjective well-being, beginning with theoretical considerations related to the understanding of utility and subjective well-being in the history of economic thought. In doing so, we place this thesis in the long (though interrupted) economic tradition of studying *happiness* and argue for the return of the cardinal notion of utility. We rely on Bentham's notion of happiness and show that self-reports on happiness or life satisfaction are a useful measure of utility. We therefore develop a conceptual framework for subjective well-being derived from both economic and psychological concepts and argue that although this subjective measure cannot be regarded as fully cardinal, an econometric analysis that ignores the ordinal nature of this measure is nevertheless permissible. Based on these theoretical considerations we address the question of how private wealth relates to subjective well-being. To do so, we provide a comprehensive literature review of the relationship between wealth and subjective well-being by applying a new method. The method that we use makes use of an online archive finding and ensures that we can consider all available studies up to a certain point in time (and make them available to the reader via Internet links). We updated the existing studies in the World Database of Happiness and compiled a total of 161 research findings derived from 113 studies.

In summary, the major finding from our literature review is that, on average, affluent people are more satisfied with their lives as a whole than less affluent people. This difference in subjective well-being is partly due to changes in wealth, which in turn suggests a causal relationship. We expected to find that one's level of total debt correlates negatively with subjective well-being, and the results show that this is particularly the case for non-mortgage or unsecured debts. If, however, the debt is incurred for investments in a business or a house it is not necessarily negatively correlated with subjective well-being. Our literature review gives no indication as to whether financial assets or real assets are more important for subjective well-being. Moreover, the review indicates that there are no substantial differences between nations in the relationship between subjective well-being and wealth; however, it suggests that there are between different populations such as rural or urban populations, men and women, or young and old. These differences, however, are not systematic, which is why we cannot make a clear statement about the nature of the relationship between subjective well-being and wealth for the different populations.

Despite the evidence presented in the course of the literature review, the link between subjective well-being and various wealth components has mostly been neglected in published literature; this is not least because of a lack of suitable data on individuals'

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and households' wealth. Moreover, the reviewed literature does not reveal the relative importance to subjective well-being of wealth compared to income. We therefore investigate further the role of wealth for subjective well-being in Germany using panel micro-data from the German Wealth Survey (Panel on Household Finances -PHF) for 2010 and 2014. The PHF survey is a unique dataset because it is dedicated to measuring wealth at a very detailed level, it contains a self-reported measure of subjective well-being and it has a substantial panel component. We employ regression analysis to consider wealth and its different components such as real assets, financial assets, mortgage (secured) and non-mortgage (unsecured) debt. We use life satisfaction as an indicator for subjective well-being, which is asked on a classic 11-point scale: 'In general, how satisfied are you currently with your life as a whole?'

Our results indicate that wealth is important for life satisfaction. If it were not accounted for then an important explanatory factor for life satisfaction may be overlooked. However, our analysis does not allow conclusions to be drawn about the relative importance of income and wealth. The characteristics of income and wealth seem to be too different to compare – not least because income is a flow figure and wealth a stock figure. Our analysis also shows that the associations between life satisfaction and various asset and debt components differ. Moreover, our results suggest that wealth levels can have differing effects for different groups of people. We show, for example, that the preferences for income and wealth differ slightly between the East and West German populations. The distinction between people living in wealthy regions and those living in less wealthy regions shows that the relationship between life satisfaction, income and wealth is mainly driven by people living in less prosperous regions. We attribute this finding, at least partially, to comparison effects under the assumption that individuals are affected by other individuals in their region.

The results of our analysis regarding relative income confirm findings of previous studies, wherein the income of others was found to be negatively related to life satisfaction (Ferrer-i-Carbonell, 2005; Luttmer, 2005; Vendrik and Woltjer, 2007). Firstly, upward comparisons play a greater role for life satisfaction. A rise in the incomes of the respective reference group is on average associated with, *c.p.*, decreasing life satisfaction. This finding is referred to as the relative deprivation effect. Secondly, the results of the estimations for both the population in Germany and the various subgroups we consider indicate that the relative effect of income is typically of greater significance for life satisfaction than the absolute income effect. The result with respect to relative debt and life satisfaction is similar to that with respect to relative income.

In contrast, the evaluation of one's own total assets is less affected by the total assets of the people with whom one might compare oneself because the absolute effect of total assets is bigger than the relative effect on life satisfaction. Additionally, the positive correlation between life satisfaction and median total assets of the respective reference group can be interpreted as tunnel effect. Thus, the population looks into the future with confidence as the larger total assets of others are *not*, on average, negatively linked to the evaluation of life. As a consequence, though, a decline in the reference total assets is, *c.p.*, also accompanied by, on average, a decline in life satisfaction. This

holds for the whole population and, in particular, for younger people and people living in less affluent regions.

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*Happiness runs in a circular motion  
Thought is like a little boat upon the sea  
Everybody is a part of everything anyway  
You can have everything if you let yourself be.*

— Donovan: *Happiness Runs*

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# 1 Introduction

## 1.1 Problem background

The concept of cardinal utility, in the tradition of Jeremy Bentham (1789 [2000]), is a notion that is reliant on introspection, and is fundamentally focused on welfare outcomes. This conceptual view is primarily concerned with the question of how much utility a person derives from a particular decision. Bentham equates ‘utility’ with ‘happiness’, and assumes that individual happiness is a cardinal measure, which enables aggregation and interpersonal comparisons. Bentham offered no indication of what measurements of happiness there could possibly be, so in this context it is interesting to look at happiness research – which has become popular among economists over the last 40 years.

Happiness research has tended to focus on people’s self-reported well-being in various domains of life, as well as with life in general. To assess subjective well-being, one approach requires individuals to record their perceived life satisfaction – or happiness – on a numerical scale. This method is regarded by many economists as an appropriate proxy for utility (Frey, 2008, p. ix). Happiness research, however, remains troubled by two unresolved problems. Firstly, its relationship to various utility concepts in economic theory is not clear and rather inexplicit (cf., for example, Kahneman and Krueger, 2006). Secondly, since no standardised terminology exists for use in empirical analysis, including predefined definitions, the terms ‘subjective well-being’, ‘life satisfaction’ and ‘happiness’ are often used synonymously. This is, perhaps, in part because these concepts mean something very similar (see, for example, Easterlin, 2001). Despite these fundamental problems, thorough analysis has been done regarding the relationship between subjective well-being and several socio-demographic characteristics, such as age, gender, and marital status (cf, for example, Dolan et al., 2008), as well as the role of unemployment (cf, for example, Di Tella et al., 2001; Winkelmann and Winkelmann, 1998).

From an economic perspective, consumption and its effect on utility is of primary interest. It has led economists to focus, in particular, on the relationship between subjective well-being and income (cf., for example, Clark et al., 2008; Easterlin, 1995;

Frank, 2005; Wunder and Schwarze, 2009). The positive correlation found in these studies between subjective well-being and income can be explained by using classic microeconomic theory: an individual derives utility from consuming goods, which can be purchased using current income, saved income (i.e. accumulated wealth), or new debt. Thus, higher levels of income and wealth should lead to higher levels of subjective well-being (utility). On the micro-level, there is no doubt that higher levels of individual consumption (often approximated via income) lead, *ceteris paribus*, to higher levels of individual utility (approximated via life satisfaction) (cf., for example, Winkelmann and Winkelmann, 1998; Ravallion and Lokshin, 2002). Consequently, average life satisfaction in a society should always increase when the incomes of all rise.

Richard Easterlin was one of the first economists to link happiness data to income. He used data from surveys repeated over a number of years in the United States (US), by the Gallup Poll and the American National Opinion Research Centre, to compare US citizens' self-reported happiness over time (Easterlin, 1974). On the macro-level, contrary to expectation, Easterlin found no associated rise in reported happiness as the average level of US citizens' income rose considerably over time – this has become known as the 'Easterlin paradox.' In 1995, he confirmed this finding “with somewhat greater assurance than twenty years ago” (Easterlin, 1995, p. 35). Clark et al. (2008) echoed this finding using data from the US General Social Survey (GSS) over the period 1973-2004. Furthermore, a similar pattern has been observed in Japan, where the income of Japanese citizens rose substantially between 1958 and 1987, while the average level of happiness remained constant (Di Tella and MacCulloch, 2006, p. 26). Initially, the findings of Easterlin (1974), Clark et al. (2008) and Di Tella and MacCulloch (2006) appear to contradict the positive correlation between subjective well-being and income that many researchers have found.<sup>1</sup> It also raises a question over the validity of the assumption that a higher level of consumption leads to more utility.

James Duesenberry (1949) was possibly the first to econometrically formulate the relative income hypotheses in accordance with the model of interdependent preferences (Pollak, 1976). He also showed that people are influenced positively by the absolute level of their own income *and* negatively by the income level of others. This preliminary work by Duesenberry led economists to explain the Easterlin paradox by the existence of social comparisons. The underlying idea being that people compare their current income with the incomes of their peers, which in turn affects their subjective well-being (Clark et al., 2008).<sup>2</sup> Easterlin (1995, p. 35) argues that the positive effect of an

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<sup>1</sup>A good overview of this topic can be found in Cummins (2000).

<sup>2</sup>Moreover, Easterlin's findings support Brickman and Campbell's (1971) idea of a *hedonic treadmill*, according to which people get used to new circumstances (higher income) quite quickly and return

increase in income on subjective well-being is offset by the negative effect of a respective increase of incomes generally. One could also argue that an increase in income resulting from a change in people's behaviour may cause negative externalities, because other people feel relatively deprived (cf., for example, Luttmer, 2005; Frank, 1997).<sup>3</sup>

In brief, since empirical analysis in the field of happiness research does not use standardised terminology based on predefined definitions, the terms 'subjective well-being', 'life satisfaction' and 'happiness' are often used interchangeably (cf., for example, Easterlin, 2001). This may be a consequence of the fact that these concepts mean something very similar, are highly correlated, and they have similar covariates (cf., for example, Frank, 1999; Frey and Stutzer, 2000; Veenhoven, 1984). However, these definitions are not often explicitly clarified, nor is active consideration given to how these concepts relate to each other and whether they really have the same meaning. Consequently, the explanation of the underlying theoretical construct of subjective well-being that is missing leads to problems in classifying the results and drawing conclusions about the research interest actually pursued. Moreover, this terminological usage risks neglecting a potentially important problem with respect to people's self-reporting. For example, the formulation of the question 'How satisfied are you?' may yield a different response to the question 'How happy are you?' – despite the seemingly marginal difference – because different wordings may affect the relative weights of cognitive and affective evaluations in their responses (Andrews and McKennell, 1980).

Furthermore, most studies have focused only on one aspect of an individual's financial situation, namely an individual's income, such that their consumption levels are only partially captured (Weinzierl, 2005). Focusing exclusively on income and so ignoring measures beyond income, such as an individual's or household's wealth (financial assets, for example), may lead to misguided or false conclusions regarding the relation-

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to a certain basic level of subjective well-being (adaptation). This can also be understood as a set-point theory stating, in this particular case, that every person has an individual level of subjective well-being to which he or she will eventually either revert or ascend to (cf., for example, Fujita and Diener, 2005).

<sup>3</sup>Some studies, for example, by Hagerty and Veenhoven (2003) or Stevenson and Wolfers (2008) contest Easterlin's view on the basis of new and longer time series data on subjective well-being. They also claim that absolute levels of income and wealth increase subjective well-being, and also find little evidence for social comparisons in the US and across nations. Moreover, empirical evidence points to a stronger relationship between aggregated subjective well-being and average income in less affluent countries (cf., for example, Di Tella et al., 2003; Helliwell, 2003; Fahey and Smyth, 2004; Rehdanz and Maddison, 2005). Veenhoven (1991) argues that income is more important to subjective well-being when it helps to satisfy basic human needs. In the same vein, Richard Layard proposes a satiation point of happiness and declares that "once a country has over \$15,000 per head, its level of happiness appears to be independent of its income per head" (Layard, 2003, p. 17).

ship between utility and an individual's consumption levels (relative to others) (Clark et al., 2008). While there have been studies carried out on the relationship between subjective well-being and wealth of nations (cf., for example, Hagerty and Veenhoven, 2003; Schyns, 2002), the relationship between subjective well-being and individual or household wealth has only recently been studied and scarcely so (cf., for example, Brown et al., 2005; Headey and Wooden, 2004; Headey et al., 2008). In addition, the relationship between subjective well-being and absolute wealth (and its various components including assets and debt) is neither sufficiently or systematically researched nor documented. Furthermore, in economics, thus far, relative wealth has only been subject to investigation in a few studies, where the relevance of interpersonal comparisons based on wealth for subjective well-being was shown (Bertram-Hümmer and Baliki, 2015; Brown and Gray, 2016); however, the direction of the effect is unclear. Additionally, while we know quite well that people compare themselves with others, it is not clear in which situations, and most of all, with whom they make these comparisons.

## 1.2 Objectives and research design

In light of the described research gaps, and in order to gain a better understanding of the conditions of human well-being, in this thesis we investigate wealth in relation to subjective well-being. For the empirical analysis it is necessary to provide a conceptual-theoretical and terminological basis in advance, including a discussion about the chosen concepts of subjective well-being, wealth, and social comparisons in order to avoid any possible confusion (Chapter 2, cf., Figure 1.1). We further examine in detail the existing literature on this topic and the results of which are systematically presented (Chapter 3). This serves as a necessary starting point for the subsequent explorative empirical analysis, which we advance from both an absolute perspective and a relative perspective (Chapter 4). To be more precise, we firstly explore the association between subjective well-being and absolute wealth, and its various components. We then examine the mechanisms for interpersonal wealth comparisons, which have scarcely been explored in the literature so far.

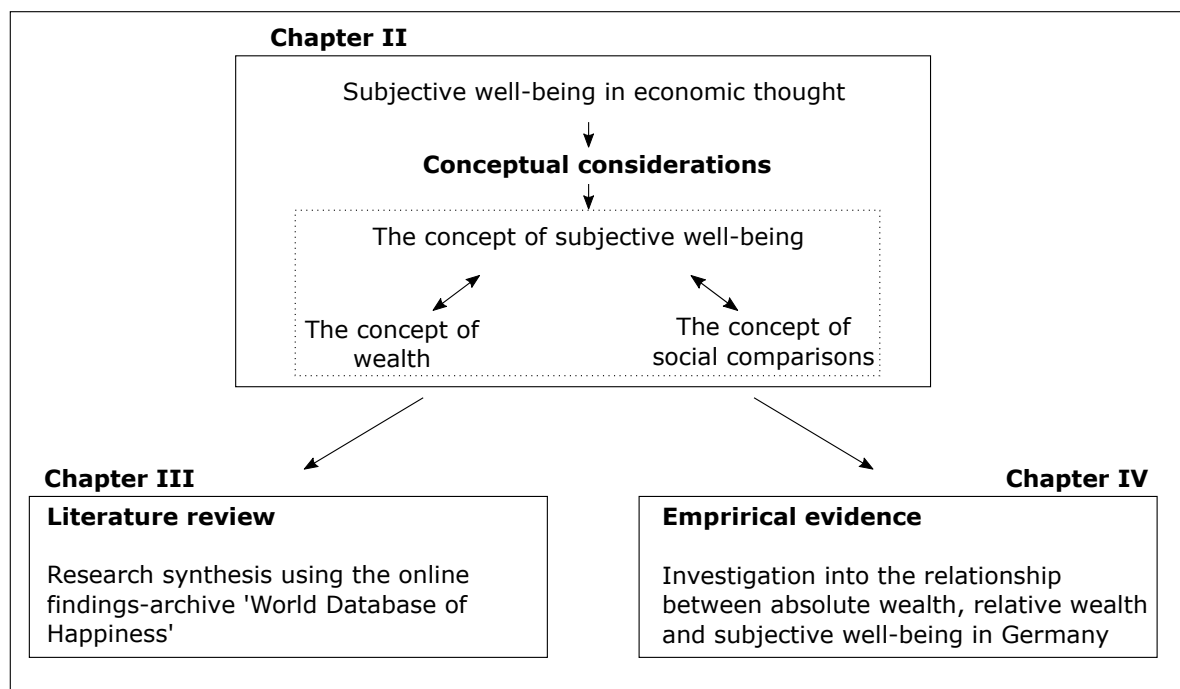
Given these objectives, we structure the thesis as follows: Chapter 2 serves as the starting point, where Section 2.1 includes theoretical considerations related to the understanding of utility and subjective well-being in the history of economic thought, including a discussion on the relationship between utility and subjective well-being. It helps to place this thesis in the long (though interrupted) economic tradition of studying *happiness*. We initially focus on Bentham's reflections on the cardinal concept of

utility and the need to investigate happiness as an adequate means of utility (Subsection 2.1.1). We then briefly trace the subsequent loss of the concept of happiness in the tradition of Bentham from the economic discourse over the 19th century, partly due to its unscientific nature (Subsection 2.1.2). The focus on ‘revealed preferences’ as a measure of ordinal utility led economists to leave behind the concept of cardinal utility. This only solved, however, the problems of Bentham’s approach by rejecting introspection and moving to revealed preferences, and still had its own issues, namely ignoring human psychology according to rational choice theory.

Therefore, the following Subsection 2.1.3 argues for the return of the cardinal notion of utility, relying on Bentham’s notion of happiness. Here we claim that self-reports on happiness or life satisfaction are a useful measure of utility, in part because they expand the ordinal notion of utility. Further, in Section 2.2 we explicitly link the concept of subjective well-being to the cardinal utility concept in the tradition of Bentham. Therefore, we explain and discuss the concept of subjective well-being in Subsection 2.2.1, and then develop an analytical framework for subjective well-being derived from both economic and psychological concepts. Furthermore, we argue that measures of subjective well-being are reliable and valid, and that although this subjective measure cannot be regarded as fully cardinal, an econometric analysis that ignores the ordinal nature of this measure is, nevertheless, permissible (Subsection 2.2.2). We further define what we mean by the term *wealth*, how it is defined and measured, and what possible correlations we expect with subjective well-being (Section 2.3). We finally explain in Section 2.4 the concept of social comparisons in an economic context and discuss potential correlations between subjective well-being and interpersonal wealth comparisons that are tentatively derived from theoretical considerations (see Subsection 2.4.1 and 2.4.2). This chapter forms the basis for the entire thesis, including for the subsequent literature review in Chapter 3, and for the empirical analyses in Chapter 4.

In Chapter 3 and 4 we address the question of how wealth relates to subjective well-being. Therefore, in Chapter 3 we conduct a comprehensive literature review using a new method, which we call ‘link-facilitated research synthesis.’ Because this type of research synthesis requires all of the results regarding a particular subject to be placed in an online findings archive in a comparable format, we use the World Database of Happiness and its so-called ‘finding pages’, which we explain in the Subsection 3.2.1. For this purpose, we updated the existing studies in the World Database of Happiness and compiled a total of 161 research findings from 113 studies. We then describe in Subsection 3.2.2 how we present all the research findings, and then show them in Section 3.3.



**Figure 1.1:** Research design of this study

Source: Own illustration.

In Chapter 4, we provide empirical evidence on household wealth in relation to subjective well-being. After specifying the research questions in Section 4.1, we describe our methodological approach in Section 4.2. For the analysis we use panel micro-data from the German Wealth Survey (Panel on Household Finances or ‘PHF’) for 2010 and 2014, which is explained in Section 4.3. In Section 4.4 we provide empirical evidence. To be more precise, in Subsection 4.4.1, we consider wealth and its different components, such as real assets, financial assets, secured and unsecured debt, and investigate how these correlate with our measure of subjective well-being, and life satisfaction specifically. Furthermore, we discuss how including wealth in our considerations affects the relationship between subjective well-being and income. We also focus on interpersonal *wealth comparisons*. We then investigate the importance to subjective well-being of household wealth relative to the wealth of other households (Subsection 4.4.2). Specifically, we analyse whether, and how, the wealth of an individual’s peer group, measured in terms of the same age-education-regional group, matters for their subjective well-being. Finally, we consider different sample splits to study whether relative wealth affects the subjective well-being of people differently over their life-cycle, or in different regions, such as wealthy and non-wealthy regions, or West and East Germany. In the final Chapter 5, we compare our results with those in published literature,

and draw overall conclusions from our findings, including new research questions or ‘ex post hypotheses’ derived from the exploration.

## 2 Subjective well-being, wealth and social comparisons: conceptual considerations

### 2.1 Subjective well-being in economic thought – the concepts of utility

#### 2.1.1 The concept of cardinal utility – or: a calculus of pleasure and pain

What Locke did, was to destroy the notion of innate ideas. What Newton did, was to throw light on one branch of science. But I have planted the tree of utility – I have planted it deep and, spread it wide (Bentham, 1843, vol. X: 588).

The Scottish philosopher David Hume held that moral action has the quality of creating happiness and that human beings, as social beings, “derive pleasure from the happiness of others”. Therefore, people should always act in such a way that the outcome of their behaviour increases the pleasure of both others and theirs (Montague, 1776 [1891], p. 5). In the early 19th century, the British moral philosopher and the founding father of modern utilitarianism, Jeremy Bentham, incorporated Hume’s thought into ‘the utilitarian system of morals’ and planted, as he put it, the ‘tree of utility’. Among other things, he equated *utility* with *happiness* and stated: “[b]y utility is meant that property in any object, whereby it tends to produce benefit, advantage, pleasure, good, or happiness, (all this in the present case comes to the same thing) or (what comes again to the same thing) to prevent the happening of mischief, pain, evil, or unhappiness to the party whose interest is considered: if that party be the community in general, then the happiness of the community: if a particular individual, then the happiness of that individual” (Bentham, 1789 [2000], p. 14 f.).

Having argued that the increase of happiness was a legitimate goal both in public institutions and in the realm of private morals, Bentham further suggested that the individual should act according to the ‘Greatest Happiness Principle’ or, as he later called it, the ‘Principle of Utility’ (Montague, 1776 [1891], p. 33). Even though the well-known phrase ‘Greatest Happiness for the Greatest Number’ does not appear in what is likely his most famous work, *An Introduction to the Principles of Morals and*

*Legislation*,<sup>1</sup> he stated, however, that “[e]thics at large may be defined, the art of directing men’s actions to the production of the *greatest possible quantity of happiness*, on the part of those whose interest is in view” (Bentham, 1789 [2000], p. 225, emphasis added).<sup>2</sup> Thus, according to Bentham’s approach, the utilitarian view can be understood as a form of consequentialism in the way that “one ought to maximize the overall good—that is, consider the good of others as well as one’s own good” (Driver, 2014).

Utilitarian thinking in the tradition of Bentham is based on a hedonistic quantifying notion of cardinal utility derived from an introspective appraisal. The whole concept of happiness, in turn, attempts to answer the question of *how much* utility or happiness an individual obtains from a decision he or she made. Bentham states that the assessment of happiness is to be based on, among others, the duration and intensity of individual pleasure and pain. In his view, it can be further understood as the balance of pleasure over pain (‘felicific calculus’ or ‘hedonic calculus’), which is, in turn, subject of measurement and of calculation. He implicitly assumed that individual utility (or happiness) can somehow be assessed, interpersonally compared, and finally aggregated. Despite the conceptual-cardinal understanding of happiness and its implications for the felicific calculus, the question of how to actually measure it remained unanswered.

Irrespective of his lack of a suitable measuring instrument, Bentham continued his considerations. He had already realised that if happiness depends on wealth, then the aggregate of happiness is reasonably dependent on how wealth is distributed. He argued that the more wealth is unequally distributed between two individuals, the lower is the ‘total mass of happiness’ (Bentham, 1843, vol. I: 305), justifying this with an extensive discussion of ‘diminishing marginal utility’ (Bentham, 1843, vol. I: 304-307; vol. III: 228-230). The British economist, William Stanley Jevons, took up Bentham’s thoughts and argued that in addition to the aggregation of happiness, marginal units of utility should be part of economic analysis also (Jevons, 1871 [1965]).<sup>3</sup> In his work, *The Evolution of Economic Ideas*, the British economic historian, Phyllis Deane, aptly summarised the period of the marginal revolution by stating that it “involved a wide-ranging transformation of the characteristic methodology of analytical economics by means of what was essentially a mathematical tool derived from calculus” (Deane, 1978, p. 95). As economics became more mathematical with the introduction of the marginal

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<sup>1</sup>His work, *An Introduction to the Principles of Morals and Legislation*, contains an analysis of the Principle of Utility.

<sup>2</sup>Bentham did not mention this phrase in his writing for at least 30 years after it appeared in his first extensive publication, *A fragment on Government*, in 1776 (Burns, 2005).

<sup>3</sup>Léon Walras and Carl Menger are also noteworthy economists of the marginal revolution, however, they cannot be called *hedonic economists*.

utility concept, for Bentham's happiness concept this simply meant a more rigorous analysis of a theoretical construct – still without having a measuring instrument.

There was, however, reasonable criticisms made of Bentham's whole concept of cardinal utility. Firstly, nobody – not even himself – knew how happiness could be measured.<sup>4</sup> Secondly, similar to the concerns of neoclassical economists, Bentham also realised there was a problem inherent to comparing quantities of happiness with the happiness of other individuals – once measured – and finally adding them up: “[t]is vain to talk of adding quantities which after the addition will continue to be as distinct as they were before; one man's happiness will never be another man's happiness: a gain to one man is no gain to another: you might as well pretend to add 20 apples to 20 pears” (cited in Halévy, 1928 [1972], p. 495). Thirdly, a very narrow interpretation of ‘cardinal’ and the scale of measurement would both require a natural (or at least identical) zero, as well as an identical unit of measurement for the happiness of all individuals under consideration (cf., Stevens, 1946).

The criticisms, made by numerous economists, such as Pareto (1900 [2007]), Hicks (1939), and Samuelson (1937), marked the beginning of the movement that rejected the concept of cardinal utility, or happiness, from the economic theory of the early 20<sup>th</sup> century. Coupled with the desire to make economics a science in its own right, as discussed by Jevons (1871 [1965], p. 3, 101), among others, it was probably inevitable that happiness, as a measure of introspective appraisal, disappeared from the focus of observation. The way was paved then for the ‘ordinal revolution’.

### 2.1.2 The concept of ordinal utility – or: the naked facts of choice

In reality and in the most general way, pure economic equations simply express the fact of a choice, and can be obtained independently of the notion of pleasure and pain. This is the most general point of view and also the most rigorous. [...] Pure economic equations and their consequences exist unchanged whether we start from the consideration of pleasure as a quantity, or we limit our investigation [...] exclusively to the fact of choice (Pareto, 1900 [2007], p. xxv).

The move towards the ordinal utility conception, and away from hedonic introspection within the cardinal utility conception, was mainly led by Vilfredo Pareto and is known as the ‘Paretian turn’. The concept of ordinal utility represents the view that

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<sup>4</sup>In order to measure pleasure and pain, the philosopher and economist, Francis Edgeworth, imagined a Hedonimeter, which is “an ideally perfect instrument, a psychophysical machine, continually registering the height of pleasure experienced by an individual” (Edgeworth, 1881, p. 101).

the utility of an outcome can be inferred by the rank order of people's choices. In other words, Pareto solved the problem of measuring happiness, or pleasure, as a requirement of economic analysis by simply ignoring it, stating: “[i]n order to examine general economic equilibrium, this measurement [of pleasure] is not necessary. It is sufficient to ascertain if one pleasure is larger or smaller than another. This is the only fact we need to build a theory” (Pareto, 1900 [2007], p. xxv). At a time when the views of the so-called ‘economic orthodoxy’ dominated, Pareto made his point even clearer, stating in a letter to the mathematician, Herman Laurent: “I am not interested in the reason why man is indifferent [between one thing and another]: I notice the pure and naked fact” (Pareto, 1899 [1989], p. 288).

Pareto, and his contemporaries, equated indifference curves with a certain level of utility as a “direct result of experience” (Georgescu-Roegen, 1999, p. 479) and did not associate this with any level of cardinal utility. The concept of indifference curves, which represent different quantities of two goods yielding the same level of utility, builds on rational choice theory. Rational choice theory, in turn, is based on the rational behaviour of individuals, who maximise their utility while utilising perfect information. If the strong assumption of rational behaviour holds, it would be sufficient to observe people's choices and build a rank order of these choices that would reflect the utility order at the same time, because only the rank order of people's choices is meaningful (Hicks, 1939; Houthakker, 1950; Robbins, 1932; Samuelson, 1937). Pareto's notion of ordinal utility and the concept of indifference curves shaped Samuelson's approach of *Revealed Preferences* (Samuelson, 1937) that, as observed in people's choices, reflect the utility of outcomes of rational individuals (Kahneman et al., 1997, p. 375). The term ‘ordinal utility’ is, however, a rather misleading one. Even if people were completely rational, which is unlikely, equating revealed preferences with ordinal utility is circular reasoning because no additional information is gained by rephrasing a preference order as a utility order (Alchian 1953: p. 31, Robinson 1962: p. 47).

According to rational choice theory, the choices that individuals make based on their own preferences, which are meant to be time-invariant, however, are not always consistent (Thaler, 2016). Given the inconsistency of people's choices, revealed preferences are sufficient in some areas, for example, for demand theorists when explaining how consumer choice translates into price. However, restricting economic analysis to observed behaviour still entails fundamental limitations, which are summarised by Hirschauer et al. (2015, p. 651): firstly, the available set of actions from which an individual can choose is defined by the subjective perception of an individual. If people are ‘boundedly rational’ (Simon, 1957), and if their preferences are subject to change over time (Tver-

sky et al., 1990), then their revealed preferences neither reflect their true preferences at the time of decision nor the utility they eventually experience (cf. Dolan and Kahneman, 2008; Kahneman and Thaler, 2006). Secondly, being limited, by definition, to the observation of behaviour, the revealed preference approach is not able to provide ex ante decision support in terms of expected utilities linked to individual choices. Thirdly, when employing the revealed preference approach to evaluate different policy measures aimed at promoting collectively rational choices, a discrimination among these measures is impossible if one restricts oneself to the observation of choices that people make in a certain institutional environment (Binmore, 2009; Harsanyi, 1955). “[A] preference order that is revealed in one decision environment (e.g. no seatbelt laws) provides no indication whatsoever of the social net effect of a different environment (e.g. compulsory seat belt legislation). Instead, the behaviorist analyst is reduced to having to state that different choices can be observed in different contexts” (Hirschauer et al., 2015, p. 651).

At first glance, it seems that the concept of ordinal utility solves the problem with measuring and comparing utility by rejecting introspection and moving toward revealed preferences, which in turn are equated to the utility an individual derives from their choices. There are, however, a number of arguments why a preference order neither necessarily equals a utility order nor is suitable for individual support or policy impact assessment. Apart from that, there is another fundamental weakness of the ordinal utility conception, which is that according to rational choice theory, human psychology is completely ignored (Sen, 1997, p. 442). This means that decisions are neither questioned nor judged, as preferences are generally assumed to be stable, and therefore not part of the analysis (Robinson, 1962). As is often claimed, however, it is important to consider the reasons for different choices in order to investigate and understand human behaviour (Bruni and Sugden, 2007; Camerer and Loewenstein, 2004; Kahneman et al., 1999; Rabin, 1998, 2002). Given the criticism of neoclassical choice theory coupled with this fundamental weakness to ignore psychology in decision making, the reintroduction of introspection into economic thought was inevitable.

### **2.1.3 The move back to hedonic introspection – or: back to Bentham?!**

The measurable concept of happiness or life satisfaction allows us to proxy the concept of utility in a satisfactory way. It proposes the opposite of something that was considered a revolution in the 1930s, when Sir John Hicks, Lord Lionel Robbins, and others claimed that utility cannot and need not be measured (Frey, 2008, p. ix).

Classical economists like Bentham saw the *greatest happiness for the greatest number* as a desirable goal of society. He and his contemporaries equated the concept of happiness with utility, the assessment of which is based on hedonic introspection. The problem was, among other things, that it was far from clear how to measure happiness. With the move to the ordinal utility conception, the question of the measurability of happiness or utility did not arise further, since utility could be derived directly from the decisions of the individuals. As a consequence, Bentham's conception of happiness lost its meaning and received no more attention; particularly, on the grounds that happiness is not (and does not have to be) measurable. However, even the ordinal utility conception was not free of problems. It attracted considerable amounts of criticism owing to one of its central assumptions: that the decision maker is rational. Consequently, the psychological component of *why* individuals make certain choices was completely ignored during the ordinal revolution, which is one reason why the order of revealed preferences does not necessarily reflect the order of utility. This, in turn, led to another paradigm shift by economists over the past 40 years, leading back to the consideration of introspection.

In this context, it is informative to examine modern happiness research, which has become popular with economists mainly through the work of economist Richard Easterlin (1974). Happiness research in economics is often based on the self-assessment of people's well-being in different areas of life, or with life in general. People are asked about their happiness or life satisfaction, and are required to record their answer on a numerical scale in order to obtain a quantitative measurement. Bok, for example, interpreted measures of subjective well-being as an operationalisation of Bentham's felicific calculus and explicitly links the past and the present. "Neither he [Bentham] nor his supporters could explain how to measure the intensity and the duration of pleasures and pains let alone how to aggregate the myriad sensations experienced by millions of citizens in order to determine the net effect of legislative proposals. As a result, his felicific calculus remained for many decades a subject suitable only for abstract discussions [...]. In the last 35 years, however, psychologists and economists in growing numbers have tried to overcome the problems of measuring happiness by the simple device of asking people directly [...] how satisfied [...] they are with the lives they are leading" (Bok, 2010, p. 5).

In contrast to Bentham, who used the terms 'happiness' and 'utility' in a theoretical construct, in modern happiness research the terms 'happiness' and 'life satisfaction' are used as umbrella terms for various manifest variables that serve to assess subjective well-being. In other words, these manifest variables, such as differently formulated



and scaled happiness or life satisfaction questions in surveys, are used as reflective measurement instruments for the theoretical construct of subjective well-being. Both Bentham's happiness (or utility) and subjective well-being are based on psychological hedonic introspection, and therefore they are similar, but possibly not identical, theoretical constructs. Any differences that may exist, however, cannot be determined precisely, since Bentham did not say anything about operationalising the measurement.

In this thesis, we follow Bok (2010) by relating self-reported well-being to the concept of cardinal utility in the tradition of Bentham. The utilitarian view led to self-reported measures on well-being analysed on the basis of the concept of utility, namely through specifying a so-called 'micro-econometric subjective well-being function' (Frey and Stutzer, 2002, p.406). In doing so, it is assumed that the concept of subjective well-being measured through happiness or life satisfaction corresponds to the economic concept of cardinal utility (Frank, 1997, p.1832).

In the following Section 2.2, we develop a framework to delineate the various terms used in happiness economics, which we base on literature pertaining to the economic and psychological elements of subjective well-being. We also discuss the reliability and validity of self-reported subjective well-being measurements, and why these measurements and their (econometric) analysis are satisfactory in spite of its problems.

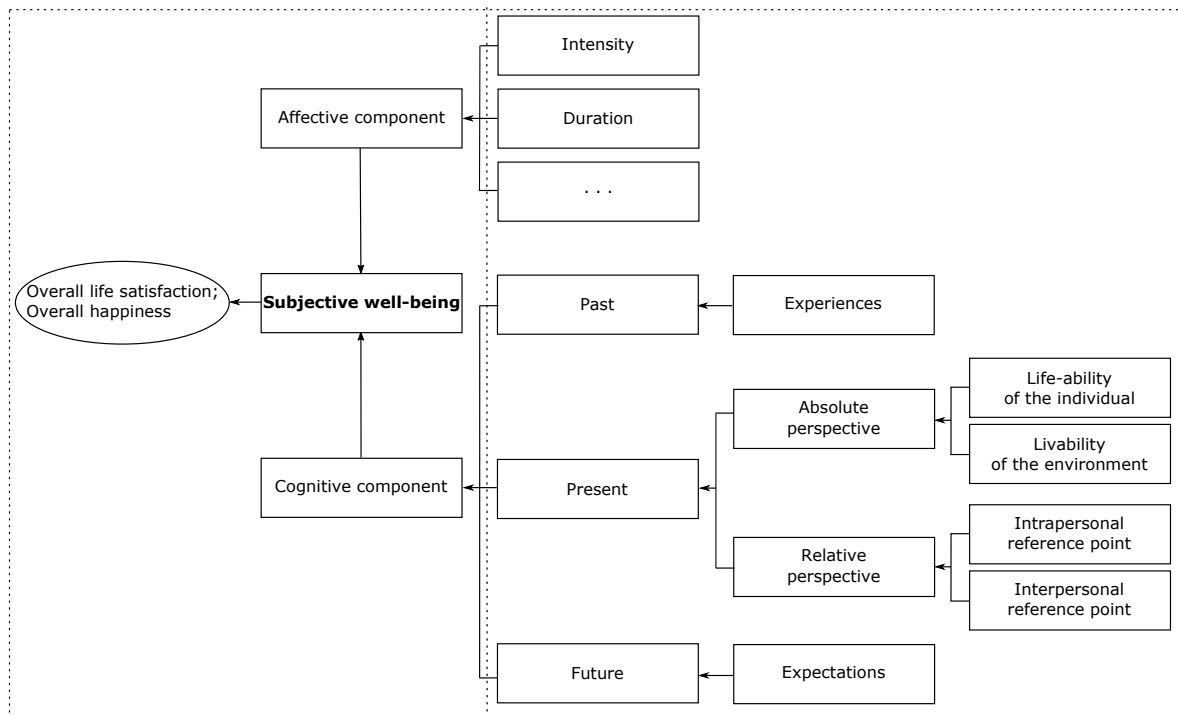
## 2.2 The concept of subjective well-being

### 2.2.1 Analytical framework

Often economists base empirical happiness research on psychological concepts of subjective well-being, since they are the empirical counterpart to the theoretical utility concept (Frank, 1997, p.1832). In psychological literature, it is customary to speak of *well-being* rather than *utility*. Furthermore, as well-being is based on hedonic introspection, and thus defined by the individual herself, the term is refined to *subjective well-being*.<sup>5</sup> Diener (2006, p. 399 f.) defines subjective well-being as "all of the various types of evaluations, both positive and negative, that people make of their lives. It includes reflective cognitive evaluations, such as life satisfaction and work satisfaction, interest and engagement, and affective reactions to life events, such as joy and sadness". We rely, among other things, on Diener's definition and use it as a basis in order to develop a framework that is shown in Figure 2.1.

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<sup>5</sup>Well-being can also be assessed by objective measures including, for example, laughter, or, in general, with the help of methods within neuroscience.

**Figure 2.1:** Analytical framework

Source: Own illustration.

The psychologist Diener (2006) has proposed that both the *affective* and the *cognitive component* are involved in the evaluation process, which means that an overall assessment of life is typically based on two sources of information. Firstly, how well do we feel most of the time? Secondly, to what extent do we perceive that we get from life that we want from it (Veenhoven, 1984, p. 25-27)? In order to understand these two different components of the whole evaluation process, it is important to be clear that they do not necessarily lead to the same outcomes (cf., for example, Andrews and Withey, 1976; Lawton, 1983; Veenhoven, 1984). For example, a person may have received everything they wanted from life, but still find that they usually feel rather unhappy, and vice versa. However, what seems counter-intuitive initially is not necessarily: whereas the affective component is based on moods and feelings,<sup>6</sup> the cognitive component within an evaluation process is more challenging because it requires reflection on life in general, including its several domains (Veenhoven, 1984, p. 26). A divergence of the results of affective and cognitive evaluation is partly due to the evaluation of different time periods over which respondents are considering their well-being (Luhmann et al., 2012). While affective well-being can be conceived as a

<sup>6</sup>The affective component is also referred to as ‘affect balance’. It indicates the degree to which positive affect predominates over negative affect (Bradburn, 1969, p. 53-70).

subjective evaluation of people's most recent activities and events, cognitive well-being can be conceived as a subjective evaluation of people's life in general.

Economists often use the terms 'life satisfaction' and 'happiness' synonymously in their scientific work. They assume that both terms mean the same thing, namely the reflection of the broad and continuing circumstances of an individual's life. In psychology, however, 'life satisfaction' and 'happiness' represent different aspects of subjective well-being. This is thoroughly discussed in literature on the topic, including that the affective and cognitive components manifest differently in an individual's assessment of their subjective well-being – in that, the effect of each depends on the choice of words that are used to ask respondents about their subjective well-being (cf., for example, Diener et al., 1999). Consequently, as economists subsume subjective well-being – measured by both life satisfaction and happiness – under the concept of utility, the differentiation between the different judgment processes – cognitive and affective – becomes unclear. While questions about 'life satisfaction' tend to address the cognitive-judgemental aspect, the question on happiness instead addresses the emotional and affective aspects within the whole evaluation process (Campbell et al., 1976; Organ and Near, 1985; McKennell, 1978; McKennell and Andrews, 1980; Andrews and McKennell, 1980; Diener et al., 1985).

This is also reflected in literature, in which it is demonstrated that responses systematically differ across individuals, depending on whether 'life satisfaction' or 'happiness' was subject of the questioning (Schwarz, 1999). These differences are explained by the less evaluative and less reflective nature of the responses to the happiness question (cf., for example, Diener et al., 1999; Helliwell and Putnam, 2004), but they are still closely related to those to the life satisfaction question and may not actually differ substantially (McKennell et al., 1980; Crooker and Near, 1998). Since the differences in the responses to the questions about happiness and life satisfaction are very small and systematic, in this thesis we use both happiness and life satisfaction as manifest variables of subjective well-being (cf. Figure 2.1). Regardless of whether the question is about life satisfaction or happiness, this suggests a stronger focus on the cognitive component within the evaluation process and, compared to momentary feelings, a longer-term perspective of subjective well-being (Diener, 2009a).

By asking respondents about their life satisfaction, the participants make the evaluation in terms of their *past*, *present* and *future* because it is based on remembered experiences, the individual's current situation and prospects and expectations for the future (Helliwell and Barrington-Leigh, 2010, p. 732). Diener (2009a, p. 42) claims that "people must search for information in memory and perform computations on that

information in order to give a report in acceptable form. [...] People must construct an answer to self-report measures based on information stored in memory.” Thus, what people have experienced in the past, to some extent influences the evaluation of life as a whole. It has been shown that when a series of questions is asked of people regarding various phases of their life, those questions which are asked prior to others can influence the evaluation of subjective well-being for other phases (or for life as a whole) when these are the subject of subsequent questions (cf., for example, Schwarz and Strack, 1991). This occurs because various events recalled through the process of questioning, which may not have been so present before, then interact with the perception the individual has of another life domain, or life as a whole, to which they are later asked to direct their attention (Diener, 2009a, p. 43).

Additionally, the respondents inevitably include future expectations, such as hope, fears and worries, in the evaluation process of their lives. While Bailey et al. (2007) show in their study that hope and optimism is associated with life satisfaction, the results of a study by Piper (2014) point to the strong role fear and pessimism have over an individual’s perception of the future, and their life satisfaction. He shows, for example, that being pessimistic about the future is more strongly associated with life satisfaction (with a negative effect) than being unemployed.

The situation for a respondent at the time of questioning or evaluation – their present situation at that time – also explains subjective well-being to a large extent. Additionally, the individuals take both an absolute and a relative perspective in evaluating their own conditions of life (Diener, 1984). With respect to the absolute perspective, Veenhoven (2013) divided components of subjective well-being into *life-ability of the individual* and *liveability of the environment*.<sup>7</sup> He defines life-ability for the individual as characteristics (or conditions) of their life, such as income, health, and education etc. Considering individual characteristics alone is, however, not enough to draw conclusions about an individual’s subjective well-being. We gain a more comprehensive picture of an individual’s subjective well-being if the liveability of the environment is also taken into consideration, namely the living conditions of the region in which they live, including, for example, economic, social, and ecological aspects. As such, we

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<sup>7</sup>In his paper, Veenhoven (2013) does not use the term ‘subjective well-being’. He rather focusses on ‘quality of life’ as its own concept. The distinction between life-ability and liveability, however, seems to be of practical use when it comes to the concept of subjective well-being too. Moreover, in recent years, various well-being measures that are intended to gauge quality of life have been suggested (e.g., Glatzer, 2015). In particular, the subjective well-being approach has been proposed as being suitable in this context (Stiglitz et al., 2010). For an investigation into quality of life across regions in Germany using a measure of subjective well-being see for example Jantsch et al. (2016).

follow Veenhoven's (2013) dichotomous distinction by classifying the determinants of subjective well-being in his categories of life-ability and liveability.

With respect to the relative perspective, Diener (1984) describes the approaches that are based on this perspective as 'judgement theories', because they suggest that people judge their lives to some relevant standard of comparison (reference points). This standard of comparison can be individually different and depends on the type of comparison. In principle, one can distinguish between two types of comparison processes: (i) *interpersonal*, such as, comparisons between people using a so-called reference group (cf. Clark et al., 2008; Ferrer-i-Carbonell, 2005; Luttmer, 2005) and (ii) *intrapersonal*, such as, comparisons over time for a single individual; for example, the individual may compare their present aspiration level (cf. McBride, 2010) with past circumstances (cf. McBride, 2001) or future expectations (cf. Liu and Shang, 2012).

In this thesis, we focus on the present situation for an individual. In doing so, we consider in our analysis both the *absolute* and *relative perspective* of an individual. Within the absolute perspective we rely only on the *life-ability of the individual*, and in doing so we separate the analysis from the *liveability of the environment* (as potential determinant of subjective well-being). Within the relative perspective, we focus on *interpersonal* comparisons with respect to wealth and leave *intrapersonal* comparisons aside.

### 2.2.2 Measurement issues

If we want to measure a theoretical construct such as subjective well-being, we need to be aware of how different measurements work. From a measurement perspective, subjective well-being is a theoretical construct; thus, it is also a latent variable that cannot be directly observed or measured. We operationalise subjective well-being by measuring it through a manifest variable, such as *overall* life satisfaction or *overall* happiness. We capture the theoretical and complex construct of subjective well-being by means of a 'direct' measurement, a single item of measure, and assume that the measure adequately corresponds to the meaning we have given to the construct. In doing so, we follow a reflective approach, in which the latent variable is assumed to determine the manifest variables because the observed outcome serves as a reflection of the defined theoretical construct.

In this thesis, we focus on subjective well-being assessed through a single item question about life satisfaction or happiness, where the respondents are given the opportunity to indicate their response on a numerical scale. With this single item question,

one would like to generate an answer that still offers enough selection possibilities to grasp the relevant variation between individuals (Helliwell and Barrington-Leigh, 2010, p. 734). There is empirical evidence, from experiments discussed in literature, showing that scales with an odd number of choices are preferable. Furthermore, scales with a higher number of possible selections are more suitable for capturing the variation in the theoretical construct (Diener et al., 2009, p. 73 f.). In empirical social research, and above all in happiness economics, the single item question with an 11-point scale has prevailed over more complex scales such as the Satisfaction With Life Scale (Diener et al., 1985). In this scale, it is possible to select integer numbers in the range from zero (0) to 10, which correlate qualitatively to ranging between completely dissatisfied (0) and completely satisfied (10). This has emerged as the preferred scale because subjective well-being reported as a single number is easier to process within econometric analyses. Moreover, a single question regarding subjective-well-being saves time and space in the already sizeable questionnaires of household surveys, such as the German Socio-economic Panel study and the Panel on Household Finances. With respect to the evaluation of subjective enjoyment of life as a whole, it is typical to ask questions in surveys such as: ‘All things considered, how happy are you these days with your life?’ Or, ‘In general, how satisfied are you currently with your life as a whole?’ In this case, life satisfaction and happiness are regarded as equivalent operationalisations of the construct ‘subjective well-being’.

There are alternatives to the single item question for assessing subjective well-being. Self-reported subjective well-being, for example, can also be assessed through more affective measures assessed several times a day, such as by the Day Reconstruction Method (cf. Kahneman and Krueger, 2006), or using several items, such as with the help of the Life Satisfaction Index-A (Neugarten et al., 1961) or the Satisfaction With Life Scale (cf. Diener et al., 1985). There are also scales that assess pleasant and unpleasant emotions, such as the Negative Affect Schedule (PANAS) introduced by Watson et al. (1988). A major difference, however, between affective measures and assessments of life as a whole is that the latter depend more on the personal circumstances, such as one’s family, work and income situation, and possibly on people’s social environment too. It can be assumed that this is a reason that ensures the reliability of life satisfaction, compared to affective measurements, as indicators of overall subjective well-being (Helliwell and Barrington-Leigh, 2010, p. 732).

Because once-off self-reports have possible limitations, methods other than self-reports have been proposed for assessing subjective well-being. Diener (2009a, p.51 f.) introduced a variety of alternative methods, including the recording of non-verbal be-

haviour, assessments done by a significant other, and the measurement of hormones and other physiological indices, such as electromyographic facial recording. Even though researchers are encouraged to use different methods to measure subjective well-being as a means to determine and understand someone's 'true' subjective well-being, in reality, methods based on self-reported information are used almost exclusively in empirical economic analyses (Diener, 2009a, p.52). As reliability and validity are key indicators of the quality of a measuring instrument, the question inevitably arises as to whether measuring subjective well-being using self-reports on 'life satisfaction' is both reliable and valid. In relation to this then, it is plausible to question the reliability and validity of subjective well-being measurements used for the same individual over time. Regarding reliability, this means that an individual's responses to the question, for example, of life satisfaction should not vary too much within a short period of time, especially if no serious event has occurred. Regarding validity, a measure of self-reported subjective well-being is valid if it reflects true introspection (Nisbett and Wilson, 1977), and if it is consistent with alternative measures that are intended to measure the same theoretical construct (Sandvik et al., 1993).

*Reliability* is a measure of the formal accuracy of how scientific measurements reflect the construct being measured, in our case 'subjective well-being'. If this is the case, the measurement would be reliable if it is free of random errors and reproducible under the same conditions (Crocker and Algina, 2008). In terms of subjective well-being, we assume a suitable measure is one which has a reasonably small within-variance (the variance of the same individual being asked) over a short period of time, and that it is assessed over a time period that is absent of any events that may affect subjective well-being. As such, in the scientific community a high test-retest correlation, namely a high *coefficient of stability*, is seen as a high measurement reliability, since we do not know the 'true' level of an individual's subjective well-being (Krueger and Schkade, 2008). Krueger and Schkade (2008), for example, found a moderate correlation ( $r=0.59$ ) when employing a test-retest reliability to an overall life satisfaction question with a four-point scale. They conclude that their reliability numbers are sufficiently high for subjective measurements, even if they are lower compared to other microeconomic variables, such as education or income, and therefore support research in the field of subjective well-being with self-reported measurements. Helliwell and Barrington-Leigh (2010, p. 736) go further and claim that "[i]f these measures are sufficiently reliable, they can be averaged across individuals to provide summary measures of the perceived quality of life in neighbourhoods, cities, regions, and countries and across population subgroups."

In addition to reliability, *validity* is another quality criterion a measuring instrument should satisfy. For a measurement made, the validity indicates the degree to which the measurement reflects the actual characteristic that we intend to measure. If a measuring instrument is reliable, it does not necessarily mean that it is valid at the same time. It is conceivable, for example, that similar outcomes are observed by repeated measurements, and so we consider the measuring instrument to be reliable, however, we may still have measured something different to what we actually intended to measure (Schnell et al., 2018, p. 135 f.). In the context of our subjective well-being measure, the empirical validity can be assessed through the correlation between the measuring instrument and an alternative measuring instrument that is supposed to capture the same theoretical construct. Sandvik et al. (1993), for example, observe a high correlation between self-reported measures of well-being and a number of non-self-reported measures of well-being, such as informant reports, experience sampling, and smiling. Another way to examine the validity of different measuring instruments is to compare the pattern of their correlates and their predictive ability for future outcomes (Kahneman and Krueger, 2006, p. 7). Kahneman and Krueger (2006, p. 9) presented a table with variables that correlate similarly with different measures of subjective well-being. Rodgers et al. (1988) used a different approach, instead employing structural equation models to determine the validity of different survey measures, in which people were asked to evaluate certain life domains. They found that the use of different methods explains about one-tenth of the variance of the responses to the different measurement instruments. To quote Ed Diener (2009b, p. 2), the “validity evidence for the scales was generally positive and [...] the effects of artefacts, although present, were often relatively small.”<sup>8</sup>

As individual life satisfaction is measured on a 11-point scale, we implicitly assume that there is a natural zero point of subjective well-being. Even if this zero point really exists, the impossibility of interpersonal comparisons remains, since “[...] one man’s happiness will never be another man’s happiness [...]” (cited in Halévy, 1928 [1972], p. 495). We can only be certain about the fact that a three (3) on the scale is better than a two (2) for the same individual, a four (4) better than a three (3), and so on. In other words, one person’s happiness level of seven (7) obtained on the scale could be different from another person’s happiness level of seven (7). One reason, among others, might be that different artefacts of different nations and cultures cause systematic differences in the responses to the question of happiness, for example, different usage of extreme numbers (Diener et al., 1995). Nevertheless, many researchers use statistical methods

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<sup>8</sup>See Diener et al. (2009) and Veenhoven (1993, Chapter 5) for an extended discussion about the reliability and validity of measures of subjective well-being.



that abstract from the ordinal nature of the variable, which may be more problematic from a theoretical point of view than from a practical point of view (Kahneman et al., 1999). In the following, we will argue why it is, indeed, still possible to treat life satisfaction variable as a cardinal metric.

Since we have so far shown that there is consensus among researchers that life satisfaction is a reliable and valid measure of subjective well-being, it can be expected that self-reported life satisfaction is related to the underlying theoretical concept of subjective well-being. This means that a higher level of self-reported life satisfaction correlates to a higher level of subjective well-being. Researchers in the field of happiness economics are unlikely to assume that the meaning of a certain number on the scale is the same for all individuals; for example, if two individuals choose an eight (8) on the scale, this does not necessarily mean that their subjective well-being is identical. A common assumption, however, in empirical happiness economics is that responses to the life satisfaction question are at least ordinal or even cardinal, and thus interpersonal comparisons are possible. This means that we implicitly assume that individuals have the same interpretation of each possible selection on the scale, such that an eight (8) on the scale means the same for everyone – in terms of the conditions of their life (Ferrer-i-Carbonell and Frijters, 2004, p. 641). In other words, numbers on the scale may ‘mean the same’ even if two people’s subjective well-being is not comparable in the sense of how they, themselves, experience it. The factors, however, that feed into the evaluation (‘the conditions of their life’) tend not to vary so much between individuals.

A study by Cantril (1965) showed that, on average, people are concerned about the same things and have similar sources of well-being. Cantril conducted a survey in fourteen different countries, where people were asked what they really want from life: three quarters of respondents mentioned material living conditions, followed by a happy family life, and good health. It is likely that each individual conceives of their own subjective well-being somewhat differently, but Cantril (1965) showed that people still function in a very similar way. Furthermore, Ng (1997) argues impressively in his essay why subjective well-being (he uses the term ‘utility’) measures can be treated uninhibitedly as cardinal, and claims that “interpersonal comparisons of utility are at most subjective judgements of fact, not value judgements”. This is in line with the empirical evidence, produced by Sandvik et al. (1993), that self-reported measures of subjective well-being correlate strongly with the predictions of other people. This, in turn, led Ferrer-i-Carbonell and Frijters (2004, p. 644) to conclude that “[...] there is a common human ‘language’ of satisfaction and that satisfaction is roughly observable and comparable among individuals.” They support their conclusion with a study by van

Praag (1991), who showed that people translate verbal evaluations into approximately the same numerical figures along a scale quite well.

By treating life satisfaction as ‘fully cardinal’, we have to further assume, beyond interpersonal comparability, that a gradual increase in an individual’s self-reported life satisfaction by one unit corresponds to a similar increase in ‘true’ subjective well-being by one unit. This means that a change of one (1) to two (2) on the scale, or nine (9) to ten (10), and the like, necessarily reflects even-spaced difference in ‘true’ subjective well-being. Even though Ng (1997) argues that we can compare subjective measures of well-being interpersonally, he does not discuss the possibility of varying differences in ‘true’ subjective well-being between integers on the life satisfaction scale. Ferrer-i-Carbonell and Frijters (2004, p. 644) remark that the assumption of even-spaced differences, however, would fail to accommodate any extreme response behaviour, such as the tendency to select extreme categories. A systematic selection of very small or very large numbers on the scale due to certain cultural norms means, for example, that the distances between the middle categories must be much smaller than the distances at the poles of the ‘true’ subjective well-being scale, since the former are not really important for these respondents (Ferrer-i-Carbonell and Frijters, 2004, p. 644).

Indeed, various studies have shown that different response behaviour exists in different cultures. Empirical evidence suggests that East Asians report significantly lower levels of life satisfaction than North Americans. One explanation for this is that different cultural norms lead to different response styles (cf. Carstensen and Cone, 1983; Diener et al., 1995; Strahan et al., 2006). In regard to topics containing a positive emotion, for example, Chinese and Japanese respondents tended to select mid-range categories more often than people from the US and Canada, who tended to select categories that represent positive emotions (Chen et al., 1995; Lee et al., 2002). This, in turn, does not indicate that a change in an individual’s self-reported life satisfaction by one unit necessarily corresponds to a similar increase in ‘true’ subjective well-being by one unit. Nevertheless, Ng (1997) and many others argue that, at least for practical reasons, it is justifiable to treat the life satisfaction measure as fully cardinal. If we had not already done so, we would probably know much less about income inequality and poverty (van Praag, 1991, p. 71).<sup>9</sup> In addition, Ferrer-i-Carbonell and Frijters (2004) showed that it is of limited importance, at least from a technical point of view, whether we treat life satisfaction responses as cardinal or ordinal. Different regression meth-

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<sup>9</sup>van Praag (1991, p. 71) also points out that several authors such as Atkinson (1970), Jorgenson and Slesnick (1984), Jorgenson and Slesnick (1990), and Apps and Savage (1989) have also used welfare concepts based on a cardinal utility function derived from implicit value judgements.

ods produce similar qualitative results, and therefore it is legitimate to use ordinary least squares for estimating the unknown parameters in a linear regression model. It is, therefore, not necessary to use ordinal regression methods, such as ordered probit. Their argument is, above all, that it is important to consider individual specific effects when estimating life satisfaction.

Although all these concerns have a direct impact on the analysis of self-reported subjective well-being data, the data collected are usually considered to be at least ordinal, often even fully cardinal, and appropriate methods are used. Typically, subjective well-being is modelled on the basis of a formalised utility calculation, for example, as a function of consumption (mostly measured through income) and leisure. In addition, since we know that individuals do not maximise their utility on the basis of consumption and leisure alone, other factors are also considered such as, marital or employment status, among others. The estimation of unknown parameters within the subjective well-being function, which capture the influence of explanatory variables on subjective well-being, is usually carried out by employing multiple regression analysis. This enables the analysis to evaluate the effect of one explanatory variable while simultaneously considering the influence of other explanatory variables. That is, it helps reveal the net effect of a unit change in the explanatory variable of interest on the mean value of the subjective well-being measured, as well as the net effect that other (including the controlled) variables may have on mean subjective well-being.

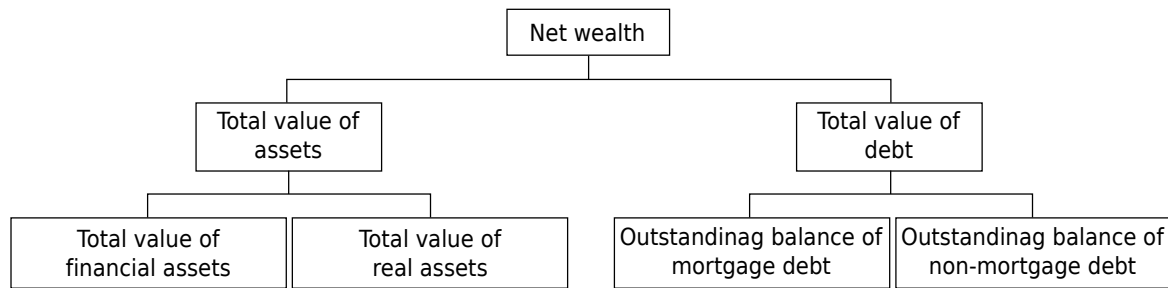
## 2.3 The concept of wealth<sup>10</sup>

### 2.3.1 Definition of wealth

As shown in Figure 2.2, net wealth is the sum of the total monetary value of an individual's assets and the total value of an individual's outstanding balance of liabilities (debt). Total assets, in turn, are composed of the value of an individual's financial assets such as bank deposits, mutual funds, current accounts, savings account, stocks and shares, pensions or whole life insurances and real assets such as value of properties. i.e. household's main residence, other real estate property, self-employed businesses, vehicles and valuables, such as jewellery. All these different components have different degrees of liquidity. While financial assets such as bank deposits are highly liquid, real assets such as real estate properties are highly illiquid.

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<sup>10</sup>This Section is based on parts of a book chapter: Jantsch, A. and R. Veenhoven (2019). Private Wealth and Happiness. A Research Synthesis Using an Online Findings-Archive. In: Brulé G., Suter C. (eds) Wealth(s) and Subjective Well-Being. Social Indicators Research Series, vol 76. Springer, Cham.

**Figure 2.2:** Net wealth and its components

Source: Jantsch and Veenhoven (2019, p. 21).

The total outstanding balance of an individual's liabilities consists of a mortgage (secured) debt on a main residence or mortgages on any other properties one owns and non-mortgage (unsecured) debts such as a credit line, credit card debt or other non-mortgage loans. Suter (2014) distinguishes different kinds of debts, such as by type of creditor: private creditors, official creditors, and multilateral financial institutions or the maturity composition such as short-term, medium-term or long-term obligations. Since this information about different types have not been included in almost all in studies which investigate the relationship between debt and subjective well-being, we did not consider this in our literature review in Chapter 3.

### 2.3.2 Aspects on assessing and analysing wealth

Generally, there are two ways to measure wealth; using data from registrations or using self-reports as assessed in surveys. Since we conceptualise wealth 'objectively' as to total of an individual's assets and debts, we not consider the subjective evaluations individuals hold on their wealth, such as how well off they are compared to other people or how worried they about their debts.

*Registration data* Some studies use wealth data which is taken from administrative tax records and used to analyse the wealth structure of specific populations, regions or countries. Comparisons of wealth between different countries are, however, difficult as the tax systems differ often considerably. While there is no administrative data on wealth, estimates of an individual's wealth can be made by utilizing the information provided on taxable income. In this case, the taxable income can be capitalized using a common rate of return on asset types. This procedure, however, does not provide any new information compared with the direct use of the income value. Advantages of administrative data are that the actual values of different wealth components reported

on a very detailed level. Furthermore, large and representative samples are available for analyses, although these data are not gathered for research purposes. Hence, a disadvantage is the lack of individual information such as information on the socio-economic status or subjective data (Browning and Leth-Petersen, 2003, p. F283).

*Survey data* The survey-based way to measure wealth is the most commonly used measure for empirical analyses. Here, an individual's wealth is assessed from responses to questions, typically multiple questions on different types of assets or debt. In contrast to survey data on income, the availability of such data on wealth is scarce. While almost everyone can specify their income reasonably well, the situation is different for wealth. There are many difficulties to be overcome recording individual wealth using surveys. One problem lies in the sampling, which may not cover poor and rich equally well. A second problem lies in the responses themselves to the question on wealth, which some respondents refuse to answer because they are not able to determine their own wealth or do not wish to answer for reasons of privacy. It is known, for example, that poor or very wealthy people in particular are more likely to refuse to respond, which will lead to a 'middle class bias' (Frick and Krell, 2010). Since it is particularly important for longitudinal studies to keep the attrition rate to a minimum, information about assets and debt is often not collected every year, such as in the German Socio-economic Panel study (GSOEP), and when it is collected, people are asked to specify their wealth between a certain range rather than be more specific.

Typically, one person, the head of the household, is asked to give information about their individual or household wealth. While the participants in some surveys, such as the GSOEP, are only asked about the main components of their assets, other surveys, such as the German Panel on Household Finances (PHF), go into greater detail with specific questions about each asset and debt component (cf., Wagner et al., 2007; Kalckreuth et al., 2012). Typically, net wealth is then calculated based on respondents' replies to the questions on the different wealth components. There are also surveys that use a one-shot question about an individual's or household's assets and debt in order to determine the net value of their wealth; however, the fewer questions on the different components of assets and debts asked in a survey, the greater the probability that net wealth of an individual or a household will be underestimated, leading to 'aggregation bias' (Frick et al., 2012).

While subjective well-being is measured at the individual level, it can be different for net wealth and its components, on which information can be provided at both individual and household level. Obtaining a full description of the overall wealth situation for a household is difficult for two reasons. (i) The net wealth of larger households is un-

derestimated. (ii) If a study relates subjective well-being to household wealth (because the data provides, for example, a measure on household wealth only), it is implicitly assumed that the individuals living together pool and share all their available resources, which will not necessarily be the case (Frick et al., 2012, p. 90). This in turn implies that all household members benefit equally from the assets when linking household wealth to individual subjective well-being. It is questionable whether this assumption is appropriate, since we do not know much about appropriate equivalence scales of assets and debt (Lersch, 2017). In empirical income analyses, equivalence scales are typically used to adjust income to differences in needs for households of different size. This accounts for economies of scale of living together (Buhmann et al., 1988). Most equivalence scale elasticities suggested by expert scales, such as the OECD equivalence scale or the one that is used in the US-Poverty Line, however, lead to an underestimation of economies of scale within a household (Schwarze, 2003). While this is a specific problem in the analysis of income, it is still questionable whether and, above all, how a potential equivalent wealth should be determined in order to analyse the relationship between subjective well-being and wealth.

### 2.3.3 Relationship between subjective well-being and wealth

The question remains whether wealth makes people happy, or whether happy people tend to accumulate wealth. We discuss briefly the causal direction between subjective well-being and wealth; i.e. we want to discuss possible mechanisms regarding the possibility that high (or low) subjective well-being levels cause more wealth holdings vs. high (or low) subjective well-being levels are a result of wealth holdings.

*Wealth*  $\rightarrow$  *subjective well-being* Typically, individuals apply strategies to cope and minimise risk. Risk, for example, can be seen as the volatility of a particular outcome such as an individual's economic performance over time. To reduce the volatility of their economic performance, individuals can (i) smooth their income by making very conservative production and/or employment choices to avoid income shocks; and they can (ii) smooth their consumption through saving or invest money or having insurances or pension contracts (Morduch, 1995).

Besides income, that is characterised as a periodic, regular received amount of money and that can be used for consumption immediately, assets are used particularly to smooth consumption over a life cycle that clearly stabilises an individual's economic situation. Assets provide security against income shocks and serve as security for debt. Finally, yet importantly, assets generate income via investment, which in their turn

contributes to subjective well-being. Given these characteristics and functions, one could expect a positive relationship between subjective well-being and assets; however, properties such as real estates can become a burden, as it has to be administrated. This, in turn, can lead to mental distress, which may lower an individual's subjective well-being. Furthermore, wealth can also affect subjective well-being negatively, possible causal effects being the envy of other people and stress resulting from protection of one's property.

Likewise, indebtedness can affect subjective well-being in different directions and through different causal mechanisms. Tay et al. (2017) developed a conceptual framework where different mechanisms of debt on subjective well-being are considered. Firstly, assuming that satisfaction with disposable income or other financial resources is part of an individual's subjective enjoyment of their life as a whole, debt may be negatively related to subjective well-being, as debt affects subjective well-being through the financial domain or other life domains. Tay et al. (2017) call this a 'bottom-up spillover' effect of debt. Secondly, total debt lowers an individual's financial resources, which, in turn, means lower consumption opportunities for the individual and therefore lower levels of subjective well-being. The association between subjective well-being and debt is therefore considered from a 'resource' perspective (Tay et al., 2017). If the various debt components are considered separately, the relationship between subjective well-being and debt can be expected to be both negative and positive. For example, mortgage indebtedness does not necessarily reduce an individual's subjective well-being, as the individual may achieve through this indebtedness a certain goal, namely owning a house (Tay et al., 2017). Moreover, it is conceivable that if the value of the monthly debt service for homeowners is lower than the rent they would have to pay for a comparable home, they will have a higher disposable income and thus a higher degree of subjective well-being. Non-mortgage or other unsecured debt have found to be negatively associated with subjective well-being (Brown et al., 2005). One reason for a negative effect could be that the added 'pleasure' of the goods paid for by, for example, credit card is less lasting or is even smaller than the 'pain' of being in debt. It is also conceivable that debts, which increase one's income or accumulate wealth in the long run, for example obtaining business loan, is positively related to an individual's subjective well-being.

In conclusion, the distinction between the different types of assets and debt is important, as it is well known that different types of assets or debt in a household's portfolio can have differential effects on subjective well-being (Office for National Statistics, 2015).

*Subjective well-being*  $\rightarrow$  *wealth* Reversed causality is also likely to exist, where subjective well-being influences the accumulation of wealth. One plausible mechanism is that subjective well-being typically ‘broadens’ one’s behavioural scope and as such foster the ‘building’ of resources (Fredrickson, 2004), in this case wealth. Subjective well-being also fosters the building of social networks, and as such happy people may more often get assets transferred by parents or through inheritances. Reversed effects may also exist, such as subjective well-being instigating careless consumptions. All this illustrates that it is difficult to predict how accumulation of wealth will work out on one’s subjective well-being on the basis of theoretical deduction. For this reason, we will not generate hypotheses, but only describe in Chapter 3 and 4 the observed relationships between subjective well-being and wealth.

## 2.4 The concept of social comparisons

### 2.4.1 Social comparisons in an economic context

A house may be large or small; as long as the neighbouring houses are likewise small, it satisfies all social requirements for a residence. But let there arise next to the little house a palace, and the little house shrinks into a hut. The little house now makes it clear that its inmate has no social position at all to maintain [...] [T]he occupant of the relatively little house will always find himself more uncomfortable, more dissatisfied, more cramped within his four walls. [...] Our wants and pleasures have their origin in society; we therefore measure them in relation to society [...] (Marx, 1847/1975, p. 33).

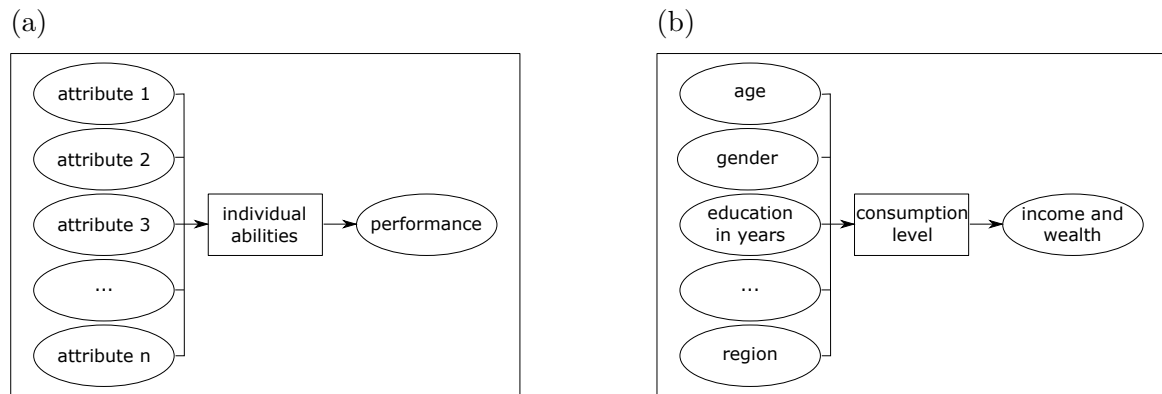
As early as the middle of the 19th century Karl Marx recorded some of the earliest thoughts on the importance of context dependent preferences and social comparisons (‘we therefore measure them [wants] in relation to society’). Approximately 50 years later, Veblen (1899) proposed in his treatise that people’s consumptive behaviour reflects their desire of being associated with a particular social class. He also advanced the idea of conspicuous consumption, meaning that one purchases expensive and visible goods in order to display social status. In a similar vein, Samuelson (1947/1971, p. 224) emphasised that people strive to ‘keep up with the Joneses’, which is to imply that preferences are context dependent and therefore subject to change over time. Duesenberry (1949) though was the first to have empirically shown that people’s preferences depend on the consumption patterns of others, which in turn affects their choice between saving and consumption.



Pollak (1976) also showed that consumption has a relative component. According to his model of interdependent preferences, a household's consumptive behaviour depends on the consumption of the relevant comparison group. In support of that, Kuhn et al. (2011) provided evidence of adjustments of households' consumption of visible goods, such as cars, in response to exogenous income shocks of their neighbours. Moreover, in some recent studies the relationship between relative wealth and life satisfaction for selected types of wealth were analysed. Foye et al. (2018), for example, have argued that homeownership is a positional good and empirically shown that in the UK the life satisfaction of homeowners decreases if the homeownership rate of the reference group increases.

The formal theoretical conception of social comparison goes back to Leon Festinger (1954). In his article titled *A Theory of Social Comparison Processes*, he described the phenomenon whereby people obtain information about their own self through comparisons with others. In order to explain the occurrence of social comparisons he formulated several hypotheses, which were examined by numerous researchers. He stated, for example, that an individual has a natural interest in evaluating one's own abilities (Festinger, 1954, p. 117). As an ability is manifested primarily through performance that can be directly measured and related to this ability, objective criteria or thresholds are needed to evaluate that performance. Festinger (1954, p. 118) explained this using the example of a runner, who could evaluate her ability on the basis of the time she ran over a certain distance. If, for example, no objective threshold is given for the time that she must achieve in order to pass a test, then she cannot evaluate whether or not her performance is good based simply on the time she ran. If it is true that individuals are interested in evaluating their abilities, the runner will compare her individual running time with that of other runners. Only by comparing her performance with others would the runner be able to evaluate her own abilities. Festinger (1954, p. 122) stated that the runner, and individuals in general, compare themselves with those whose abilities are similar to their own (*similarity hypotheses*).

Festinger's similarity hypothesis was somewhat specified by Goethals and Darley (1977). They stated that the tendency of people to compare themselves with others increases "when persons are perceived to be similar to oneself on *attributes* related to an opinion or performance [...]" (Goethals and Darley, 1977, p. 265, emphasis added). Although this does not directly contradict Festinger's statement that one compares oneself with those whose *abilities* are similar, it does differ in the respect that one looks instead at the potential abilities (*'attributes'*) when selecting the comparison target. This is because abilities cannot be observed directly. If we consider the runner

**Figure 2.3:** Measuring individual abilities

Source: Own illustration.

again, we could say that age, sex, diet and frequency of practising, as examples, are the attributes and therefore the potential ability. In other words, attributes (manifest variables) are presumed to capture the determinants of an individual's ability (latent variable). Also, ability can be measured by the subsequent performance (manifest variable) – her running time – which itself is the subject of comparison (cf. Figure 2.3 (a)). Here, her performance is the observable outcome, which is assumed to be determined by the latent variable, her ability.

This can easily be transferred to the economic context too. As already discussed, the abilities (which in our case is the consumption level) cannot be observed directly. It is therefore conceivable that the abilities become visible by means of income and wealth, which is to be considered available for consumption. In order to select a potential comparison target with whom we compare our performances, we need to think about which attributes determine the consumption level. In our stylised example (Figure 2.3 (b)) we consider among other factors age, gender, number of years in education and the region where an individual is living as attributes that explain the consumption level of individuals. Since the performance, measured through income and wealth, represents an individual's abilities, and the performance is determined by these attributes, it is likely that people choose comparison targets that have similar attributes in order to compare their performances.<sup>11</sup>

<sup>11</sup> Assuming both income and wealth are available for consumption, we speak of consumption level, because, for example, a house owned by an individual can be liquidated through a sale and this money is then, in principle, available for consumption. When we talk about wealth that is available for consumption, we mean net wealth. For the sake of simplicity, we therefore use the term consumption level.

### 2.4.2 Direction of comparisons, resulting effects and the individual utility function

Social comparisons are usually made by comparing one's own consumption level,  $C$ , with the consumption level of the respective reference group,  $C_r$ . We distinguish between two types of social comparisons. Firstly, upward comparisons are made by reference to those with higher consumption levels than the individual making the comparison ( $C < C_r$ ). Secondly, downward comparisons are made by reference to those with lower consumption levels than the individual making the comparison ( $C > C_r$ ) (Wheeler, 1991). Duesenberry (1949, Chapter 2) have empirically shown that making a comparison with groups that are better off affects individuals negatively, while a downward comparison does not evoke a positive effect. In other studies, however, it has been shown that comparisons are made in both directions; though, they are asymmetrical, with the upward comparison having a greater negative effect on well-being than the positive effect of the downward comparison (Holländer, 2001; Ferrer-i-Carbonell, 2005; Vendrik and Woltjer, 2007). There is, however, also empirical evidence that indicates that the positive feeling of downward comparison dominates the negative feeling of upward comparison (McBride, 2001).

Irrespective of the direction, social comparisons affect people, which is reflected in the judgement of one's own life satisfaction. These effects, in turn, can both enhance and reduce life satisfaction (cf. Smith 2000, p. 175 for a comprehensive literature overview).<sup>12</sup> Table 2.1 shows the effects that can be derived from considerations of the feelings of social comparisons. With regard to positive effects of social comparisons, upward comparisons can evoke hope and optimism for an individual's own potential consumption levels in the future. This effect is better known as (I) *tunnel effect*, as the individual anticipates better consumption levels for the future and is therefore optimistic.

Hirschman and Rothschild (1973) presented evidence of this effect with respect to income and assumed that people perceive their income as variable in time, and at the same time use others' incomes as information regarding their own (potential) future income. The assumption behind this is that people use information of their relevant reference group's income to predict their own future income and thereby derive utility from the higher incomes of others. The tunnel effect is also referred to as an *information effect* (Hirschman and Rothschild, 1973). Furthermore, downward comparisons can create a sense of pride in one respect because individuals may realise that they are

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<sup>12</sup>We consider the effects that cause self-regarded feelings only. Other-regarded feelings which are not considered in this research are, for example, *schadenfreude* or sympathy.

**Table 2.1:** Effects resulting from downward and upward comparisons

	Upward comparison	Downward comparison
Positive effects	(I) <b>Tunnel effect</b> Indication of economic chances from upward comparison	(II) <b>Relative gratification</b> Positive feelings from downward comparison
Negative effects	(III) <b>Relative deprivation</b> Negative feeling from upward social comparison	(IV) <b>Fear of social decline</b> Indication of economic threats from downward comparison

better off. It can also create a sense of relief because individuals may realise that they are not as worse off as others. This effect is better known as (II) *relative gratification*.

With regard to the negative effects of social comparisons, upward comparisons can give rise to envy and resentment because the individual is worse off and feels irritated about it. This effect is the counterpart to relative gratification and better known as (III) *relative deprivation*. Relative deprivation is “a psychological effect deriving from comparison with others who have achieved something that would be feasible to achieve for oneself that one desires but does not have himself” (Runciman, 1966, p. 9). Furthermore, downward comparisons can cause (IV) *fear of social decline*, as the individual becomes afraid or worries about being as worse off as others. Hence, the individual takes the performance of others as an informative indicator of their own future performance.

James Duesenberry (1949) was the first to formulate the relative income hypotheses according to the model of interdependent preferences (Pollak, 1976), and to have empirically shown that people are influenced positively by the absolute level of their own income and negatively by the income level of others. This preliminary work has been taken up and further developed in economic (happiness) research. As self-reported measures of subjective well-being tell us something about individual utility, we can also formulate a utility function that takes into account both an absolute component and a relative component of consumption levels (Clark et al., 2008). The utility component resulting from social comparison is referred to as the relative utility component in the following.<sup>13</sup> Thus, an individual’s utility,  $U$ , can be expressed formally as the following (cf. Clark et al., 2008):

<sup>13</sup>As we have already stated, we consider the interpersonal comparisons only, thus we ignore intrapersonal comparisons, such as comparisons with one’s own consumption levels in the past. Therefore, we cannot take into account the fact that individuals might have adapted to a higher or lower level of consumption compared to the past.

$$U_i = U(u_1(C_i), u_2(C_i|C_r), u_3(\mathbf{x}_i)), \quad (2.1)$$

where  $U(\cdot)$  is the utility function of the individual,  $i$ , and is dependent on three subutility functions. The first subutility function,  $u_1$ , is referred to as the absolute utility depending on one's own consumption level,  $C_i$ , usually operationalised via income. The second subutility function,  $u_2$ , is referred to as the relative utility component resulting from the comparisons with one's own consumption level ( $C_i$  again) with that of a previously defined reference group,  $C_r$ . If we assume that relative inferiority in terms of the current consumption level leads to a negative and relative superiority to a positive value of relative utility (Dakin and Arrowood, 1981, p. 93), then relative utility can be expressed formally as a function of interpersonal difference of consumption levels  $\ln C_i - \ln C_r$  (cf. Clark et al., 2008). The third subutility function,  $u_3$ , is itself a function of socio-economic and socio-demographics represented through the vector  $\mathbf{x}_i$ , which is assumed to influence an individual's utility,  $U_i$ , too.

Many studies have been premised on this model and the results at the micro-level point to the importance of relative income rather than absolute income for subjective well-being. While some authors have found a negative effect of relative income (cf. Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005; Vendrik and Woltjer, 2007; Layard et al., 2010), others have found the opposite effect on subjective well-being (cf. Senik, 2004, 2008; Knies, 2012; D'Ambrosio and Frick, 2012), or even both (cf. FitzRoy et al., 2014). In the event that an increase in the reference income reduces subjective well-being, and "[...] if utility depends on relative consumption, one person's increase in consumption has a negative externality on others because it lowers the relative consumption of others" (Luttmer, 2005, p. 964). Similarly, the positive effects on subjective well-being of a rising reference income would have to correspond to positive externalities. Frank (1991) referred to the externalities emanating from individuals' consumption as positional externalities.

In economic empirical happiness research, the effect of relative consumption is usually represented by  $\ln C/C_r$ , whereby consumption is often represented by income  $Y$  only (cf. Clark et al., 2008, p. 100). It is often the case, however, that no clear distinction is made between the different effects described in Table 2.1. Usually only two effects are referred to, those being the tunnel effect and relative deprivation. These two effects are an aggregate though, as they result from the average effect of both downward and upward comparison. A premature interpretation of the effect of relative consumption

levels on subjective well-being – without taking into account whether  $C$  is greater or less than  $C_r$  – could therefore lead to incorrect conclusions being drawn. In order to identify potential asymmetric effects, we distinguish between individuals below and above the reference consumption level. Depending on whether downward or upward comparison dominate there are different interpretations of the observed overall effect.

## 2.5 Summary and concluding remarks

In this chapter we have developed a conceptual framework of subjective well-being, which is based on theoretical considerations related to the understanding of utility in the history of economic thought, and we have discussed the relationship between utility and happiness. It helps to place this thesis in the long (though interrupted) economic tradition of studying *happiness*.

We initially focused on Bentham's reflections on the concept of cardinal utility, the need to investigate happiness as an adequate means of utility, and its subsequent loss from economic discourse over the 19th century, partly due to its unscientific nature. But, as discussed, the ordinal utility concept does not resolve all of the issues discussed either because it ignores, among other things, reasons such as values or intentions for human behaviour. As such, it says nothing about the utility derived from different choices. Van Praag and Ferrer-i-Carbonell (2008, p. 4) summarised it by stating, "everybody talks about utility but nobody dares to operationalize the concept by measurement". We, therefore, have argued for the return of the cardinal notion of utility, relying on Bentham's notion of happiness, and showed that self-reports on happiness or life satisfaction are a useful measure of utility and expand the ordinal notion of utility (Frey, 2008, p. ix).<sup>14</sup>

We follow Frank (1997, p.1832) by linking the concept of subjective well-being to the concept of cardinal utility, which can be operationalised by self-reported overall individual happiness or life satisfaction. The problem of the missing measuring instrument in Bentham's theoretical construct of happiness (or utility) has therefore been resolved in a rather trivial way: one simply asks people directly about their subjective well-being, the evaluation of which is then equated with individual happiness or utility. It is implicitly assumed that the individual considers the balance of pleasure and pain in formulating their response. We also showed that these self-reported measures

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<sup>14</sup>It should be noted, however, that the ordinal utility concept is not being rejected here, rather we extended it by using the empirical happiness economics approach, and therefore also by increasing the number of possible analysis methods (Clark et al., 2008, p. 136 f.).

of subjective well-being are reliable and valid, and argued that an econometric analysis that ignores the ordinal nature of this measure is, nevertheless, permissible. By assuming a cardinal measurement of subjective well-being in a narrow sense – with a natural zero and an identical unit of measurement of all individuals under consideration – we enable the quantification of utility differences among the different courses of action that people choose. It would also enable public policy analysts to estimate the social costs and benefits of policies by aggregating utility over individuals (Gossen, 1854; Pigou, 1920). Stutzer and Frey (2006, p. 20) summarised this in the statement, “[t]he possibility to proxy utility in a satisfactory way using life satisfaction or happiness enables economists to empirically study the difference between decisions made and the satisfaction produced.”

We also explained in this chapter how we conceive of ‘wealth’ and how it can be surveyed. We use wealth collected from household surveys for our empirical analysis later in this thesis. Although we discuss in Section 2.3 that the causal direction is not fully clarified, we assume that total assets and debt determine life satisfaction. Furthermore, in Section 2.4 we explained what we understand by social comparison processes and how these can be placed in an economic context. Here, too, we discussed how these social comparisons may be related to life satisfaction. To summarise, this chapter forms the basis for the entire thesis, including for the literature review in Chapter 3, which follows this one, and for the subsequent empirical analyses in Chapter 4.

## **3 Subjective well-being and wealth: a research synthesis using an online findings-archive<sup>1</sup>**

### **3.1 Demand for information about effects of wealth on subjective well-being**

In western countries, people typically earn more money than required for their basic needs. Consequently, we face the question of how we should spend this surplus money in order to increase subjective well-being. In general, people have two options between which they can choose: spending or saving. While spending is likely to increase subjective well-being in the short term, it may reduce subjective well-being in the long term though. This dilemma is illustrated in Lafontaine's fable of 'The ant and the cricket', in which the cricket enjoyed the summer singing carelessly, while the ant worked all the time. The cricket ended up unhappy in the winter, while the ant was happy enjoying the fruit of his earlier labour. This illustration raises the question of how much saving or spending into what is optimal for long-term subjective well-being. Or to put it in other words, what is the best way to accumulate wealth? Should one deposit money in a bank account, buy a life-insurance, put it into stocks and shares or invest in durables such as a house or car? There are pros and cons; for example, buying a house will provide consumptive reward, but at the cost of financial flexibility. We cannot see into the future, but we can orient on past experience. In this context it is worth knowing how happy people are who have saved or spent more or less, and, in particular, how saving and spending has affected subjective well-being of people with similar personal characteristics and living in similar situations. Bits of such information are available from hearsay and from examples in the media, but we would fare better with data based on scientific research.

While there have been studies on the relationship between subjective well-being and wealth of nations (Hagerty and Veenhoven, 2003; Schyns, 2002), the relationship be-

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<sup>1</sup>This Chapter is based on a book chapter: Jantsch, A. and R. Veenhoven (2019). Private Wealth and Happiness. A Research Synthesis Using an Online Findings-Archive. In: Brulé G., Suter C. (eds) Wealth(s) and Subjective Well-Being. Social Indicators Research Series, vol 76. Springer, Cham.



tween subjective well-being and the wealth of an individual or a household has only recently been studied. In this chapter, we review this latter strand of research and attempt to answer the following research questions. (i) How is wealth associated with subjective well-being? (ii) How are the different wealth components related to subjective well-being? (iii) Do the effects of wealth on subjective well-being differ among nations and populations? (iv) What is the effect size of wealth on subjective well-being? These questions imply a focus on what wealth does to subjective well-being, not why. The answering of these questions requires description of the relationship, not an explanation.

In this thesis we focus on ‘wealth’ in the sense of material possessions; we do not consider non-material resources denoted using this term, such as ‘mental wealth’ or ‘moral indebtedness’. Given our research questions, we limit to individual or household wealth and do not consider assets of groups or nations. Briefly, wealth is the value of all the material resources an individual or a household possesses. We sought to answer the above questions by taking stock of the available research findings on this subject. To do this, we applied a new method of research synthesis, which makes use of an online ‘findings archive’ and takes advantage of a technical innovation. The World Database of Happiness, the available online findings archive, contains standardised descriptions of quantitative research findings, which are presented on separate finding pages and with a unique internet address each. Due to a change in academic publishing from text printed on paper to text in electronic formats, we considered all studies available in the World Database of Happiness and provide links to all of them. We call it ‘link-facilitated research synthesis’. Details of the technique will be discussed in Section 3.2.<sup>2</sup>

In this chapter we draw on an existing collection of research findings on the relationship between subjective well-being and wealth available in the World Database of Happiness. We only consider studies where a measure of subjective well-being is on the left side of the equation and a measure of wealth on the right side. It is therefore assumed that wealth has an explanatory content for subjective well-being of the people – rather than the other way around. Moreover, we rely on the briefly discussed conception of wealth and how it is assessed (cf. Section 2.3). In Section 3.2, we describe the procedure of this review including a description of the World Database of Happiness

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<sup>2</sup>In this chapter, we focus on ‘subjective well-being’ in the sense of the ‘subjective enjoyment of one’s life as a whole’, which is thoroughly explained in the previous Chapter 2. On that basis we select measures that fit this concept. In the following we will use the term subjective well-being regardless of if the respondents were asked about their overall life satisfaction or overall happiness.

and of how we present the results, which are shown and discussed in Section 3.3. Our conclusions are drawn in the final Section 3.4.

## **3.2 Methodical approach of a research synthesis using a findings-archive**

### **3.2.1 Use of a findings-archive – The World Database of Happiness**

Until now, May 2018, subjective well-being has been the subject of research in around 6,000 empirical studies, and this year around 700 further studies are expected on this subject (Veenhoven et al., 2018, p. 3). This number of studies dealing with subjective well-being is now too large and growing rapidly. This makes it very difficult, almost impossible, to get an overview of the exact object of investigation and the corresponding result. For this reason, the ‘World Database of Happiness’ was set up to meet the challenge of monitoring empirical findings in this field of research. This database is freely available on the Internet and organises quantitative results in a uniform format and sorted by topic (Veenhoven, 2018e). A recent description of this novel technique for the accumulation of research findings can be found with (Veenhoven, 2018b). For this chapter, we used this source for the following purposes.

*Gathering studies.* Over the years, many findings have been entered in the World Database of Happiness, among which findings on subjective well-being and wealth, sometimes as side results of studies that aimed at other things. May 2018, we completed the collection to that date on the basis of an additional literature search. This chapter is based on scientific publications that report findings on the relationships between subjective well-being and wealth as defined in Section 2.3. We also considered studies that report findings on particular changes in financial assets such lottery winnings.

*Selection of findings.* The World Database of Happiness limits to the studies that assess subjective well-being as defined in Section 2.2 and use a valid measure of that concept. This selection process is described in detail in Chapter 3 of the introductory text to the Collection of Happiness Measures (Veenhoven, 2018d). Selection on a specific concept of subjective well-being implies that we have not included studies on the relationship between subjective well-being in different domains and wealth, such as the otherwise interesting papers of Dean et al. (2007) and Dew (2008) on ‘marital satisfaction’. Selection on measurement of subjective well-being implied that we did not include a longitudinal study on financial windfalls in which subjective well-being was measured using a health questionnaire (Gardner and Oswald, 2001). Rigorous selection

on a clear concept, in our case subjective well-being well defined, is required for fruitful research synthesis. Together we found 113 studies that are linked in the tables of this chapter and whose links lead to the corresponding finding pages in the World Database of Happiness. As far as we know, we have gathered all the qualifying studies available in the World Database of Happiness up to May 2018.


*Standardised description of the findings.* In the World Database of Happiness, findings observed in selected studies are described individually on electronic ‘finding pages’, where a standard format and a well-defined technical terminology is used. Each finding page contains bibliography information and a link to the original study. In addition, information is provided on the data used, i.e. which population was considered, how many observations were taken into account and information on the respective sample design. Furthermore, it is reported how both subjective well-being and the variable of interest, in our case wealth, were operationalised in the respective study. Furthermore, the methods used and the corresponding control variables are specified and the results presented in the form of statistical indicators. This standardisation is required to enable accurate comparisons of research findings and prevent confusion due to different presentations in the original research reports. The way of uniform notation is described in detail in Chapter 4 of the Introductory Text to the Collection of Correlational Findings of the World Database of Happiness (Veenhoven, 2018c). An example of a finding page on subjective well-being and wealth is given on Figure 3.1.

*Storing the findings.* The finding pages are entered in the electronic archive and made available on the Internet, where they can be easily found in searches, such as on subject, population, research technique and bibliographics within the World Database of Happiness. This makes the results more assessable than in the original research reports and lays the foundation for a continuous accumulation of knowledge, as qualified new findings can be added at will according to the standard format. Complete and accessible storage of all details, using standard notation, is required for controllable reviews. The findings on subjective well-being and wealth are stored in the subject section ‘Happiness and Possessions’ (Veenhoven, 2018b) of the Collection of Correlational Findings.

### 3.2.2 Presenting of findings in this chapter

*Notation of the findings.* We present the results differentiated according to net wealth and the various wealth components in tables. We present the observed statistical relationships between subjective well-being and wealth with the help of + and – signs.

**Figure 3.1:** Example of a finding page in the World Database of Happiness

<b>Correlational finding on Happiness and POSSESSIONS</b>		
Subject code: P10		
<b>Study</b>	<a href="#">Headey &amp; Wooden (2004): study AU 2002</a>	
	<i>Title</i> The Effects of Wealth and Income on Subjective Well-Being and Ill-Being.	
	<i>Source</i> Economic Record, 2004, Vol. 80, 24 - 33	
	<i>URL</i> <a href="http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4932.2004.00181.x/abstract">http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4932.2004.00181.x/abstract</a> 	
	<i>Public</i> 20-59 aged, general public, Australia, 2002	
	<i>Sample</i> Probability multi-stage cluster sample	
	<i>Non-Response</i>	
	<i>Respondents N</i> = 7934	
<b>Correlate</b>	<i>Author's label</i> Log net worth	
	<i>Page in Source</i> 8-10, 22	
	<i>Our classification</i> POSSESSIONS, code P10	
	<i>Operationalization</i> Estimates based on responses to detailed questions about income components. Networth is assets minus debts. The natural logarithm is used since wealth is highly skewed towards the top end	
	<i>Remarks</i> Assets covered housing, businesses, equity- and cash-type investments, vehicles and collectibles. Individual assets (superannuation, bank accounts) and debts (credit card, HECS other personal debts) were included.	
<b>Observed Relation with Happiness</b>	<i>Statistics</i>	<i>Elaboration/Remarks</i>
<i>Happiness Measure</i>		
<a href="#">O-SLW-u-sq-n-11-d</a>	<a href="#">b=+.57 p &lt; .001</a>	
<a href="#">O-SLW-u-sq-n-11-d</a>	<a href="#">Beta=+.71 p &lt; .001</a>	B and Beta controlled for: - equivalised Income - gender - age - partnered - educational attainment - employment status - disability status

Whereas + sign indicates a positive correlation, a – sign denotes a negative correlation between subjective well-being and wealth. These signs are to be considered independent of the effect size. If a finding in the originally study is statistically significant, we will mark it using a **bold** sign: + or –. If different results are reported for different specifications, we will use a string of symbols: a finding, for example, showing +/- indicates that subsequent controls have changed an initial positive correlation to a negative correlation. By clicking these signs they link to the respective finding page in the World Database of Happiness containing the full detail about this particular research finding.

We also consider the observed effect sizes and here we met the problem that different statistics that show the degree of association have been used in the different studies, many of which are not comparable; e.g. Ordered Probit Coefficients and Odds Ratio's. For that reason, we limited our overview of observed effect sizes to correlation coefficients standardised on a range from -1 to +1; for bivariate correlations the Pearson Correlation coefficient ( $r$ ) and for partial correlations as a result of multiple analysis the standardised regression coefficient obtained from OLS regressions ( $Beta$ ). The standardised regression coefficients  $Beta$  result from a linear regression in which the independent and dependent variables have been standardised, i.e. the expected value equals zero and the variance equals one. If no standardized regression coefficients were reported in the original studies, we calculated them on the basis of the given regression coefficients:  $Beta_j = B_j * s_{x_j} / s_y$  with being  $B_j$  the regression coefficient of the explanatory variable  $x_j$ ,  $s_{x_j}$  the standard deviation of  $x_j$  and  $s_y$  the standard deviation of the explained variable  $y$ . These effect sizes are presented in stem-leaf diagrams (Table 3.7 and Table 3.8).

*Classification of the findings.* We organised the findings in separate tables. We started with a presentation of all 161 findings, where we distinguish between findings on net wealth, total assets and debt, and their components, respectively (Table 3.1). For a more refined picture, we assigned all findings to their respective categories such as, for example, savings or stocks within financial assets (see Table 3.2), and mortgage or business debt within secured debt (see Table 3.3). Furthermore, we split all findings on the relationship between assets and debt by nations (see Table 3.4 and Table 3.5, respectively) and by populations such as among others elderly or rural population (see Table 3.6). In the tables, we sort findings by the research method used, differentiating between research design and statistical analysis.

*Differentiation by research design and statistical analysis used.* We distinguished between studies that make use of (i) cross-sectional data, in which the same-time correla-

tion between levels of wealth and subjective well-being is assessed, and (ii) longitudinal data, in which the relationship between change in assets or debt and change in subjective well-being is assessed. Some studies report findings using more than one method, which explains the same finding pages appearing in different columns of the tables and thus the difference in numbers between considered studies (113) and findings (161) in this chapter.

To the best of our knowledge, however, none of these studies claim to be causal, which in turn increases the risk of spurious correlation; i.e. the relationship between wealth and subjective well-being is explained by a third factor not considered, for example marriage. One could imagine that, for example, marriage influences both the accumulation of wealth and subjective well-being, while there is no connection between wealth and subjective well-being. This problem is most pressing in studies that use cross-sectional data but can also exist in studies that use longitudinal data. In order to face the problem and to get a more refined picture, multiple analysis is usually carried out. In the tables, we distinguished between (a) bivariate correlations and (b) partial correlations. For the partial correlations, we further distinguish between three methods: Ordinary Least Squares (OLS), Ordered Probit/Logit (OPL), and Instrumental Variable analysis (IV).

*Advantages and disadvantages of this link-facilitated review technique.* This kind of literature review, a link-based research synthesis, has several advantages over traditional literature reviews. While traditional literature review articles are restricted to the printed page, a link-based research synthesis like this one can take advantage of the Internet (Veenhoven et al., 2018). Since the links provided in this text lead the reader directly to research results that follow standardised descriptions, verification with the available data is faster and easier. In addition, empirical studies in traditional literature review articles can often only be selectively explained and cited due to lack of space. The referencing in a link-based review, in contrast, is almost complete. In other words, this method used here provides easy access to much more detailed information in online ‘finding pages’ (Veenhoven et al., 2018).

A disadvantage is that much detail is not directly visible in the signs by which the quantitative relationships are summarised, in particular not the effect size and control variables used. Further disadvantages are that links work only in electronic texts and this technique requires a specialised infrastructure to have been created, a findings-archive, the establishment of which will only be worthwhile when a lot of research has to be covered and a long-term perspective needs to be taken on the type of research being archived.

## 3.3 Results

### 3.3.1 Association between wealth and subjective well-being

*Wealthy people are happier.* In Table 3.1 all 161 findings on the relationship between subjective well-being and wealth are shown.<sup>3</sup> Focusing on net wealth, the second column shows the simple bivariate correlation between subjective well-being and net wealth, which is in most cases positive. Clearly, the people who are better off tend to be happier than the people who are worse off. A similar picture emerges when looking at the partial correlations: when controlling for other important determinants of subjective well-being, the coefficient for net wealth remains positive and statistically significant in most cases. Two findings for a sample containing the ‘unhappy’ only suggest a negative relationship between net wealth and subjective well-being. Another finding suggests a negative relationship when an instrumental variable approach was used with income as the instrumented variable.<sup>4</sup>

When we have a look at financial assets, a positive relationship between subjective well-being and financial assets is revealed, with two exceptions. Firstly, financial assets are negatively related to subjective well-being for rural-urban migrants in China, although the regression coefficient is not statistically significant different from zero. Secondly, the regression coefficient for people who own stocks or bonds, which is only one component of financial assets, is negative for West Germans by using an instrumental variable regression. The studies using longitudinal data, however, reveal a clear positive and statistically significant relationship (see Table 3.2). The bivariate correlation between subjective well-being and real assets is also positive apart from two exceptions and mostly statistically significant. The statistically insignificant, negative OLS coefficients for real assets in some cases (Table 3.1) mainly concern home ownership by elderly people or other real assets such as cars.

The greater subjective well-being of wealthy people could be due to other factors than their wealth, such as a better health or education. Positive correlations can be misleading if homeowners, for example, are more often married and their greater subjective well-being is derived from their marital status. The possibility of spurious

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<sup>3</sup>Again, each + and - symbol represents exactly one finding of the respective study. However, in some studies several methods were used to describe the association between subjective well-being and wealth. If several findings of different methods are presented in the same study (for example, findings obtained from OLS *and* OPL), this particular study will appear in several columns of our table. For example, this table shows 161 findings from ‘only’ 113 studies. Moreover, if results from different models are shown (for example, with and without controls), but the same methodology is used, a finding is marked with a string of symbols, such as +/-.

<sup>4</sup>Knight and Gunatilaka (2019) (Link)





relationships can be excluded by conducting multiple regression analyses. This did not change the positive relationship and only slightly reduced the number of statistical significant associations.

*Indebted people are less happy.* The bivariate correlations between total debt and subjective well-being shown in Table 3.1 suggest that the sum of an individual's or a household's total debt is negatively related to subjective well-being. The picture changes if we distinguish between secured and unsecured debt. The relationship between subjective well-being and secured debt is mostly positive. Findings based on longitudinal data, and therefore changes in debt over time, confirm this positive relationship between subjective well-being and secured debt. Mixed results appear for the relationship between subjective well-being and unsecured debt. While the partial correlation of cross sectional data is positive, two findings based on longitudinal data and therefore on changes in unsecured debt show a clear negative relationship between total debt and subjective well-being.

*Causal effect is likely.* A non-spurious same-time correlation could still result from reversed causality, subjective well-being facilitating the accumulation wealth (see Subsection 2.3.3). Several techniques have been used to identify a causal effect of wealth on subjective well-being. Instrumental variable analysis (IV) was applied on cross-sectional data in three studies and show mixed results: two statistically insignificant, positive associations and two negative associations, of which one is statistically significant. This latter coefficient results from an analysis, where the authors additionally consider the importance of family, friends and religion.<sup>5</sup> The 15 findings based on longitudinal data that consider changes in subjective well-being following changes in wealth show that growing wealth tends to go with rising subjective well-being; however, subjective well-being can have been raised for other reasons and raised wealth in its trail.

For a definite proof of the causal effect of wealth on subjective well-being we need experimental data. Since laboratory experiments are not really possible on this topic, we must make do with natural experiments and assess whether substantial financial windfalls, such as inheritances and lottery wins, raise long-term subjective well-being. This was the subject of the above-mentioned study by Gardner and Oswald (2001), which regrettably did not use an acceptable measure of subjective well-being. To our knowledge the effect of inheritances on subjective well-being has yet to be assessed. The bivariate findings on lottery winners are not conclusive, since some studies find

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<sup>5</sup>Knight et al. (2009) (Link)

slightly greater subjective well-being among lottery players, irrespective of winning (Veenhoven, 2018a).

### 3.3.2 Associations between wealth components and subjective well-being

Once we know that net wealth tends to contribute to subjective well-being, the next question is whether all types of assets contribute to and all types of debts lower subjective well-being in a similar way. One can choose to invest in financial assets and real assets and in both cases between variants of these. In the reverse case of going into debt there is a choice between secured and unsecured debt. How are such choices related to subjective well-being?

Table 3.1 shows that, apart from a few exceptions, both financial and real assets are positively associated with subjective well-being. By comparing the effect sizes of (the few) findings on financial and real assets, it seems that financial assets matter more for subjective well-being than real assets do (see Table 3.7). The number of findings on financial assets, however, is too little in order to allow a meaningful comparison.

Since there are many options to spend the money on such as open a savings account at a bank, buy bonds, insurances, cars or houses, we want to have a look at the different types of financial and real assets (see Table 3.2). All types of financial assets tend to go with greater subjective well-being.<sup>6</sup> When investing in real assets, there are also many options, such as buying furniture, pieces of art, and jewellery. Findings on the relationship between having such assets and subjective well-being are available only for two such options; (i) owning a house and (ii) owning a car. The findings reported in Table 3.2 reveal a positive relationship between subjective well-being and real assets apart from a few exceptions indicating that owning a car is not always associated with greater subjective well-being.

*Homeowners are happier.* Until now (May 2018), the World Database of Happiness contains 58 findings on the relationship between subjective well-being and housing, focusing on the ownership of a home as a particular type of real asset (see Table 3.2). In particular, the subjective well-being of owners and non-owners as well as owners and tenants were compared, but also other types in addition to full home ownership such as co-ownership, temporary ownership (buy-back), the right to use a house free of charge and usufruct were compared. All but five of the other 53 relationships, whether bivariate or partial and regardless of whether cross-sectional or longitudinal data have

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<sup>6</sup>We exclude operating assets as they contain both types of assets financial and real.

been used, are positive, suggesting that home ownership and similar concepts contribute to subjective well-being.

It is interesting to note that the direction of the relationship can change as soon as in empirical studies the satisfaction with other areas of life is additionally controlled for. Five findings from two studies (Shu and Zhu, 2009; Mollenkopf and Kaspar, 2005), for example, show a negative correlation between subjective well-being and home ownership, as soon as ‘satisfaction with living’ as a domain of satisfaction with life as a whole was additionally controlled for, which probably led to a reversal of the relationship. This could lead to a problem because it is conceivable that the ownership of the house where one lives could at least partially explain the satisfaction with living itself.

One of these studies, which observed a negative correlation, focused only on women Bucchianeri (2011). Moreover, in this study, in addition to the usual control variables, the author controlled for family situation and reference income. It is therefore not entirely clear whether there is a general difference between women and men in this context or whether the additional control variables caused a change in the picture.

*Cars do not necessarily contribute to subjective well-being.* The bivariate correlation between subjective well-being and ownership of a car is in most cases positive with two exceptions. Females in the UK, for example, tend to be unhappier when they have access to a car whenever they want, although this correlation is not statistically significant. Another study investigated the relationship between subjective well-being and price of the car one owns. The bivariate correlation and the partial correlation between subjective well-being and a car in the lowest price category is found to be negative for the US. Other studies have also revealed a negative partial relationship between subjective well-being and owning a car (see Table 3.2, column OLS).

The relationship between subjective well-being and secured debt is positive with the exception of four findings (Table 3.1). In the case of the bivariate correlation, this is not surprising as the bivariate correlation neglects other important determinants of subjective well-being. Hence, it is not possible to distinguish between the negative effects of being indebted and the positive effect, for example, of being a homeowner, and having mortgage. In this case, the joy of owning and living in a house is higher than the pain of being indebted. Even if controlled for other important determinants of subjective well-being, the partial correlation is also positive in most cases. A possible reason for this could be that, for example, the monthly debt service for homeowners is lower than the rent they would have to pay if they wanted to rent a comparable house. Moreover, such debts, as the name suggests, are secured, which in turn means that,

even though someone has an unexpected job loss and resulting inability to service, the monthly debt payment can still sell the house and can get out of that debt. Three of five findings on subjective well-being and unsecured debt shown in Table 3.1 suggest a clear negative relationship. Microfinance loans as a specific type of unsecured debt are positively correlated to subjective well-being, while other types of unsecured debt such as student loans are negatively correlated (see Table 3.3).

### 3.3.3 Wealth effects on subjective well-being across nations and populations

Now we will have a look at the relationship between subjective well-being and net wealth, separately for assets and debt among different nations and populations.

*Similar across nations.* Among all nations, net wealth is positively correlated with subjective well-being apart from a negative relationship for China and the US (see Table 3.1, findings for net wealth). Moreover, in most nations a positive relationship has been observed between assets and subjective well-being (see Table 3.4). One finding suggests a negative relationship in Australia once satisfaction with wealth is controlled for. The same is true for a study among the general public in China, Germany and the UK where a negative correlation between assets and subjective well-being has been found. The coefficient for being a homeowner becomes negative, again, once satisfaction for several life domains is controlled for. One study considers rural-urban migrants in China, where financial assets in most specifications are negatively related to subjective well-being, however, this finding is not explained by the authors. Interestingly, the number of cars, or the value of the cars a household owns, is in most cases negatively related to subjective well-being, irrespective of the country where this issue has been explored. If you look at Table 3.5 debt is mostly negatively related to subjective well-being apart from Argentina (microfinance loan) and Italy (mortgage). Interestingly, the relationship between subjective well-being and debt is often positive in China.

*Similar across populations.* Among all populations, net wealth is also positively correlated with subjective well-being apart from a negative relationship for individuals living in rural China and elderly living in the US (see Table 3.1, findings for net wealth). The (few) available splits made by populations are presented in Table 3.6. Of the 18 findings on the relationship between subjective well-being and assets, five are negative. Among those, negative relationships have been found for females, elderly, migrants as well as rural population. We find mixed results for the relationship between subjective well-being and debt. Four findings indicate a positive relationship among urban populations. Three findings suggest a negative relationship among younger people, rural as



**Table 3.3:** 26 Research findings on subjective well-being and debt components

	Same-time correlation (cross-sectional)				Over-time correlation (longitudinal)			
	bivariate		partial		bivariate		partial	
	OLS	OPL	OPL	IV	OLS	OPL	OPL	IV
<b>Secured debt</b>								
Mortgage	+	+-	-	+			++++	+
Business loan	+			+			+ -	
<b>Unsecured Debt</b>								
Student loan	-							
Microfinance loan	+			+				
<b>Others (unspecified)</b>	-	-	-	-	+/-			+/-

A + sign indicates a positive correlation, a - sign denotes a negative correlation between subjective well-being and wealth. If a finding in the originally study is statistically significant, it is marked using a **bold** sign + or -. If different results are reported for different specifications, we will use a string of symbols, for example, +/- . By clicking these signs they link to the respective finding page in the World Database of Happiness containing the full detail about this particular research finding.

**Table 3.4:** 121 Research findings on subjective well-being and assets: Split by nations

	Same-time correlation (cross-sectional)				Over-time correlation (longitudinal)			
	bivariate		partial		bivariate		partial	
	OLS	IV	OPL	IV	OLS	OPL	IV	
Europe	+		++/+					
Australia	+	+	+	+/-	+/+	+/+	+	+
China	+	+	+	+	+/-		+	-
Germany	+	+/+	+	+	+	+	+	+
The Netherlands	+	+	+	+	+			
UK	+	+	+		+			
US	+	+	+	+	+	+		+
Others	+	+	+	+	+	+	+	+

A + sign indicates a positive correlation, a - sign denotes a negative correlation between subjective well-being and wealth. If a finding in the originally study is statistically significant, it is marked using a **bold** sign + or -. If different results are reported for different specifications, we will use a string of symbols, for example, +/-. By clicking these signs they link to the respective finding page in the World Database of Happiness containing the full detail about this particular research finding.

**Table 3.5:** 25 Research findings on subjective well-being and debt: Split by nations

	Same-time correlation (cross-sectional)				Over-time correlation (longitudinal)			
	bivariate		partial		bivariate		partial	
	OLS	OPL	OLS	IV	OLS	OPL	OLS	IV
Europe								
Australia	---							
China			+	+/-			+	+
Germany								
The Netherlands								
UK								
US								
Others								

A + sign indicates a positive correlation, a - sign denotes a negative correlation between subjective well-being and wealth. If a finding in the originally study is statistically significant, it is marked using a **bold** sign + or -. If different results are reported for different specifications, we will use a string of symbols, for example, +/--. By clicking these signs they link to the respective finding page in the World Database of Happiness containing the full detail about this particular research finding.



**Table 3.6:** 45 Research findings on subjective well-being and net wealth: split by populations

	Same-time correlation (cross-sectional)				Over-time correlation (longitudinal)			
	bivariate		partial		bivariate		partial	
	OLS	OPL	OPL	IV	OLS	OPL	OPL	IV
<b>Net wealth</b>								
<b>Female/Male</b>	+F +M							
<b>Rural/Urban</b>	+R	+/-R		-R				
<b>Young/Mid/Old</b>	+O +M +O +O -O	+O +O			+O		+O	
<b>Assets</b>								
<b>Female/Male</b>	+F -F +M +/-F							
<b>Rural/Urban</b>	+U +R +R -R	+/-U		+U				
<b>Young/Mid/Old</b>	+M +M +O +O -O -O	+Y +O						
<b>Migrants</b>								
<b>Debt</b>	+ -							
<b>Female/Male</b>					+F +M			
<b>Rural/Urban</b>	+U +/-R -U	+/-U +/-R			+U +U +U -R			
<b>Young/Mid/Old</b>								-Y

A + sign indicates a positive correlation, a - sign denotes a negative correlation between subjective well-being and wealth. If a finding in the originally study is statistically significant, it is marked using a **bold** sign + or -. If different results are reported for different specifications, we will use a string of symbols, for example, +/-. By clicking these signs they link to the respective finding page in the World Database of Happiness containing the full detail about this particular research finding.

well as urban populations too, whereas in three findings a different specification of the model changed the picture. As the findings, however, do not show a consistent difference in the effects of assets on subjective well-being between these different populations, no conclusion can be drawn.

### 3.3.4 Effect sizes of wealth on subjective well-being

As noted in Subsection 3.2.2 we selected findings expressed in a comparable effect size from -1 to +1 and present these in stem-leaf diagrams. The four bivariate correlations for net wealth obtained in cross-sectional studies vary between +0.13 and +0.19 with an average of +0.15 and a standard deviation of 0.03 (see Table 3.7). The 8 partial correlations varying between -0.23 and +0.12 with an average of -0.004 and a standard deviation of 0.13. The effect sizes of the only finding obtained from a study where longitudinal data are used reports an effect size of +0.06. Despite the fact that the average value of the standardized regression coefficients is negative in one case, the vast majority of the findings indicates a positive correlation between net wealth and subjective well-being.

The 44 bivariate correlations for financial and real assets obtained in cross-sectional studies vary between -0.03 and +0.36 with an average of +0.10 and a standard deviation of 0.08 (see Table 3.7). The 9 partial correlations are about half this size varying between -0.17 and +0.18 with an average of +0.01 and a standard deviation of 0.13. The effect sizes of the 8 findings obtained from studies that use longitudinal data are in a similar range. The average effect size of the two bivariate correlations is +0.23 and the seven Beta's range between +0.07 and +0.25 with an average of +0.16 and a standard deviation of 0.08.

The observed relationships between total debt, secured and unsecured debt and subjective well-being are shown in Table 3.8. The three bivariate correlations between total debt and unsecured debt and subjective well-being range from -0.25 to -0.13 (Mean=-0.21; SD=0.07) and indicate a clear negative relationship.

The standardised correlation and regression coefficients do not tell us much about the importance of wealth for subjective well-being. At the moment they only tell us how many standard deviations subjective well-being would change if a certain measure of wealth changed by about one standard deviation. Coupled with the fact that we observe different measures for subjective well-being (sometimes 7-point scale, sometimes a 11-point scale) and for wealth (sometimes the absolute value and sometimes the logarithm of wealth), this makes it difficult to say, whether these effects are meaningful or not. To

**Table 3.7:** Stem-and-leaf diagram: observed relationships between net wealth, total (financial and real) assets and subjective well-being

	Same-time correlation (cross-sectional)		Over-time correlation (longitudinal)	
	bivariate $r$	partial $Beta$	bivariate $r$	partial $Beta$
+0.3	<b>3 6</b>			
+0.2	<b>3 8</b>		6	<b>3 3 5</b>
+0.1	<b>3 4 4 9 6 0 0 1 2</b> <b>2 2 2 2 4 4 5 5 5</b> <b>7 8</b>	<b>2 1 8</b>	9	<b>2</b>
+0.0	<b>0 2 2 4 4 5 5 5 6 6</b> <b>7 7 7 7 7 7 7 8</b> <b>8 9 9</b>	<b>0 5 6 8 8 9 5 3 7</b>		<b>6 7 8</b>
-0.0	<b>3 3</b>	1		
-0.1		<b>9 4 7</b>		
-0.2		<b>3</b>		

*Note:* Colours of the figures indicate: **net wealth**, **total assets**, **financial assets**, **real assets**; **bold** figures: statistically significant; *italics* figures: special public other than the general public (for example, male/female or rural/urban); figures link to online detail about this finding.

answer this question, we have to compare these average effect sizes with average effect sizes of other variables, such as another monetary variable like income. Standardised coefficients, however, tell us whether assets or debt are more important for subjective well-being. The average effect size of the regression coefficients for total assets of the studies that used longitudinal data is larger (0.16) than the respective absolute value of the average effect size for debt (-0.06) on subjective well-being. Assuming a causal relationship between wealth and subjective well-being, these results suggest that assets have a greater positive impact on subjective well-being compared with debt having a negative impact.

### 3.4 Concluding remarks

The aim of this review was to see how individual wealth affects subjective well-being in order to provide a basis for making informed choices with respect to the surplus income. Are we any wiser now?

The available findings show that wealthy people are typically happier than non-wealthy people and that at least part of this difference is due to changes in wealth and

**Table 3.8:** Stem-and-leaf diagram: observed relationships between total debt, secured and unsecured debt and subjective well-being

	Same-time correlation (cross-sectional)		Over-time correlation (longitudinal)	
	bivariate $r$	partial $Beta$	bivariate $r$	partial $Beta$
+0.3				
+0.2				
+0.1				
+0.0		2 5		0 0 1 1 1 1
-0.0		2 5		5 0 0 6
-0.1	3			
-0.2	4 5			

*Note:* Colours of the figures indicate: **total debt**, **secured debt**, **unsecured debt**; **bold** figures: statistically significant; *italics* figures: special public other than the general public (for example, male/female or rural/urban); figures link to online detail about this finding.

therefore to be expected as causal. The findings also show that being in debt typically lowers subjective well-being, having unsecured debts in particular. Debt made for investment in a business or a house, however, seems to be positively related to subjective well-being. By computing the standardised correlation and regression coefficients we were able to show the relative importance of each wealth component for subjective well-being. Since the number of findings on financial assets is too little in order to allow a meaningful comparison, however, we do not know yet whether having financial assets or real assets is more important for subjective well-being. When we opt for investing in real assets, we know that investing in a house will probably contribute more to our subjective well-being than buying a car, but we do not know how other investment will work out on our subjective well-being, such as buying art or jewellery.

Our knowledge of what works best for whom is quite limited as yet, although the available data do not show much difference in bivariate relations across nations and social categories. It might be worth a second look, whether the effect of wealth is similar for women and men. Moreover, it would be interesting to know whether the effects of wealth change and if so, how they change over the lifespan. Additionally, we cannot say anything about the size of the effect in relation to other determinants of subjective well-being, as different measures of wealth as well as of subjective well-being and different methods to analyse their relationship were used. More research has to

be carried out in order to investigate the relative importance of wealth for subjective well-being.

To get a better view on causality we need studies that assess the effects of externally induced changes in wealth, such as inheritances or random financial mishap. To get a view on the long-term consequences of financial choices, these longitudinal studies should cover many years. To enable comparisons between the effects of saving and spending on subjective well-being, these studies should cover both aspects of wealth. Future studies should be sufficiently large to allow investigations of the relationship between subjective well-being and different populations. As things are, some of the required information will become available within the growing stream of empirical research in this field. Periodical synthesis of this data will be helpful, in particular when building on the foundations laid down in this chapter.

Even though the empirical evidence on the relationship between wealth and subjective well-being provide some clues on how to use one's surplus money (net wealth contributes to subjective well-being), the available data, however, do not inform us about the best ratio of saving and spending. It only allows us a first glance at what financial choices might work out best for what kind of people. We do not know whether saving or spending fosters subjective well-being in the long term. More research has to be carried out on this topic. For now, the cricket may still be happier than the ant.

## 4 Subjective well-being and wealth: empirical evidence from Germany

### 4.1 Background and research questions

Apart from providing instantaneous consumption opportunities, wealth has some additional features making it prone to positively influencing subjective well-being: it can be used to smooth consumption over an individual's life cycle, it provides security against income shocks, it serves as collateral for debt, and it generates income itself. Given these features of wealth, it is not surprising that several recent studies point to a positive relationship between subjective well-being and wealth. At the same time, it is conceivable that wealth might cause mental distress because it needs, for example, to be administered (see Subsection 2.3.3 for a brief discussion). When the different components of wealth such as total assets and total debt are considered separately, a positive correlation between subjective well-being and assets has generally been found, whereas the correlation between subjective well-being and debt has often been found to be negative (see Chapter 3 for an in-depth discussion).

Headey and Wooden (2004), for example, estimated the combined effects of disposable income and net wealth on subjective well-being and ill-being using cross-sectional data from the Household, Income and Labour Dynamics Survey in Australia (HILDA). The results indicate that income and net wealth promote subjective well-being and relieve ill-being almost in the same way. In another study, Headey et al. (2008) empirically investigated the combined effects of net wealth, disposable income and consumption on overall life satisfaction. Using data from five national household panels (Australia, Britain, Germany, Hungary and the Netherlands), he found a stronger correlation between life satisfaction and net wealth compared to the correlation between life satisfaction and income. Furthermore, it has been found that the relationship between subjective well-being and net wealth is rather weak in wealthy Western societies compared to their non-Western counterparts (Diener et al., 1999; Howell et al., 2006; Schyns, 2002).

Since Headey et al. (2008) considered net wealth and did not distinguish between total assets and total debt, they took two different dimensions – the effect of total assets and the effect of indebtedness – into consideration simultaneously; however, there is evidence that the different components of wealth correlate with subjective well-being differently. Two British studies (Brown and Gray, 2016; Office for National Statistics, 2015) have shown that assets and debts can have opposite effects on subjective well-being. In addition to splitting wealth into assets and debts, different types of assets in households' portfolios can have differential effects. Empirical evidence from literature on housing, for example, suggests that homeowners are, on average, more satisfied with their lives (Zumbro, 2014) and have a better mental health status (Manturuk, 2012) than renters. In contrast, a study published by the Office for National Statistics (2015) found that property ownership (and private pension wealth) is not statistically significantly related to life satisfaction in Britain. Instead, they found a positive relationship between net financial wealth and life satisfaction.

Moreover, different types of assets in a household's portfolio differ in both their risk properties and their liquidity. While liquid financial assets can be used to buy consumption goods, illiquid assets are more difficult to utilise for consumption purposes. These illiquid forms of wealth, however, can be considered as highly conspicuous goods, such as houses and cars. In his treatise, Veblen (1899) argued that highly conspicuous goods can be used to achieve greater social status. As greater social status can lead to greater levels of subjective well-being (Pinquart and Sörensen, 2000), assets which are more easily observed by others, such as real estate assets, may be correlated more closely with subjective well-being than other 'hidden assets', such as financial assets.

Regarding different types of debt, Brown et al. (2005) explored the role of unsecured and secured debt for psychological well-being. Using the British Household Panel Survey (BHPS) they found that unsecured – opposed to secured debt – had a detrimental effect on psychological well-being. One reason for this finding might be that the additional 'pleasure' derived from goods paid for by credit card, for example, is weaker and of shorter duration than the 'pain' one experiences when in debt (Jantsch and Veenhoven, 2019). Secured debt, such as mortgage debt, does not necessarily lower subjective well-being (Tay et al., 2017).

Despite the evidence cited in the studies discussed above, the link between subjective well-being and various wealth components has mostly been neglected in the existing literature, not least because of a lack of suitable data on individuals' and households' wealth. Most of the analyses of the reviewed studies in Chapter 3 were limited either to net wealth or to a single component such as homeownership or savings. Of the twenty

findings, for example, on the relationship between subjective well-being and wealth in Germany shown in Table 3.4, only three pertain to net wealth, with the remaining 17 related to individual asset components such as house ownership, car ownership or savings. Moreover, the reviewed literature does not reveal the relative importance of wealth compared to income for subjective well-being. Only one study considered the question of relative importance of wealth and income for subjective well-being. By comparing standardised regression coefficients, Headey et al. (2008) concluded that net wealth is “is at least as important as income” (p. 75). Further, some authors have postulated that the link between subjective well-being, income and wealth may be weaker if an individual lives in an area surrounded by many affluent households (Luttmer, 2005). The cause of this effect is attributed to interpersonal preferences “that incorporate relative income concerns [which] drive the negative association between neighbors’ earnings and own well-being” (Luttmer, 2005, p. 966-967). This is also supported by Vera-Toscano and Ateca-Amestoy (2008), who investigated housing satisfaction as a particular domain of life satisfaction. They found that renters in neighbourhoods with a greater share of homeowners reported, on average, lower levels of housing satisfaction than renters in neighbourhoods with a lower share of homeowners. They also showed that homeowners in a predominantly renting neighbourhood report no ‘additional’ satisfaction with their houses.

As already indicated in Subsection 2.4.2, considerable amounts of research have been done in the past with regard to social comparisons that focus on income. Duesenberry (1949) was the first to formulate the relative income hypothesis econometrically and to have empirically shown that people tend to make upward comparisons, which in turn has a negative effect on them and influences their consumption behaviour. Using the notion of externalities, the consumption behaviour of others can cause either positive or negative externalities, i.e. the reference income can correlate both positively and negatively with subjective well-being. However, social comparisons regarding wealth have scarcely been explored in the past. A notable exception – although no measure of subjective well-being was taken into account – is a study by Bertram-Hümmer and Baliki (2015); therein, they examined the role of visible assets for perceived relative deprivation by using a question on self-assessed economic deprivation in Kyrgyzstan. The authors showed that visible assets correlate more strongly with perceived relative deprivation than income. In addition to this study and as previously discussed, Brown and Gray (2016) examined the comparison effects of income, assets and debt in Australia. However, to the best of our knowledge, there exist no other studies that considered the question of how wealth comparisons affect subjective well-being.



Against this background, we investigate the role of wealth for subjective well-being in Germany. In particular, we attempt to answer the following research questions:

- (i) *How does wealth relate to subjective well-being?*

In order to answer this research question, we describe the relationship we observed between life satisfaction as an indicator of subjective well-being and total assets and total debt as indicators of wealth. We also briefly discuss how the association between life satisfaction and income changes when wealth (total assets and total debt) enters the equation.

- (ii) *What is the relative importance of wealth for subjective well-being compared to income?*

In order to answer this research question, we calculate the amount of total assets that is necessary for an individual to achieve a change in life satisfaction equivalent to the same change in life satisfaction that is instead caused by an increase of net annual income by 1,000 Euros.

- (iii) *How do the different components of wealth relate to subjective well-being?*

In order to answer this research question, we separately consider the various components of total assets, such as real assets, financial assets, as well as total debt, such as mortgage (secured) and non-mortgage (unsecured) debt.

- (iv) *Are there regional heterogeneities in the relationship between subjective well-being and wealth?*

In order to answer this research question, we perform the analysis separately for East and West Germany because there are still systematic differences between these two regions. This includes differences in average life satisfaction and economic performance, which may have causes related to the differences between the formerly separated regions of Germany (Frijters et al., 2004b; Pfaff and Hirata, 2013). Furthermore, we conduct our analysis separately for people living in wealthy and non-wealthy areas to account for empirical evidence that has shown there is a weaker relationship between subjective well-being and wealth for individuals living in an area surrounded by many affluent households (Luttmer, 2005; Clark et al., 2008). This paves the way for the subsequent analysis of social comparisons.

- (v) *How is an increase in wealth of the respective reference group associated with subjective well-being?*

We will look at the relationship between subjective well-being and *relative* wealth. On the basis of all preliminary considerations and existing empirical evidence on income comparisons, we estimate the association between subjective well-being and the reference consumption level, itself represented by the wealth of the respective refer-

ence group in relation to their own wealth. In doing so, we also consider whether the individual is above or below the reference consumption level.

- (vi) *Are there differences in the relationship between subjective well-being and relative wealth for younger and older people?*

FitzRoy et al. (2014) studied the variation of both *tunnel effect* and the effect of *relative deprivation* over an individual's life span for West Germany and the UK. Their results suggest that the negative effect of relative deprivation dominates later in life, while the tunnel effect appears earlier in life. Brown and Gray (2016) found similar results when analysing the relationship between subjective well-being and relative wealth using HILDA data. Motivated by these studies, we also perform our analysis separately for people younger than 45 years and people 45 years or older.

- (vii) *Are there regional heterogeneities in the relationship between subjective well-being and relative wealth?*

Additionally, we split our sample into East and West German regions, again, to account for the systematic differences between the two parts of Germany. Moreover, as previously discussed, some authors have postulated that the relationship of subjective well-being, income and wealth may be weaker if a household lives in an area surrounded by many affluent households. Thus, in this context we explore whether the comparison effects also differ depending on regional wealth by conducting the analysis separately for wealthy and non-wealthy areas.

Our analysis contributes to the understanding of the relationship between subjective well-being and wealth in Germany. In doing so, we provide new empirical evidence for Germany by using an extensive and unique dataset of the Deutsche Bundesbank called the Panel on Household Finance (PHF), which provides detailed information about respondents' household wealth. As we do not know of another dataset that reflects the wealth structure in Germany in greater detail, this dataset is particularly well suited to investigate how wealth and its various components are linked to subjective well-being. After explaining the empirical strategy in Section 4.2, we explain how we define the respective reference group and what the underlying reference income and wealth is. In order to answer the research questions, we employ multiple regression analysis, for which the results are shown in Section 4.4.

## 4.2 Empirical strategy

### *Subjective well-being and absolute wealth: econometric model*

We must first decide the appropriate estimation technique to analyse the question posed to survey respondents about their general life satisfaction. The responses given in the survey to this question can be treated as an ordinal or a cardinal variable, using either ordered logit/probit models or OLS. A widely cited paper by Ferrer-i-Carbonell and Frijters (2004) states “that assuming ordinality or cardinality of happiness scores makes little difference” (p. 641), but that one should use fixed effects specifications in panel settings to account for household unobserved heterogeneity (cf. Section 2.2.2). We follow their suggestion and perform panel OLS regressions using household fixed effects on the balanced panel. Hence, in order to explain subjective well-being (*SWB*) of individual  $i$  at time  $t$ , we use the following regression equation:

$$\begin{aligned}
 SWB_{it} = & \beta_1 \ln Y_{it} + \beta_2 \ln A_{it} + \beta_3 \ln D_{it} \\
 & + \mathbf{x}'_{it} \boldsymbol{\delta} + \alpha_i + \lambda_t + \varepsilon_{it},
 \end{aligned}
 \tag{4.1}$$

where *SWB* is self-reported life satisfaction on an 11-point scale ranging from zero (0) to 10.  $Y$ ,  $A$  and  $D$  denote annual net household income, total household assets and total household debt, respectively. In the literature on the relationship between life satisfaction and income, researchers typically make use of a logarithmic transformation of income in order to deal with extreme outliers and to account for diminishing marginal utility of income (Layard et al., 2008). For our analysis, we also transform annual net household income, total assets and total debt, as well as the individual components of total assets and total debt using the logarithmic transformation. Moreover, once respondents indicated that they do not own any assets or debts, we assigned the value zero to the log transformed variable. The parameter designated by  $\beta$  gives us an indication of how income and wealth are associated with subjective well-being. The regression results from this equation therefore provide the answer to the first and second research question.

The vector  $\mathbf{x}$  contains control variables for socio-demographic and socio-economic characteristics, including the respondent’s age in years (also squared and cubed) at the time of the interview, the number of children below 16 that they have, their marital status (single–never married, married, divorced, widowed), their German citizenship

status, their place of residence (East/West Germany), their education level using the ISCED standard<sup>1</sup>, and their employment status (manual worker, employee, civil servant, self-employed, apprenticeship, student, unemployed, other not working).<sup>2</sup> The parameters designated by  $\alpha$  and  $\lambda$  denote fixed effects for the household and the time respectively, and  $\varepsilon$  is the remaining error, which is assumed to be independently and identically distributed (IID); finally,  $\beta$  and  $\delta$  are the parameters to be estimated. According to the literature review in Chapter 3 we assume that the amount of total assets is positively related to subjective well-being, while the amount of total debt is the opposite (negatively related). Therefore, the parameter  $\beta_3$  is supposed to be non-positive.

Since income is measured at the household level, the regression must also take into account the number of people living together in a household who share that income. Typically, equivalence scales are used to adjust income to differences in needs for households of different size. This accounts for the economies of scale of living together (Buhmann et al., 1988). Since it is very likely that this is also true for wealth and therefore the equivalence scale elasticity of wealth is not zero, we use equivalence scales for income as well as for assets and debt. We do not, however, use ex-ante equivalence scales for income, assets or debt, such as the OECD equivalence scale. We include instead the logarithm of household size in the equation, which allows us to estimate the additional income and wealth needed to compensate for the decline in subjective well-being if the household size increases. One reason to do so is that most equivalence scale elasticities regarding income suggested by expert scales are higher than the estimated scales based on subjective data. This, in turn, could lead to an underestimation of economies of scale within a household (Schwarze, 2003).<sup>3</sup>

In order to investigate the relationship between subjective well-being and wealth components, we now include real assets,  $A^{REAL}$ , financial assets,  $A^{FIN}$ , mortgage debt,  $D^{SEC}$ , and non-mortgage debt,  $D^{UNSEC}$ . According to the overall result of our literature in Chapter 3, the following regression equation results:

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<sup>1</sup>ISCED stands for International Standard Classification of Education, a system developed by the OECD for international comparison reasons.

<sup>2</sup>We cannot consider gender due to our fixed effect approach, since it usually does not change over the lifespan. See the appendix (Table A.6) for a detailed description of the variables used in our analysis.

<sup>3</sup>The equation for estimating the equivalence scale elasticity,  $e$ , is shown and explained in the appendix B.

$$\begin{aligned}
SWB_{it} = & \beta_1 \ln Y_{it} + \gamma_1 \ln A_{it}^{REAL} + \gamma_2 \ln A_{it}^{FIN} + \gamma_3 \ln D_{it}^{SEC} + \gamma_4 \ln D_{it}^{UNSEC} \\
& + \mathbf{x}'_{it} \boldsymbol{\delta} + \alpha_i + \lambda_t + \varepsilon_{it}.
\end{aligned} \tag{4.2}$$

The parameter designated by  $\gamma$  gives us an indication of how the individual components of wealth are associated with subjective well-being. The regression results from this equation are therefore the answer to the third research question.

*Subjective well-being and relative wealth: econometric model*

In the next step, the aim is to explain subjective well-being using a function that contains both an absolute and a relative component. To answer our research questions and together with the preceding considerations on the absolute and relative utility function in Subsection 2.4.1 and 2.4.2, we rely on specifications used in a similar way by Ferrer-i-Carbonell (2005) and partly by Vendrik and Woltjer (2007), and start with the following equation which extends the baseline specification (4.1):

$$\begin{aligned}
SWB_{irt} = & \beta_1 \ln Y_{it} + \beta_2 \ln A_{it} + \beta_3 \ln D_{it} \\
& + \kappa_1 \ln Y_{rt} + \kappa_2 \ln A_{rt} + \kappa_3 \ln D_{rt} \\
& + \mathbf{x}'_{it} \boldsymbol{\delta} + \alpha_i + \lambda_t + \varepsilon_{irt},
\end{aligned} \tag{4.3}$$

where current consumption level is determined not only by current annual net household income,  $Y$ , but also by total household assets,  $A$ , and total household debt,  $D$ , which is basically available for an individual's,  $i$ , and consumption at time,  $t$  (cf. Section 2.3). Similarly,  $Y_r$ ,  $A_r$  and  $D_r$  represent measures of income, total assets, and total debt for the respective reference group  $r$ . The definition of our reference group is based on individual characteristics and place of residence. Based on this definition, the composition of which is explained in more detail below, 30 different individual reference groups result. The parameter designated by  $\kappa$  gives us an indication of how the reference wealth is associated with subjective well-being. The regression results from this equation are therefore the answer to the fifth research question, without considering whether an individual is above or below reference wealth.

Assuming that people have ‘a unidirectional drive upward’ due to a desire for social advancement (Festinger, 1954, Hypothesis IV, p. 124), a rise in the consumption level of the respective reference group,  $r$ , is negatively associated with subjective well-being  $SWB$  – even if their own consumption level is already above that of the reference group. Therefore, the parameter  $\kappa$  is supposed to be non-positive.<sup>4</sup> According to that and to Clark et al. (2008), equation (4.3) can be rewritten using an expression of interpersonal difference of consumption levels ( $\ln Y_{it} - \ln Y_{rt}$ ), ( $\ln A_{it} - \ln A_{rt}$ ), and ( $\ln D_{it} - \ln D_{rt}$ ):

$$\begin{aligned} SWB_{irt} &= (\beta_1 + \kappa_1) \ln Y_{it} + (\beta_2 + \kappa_2) \ln A_{it} + (\beta_3 + \kappa_3) \ln D_{it} \\ &\quad - \kappa_1(\ln Y_{it} - \ln Y_{rt}) - \kappa_2(\ln A_{it} - \ln A_{rt}) - \kappa_3(\ln D_{it} - \ln D_{rt}) \quad (4.4) \\ &\quad + \mathbf{x}'_{it} \boldsymbol{\delta} + \alpha_i + \lambda_t + \varepsilon_{irt}. \end{aligned}$$

where ( $\ln Y_{it} - \ln Y_{rt}$ ), ( $\ln A_{it} - \ln A_{rt}$ ), and ( $\ln D_{it} - \ln D_{rt}$ ) correspond to the relative consumption level and can also be written as  $\ln(Y_{it}/Y_{rt})$ ,  $\ln(A_{it}/A_{rt})$ , and  $\ln(D_{it}/D_{rt})$ . Moreover, equation (4.4) makes it possible to separate the effect on  $SWB$  of the individual consumption level relative to the reference consumption level from the effect of the absolute individual consumption level (Ferrer-i-Carbonell, 2005; Vendrik and Woltjer, 2007).

The expressions  $\ln Y_{it} - \ln Y_{rt}$ ,  $\ln A_{it} - \ln A_{rt}$ , and  $\ln D_{it} - \ln D_{rt}$  also indicate the distance between one’s own consumption level and that of the corresponding reference group. We call this difference  $Diff$ . However, this specification does not allow for asymmetries in comparisons. To find out which effect dominates – fear of social decline, tunnel effect, relative deprivation or relative gratification – we have to consider whether the individual’s consumption level is above or below that of the respective reference group’s consumption level. Therefore, we define a positive difference,  $Diff^+$ , if the level of one’s own income and wealth is above that of the reference group, and a negative difference,  $Diff^-$ , if the level of one’s own income and wealth is below that of the reference group (see equation (4.5)). In the example of income, as soon as the difference between an individual’s and the reference income is positive, i.e.  $Y_{it} > Y_{rt}$ , then  $Diff^+_Y$  equals  $Diff_Y$  and  $Diff^-_Y$  equals zero. If the difference between an individual’s and the

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<sup>4</sup>The vector  $\mathbf{x}$  contains the same controls for socio-demographic and socio-economic characteristics introduced in Section 4.2. The parameters  $\alpha$  and  $\lambda$  denote fixed effects for the household and the time respectively,  $\varepsilon$  is the error term assumed to be independent and identically distributed (IID), and  $\beta$ ,  $\delta$  and  $\kappa$  are the parameters to be estimated.

reference income is negative, i.e.  $Y_{it} < Y_{rt}$ , then  $Diff_Y^-$  equals  $Diff_Y$  and  $Diff_Y^+$  equals zero (cf. Ferrer-i-Carbonell, 2005). The term  $\beta - \kappa$  is represented by the coefficient  $\theta$ .

$$\begin{aligned}
SWB_{irt} = & \theta_1 \ln Y_{it} + \theta_2 \ln A_{it} + \theta_3 \ln D_{it} \\
& - \kappa_1^+ Diff_Y^+ - \kappa_2^+ Diff_A^+ - \kappa_3^+ Diff_D^+ \\
& - \kappa_1^- Diff_Y^- - \kappa_2^- Diff_A^- - \kappa_3^- Diff_D^- \\
& + \mathbf{x}'_{it} \boldsymbol{\delta} + \alpha_i + \lambda_t + \varepsilon_{irt}
\end{aligned} \tag{4.5}$$

The parameters  $\kappa^+$  and  $\kappa^-$  give us an indication of the association between subjective well-being and the reference wealth and reference income, taking into account whether an individual is above or below reference income and reference wealth, respectively. Regression results from this equation are therefore linked to research questions five through to seven.

A difficulty arises from the technical side of the estimation process. Information about wealth and income in the PHF is multiply imputed.<sup>5</sup> In our sample, almost 40% of the values for total assets, 12% for total debt, and 4% for net income are imputed. For the estimation of equations (4.1) and (4.2), we take into account the uncertainty introduced by the multiple imputation (five imputates) of our independent variables by running the regression on each of the imputed datasets; thus we obtain five completed-data estimates of coefficients and their variance-covariance matrices corresponding to the parameter estimates. According to the combination rules by Rubin (1987), the coefficients and standard errors (SE) are then adjusted for the variability between imputations. The estimation was done in Stata MP 13 using the command `mi estimate`.

In general, the calculation of simple means or medians, but also of point estimates and their respected standard errors, will be biased when the complex survey design of the PHF is ignored. Firstly, the sampling design contains an unequal selection probability. Secondly, wealthy households are systematically over-represented. These biases can be compensated for by using appropriate weights that denote both the inverse of the probability that a household is included and the sampling stratification. For our analysis we estimate a population regression by using survey weights, which we will

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<sup>5</sup>The life satisfaction question is not imputed. This has no consequences for our analysis.

explain in more detail in Subsection 4.3.1. However, we cannot take into account the complex sampling design within our fixed effects approach to compute correct standard errors due to a software limitation in the statistical software STATA MP 13. Therefore, we cannot appropriately compute the standard errors. In summary, when estimating the population regression from our sample using weights, we obtain unbiased point estimates (Solon et al., 2015). However, in this thesis we refrain from reporting the estimate of the uncertainty associated with the point estimate (standard error) because standard errors cannot be used as a statistical tool to answer the question of population validity when computed incorrectly.<sup>6</sup>

*Definition of an individual's reference group*

In order to account for the fact that an individual's life satisfaction might be affected by income or wealth in relative rather than in absolute terms, we must first define the respective reference group of each individual under consideration. The difficulty is to accurately conceptualise which people an individual will include in their reference group. Several authors have made use of a geographical interpretation of reference group in the context of income. Persky and Tam (1990) assumed that subjective well-being of people is only affected by the people living in the same region. As Becchetti et al. (2013) showed in their paper, 'region' is a vague term and leaves room for interpretation. They argued that whole countries can serve as reference groups and not just the people living nearby. Knight et al. (2009) asked people in rural China directly about whom they compare themselves and found that most of the surveyed people were comparing themselves to neighbours or fellow villagers. Some studies have used a narrower interpretation of a geographical reference group and define only people living in an immediate vicinity as a relevant reference group (Luttmer, 2005; Knies et al., 2008).

In Subsection 2.4.1, however, we learnt that people select their comparison target on the basis of similar attributes. McBride (2001) picked up this idea by defining an individual's reference group based on age, where the reference interval includes all people who are five years younger or older. In addition, Layard et al. (2010) explored the inclusion of education and gender in the construction of the reference group. Ferrer-i-Carbonell (2005) combined both the individual characteristics and 'geography'; i.e. she considers only those people living in the same region as the reference group, in addi-

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<sup>6</sup>Without considering the stratification and clustering in the sample, the standard errors are not computed correctly. We cannot even determine if they are too small or too large. Nevertheless, we provide robust standard errors in the appendix for interested readers, but we do not use them as inferential statistical tools.



tion to the socio-demographic characteristics (in her paper, East and West Germany). Particularly in the German context, the distinction between East and West Germany could give an indication about expected income for individuals; according to the Federal Employment Agency the incomes in West Germany even almost 30 years after the reunification are, on average, still higher than those in East Germany (Statistik der Arbeit Bundesagentur für Arbeit, 2019).

Clark and Oswald (1996) and Senik (2004) chose a different approach. They predicted the reference income individually for each person as a result of an estimation based on a “conventional earnings equation” (Clark and Oswald, 1996, p. 368). Senik (2004) predicted “the logarithm of the typical real income of an individual, based on his education, years of working experience, region, branch, age, sex, and primary occupation” (p. 2105) for each wave in their panel. In doing so, she assumed that people have the income equivalent to the ‘typical real income’ of people with given characteristics in mind. She further assumed that this post-estimation prediction for individual income serves as a good indicator of what individuals might expect for their own income and thus serves as reference group income.

All approaches of defining the reference group and calculating the reference income based on survey data have advantages and disadvantages. The geographical approach is based on what people really ‘see’, namely those who live in the same region, although the term ‘region’ leaves room for interpretation. This approach, however, ignores that people might compare themselves with people who have similar ‘attributes’ such as gender, age or education. Therefore, it is reasonable to extend this estimation to consider these other attributes in addition to the region, as Ferrer-i-Carbonell (2005) did. Still, the problem with this approach, in general, is that it is strongly dependent on the number of observations within the dataset used for each reference group because they are the basis of the reference income calculation. Compared to the approach of calculating reference income based on sample means for a predefined reference group, the post-estimation approach has the advantage of predicting reference income, even if there are only one or two observations in the sample that cover all these attributes. However, this approach, in turn, only reflects the social comparison to a limited extent because a comparison could also take place with persons with other characteristics. For example, a woman could compare herself with a man. Or individuals could compare themselves with people of a different age, such as if an individual assesses whether they have achieved what an older reference individual had when they were at the age of the individual making the comparison.

In this thesis, we follow Ferrer-i-Carbonell (2005) and calculate reference income, reference wealth, and reference debt of people belonging to the same education level, the same age group, and living in the same region. With this approach we assume that people compare themselves with similar people. In order to define our reference groups, we divide the education level into three categories, namely, ‘low’ (primary and lower secondary education), ‘medium’ (upper secondary and post-secondary non-tertiary education), and ‘high’ (first and second stage tertiary education). Moreover, we draw five age groups, namely, <35 years, 35-44 years, 45-54 years, 55-64 years and 65 years and older. Finally, we also differentiate between households living in East and West Germany. In doing so we assume that individuals have a good knowledge of the socio-economic situation of people living in East and West Germany because they are able to observe and assess their living conditions.<sup>7</sup> For each of the 30 resulting groups we calculated the group median for net income, total assets and total debt. Finally, though Ferrer-i-Carbonell (2005) used the mean, we decided to use the median on its own because it is a robust measure of income and wealth within the respective reference group and less sensitive to outliers (than the mean).<sup>8</sup>

## 4.3 Data and descriptive statistics

### 4.3.1 Data –The Panel on Household Finances

For our analysis we used data from the first two waves of the German Wealth Survey (‘Panel on household finances’ - PHF) carried out in 2010 and 2014. The survey is based on a random stratified sample of private households in Germany, with oversampling of wealthy areas.<sup>9</sup> The PHF net samples comprised 3,565 households in 2010 and 4,661 households in 2014. To account for attrition and to ensure cross-sectional representativeness, a refresher sample was drawn for the 2014 survey. 2,179 households (incl. 40 split off households) participated in both of the survey years, i.e. 2010 and 2014.

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<sup>7</sup>It is preferable to choose smaller educational groups and age brackets, and define the region using a higher level of spatial specificity, such as federal state or district level; however, this is not possible due to the low number of observations in our dataset.

<sup>8</sup>Descriptive statistics for comparison group income, total assets and total debt are shown in Table A.10 and Table A.11 in the appendix.

<sup>9</sup>The PHF survey was conducted in 2010 (September 2010 to June 2011) and 2014 (April to November 2014). Detailed data on households’ assets and debts were collected by interviewers in face-to-face CAPI interviews, which last one hour, on average. The German surveys are part of a larger effort to collect harmonised wealth data in the European area, under the project title of ‘Household Finance and Consumption Survey’ (HFCS). Unfortunately, information on life satisfaction is not part of the ‘core questionnaire’ for all countries. For more information on the survey, see Kalckreuth et al. (2012) and [www.bundesbank.de/phf-research](http://www.bundesbank.de/phf-research).

The survey is well suited for our analysis as it contains detailed information on monthly household income and, in particular, on household wealth. It provides information on real assets (properties, self-employed businesses, vehicles and valuables) and financial assets (current accounts, savings account, stocks, bonds and other securities, pension contracts, managed accounts, non-self-employed business wealth), as well as debt (mortgages, consumer loans, private loans, overdue bills). Except for income and pension assets, all the information is collected at the household level. To deal with missing values, the wealth and income variables of the PHF were multiply imputed by colleagues of the research centre of the Deutsche Bundesbank using Rubin's (1987) method. If a respondent did not know the exact value of their assets or debt or did not want to answer this question, the imputation procedure was employed in place of their direct response.<sup>10</sup> According to the predefined imputation procedure, five different values (implicates) for the missing value of asset or debt type were calculated (imputed) to approximate it. If the exact values of assets and debt were actually recorded by the respondent, the imputation procedure would give identical values for all five of the implicates. In our analysis, we used total assets calculated as the sum of all real and financial assets, as well as total debt, the amount of outstanding mortgage debt and non-mortgage debt (cf. Figure 2.2 on page 25). For our analysis we also used annual net household income calculated from a one-shot question on total monthly net household income.

Our dependent variable was taken from a question on life satisfaction using a 11-point scale: 'In general, how satisfied are you currently with your life as a whole?', which respondents answered by ticking one option on a list running from zero (0) meaning they were 'completely dissatisfied with life' to 10 meaning they were 'completely satisfied with life'. This question, like all the other questions on beliefs, expectations and evaluations, was only answered by one person in the household, the 'financially knowledgeable person (FKP)', i.e. the person who was most informed with respect to the household's finances.<sup>11</sup>

The random sample was conducted in three stages so that the stratification of the sample could be done by wealth. In the first sampling stage, municipalities were selected according to their wealth: municipalities with less than 100,000 inhabitants were assigned to two strata, labelled 'wealthy small municipality' and 'other small munic-

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<sup>10</sup>See the paper by Zhu and Eisele (2013), which is part of the PHF user guide and in which the imputation process is described in detail.

<sup>11</sup>Since wealth is measured at the household level and life satisfaction is measured at the individual level, we have to assume that all persons in a household have equal access to the resources of the household.

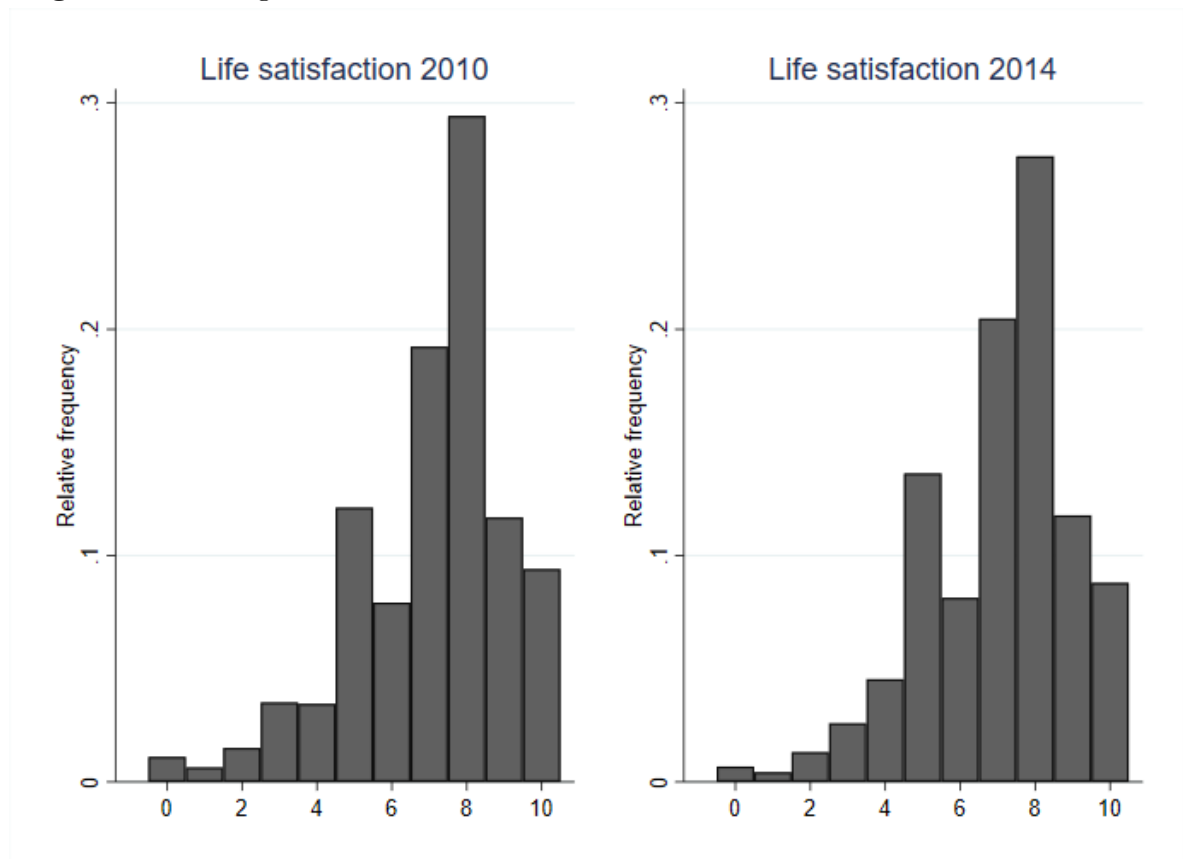
pality', which were based on the share of taxpayers with high income. In the second stage, a selection of street segments in larger cities with a population of 100,000 and more took place. In other words, we identified streets in wealthy neighbourhoods and other streets based on micro-geographic characteristics, such as housing structure. In a next step, individuals 18 years or older residing in previous selected municipalities and street sections were selected using a public register ('Einwohnermeldeamtsregister') and by employing a systematic random selection process (see Kalckreuth et al., 2012, p. 7 f., for a more detailed description of the sampling design). This information allowed us to investigate whether the relationship between life satisfaction and income or wealth varies across regions with different levels of wealth.

The unbalanced panel contains 3,748 households. We, however, concentrated our analysis on the balanced panel, since this allowed us to capture the change in assets and debt over time. Of the 2,139 panel households that could potentially be linked across the two waves of the survey we used 2,114 for our analysis. We deleted four observations with missing information on life satisfaction in either one of the survey waves. We also excluded one household with net wealth of more than 50 million Euro. Finally, we also removed 20 individuals from our analysis because we could not assign them an ISCED education status.<sup>12</sup>

In order to obtain unbiased point estimates we used the provided weights for the subsequent analysis. As we want to follow respondents from the first wave forward, we used the cross-sectional weights computed for the first wave. The weights corrected for three different aspects. Firstly, the 'design weights' were formed for all stages of the sample by calculating the inverse selection probability. Secondly, an adjustment of the design weights was done, which corrected for different participation probabilities of specific population groups ('non-response adjustment of the design weights'). Thirdly, a subsequent calibration (redressing) was done on key distributions of households or characteristics of the main income earner of a household, respectively. In doing so, the distributions of the following characteristics of households and main income earners according to the results of the microcensus in 2013 were taken into account: combination of age and gender, combination of the highest educational attainment and age, employment status, nationality, household size, federal state (*Bundesland*), *politische*

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<sup>12</sup>Those individuals had only provided 'other education' as an answer to the questions on their educational background.

**Figure 4.1:** Histogram of life satisfaction measures 2010 and 2014

Source/Notes: PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

*Gemeindegrößenklasse*, combination of ownership status of the dwelling and dwelling size.<sup>13</sup>

### 4.3.2 Descriptive statistics

We found that the respondents in the balanced panel have, on average, a fairly high level of life satisfaction. Average life satisfaction was almost identical in both waves: 7.00 in 2010 and 7.04 in 2014, with a standard deviation of 2.02 in 2010 and 1.95 in 2014. Both the mean and the distribution were very similar across the two years, as Figure 4.1 shows. The mode in both years was at eight (8) and the mid-point of the scale (value 5) had a higher frequency than the next highest increment (value 6).

While the overall distribution of life satisfaction was very stable across time, there were many transitions at the individual level (see Table 4.1). Even though the values

<sup>13</sup>For a detailed description of the weights, see ‘Methodenbericht - Welle 1’ and ‘Methodenbericht - Welle 1’ provided on <https://www.bundesbank.de/en/bundesbank/research/panel-on-household-finances/user-documentation>.

**Table 4.1:** Life satisfaction in transitions (2010 and 2014)

		Year 2010							Total
		0-4	5	6	7	8	9	10	
Year 2014	0-4	35	27	6	14	11	1	6	100
	5	17	32	9	11	16	2	8	100
	6	11	21	10	16	29	4	3	100
	7	6	11	14	29	30	6	4	100
	8	7	8	6	24	38	12	5	100
	9	3	3	4	15	33	24	18	100
	10	3	1	7	16	19	22	32	100
	Total	10	14	8	20	28	10	10	100

*Source/Notes:* PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only. We combined the first categories (0-4) due to a small number of observations.

on the diagonal are, as expected, higher than the other figures, none of the diagonal elements exceed 50%; this indicates that more than half of our sample population reported changes in their life satisfaction, with no clear tendency towards more or less life satisfaction. Moreover, 34% of the respondents in our sample reported a reduction in life satisfaction, 34% an increase and 32% no change. Of those households with positive changes, 56% reported an increase of one-point on the 11-point scale and an additional 21% reported an increase of two points. For households reporting a decrease the respective numbers were 53% and 25% across the respective increments. Thus, it is clear the average life satisfaction remained nearly unchanged, despite the frequency of change in the life satisfaction of individuals, because the aggregate of negative and positive changes in the full sample were almost balanced exactly.

With respect to wealth and income, the mean (median) annual net household income was €28,561 (€24,000) in 2010 and €29,638 (€24,000) in 2014. Mean (median) total assets were at €233,433 (€81,850) in 2010 and at €237,901 (€108,600) in 2014.<sup>14</sup> There were also substantial changes at the micro-level in our two main explanatory variables of interest, total assets and total debt (see Table A.3 and A.4 in the appendix).<sup>15</sup> We found that the decile that households' total assets were in had changed between 2010

<sup>14</sup>Values for income and wealth were not adjusted for inflation. Median and mean values for wealth components as well as participation rates are presented in Table A.1 in the appendix. Descriptive statistics for control variables included in the regression analysis are presented in Table A.2. Both annual net household income and total household net wealth were substantially higher than the weighted averages for the total population, reflecting the oversampling of the wealthy. This leads to high mean and median values if the unequal probability of selection is ignored.

<sup>15</sup>Please note that we show the transitions within the wealth and debt distributions without considering where the households are in the life satisfaction distribution. It is not possible to infer from these tables how changes in wealth and debt are linked to changes in life satisfaction. This is the main topic of our multiple regression analysis presented below.

and 2014 for about half of the panel: 30% moved to a higher decile and 22% to a lower decile, while approximately 48% remained in the same decile. For total debt only about one third of households (34%) remained in the same decile, 27% moved up one or more decile and 38% down by at least one decile.

Before presenting the main results of our multiple regression analysis, we examine the bivariate relationship between life satisfaction and each of net income and wealth in Germany (see Figures 4.2, 4.3 and 4.4). We found average life satisfaction increased with annual net household income (see Figure 4.2), which reflects the well-known positive relationship between life satisfaction and annual net household income (see Frijters et al., 2004a). The same picture emerged with life satisfaction and total household assets (see Figure 4.3). This indicates that the higher the asset quintile in which a household is located, the higher the average life satisfaction. These results are broadly consistent with those of the studies listed in Table 3.1 on page 45. Interestingly, Figure 4.4 also shows increasing average life satisfaction the higher the debt quintile in which a household is located. This is contrary to the expectation we formed according to the results of the listed studies on debt in Table 3.1. It is conceivable that the relationship between life satisfaction total debt shown in Figure 4.4 is explained by a third factor not considered, such as income. We conducted multiple regression analysis in order to control for variables that correlate with life satisfaction in addition to debt, and report the results in the next section.

## 4.4 Empirical evidence

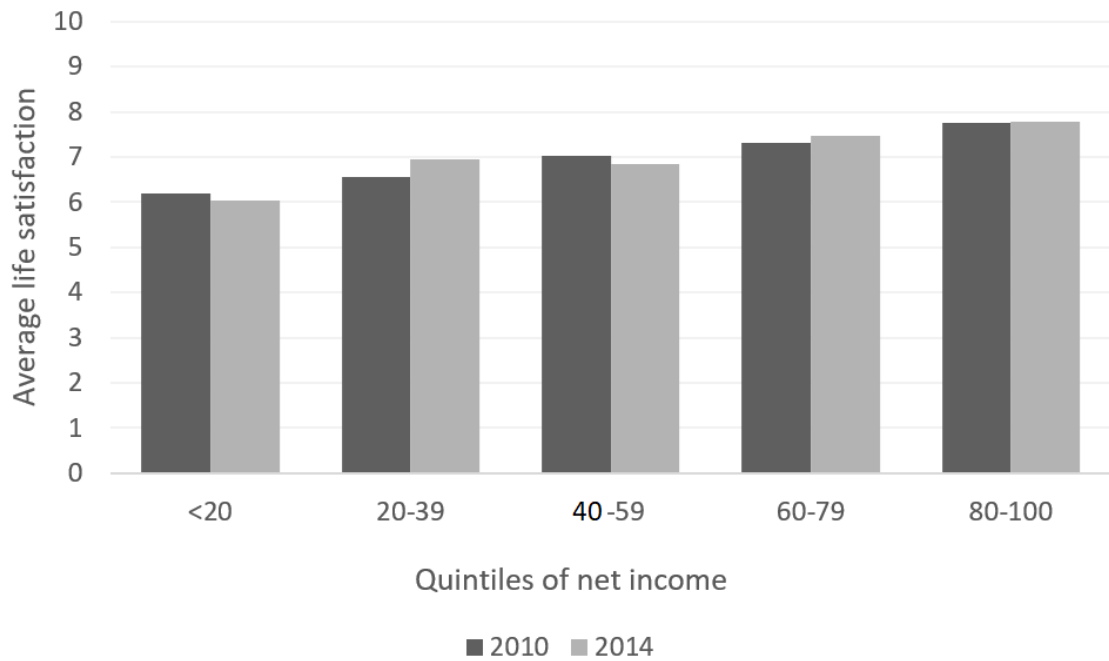
### 4.4.1 Relationship between life satisfaction, wealth and its components

We now turn to the panel regression results and first discuss the role of wealth and whether the effect of income on life satisfaction changes once household wealth is considered simultaneously. In a subsequent step, we estimate the association between life satisfaction and the various components of wealth. In doing so, we distinguish between real assets, financial assets, mortgage debt, and non-mortgage debt. We will then investigate regional heterogeneities with regard to the relationship between life satisfaction and income and wealth.

(i) *How does wealth relate to subjective well-being?*

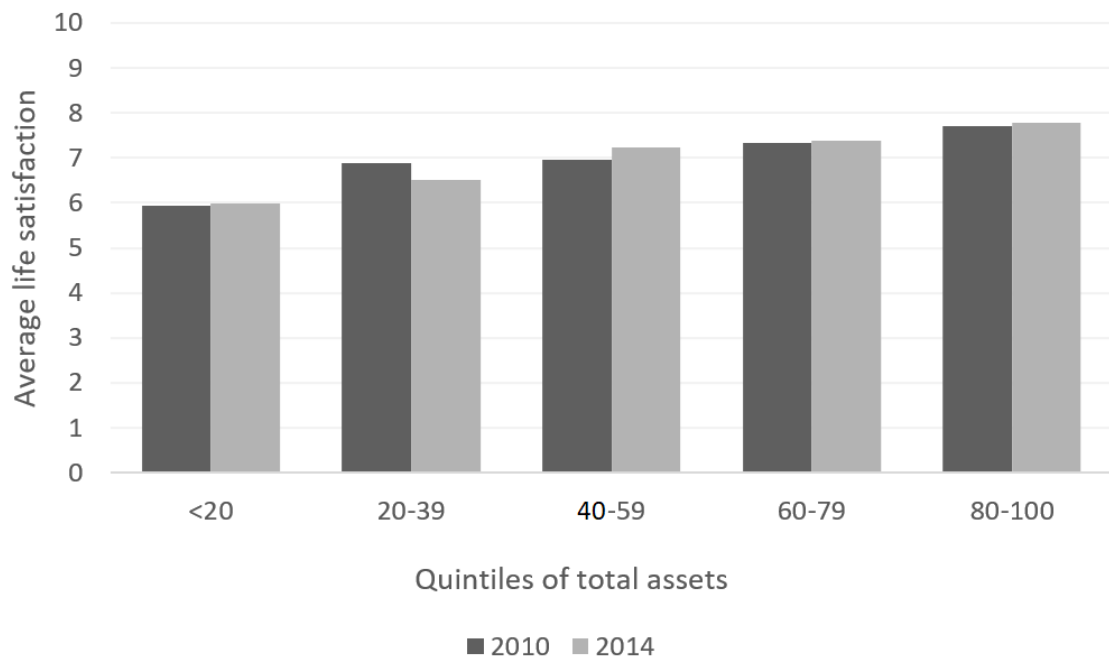
The estimation results for equation (4.1) are shown in Table 4.2. As expected, we found net income to be positively associated with individual life satisfaction. Interestingly, the association between life satisfaction and net income changed minimally once

**Figure 4.2:** Average life satisfaction by annual household net income quintiles for the years 2010 and 2014



Source/Notes: PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

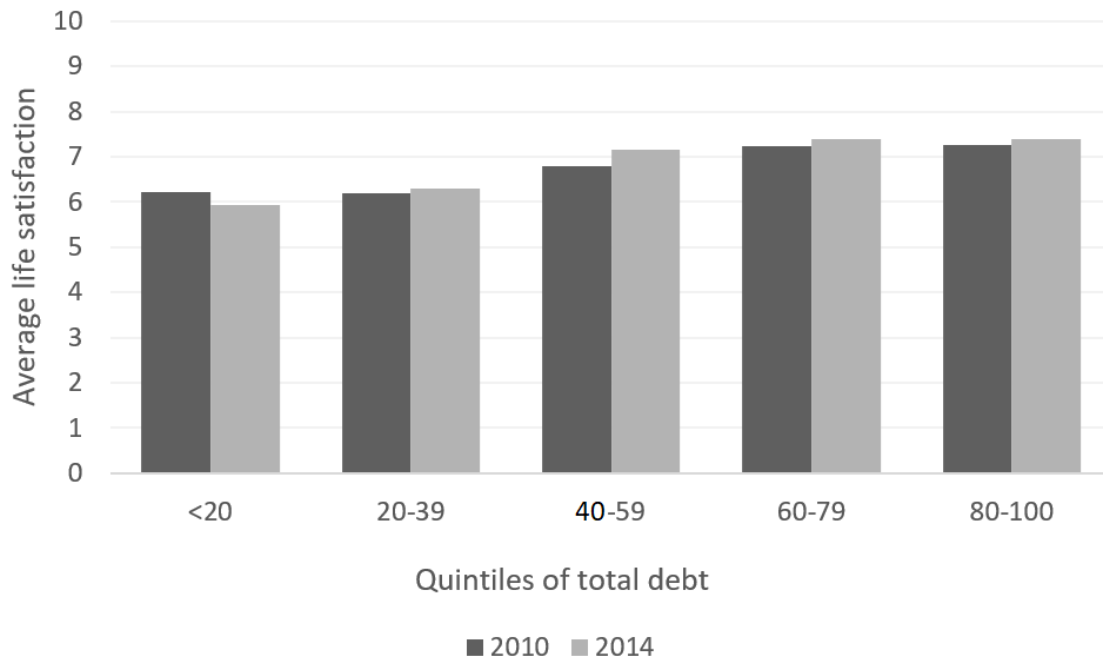
**Figure 4.3:** Average life satisfaction by total household assets quintiles for the years 2010 and 2014



Source/Notes: PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.



**Figure 4.4:** Average life satisfaction by total household debt quintiles for the years 2010 and 2014



*Source/Notes:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

wealth was factored in. While total assets were positively associated with life satisfaction, total debt had a negative association with life satisfaction; each of these results were found when we controlled for household income and other socio-demographic characteristics of the individual.<sup>16</sup> In a direct comparison, the relationships between life satisfaction and total assets and, in particular, total debt, seem to be much weaker compared to that between life satisfaction and net income. The doubling the household income was associated with, on average, 0.489 points higher life satisfaction on the 11-point scale, other things held constant. In contrast, the doubling of total assets was associated, *c.p.*, on average with approximately 0.118 points less life satisfaction. In connection to this, the absolute value of the negative effect of total debt ( $\beta_2 = -0.041$ ) to be smaller than the positive effect of total assets ( $\beta_1 = 0.118$ ) on life satisfaction. This could be an indication that the positive effect of having assets has more of an impact on life satisfaction than the negative effect of indebtedness. We will return to this issue below when we analyse different components of debt and assets. As an alternative to this method it is possible to use non-parametric models and add wealth quintiles as explanatory variables. We estimated the baseline specification using quintiles as a

<sup>16</sup>Pooled and random effects OLS regressions yield qualitatively similar results as shown in Table A.5 – columns 3 to 6 in the appendix.

**Table 4.2:** Panel regressions of individuals' life satisfaction on household net income and net wealth - coefficients from fixed effects panel-regressions

Variables	(1)	(2)	(3)
Household income: $\ln(Y)$	0.520	0.465	0.489
Household assets: $\ln(A)$		0.108	0.118
Household debt: $\ln(D)$			-0.041
Age	-0.222	-0.235	-0.233
Age squared/100	0.282	0.300	0.289
Age cubed/1000	-0.014	-0.015	-0.014
Marital status (reference: single)			
Divorced, widowed, separated	-0.170	-0.150	-0.104
Married	0.482	0.479	0.543
German national [0/1]	1.518	1.449	1.299
East Germany [0/1]	-3.052	-3.112	-3.117
Education (reference: ISCED 1-2)			
ISCED 3	-0.652	-0.673	-0.623
ISCED 4	-0.739	-0.769	-0.762
ISCED 5-6	-0.569	-0.573	-0.518
Employment status (reference: manual worker)			
Employee	0.328	0.285	0.270
Civil servant	0.019	-0.023	0.000
Self-employed	0.655	0.677	0.656
Vocational training, student	0.533	0.516	0.361
Unemployed	-0.038	-0.059	-0.079
Not in the labour force	0.631	0.606	0.553
$\ln(\text{household size})$	-0.312	-0.410	-0.375
Number of children below 16	-0.139	-0.145	-0.149
2014 Survey [0/1]	0.165	0.155	0.146
Constant	7.038	6.880	6.878
Equal FMI model test F statistic	1.845	2.021	2.263
Observations	4,108	4,108	4,108
Number of individuals	2,054	2,054	2,054

Note: Individual characteristics, fixed effects of the household and the year are included.

Source: PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

robustness check and the results did not change substantially (see Table A.5 – column (2) in the appendix).<sup>17</sup>

The values for the remaining point estimates of the baseline regression are in line with findings of other studies, in general. The literature on life satisfaction and age suggests that there is a U-shaped relationship with a “minimum, other things held constant, around the age of 40” (Blanchflower and Oswald, 2004, p. 1381). This means

<sup>17</sup>Additionally, results in column (2) show that individuals in higher quintiles of total assets reported, *c.p.*, on average higher levels of life satisfaction than those in lower asset quintiles. At the same time, the increase in life satisfaction systematically diminishes from one quintile to the next. This, in turn, may indicate diminishing marginal utility of total assets to life satisfaction, which justifies the use of the natural logarithm of total assets as we have done in the specification, for which results are shown in column (1).

that life satisfaction initially decreases with age and increases later in life. While some studies echo this finding (Clark and Oswald, 1994; Gerdtham and Johannesson, 2001; Blanchflower and Oswald, 2008; Laaksonen, 2018), others, however, do not support the finding or find only weak evidence of a U-shaped relationship between life satisfaction and age (cf., for example Pedersen and Schmidt, 2011; Glenn, 2009). Referring to the U-shaped relationship between life satisfaction and age, Clark (2007, p. 14) stated that it is an open question as to what lies behind the life events between the ages of 35 and 45 years that lead to a decrease in self-reported life satisfaction. He suggested that this is due to the effect of increased stress at work into middle age, sometimes accompanied by the fact that young or adolescent children live in the same household. By using semiparametric regressions, Wunder et al. (2013) revealed three age brackets (or stages) that demarcate transitions in life satisfaction over the lifespan of people in Germany and the UK. For the German sample, they found using the GSOEP that life satisfaction decreases for people in their early fifties (first age stage) but that this is followed by an increase up to an age of approximately 65 (second age stage). In their results, the third age stage showed a subsequent decline in life satisfaction for people over 65. They concluded that a U-shaped profile of the life satisfaction and age relationship is a good approximation up to an age of 60. Since respondents older than 60 years make up 46% of our sample, we include a cubic term of age to capture the third age stage with its second turning point in later life. However, our results regarding the relationship between subjective well-being and age do not consist of any extrema; we found life satisfaction fell steadily with increasing age, although it dropped slightly more sharply up to an age of about 68 than afterwards.<sup>18</sup>

Compared to singles, people reported, on average, a lower level of life satisfaction if they were divorced, widowed or separated, while in contrast marriage was positively related to life satisfaction. Becoming a German national was also positively associated with life satisfaction. The effect of moving to East Germany was negative; however, this result is based on only nine movers in the sample. Educational attainment, measured in years of schooling and vocational training, was negatively related to life satisfaction. Even though a higher level of education is typically associated with better employment and career opportunities, this negative correlation is a well-known phenomenon in literature regarding job satisfaction (cf. Clark, 2007). In the context of life satisfaction,

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<sup>18</sup>By taking into account the household specific fixed effect, the linear age term cannot be identified. According to the user manual of the PHF, a stochastic component on age was added for all respondents over the age of 70. This means that the information on age in our dataset ranges between -2 and +2 years from the actual age. This approach has little effect on the distribution of the age of the household members over 70 in the sample and is intended to ensure additional anonymisation of the data.

however, we expected a positive correlation (cf. Dolan et al., 2008, p. 99 f.). The negative correlation in our study may, however, indicate that as the level of education increases, so does the pressure at work on account of an increased level of responsibility. With regard to the employment status, non-manual workers (employees), civil servants, the self-employed, students and the people that were not in the labour force such as retirees reported, on average, higher levels of life satisfaction compared to the manual workers in our sample. As expected, the unemployed in our sample were less satisfied with their lives.

We found that the relationship between the number of children below 16 years (in the household) and life satisfaction (of the household's FKP) was negative. Additionally, we found the point estimate of the logarithm of household size (in terms of number of inhabitants) to be negative, which means that an increase in household size between two periods lead to a lower level in reported life satisfaction, all else being equal, household income in particular. This finding is consistent with our expectation because an increase in household size, *c.p.*, lead to lower financial satisfaction (because less income per capita was available) and ultimately to a lower level of life satisfaction. We were then able to compute the equivalence scale elasticity according to equation (B.3) in the appendix. We observed an equivalence elasticity of  $e = 0.66$ . In published literature regarding equivalence scales, the equivalence elasticity varies between a wide range of 0.2 to 0.8. Compared with those computed from expert scales the computed elasticity is higher (cf. Table 4 in Schwarze, 2003).

With the equal fractions of missing Information (FMI) model test all parameters are jointly tested. It rejects the hypothesis that all coefficients are equal to zero. Thus a 'constant-only model' for life satisfaction is able to be ruled out.

(ii) *What is the relative importance of wealth for subjective well-being compared to income?*

To judge the relative importance of net income, total assets, and total debt to life satisfaction, we predicted how life satisfaction would change if the individual lives in a household with mean  $\ln(\text{net income})$ ,  $\ln(\text{total assets})$  and  $\ln(\text{total debt})$ , and if this household would additionally receive, *c.p.*, the value of a standard deviation (SD) of the logarithm of each of these particular variables. The values for the average change in life satisfaction in the last column of Table 4.3 are calculated on the basis of the estimated coefficients in column (3) of Table 4.2, where we implicitly assumed that the structure of total assets and total debt is increased in equal shares for all components. Hence, the values for the average change in life satisfaction correspond to the standardised regression coefficients. The results presented in Table 4.3 show that we found an average

**Table 4.3:** Change in life satisfaction for a one SD increase of  $\ln(\text{net income})$ ,  $\ln(\text{total assets})$  and  $\ln(\text{total debt})$  over the respective mean

Variables	Mean of logarithm (€)	Mean of logarithm + SD of logarithm (€)	$\Delta$ Life satisfaction
Net income	24,204.89 €	44,225.90 €	0.295
Total assets	42,494.09 €	651,753.69 €	0.323
Total debt	94.11 €	13,568.32 €	-0.202

*Note:* The Euro values shown are calculated based on the mean of the logarithm of the variable plus one standard deviation of the logarithm of the variable. In the case of net income, for example, the mean is calculated as  $\exp(10.09431) = \text{€}24,204.89$  and the mean + SD is calculated as  $\exp(10.09431+0.6027559) = \text{€}44,225.90$ . The values for the average change in life satisfaction are calculated on the basis of the estimated coefficients shown in column (3) of Table 4.2. The average change in life satisfaction for income is calculated as  $((10.09431 + 0.6027559) \cdot 0.489) - (10.09431 \cdot 0.489) = 0.295$ .

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

increase in life satisfaction of 0.323 points on the 11-point scale after an SD of  $\ln(\text{total assets})$  was added to the mean of  $\ln(\text{total assets})$ . This was 0.028 points more than the average change in life satisfaction when an SD of  $\ln(\text{net income})$  was added to the mean of  $\ln(\text{net income})$ . Moreover, on average life satisfaction decreased by 0.202 points on the scale after an SD of  $\ln(\text{debt})$  was added to its mean.<sup>19</sup> These results suggest that total assets could be slightly more important for life satisfaction than income. Moreover, for a one SD increase in income or total assets, the increase in life satisfaction was larger than the decrease in life satisfaction caused by the same change in total debt (+0.323 compared to -0.202).

However, with this calculation we cannot make a clear statement as to whether total assets are more important for life satisfaction than net income. The distribution of total assets and net income is very different, i.e. one standard deviation of  $\ln(\text{net income})$  is almost the same as its mean, while it is about fourteen times the mean of  $\ln(\text{total assets})$ . Instead of adding one standard deviation to the respective mean, we gave a household with median  $\ln(\text{net income})$  – which corresponds to  $\text{€}24,000$  – an additional amount of  $\text{€}1,000$  annual net income. We calculated then that life satisfaction for that household should increase by 0.020 points on the 11-point scale.<sup>20</sup> We then calculated the value of total assets needed by a household with median  $\ln(\text{total assets})$ , which corresponded to  $\text{€}94,500$ , to increase life satisfaction of an individual living in this household by 0.020 points. To achieve an equivalent increase in life satisfaction for

<sup>19</sup>For total assets, the average change in life satisfaction was calculated to be  $((10.65712 + 2.730302) \cdot 0.118) - (10.65712 \cdot 0.118) = 0.323$ . For total debt, the average change in life satisfaction was calculated to be  $((4.544518 + 4.970975) \cdot -0.041) - (4.544518 \cdot -0.041) = -0.202$ .

<sup>20</sup>Again, in order to calculate the change in life satisfaction we used the estimated coefficients in column (3) of Table 4.2. For income, we calculated  $\ln(24,000 + 1,000) \cdot 0.489 - \ln(24,000) \cdot 0.489 = 0.020$ .

an individual living in a household with median  $\ln(\text{total assets})$ , we found that an additional €17,137 would need to be added to the value of their median total assets, everything else being equal.

As income is a flow variable, while assets are a stock variable, comparing an increase of €1,000 to annual net income with a one-off asset increase of €17,137 to total assets does not allow us to make any meaningful conclusions as to whether income or total assets is of greater importance for life satisfaction. That would require us to make further assumptions. Assuming that the household with medium total assets could draw a constant amount from the additional total assets of €17,137 for 20 years, the household with medium net income would also have to receive an increase of €1,000 to their annual net income for 20 years. Assuming further an interest rate of 2%, an increase in income of €1,000 over the next 20 years corresponds to a present value of €16,351. The value of €16,351 can now be compared with the previously calculated monetary value of assets (€17,137) that the other household has to receive in order to obtain the same increase in life satisfaction; thus, implicitly assuming that the structure of total assets is increased in equal shares for all asset components. Comparing those two values shows that the present value of €16,351 is worth as much to the household as an increase in total assets of €17,137, indicating a slightly greater importance of income for life satisfaction than total assets. The reason for this finding could be due to the fact that total assets are composed of liquid and illiquid components, some of which are not immediately available for use in consumption opportunities; whereas income can be immediately used for consumption, total assets is often not directly accessible.

However, a slight change in the assumptions of this thought experiment changes the statement on the relative importance of net income and total assets for life satisfaction. If the household with median net income receives €1,000 additional net income for slightly more than 21 years, this corresponds to the same net present value as the value of €17,137 total assets, indicating in this instance that the importance of net income and total assets to life satisfaction are the same. Also, if one assumes an interest rate of only 1% over 20 years, the net present value of the income would be €18,046. This means that one would have to give the household with median net income more than €1,000 per year additional net income in order to achieve the same increase in life satisfaction as the household that has total assets worth €17,137 above the median value. Under these conditions, total assets would be somewhat more important for life satisfaction than income. In summary, the question of what is ultimately more important for life satisfaction cannot be answered clearly at this point as the outcome of the analysis is highly sensitive to the assumptions made in order to do it.

(iii) *How do the different components of wealth relate to subjective well-being?*

To further investigate the importance of wealth to life satisfaction, we now turn to an analysis of different types of assets. With respect to various wealth components, real assets are very illiquid, and since the evaluation of satisfaction with life could also capture an individual's perceived ability to smooth consumption, liquid assets may be more important as they can be easily accessed for consumption. If the different components of total assets are to be associated differently with life satisfaction, it is also interesting to look at how different components of total debt relate to life satisfaction. Mortgages are typically used to purchase real estate, which is why they are also called a secured debt. Non-mortgage debts, in contrast, are used to purchase goods for consumption and are typically not linked to investments, which is why they are also called an unsecured debt. We therefore investigate whether the different components of total assets and total debt relate differently to an individual's satisfaction with life.

The relationship of different wealth components with life satisfaction are shown in Table 4.4. Considering both indicators and levels of assets and debt, financial assets drove the positive effect of total assets, and it was, in particular, non-mortgage debt that reduced life satisfaction the most. Non-mortgage debt was in most cases linked to (non-durable) consumption expenditure. For which, our results indicate that the 'burden' of being indebted and having to service non-mortgage debt may be higher (or more long-lasting) than the average increase in life satisfaction derived from consumption financed by such debt. Moreover, the results of the indicators revealed that owning real assets – while not considering the actual monetary value of those real assets – were negatively correlated to life satisfaction. When it comes to the actual level of these real assets, however, life satisfaction increased, *c.p.*, with higher levels of real assets.

(iv) *Are there regional heterogeneities in the relationship between subjective well-being and wealth?*

We now identify possible regional heterogeneities between East and West Germany. It is well known that there are still systematic differences between the two parts of Germany in average life satisfaction and economic performance, some of which have cultural causes due to the historical differences between the East and West (Frijters et al., 2004b; Pfaff and Hirata, 2013). Thus, it is worth splitting the German sample into East and West regions, in order to capture differences in wealth levels. Table 4.5 shows that the average life satisfaction, average income, and average values of total assets and total debt were significantly lower in East Germany than in West Germany. However, in order to be able to judge whether the estimated means of life satisfaction,

**Table 4.4:** Life satisfaction and net wealth components - coefficients from fixed effects panel- regressions

Variables	Indicators	Levels
Household income: $\ln(Y)$	0.540	0.516
Has real assets [1/0]	-0.220	
Has financial assets [1/0]	0.911	
Has mortgage debt [1/0]	0.065	
Has non-mortgage debt [1/0]	-0.558	
$\ln(\text{real assets})$		0.007
$\ln(\text{fin. assets})$		0.060
$\ln(\text{mortgage debt})$		0.006
$\ln(\text{non-mortgage debt})$		-0.067
Controls	yes	yes
Constant	6.207	7.082
Equal FMI model test F statistic	2.544	2.484
Observations	4,108	4,108
Number of individuals	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. A table with coefficient estimates for all variables including control variables is included in the appendix (Table A.7)

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table 4.5:** Average life satisfaction, net income and wealth for East and West Germany

Variables	West Germany		East Germany	
	Mean	SD	Mean	SD
Life satisfaction	7.16	0.03	6.48	0.08
Annual net income (in €)	30,569.75	395.71	23,597.75	865.64
Total assets (in €)	270,049.70	11,633.17	103,350.70	25,278.16
Total debt (in €)	29,531.69	79,012.34	20,306.77	3,488.28
Observations	3,349		759	
Number of individuals	1,679		384	

*Source/Note:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

income, assets and debt actually differed between East and West Germany, we need to examine the confidence intervals (CI); the respective estimated population averages revealed that they either do not overlap in the case of life satisfaction and income, or just slightly overlap in the case of total assets and total debt. This, in turn, indicates that the values for these metrics in East and West Germany might be meaningfully different.

The regression results that we calculated and present in Table 4.6 indicate a point estimate of income that is more than twice as high in East Germany compared to West Germany; this suggests the income effect on life satisfaction might be more pronounced



**Table 4.6:** Life satisfaction and wealth in East and West Germany - coefficients from fixed effects panel regressions

Variables	West Germany	East Germany
Household income: $\ln(Y)$	0.366	0.756
Household assets: $\ln(A)$	0.136	0.086
Household debt: $\ln(D)$	-0.033	-0.083
Controls	yes	yes
Constant	5.364	20.797
Equal FMI model test F statistic	1.338	148,067
Observations	3,349	759
Number of individuals	1,679	384

*Note:* Individual characteristics, fixed effects of the household and the year are included. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.8).  
*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

in East Germany. Moreover, other things held constant, the association between satisfaction and total assets was, on average, stronger in West Germany compared to East Germany. In contrast to the effect of total assets, the negative association of life satisfaction and total debt was slightly greater in the East German sample than in the West German sample. These results indicate that the East and West German samples might differ by more than just wealth and income levels, but also in their preferences regarding income and wealth. However, we are not able to definitively determine whether the coefficients actually differ between East and West Germany because we cannot compute standard errors correctly and therefore we do not know anything about the accuracy of the point estimates.

We now utilise the data collected in the PHF survey to identify possible regional heterogeneities across non-wealthy and wealthy regions regarding the relationship between life satisfaction and wealth. The sample design of the PHF survey allowed us to group individuals by regional wealth levels (see Section 4.3 for details), and so we were able to directly identify households that live in wealthy areas across different geographical regions. This analysis also serves as a starting point for the analysis of the importance of relative wealth in Section 4.4.2 as we analyse neighbourhood effects of (non-)wealthy households. As we were able to determine which individuals were living in an area with a high proportion of wealthy individuals around them, the idea behind this approach was to investigate whether there were carryover effects of the presence of other individuals or not. This means that in regions with many affluent (/less wealthy) people the positive effect of wealth on life satisfaction may be less (/more) pronounced. Thus, from the viewpoint of the individuals who live in wealthy regions, the higher proportion

**Table 4.7:** Average life satisfaction, net income and wealth by sampling strata 2014

Variables	Wealthy regions		Non-wealthy regions	
	Mean	SD	Mean	SD
Life satisfaction	7.40	0.03	6.97	0.10
Annual net income (in €)	38,797.62	1,082.09	27,852.19	372.65
Total assets (in €)	410,098.00	31,888.87	212,572.90	11,039.34
Total debt (in €)	45,180.22	3,829.43	25,305.88	1,393.43
Observations	2,032		2,076	
Number of individuals	1,016		1,038	

*Source/Note:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

of wealthy people in their immediate surroundings may have characteristics of a public bad (/good) as it could cause negative (/positive) externalities. This rationale also applies to income.

In Table 4.7 we present the average values of life satisfaction, annual net income, total assets and total debt. All values were determined to be considerably smaller in non-wealthy regions. We then employed equation (4.1) for the individuals who live in wealthy and non-wealthy areas, respectively, and compared the estimated associations between life satisfaction and wealth between those distinct areas (see Table 4.8).

Interestingly, the association between life satisfaction and net income was stronger, on average, for people living in wealthy regions, everything else being equal. A doubling of net income for people living in affluent regions raised life satisfaction by an average of 0.637 scale points. Life satisfaction among people in less affluent regions, however, was associated with an average increase of only 0.481 scale points for the same increase of net income. Assuming that most individuals of our sample who live in non-wealthy areas were in one of the lower parts of the overall net income distribution of our sample, we expected a different result – with a stronger relationship of life satisfaction and net income in non-wealthy regions reflecting diminishing marginal utility of income. Additionally, we obtained a negative correlation between life satisfaction and total assets for people living in wealthy regions. Furthermore, there was a negative correlation between debt and life satisfaction, *c.p.*, with the exception of individuals that were living in a wealthy region. Again, this is a result that we did not expect based on the literature review in 3.

Results shown in Table 4.8 indicate that the relationships observed for the overall sample is mainly driven by individuals living in non-wealthy regions. At the same time,

**Table 4.8:** Life satisfaction and wealth in wealthy regions and non-wealthy - coefficients from fixed effects panel regressions

Variables	Wealthy regions	Non-wealthy regions
Household income: $\ln(Y)$	0.637	0.481
Household assets: $\ln(A)$	-0.120	0.141
Household debt: $\ln(D)$	0.013	-0.048
Controls	yes	yes
Constant	-3.262	7.538
Equal FMI model test F statistic	251.578	2.215
Observations	2,032	2,076
Number of individuals	1,016	1,038

*Note:* Individual characteristics, fixed effects of the household and the year are included. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.9).

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

these results indicate that, as well as its absolute level, the relationship between life satisfaction and household wealth is somehow linked to the wealth of others.

#### 4.4.2 Investigation into the relationship between life satisfaction and relative wealth

In the following Subsection we investigate the relationship between life satisfaction and the consumption level of the respective reference group. We therefore consider how life satisfaction is, on average, predicted to change if the consumption level of the respective reference group changes. According to our research questions, we estimate in a first step the association between life satisfaction and reference consumption level represented by reference income and reference wealth. In doing so, we also consider whether the individual is above or below the reference consumption level. We then discuss the results of our regression analysis for two groups of people: those younger than 45 years of age and those 45 years or older. Further, we split our sample by reference to the East and West German regions to account for the systematic differences between the two parts of Germany. Finally, we discuss the results of running the regression separately for wealthy and non-wealthy areas in order to investigate whether the comparison effects also differ depending on regional wealth.

- (v) *How is an increase in wealth of the respective reference group associated with subjective well-being?*

As we are interested in exploring from which externalities the relevant reference group exhibits its consumption level from, we first successively included the reference income, reference total assets and reference total debt to our baseline regression according to equation (4.1). The respective results are shown in Table 4.9. Besides identifying the externalities, this also enables us to observe potential changes regarding the relationship between life satisfaction and the absolute values of income, assets and debt (Table 4.9).

Interestingly, the successive addition of reference income, reference total assets and reference total debt to the regression equation does not alter any of the results regarding the positive relationship between life satisfaction and the level of the household's own income and total assets, as well as the negative relationship between life satisfaction and total debt.

Looking further at the coefficients of the reference measures, it appears that reference income was positively associated with life satisfaction, but only if we do not include reference total assets and reference total debt (see column (2) of the Table 4.9).<sup>21</sup> This indicates that the average life satisfaction increased when the income of the reference group increased. However, when we took reference assets into account, the sign of the

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<sup>21</sup>The comparison effect of income remained positive also when we did not control for household total assets and total debt.

**Table 4.9:** Life satisfaction and reference income, reference assets and reference debt - coefficients from fixed effects panel regressions

Variables	(1)	(2)	(3)	(4)
Household income: $\ln(Y)$	0.489	0.481	0.460	0.471
Household assets: $\ln(A)$	0.118	0.119	0.116	0.117
Household debt: $\ln(D)$	-0.041	-0.041	-0.041	-0.042
Reference income: $\ln(Y_r)$		0.271	-0.287	-0.360
Reference assets: $\ln(A_r)$			0.226	0.189
Reference debt: $\ln(D_r)$				0.086
Controls	yes	yes	yes	yes
Constant	6.878	4.339	7.979	8.167
Equal FMI model test F statistic	31.638	33.993	32.077	29.637
Number of observations	4,108	4,108	4,108	4,108
Number of individuals	2,054	2,054	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference group of each household. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.12)

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

reference income in column (3) changed and we observed a negative correlation which is in accordance with our expectations ( $\kappa_1 = -0.287$ ). When we added reference debt, as presented in column (4), the estimated coefficient for reference income increased ( $\kappa_1 = -0.360$ ). Hence, a 10% increase in reference income reduced life satisfaction on average by 0.036 scale points. If the upward comparison dominates, then this finding can be interpreted as a deprivation effect. If the downward comparison dominates though, this finding can be interpreted as a gratification effect. This result also suggests that the neglect of reference assets and reference debt may lead to incorrect conclusions being drawn regarding the comparison effect of income.

In contrast, an increase in the level of reference total assets was on average accompanied by an increase in individual life satisfaction. This means that, on average, satisfaction with life is predicted to decrease with the decreases also in the difference between one's own total assets and reference assets. Here, too, it depends on whether the effect of the downward or upward comparison dominates. If the effect is dominated by those who compare upwards, then this positive correlation can also be interpreted as the tunnel effect. If the observed correlation results from the comparison of those who compare themselves downwards, then this may be interpreted as relating to fears and worries of social decline.

**Table 4.10:** Life satisfaction, relative income, relative assets and relative debt - coefficients from fixed effects panel regressions

Variables	(1a)	(1b)	(2)
Household income: $\ln(Y)$	0.471	0.111	0.152
Household assets: $\ln(A)$	0.117	0.306	0.299
Household debt: $\ln(D)$	-0.042	0.044	0.061
Reference income: $\ln(Y_r)$	-0.360		
Reference assets: $\ln(A_r)$	0.189		
Reference debt: $\ln(D_r)$	0.086		
$\ln(Y/Y_r)$		0.360	
$\ln(A/A_r)$		-0.189	
$\ln(D/D_r)$		-0.086	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			0.676
$\text{Diff}_Y^+: \ln(Y/Y_r)$			-0.051
$\text{Diff}_A^-: \ln(A/A_r)$			-0.209
$\text{Diff}_A^+: \ln(A/A_r)$			-0.179
$\text{Diff}_D^-: \ln(D/D_r)$			0.094
$\text{Diff}_D^+: \ln(D/D_r)$			-0.118
Controls	yes	yes	yes
Constant	8.167	8.167	7.915
Equal FMI model test F statistic	29.637	29.637	32.221
Number of observations	4,108	4,108	4,108
Number of individuals	2,054	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $\text{Diff}^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $\text{Diff}^+$  represents a downward comparison with the own consumption level being above that of the reference group. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.13).

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

Regarding the observed association between life satisfaction and total debt, life satisfaction was positively related to the respective reference group's total debt. If the effect was dominated by those who compare upwards, i.e. who have more debt than the respective reference group, this positive correlation can also be interpreted as a deprivation effect. A possible interpretation could be that for a given level of total assets and total debt, higher total debt of the respective reference group implies a higher position of the individual in the wealth distribution. If the observed correlation results from the comparison of those who compare themselves downwards, i.e. have less debt than the respective reference group, this is to be interpreted as a gratification effect. This means that an individual could feel a sense of relief from being better off than their peers.

The effects of  $\ln(Y)$ ,  $\ln(A)$  and  $\ln(D)$  in column (1a) of Table 4.10 are each composed of an absolute and a relative component (cf. Section 4.2). Therefore, we respecify equation (4.3) according to (4.4). This respecification contains exactly the same information as that which results are shown in column (1a). It, however, allows us to separate the relative income and wealth effect from the respective absolute effects. In some studies, it has been shown that the relative income effect,  $Y/Y_r$ , is of greater importance for life satisfaction than the absolute income effect,  $Y$  (McBride, 2001; Ferrer-i-Carbonell, 2005; Vendrik and Woltjer, 2007). Column (1b) of Table 4.10 shows the results of the respecification of equation (4.3). Comparing the size of the estimated coefficients in column (1b), the result corroborates those of other studies as the relative income effect was more pronounced than the absolute income effect. Furthermore, we found that the relative effect of total assets was smaller than the absolute effect. It was to the contrary with regard to household debt, however, as the relative effect was larger than the absolute effect, which leads to the fact that the absolute debt effect in column (1b) was positive.

To investigate further the ‘construction’ of  $\kappa$ , we allowed for asymmetries in comparisons. According to equation (4.5), we included both the relative position of the individual with respect to their reference group’s income and wealth in the regression as well as the distance. In doing so, it also allowed us to distinguish between positive and negative differences between household’s own wealth and reference wealth, and individual’s own income and reference income, respectively. The results of the regression, including the additional relative income and wealth indicators, are reported in column (2) of Table 4.10. We now take a closer look at how net income, total assets and total debt of the respective reference group were associated with life satisfaction, taking into account whether individuals were below or above the reference group’s income, total assets and total debt.

The negative difference,  $Diff^-$ , represents an upward comparison, wherein one’s own income and total assets are below that of the reference group. According to equation (4.5) in Section 4.2, a negative sign of the estimated coefficient of  $Diff_Y^-$  and  $Diff_A^-$  correspond to the tunnel effect, whereas a positive sign of the estimated coefficient of  $Diff_Y^-$  and  $Diff_A^-$  correspond to the relative deprivation effect (see Figure 4.5 which shows again the effects that can result from income and asset comparisons). However, this interpretation of the signs does not hold for the coefficients of relative debt; it is the other way around. Here,  $Diff_D^-$  corresponds to downward comparison as the reference group is worse off due to holding more debt (see Figure 4.6). Hence, a negative sign of the estimated coefficient of  $Diff_D^-$  corresponds to the relative gratification effect

because as the total debt of the reference group decreases, so too does the distance between one's own and the reference debt decrease. This also reduces the relative gratification effect. A positive sign of the estimated coefficient of  $Diff_D^-$  corresponds to a fear and worry of social decline. The logic here is that as the debt of the reference group decreases, life satisfaction is expected to decrease also as fear and worry of future social decline set in.

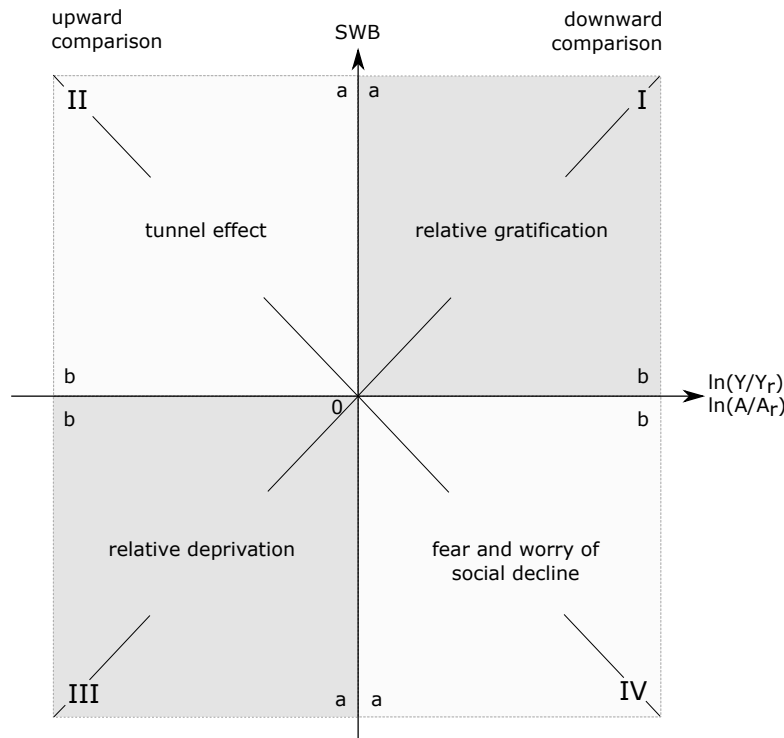
The positive difference,  $Diff^+$ , represents a downward comparison, wherein one's own income and total assets are above that of the reference group. Looking at  $Diff_Y^+$  and  $Diff_A^+$ , a negative sign corresponds to a sense of fear and worry about one's own social decline, whilst a positive sign of the estimated coefficient is associated with the effect of relative gratification. Here, too, these interpretations do not hold for the relative debt indicators (see Figure 4.5). The term  $Diff_D^+$  represents an upward comparison, as it implies that one's own total debt is larger than the median in the reference group. A negative sign of the estimated coefficient of  $Diff_D^+$  corresponds to the relative deprivation effect because with decreasing reference total debt, and therefore an increasing  $Diff_D^+$ , a lower level of life satisfaction would be expected. It follows that if the sign of the coefficient for  $Diff_D^+$  is positive, a higher life satisfaction is expected when reference total debt decreases and  $Diff_D^+$  gets larger. In this case, therefore, (positively assessed) information is derived so that the household can also achieve the low debt level of the reference group in the future. Hence, a positive sign of the estimated coefficient of  $Diff_D^+$  corresponds to the tunnel effect (see Figure 4.6).

According to the size of the point estimates in column (2) of Table 4.10, the comparison effect of income is asymmetric; the coefficient indicating the upward comparison was determined to be more than ten times as large as the coefficient indicating the downward comparison. With this finding of the upward comparison dominating the downward comparison, we corroborate previous empirical evidence that points to upward comparisons being more relevant to people with respect to income (Duesenberry, 1949; Holländer, 2001; Ferrer-i-Carbonell, 2005; Vendrik and Woltjer, 2007).

Results regarding social comparisons with respect to total assets indicate that life satisfaction would decrease the larger the difference becomes between the total assets of one's own and those of the respective reference group. This is regardless of whether the household's total assets are above or below the level for the reference assets. Our results also indicate that there is no dominance of the upward comparison over the downward comparison when comparing the size of the estimated coefficients.



**Figure 4.5:** Potential effects from upward and downward comparisons of income and total assets

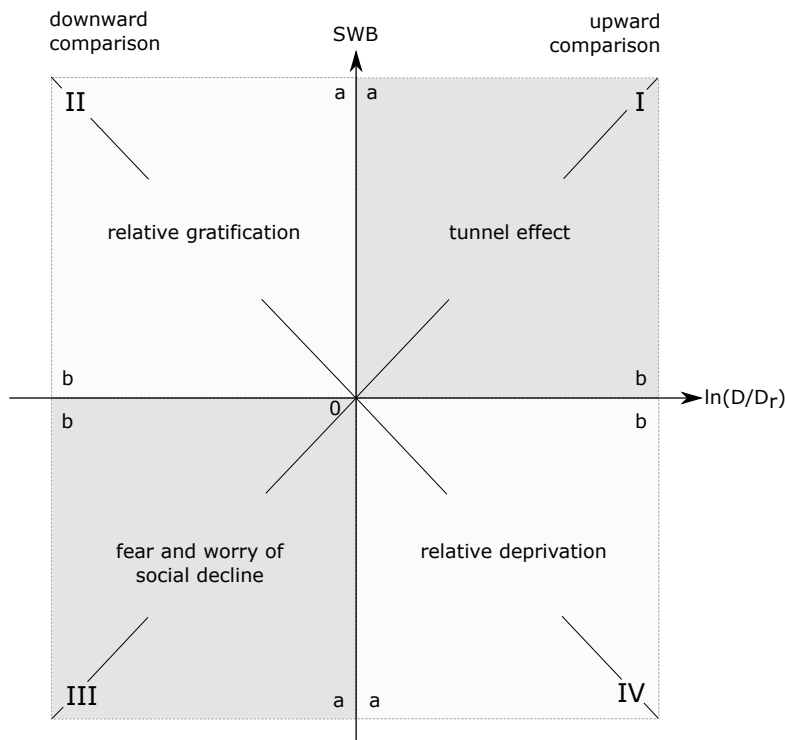


Source: Own illustration.

Regarding debt comparisons, the results indicate that having more debt than the respective reference group was associated with, on average, lower levels of life satisfaction. Furthermore, the association of the upward comparison was more pronounced than that of the downward comparison. This can be interpreted as the effect of relative deprivation dominating the effect of being afraid and worrying about social decline in the future.

- (vi) *Are there differences in the relationship between subjective well-being and relative wealth for younger and older people?*

The results presented above raise at least two questions: (1) who are the individuals that used the higher level of total assets of others as information for their own potential level of total assets in the future? And (2), who are the individuals whose own life satisfaction decreased due to the greater income of others? FitzRoy et al. (2014) have postulated that relative deprivation effect with respect to income dominates in later life, while the positive tunnel is more important early in life. We thus split the sample by age in a subsequent step and repeated the analysis, including relative income as well

**Figure 4.6:** Potential effects from upward and downward comparisons of total debt

Source: Own illustration.

as relative wealth indicators for individuals younger than 45 years and individuals 45 years and older. The results for this split sample are shown in Table 4.11.

Interestingly, income, total assets and total debt did not seem to influence the life satisfaction of younger individuals, as is indicated by the size of the estimated coefficients shown in column (1a). Household income appears to have been more important for life satisfaction among the older population, which is indicated on one side by the larger point estimate; the same applies to both total assets and total debt. Looking at the association between life satisfaction and reference income, the results in columns (1a) and (3a) show that for both younger and older people the reference income was negatively associated with life satisfaction. Looking at the size of the estimated coefficients, this association was even stronger for the younger population. In both populations, the relative effect of income, as shown in columns (1b) and (3b), was greater than the absolute income effect. For the younger population, the association between their own relative income and life satisfaction was negative.

Since the upward comparisons dominated with respect to relative income, the negative effect of the reference income can be interpreted as a relative deprivation effect. With this analysis, we did not observe similar results to FitzRoy et al. (2014) for relative

**Table 4.11:** Separate fixed effects panel regressions of life satisfaction on absolute and relative income and relative wealth for younger and older people

Variables	Younger (aged < 45)			Older (aged ≥ 45)		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.178	-0.807	-0.654	0.544	0.198	0.308
Household assets: $\ln(A)$	-0.027	0.435	0.273	0.127	0.327	0.428
Household debt: $\ln(D)$	0.016	-0.092	-0.104	-0.064	-0.006	0.049
Reference income: $\ln(Y_r)$	-0.985			-0.347		
Reference assets: $\ln(A_r)$	0.461			0.200		
Reference debt: $\ln(D_r)$	-0.108			0.058		
$\ln(Y/Y_r)$		0.985			0.347	
$\ln(A/A_r)$		-0.461			-0.200	
$\ln(D/D_r)$		0.108			-0.058	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			1.431			0.496
$\text{Diff}_Y^+: \ln(Y/Y_r)$			0.253			-0.086
$\text{Diff}_A^-: \ln(A/A_r)$			-0.657			-0.148
$\text{Diff}_A^+: \ln(A/A_r)$			-0.243			-0.318
$\text{Diff}_D^-: \ln(D/D_r)$			0.376			0.150
$\text{Diff}_D^+: \ln(D/D_r)$			0.099			-0.136
Controls	yes	yes	yes	yes	yes	yes
Constant	-0.248	-0.248	-0.966	-32.354	-32.354	-33.739
Equal FMI model test F statistic	45.61328	45.61328	22.57451	172.2586	172.2589	149.4828
Number of observations	814	814	814	3,294	3,294	3,294
Number of individuals	407	407	407	1,647	1,647	1,647

*Note:* Individual characteristics, fixed effects of the household and the year are included. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $\text{Diff}^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $\text{Diff}^+$  represents a downward comparison with the own consumption level being above that of the reference group. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.14)

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

income, as we found that the relative deprivation effect plays a role in both younger and later life. Furthermore, our results do not suggest there is a tunnel effect with respect to income.

Furthermore, the psychological phenomenon called ‘loss aversion’ is evident in our results with respect to income for the younger population. This basically means that there is an asymmetric effect between losses and gains of income with respect to their effect on utility: the loss of a certain amount of income measured at a particular reference point decreases the utility more than an increase in income (of the same amount) increased utility (Kahneman and Tversky, 1979). In our case, the difference between the individual’s own income level and that of the reference group is referred to as losses if it is negative and gains if the difference is positive (Kahneman and Varey, 1991; Vendrik and Woltjer, 2007). It is shown in column (2) of Table 4.11 that the coefficient of the upward comparison with respect to income was larger (1.431) than the coefficient of the downward comparison (0.253); this means that the effect of relative deprivation dominated the relative gratification effect. As a consequence, if the median income of the respective reference group decreases and so an individual’s position within the income distribution improves then it is predicted, *c.p.*, to increase their life satisfaction.

In terms of total assets, increasing the reference assets was associated with increased life satisfaction in both populations (columns (1a) and (3a)). The positive association of the reference total assets with life satisfaction seems to be of greater importance again for the younger population, which is suggested by the larger point estimate (0.461). Column (1b) also shows that the relative effect of total assets in the younger population was greater than the absolute effect of total assets. For the older population, the opposite was true (column (3b)). The upward comparison dominated among the young population. Thus, the tunnel effect also dominated over the effect of fear and worry of social decline. The opposite was true for the older population. This population group was more influenced by downward comparison, which is associated with fear and worry about social decline.

Now we come to the relationship between life satisfaction and total debt. The point estimate for total debt shown in column (1a) returned a positive sign for the younger population. In contrast, the association between life satisfaction and total debt was negative for the older population, as expected (column (3a)). In both population groups, the downward comparison dominated, i.e. towards those with a higher level of total debt. Thus, the feeling of fear and worry of social decline also dominated among both population groups.

While we observed slightly different preferences for relative income and relative debt depending on age, this did not apply to relative assets. Here, our results partly support those of FitzRoy et al. (2014). For young individuals, higher reference assets were associated positively with life satisfaction. Surprisingly, this was also true for individuals 45 years and older; this result, however, is not consistent with one of the findings of FitzRoy et al. (2014), that being that the relative deprivation effect dominates for older individuals. However, while younger individuals seem to be optimistic about their ability to achieve the asset level of their peers (eventually), older individuals correspond the lower asset level of their peers with fear and worry of social decline. The dominating effect of relative debt on life satisfaction was also the same regardless of age. Both the young and the old associated the lower debt level of their peers with fear and worry over their own social decline.

- (vii) *Are there regional heterogeneities in the relationship between subjective well-being and relative wealth?*

For regional cuts of the data we have no clear expectations. We nonetheless explore the effect of wealth on subjective well-being by separating our sample into regions in two different ways: firstly, geographically by separating it into the East and West German regions, and secondly, in a separate analysis we split the sample according to the wealth of different municipalities, similar to the analysis for absolute wealth, for which the results are shown in Table 4.8.

When splitting our sample into East and West Germany (Table 4.12), we considered a definition of reference groups based on education level and age within East and West Germany, respectively. In doing so, we again observed a negative relationship between reference income and life satisfaction in both East and West Germany. Since upward comparisons dominated in both regions, a comparison with the incomes of the respective reference group was, on average, associated with the feeling of relative deprivation. Furthermore, the coefficient of the upward comparison with respect to income was determined to be larger (0.782) than the coefficient of the downward comparison (0.065). This can be interpreted as loss aversion with respect to income. While in West Germany the relative income effect is greater than the absolute income effect, the relative income is also of similar importance for life satisfaction in East Germany.

Total assets of the reference group were positively associated with life satisfaction in West Germany but negatively in East Germany, all else being equal. Interestingly, in these population groups the upward comparisons did not dominate. Rather, downward comparisons dominated, i.e. the comparison with those who are worse off. In West

**Table 4.12:** Separate fixed effects panel regressions of life satisfaction on absolute and relative income and relative wealth for East Germany and West Germany

Variables	West Germany			East Germany		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.324	0.010	-0.143	0.770	0.397	0.390
Household assets: $\ln(A)$	0.135	0.396	0.519	0.099	-0.068	-0.230
Household debt: $\ln(D)$	-0.033	0.059	0.093	-0.086	0.237	0.225
Reference income: $\ln(Y_r)$	-0.315			-0.373		
Reference assets: $\ln(A_r)$	0.261			-0.167		
Reference debt: $\ln(D_r)$	0.092			0.323		
$\ln(Y/Y_r)$		0.315			0.373	
$\ln(A/A_r)$		-0.261			0.167	
$\ln(D/D_r)$		-0.092			-0.323	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			0.782			0.697
$\text{Diff}_Y^+: \ln(Y/Y_r)$			0.065			-0.085
$\text{Diff}_A^-: \ln(A/A_r)$			-0.187			-0.015
$\text{Diff}_A^+: \ln(A/A_r)$			-0.408			0.394
$\text{Diff}_D^-: \ln(D/D_r)$			0.101			-0.191
$\text{Diff}_D^+: \ln(D/D_r)$			-0.144			-0.320
Controls	yes	yes	yes	yes	yes	yes
Constant	6.547	6.547	6.032	18.987	18.987	17.297
Equal FMI model test F statistic	81.645	81.645	98.877	553.424	553.424	255.324
Number of observations	3,349	3,349	3,349	759	759	759
Number of individuals	1,679	1,679	1,679	384	384	384

*Note:* Individual characteristics, fixed effects of the household and the year are included. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $\text{Diff}^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $\text{Diff}^+$  represents a downward comparison with the own consumption level being above that of the reference group. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.15)

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

Germany, this comparison triggered, on average, fear and worry of social decline, while in East Germany it was associated with pride or gratification.

Looking now at the signs of the coefficients of reference debt, these were determined to be positively linked to life satisfaction. This means that if the total debt of the comparison group increases, the average life satisfaction is also predicted to increase, everything else remaining constant. In both population groups, upward comparisons dominated, i.e. with those who have less debt and are therefore better off; this downward comparison triggered a feeling of relative deprivation.

Finally, the results of the sample split by regional wealth are presented in Table 4.13. We used a classification for wealthy regions that was based on the stratification scheme used to oversample wealthy households in the PHF survey (see Section 4.3 for details). With this classification we tried to separate regions by wealth. Using the sampling information to assign households to wealthy and non-wealthy<sup>22</sup> regions we found the following: if one compares the relative income effect between wealthy and non-wealthy regions, the reference income also appears to be negatively linked to life satisfaction. For people in both regions, the relative effect of income seemed to exceed the absolute effect. In wealthy regions, downward comparisons tended to dominate, which is why the relative gratification effect also dominated. In less affluent regions it is the other way around, upward comparisons dominated and with them also the effect of relative deprivation.

With respect to total assets, social comparisons appear to have played a role in both wealthy and non-wealthy regions – in a different way though. Interestingly, the coefficients of reference total assets have the opposite sign indicating a different association with life satisfaction. In wealthy areas, others' higher level of total assets negatively correlated with individual's life satisfaction. The opposite was true for people living in non-wealthy areas. In both regions, however, the absolute effect was greater than the relative effect of total assets. Regarding asymmetric effects of the comparison, the results again suggest that upward and downward comparisons are asymmetric, whereby upward comparisons dominated. This allows the negative effect of the reference assets to be interpreted as more of a relative deprivation effect. In non-wealthy regions, however, the tunnel effect tended to be more pronounced. This means that people in less affluent regions looked optimistically to the future with regard to their own total assets.

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<sup>22</sup>Although the label 'other regions' would be more precise, we chose the label 'non-wealthy regions' for the sake of simplicity.

**Table 4.13:** Separate fixed effects panel regressions of life satisfaction on absolute and relative income and relative wealth for wealthy and non-wealthy regions

Variables	Wealthy regions			Non-wealthy regions		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.683	0.022	-0.119	0.463	0.156	0.212
Household assets: $\ln(A)$	-0.120	-0.199	-0.049	0.141	0.348	0.323
Household debt: $\ln(D)$	0.013	-0.248	-0.204	-0.049	0.058	0.072
Reference income: $\ln(Y_r)$	-0.660			-0.307		
Reference assets: $\ln(A_r)$	-0.078			0.207		
Reference debt: $\ln(D_r)$	-0.261			0.107		
$\ln(Y/Y_r)$		0.660			0.307	
$\ln(A/A_r)$		0.078			-0.207	
$\ln(D/D_r)$		0.261			-0.107	
$Diff_Y^-: \ln(Y/Y_r)$			0.575			0.656
$Diff_Y^+: \ln(Y/Y_r)$			0.954			-0.154
$Diff_A^-: \ln(A/A_r)$			0.270			-0.253
$Diff_A^+: \ln(A/A_r)$			-0.149			-0.175
$Diff_D^-: \ln(D/D_r)$			0.266			0.100
$Diff_D^+: \ln(D/D_r)$			0.205			-0.137
Controls	yes	yes	yes	yes	yes	yes
Constant	5.861	5.861	3.486	7.877	7.877	8.009
Equal FMI model test F statistic	224.140	224.140	123.798	39.143	39.143	44.339
Number of observations	2,032	2,032	2,032	2,076	2,076	2,076
Number of individuals	1,016	1,016	1,016	1,038	1,038	1,038

*Note:* Individual characteristics, fixed effects of the household and the year are included. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $Diff^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption level being above that of the reference group. A table with coefficient estimates for all variables including control variables is included in the Appendix (Table A.16)

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.



The association between life satisfaction and reference total debt also differ in the two regions. In wealthy regions, increases to total debt of the reference group are associated with declining life satisfaction. Since downward comparisons also dominated here, these comparisons with those worse off are associated with fear and worry of social decline. In contrast, in non-wealthy regions increases to total debt of the reference group were associated with rising life satisfaction. Since here the upward comparisons dominated slightly (i.e. comparisons with those who have less debt and are therefore better off), a feeling of relative deprivation arose.

*Summary of the findings regarding life satisfaction and relative income and relative wealth*

In order to summarise our findings, the effects of relative income  $\ln(Y/Y_r)$ , relative total assets  $\ln(A/A_r)$  and relative total debt  $\ln(D/D_r)$  for the whole population of Germany, as well as the corresponding population groups, are shown in Table 4.14. We have distinguished between upward comparison effects  $\kappa^-$  and downward comparison effects  $\kappa^+$ , and indicate the dominant effect based on the size of the point estimates using  $<$  and  $>$ , respectively.

With regard to the effect of *relative income*, our results correspond with those of previous studies. Apart from one exception (people living in wealthy regions), upward comparisons dominated downward comparisons, i.e. comparisons with people who are better off. Thus, our results suggest that if the reference income increases, life satisfaction is predicted to decrease on average, everything else being equal. Formally, we interpret this result as the *relative deprivation effect*. It therefore suggests that on average life satisfaction, *c.p.*, would also decrease when all incomes increase except one's own.

We also found that the relative effect of income had a stronger association with life satisfaction than the absolute effect of income. The increase in life satisfaction is on average thus, *c.p.*, expected to be lower if one considers the increase in income regardless of the change in position within the income distribution. Meanwhile, the increase in life satisfaction is expected to be higher if the increase in income is also associated with a better position within the income distribution, everything else remaining the same.

With regard to the effect of *relative total assets*, our results are somewhat ambiguous. In summary, for the whole population the upward comparison also dominated the downward comparison. In contrast to income comparisons, however, comparisons with the wealthier individuals of the respective reference group were associated with increasing life satisfaction. We interpret this result as the *tunnel effect*. The total assets

**Table 4.14:** Observed effects resulting from downward and upward comparisons for the whole German sample and other sample splits

	Direction of comparison	
	upward	downward
<b>Germany</b>		
$\ln(Y/Y_r)$	relative deprivation	> fear and worry of social decline
$\ln(A/A_r)$	tunnel effect	> fear and worry of social decline
$\ln(D/D_r)$	relative deprivation	> fear and worry of social decline
<b>Young</b>		
$\ln(Y/Y_r)$	relative deprivation	> relative gratification
$\ln(A/A_r)$	tunnel effect	> fear and worry of social decline
$\ln(D/D_r)$	tunnel effect	< fear and worry of social decline
<b>Old</b>		
$\ln(Y/Y_r)$	relative deprivation	> fear and worry of social decline
$\ln(A/A_r)$	tunnel effect	< fear and worry of social decline
$\ln(D/D_r)$	relative deprivation	< fear and worry of social decline
<b>West Germany</b>		
$\ln(Y/Y_r)$	relative deprivation	> relative gratification
$\ln(A/A_r)$	tunnel effect	< fear and worry of social decline
$\ln(D/D_r)$	relative deprivation	> fear and worry of social decline
<b>East Germany</b>		
$\ln(Y/Y_r)$	relative deprivation	> fear and worry of social decline
$\ln(A/A_r)$	tunnel effect	< relative gratification
$\ln(D/D_r)$	relative deprivation	> relative gratification
<b>Wealthy regions</b>		
$\ln(Y/Y_r)$	relative deprivation	< relative gratification
$\ln(A/A_r)$	relative deprivation	> fear and worry of social decline
$\ln(D/D_r)$	tunnel effect	< fear and worry of social decline
<b>Non-wealthy regions</b>		
$\ln(Y/Y_r)$	relative deprivation	> fear and worry of social decline
$\ln(A/A_r)$	tunnel effect	> fear and worry of social decline
$\ln(D/D_r)$	relative deprivation	> fear and worry of social decline

*Note:* This table is based on the regression results shown in column (2) and (4), respectively, of the respective Tables 4.10, 4.11, 4.12 and 4.13.

of the comparison group are therefore used as information for estimating the amount of one's own (potential) future total assets. With regard to the total assets, the population appeared to look into the future with confidence, which we infer from the result that suggests larger total assets of others are *not*, on average, negatively linked to the evaluation of life satisfaction.

Looking at the different population groups, upward and downward comparisons were balanced in our results (there was no predominant comparison). What is interesting here is that the results indicate that the younger population, in particular, seemed optimistic about the future. In contrast, the older population tended to look at the less wealthy individuals or households in their comparison group and associate a decline in reference total assets with fears and worries of social decline. It is also interesting to note that in contrast to income, we found that the absolute effect of total assets was almost always greater than the relative effect. This means that regardless of the relative position in the asset distribution, an increase in one's own total assets had a stronger association to life satisfaction than a change of the position in the assets distribution. Coupled with the dominance of the tunnel effect, it suggests that when life satisfaction increases as a result of an increase in total assets, one's own total assets are evaluated less in their relation to those of the relevant reference group (and more in their absolute value).

With regard to *relative total debt*, we found that as in the case of income, the relative effect of total debt was greater than the absolute effect. Thus, for life satisfaction, the evaluation of one's own total debt in relation to those of the relevant comparison group is important. The situation here is similar to that of income with people tending to compare themselves with people better off; by making comparison with wealthier individuals of the respective reference group, i.e. those who have less total debt, life satisfaction decreased on average, if reference total debt increased, everything else being equal. This is referred to as the *relative deprivation effect*. In contrast, we observed that the increase in the total debt of those that are wealthier had a weaker association with pride and relief (relative gratification effect) than with fear and worries of social decline.

To sum up, two thirds of the social comparisons we have looked at were directed upwards, that is to say with those who are better off. In the case of income and debt, these comparisons were rather negatively associated with life satisfaction. In the case of total assets, life satisfaction increased on average.

## 4.5 Summary and concluding remarks

The link between subjective well-being and various wealth components has mostly been neglected in published literature, not least because of a lack of suitable data on individuals' and households' wealth. Moreover, the literature we reviewed in Chapter 3 did not reveal the relative importance of wealth to subjective well-being compared to income. We therefore investigated the role of wealth for subjective well-being in Germany using panel micro-data from the German Wealth Survey (Panel on Household Finances -PHF) for 2010 and 2014. The PHF survey is a unique dataset, since it is dedicated to measuring wealth at a very detailed level, it contains a self-reported measure of subjective well-being and has a substantial panel component. We employed a regression analysis considering wealth and its different components such as real assets, financial assets, mortgage and non-mortgage debt. Additionally, we used life satisfaction as an indicator for subjective well-being which was answered by respondents to the survey using an 11-point scale for the question: 'In general, how satisfied are you currently with your life as a whole?'

The encouraging outcome from our research is that the association between life satisfaction and income changed only minimally when we took wealth into account. Our results indicate though that wealth is still important for life satisfaction; if it was not taken into account, an important explanatory factor for life satisfaction might be neglected. However, our analysis does not allow conclusions to be drawn about the relative importance of income and wealth. The characteristics of income and wealth seem to be too different to compare. Not least because income is a flow figure and wealth a stock figure. In addition, statements about the importance of income in relation to wealth depend significantly on the assumptions that have to be made to compare these two measures.

Our analysis also shows that the associations between life satisfaction and the individual asset components differ. We suppose that it is due to the fact that the different components of total assets have differing characteristics, such as varying degrees of liquidity. In addition, real assets are more visible to others than financial assets, which in turn could affect the evaluation of life satisfaction through status effects. Characteristics of various debt components differ too. While mortgages are a secured form of debt, others are not, such as consumer debts (non-mortgage debt). Our results point to the different effects of various debt components for the evaluation of life.

Moreover, our results suggest that wealth levels can have differing effects for different groups of households. We show, for example, that the preference for income and wealth

differ slightly between the East and West German populations. Apart from the fact that the average levels of income and wealth are different between these two regions, the variation in socialisation may be another reason the aggregate preferences of individuals in these regions vary too. The analysis of the distinction we made between people living in wealthy regions and those living in less wealthy regions indicates that the relationship between life satisfaction, income and wealth is mainly driven by people living in less prosperous regions; this means that in less wealthy regions an individual derives more happiness out of their total assets compared to individuals who live in wealthy regions.

The results of the analysis concerning relative income corroborate findings of previous studies whereby the income of others was negatively related to life satisfaction (Ferrer-i-Carbonell, 2005; Luttmer, 2005; Vendrik and Woltjer, 2007). Our results revealed an asymmetrical effect of comparisons made by an individual to those wealthier and those that are worse off, whereby upward comparisons played a greater role for life satisfaction. Moreover, the results of the estimations for both the German population and the various other population groups considered indicate that the relative effect of income is typically of greater significance for life satisfaction than the absolute income effect. We found a similar result with respect to relative debt and life satisfaction.

In contrast, we found that the evaluation of one's own total assets was less affected by the total assets of the people with whom one might compare oneself, because we determined the absolute effect of total assets was larger than the relative effect on life satisfaction. Additionally, the positive correlation that we found between life satisfaction and median total assets of the respective reference group is able to be understood as the tunnel effect. Thus, the population looked into the future with confidence as the higher total assets of others were not, on average, negatively linked to the evaluation of life satisfaction. As a consequence, though, declines in the reference total assets of wealthier individuals were, *c.p.*, also accompanied by a decline in life satisfaction. This held for the whole population and, in particular, for younger people and people living in less affluent regions.

Often, analyses of relative income effects are motivated by potential preferences for redistribution or justification for state intervention. In the case of income, the distribution is an important yardstick, *c.p.*, by which people in Germany assess their lives. In the case of total assets, though, this does not seem to be the case for the majority. The question that then arises is what the present results of the social comparisons mean for a possible redistribution by intervention of the state.

The finding of the dominance of the relative deprivation effect in the case of income means that negative externalities emanate as a result of those whose income increases – life satisfaction is predicted to decrease, on average, for those whose income does not change as a result of being in a worse position in the income distribution. If the aim is to reduce negative externalities in order, for example, to achieve a pareto improvement, the state has two options. First, the establishment of certain incentives such as consumption and income taxes, which should prevent individuals from expanding their labour supply and not increasing their incomes as a result (Frank, 1997). Secondly, through state transfers, the incomes of all individuals could be raised equally to a higher level on average. However, since the relative income effects are greater than the absolute ones, an increase in average income of the population would not have a large effect on life satisfaction. Moreover, Easterlin (1995, p. 35) has argued that the positive effect of an increase in income on subjective well-being is offset by the negative effect of a respective increase of the incomes generally.

If one considers the effects of social comparison with regard to total assets, a redistribution of assets towards a more equal distribution would, on average, reduce life satisfaction everything else being equal. The logical consequence would be to increase inequality in the population, since life satisfaction, *c.p.*, is positively associated with a higher level of total assets of the reference group. As Ravallion and Lokshin (2000), however, showed that preferences for redistribution depend on more than the future expectations of individuals. In addition, this one-dimensional view neglects other negative effects due to the increase in inequality. In Germany in particular, there is still much to do in researching the inequality of income and wealth and their macroeconomic effects. The Panel on Household Finances of the Deutsche Bundesbank provides good statistical coverage, especially of the high income and wealth households in Germany. This, in turn, is a prerequisite for such an analysis and a subject for future research.

## 5 Conclusion

Jeremy Bentham (1789 [2000]) planted, as he put it, the ‘tree of utility’. He and his contemporaries equated the concept of utility with happiness, the assessment of which was presumably to be based on hedonic introspection. The problem was that it was far from clear how to obtain a cardinal measurement of happiness that is comparable across individuals. Based on the critique that happiness is not measurable, the concept of happiness received no more attention for nearly two centuries. However, even the ordinal utility conception, which avoids the need to cardinally measure utility, had its shortcoming. This, in turn, has led economists over the past 40 years back to considering introspection. The so-called ‘economics of happiness’ equated the concept of subjective well-being to the concept of cardinal utility, which can be operationalised by self-reported life satisfaction. The problem of the missing measuring instrument in Bentham’s theoretical construct of happiness (or utility) has therefore been resolved in a rather trivial way: one simply asks people directly about their subjective well-being, the evaluation of which is then equated with individual happiness or utility. This field of research opens up the possibility to empirically investigate associations between various living conditions such as being married or unemployed, and, in particular, the individual’s consumption capacity provided by individual income.

An individual’s consumption is often approximated via income. Empirical evidence supports the hypothesis that an individual’s relative income – rather than the absolute level of income – determines subjective well-being. In most cases, consumption is equated only with income. However, focusing exclusively on income and ignoring measures beyond income, such as an individual’s or household’s wealth (financial assets, for example), may lead to misguided or false conclusions being drawn regarding the relationship between utility and an individual’s consumption levels (relative to others) (Clark et al., 2008). Based on theoretical considerations, this thesis has focused on the question of how private wealth and wealth of the respective peer group relate to subjective well-being.

In this thesis, the term ‘subjective well-being’ was explicitly linked to various utility concepts. Based on this we developed a definition of subjective well-being, which in turn provided the basis for a comprehensive literature review that included 113

studies. This literature review makes two important contributions in itself: firstly, it was the first of its kind on this topic to have been so extensive. Secondly, we applied a new method (which we call link-facilitated review technique), which makes it possible to record and systematically present so many studies. We found a large number of studies that considered (components of) wealth in their analyses, yet only a few have *explicitly* focused on the relationship between subjective well-being and wealth; or, they illuminated only one aspect, such as subjective well-being and home-ownership. Moreover, at the time the literature review was conducted, relative wealth was linked to subjective well-being in only one study. For this reason, we also conducted an empirical analysis in which we examined the relationship between subjective well-being and absolute wealth, as well as its components. We have also been one of the first to consider relative wealth for the German population. As far as we can ascertain, this relationship has been investigated in only one other study within the economics discipline, that by Brown and Gray (2016) which focussed on the Australian population.

The empirical analysis in this thesis suggests that there is a positive relationship between subjective well-being and total assets, with financial assets as the driver of this positive relationship. Furthermore, the results suggest that the mere fact of owning real assets does not necessarily imply higher levels of subjective well-being. Furthermore, a negative relationship was found between subjective well-being and total debt. Here, it was non-mortgage debt that was the driving force behind this negative relationship. With these results we confirmed the findings of Brown and Gray (2016). Interestingly, the relationship between subjective well-being and income hardly changed once we simultaneously considered assets and debt. Thus, the question whether wealth or income is more important to subjective well-being remains unclear.

We found that when people compare their income and wealth they tend to compare themselves with those who are better off, i.e., upward comparisons dominate downward comparisons. There is one important characteristic to this: those upward comparisons of total assets were on average positively associated with subjective well-being. Only among people in affluent regions did subjective well-being decline as the total assets of the comparison group increased. In this thesis, we have interpreted this positive association between subjective well-being and others' higher total assets as the tunnel effect. This means that people look positively into the future when they compare themselves with those who are better off. The fact that we found the tunnel effect may be good news with regard to the debate about increasing worries about social relegation and fear of the future among the middle class in Germany. Our results tell a story similar to that of a study by the Roman Herzog Institute, which showed that



one third of middle-class people are worried about the future, while two thirds are optimistic about it (Niehues and Orth, 2018).

For our analysis we used the Panel on Household Finances, PHF, which is particularly well suited to answer the research questions we posed; this is not least due to the fact that the respondents' wealth is recorded in great detail. Moreover, wealthy households are over-represented in the PHF, which has meant that the wealth structure could be analysed sufficiently well. The use of the provided sample weights allowed us to employ population regressions that obtained unbiased point estimates. However, we were unable to use standard errors as an inferential statistical tool as we could not account for the complex survey design when computing standard errors; as such, to validate the results of this thesis a statistical replication is necessary. Moreover, the fixed effects approach did not allow us to make any statements about causal relationships; for example, it could not be determined whether a larger amount of wealth tends to make people happier, or whether happier people tend to have more wealth. The insights of the associations we found regarding both of one's own total assets and total debt and the social comparisons in relation to these are novel, however, the results we obtained should be treated with caution. Nevertheless, they give us an idea of how absolute wealth and relative wealth are related to subjective well-being in Germany.

Which avenues of future research can be derived from the present thesis? The implications arising from our research are due partly to our findings and partly to the mentioned limitations. Here, we suggest that future research is needed to fully understand the mechanisms behind a change in different wealth components, at first in order to fully understand the relationship between wealth and subjective well-being. In particular, it would be interesting to see how, in Bentham's words, intensity and duration of pleasure and pain look when someone consumes or acquires a good that is financed, for example, by a non-mortgage debt. A question that arises in this context is, for example, whether the psychological burden of consumer or non-mortgage debt is greater than the benefits of consuming the goods financed by this type of debt? In this vein, another question that arises is, in which situation(s) does it make people rather dissatisfied to possess real assets and what is the reason (or reasons) for this? Could it be, on the one hand, the administrative effort and the ongoing maintenance and repair of, for example, real estate? Could it be, on the other hand, the lack of mobility in some cases that such property entails? Or does it potentially only hold for certain populations? For example, is the ownership of real estate more of a burden for young people than older people? This thesis serves as a starting point for these further

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questions, in particular in the context of the question: ‘What is the best way to spend money and when?’

In interpreting the positive association between subjective well-being and the total assets of others, we follow the conventional interpretation of the tunnel effect; however, we note that it is very restrictive because it is not clear whether the sole interpretation of the tunnel effect is sufficient. Do people really feel optimistic if their amount of total assets is below that of their peer group? Or could this be subject to something completely different? Deaton and Stone (2013, p. 592), for example, suggested an alternative interpretation when they stated “living with rich people provides public goods – parks, schools, libraries, etc. – that enhance evaluative well-being”. It would thus make sense to simultaneously consider various amenities in a further analysis to account for that.

Moreover, while there is no doubt that one’s own income and wealth are important not only in absolute but also in relative terms, the question of how the reference group is constructed in future studies remains open. It is conceivable that the results would change if a different definition of the comparison group were adopted. Moreover, Falk and Knell (2004, p. 418) assumed that the motives related to self-improvement and self-enhancement guide people in selecting their comparison targets. For self-improvement, people would be expected to compare themselves upwards, not only to ‘keep up with the Joneses’, but also to improve their own performance. For self-enhancement though people would be expected to compare themselves downwards in order to feel better. This implies that the choice of comparison groups is flexible and adjusted to current needs (Do I need to feel better? vs. Do I want to improve my own performance?). Therefore, rather than including the relative income and relative wealth resulting from the definition of a reference group, we should take the whole comparison process into account (van Praag, 2011, p. 126). However, even if we know exactly with whom people compare themselves, it is not clear which object of comparison is chosen. With regard to income and wealth, we do not know exactly what ‘measure’ people ‘use’ to compare themselves. Do people perceive the imagined ‘middle’ represented by the median or rather the upper quintile of the distribution within the reference group? It is not yet fully understood with whom we really compare ourselves, in which situations, and using which object of comparison and so this should be a subject of further research.

Although some questions remain unanswered, this thesis contributes to a better understanding of social comparisons. Moreover, this work illuminates the social comparison processes not only with regard to income but it is also one of the first to consider this issue in relation to wealth, which has long been disregarded.

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# Appendix

## A Descriptive statistics for Chapter 4

**Table A.1:** Descriptive statistics for income and wealth variables included in the analysis

	Participation rate in %	Mean (in €)	Median (in €)	SD (in €)
<b>Year 2010</b>				
Net household income	100.0	28,561	24,000	23,921
Total assets	100.0	233,433	81,850	800,855
Total real assets	90.5	225,119	99,500	841,781
Total financial assets	99.6	48,780	18,300	118,696
Total debt	51.0	53,367	14,175	88,922
Total outstanding balance of mortgage debt	30.4	99,850	75,000	105,517
Total outstanding balance of non-mortgage debt	31.9	9,414	3,650	23,393
<b>Year 2014</b>				
Net household income	100.0	29,638	24,000	20,995
Total assets	100.0	237,901	108,600	490,646
Total real assets	90.7	221,395	117,000	459,694
Total financial assets	99.8	54,094	19,400	128,099
Total debt	47.7	61,408	20,500	106,489
Total outstanding balance of mortgage debt	29.2	107,213	80,000	127,118
Total outstanding balance of non-mortgage debt	29.0	10,992	3,620	23,103

Source/Notes: PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only.

**Table A.2:** Descriptive statistics for life satisfaction and control variables included in the analysis

	2010		2014	
	Mean	SD	Mean	SD
Life Satisfaction	7.00	2.02	7.04	1.95
Age in years	52.50	16.75	55.80	16.70
Female (in %)	48.10	50.00	48.10	50.00
Family Status (in %)				
Single	22.12	41,51	20.63	40,46
Divorced, widowed, separate	27.13	44,46	26.22	43,99
Married	50.75	50,00	53.15	49,90
German national (in %)	88.49	31,92	88.25	32,21
Living in East Germany (in %)	20.79	40,58	20.48	40,35
Household size	2.13	1.13	0.61	0.54
Number of children below 16	0.35	0.76	0.35	0.75
Education (in %)				
Low education (ISCED 1,2)	0.14	34,67	0.13	33,92
Medium-low education (ISCED 3)	0.52	49,95	0.51	50,00
Medium-high education (ISCED 4)	0.06	23,90	0.06	23,05
High education (ISCED 5, 6)	0.28	44,69	0.30	45,91
Employment Status (in %)				
Worker	0.12	32,77	0.12	31,84
Employee	0.33	46,92	0.34	47,34
Civil servant	0.05	20,63	0.04	19,54
Self-employed	0.07	25,81	0.07	25,48
Student/vocational training	0.01	10,81	0.01	6,16
Unemployed	0.04	20,51	0.03	18,13
Not in the labour force	0.38	48,50	0.40	48,98
Number of individuals	2,054	–	2,054	–

Source/Note: PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only.

**Table A.3:** Total assets quintiles in 2010 and 2014 - transitions (row percentages)

		Year 2010					Total
		< 20	20-39	40-59	60-79	80-100	
Year 2014	< 20	63	27	8	1	1	100
	20-39	17	50	25	5	3	100
	40-59	5	16	49	22	8	100
	60-79	2	2	14	52	30	100
	80-100	0	0	2	10	88	100
Total		10	12	15	20	43	100

Source/Note: PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only.

**Table A.4:** Total debts quintiles in 2010 and 2014 - transitions (row percentages)

		Year 2010					Total
		LT 20	20-39	40-59	60-79	80-100	
Year 2014	LT 20	39	24	21	9	6	100
	20-39	26	22	35	10	7	100
	40-59	12	28	36	15	9	100
	60-79	3	6	25	50	16	100
	80-100	1	1	4	17	77	100
Total		10	12	21	23	34	100

Source/Note: PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only.

**Table A.5:** Panel regressions of individuals' life satisfaction on net household income and net wealth

	Fixed-Effects		Pooled		Random-Effects	
	OLS Regression		OLS Regression		OLS Regression	
	(1)	(2)	(3)	(4)	(5)	(6)
Household income: $\ln(Y)$	0.489		0.674		0.558	
	(0.195)		(0.115)		(0.066)	
Household assets: $\ln(A)$	0.118		0.161		0.154	
	(0.052)		(0.025)		(0.019)	
Household debt: $\ln(D)$	-0.041		-0.040		-0.022	
	(0.017)		(0.010)		(0.006)	
Net annual household income						
2nd quintile		0.206		0.499		0.208
		(0.321)		(0.202)		(0.147)
3rd quintile		0.304		0.626		0.485
		(0.367)		(0.200)		(0.151)
4th quintile		0.380		0.989		0.706
		(0.368)		(0.209)		(0.151)
5th quintile		0.736		1.290		0.977
		(0.411)		(0.229)		(0.155)
Household total assets						
2nd quintile		0.232		0.452		0.405
		(0.331)		(0.207)		(0.160)
3rd quintile		0.371		0.805		0.736
		(0.369)		(0.203)		(0.159)
4th quintile		0.708		0.948		0.970
		(0.419)		(0.206)		(0.160)
5th quintile		0.885		1.224		1.182
		(0.451)		(0.221)		(0.160)
Household total debt						
2nd quintile		-0.573		-0.537		-0.235
		(0.274)		(0.224)		(0.126)
3rd quintile		0.006		-0.103		-0.071

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Table A.5 – continued from previous page

	Fixed-Effects		Pooled		Random-Effects	
	OLS Regression		OLS Regression		OLS Regression	
	(1)	(2)	(3)	(4)	(5)	(6)
		(0.256)		(0.149)		(0.091)
4th quintile		-0.233		-0.179		-0.157
		(0.205)		(0.159)		(0.091)
5th quintile		-0.122		-0.511		-0.272
		(0.245)		(0.132)		(0.087)
Age	-0.233	-0.203	-0.053	-0.036	-0.213	-0.209
	(0.282)	(0.271)	(0.085)	(0.086)	(0.064)	(0.064)
Age squared/100	0.289	0.221	0.010	-0.025	0.329	0.317
	(0.545)	(0.526)	(0.163)	(0.165)	(0.121)	(0.122)
Age cubed/1000	-0.014	-0.009	0.004	0.007	-0.016	-0.015
	(0.033)	(0.032)	(0.010)	(0.010)	(0.007)	(0.007)
Female [0/1]			0.043	0.050	-0.001	0.006
			(0.105)	(0.102)	(0.071)	(0.071)
Marital status (reference: single)						
Divorced, widowed, separated	-0.104	-0.125	0.068	0.042	-0.013	-0.027
	(0.628)	(0.585)	(0.197)	(0.194)	(0.144)	(0.143)
Married	0.543	0.565	0.238	0.229	0.229	0.215
	(0.483)	(0.462)	(0.182)	(0.179)	(0.133)	(0.132)
German national [0/1]	1.299	1.383	0.156	0.123	0.144	0.126
	(1.842)	(1.940)	(0.162)	(0.165)	(0.134)	(0.133)
East Germany [0/1]	-3.117	-3.247	-0.375	-0.343	-0.435	-0.425
	(0.948)	(0.990)	(0.131)	(0.132)	(0.092)	(0.094)
Education (reference: ISCED 1-2)						
ISCED 3	-0.623	-0.650	-0.202	-0.168	0.035	0.081
	(0.343)	(0.333)	(0.174)	(0.178)	(0.149)	(0.151)
ISCED 4	-0.762	-0.734	-0.023	0.004	0.077	0.131
	(0.445)	(0.445)	(0.228)	(0.231)	(0.174)	(0.176)
ISCED 5-6	-0.518	-0.556	-0.131	-0.130	0.157	0.209
	(0.421)	(0.412)	(0.190)	(0.192)	(0.156)	(0.157)
Employment status (reference: manual worker)						
Employee	0.270	0.350	0.287	0.294	0.341	0.342
	(0.319)	(0.319)	(0.186)	(0.187)	(0.150)	(0.151)
Civil servant	0.000	0.030	0.044	-0.045	0.285	0.241
	(0.592)	(0.617)	(0.285)	(0.286)	(0.195)	(0.198)
Self-employed	0.656	0.706	0.179	0.246	0.249	0.314
	(0.947)	(0.882)	(0.235)	(0.238)	(0.185)	(0.187)
Vocational training, student	0.361	0.400	0.430	0.542	0.344	0.402
	(0.598)	(0.651)	(0.580)	(0.628)	(0.573)	(0.580)
Unemployed	-0.079	-0.035	-0.446	-0.599	-0.452	-0.577
	(0.391)	(0.392)	(0.330)	(0.328)	(0.229)	(0.230)
Not in the labour force	0.553	0.579	0.248	0.244	0.384	0.354
	(0.341)	(0.348)	(0.211)	(0.214)	(0.160)	(0.162)
ln(household size)	-0.375	-0.358	-0.357	-0.408	-0.253	-0.253
	(0.333)	(0.320)	(0.178)	(0.180)	(0.110)	(0.111)
Number of children below 16	-0.149	-0.167	0.213	0.233	0.078	0.078
	(0.132)	(0.136)	(0.090)	(0.091)	(0.058)	(0.059)

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**Table A.5 – continued from previous page**

	Fixed-Effects		Pooled		Random-Effects	
	OLS Regression		OLS Regression		OLS Regression	
	(1)	(2)	(3)	(4)	(5)	(6)
2014 Survey [0/1]			-0.036	-0.001	-0.066	-0.033
			(0.096)	(0.095)	(0.042)	(0.043)
Constant	6.878	11.556	0.249	7.024	3.700	9.669
	(4.605)	(4.557)	(1.638)	(1.397)	(1.152)	(1.054)
Equal FMI model test F statistic	2.263	1.538	12.420	9.407	21.753	15.963
Observations	4,108	4,108	4,108	4,108	4,108	4,108
Number of individuals	2,054	2,054			2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. SEs in parentheses. Multiple imputation (5 imputates) taken into account in the calculation of SEs.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.6:** Construction of variables

<b>Variable</b>	<b>Scale</b>	<b>Measure</b>
Net monthly household Income	logarithm	Question: 'What do you estimate the monthly net disposable income is in your household, that is, the amount of money which is available to the entire household after the deduction of taxes and social security contributions to cover the expenditure?'
<b>Wealth variables</b>		
Total assets	logarithm	Total value of total real assets and total financial assets (sum).
Total real assets	logarithm	Total value of properties (household main residence, other properties), net self-employment businesses wealth, vehicles and valuables at time of interview.
Total financial assets	logarithm	Total value of current accounts, savings account, stocks, bonds and other securities, pension contracts, managed accounts, non-self-employed business wealth at the time of interview.
Total debt	logarithm	Total value of total outstanding balance of mortgage debt and total outstanding balance of non-mortgage debt (sum).
Total outstanding balance of mortgage debt	logarithm	Total outstanding balance on mortgages on household main residence or other properties at the time of interview.
Total outstanding balance of non-mortgage debt	logarithm	Total outstanding balance on mortgages, consumer loans, private loans, loans from an employer, student loans, overdue bills and other unsecured loans at the time of interview.
Has real assets	dummy	Household owns household main residence, other properties, self-employment business, vehicles or valuables at time of interview.
Has financial assets	dummy	Household owns current accounts, savings account, stocks, bonds and other securities, pension contracts, managed accounts or non-self-employed business at the time of interview.
Has mortgage debt	dummy	Household has outstanding balance on mortgages on household main residence or other properties at the time of interview.
Has non-mortgage debt	dummy	Household has outstanding balance on mortgages, consumer loans, private loans, loans from an employer, student loans, overdue bills and other unsecured loans at the time of interview.
<b>Socio-demographics</b>		
Respondent's age	continuous	Respondent's age at time of interview in years, also included squared and cubed
Female	dummy	One, if person is female, zero otherwise

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**Table A.6 – continued from previous page**

Variable	Scale	Measure
Marital status	dummy variables	Marital status at time of interview. Categories from which dummies are generated: 0 'single' (reference category), 1 'divorced, widowed, separated', 2 'married'
German national	dummy	One, if person is a German national at time of interview, zero otherwise
East Germany	dummy	One, if person resides in East Germany (including Berlin) at time of interview, zero otherwise
Education	dummy variables	ISCED classification of education categories, low education (ISCED 0,1,2 -reference category), medium-low education (ISCED 3), medium-high education (ISCED 4), high education (ISCED 5,6)
Employment status	dummy variables	Categories from which dummies are generated: 0 'worker', 1 'employee', 2 'civil servant', 3 'self-employed', 4 'student/vocational training', 5 'unemployed', 6 'not in the labour force, e.g. retired, homemaker,...'
Household size	Log	number of household members
Number of children below 16	continuous	number of household members with the age of 16 or less
<b>Classification of Regions</b>		
Wealthy sampling region	dummy	One if household resided in a wealthy small municipality or wealthy street section at the time of drawing the sample.
Non-wealthy sampling region	dummy	One if household DID NOT resided in a wealthy small municipality or wealthy street section at the time of drawing the sample.

*Source/Note:* PHF 2010/11, PHF 2014 - Scientific Use File.



**Table A.7:** Life satisfaction and net wealth components - Coefficients from Fixed Effects Panel- Regressions

Variables	Indicators	Levels
Household income: $\ln(Y)$	0.540 (0.195)	0.516 (0.199)
Has real assets [1/0]	-0.220 (0.317)	
Has financial assets [1/0]	0.911 (0.403)	
Has mortgage debt [1/0]	0.065 (0.146)	
Has non-mortgage debt [1/0]	-0.558 (0.146)	
$\ln(\text{real assets})$		0.007 (0.033)
$\ln(\text{fin. assets})$		0.060 (0.043)
$\ln(\text{mortgage debt})$		0.006 (0.014)
$\ln(\text{non-mortgage debt})$		-0.067 (0.018)
Age	-0.191 (0.276)	-0.216 (0.282)
Age squared/100	0.217 (0.536)	0.247 (0.546)
Age cubed/1000	-0.011 (0.032)	-0.011 (0.033)
Marital status (reference: single)		
Divorced, widowed, separated	-0.080 (0.639)	-0.117 (0.621)
Married	0.518 (0.496)	0.549 (0.489)
German national [0/1]	1.227 (1.807)	1.207 (1.826)
East Germany [0/1]	-3.148 (0.872)	-3.105 (0.846)
Education (reference: ISCED 1-2)		
ISCED 3	-0.621 (0.347)	-0.575 (0.348)
ISCED 4	-0.792 (0.460)	-0.737 (0.459)
ISCED 5-6	-0.527 (0.425)	-0.459 (0.433)
Employment status (reference: manual worker)		
Employee	0.288 (0.309)	0.325 (0.314)
Civil servant	0.008 (0.520)	-0.080 (0.499)
Self-employed	0.712 (0.874)	0.697 (0.953)

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Table A.7 – continued from previous page

Variables	Indicators	Levels
Vocational training, student	0.298 (0.589)	0.363 (0.594)
Unemployed	0.034 (0.398)	0.019 (0.397)
Not in the labour force	0.610 (0.338)	0.613 (0.343)
ln(household size)	-0.275 (0.311)	-0.370 (0.328)
Number of children below 16	-0.160 (0.128)	-0.152 (0.131)
2014 Survey	0.169 (0.134)	0.153 (0.137)
Constant	6.207 (4.598)	7.082 (4.625)
Equal FMI model test F statistic	2.544	2.484
Observations	4,108	4,108
Number of individuals	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. SEs in parentheses. Multiple imputation (5 implicates) taken into account in the calculation of SEs.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.8:** Life satisfaction and wealth, total debt and net income in East and West Germany - Coefficients from Fixed Effects Panel- Regressions

Variables	West Germany	East Germany
Household income: ln(Y)	0.366 (0.201)	0.756 (0.600)
Household assets: ln(A)	0.136 (0.060)	0.086 (0.097)
Household debt: ln(D)	-0.033 (0.019)	-0.083 (0.042)
Age	-0.097 (0.276)	-1.123 (0.765)
Age squared/100	-0.008 (0.543)	2.027 (1.415)
Age cubed/1000	0.004 (0.033)	-0.123 (0.083)
Marital status (reference: single)		
Divorced, widowed, separated	0.546 (0.598)	-1.657 (0.649)
Married	0.744 (0.592)	-0.038 (0.557)
German national [0/1]	1.651 (1.946)	-1.229 (0.350)
Education (reference: ISCED 1-2)		
ISCED 3	-0.434 (0.375)	-1.796 (0.793)
ISCED 4	-0.598 (0.478)	-1.432 (0.929)
ISCED 5-6	-0.375 (0.458)	-1.479 (0.875)
Employment status (reference: manual worker)		
Employee	0.103 (0.283)	0.430 (0.766)
Civil servant	-0.647 (0.486)	2.342 (0.898)
Self-employed	-0.091 (0.800)	2.990 (1.924)
Vocational training, student	0.370 (0.583)	-3.024 (1.299)
Unemployed	-0.321 (0.492)	0.381 (0.683)
Not in the labour force	0.364 (0.328)	1.106 (0.881)
ln(household size)	-0.514 (0.364)	0.996 (0.724)
Number of children below 16	-0.140 (0.139)	-0.308 (0.336)
2014 Survey [0/1]	0.159 (0.146)	0.523 (0.320)

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**Table A.8 – continued from previous page**

Variables	West Germany	East Germany
Constant	5.364 (4.837)	20.797 (12.262)
Equal FMI model test F statistic	1.338	148,067
Observations	3,349	759
Number of individuals	1,679	384

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 implicates) taken into account in the calculation of SEs. SEs in parentheses.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.9:** Life satisfaction and wealth, total debt and net income in wealthy and non-wealthy regions - Coefficients from Fixed Effects Panel- Regressions

Variables	Wealthy regions	Non-wealthy regions
Household income: ln(Y)	0.637 (0.227)	0.481 (0.217)
Household assets: ln(A)	-0.120 (0.116)	0.141 (0.056)
Household debt: ln(D)	0.013 (0.017)	-0.048 (0.020)
Age	0.302 (0.355)	-0.291 (0.320)
Age squared/100	-0.645 (0.559)	0.403 (0.621)
Age cubed/1000	0.045 (0.034)	-0.022 (0.037)
Marital status (reference: single)		
Divorced, widowed, separated	0.327 (0.635)	-0.146 (0.740)
Married	0.110 (0.472)	0.570 (0.543)
German national [0/1]	-0.202 (0.349)	1.735 (2.128)
East Germany [0/1]	-1.340 (0.288)	-3.342 (1.034)
Education (reference: ISCED 1-2)		
ISCED 3	0.548 (0.552)	-0.681 (0.368)
ISCED 4	-0.071 (0.637)	-0.739 (0.485)
ISCED 5-6	0.236 (0.624)	-0.473 (0.462)
Employment status (reference: manual worker)		
Employee	0.083 (0.322)	0.268 (0.344)
Civil servant	0.582 (0.612)	-0.091 (0.647)
Self-employed	0.235 (0.642)	0.656 (1.038)
Vocational training, student	1.862 (0.940)	0.213 (0.633)
Unemployed	-0.128 (0.780)	-0.089 (0.409)
Not in the labour force	0.455 (0.392)	0.512 (0.366)
ln(household size)	0.163 (0.360)	-0.466 (0.385)
Number of children below 16	-0.289 (0.144)	-0.108 (0.153)

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**Table A.9 – continued from previous page**

Variables	Wealthy regions	Non-wealthy regions
2014 Survey	0.087 (0.510)	0.136 (0.155)
Constant	-3.262 (10.054)	7.538 (5.189)
Equal FMI model test F statistic	251.578	2.215
Observations	2,032	2,076
Number of individuals	1,016	1,038

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 imputates) taken into account in the calculation of SEs. SEs in square brackets.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, unweighted, panel households only.

Table A.10: Descriptives for comparison group life satisfaction, income, total assets and total debt

age group	education group	region	n	life satisfaction			annual net income (in €)			total assets (in €)			total debt (in €)		
				mean	median	sd	mean	median	sd	mean	median	sd	mean	median	sd
< 35 years	low	West	32	5.88	24,000	18,225	16,058	10,800	6,600	85,638	3,500	3,063	21,529		
		East	12	6.17	11,340	12,615	6,484	1,500	1,000	10,237	14,175	931	4,594		
	medium	West	182	7.27	21,000	20,164	13,973	14,500	14,065	217,412	5,500	5,755	45,794		
		East	54	6.78	22,800	20,933	9,691	12,800	11,167	41,838	10,500	7,513	45,443		
high	West	98	7.65	29,160	29,160	14,444	51,800	51,800	202,170	12,950	12,950	88,702			
	East	16	7.13	30,150	30,150	13,869	25,031	25,031	59,317	1,644	1,644	64,007			
35 to 44 years	low	West	24	5.79	25,200	23,700	10,919	54,400	32,838	66,882	17,400	13,483	45,275		
		East	4	6.25	28,000	26,100	6,581	26,150	19,653	22,346	4,000	3,050	88		
	medium	West	221	7.47	25,200	26,557	15,816	41,200	58,938	1,053,343	14,000	21,873	78,977		
		East	59	6.78	27,600	25,892	10,209	81,850	99,670	92,652	25,000	37,054	50,988		
high	West	199	7.74	40,800	41,337	24,081	205,900	217,224	506,090	92,310	95,749	117,098			
	East	37	7.43	28,800	33,470	23,166	37,200	82,686	713,010	28,000	41,573	107,768			
45 to 54 years	low	West	38	6.16	18,000	23,684	14,349	7,606	65,686	121,791	5,800	26,168	79,951		
		East	5	6.00	20,400	20,400	10,407	4,400	4,120	257,246	12,280	13,924	7,789		
	medium	West	370	7.01	26,400	26,974	25,668	164,010	148,075	456,127	16,000	28,438	79,140		
		East	81	5.57	24,356	24,356	12,219	44,154	44,154	104,122	17,975	17,975	54,550		
high	West	316	7.67	37,800	37,800	31,666	260,000	260,000	1,057,183	56,500	56,500	149,220			
	East	45	7.07	14,400	21,680	17,337	139,480	168,143	329,340	16,100	22,587	67,347			
55 to 64 years	low	West	39	6.56	18,960	21,286	25,342	114,600	90,715	213,462	4,000	5,431	63,832		
		East	4	6.25	16,200	16,200	10,826	575	575	83,258	2,500	2,500	6,709		
	medium	West	348	7.05	24,000	25,186	22,510	156,700	151,411	1,297,923	18,500	17,511	96,061		
		East	97	5.94	16,800	16,800	113,587	39,500	34,397	115,842	4,000	3,443	51,149		
high	West	341	7.66	36,000	36,845	38,821	277,010	325,475	1,450,393	48,000	50,478	133,036			
	East	69	7.03	31,200	28,852	17,556	222,000	193,357	485,189	35,000	27,174	73,099			
>= 65 years	low	West	100	7.22	14,040	14,266	28,186	24,200	29,628	138,290	8,500	8,132	26,457		
		East	16	6.06	13,200	12,675	42,502	5,000	2,961	67,415	12,120	8,130	5,335		
	medium	West	498	7.61	21,055	21,055	15,146	161,961	161,961	347,104	6,545	6,545	73,348		
		East	94	6.76	16,353	16,353	7,418	21,171	21,171	122,831	2,772	2,772	18,383		
high	West	543	8.01	30,000	27,870	45,311	296,900	266,453	1,308,694	35,000	32,781	195,680			
	East	166	7.28	22,308	21,492	13,833	49,500	48,281	333,910	3,300	3,642	55,141			

*Note:* In order to define our reference groups, we draw four five groups, namely, <35 years, 35-44 years, 45-54 years, 55-64 years and 65 years and older. Moreover, we divide the education level into three groups, 'low' (primary and lower secondary education), 'medium' (upper secondary and post-secondary non-tertiary education), and 'high' (first and second stage tertiary education). Finally, we also differentiate between households living in former West and East Germany.

*Source:* PHF 2010/11, PHF 2014 - SUF Files, weighted, panel households only.

**Table A.11:** Descriptives for measures of relative income and relative wealth

	2010				2014			
	N	median	mean	SD	N	median	mean	SD
$\text{Diff}_Y^-: \ln(Y/Y_r)$	675	-0.377	-0.463	0.397	627	-0.365	-0.434	0.354
$\text{Diff}_Y^+: \ln(Y/Y_r)$	1,295	0.323	0.414	0.363	1,366	0.368	0.431	0.315
$\text{Diff}_A^-: \ln(A/A_r)$	705	-1.400	-2.323	0.595	727	-1.701	-2.369	2.383
$\text{Diff}_A^+: \ln(A/A_r)$	1,317	0.879	1.107	0.851	1,316	0.873	1.164	1.001
$\text{Diff}_D^-: \ln(D/D_r)$	1,433	-8.882	-6.998	3.66	1,477	-8.700	-7.415	3.562
$\text{Diff}_D^+: \ln(D/D_r)$	590	1.281	1.435	0.924	555	1.057	1.333	1.003

Source/Notes: PHF 2010/11, PHF 2014 - Scientific Use File, weighted, persons in panel households only.

**Table A.12:** Life satisfaction and reference income, assets and debt - coefficients from fixed effects panel-regressions

Variables	(1)	(2)	(3)	(4)
Household income: $\ln(Y)$	0.489 (0.175)	0.481 (0.179)	0.460 (0.177)	0.471 (0.180)
Household assets: $\ln(A)$	0.118 (0.045)	0.119 (0.045)	0.116 (0.045)	0.117 (0.045)
Household debt: $\ln(D)$	-0.041 (0.019)	-0.041 (0.019)	-0.041 (0.019)	-0.042 (0.019)
Reference income: $\ln(Y_r)$		0.271 (0.286)	-0.287 (0.363)	-0.360 (0.347)
Reference assets: $\ln(A_r)$			0.226 (0.120)	0.189 (0.139)
Reference debt: $\ln(D_r)$				0.086 (0.094)
Age	-0.233 (0.264)	-0.239 (0.264)	-0.215 (0.260)	-0.210 (0.252)
Age squared/100	0.289 (0.506)	0.305 (0.506)	0.220 (0.502)	0.199 (0.480)
Age cubed/1000	-0.014 (0.032)	-0.016 (0.032)	-0.009 (0.032)	-0.007 (0.030)
Marital status (reference: single)				
Divorced, widowed, separated	-0.104 (0.599)	-0.084 (0.606)	-0.072 (0.601)	-0.050 (0.601)
Married	0.543 (0.377)	0.564 (0.377)	0.536 (0.369)	0.551 (0.372)
German national [0/1]	1.299 (1.709)	1.318 (1.714)	1.339 (1.714)	1.333 (1.723)
East Germany [0/1]	-3.117 (0.820)	-3.080 (0.824)	-2.984 (0.863)	-2.911 (0.904)
Education (reference: ISCED 1-2)				
ISCED 3	-0.623 (0.211)	-0.692 (0.189)	-0.888 (0.189)	-0.845 (0.190)
ISCED 4	-0.762 (0.286)	-0.816 (0.268)	-1.039 (0.302)	-1.030 (0.310)

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Table A.12 – continued from previous page

Variables	(1)	(2)	(3)	(4)
ISCED 5-6	-0.518 (0.236)	-0.674 (0.208)	-0.878 (0.221)	-0.882 (0.224)
Employment status (reference: manual worker)				
Employee	0.270 (0.223)	0.278 (0.220)	0.208 (0.203)	0.208 (0.200)
Civil servant	0.000 (0.441)	-0.025 (0.439)	-0.144 (0.407)	-0.180 (0.403)
Self-employed	0.656 (0.843)	0.678 (0.835)	0.662 (0.779)	0.645 (0.772)
Vocational training, student	0.361 (0.489)	0.378 (0.487)	0.311 (0.477)	0.294 (0.484)
Unemployed	-0.079 (0.259)	-0.065 (0.252)	-0.168 (0.236)	-0.169 (0.238)
Not in the labour force	0.553 (0.287)	0.574 (0.276)	0.448 (0.273)	0.456 (0.272)
ln(household size)	-0.375 (0.290)	-0.388 (0.292)	-0.344 (0.284)	-0.367 (0.277)
Number of children below 16	-0.149 (0.097)	-0.148 (0.097)	-0.164 (0.097)	-0.153 (0.097)
2014 Survey	0.146 (0.127)	0.152 (0.126)	0.171 (0.123)	0.157 (0.114)
Controls	yes	yes	yes	yes
Constant	6.878 (4.498)	4.339 (4.919)	7.979 (4.973)	8.167 (4.901)
Equal FMI model test F statistic	31.638	33.993	32.077	29.637
Number of observations	4,108	4,108	4,108	4,108
Number of individuals	2,054	2,054	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 implicates) taken into account in the calculation of SEs. SEs in parentheses. SEs clustered at reference group level. Reference income, assets  $A_r$  and debts  $D_r$  refer to the median income, assets and debts of the previously defined reference group of each household.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.13:** Life satisfaction, relative income, assets and debt - coefficients from fixed effects panel-regressions

Variables	(1a)	(1b)	(2)
Household income: $\ln(Y)$	0.471 (0.180)	0.111 (0.395)	0.152 (0.384)
Household assets: $\ln(A)$	0.117 (0.045)	0.306 (0.142)	0.299 (0.176)
Household debt: $\ln(D)$	-0.042 (0.019)	0.044 (0.093)	0.061 (0.099)
Reference income: $\ln(Y_r)$	-0.360 (0.347)		
Reference assets: $\ln(A_r)$	0.189 (0.139)		
Reference debt: $\ln(D_r)$	0.086 (0.094)		
$\ln(Y/Y_r)$		0.360 (0.347)	
$\ln(A/A_r)$		-0.189 (0.139)	
$\ln(D/D_r)$		-0.086 (0.094)	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			0.676 (0.385)
$\text{Diff}_Y^+: \ln(Y/Y_r)$			-0.051 (0.400)
$\text{Diff}_A^-: \ln(A/A_r)$			-0.209 (0.162)
$\text{Diff}_A^+: \ln(A/A_r)$			-0.179 (0.173)
$\text{Diff}_D^-: \ln(D/D_r)$			0.094 (0.116)
$\text{Diff}_D^+: \ln(D/D_r)$			-0.118 (0.101)
Age	-0.210 (0.252)	-0.210 (0.252)	-0.247 (0.256)
Age squared/100	0.199 (0.480)	0.199 (0.480)	0.274 (0.492)
Age cubed/1000	-0.007 (0.030)	-0.007 (0.030)	-0.011 (0.031)
Marital status (reference: single)			
Divorced, widowed, separated	-0.050 (0.601)	-0.050 (0.601)	-0.023 (0.607)
Married	0.551 (0.372)	0.551 (0.372)	0.550 (0.387)
German national [0/1]	1.333 (1.723)	1.333 (1.723)	1.244 (1.678)
East Germany [0/1]	-2.911 (0.904)	-2.911 (0.904)	-2.906 (0.883)

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Table A.13 – continued from previous page

Variables	(1a)	(1b)	(2)
Education (reference: ISCED 1-2)			
ISCED 3	-0.845 (0.190)	-0.845 (0.190)	-0.834 (0.199)
ISCED 4	-1.030 (0.310)	-1.030 (0.310)	-1.073 (0.315)
ISCED 5-6	-0.882 (0.224)	-0.882 (0.224)	-0.878 (0.233)
Employment status (reference: manual worker)			
Employee	0.208 (0.200)	0.208 (0.200)	0.198 (0.203)
Civil servant	-0.180 (0.403)	-0.180 (0.403)	0.004 (0.428)
Self-employed	0.645 (0.772)	0.645 (0.772)	0.582 (0.682)
Vocational training, student	0.294 (0.484)	0.294 (0.484)	0.215 (0.496)
Unemployed	-0.169 (0.238)	-0.169 (0.238)	-0.185 (0.251)
Not in the labour force	0.456 (0.272)	0.456 (0.272)	0.448 (0.265)
ln(household size)	-0.367 (0.277)	-0.367 (0.277)	-0.337 (0.283)
Number of children below 16	-0.153 (0.097)	-0.153 (0.097)	-0.179 (0.094)
2014 Survey	0.157 (0.114)	0.157 (0.114)	0.144 (0.130)
Controls	yes	yes	yes
Constant	8.167 (4.901)	8.167 (4.901)	7.915 (5.274)
Equal FMI model test F statistic	29.637	29.637	32.221
Number of observations	4,108	4,108	4,108
Number of individuals	2,054	2,054	2,054

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 imputates) taken into account in the calculation of SEs. SEs in parentheses. SEs clustered at reference group level. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $Diff^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption level being above that of the reference group.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.14:** Separate fixed-effects panel regressions of life satisfaction on absolute and relative income and relative wealth for younger and older people

Variables	Younger (aged < 45)			Older (aged ≥ 45)		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.178 (0.471)	-0.807 (0.458)	-0.654 (0.534)	0.544 (0.190)	0.198 (0.627)	0.308 (0.577)
Household assets: $\ln(A)$	-0.027 (0.084)	0.435 (0.110)	0.273 (0.140)	0.127 (0.037)	0.327 (0.232)	0.428 (0.270)
Household debt: $\ln(D)$	0.016 (0.024)	-0.092 (0.100)	-0.104 (0.117)	-0.064 (0.022)	-0.006 (0.157)	0.049 (0.163)
Reference income: $\ln(Y_r)$	-0.985 (0.548)			-0.347 (0.583)		
Reference assets: $\ln(A_r)$	0.461 (0.137)			0.200 (0.233)		
Reference debt: $\ln(D_r)$	-0.108 (0.104)			0.058 (0.165)		
$\ln(Y/Y_r)$		0.985 (0.548)			0.347 (0.583)	
$\ln(A/A_r)$		-0.461 (0.137)			-0.200 (0.233)	
$\ln(D/D_r)$		0.108 (0.104)			-0.058 (0.165)	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			1.431 (0.730)			0.496 (0.507)
$\text{Diff}_Y^+: \ln(Y/Y_r)$			0.253 (0.690)			-0.086 (0.696)
$\text{Diff}_A^-: \ln(A/A_r)$			-0.657 (0.237)			-0.148 (0.233)
$\text{Diff}_A^+: \ln(A/A_r)$			-0.243 (0.126)			-0.318 (0.276)
$\text{Diff}_D^-: \ln(D/D_r)$			0.376 (0.221)			0.150 (0.149)
$\text{Diff}_D^+: \ln(D/D_r)$			0.099 (0.120)			-0.136 (0.177)
Age	1.329 (1.046)	1.329 (1.046)	1.558 (1.163)	1.833 (1.594)	1.833 (1.594)	1.701 (1.539)
Age squared/100	-4.685 (2.981)	-4.685 (2.981)	-5.653 (3.437)	-2.903 (2.328)	-2.903 (2.328)	-2.658 (2.264)
Age cubed/1000	0.506 (0.292)	0.506 (0.292)	0.613 (0.336)	0.148 (0.121)	0.148 (0.121)	0.135 (0.119)
Marital status (reference: single)						
Divorced, widowed, separated	1.196 (0.617)	1.196 (0.617)	1.250 (0.633)	-1.895 (0.616)	-1.895 (0.616)	-1.824 (0.570)
Married	0.863 (0.313)	0.863 (0.313)	0.931 (0.379)	-0.950 (0.503)	-0.950 (0.503)	-0.927 (0.530)
German national [0/1]	2.285 (2.301)	2.285 (2.301)	2.194 (2.204)	-1.348 (0.196)	-1.348 (0.196)	-1.474 (0.223)
East Germany [0/1]	-2.812 (1.480)	-2.812 (1.480)	-2.936 (1.297)	-2.358 (0.488)	-2.358 (0.488)	-2.125 (0.583)
Education (reference: ISCED 1-2)						
ISCED 3	-0.892 (0.268)	-0.892 (0.268)	-0.915 (0.304)	-0.928 (0.205)	-0.928 (0.205)	-0.935 (0.214)
ISCED 4	-1.606 (0.470)	-1.606 (0.470)	-1.541 (0.413)	-0.661 (0.382)	-0.661 (0.382)	-0.796 (0.382)
ISCED 5-6	-1.059 (0.428)	-1.059 (0.428)	-0.990 (0.377)	-0.796 (0.234)	-0.796 (0.234)	-0.932 (0.263)
Employment status (reference: manual worker)						

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Table A.14 – continued from previous page

Variables	Younger (aged < 45)			Older (aged >= 45)		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Employee	0.006 (0.279)	0.006 (0.279)	-0.056 (0.298)	-0.106 (0.291)	-0.106 (0.291)	-0.096 (0.304)
Civil servant	-0.947 (0.533)	-0.947 (0.533)	-0.846 (0.503)	-0.350 (0.582)	-0.350 (0.582)	0.040 (0.623)
Self-employed	1.490 (1.884)	1.490 (1.884)	1.097 (1.447)	0.588 (0.412)	0.588 (0.412)	0.534 (0.412)
Vocational training, student	0.393 (0.730)	0.393 (0.730)	0.299 (0.667)	0.248 (0.776)	0.248 (0.776)	0.084 (0.768)
Unemployed	-0.766 (0.231)	-0.766 (0.231)	-0.774 (0.279)	-0.294 (0.287)	-0.294 (0.287)	-0.346 (0.310)
Not in the labour force	0.387 (0.383)	0.387 (0.383)	0.205 (0.405)	0.270 (0.355)	0.270 (0.355)	0.333 (0.356)
ln(household size)	0.199 (0.416)	0.199 (0.416)	0.271 (0.395)	-0.671 (0.431)	-0.671 (0.431)	-0.649 (0.415)
Number of children below 16	-0.355 (0.141)	-0.355 (0.141)	-0.343 (0.116)	0.020 (0.178)	0.020 (0.178)	0.014 (0.165)
2014 Survey	0.142 (0.916)	0.142 (0.916)	0.332 (0.916)	0.038 (0.601)	0.038 (0.601)	-0.032 (0.608)
Controls	yes	yes	yes	yes	yes	yes
Constant	-0.248 (17.371)	-0.248 (17.371)	-0.966 (18.754)	-32.354 (36.760)	-32.354 (36.760)	-33.739 (35.544)
Equal FMI model test F statistic	45.61328	45.61328	22.57451	172.2586	172.2589	149.4828
Number of observations	814	814	814	3,294	3,294	3,294
Number of individuals	407	407	407	1,647	1,647	1,647

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 implicates) taken into account in the calculation of SEs. SEs in parentheses. SEs clustered at reference group level. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $Diff^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption level being above that of the reference group.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.15:** Separate fixed-effects panel regressions of life satisfaction on absolute and relative income and relative wealth for West and East Germany

Variables	West Germany			East Germany		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.324 (0.200)	0.010 (0.615)	-0.143 (0.641)	0.770 (0.497)	0.397 (0.800)	0.390 (0.761)
Household assets: $\ln(A)$	0.135 (0.039)	0.396 (0.189)	0.519 (0.233)	0.099 (0.119)	-0.068 (0.200)	-0.230 (0.214)
Household debt: $\ln(D)$	-0.033 (0.021)	0.059 (0.163)	0.093 (0.172)	-0.086 (0.047)	0.237 (0.156)	0.225 (0.147)
Reference income: $\ln(Y_r)$	-0.315 (0.532)			-0.373 (0.475)		
Reference assets: $\ln(A_r)$	0.261 (0.184)			-0.167 (0.204)		
Reference debt: $\ln(D_r)$	0.092 (0.162)			0.323 (0.161)		
$\ln(Y/Y_r)$		0.315 (0.532)			0.373 (0.475)	
$\ln(A/A_r)$		-0.261 (0.184)			0.167 (0.204)	
$\ln(D/D_r)$		-0.092 (0.162)			-0.323 (0.161)	
$\text{Diff}_Y^-: \ln(Y/Y_r)$			0.782 (0.595)			0.697 (0.397)
$\text{Diff}_Y^+: \ln(Y/Y_r)$			0.065 (0.570)			-0.085 (0.919)
$\text{Diff}_A^-: \ln(A/A_r)$			-0.187 (0.170)			-0.015 (0.235)
$\text{Diff}_A^+: \ln(A/A_r)$			-0.408 (0.237)			0.394 (0.231)
$\text{Diff}_D^-: \ln(D/D_r)$			0.101 (0.166)			-0.191 (0.219)
$\text{Diff}_D^+: \ln(D/D_r)$			-0.144 (0.174)			-0.320 (0.154)
Age	-0.125 (0.298)	-0.125 (0.298)	-0.155 (0.299)	-0.848 (0.506)	-0.848 (0.506)	-0.699 (0.420)
Age squared/100	-0.008 (0.571)	-0.008 (0.571)	0.054 (0.578)	1.464 (0.977)	1.464 (0.977)	1.280 (0.864)
Age cubed/1000	0.006 (0.036)	0.006 (0.036)	0.003 (0.037)	-0.086 (0.058)	-0.086 (0.058)	-0.079 (0.053)
Female [0/1]	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Marital status (reference: single)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Divorced, widowed, separated	0.608 (0.535)	0.608 (0.535)	0.697 (0.550)	-1.654 (0.604)	-1.654 (0.604)	-1.741 (0.577)
Married	0.762 (0.476)	0.762 (0.476)	0.782 (0.510)	-0.358 (0.359)	-0.358 (0.359)	-0.505 (0.328)
German national [0/1]	1.714 (1.856)	1.714 (1.856)	1.656 (1.780)	-1.317 (0.212)	-1.317 (0.212)	-1.185 (0.260)
Education (reference: ISCED 1-2)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
ISCED 3	-0.721 (0.180)	-0.721 (0.180)	-0.686 (0.200)	-1.568 (0.560)	-1.568 (0.560)	-1.508 (0.574)
ISCED 4	-0.895 (0.309)	-0.895 (0.309)	-0.927 (0.318)	-1.644 (0.642)	-1.644 (0.642)	-1.515 (0.607)
ISCED 5-6	-0.883 (0.198)	-0.883 (0.198)	-0.851 (0.191)	-1.231 (0.560)	-1.231 (0.560)	-1.019 (0.618)
Employment status (reference: manual worker)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Employee	0.057 (0.210)	0.057 (0.210)	0.063 (0.217)	0.340 (0.346)	0.340 (0.346)	0.157 (0.408)
Civil servant	-0.746 (0.210)	-0.746 (0.210)	-0.640 (0.217)	1.794 (0.346)	1.794 (0.346)	1.829 (0.408)

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Table A.15 – continued from previous page

Variables	West Germany			East Germany		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
	(0.382)	(0.382)	(0.371)	(0.898)	(0.898)	(0.812)
Self-employed	-0.025	-0.025	0.040	2.880	2.880	2.478
	(0.661)	(0.661)	(0.586)	(1.828)	(1.828)	(1.426)
Vocational training, student	0.318	0.318	0.355	-3.595	-3.595	-3.594
	(0.611)	(0.611)	(0.623)	(1.096)	(1.096)	(0.998)
Unemployed	-0.415	-0.415	-0.406	0.276	0.276	0.136
	(0.324)	(0.324)	(0.355)	(0.325)	(0.325)	(0.328)
Not in the labour force	0.250	0.250	0.323	0.920	0.920	0.764
	(0.300)	(0.300)	(0.288)	(0.710)	(0.710)	(0.659)
ln(household size)	-0.497	-0.497	-0.488	0.924	0.924	0.936
	(0.263)	(0.263)	(0.268)	(0.731)	(0.731)	(0.764)
Number of children below 16	-0.141	-0.141	-0.186	-0.305	-0.305	-0.346
	(0.095)	(0.095)	(0.097)	(0.318)	(0.318)	(0.308)
2014 Survey	0.173	0.173	0.105	0.545	0.545	0.559
	(0.118)	(0.118)	(0.126)	(0.179)	(0.179)	(0.157)
Constant	6.547	6.547	6.032	18.987	18.987	17.297
	(6.531)	(6.531)	(6.415)	(6.395)	(6.395)	(6.442)
Equal FMI model test F statistic	81.645	81.645	98.877	553.424	553.424	255.324
Number of observations	3,349	3,349	3,349	759	759	759
Number of individuals	1,679	1,679	1,679	384	384	384

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 imputates) taken into account in the calculation of SEs. SEs in parentheses. SEs clustered at reference group level. Reference income, assets  $A_r$  and debts  $D_r$  refer to the median income, assets and debts of the previously defined reference groups of each household. The negative difference  $Diff^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption level being above that of the reference group.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

**Table A.16:** Separate fixed-effects panel regressions of life satisfaction on absolute and relative income and relative wealth for wealthy and non-wealthy regions

Variables	Wealthy regions			Non-wealthy regions		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Household income: $\ln(Y)$	0.683 (0.150)	0.022 (0.861)	-0.119 (0.896)	0.463 (0.207)	0.156 (0.417)	0.212 (0.409)
Household assets: $\ln(A)$	-0.120 (0.070)	-0.199 (0.169)	-0.049 (0.206)	0.141 (0.049)	0.348 (0.157)	0.323 (0.195)
Household debt: $\ln(D)$	0.013 (0.011)	-0.248 (0.250)	-0.204 (0.246)	-0.049 (0.021)	0.058 (0.101)	0.072 (0.108)
Reference income: $\ln(Y_r)$	-0.660 (0.864)			-0.307 (0.358)		
Reference assets: $\ln(A_r)$	-0.078 (0.193)			0.207 (0.151)		
Reference debt: $\ln(D_r)$	-0.261 (0.250)			0.107 (0.102)		
$\ln(Y/Y_r)$		0.660 (0.864)			0.307 (0.358)	
$\ln(A/A_r)$		0.078 (0.193)			-0.207 (0.151)	
$\ln(D/D_r)$		0.261 (0.250)			-0.107 (0.102)	
$\text{Diff}_{\bar{Y}}^-: \ln(Y/Y_r)$			0.575 (0.836)			0.656 (0.410)
$\text{Diff}_{\bar{Y}}^+: \ln(Y/Y_r)$			0.954 (1.004)			-0.154 (0.420)
$\text{Diff}_{\bar{A}}^-: \ln(A/A_r)$			0.270 (0.182)			-0.253 (0.180)
$\text{Diff}_{\bar{A}}^+: \ln(A/A_r)$			-0.149 (0.255)			-0.175 (0.187)
$\text{Diff}_{\bar{D}}^-: \ln(D/D_r)$			0.266 (0.216)			0.100 (0.131)
$\text{Diff}_{\bar{D}}^+: \ln(D/D_r)$			0.205 (0.251)			-0.137 (0.111)
Age	0.324 (0.337)	0.324 (0.337)	0.380 (0.302)	-0.258 (0.276)	-0.258 (0.276)	-0.309 (0.281)
Age squared/100	-0.695 (0.511)	-0.695 (0.511)	-0.783 (0.471)	0.287 (0.529)	0.287 (0.529)	0.393 (0.542)
Age cubed/1000	0.047 (0.029)	0.047 (0.029)	0.052 (0.027)	-0.013 (0.033)	-0.013 (0.033)	-0.019 (0.034)
Marital status (reference: single)						
Divorced, widowed, separated	0.257 (0.582)	0.257 (0.582)	0.215 (0.537)	-0.076 (0.734)	-0.076 (0.734)	-0.065 (0.735)
Married	0.114 (0.340)	0.114 (0.340)	0.075 (0.317)	0.590 (0.403)	0.590 (0.403)	0.592 (0.426)
German national [0/1]	-0.228 (0.261)	-0.228 (0.261)	0.015 (0.292)	1.786 (1.941)	1.786 (1.941)	1.641 (1.910)
East Germany [0/1]	-1.873 (0.584)	-1.873 (0.584)	-1.702 (0.531)	-3.091 (0.917)	-3.091 (0.917)	-3.092 (0.897)
Education (reference: ISCED 1-2)						
ISCED 3	0.878 (0.455)	0.878 (0.455)	0.940 (0.469)	-0.955 (0.202)	-0.955 (0.202)	-0.948 (0.213)
ISCED 4	0.274 (0.532)	0.274 (0.532)	0.284 (0.538)	-1.065 (0.336)	-1.065 (0.336)	-1.106 (0.337)
ISCED 5-6	1.210 (0.560)	1.210 (0.560)	1.198 (0.577)	-0.945 (0.245)	-0.945 (0.245)	-0.945 (0.256)
Employment status (reference: manual worker)						

Continued on next page



Table A.16 – continued from previous page

Variables	Wealthy regions			Non-wealthy regions		
	(1a)	(1b)	(2)	(3a)	(3b)	(4)
Employee	0.099 (0.333)	0.099 (0.333)	0.061 (0.299)	0.198 (0.208)	0.198 (0.208)	0.180 (0.212)
Civil servant	0.733 (0.621)	0.733 (0.621)	0.754 (0.606)	-0.325 (0.420)	-0.325 (0.420)	-0.116 (0.459)
Self-employed	0.196 (0.425)	0.196 (0.425)	0.059 (0.389)	0.652 (0.847)	0.652 (0.847)	0.556 (0.733)
Vocational training, student	1.880 (0.933)	1.880 (0.933)	1.889 (0.856)	0.137 (0.511)	0.137 (0.511)	0.058 (0.527)
Unemployed	-0.148 (0.607)	-0.148 (0.607)	-0.106 (0.634)	-0.192 (0.256)	-0.192 (0.256)	-0.215 (0.275)
Not in the labour force	0.422 (0.305)	0.422 (0.305)	0.359 (0.273)	0.407 (0.293)	0.407 (0.293)	0.391 (0.284)
ln(household size)	0.247 (0.223)	0.247 (0.223)	0.170 (0.216)	-0.467 (0.325)	-0.467 (0.325)	-0.432 (0.331)
Number of children below 16	-0.328 (0.127)	-0.328 (0.127)	-0.313 (0.134)	-0.114 (0.107)	-0.114 (0.107)	-0.139 (0.105)
2014 Survey	0.189 (0.464)	0.189 (0.464)	0.142 (0.400)	0.152 (0.124)	0.152 (0.124)	0.150 (0.145)
Constant	5.861 (11.495)	5.861 (11.495)	3.486 (10.799)	7.877 (5.208)	7.877 (5.208)	8.009 (5.712)
Equal FMI model test F statistic	224.140	224.140	123.799	39.143	39.143	44.339
Number of observations	2,032	2,032	2,032	2,076	2,076	2,076
Number of individuals	1,016	1,016	1,016	1,038	1,038	1,038

*Note:* Individual characteristics, fixed effects of the household and the year are included. Multiple imputation (5 imputates) taken into account in the calculation of SEs. SEs in parentheses. SEs clustered at reference group level. Reference income  $Y_r$ , assets  $A_r$  and debt  $D_r$  refer to the median income, assets and debts of the previously defined reference group of each household. The negative difference  $Diff^-$  represents an upward comparison with the own consumption level being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption level being above that of the reference group.

*Source:* PHF 2010/11, PHF 2014 – SUF Files, weighted, panel households only.

## B Further information

### Equivalence scale elasticity of income and wealth

Assuming that life satisfaction relates to household income and wealth for a given number of household members, in other words equivalised income or wealth, it is possible to estimate the equivalence scale elasticity from data on life satisfaction. We therefore follow Schwarze (2003) and explain subjective well-being  $SWB$  of individual  $i$  in household  $h$  at time  $t$  by specifying the following regression equation:

$$SWB_{iht} = \beta_0 + \beta_1 \ln\left(\frac{Y_{ht}}{hh - size_h^e}\right) + \beta_2 \ln\left(\frac{A_{ht}}{hh - size_h^e}\right) + \beta_3 \ln\left(\frac{D_{ht}}{hh - size_h^e}\right) + \mathbf{x}'_{iht} \boldsymbol{\delta} + \varepsilon_{iht}, \quad (\text{B.1})$$

where  $SWB$  is self-reported life satisfaction on an 11-point scale ranging from 0 to 10.  $Y$ ,  $A$  and  $D$  denote net household income, total household assets and total household debt, respectively. The vector  $\mathbf{x}$  contains the usual controls for socio-demographic and socio-economic characteristics.<sup>1</sup> The expressions  $\frac{Y_{ht}}{hh - size_h^e}$ ,  $\frac{A_{ht}}{hh - size_h^e}$ , and  $\frac{D_{ht}}{hh - size_h^e}$  represent the equivalence income, assets, and debt, respectively. The parameter  $\varepsilon$  is the remaining independently and identically distributed (IID) error term, and  $\beta$  and  $\delta$  are the parameters to be estimated.

Equation (B.1) can be rewritten as

$$SWB_{iht} = \beta_0 + \beta_1 \ln(Y_{ht}) + \beta_2 \ln(A_{ht}) + \beta_3 \ln(D_{ht}) - \beta_4 \ln(hh - size_{ht}) + \mathbf{x}'_{iht} \boldsymbol{\delta} + \varepsilon_{iht}, \text{ with } \beta_4 = (\beta_1 e + \beta_2 e + \beta_3 e). \quad (\text{B.2})$$

This expression allows to estimate the equivalence scale elasticity  $e$  for income and wealth:

$$e = \frac{e(\beta_1 + \beta_2 + \beta_3)}{(\beta_1 + \beta_2 + \beta_3)} = \frac{\beta_4}{(\beta_1 + \beta_2 + \beta_3)}. \quad (\text{B.3})$$

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<sup>1</sup>See the appendix (Table A.6) for a detailed description of the variables used in our analysis.

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## **Eidesstattliche Erklärung / Declaration under Oath**

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I declare under penalty of perjury that this thesis is my own work entirely and has been written without any help from other people. I used only the sources mentioned and included all the citations correctly both in word or content.

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Datum / Date

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Unterschrift des Antragstellers /  
Signature of the applicant