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# Beyond Income: Exploring the Role of Household Wealth for Subjective Well-Being in Germany

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## Abstract

An individual's financial situation positively impacts her subjective well-being (SWB) according to the literature. However, most existing studies focus solely on income, neglecting other aspects of an individual's financial situation such as wealth. In this paper, we empirically examine the relationship between SWB, income, household wealth, and its components. Additionally, we explore the significance of one's wealth relative to others' for SWB. Our contribution expands the limited literature on absolute and relative wealth and SWB by utilizing unique microdata from a German wealth survey, the German Panel on Household Finances (PHF). Our findings indicate that both assets and debts, alongside income, are associated with an individual's SWB. In particular, a similar relative increase in financial assets is associated with a greater increase in SWB than the same percentage increase in real assets, and SWB decreases as the level of unsecured debt increases. Furthermore, individuals tend to experience decreased SWB when comparing themselves to others with more assets or less debt. Interestingly, we observe divergent effects of relative wealth on SWB among younger and older individuals. These results underscore the significance of considering wealth, in addition to income, when analyzing determinants of SWB.

**Keywords** Relative wealth · Debt · Assets · Subjective well-being · Relative deprivation · Tunnel effect

**JEL Classification** I31 · D19 · D31

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## 1 Introduction

Whether money can buy happiness is a question addressed by several authors in empirical studies on subjective well-being, SWB (see, e.g. Diener & Biswas-Diener, 2002; Headey et al., 2004; Kahneman & Deaton, 2010; Killingsworth et al., 2023). A common finding of most of these studies is that an individual's financial situation has a positive impact on their SWB.<sup>1</sup> Most studies focus on only one aspect of an individual's financial situation, i.e., income (Weinzierl, 2005). The link between SWB and wealth (components) has mostly been neglected in the existing literature, not least because of a lack of suitable microdata on households' wealth. Most of the studies, which include wealth, are limited either to one measure of total net wealth or to a single wealth component, such as homeownership or savings.<sup>2</sup> Relying exclusively on income and ignoring wealth may lead to wrong conclusions regarding the relationship between SWB and an individual's financial situation (Clark et al., 2008).

Classic microeconomic theory can be used to explain why SWB should be influenced by wealth and debt holdings: an individual derives utility from consuming goods, which can be purchased using current income, saved or accumulated income (wealth), or new debt. Thus, higher levels of income and wealth should lead—through increased consumption opportunities—to higher utility or SWB levels. Apart from providing consumption opportunities, wealth has some additional features making it prone to positively influence SWB: 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 functions of wealth, it is not surprising that several recent studies have found a positive relationship between SWB and wealth holdings (for example, Brown & Gray, 2016; D'Ambrosio et al., 2020; Foye et al., 2018; Hagerty & Veenhoven, 2003; Headey & Wooden, 2004; Office for National Statistics, 2015).

Going beyond the classic absolute utility theory that focuses on the *levels* of income, wealth or consumption, the levels of these measures relative to those of others also seem to affect SWB according to relative utility theory (Kuhn et al., 2011; Pollak, 1976). Here again, the empirical studies have mainly focused on income.<sup>3,4</sup> Only recently, some studies confirmed the relevance of interpersonal comparisons based on wealth for SWB (see e.g., Brown & Gray, 2016; D'Ambrosio et al., 2020); however, the direction of the effect is unclear. On the one hand, wealthy people may cause negative externalities (Frank, 1989; Layard, 1980) because they make their peers feel relatively deprived (Runciman, 1966).

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<sup>1</sup> In this paper, we focus mainly on the correlation between income and wealth and subjective well-being through the lens of economics. Related disciplines go beyond the economic discussion on income and wealth effects and study psychological, unemployment or social class outcomes and their impact on life satisfaction (see e.g. Firebaugh & Schroeder, 2009; Prechsl & Wolbring, 2023; Eberl et al., 2023; Kaiser & Tinh, 2021).

<sup>2</sup> See Jantsch and Veenhoven (2019) for a comprehensive review.

<sup>3</sup> Social comparisons have long been known to be relevant for well-being, as shown for example by Clark (2003) regarding employment status and Piper (2015) regarding education.

<sup>4</sup> See Killingsworth et al (2023) for a recent discussion in the psychology literature on the effects of social comparisons and income on subjective well-being. This research indicates that while happiness tends to increase with income, the relationship is not linear for everyone. The findings suggest that emotional well-being rises with income up to a certain point, after which additional income does not significantly enhance happiness. This phenomenon is often referred to as "income satiation," where individuals experience diminishing returns on happiness as their income increases beyond a certain threshold (around 75,000 to 90,000 US dollar).

On the other hand, wealthy people may cause positive externalities because their wealth and income levels serve as information for their peers' potential income and wealth in the future. The prospect of reaching these income and wealth levels in the future may positively affect SWB now. This information effect is also called *tunnel effect* (Hirschman & Rothschild, 1973).

We contribute to the literature by empirically analyzing the link between SWB and different types of households' wealth as well as debt components. Using panel microdata on household wealth in Germany from the Panel on Household Finances (PHF) 2010 and 2014, we first consider wealth and its different components, such as real assets, financial assets, secured and unsecured debt, in addition to income, and investigate how these are associated with our measure of SWB, i.e., life satisfaction. Second, we discuss whether considering wealth alters the relationship between SWB and income. Third, we investigate the importance of one's own wealth relative to the wealth of other households for SWB. Specifically, we analyze whether and how the wealth of an individual's reference group matters for SWB.

Our comprehensive empirical analysis of various types of financial assets and their relationship with subjective well-being (SWB) shows that wealth (and its different components) and debt indeed play a role for the SWB of an individual, in addition to income. Financial assets play a significant role regarding the positive effect of total assets on life satisfaction, while the evidence on real assets is less clear. Analyzing different types of debt, we find that unsecured debt, typically associated with non-durable consumption, has the most pronounced negative association with life satisfaction. The 'burden' of servicing unsecured debt appears to outweigh the average increase in life satisfaction derived from consumption financed by such debt. These insights underscore the importance of considering specific components within wealth and debt when exploring their associations with individual life satisfaction.

Not only the absolute levels of wealth and debt seem to matter, but also wealth and debt levels in comparison to those of the reference group. While we find a negative correlation between holding less assets compared to the peer group on SWB for younger individuals, the SWB of older people seems to increase with the raising assets of their reference group, suggesting a tunnel effect. Notably, reference debt is positively associated with life satisfaction for both age groups, with a stronger association observed among younger individuals.

In summary, we show that a broader concept, going beyond income, is important when analysing the relationship between SWB and the financial situation of a household or individual.

This paper is structured as follows. In the next section, we review the literature on life satisfaction, income, and wealth. The data set and some descriptive statistics are presented in section three. Our methodology is described in section four, and section five contains the results. Conclusions are drawn in section six.

## 2 Literature Review: Subjective Well-Being, Wealth and Social Comparisons

### 2.1 Empirical Evidence on SWB and (Relative) Wealth

The empirical literature on wealth and SWB is relatively scarce. However, there have been several contributions utilizing Australian survey data. Headey and Wooden (2004), for example, estimate the combined effects of disposable income and net wealth on SWB using cross-sectional data from the Household, Income and Labour Dynamics Survey in Australia (HILDA). The results indicate that income and net wealth promote SWB and relieve ill-being almost in the same way. In another study, Headey et al. (2004) empirically investigate the combined effects of net wealth, disposable income, and consumption on overall life satisfaction as an indicator of SWB. Using data from five national household panels (Australia, Britain, Germany, Hungary, and the Netherlands), they find 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 SWB and net wealth is relatively weak in wealthy Western societies compared to their non-Western counterparts (Diener et al., 1999; Howell et al., 2006; Schyns, 2002). Using data from the Survey of Health, Aging, and Retirement in Europe (SHARE), Hochman and Skopek (2013) compare the effects of wealth on SWB across three welfare-state regimes: conservative (Germany), liberal (Israel), and social-democratic (Sweden). Their results indicate that income and wealth explain a greater part of the variance in SWB when taken together and that the welfare state has an important impact on the wealth-SWB relation.

Two studies by the Office for National Statistics (2015) and Brown and Gray (2016) extend the analysis of the effects of wealth on SWB by distinguishing between assets and debt. They show that assets and debts can have opposite effects on SWB and that different types of assets in households' portfolios can have differential effects. Empirical evidence, for example from the housing literature, 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 British Office for National Statistics (2015) shows that property ownership (and private pension wealth) is not statistically significantly related to life satisfaction. Instead, they find a positive relationship between net financial wealth and life satisfaction. D'Ambrosio et al. (2020) show a positive effect of net real estate, financial and business assets on life satisfaction in Germany.

Regarding different types of debt, Brown, Taylor, and Wheatley Price (2005) explore the role of unsecured and secured debt for psychological well-being. Using the British Household Panel Survey (BHPS), they find that unsecured—opposed to secured debt—has a detrimental effect on psychological well-being. One possible reason for this negative effect could be that the additional “pleasure” of goods paid for by credit card, for example, is weaker and of shorter duration than the “pain” experienced when in debt (Jantsch & Veenhoven, 2019). According to Tay et al. (2017), secured debt, such as mortgage debt, does not necessarily lower SWB. Hochman et al. (2019) and Müller et al. (2021) study the role of debt in shaping the negative relationship between negative life events and general life satisfaction and overall find that debt does not change the relationship between experiencing a negative life event and general life satisfaction.

## 2.2 SWB and Social Comparisons

Richard Easterlin uses data from repeated surveys carried out in the United States to compare self-reported happiness of U.S. citizens over time (Easterlin, 1974). He finds no associated rise in reported happiness even though the average levels of U.S. incomes had risen remarkably over time—the Easterlin-Paradox (see also Easterlin, 1995, p. 35).<sup>5</sup>

Easterlin's findings raise the question of whether the assumption that greater levels of income lead to greater utility is adequate. Indeed, the Easterlin-Paradox has been mainly explained by social comparison; i.e., people compare their current income to the incomes of their peer or reference groups (Clark et al., 2008).

Social comparisons typically involve comparing one's consumption opportunities with that of a reference group. James Duesenberry (1949, Chapter 2) notes, for example, that individuals frequently prioritize maintaining or enhancing their relative social standing over solely pursuing absolute gains in income. There are two types: upward comparisons and downward comparisons (Wheeler, 1991) and some studies show asymmetrical effects, with upward comparisons having a greater negative impact on SWB (Ferrer-i-Carbonell, 2005; Holländer, 2001; Vendrik & Woltjer, 2007). Yet, there is evidence that positive feelings from downward comparisons dominate negative feelings from upward ones (McBride, 2001).

Regardless of the direction, social comparisons affect SWB (cf. Smith, 2000, p. 175 for a comprehensive literature overview). Positive effects can be attributed to the (I) *tunnel effect*, where upward comparisons generate hope and optimism for future consumption opportunities. The phenomenon was first studied by Hirschman and Rothschild (1973), who assumed that people perceive their comparatively low income as only temporary and, at the same time, use others' higher incomes as information regarding their own (potential) future income. In some cases, this positive effect of an increase in peers' income may dominate the negative effect on SWB from a relatively worse position in the income distribution (Senik, 2004, 2101). Additionally, downward comparisons create a sense of pride and relief as individuals realize they are better off or not as worse off as others. This (II) *relative gratification effect* refers to the positive feelings individuals experience when they perceive themselves as doing relatively better compared to others (Grofman & Muller, 1973; Guimond & Dambrun, 2002; Leach et al., 2002; Jantsch, 2020, 33).

With regard to the negative effects of social comparisons, Easterlin (1995, 35) argues that a respective increase in the income of others offsets the positive effect of an increase in own income on SWB. This negative effect is also known as the (III) *relative deprivation effect*, leading to envy and resentment when the individual feels worse off (Runciman, 1966). This literature indicates that individuals take their own objective status and that of their peers into account when assessing their level of SWB (Easterlin, 1995, 36).<sup>6</sup> Thus, for a given income, a higher average income of others implies a lower position in the income distribution. This means that an individual may end up relatively worse-off compared to

<sup>5</sup> Clark, Frijters, and Shields (2008) echo this finding for the United States using data from the General Social Survey (GSS) over the period 1973–2004. A similar pattern has been observed for Japan where incomes of Japanese citizens rose substantially between 1958 and 1987 (by a factor of five)—the average level of happiness remained constant (Di Tella & MacCulloch, 2006, p. 26).

<sup>6</sup> Some recent literature (for example Hagerty & Veenhoven, 2003) contests Easterlin's view on the basis of new and longer time series data on SWB and claims that absolute levels of income and wealth increase SWB and find little evidence for social comparisons in the U.S. and across nations.

the rest of society even if the level of her own disposable income has not changed. Downward comparisons, on the other hand, can cause (IV) *fear of social decline*, where individuals worry about being as worse off as others in the future, using others' performance as an indicator of their own future performance (Jantsch, 2020, 33). Effects on SWB resulting from downward and upward comparisons are summarized in Table 1.

To date, there is a large body of empirical evidence in the economics, psychological and social science literature that points to the importance of relative income rather than absolute income for SWB (see, for example, Clark & Oswald, 1996; Senik, 2004; Ferrer-i-Carbonell, 2005; Luttmer, 2005; Wunder, 2009; Layard et al., 2010).

As already mentioned, an increase in reference group income is not necessarily associated with lower levels of SWB. Instead, empirical evidence suggests that comparisons with the respective reference group that is relatively better off could also have a positive effect on SWB (Firebaugh & Schroeder, 2009; FitzRoy et al., 2014; Knies, 2012; Senik, 2004, 2008). For example, Firebaugh and Schroeder (2009) find that the relative income hypothesis does not hold at the neighborhood level. Net of the effects of their own income, Americans tend to be happier when their nearby neighbors are rich, but at the same time when their income is higher than that of more distant neighbors. In other words, the overall effect of residential income on individual happiness reverses from positive to negative as geographic scale increases. Reference effects can also go beyond income. Looking at social class and social mobility, Kaiser and Trinh (2021) find that one's own social mobility generally improves life satisfaction while higher reference mobility leads to a decrease in life satisfaction.

FitzRoy et al. (2014) study relative income effects over the life cycle and show that the negative effect of income comparisons dominates later in life, while the positive effect appears to be more important in early life. Brown et al. (2016) confirm these results by analysing the relationship between SWB and relative wealth using HILDA data. In their recently published study, D'Ambrosio et al. (2020) show a positive effect on individual's life satisfaction and permanent wealth of the reference group using data from the German Socio-Economic Panel.

Some recent studies analyse the relationship between relative wealth and life satisfaction for some selected types of wealth. Foye et al. (2018) argue that home ownership is a positional good and show empirically for the UK that the life satisfaction of homeowners decreases if the home ownership rate of the reference group increases. Odermatt and Stutzer (2022) find that homebuyers systematically overestimate their future life satisfaction just before as well as just after having relocated to their acquired dwelling. Brown et al. (2017) use data from the US to examine the importance of the relative rank within a social comparison group for life satisfaction. Among other indicators, they look at mortgage debt and financial assets. They show that the relative position in the distribution and not the absolute level of mortgage debt and financial asset holdings affect life satisfaction.

### 3 Data and Descriptive Statistics

#### 3.1 Data: The Panel on Household Finances

For our analysis we use data from the 2010 and 2014 waves of the "Panel on Household Finances" (PHF). The survey is based on a random stratified sample of private households

in Germany, with oversampling of wealthy areas.<sup>7</sup> The PHF net samples comprised 3565 households in 2010 and 4661 households in 2014. To account for attrition and to ensure cross-sectional representativeness, a refresher sample was drawn for the 2014 survey. Attrition rates were low for a survey with a three-year frequency. About 68% of the households in the 2010 wave also participated in the 2014 wave. The survey thus has a large panel component, which we use in our analysis. More than two thousand households (2191 incl. 40 split off households) participated in both 2010 and 2014.

The survey is well suited for our analysis as it contains detailed information on monthly household income and household wealth. It provides information on real assets (properties, self-employed businesses, vehicles, and valuables) and financial assets (current accounts, savings accounts, stocks, bonds and other securities, pension contracts, managed accounts, non-self-employed business wealth) as well as liabilities (mortgages/secured debt, consumer loans, private loans, overdue bills). To deal with missing values, the wealth and income variables of the PHF are multiply imputed using Rubin's (1987) method.<sup>8</sup> Except for gross income and pension assets, all the financial information is collected at the household level. In our analysis, we use total assets calculated as the sum of all real and financial assets as well as total debt, the amount of outstanding secured debt and unsecured debt. Net income is taken from a single question on total monthly net household income.

The scientific use file contains paradata from the sampling stage, i.e., the stratification of the sample by wealth. Municipalities with less than 100,000 inhabitants were assigned to two strata, labelled "wealthy small municipality" and "other small municipality", based on the share of taxpayers with high income. In large cities, wealthy street sections were identified based on micro-geographic characteristics, such as housing structure. This information allows us to investigate whether the relationship between life satisfaction and income or wealth is affected by the "wealth" in the area the person lives in.<sup>9</sup>

We use *life satisfaction* as an indicator of SWB. It is taken from a question using a classic 11-point Likert scale: "In general, how satisfied are you currently with your life as a whole?" which respondents answer by ticking one option on a list running from 0 "completely dissatisfied with life" to 10 "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)" which is the person who knows best about the household's finances.<sup>10,11</sup>

We concentrate our analysis on the balanced panel. Of the 2250 panel households that could potentially be linked across the two waves we use 2,114 for our analysis. We delete four observations with missing information on life satisfaction in either one of the two survey waves. We also exclude 61 households in which the financially knowledgeable person

<sup>7</sup> The PHF survey was conducted in 2010 (September 2010 to June 2011) and 2014 (April to November 2014). Interviewers collect detailed data on households' assets and liabilities in face-to-face CAPI interviews, which last, on average, about 1 h. The German surveys are part of a larger effort to collect harmonized wealth data in the euro area, the "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 Altmann et al. (2020) or visit the website of the Deutsche Bundesbank/PHF.

<sup>8</sup> A detailed description of the imputation method is available in Zhu and Eisele (2013). Altmann et al. (2020) describes the basic features.

<sup>9</sup> See Altmann et al. (2020) for more details.

<sup>10</sup> Since wealth and income are measured at the household level and life satisfaction is measured at the individual level, we have to assume that all persons in a household participate equally in the resources of the household.

<sup>11</sup> See, for example, Cherchye et al. (2017).



**Table 1** Effects resulting from downward and upward comparisons

	Upward comparison	Downward comparison
Positive effects	(1) <i>Tunnel effect</i> Indication of economic chances from upward comparison	(2) <i>Relative gratification</i> Positive feelings from downward comparison
Negative effects	(3) <i>Relative deprivation</i> Negative feeling from upward social comparison	(4) <i>Fear if social decline</i> Indication of economic threats from downward comparison

Source: Jantsch (2020)

has changed across waves to avoid comparing life satisfaction measures of different people across time, and 52 households are excluded because there are no households to link them to in wave 1. The 52 households include 40 split-off households and 12 households where the structure changed so substantially between waves 1 and 2 that they could no longer be considered the same households. Finally, we had to drop 19 individuals because we could not assign them an ISCED education status.<sup>12</sup>

### 3.2 Descriptive Statistics

We find that the respondents in the balanced panel have, on average, a fairly high level of life satisfaction. Average life satisfaction is almost identical in both waves: 7.32 in 2010 and 7.33 in 2014, with a standard deviation of 1.9 in each of the two years. Both the mean and the distribution are very similar across the two years, as Fig. 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).

With respect to wealth and income, the mean (median) annual net household income is €38,491 (32,400) in 2010 and €40,594 (35,316) in 2014. Mean (median) total gross wealth is at €432,003 (227,000) in 2010 and at €475,533 (256,888) in 2014 (Tables 7 and 10 in the Appendix).<sup>13</sup> There are substantial changes at the microlevel in our two main explanatory variables of interest,<sup>14</sup> total gross wealth (total assets) and total debt (see Tables 8 and 9 in the Appendix). We find that about half of the panel households change the decile of their total assets between 2010 and 2014: 30% move to a higher decile and 22% to a lower decile, approximately 48% stay in the same decile. For total debt only about one third of households (34%) stay in the same decile, 27% move up one or more decile and 38% down by at least one decile.

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

<sup>13</sup> Median and mean values for wealth components are presented in Table 7 in the Appendix. Descriptive statistics for control variables included in the regression analysis are presented in Table 10 in the Appendix. Both total net household income and total household wealth are substantially higher than the weighted averages for the total population, reflecting the oversampling of the wealthy.

<sup>14</sup> Please note that we do 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 multivariate analysis presented below.

## 4 Empirical Strategy

### 4.1 Subjective Well-Being and Absolute Wealth: Econometric Model

There is some discussion in the literature about what is the most appropriate estimation technique to use when analysing responses from Likert scale questions, such as our SWB question. The answers can be interpreted as an ordinal or a cardinal variable. Depending on what is assumed, either ordered logit/probit models or regular OLS should be used. A widely cited paper by Ferrer-i-Carbonell and Frijters (2004) suggests "... that assuming ordinality or cardinality of happiness scores makes little difference, ..." (p. 641). They also show that one should use fixed effects specifications in panel settings to account for individual unobserved heterogeneity. We follow their suggestion and perform panel OLS regressions using individual fixed effects on the balanced panel. The regression equation is:

$$LS_{it} = \beta_1 \ln Y_{it} + \beta_2 \ln A_{it} + \beta_3 \ln D_{it} + \mathbf{x}'_{it} \delta + \alpha_i + \varepsilon_{it}, \quad (1)$$

where  $LS$  is self-reported life satisfaction of individual  $i$  at time  $t$  measured on an 11-point scale ranging from 0 to 10.  $Y$ ,  $A$  and  $D$  denote annual net household income, total household assets and total household debt, respectively. The literature on the relationship between life satisfaction and income typically makes use of a logarithmic transformation<sup>15</sup> of income to account for the diminishing marginal utility of income (Layard et al., 2008) and to deal with extreme outliers. For our analysis, we also transform yearly net household income, assets and debts and the individual components of total assets using the logarithmic transformation.<sup>16</sup> Moreover, we include 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 SWB if the household size increases.<sup>17</sup> Including log-transformed household size serves as an "implicit equivalence scale" for income as well as for assets and debt to account for economies of scale of living together (Buhmann et al., 1988).

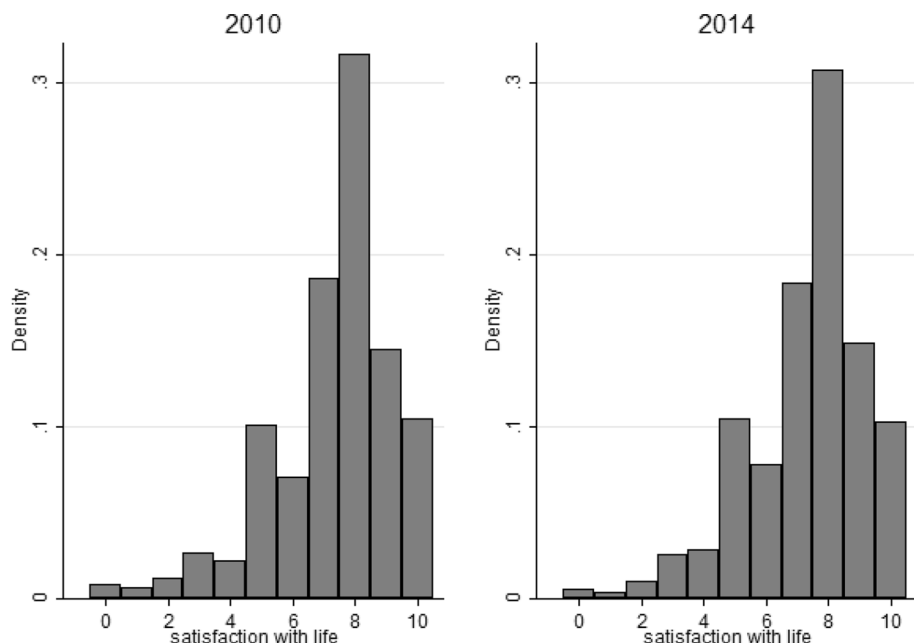
The vector  $x$  contains control variables for sociodemographic and socioeconomic characteristics, including the respondent's age in years (also squared and cubed) at the time of the interview, the number of children below 16 that live in the respondent's household, their marital status (single-never married, married, divorced, widowed), their citizenship (German vs Non-German), their place of residence (East/West Germany), their education level, according to the ISCED standard,<sup>18</sup> and their employment status (manual worker, employee, civil servant, self-employed, apprenticeship, student, unemployed, other not

<sup>15</sup> The inverse-hyperbolic is a very similar transformation since the transformation explicitly allows for zero and negative values.

<sup>16</sup> In the case where the household owns zero assets or debts or has no income, we assigned the value zero to the log transformed variable. The share of observations "imputed" with a zero can be inferred from Table 7, by calculating the difference between 100% and the participation rate. Alternatively, researchers could use wealth quintiles as explanatory variables. Using quintiles allows for non-linear effects of wealth on life satisfaction. It also avoids having to assume a diminishing marginal utility of wealth. We estimate the baseline specification using quintiles as a robustness check. (Results available in the Online Appendix).

<sup>17</sup> One reason to do so is that most equivalence scale elasticities regarding income suggested by expert scales, such as OECD equivalence scale, 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). Results are very similar to those obtained for different equivalence scales (see Table 13 in the Appendix).

<sup>18</sup> ISCED stands for International Standard Classification of Education, a system developed by the OECD for international comparison reasons.



**Fig. 1** Histogram of life satisfaction measures 2010 and 2014. *Source/Notes:* PHF 2010/11, PHF 2014—SUF Files, unweighted, panel households only

working).<sup>19</sup> The parameter designated by  $\alpha$  denotes fixed effects for the household, 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.

In order to investigate the relationship between SWB and wealth components, we include real assets,  $A^{REAL}$ , financial assets,  $A^{FIN}$ , secured debt,  $D^{SEC}$ , and unsecured debt,  $D^{UNSEC}$  separately in the baseline equation:

$$LS_{it} = \beta_1 \ln Y_{it} + \gamma_1 \ln A_{it}^{REAL} + \gamma_2 \ln A_{it}^{FIN} + \gamma_3 \ln D_{it}^{SEC} + \gamma_4 \ln D_{it}^{UNSEC} + \mathbf{x}'_{it} \delta + \alpha_i + \varepsilon_{it}. \quad (2)$$

The parameter designated by  $\gamma$  gives us an indication of how the individual components of wealth are associated with life satisfaction.

## 4.2 Subjective Well-Being and Relative Wealth: Econometric Model

James Duesenberry (1949) first formulated the relative income hypothesis, showing that individuals are positively influenced by their own income and negatively by others' income. This work influenced economic happiness research, leading to utility functions considering both absolute and relative components of consumption levels (Clark et al., 2008). We focus on interpersonal comparisons, excluding intrapersonal ones such as comparisons with past

<sup>19</sup> See the [Appendix](#) (Table 11) for a detailed description of the variables used in our analysis.

consumption levels. In the next step, the aim is to explain SWB by an absolute and a relative component. In doing so, we rely on specifications used in a similar way by Ferrer-i-Carbonell (2005) and Vendrik and Woltjer (2007), and start with the following equation which extends the baseline specification (1):

$$LS_{irt} = \beta_1 \ln Y_{it} + \beta_2 \ln A_{it} + \beta_3 \ln D_{it} + \kappa_1 \ln Y_{rt} + \kappa_2 \ln A_{rt} + \kappa_3 \ln D_{rt} + \mathbf{x}'_{it} \delta + \alpha_i + \varepsilon_{irt}, \tag{3}$$

where the current financial situation is not only captured by current annual net household income,  $Y$ , but also by total household assets,  $A$ , and total household debt,  $D$ . The relative components are  $Y_r$ ,  $A_r$  and  $D_r$ , which represent measures of income, total assets, and total debt for the respective reference group  $r$ .<sup>20</sup> The parameters designated by  $\kappa$  give us an indication of how the reference wealth is associated with life satisfaction.

Assuming that people have ‘a unidirectional drive upward’ due to a desire for social advancement (Festinger, 1954, 124, Hypothesis IV), a rise in the consumption opportunities of the respective reference group,  $r$ , is negatively associated with life satisfaction LS—even if their own consumption opportunities are already above that of the reference group. Therefore, the parameter  $\kappa$  is supposed to be negative.<sup>21</sup>

In Eq. (3) we do not consider whether an individual is above or below the income or wealth level of her reference group.

According to Clark et al. (2008), Eq. (3) can be rewritten using an expression of interpersonal difference of consumption opportunities ( $\ln Y_{it} - \ln Y_{rt}$ ), ( $\ln A_{it} - \ln A_{rt}$ ), and ( $\ln D_{it} - \ln D_{rt}$ ):

$$LS_{irt} = (\beta_1 + \kappa_1) \ln Y_{it} + (\beta_2 + \kappa_2) \ln A_{it} + (\beta_3 + \kappa_3) \ln D_{it} - \kappa_1 (\ln Y_{it} - \ln Y_{rt}) - \kappa_2 (\ln A_{it} - \ln A_{rt}) - \kappa_3 (\ln D_{it} - \ln D_{rt}) + \mathbf{x}'_{it} \delta + \alpha_i + \varepsilon_{irt}, \tag{4}$$

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 opportunities and can also be written as  $\ln(Y_{it}/Y_{rt})$ ,  $\ln(A_{it}/A_{rt})$ , and  $\ln(D_{it}/D_{rt})$ . Moreover, Eq. (4) makes it possible to separate the effect on LS of the individual consumption opportunities relative to the reference consumption opportunities from the effect of the absolute individual consumption opportunities (Ferrer-i-Carbonell, 2005; Vendrik & 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 opportunities and that of the corresponding reference group. We call this difference *Diff*. However, specification (4) does not allow for asymmetries in comparisons. To find out which effect dominates, we have to consider whether the individual’s consumption opportunities are above or below that of the respective reference group’s consumption opportunities. 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 Eq. (5) below). In the example of income, as soon as the difference

<sup>20</sup> The definition of our reference group is based on individual characteristics and place of residence resulting in 30 different individual reference groups (see below for details).

<sup>21</sup> The vector  $\mathbf{x}$  contains the same controls for sociodemographic and socioeconomic characteristics introduced earlier. The parameter  $\alpha$  denotes a fixed effect for the household,  $\varepsilon$  is the error term assumed to be independent and identically distributed (IID), and  $\beta$ ,  $\delta$ , and  $\kappa$  are the parameters to be estimated.

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 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  $\theta$ .

$$\begin{aligned}
 LS_{irt} = & \theta_1 \ln Y_{it} + \theta_2 \ln A_{it} + \theta_3 \ln D_{it} \\
 & - \kappa_1^+ Diff_y^+ - \kappa_2^+ Diff_A^+ - \kappa_3^+ Diff_D^+ \\
 & - \kappa_1^- Diff_y^- - \kappa_2^- Diff_A^- - \kappa_3^- Diff_D^- \\
 & + \mathbf{x}'_{it} \delta + \alpha_i + \varepsilon_{irt}.
 \end{aligned} \tag{5}$$

The parameters  $\kappa^+$  and  $\kappa^-$  indicate the association between life satisfaction, reference wealth and reference income, taking into account whether an individual is above or below reference income and reference wealth, respectively.

For the estimation of Eqs. (1) to (5), we take into account the uncertainty introduced by the multiple imputation (five implicates) of our independent variables by running the regression on each of the imputed datasets; thus we obtain five coefficient estimates and the variance–covariance matrices corresponding to the parameter estimates.<sup>22</sup> According to the combination rules by Rubin (1987), the coefficients and standard errors (SE) are then adjusted for the variability between imputations.<sup>23</sup>

### 4.3 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 first need to 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 (Becchetti et al., 2013; Knies, 2012; Luttmer, 2005; Persky & Tam, 1990). It is also well known from the literature that people select their comparison target on the basis of similar attributes (Layard et al., 2010; McBride, 2001). There are also studies that ask respondents directly for their reference groups (Dufhues et al., 2023, Jantsch et al., 2024).

In this paper, we combine both, the individual characteristics and 'geography', and 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

<sup>22</sup> See Zhu and Eisele (2013) for details on the imputation process in the PHF.

<sup>23</sup> It has to be noted that we did not consider the complex sampling design of the PHF in the calculation of standard errors. Whether considering the stratification and clustering in the sample design would increase or decrease the standard errors is not a-priori clear (Hirschauer et al. 2020). We still provide robust standard errors for interested readers, but also interpret coefficients, even if they are not statistically significant following conventional definitions, as we think they provide valuable insights into the direction of the associations between wealth and SWB.

households living in East and West Germany. In doing so, we assume that individuals have a good knowledge of the socioeconomic situation of people living in East and West Germany because they are able to observe and assess their living conditions.<sup>24</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>25</sup>

## 5 Results<sup>26</sup>

### 5.1 Subjective Well-Being and Absolute Wealth

The results from regression Eq. (1) are shown in Table 2. The first column displays the correlation of life satisfaction and household income, the second column adds total household assets, and in the third column we show results for also adding household indebtedness.

As expected, we find net income to be positively associated with individual life satisfaction. Interestingly, the association between life satisfaction and net income changed only minimally once wealth is factored in, pointing to an effect of wealth in addition to that of income. Even though income and net wealth are correlated at the household level, they seem to have a separately identifiable relationship with life satisfaction. While a change in total assets is positively associated with life satisfaction, a change in total debt is predicted to lower the level of life satisfaction, controlling for household income and other sociodemographic characteristics of the individual in the regression.<sup>27</sup>

To further investigate the importance of wealth for life satisfaction, we next turn to an analysis of different types of assets and debt. The results for different wealth and debt components from regression Eq. (2) are shown in Table 3. Considering both indicators and levels of assets and debt, financial assets drive the positive relationship between total assets, and it is, in particular, unsecured debt that reduces life satisfaction the most. The positive relationship with financial assets can potentially be attributed to its liquidity features. While real assets are very illiquid, financial assets are typically liquid and can thus be more easily accessed for consumption. This liquidity feature also allows individuals to better smooth their consumption. Both aspects may have a positive effect on SWB. As far as debt is concerned: unsecured debt is in most cases linked to (non-durable) consumption expenditure. For which, our results indicate that the ‘burden’ of being indebted and having

<sup>24</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 limited number of observations in our dataset.

<sup>25</sup> Descriptive statistics for comparison group income, total assets and total debt are shown in Table 12 in the Appendix.

<sup>26</sup> The syntax file of the analysis is available in Jantsch et al. (2024). Additional results, e.g. regression tables with coefficients for all control variables, are available in the Online Appendix.

<sup>27</sup> We also perform pooled OLS and pooled ordered probit regressions which both yield qualitatively similar results. Moreover, as a robustness check we estimate a model where we allow for non-linear effects of income and wealth on life satisfaction by including dummy variables for income and wealth quintiles as explanatory variables rather than income and wealth levels. The results do not change substantially. Results for the additional regressions are available in the Online Appendix.

to service unsecured debt may be higher (or more long-lasting) than the average increase in life satisfaction derived from consumption financed by such debt.

## 5.2 Subjective Well-Being and Relative Wealth

In this section, we investigate the relationship between a change in life satisfaction and a change in assets or liabilities of the respective reference group. We estimate the association between life satisfaction and reference income and reference wealth. Furthermore, we also consider whether the individual is above or below the reference groups' wealth and debt. Motivated by previous findings by FitzRoy et al. (2014) and Brown and Gray (2016) regarding different effects of relative income and relative wealth for different age groups, 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.

We first successively add the reference income, reference total assets and reference total debt to our baseline regression according to Eq. (1). The respective results are shown in Table 4. 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.<sup>28</sup>

Looking further at the coefficients of the reference measures, it appears that the change in reference income is positively associated with life satisfaction. This indicates that the average life satisfaction is predicted to increase when the income of the reference group increases. This result is in contrast to what has been found in other studies (Clark et al., 2008; Ferrer-i-Carbonell, 2005). When we add reference debt in column (4), the estimated coefficient for reference income decreases substantially and becomes economically meaningless. This result suggests that the neglect of reference assets and reference debt may lead to incorrect conclusions being drawn regarding the comparison effect of income.

The analysis so far only takes into account the changes in the level of wealth, debt and income of the reference group, but not the position of an individual relative to her reference group. We next take into account whether individuals are below or above the reference group's income, total assets and total debt.

Following the logic behind Eq. (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, we can distinguish between positive and negative differences between household's own wealth and reference wealth, and individual's own income and reference income, respectively. It also allows us to investigate in more detail whether the tunnel or the deprivation effect is at play for wealth and how important these effects are. The tunnel effect is at play when being below the median wealth of the respective reference group is positively correlated with life satisfaction, i.e., individuals are optimistic about their own prospects. In contrast, the deprivation effect dominates if individuals are more satisfied with their lives because their wealth is higher than their reference group's wealth.

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<sup>28</sup> Please note that we cluster the standard errors for reference groups as the reference variables' effects is the main interest in this section. For the baseline estimations presented Table 2 we clustered at the level of individuals.

**Table 2** Life satisfaction, net income, total assets, and total debt in Germany—coefficients from fixed effects panel-regressions<sup>a</sup>

Variables	(1)	(2)	(3)
ln(total assets)		0.097*** [0.035]	0.103*** [0.036]
ln(total debt)			- 0.016* [0.009]
ln(hh-income)	0.370*** [0.115]	0.329*** [0.113]	0.334*** [0.113]
Controls	Yes	Yes	Yes
Constant	9.565 [2.954]	9.500 [2.956]	9.509 [2.961]
Model test F statistic	3.82	3.14	3.14
MI model test <i>p</i> -value	< 0.001	< 0.001	< 0.001
Observations	4108	4108	4108
Number of individuals	2054	2054	2054

*Source/Notes:* PHF 2010/11, PHF 2014–SUF Files, unweighted, persons in panel households only. The models are based on Eq. 1. Multiple imputation taken into account in the calculation of SEs

\*\*\* $p < 1\%$ , \*\* $p < 5\%$ , \* $p < 10\%$

<sup>a</sup>These results are robust to excluding households with change in their composition (see Supplemental Table 1 in the online Appendix)

Here, 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 Eq. (5), a negative sign of the estimated coefficients of  $Diff_Y^-$  and  $Diff_A^-$  correspond to the tunnel effect, whereas a positive sign of the estimated coefficients of  $Diff_Y^-$  and  $Diff_A^-$  correspond to the relative deprivation effect (see Table 1 in subsection 2.2 for an overview of the effects). 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. 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. 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. 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



**Table 3** Life satisfaction and net wealth components: coefficients from fixed effects panel-regressions<sup>a</sup>

Variables	Indicators (1)	Values (2)
Has real assets	− 0.102 [0.220]	−
Has financial assets	0.684*** [0.242]	−
Has secured debt	0.010 [0.096]	−
Has unsecured debt	− 0.255*** [0.085]	−
ln(real assets)	−	0.012 [0.021]
ln(fin. assets)	−	0.071*** [0.025]
ln(secured debt)	−	0.001 [0.009]
ln(unsecured debt)	−	− 0.031*** [0.010]
ln(hh-income)	0.369*** [0.114]	0.328*** [0.114]
Controls	Yes	yes
Constant	9.281 [2.941]	9.758 [2.948]
Model test F statistic	3.150	3.256
MI model test <i>p</i> value	< 0.001	< 0.001
Observations	4108	4108
Number of individuals	2054	2054

*Source/Notes:* PHF 2010/11, PHF 2014–SUF Files, unweighted, persons in panel households only. The models are based on Eq. 2. Multiple imputation taken into account in the calculation of SEs

\*\*\* $p < 1\%$ , \*\* $p < 5\%$ , \* $p < 10\%$

<sup>a</sup>A table with coefficient estimates for all variables including control variables is available in the Online Appendix

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.

According to the size of the point estimates in column (2) of Table 5, the comparison effect of income is symmetric as the coefficients are of similar size. With this finding of the upward comparison not dominating the downward comparison, we do not corroborate previous empirical evidence that points to upward comparisons being more relevant to people with respect to income (Duesenberry, 1949; Ferrer-i-Carbonell, 2005; Holländer, 2001; Vendrik & Woltjer, 2007). Here, the relative deprivation effect with one's own income being below and fear and worry of social decline with one's own income being above that of the respective reference group's income is at play.

Results regarding social comparisons with respect to total assets indicate that there is, in accordance with expectations, dominance of the upward comparison over the downward

**Table 4** Life satisfaction and reference group median wealth, debt and net income: coefficients from fixed effects panel-regressions<sup>a</sup>

Variables	Baseline (1)	+Ref income (2)	+Ref assets (3)	+Ref debt (4)
Total assets: $\ln(A)$	0.103*** [0.031]	0.104*** [0.032]	0.103*** [0.031]	0.103*** [0.031]
Total debt: $\ln(D)$	- 0.016 [0.011]	- 0.017 [0.011]	- 0.017 [0.011]	- 0.017 [0.011]
Net income: $\ln(Y)$	0.334*** [0.110]	0.329*** [0.109]	0.328*** [0.109]	0.330*** [0.110]
Reference income: $\ln(Y_r)$	-	0.305 [0.224]	0.202 [0.257]	- 0.000 [0.293]
Reference assets: $\ln(A_r)$	-	-	0.039 [0.069]	- 0.031 [0.096]
Reference debt: $\ln(D_r)$	-	-	-	0.124 [0.082]
Controls	yes	yes	yes	yes
Constant	9.509 [2.961]	8.597 [2.359]	8.552 [2.792]	9.086 [2.771]
Model test F statistic	3.145	41.985	41.720	30.500
MI model test $p$ value	<0.001	<0.001	<0.001	<0.001
Observations	4108	4108	4108	4108
Number of individuals	2054	2054	2054	2054

*Source/Notes:* PHF 2010/11, PHF 2014–SUF Files, unweighted, persons in panel households only. The models are based on Eqs. 1 (column 1) and 3 (columns 2–4). Multiple imputation taken into account in the calculation of SEs. \*\*\*  $p < 1\%$ , \*\*  $p < 5\%$ , \*  $p < 10\%$ . Standard errors clustered at reference group level. Reference income  $\ln(Y_r)$ , assets  $\ln(A_r)$  and debt  $\ln(D_r)$  refer to the median income, assets and debt of the previously defined reference group  $r$  of each household

<sup>a</sup>A table with coefficient estimates for all variables including control variables is available in the Online Appendix

comparison when comparing the size of the estimated coefficients. In the case of the upward comparison, life satisfaction is expected to increase the smaller the difference becomes between the total assets of one's own and those of the respective reference group. This is an indication for the relative deprivation effect being at play. If the household's total assets are above the level of the reference assets, life satisfaction is expected to slightly decrease the smaller the difference becomes between the total assets of one's own and those of the respective reference group with the point estimate being close to zero though.

Results regarding social comparisons with respect to total debt indicate that life satisfaction is expected to increase the larger the difference becomes between the total debt of one's own and those of the respective reference group. This is regardless of whether the household's total debt is above or below the level for the reference assets. Our results also indicate that there is dominance of the upward comparison and therefore the relative deprivation effect over the downward comparison when comparing the size of the estimated coefficients.

The results presented above raise at least two questions: (1) who are the individuals whose own life satisfaction decreased due to the greater income and assets of others?

**Table 5** Life satisfaction and reference group wealth measures: coefficients from fixed effects panel-regressions<sup>a</sup>

Variables	(1)	(2)
Total assets: $\ln(A)$	0.103*** [0.031]	0.099 [0.117]
Total debt: $\ln(D)$	- 0.017 [0.011]	0.121 [0.083]
Net income: $\ln(Y)$	0.330*** [0.110]	0.350 [0.299]
Reference income: $\ln(Y_r)$	- 0.000 [0.293]	-
Reference assets: $\ln(A_r)$	- 0.031 [0.096]	-
Reference debt: $\ln(D_r)$	0.124 [0.082]	-
$Diff_Y^-: \ln(Y/Y_r)$	-	0.136 [0.347]
$Diff_Y^+: \ln(Y/Y_r)$	-	- 0.156 [0.267]
$Diff_A^-: \ln(A/A_r)$	-	0.059 [0.092]
$Diff_A^+: \ln(A/A_r)$	-	- 0.006 [0.121]
$Diff_D^-: \ln(D/D_r)$	-	- 0.043 [0.105]
$Diff_D^+: \ln(D/D_r)$	-	- 0.144* [0.084]
Controls	Yes	Yes
Constant	9.086 [2.771]	8.119 [2.873]
Model test F statistic	30.500	45.785
MI model test $p$ value	< 0.001	< 0.001
Observations	4108	4108
Number of individuals	2054	2054

*Source/Notes:* PHF 2010/11, PHF 2014–SUF Files, unweighted, persons in panel households only. The models are based on Eqs. 4 and 5. Multiple imputation taken into account in the calculation of SEs. Standard errors clustered at reference group level. \*\*\* $p < 1\%$ , \*\* $p < 5\%$ , \* $p < 10\%$ . Reference income  $\ln(Y_r)$ , assets  $\ln(A_r)$  and debt  $\ln(D_r)$  refer to the median income, assets and debt of the previously defined reference group  $r$  of each household. For the case of income and total assets, the negative difference  $Diff^-$  represents an upward comparison with the own consumption opportunities being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption opportunities being above that of the reference group. For the case of debt, the opposite applies

<sup>a</sup>The correlation between the different indicators, particularly median reference income and debt, is relatively high. Data from the PHF survey indicate that higher-income households tend to have higher levels of outstanding liabilities compared to lower-income households, likely due to their greater capacity to service mortgages or other forms of

**Table 5** (continued)

debt. Additionally, the high correlation observed in our analysis may be partly attributable to the limited number of reference groups considered. A table with coefficient estimates for all variables including control variables is available in the Online Appendix

And (2), are there individuals who use the higher level of income or total assets of others as information for their own potential level of income or total assets in the future?

FitzRoy et al. (2014) have postulated that relative deprivation effects with respect to income dominates in later life, while the positive tunnel effect 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 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 6.

Interestingly, income, total assets and total debt do not seem to be associated with life satisfaction of younger individuals, as is indicated by the size of the estimated coefficients shown in column (1). Household income appears to have been more important for life satisfaction among the older population, which is indicated by the larger point estimate; the same applies to both total assets and total debt.

Reference income and reference assets show opposite associations with life satisfaction for younger and older individuals. Whereas higher incomes and assets of the respective reference group are associated with, on average, lower levels of life satisfaction for the young, they slightly increase life satisfaction for the older individuals. With this finding we do not confirm FitzRoy et al. (2014) results with the tunnel effect being more important in early life.

Looking at the association between life satisfaction and reference debt, the results in columns (1) and (3) show that for both younger and older people the reference debt was positively associated with life satisfaction. This means that life satisfaction is predicted to increase on average with an increase in reference group's debt. Looking at the size of the estimated coefficients, this association was even stronger for the younger population.

Column (2) in Table 6 displays that the upward comparisons dominated with respect to relative income in the younger sample. The negative associations of the reference income can be interpreted as a relative deprivation effect. With this analysis, we do not observe similar results to FitzRoy et al. (2014) for relative 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. In the sample containing older individuals, downward comparisons seem to be more pronounced as seen in column (3). As the coefficient appears to be negative, we interpret this as fear and worries of social decline because an increase in reference income is associated with lower levels in life satisfaction.

In terms of total assets, downward comparisons dominated in both the younger and the older sample. In the case of the younger sample, the positive coefficient of the downward comparison is associated relative gratification whereas in the older sample the negative coefficient is associated with fear and worries of social decline. Regarding the relationship between life satisfaction and total reference debt, the upward comparison, i.e., towards those with a lower level of total debt, dominated in both population groups. Thus, the feeling of relative deprivation also dominated among both population groups since the point estimate appears to be negative.

## 6 Concluding Remarks

Our study contributes to the ongoing debate on the relationship between individuals' financial situation and subjective well-being (SWB). We show that a broader concept, going beyond income, is important when analysing the relationship between SWB and the financial situation of a household or individual.

In line with the existing literature, we find the expected positive association between net income and individual life satisfaction. This relationship remains relatively stable even after accounting for wealth, suggesting that income and wealth exert separately identifiable associations with life satisfaction.

While we observe a positive association between total assets and life satisfaction, total debt exhibits a negative relationship with life satisfaction. These associations hold true even after controlling for household income and other sociodemographic factors.

Contrary to the existing literature, when examining the interplay between life satisfaction and the financial situation of one's reference group, we find that reference income is positively associated with life satisfaction. The subsequent addition of reference debt suggests a marginal and economically small tunnel effect. In contrast, an increase in reference total assets correlates with a decrease in individual life satisfaction, indicative of a deprivation effect. Moreover, life satisfaction is positively related to the total debt of the reference group, reinforcing the deprivation effect.

The impact of reference income and reference assets on life satisfaction varies between age groups, with higher incomes and assets reducing life satisfaction for the young but slightly increasing it for the older population. These findings challenge previous claims of a dominant tunnel effect in early life and a relative deprivation effect in later life.

While our results are robust to different versions of the main regressions, our findings must be considered in the light of several limitations. While we take the change in income and wealth for SWB into account, we do not (fully) consider the source of the variation explicitly. Inheritances and gifts, but also life events like divorces or unemployment spells could easily influence the development of wealth and income as well as SWB directly. The SWB of a household that "lost" wealth because an investment going bad may be markedly different from the SWB of a household which just transferred the same amount of wealth to its children. However, in our approach the "loss" in wealth would be treated equally. A second limitation is that we only observe households every four years. The four-year gap between the two-panel waves may raise concerns about reverse causality, i.e., SWB not only being influenced but also influencing wealth or debt accumulation. While we cannot completely rule this out, we think that given that wealth typically builds up and changes slowly, it does not call our analyses into question. However, given our setup, the point estimates should be interpreted as associations and not as causal effects. The slow accumulation of wealth may also limit the generalizability of our results. A longer-term perspective may be necessary to better assess the impact of wealth *dynamics* on SWB.

Future research is needed to fully understand the mechanisms behind a change in different wealth components, in order to fully understand the relationship between wealth and SWB. In particular, it would be interesting to see how, to paraphrase Bentham (1789/2000, 31), intensity and duration of pleasure and pain look when someone consumes or acquires a good that is financed, for example, by unsecured debt. Questions that would be worth exploring in this context refer to the psychological burden of consumer debt relative to the benefits of consuming the debt-financed goods or reasons when the possession of real assets is associated with lower life satisfaction.

**Table 6** Separate fixed-effects panel regressions of individuals' life satisfaction on absolute wealth and relative wealth for Younger and Older people<sup>a</sup>

Variables	Younger (aged < 45)		Older (aged ≥ 45)	
	(1)	(2)	(3)	(4)
Total assets: $\ln(A)$	0.064 [0.063]	- 0.213 [0.206]	0.084** [0.031]	0.212 [0.152]
Total debt: $\ln(D)$	0.007 [0.022]	0.306** [0.132]	- 0.021* [0.011]	0.065 [0.095]
Net income: $\ln(Y)$	0.048 [0.299]	0.053 [0.799]	0.352** [0.128]	0.486 [0.395]
Reference income: $\ln(Y_r)$	- 0.142 [1.075]	-	0.098 [0.347]	-
Reference assets: $\ln(A_r)$	- 0.143 [0.260]	-	0.076 [0.126]	-
Reference debt: $\ln(D_r)$	0.210* [0.115]	-	0.076 [0.098]	-
$Diff_Y^-$ : $\ln(Y/Y_r)$	-	0.405 [1.152]	-	- 0.039 [0.399]
$Diff_Y^+$ : $\ln(Y/Y_r)$	-	- 0.300 [0.858]	-	- 0.222 [0.318]
$Diff_A^-$ : $\ln(A/A_r)$	-	0.089 [0.267]	-	0.025 [0.112]
$Diff_A^+$ : $\ln(A/A_r)$	-	0.296 [0.235]	-	- 0.147 [0.157]
$Diff_D^-$ : $\ln(D/D_r)$	-	- 0.091 [0.190]	-	0.027 [0.115]
$Diff_D^+$ : $\ln(D/D_r)$	-	- 0.315** [0.125]	-	- 0.093 [0.097]
Controls	Yes	Yes	Yes	Yes
Constant	12.177 [9.397]	13.394 [9.014]	- 1.453 [12.604]	- 1.593 [11.647]
Model test F statistic	47.394	120.367	417.410	449.820
MI model test $p$ value	< 0.05	0.128	< 0.001	< 0.001
Observations	814	814	3,294	3,294
Number of individuals	407	407	1,647	1,647

*Source/Notes:* PHF 2010/11, PHF 2014–SUF Files, unweighted, persons in panel households only. The models are based on Eqs. 4 and 5. Results Multiple imputation taken into account in the calculation of SEs. Standard errors clustered at reference group level. \*\*\*  $p < 1\%$ , \*\*  $p < 5\%$ , \*  $p < 10\%$ . Reference income  $\ln(Y_r)$ , assets  $\ln(A_r)$  and debt  $\ln(D_r)$  refer to the median income, assets and debt of the previously defined reference group  $r$  of each household. For the case of income and total assets, the negative difference  $Diff^-$  represents an upward comparison with the own consumption opportunities being below that of the reference group. The positive difference  $Diff^+$  represents a downward comparison with the own consumption opportunities being above that of the reference group. For the case of debt, the opposite applies

<sup>a</sup>A table with coefficient estimates for all variables including control variables is available in the Online Appendix

Our findings have a number of practical implications for policymakers. Given the importance of relative aspects of wealth and income, policymakers should design policies that address not only absolute levels of material well-being, such as income and wealth but also relative ones. Policies aimed at wealth redistribution, progressive taxation, and social welfare programs can mitigate the negative effects of inequality. By enhancing social cohesion and reducing the gap between the rich and the poor, such policies can improve overall subjective well-being. Furthermore, these insights can guide public policy to focus on measures that consider both material and psychological components of well-being, ensuring a more holistic approach to improving quality of life. Some international policy institutions are indeed going in this direction: the OECDs Wellbeing framework (OECD, 2020) and the current work of the European Commission on Sustainable and Inclusive Wellbeing (Benzur et al., 2024) acknowledge the crucial importance of people's economic conditions for well-being and for determining consumption possibilities but also recognise other factors that have wide-ranging consequences for other aspects of life, such as education and health.

## Appendix

See Tables 7 , 8, 9, 10, 11, 12, 13.

**Table 7** Descriptive statistics for wealth variables included in the analysis

	Participation rate (%)		Conditional mean	Conditional median	Conditional SD
<i>2010</i>					
Total gross wealth	100.0	432,003	227,000	923,634	
Total net wealth	100.0	382,787	184,000	888,129	
Total real assets	90.5	359,150	202,000	805,480	
Total financial assets	99.6	101,247	37,000	306,659	
Total outstanding balance of secured debt	30.4	128,673	88,000	164,889	
Total outstanding balance of non-secured debt	31.9	12,430	4000	33,178	
<i>2014</i>					
Total gross wealth	100.0	475,533	256,888	841,092	
Total net wealth	100.0	434,306	213,150	826,801	
Total real assets	90.7	402,880	220,400	684,916	
Total financial assets	99.8	114,310	39,200	351,505	
Total outstanding balance of secured debt	29.2	143,289	90,000	226,249	
Total outstanding balance of non-secured debt	29.0	11,876	4500	35,590	

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



**Table 8** Total assets quintiles in 2010 and 2014: transitions, (row percentages)

2014	2010					<i>Total</i>
	<20	20–39	40–59	60–79	80–100	
<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
<i>Total</i>	10	12	15	20	43	100

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

**Table 9** Total debt quintiles in 2010 and 2014: transitions, (row percentages)

2014	2010					<i>Total</i>
	<20	20–39	40–59	60–79	80–100	
<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
<i>Total</i>	10	12	21	23	34	100

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

**Table 10** Descriptive statistics for life satisfaction and control variables included in the analysis

	2010		2014		z-score
	Mean	SD	Mean	SD	
Life satisfaction	7.323	1.940	7.333	1.887	- 0.004
Household net income in euro	38,479	38,466	40,594	48,758	- 0.034
Age in years	54.935	15.234	58.261	15.187	- 0.155
Gender (female = 1)	0.425	0.494	0.425	0.494	0.000
<i>Family status</i>					
Single	0.152	0.359	0.135	0.342	0.034
Divorced, widowed, separate	0.198	0.399	0.186	0.389	0.021
Married	0.650	0.477	0.678	0.467	- 0.043
German national	0.922	0.269	0.921	0.270	0.003
Living in East Germany	0.186	0.389	0.184	0.387	0.004
Household size	2.277	1.065	0.720	0.475	1.335
Number of children below 16	0.306	0.718	0.299	0.717	0.007
<i>Education</i>					
Low education (ISCED 1,2)	0.068	0.251	0.065	0.247	0.007
Medium-low education (ISCED 3)	0.428	0.495	0.406	0.491	0.032
Medium-high education (ISCED 4)	0.069	0.253	0.074	0.261	- 0.014
High education (ISCED 5, 6)	0.436	0.496	0.455	0.498	- 0.028
<i>Employment Status</i>					
Worker	0.068	0.251	0.054	0.227	0.039
Employee	0.314	0.464	0.308	0.462	0.010
Civil servant	0.059	0.236	0.049	0.216	0.032
Self-employed	0.085	0.278	0.076	0.266	0.022
Student/vocational training	0.004	0.066	0.003	0.050	0.022
Unemployed	0.046	0.209	0.034	0.181	0.042
Not in the labour force	0.424	0.494	0.476	0.499	- 0.073

*Source/Notes:* PHF 2010/11, PHF 2014-SUF Files, unweighted, panel households only

**Table 11** Construction of variables

Variable	Scale	Measure
<b>Income variables</b>		
Net annual household income	Logarithm	“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 secured debt	Logarithm	Total outstanding balance on mortgages on household main residence or other properties at the time of interview
Total outstanding balance of unsecured 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 secured debt	Dummy	Household has outstanding balance on mortgages on household main residence or other properties at the time of interview
Has unsecured 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>Sociodemographics</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
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”

**Table 11** (continued)

Variable	Scale	Measure
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)	Log	number of household members
Number of children below 16	Continuous	number of household members age 16 or less
Classification of Regions		
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

**Table 12** Descriptive Statistics for comparison group life satisfaction, income, total assets and total debt

Age group	Education group	Region	n	Life satisfaction				Annual net income				Total assets				Total debt			
				Mean		SD		Median		Mean		SD		Median		Mean		SD	
< 35 years	Low	West	32	5.88	2.14	16,200	20,985	17,055	3,580	47,433	107,757	65	6773	18,794					
		East	12	6.17	2.44	11,700	13,770	6267	485	2162	3469	1580	4490	6313					
35–44 years	Medium	West	182	7.27	1.60	24,000	26,130	15,569	19,115	120,843	252,344	500	17,683	50,223					
		East	53	6.75	1.94	22,800	23,269	10,558	13,000	42,943	76,677	1500	17,972	39,799					
35–44 years	High	West	98	7.65	1.71	33,600	37,615	20,319	64,950	189,746	278,774	1050	51,228	102,423					
		East	16	7.13	1.02	32,400	29,250	9718	35,350	65,681	74,347	6250	26,534	47,996					
35–44 years	Low	West	24	5.79	2.40	26,400	25,480	9595	42,475	73,386	86,798	9550	30,899	47,762					
		East	4	6.25	3.77	22,200	22,800	5628	46,000	51,538	27,829	100	1050	1969					
35–44 years	Medium	West	221	7.47	1.79	36,000	37,388	18,790	175,900	335,683	1,120,216	6000	61,054	89,206					
		East	59	6.78	2.46	28,800	28,609	11,545	70,750	105,946	135,232	6860	43,191	80,001					
35–44 years	High	West	199	7.74	1.64	49,200	54,872	29,980	325,400	407,757	396,307	53,000	110,460	144,356					
		East	37	7.43	1.66	40,800	39,120	15,230	129,450	358,009	984,528	5000	67,292	106,484					
45–54 years	Low	West	38	6.16	2.49	28,800	28,607	17,079	121,650	145,846	157,162	1750	33,907	56,379					
		East	5	6.00	2.92	20,400	21,744	15,746	3500	186,450	412,195	2200	6996	9099					
45–54 years	Medium	West	370	7.02	1.99	34,800	38,796	26,169	227,950	391,752	731,847	2000	52,349	99,302					
		East	81	5.57	2.22	27,600	27,791	14,919	53,400	100,890	129,147	7500	31,557	50,911					
45–54 years	High	West	316	7.67	1.58	49,800	60,008	74,530	391,501	643,249	993,162	34,450	104,391	242,842					
		East	45	7.07	1.90	33,600	45,293	32,574	251,900	347,223	302,812	16,100	66,133	112,876					
55–64 years	Low	West	39	6.56	1.82	24,000	32,751	46,125	113,600	281,120	601,427	4000	27,833	48,617					
		East	4	6.25	0.96	22,200	22,050	11,607	3120	46,373	88,454	1000	2500	3786					
55–64 years	Medium	West	348	7.05	2.03	30,000	33,477	20,628	230,800	468,327	1,168,929	600	33,653	95,095					
		East	97	5.94	2.31	19,200	23,785	15,659	40,100	143,035	271,898	250	22,990	80,224					
55–64 years	High	West	341	7.66	1.63	44,400	56,411	99,261	505,000	813,544	1,270,639	620	65,476	163,904					
		East	68	7.01	2.06	34,800	38,349	23,990	246,550	357,836	409,217	50	46,760	102,417					

**Table 12** (continued)

Age group	Education group	Region	n	Life satisfaction		Annual net income		Total assets		Total debt				
				Mean	SD	Median	Mean	Median	Mean	Median	Mean	SD		
>= 65 years	Low	West	100	7.22	2.03	16,200	22,888	29,247	83,175	174,395	267,852	0	4596	17,615
		East	16	6.06	3.11	13,200	13,845	3775	5000	102,614	256,820	0	963	3014
	Medium	West	501	7.60	1.82	27,600	32,962	28,689	301,500	446,943	599,841	0	13,592	47,298
		East	94	6.76	2.04	19,200	22,845	12,534	42,000	165,281	322,958	0	1267	8252
	High	West	542	8.01	1.59	40,800	47,026	36,360	468,800	791,561	1,145,554	0	36,260	164,157
		East	166	7.28	1.67	30,000	33,753	18,932	209,300	434,421	1,063,632	0	15,293	56,268

Source: PHF 2010/11, PHF 2014—SUF Files, unweighted, panel households only

**Table 13** Life satisfaction and equalized income/wealth—coefficients from fixed effects panel-regressions

Equivalence scale									
		Per capita income/wealth	“Oxford” scale (“Old OECD scale”)	“OECD-modified” scale	Square root scale	Schwarze	Household Income/wealth	Estimated for income (+ wealth) <sup>1</sup>	
<b>Equalized income only</b>									
Elasticity $e$	$I$		0.73	0.53	0.50	0.35	0	-0.19 <sup>1</sup>	
In(total assets)		0.113***	0.110***	0.108***	0.107***	0.106***	0.102***	0.101***	
In(total debt)		-0.015*	-0.015*	-0.015*	-0.015*	-0.015*	-0.016*	-0.016*	
In(eqinc)		0.268**	0.311***	0.336***	0.339***	0.351***	0.355***	0.346***	
In(hhszize)								0.065	
<b>Equalized income and assets</b>									
Elasticity $e$	$I$		0.73	0.53	0.50	0.35	0	-0.15 <sup>2</sup>	
In(eqassets)		0.115**	0.118**	0.119**	0.119**	0.119**	0.102***	0.101***	
In(total debt)		-0.014	-0.014	-0.015	-0.015	-0.015	-0.016*	-0.016*	
In(eqinc)		0.263**	0.321***	0.354***	0.358***	0.374***	0.355***	0.346***	
In(hhszize)								0.065	

<sup>1</sup>By rearranging the equation, the scale elasticity  $e$  is calculated as follows:

$$e = -b_{\ln(\text{hhszize})} / b_{\ln(\text{eqinc})}$$

$$^2 e = -b_{\ln(\text{hhszize})} / (b_{\ln(\text{eqinc})} + b_{\ln(\text{total assets})})$$

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