Subjective Socioeconomic Status and Health in Cross-National Comparison

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Abstract

Research has established a robust association between subjective socioeconomic status (SES) and health outcomes, which holds over and above the associations between objective markers of SES and health. Furthermore, comparative research on health inequalities has shown considerable variation in the relationship between different objective markers of SES and health across countries. Drawing on data from 29 countries, we present the first cross-national study on the subjective SES–health relationship. For two health outcomes, namely self-rated health (SRH) and psychological wellbeing, we are able to confirm that subjective SES is related to health in all countries under study, even when income, education, and occupational prestige are accounted for. Furthermore, we document considerable variation in the strength of the subjective SES–health association across countries. This variation however is largely independent of country differences in income inequality and country affluence. The health benefits of a high subjective SES appear to be slightly larger in more affluent countries, but only for SRH, not for psychological wellbeing.

Keywords: Perceived social position; Subjective social status; Self-rated health; Health inequalities; International comparison; Psychological wellbeing

1. Introduction

The relationship between objective and subjective socioeconomic status (SES) is a classic topic within sociology (Evans & Kelley, 2004; Lindemann & Saar, 2014; Marx, 1976) that has recently resurfaced in public health research (Adler, 2013; Nobles et al., 2013; Singh-Manoux et al., 2005; Wolff et al., 2010). While

sociological research on the issue long focused on class conflict and the potential for social revolution, public health research has discovered a robust association between subjective SES and a diverse range of health outcomes, usually over and above the influence of objective measures of social status. The general finding appears to be that those with a higher self-perception rating of their socioeconomic status enjoy better health (Adler, 2013).

Contrary to objective, long-established measures of socioeconomic status like education, income, and occupational prestige, subjective socioeconomic status is a self-appraisal about one's location in a socioeconomic status order (Ross & Mirowsky, 2002). Terms that are sometimes used synonymously are perceived social position (Garbarski, 2010) and subjective social status (Adler et al., 2000; Demakakos et al., 2008). The great recent interest in subjective SES among public health researchers has two reasons. Firstly, the subjective SES–health link has great potential to reveal the effects of social hierarchy on health. One strand of research, inspired by the works of Wilkinson (1992), suggests that subjective socioeconomic status reflects the relative rather than absolute position in the hierarchy of a society, and that the perception of inequality and subordination in the hierarchy of a society has damaging effects on health outcomes. Secondly, a more methodological reason for the relevance of the subjective SES–health relationship, is the interest in the general performance of subjective SES as a general marker of SES compared to other indicators like income or education. Some public health researchers, for instance Singh-Manoux et al. (2005), suggest that subjective socioeconomic status could be a 'cognitive average' of objective SES markers, yielding a more precise measurement of overall SES.

With our study, we aim to shed light onto previously understudied aspects of the relationship between subjective SES and health, namely examining how this relationship operates in cross-national comparison. While existing comparative research on health inequalities has so far focused on objective SES indicators, such as education (Mackenbach et al., 2008), income (Huijts et al., 2010), or class (Eikemo et al., 2008b), our study will extend that line of research by focusing on an innovative SES measure, namely subjective SES. Different indicators of SES

cannot be used interchangeably (Torssander & Erikson, 2010), as they all tap at different, loosely related aspects of SES and vary in the strength of their association to health. Given the variation in levels of subjective SES across countries (Lindemann & Saar, 2014), we expect that comparing subjective SES–health gradients across societies is a valuable contribution to the literature. In fact, a recent review article on subjective SES and health explicitly demanded more cross-nationally comparative research on the subjective SES–health relationship (Euteneuer, 2014). Drawing on comparable data from 29 societies from all continents of the world, we explore the variability in the relationship between subjective SES and health. By doing so, we contribute to the recent 'comparative turn' in research on health inequalities (Beckfield et al., 2013; Eikemo et al., 2008a; Olafsdottir et al., 2013).

1.1. The subjective SES–health relationship

Public health research was able to amass substantial evidence for the existence of an association between subjective socioeconomic status and health. Health outcomes linked to subjective socioeconomic position included self-rated health (SRH; Demakakos et al., 2008; Singh-Manoux et al., 2005), depression (Demakakos et al., 2008; Sakurai et al., 2010; Singh-Manoux et al., 2003), nurse-rated health (Nobles et al., 2013), cortisol (Adler et al., 2000; Wright & Steptoe, 2005), and mortality rates (Kopp et al., 2004). While some studies showed that the association between subjective socioeconomic status and health was explained when accounting for objective markers of SES, at least for some outcomes (Singh-Manoux et al., 2003), the majority of studies suggest that subjective SES is associated with health even after controlling for objective SES.

These findings do not only pertain to US or UK samples (Operario et al., 2004; Seeman et al., 2014; Singh-Manoux et al., 2003, 2005), a number of studies also drew on samples from other regions, such as Finland (Karvonen & Rahkonen, 2011), Hungary (Kopp et al., 2004), Indonesia (Nobles et al., 2013), Japan (Sakurai et al., 2010), Taiwan (Collins & Goldman, 2008), or Canada (Dunn et al., 2006). While many of the studies focused on select populations, such as

pregnant women (Reitzel et al., 2007), adolescents (Quon & McGrath, 2014), older adults (Garbarski, 2010), or civil service workers (Singh-Manoux et al., 2003, 2005), relatively few used representative samples of the general population (Nobles et al., 2013; Sakurai et al., 2010; Wolff et al., 2010). Understanding the interplay of objective and subjective SES, however, requires samples that are free from selection bias, including all SES groups of a population, as associations found in restricted samples might misrepresent those apparent in the general population.

An important function of cross-national research is to confirm the presence of relationships found in single-context studies in a variety of contexts. Based on the mass of research findings, we pose the following hypotheses:

H1A: Subjective SES is positively related to health in all countries under study.

H1B: Subjective SES is positively related to health in all countries under study after accounting for objective measures of SES (household income, education, and occupational prestige).

1.2. Country affluence, income inequality, and the subjective SES–health relationship

Two major contextual factors that are frequently discussed in the literature on social determinants of health are the economic resources of a country, most commonly expressed as GDP per capita, and income inequality, usually expressed as the Gini coefficient. While most of the current literature focuses on the direct effects of country affluence and income inequality on health, we will extend this literature by making a case that both these factors can have moderating effects on the subjective SES–health relationship.

The effects of country affluence on population health have been variously and prominently demonstrated (Deaton, 2013). Populations flourish in terms of health when economic resources are available in great quantity. Societies with greater resources available in the infrastructure can benefit all their members,

reducing the importance of individual perceptions for health and wellbeing. In line with the notion of 'A rising tide lifts all boats,' greater wealth in a country might decrease the strength of the subjective SES–health relationship. Semyonov et al. (2013) also suggest that the availability of resources in a country could reduce the relationship between SES and health, as individual command over resources becomes less important. The same could be true for the subjective SES–health relationship, as status competition might be less crucial as long as basic needs are met.

H2: The subjective SES–health association is weaker in countries with greater affluence.

Some researchers, however, have pointed out that the relationship between country affluence becomes unimportant for population health as soon as a certain threshold of wealth has been surpassed (Wilkinson, 1997; Wilkinson & Pickett, 2010). After that level has been reached, it is presumably income inequality that becomes the important driver of population health (Wilkinson & Pickett, 2010). The debate about the relationship between income inequality and health has been discussed at length in the literature (Ellwardt et al., 2014; Kondo et al., 2009; Pickett & Wilkinson, 2015), however, here we would like to focus on any moderating effects of income inequality on the subjective SES–health association.

A few previous studies have suggested that income inequality might exacerbate health inequalities (Beckfield et al., 2013; Semyonov et al., 2013; Wilkinson & Pickett, 2008). Beckfield et al. (2013) suggest a 'fundamental cause' (Phelan et al., 2010) explanation for this hypothesized relationship. High-SES invididuals in less egalitarian societies might have even more resources that they can translate more easily into better health, leaving the disadvantaged even further behind in terms of health. Also, given that income can serve as a buffer for the stress individuals face in their lives, low-income individuals in less egalitarian societies should be more stressed and, thus, less healthy, exacerbating the health gradient in less egalitarian countries. Semyonov et al. (2013) point to

the neo-materialist pathway (Lynch et al., 2000) that is suggested to connect income inequality and average population health. According to this pathway, societies with a high degree of income inequality are also characterized by a country's systematic underinvestment across a wide range of human, physical, and social infrastructures. The less well-off are likely to suffer most from these underinvestments, as they lack the personal resources to make up for these public underinvestments, thus, it is reasonable to expect that health inequalities in countries with greater income inequality should be greater as well. Wilkinson & Pickett (2008) suggest that status competition should be stronger in places characterized by greater income inequality, which exacerbates health inequalities via a status differentiation pathway.

The empirical evidence, however, has been mixed. Semyonov et al. (2013) report that any exacerbating effect of income inequality on the relationship between household wealth and health in their sample of countries is solely driven by the US. For the other, mostly Western European countries in their sample, they do not find any relationship between income inequality and health. Beckfield et al. (2013) study a heterogeneous sample of countries from around the world and find a weak moderating effect of income inequality on the association between income and SRH, but a sizable interaction between income inequality, education, and SRH in a country; the more unequal a society in terms of income, the stronger the relationship between education and SRH. Wilkinson & Pickett (2008) study counties in the US and are able to show that mortality rates for different causes of death, which are more strongly related to median county income, are also more strongly correlated with income inequality, suggesting that there is indeed a link between income inequality and health gradients.

However, in the context of a subjective SES measure, one could expect that an interaction effect of income inequality and subjective SES would be strong evidence for the interpretation of subjective SES being a marker of the negative health effects of low social status. Wilkinson & Pickett (2010) argue that greater social inequality in a country makes status comparisons more painful, creating greater stress and leading to worse health outcomes for those lower in the social

hierarchy. While evidence for this mechanism is so far mixed (Layte, 2012; Präg et al., 2014), the test proposed here tackles the issue from a new angle.

H3: The subjective SES–health association is stronger in countries with greater income inequality.

2. Methods

2.1. Data

2.1.1. Individual-level data

Our analyses make use of the recently released 2011 International Social Survey Program (ISSP) module "Health and Health Care" (ISSP Research Group, 2015). Our analysis contains information from respondents from 29 countries from all major regions of the world, namely Australia (AU), Belgium (BE), Bulgaria (BG), Switzerland (CH), Chile (CL), China (CN), the Czech Republic (CZ), Germany (DE), Denmark (DK), Spain (ES), Finland (FI), France (FR), Croatia (HR), Israel (IL), Japan (JP), South Korea (KR), Latvia (LV), the Netherlands (NL), Norway (NO), the Philippines (PH), Poland (PL), Portugal (PT), Russia (RU), Sweden (SE), Slovenia (SI), Slovakia (SK), Turkey (TR), Taiwan (TW), and South Africa (ZA). Italy, the United Kingdom, and the United States had to be excluded, as the focal predictor, subjective SES, was not available for these samples. Depending on country, samples are based on either simple or multi-stage stratified random sampling, yielding representative samples of the adult population. Realized samples range from about 1,000 to 5,600 respondents per country. Interviews were conducted in the period 2011–2013 and response rates range between 30.2 per cent (Wallonian region of Belgium) and 85.9 per cent (South Africa). Response rates per country are reported in Appendix Table A.2.

We restrict the age range of respondents to 25–74 years, as 1) we want to ensure most respondents have completed education, and 2) some countries used upper and lower age cut-offs during data collection. Sample sizes per country are reported in Appendix Table A.2.

Outcome variables

Self-rated overall health (SRH) was measured with the question: "In general, would you say your health is . . . excellent (4), very good (3), good (2), fair (1), or poor (0)?" Self-rated health is a general assessment of one's health status, not connected to any specific illness, but covering largely physical and functional aspects of health.

As a second outcome, we use a measure of *psychological wellbeing*, based on three items. Respondents were asked how often in the past four weeks they 'felt unhappy and depressed,' 'lost confidence in yourself,' and 'felt you could not overcome your problems.' Response options were 'never,' (0) 'seldom,' (1) 'sometimes,' (2) 'often,' (3) and 'very often' (4). A principal component analysis of the three items yields a one-dimensional solution (explained variance 89 per cent); all three items exhibit factor loadings exceeding .88. Cronbach's alpha for the three items is .87 (range $\alpha = .72$ (PH) to $\alpha = .91$ (LT)), indicating high internal consistency in all countries under study. We calculated the average score of the three items, yielding a variable ranging from 0 to 4, with higher values indicating greater psychological wellbeing.

Both outcome variables correlate with $r = .39$ at the individual level, indicating that they that capture related, yet distinct aspects of health.

Predictor variables

Subjective socioeconomic status was measured with the question: "In our society, there are groups which tend to be towards the top and groups which tend to be towards the bottom. Below is a scale that runs from the top to the bottom. Where would you put yourself on this scale?" Respondents were presented a ladder with rungs assigned numbers from 1 to 10, 1 indicating the bottom and 10 the top rung of the ladder. This measure resembles the one introduced by Adler et al. (2000), which is frequently used in current research (Nobles et al., 2013). Cundiff et al. (2013) demonstrated the construct validity of the scale. Evans & Kelley (2004) make a case for the cross-national comparability of the question, pointing to 1) the simple, abstract structure of the question,

facilitating comparability across countries; 2) the problems that would arise if respondents have to force themselves into a restricted, pre-assigned class-scheme; and 3) its avoidance of in many countries politically charged terms like 'middle class' or 'working class.'

In order to assess *objective socioeconomic status*, we rely on three indicators. *Education* distinguishes between the lower educated (ISCED 0–2), those with medium education (ISCED 3–4), and those with tertiary degrees (ISCED 5–6) (UNESCO, 2006). *Household income* before taxes was equivalized by dividing it by the square root of the number of household members and transformed into country-specific income quintiles. For those respondents who failed to report their income, we added an additional category to retain them for our analyses. *Occupational prestige* was assessed by creating ISEI scores (International Socio-Economic Index, Ganzeboom et al., 1992) based on the ISCO-88 occupational classification. Originally, the ISEI ranges from 16 to 90; to facilitate interpretation of regression coefficients, we have rescaled the predictor by dividing it by 10. For respondents who have never worked (and thus do not have an ISEI score), we included a dummy variable and imputed the average ISEI. The coefficient of the dummy indicator denotes the average difference between those who have never worked and those who have or had a job with an average ISEI.

We further control for *age* (measured in years), *sex* (1 = female, 0 = male), and a set of dummies to control for *marital status* ('married/civil partnership' (ref.), 'separated/divorced,' 'widowed,' 'single/never married').

2.1.2. Country-level data

Information on *income inequality* comes from the Standardized World Income Inequality Database (SWIID, Solt, 2009) as expressed in Gini coefficients. The Gini coefficient ranges from 0 to 1, with higher values indicating greater inequality. Country affluence (*GDP per capita*, log transformed) was obtained from the World Bank (2014) and information for Taiwan was obtained from the IMF (2012). Descriptive statistics of country-level covariates are reported in Appendix Table A.2.

2.2. Modeling strategy and analysis

We rely on multilevel (random coefficient) modeling (Snijders & Boskers, 2012) (using Stata 13) for our analyses, as this allows us to account for the respondents in our sample being nested in countries. Furthermore, we can explicitly model between-country variation, while simultaneously accounting for compositional differences between countries. Our models include random intercepts and random slopes, thus allowing for both country-specific constant and predictor terms in the regression equations. To facilitate interpretation of interactions and the random components, all continuous predictor variables have been grand-mean centered.

To test Hypothesis 1A, we draw on the empirical Bayes estimates obtained from the random coefficient models 1a and 1b reported in Table 1. Empirical Bayes estimates are country-specific residuals that indicate the country-level deviation from the fixed coefficients and are sometimes referred to as posterior slopes (Snijders & Boskers, 2012). Specifically, we are fitting models

$$Y_{ij} = \beta_0 + \beta_{1j}\text{subjective SES}_{ij} + \beta_2\text{controls}_{ij} + u_{0j} + u_{1j} + e_{0ij}$$

where Y_{ij} is a health outcome, u_{0j} denotes the variation around the intercept β_0 and u_{1j} the slope variation around β_{1j}. From this model, we obtain the empirical Bayes residuals $\hat{u}_{1j}$ (Snijders & Boskers, 2012, section 4.8), which are substantively the country-specific deviations from the fixed coefficient of subjective SES β_{1j}. Hypothesis 1A posits that

$$\beta_{1j} + \hat{u}_{1j} > 0$$

It follows that

$$\hat{u}_{1j} > -\beta_{1j}$$

So in order to test that $\beta_{1j} + \hat{u}_{1j}$ is greater than 0 in all countries at the

99 % level, the lower bound of the 95 % CI of $\hat{u}_{1j}$ must not overlap with -1 times the upper bound of the 95 % CI of β_{1j}. (Note that when two 95 % CI's do not overlap, the respective point estimates are significantly different at least at the 99 % level, not just the 95 % level, see e.g. Cumming & Finch, 2005)

Hypothesis 1b is tested in the same fashion, making use of the empirical Bayes estimates obtained from models 2a and 2b reported in Table 1. The only difference is that the objective SES indicators are among the control variables in these models.

To test Hypotheses 2 and 3, we estimate models 3 and 4 with cross-level interactions (Snijders & Boskers, 2012, section 5.2). For this, we add a product term of subjective SES and GDP per capita or income inequality, respectively, to the regression equation.

As a robustness check, we present analyses based on two-step ordinary least squares (OLS) regression models in the on-line Appendix.

To express the substantive relevance of key coefficients in our analyses, we will express them in terms of the standard deviations of the outcome variable and refer to these measures as 'effect sizes.'

3. Results

Figure 1 displays the country averages in subjective SES across countries. By and large, the country averages follow national income ($r = .65$, see the Appendix Figure A.1 for a scatterplot of GDP per capita and subjective SES), with individuals in high-GDP countries reporting on average higher subjective SES. However, this pattern is not without exceptions. For instance, Israelis report the third-highest subjective SES, right after the Danes and the Germans. The bottom of the ranking is occupied by Russia, Chile, China, and Bulgaria: Four countries with a comparably low GDP per capita. However, Portugal and South Korea occupy the next-highest positions in the ranking.

We find a statistically significant relationship between subjective SES and health in Models 1a and 1b of Table 1. For SRH in Model 1a, the associa-

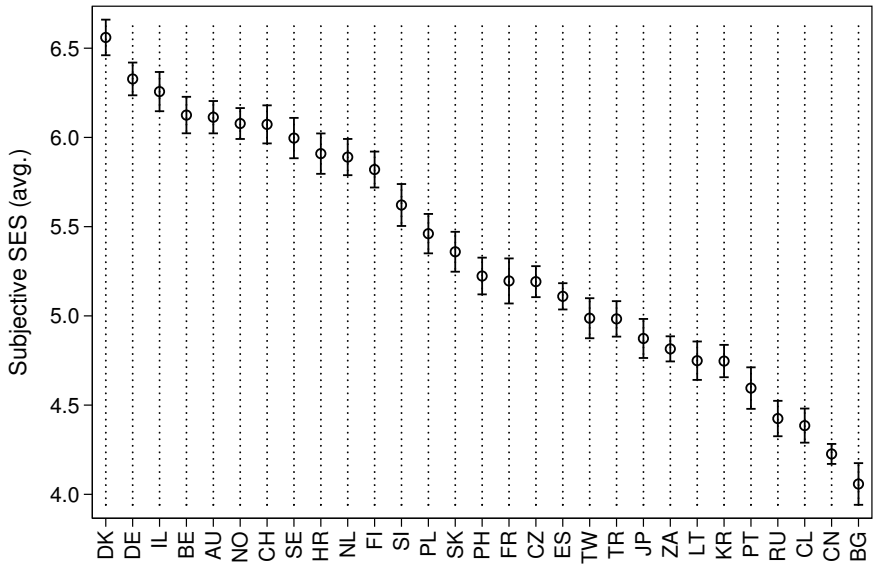

Figure 1: Average subjective SES by country
Note: Error bars denote 95% CI's

tion with subjective SES amounts to 0.132. For each additional rung on the subjective SES ladder, SRH increases by 0.132 points. Given the fact that the standard deviation of self-rated health is 1.00 (see Appendix Table A.1), this amounts to an increase of 0.132 standard deviations, a small yet statistically significant effect size. In Model 1b for psychological wellbeing, findings are similar, with the subjective SES coefficient being 0.123. When standardizing this with the standard deviation of the psychological wellbeing variable ($SD = 0.91$, see Appendix Table A.1), it shows that an additional rung on the subjective SES ladder goes along with an increase of 0.13 standard deviations in psychological wellbeing, again a small effect size. The upper-row panels of Figure 2, which display the empirical Bayes regression lines of subjective SES on SRH (upper left) and psychological wellbeing (upper right) obtained from Models (1a) and (1b), illustrate the cross-country variation in the subjective SES–health relationship.

Table 1: Self-rated health and psychological wellbeing regressed on several predictors (parameter estimates from random coefficient models, t-statistics in parentheses)

	(1a) Self-rated general health	(1b) Psychological wellbeing	(2a) Self-rated general health	(2b) Psychological wellbeing	(3a) Self-rated general health	(3b) Psychological wellbeing	(4a) Self-rated general health	(4b) Psychological wellbeing
Subjective SES	0.132***	0.123***	0.110***	0.107***	0.109***	0.107***	0.140***	0.0859***
	(21.89)	(18.20)	(18.36)	(16.08)	(19.48)	(15.98)	(6.61)	(3.56)
Education (*ref.* low education)								
Medium education			0.0671***	0.0459***	0.0673***	0.0459***	0.0672***	0.0458***
			(5.10)	(3.62)	(5.12)	(3.63)	(5.12)	(3.62)
High education			0.0943***	0.0137	0.0936***	0.0139	0.0940***	0.0142
			(5.56)	(0.84)	(5.51)	(0.85)	(5.54)	(0.87)
ISEI			0.0195***	0.0110**	0.0193***	0.0110**	0.0194***	0.0111**
			(5.08)	(2.97)	(5.04)	(2.97)	(5.06)	(2.99)
Never worked (*ref.* works/worked)			-0.0404	-0.0574**	-0.0406	-0.0577**	-0.0410	-0.0575**
			(-1.93)	(-2.85)	(-1.94)	(-2.86)	(-1.96)	(-2.85)
Income (*ref.* lowest quintile)								
Second quintile			0.0830***	0.115***	0.0831***	0.115***	0.0830***	0.115***
			(4.63)	(6.64)	(4.64)	(6.63)	(4.63)	(6.63)
Third quintile			0.0896***	0.184***	0.0896***	0.183***	0.0895***	0.183***
			(4.90)	(10.41)	(4.90)	(10.41)	(4.89)	(10.41)
Fourth quintile			0.140***	0.215***	0.140***	0.214***	0.140***	0.214***
			(7.60)	(12.09)	(7.61)	(12.08)	(7.60)	(12.08)
Highest quintile			0.184***	0.226***	0.184***	0.225***	0.184***	0.225***
			(9.51)	(12.14)	(9.53)	(12.12)	(9.52)	(12.10)
Income missing			0.132***	0.189***	0.133***	0.189***	0.132***	0.189***
			(7.33)	(10.92)	(7.38)	(10.91)	(7.36)	(10.89)

Age	-0.0174***	-0.00123**	-0.0165***	-0.000669	-0.0165***	-0.000663	-0.0165***	-0.000667
	(-42.75)	(-3.13)	(-39.57)	(-1.67)	(-39.60)	(-1.65)	(-39.56)	(-1.66)
Female (*ref.* male)	-0.0688***	-0.169***	-0.0612***	-0.158***	-0.0610***	-0.158***	-0.0611***	-0.158***
	(-6.83)	(-17.40)	(-6.01)	(-16.13)	(-6.00)	(-16.13)	(-6.00)	(-16.13)
Marital status (*ref.* married/cohabiting)								
Divorced	-0.0324	-0.206***	-0.0230	-0.188***	-0.0226	-0.188***	-0.0228	-0.189***
	(-1.74)	(-11.48)	(-1.24)	(-10.50)	(-1.21)	(-10.50)	(-1.22)	(-10.51)
Widowed	-0.0943***	-0.213***	-0.0702**	-0.183***	-0.0703**	-0.183***	-0.0703**	-0.183***
	(-4.33)	(-10.14)	(-3.23)	(-8.73)	(-3.23)	(-8.74)	(-3.23)	(-8.73)
Single	-0.0345*	-0.127***	-0.0346*	-0.119***	-0.0343*	-0.119***	-0.0346*	-0.119***
	(-2.20)	(-8.44)	(-2.21)	(-7.87)	(-2.19)	(-7.86)	(-2.21)	(-7.87)
GDP per capita (logged)					0.0721	-0.0213		
					(1.54)	(-0.64)		
GDP per capita (logged) × subjective SES					0.0126*	0.00212		
					(2.22)	(0.31)		
Income inequality							-0.00318	0.000912
							(-0.62)	(0.26)
Income inequality × subjective SES							-0.000882	0.000632
							(-1.44)	(0.90)
Intercept	2.064***	3.230***	1.902***	3.044***	1.891***	3.047***	2.005***	3.015***
	(45.47)	(98.40)	(39.39)	(87.07)	(40.20)	(86.91)	(11.54)	(25.03)
Variance(intercept)	0.0577***	0.0293***	0.0591***	0.0276***	0.0545***	0.0272***	0.0584***	0.0275***
Variance(residual)	0.806***	0.748***	0.799***	0.742***	0.799***	0.742***	0.799***	0.742***
Variance (subjective SES)	0.000755***	0.00106***	0.000704***	0.000962***	0.000561***	0.000960***	0.000641***	0.000929***
Covariance (subj. SES, int.)	.00147	-0.00235	0.000987	-0.00247	0.000212	-0.00243	0.000830	-0.00254
Deviance	87598.5	85098.4	87296.8	84803.0	87290.4	84802.6	87294.6	84801.7
N countries	29	29	29	29	29	29	29	29
N individuals	33,342	33,342	33,342	33,342	33,342	33,342	33,342	33,342

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

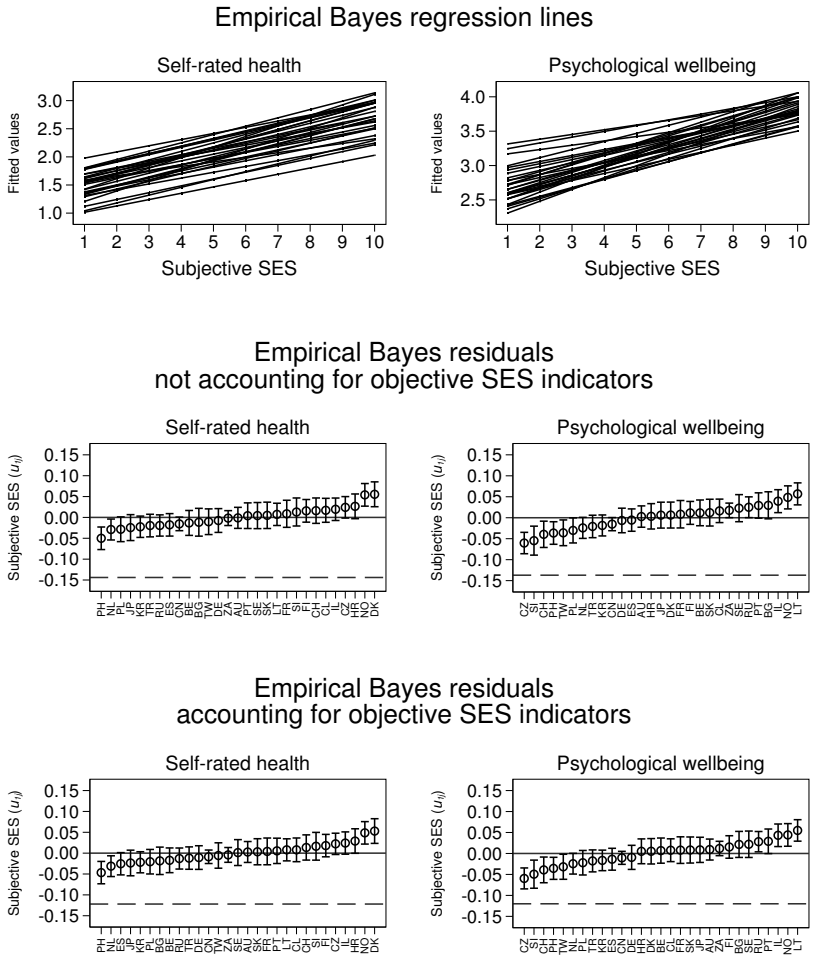

Figure 2: Panels in *top* row: Empirical Bayes regression lines based on Models 1a (left panel) and 1b (right panel) for all countries. *Middle* row: Caterpillar plots of the association between subjective SES and health outcomes across countries (u_{1j}) based on Models 1a (left panel) and 1b (right panel). *Bottom* row: Caterpillar plots of the association between subjective SES and health outcomes across countries (u_{1j}) based on Models 2a (left panel) and 2b (right panel)

Notes: Dashed lines in middle and lower panels denote the upper bounds of the 95% CI's $\times$ -1 of the fixed coefficient of subjective SES, as obtained from Models 1a and 1b (middle row) and Models 2a and 2b (lower row). Error bars denote 95% CI's of posterior means.

Hypothesis 1A is supported by the evidence presented in the panels in the middle row of Figure 2. Hypothesis 1A had posited that the relationship be-

tween subjective SES and health exists in all countries of our sample. The panels in the middle row display caterpillar plots of the empirical Bayes residuals as obtained after fitting a random coefficient model (specifically, Models 1a and 1b) for the health outcomes, including subjective SES (random and fixed component), and age, sex, and marital status as control variables. For the left-hand panel in the middle row pertaining to SRH, there is significant variation in the subjective SES–SRH association across countries, with the Philippines and the Netherlands showing the weakest effects of subjective SES on SRH, and the Nordic countries Denmark and Norway showing the strongest effect. The line towards the bottom of the panel indicates –1 times the upper bound of the 95 per cent confidence interval of the fixed coefficient of subjective SES. Given the non-overlap of the error bars with this line, the relationship of subjective SES on SRH is significantly different from zero in all countries under study. In the right-hand panel in the middle row, we see a similar pattern for psychological wellbeing: the subjective SES–psychological wellbeing association is different from zero in all countries under study. The order of countries differs somewhat from the one found for the subjective SES–SRH association. In Norway and Latvia, the association between subjective SES and psychological wellbeing is strongest, while it is weakest in the Czech Republic and Slovenia.

In Models 2a and 2b of Table 1, we additionally control for objective SES indicators, namely education, occupational prestige (ISEI), and household income. The relationship between subjective SES and SRH is slightly reduced (to .110) in Model 2a. Gradients for all objective SES indicators arise. The better educated and those with more prestigious jobs fare better in terms of SRH, and those with higher income report better health than the poor. Those who have never held a job appear to have no health disadvantages when compared to those with an average ISEI score. A similar pattern arises for psychological wellbeing in Model 2b. The coefficient of subjective SES drops (to .107) as well. The coefficients for education show that the relationship to psychological wellbeing is non-linear, with those with a medium degree reporting greater wellbeing than both those in the bottom and the top educational groups. For

occupational prestige, there is a positive relationship to wellbeing, and those who have never held a job report slightly worse psychological wellbeing than those with an average ISEI score. The coefficients for household income reveal that reported wellbeing increases with each income quintile. Results show that the subjective SES–health relationship exists over and above the effects of objective SES, for both SRH and psychological wellbeing, but so far only for the fixed-effects, average coefficient.

Our evidence also supports Hypothesis 1B, which had posited that subjective SES is positively related to health in all countries under study even after controlling for indicators of objective SES. The bottom row of Figure 2 shows two caterpillar plots as obtained from Models 2a and 2b, which control for objective SES indicators. There is no overlap between the confidence intervals of the estimates for each country and the dashed lines denoting the upper bounds of the 95 per cent confidence intervals of the fixed effect coefficients of subjective SES. This indicates that the relationship between subjective SES and both outcomes is greater than zero in all countries, supporting Hypothesis 1B. A comparison of caterpillar plots across models further shows that controlling for objective SES indicators has little impact on the ordering of countries.

Hypothesis 2 is not supported by our evidence. Hypothesis 2 posited that country affluence decreases the importance of subjective SES for health outcomes. Table 1 tests this hypothesis in Models 3a and 3b. Model 3a reveals that there is a statistically significant interaction between GDP per capita and subjective SES for SRH, but not for psychological wellbeing (Model 3b). Figure 3 plots the predicted slopes for the subjective SES–SRH correlation at different levels of subjective SES and GDP per capita (left panel) and shows how countries vary in the size of of the subjective SES coefficient as a function of GDP (right panel). Results contradict Hypothesis 2. The more affluent a country, the greater the health inequalities as measured by subjective SES. Thus, our findings do not support Hypothesis 2.

Hypothesis 3 is also not supported by our findings. Hypothesis 3 posited that the greater the income inequality in a country, the stronger the relationship

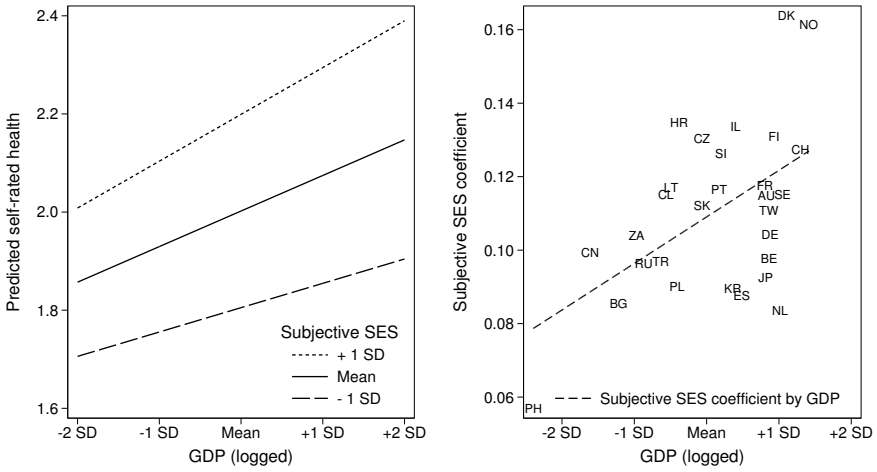

Figure 3: Cross-level interaction plots based on model (3a). *Left panel:* Regression of SRH on GDP for three levels of subjective SES. *Right panel:* Scatterplot of country-specific subjective SES coefficients against GDP and subjective SES coefficient as a function of GDP.

between subjective SES and health. Models 4a and 4b test Hypothesis 3 and reveal that there is no such interaction. Coefficients are small and statistically not different from zero: the strength of the relationship between subjective SES and health in a country does not depend on its income distribution.

In the Appendix, we present sensitivity analyses based on two-step OLS regression models. Our results prove to be robust to this additional check.

4. Discussion

Research has established a relationship between subjective socioeconomic status (SES) and health that appears to hold over and above the associations health has with objective indicators of SES. Drawing on data from 29 countries, we present the first cross-national study confirming this finding for two different health outcomes: self-rated overall health (SRH) and psychological wellbeing. Subjective SES is significantly related to SRH and psychological wellbeing in all countries in our sample. Furthermore, we document significant variation across

countries in the subjective SES–health relationship, with stronger relationships in countries such as Norway, and a weaker association in the Philippines and the Netherlands. Thus, our results add to the emerging body of comparative research on social inequalities in health (Beckfield et al., 2013; Mackenbach et al., 2008; Olafsdottir et al., 2013). Comparing the extent of health inequalities across countries allows to put them into context and gives an fresh impression of which inequalities can considered to be 'large' or 'small' (Olafsdottir et al., 2013). Furthermore, comparing health inequalities across societies allows identifying contextual factors, such as income inequality or welfare state policies, that can affect the size of socioeconomic gradients in health.

Our finding of a significant positive effect of subjective health on SRH and psychological wellbeing remained even after controlling for the objective SES markers of income, education, and occupational prestige. Again, this finding replicated across all 29 countries. Substantively, this finding indicates that the subjective SES–health may reflect the harm to health caused by the cognitive and emotional reactions to lower status positions, as the association is apparently not due to a comprehensive set of objective SES indicators. Again, we are able to show that there is cross-country variation in the strength of the subjective SES–health association, also after controlling for objective SES markers.

However, similar to many other studies (e.g. Brennenstuhl et al., 2012), it is difficult to explain patterns of cross-national variation in health inequalities. Hypothesized country-level moderation effects of country affluence could not be found. Contrary to what we expected, we find an exacerbating effect of country affluence on the subjective SES gradient in SRH. The richer a country, the greater the self-reported health benefits of subjective SES. This can be interpreted in the light of Wilkinson & Pickett's (2010) idea that subjective status considerations are more important for health in more affluent countries than in countries where the fulfilment of basic needs is more important for health. Nonetheless, the questions remain whether, on the one hand, an effect of the size we find is clinically relevant and, on the other hand, why such an effect is not found for psychological wellbeing, which should presumably be more

sensitive to status considerations than a measure of general health.

The absence of a moderating effect of income inequality was also unexpected, as greater social inequality in a country could, in principle, make perceived low social status more painful. However, this notion could not be corroborated. The strength of the association between subjective SES and SRH, as well as psychological wellbeing, is independent of the income distribution in a country. This contradicts the findings of Wilkinson & Pickett (2008), who suggested that greater income inequality exacerbates health inequalities due to more status competition. While Wilkinson & Pickett (2008) examined average income and mortality rates in US counties, we put their explanation to a more stringent test, looking at subjective SES, SRH, and psychological wellbeing: three indicators much closer to the hypothesized status competition mechanism than average income and aggregate mortality.

As any empirical study, our study has strengths and limitations. In terms of strengths, our study made use of high-quality survey data of the general population that comprised information from a large number of countries. We were able to make use of two related, yet distinct health outcomes that allowed us to assess the robustness of our findings. Also, our three fine-grained markers of objective SES allowed us to comprehensively cover key aspects of socioeconomic status to disentangle the objective and subjective aspects of the SES–health association. To assess model dependence of our findings, we made use of random coefficient and two-step regression models, both yielding similar findings. In terms of limitations, response rates of the surveys differed between the 29 countries under study. Health inequalities can be underestimated due to nonresponse when response rates are lower among low-SES and less healthy respondents. In countries with lower response rates it can be assumed that underestimation is greater. Given the reliance on self-reported data, which is a widespread problem in cross-national research on health inequalities (Olafsdottir et al., 2013), it is difficult to make causal claims based on the findings at hand. Previous research suggests that cross-national analyses of self-rated health should be approached with caution (Jylhä et al., 1998), as they may not be directly comparable across cultures.

A need to develop new measures of general health that are easily comparable across cultures remains (Grol-Prokopczyk et al., 2015). Another problematic aspect of our study is our use of cross-sectional data, which also hampers drawing causal conclusions. Previous longitudinal research within single countries has been able to establish that a part of the subjective SES–health relationship can be attributed to reverse causality (Garbarski, 2010; Nobles et al., 2013). How much of our findings of our study are due to reverse causation we cannot establish with the data at hand, highlighting the need for longitudinal cross-national data collection. Another aspect of endogeneity that could affect our findings is omitted variable bias. Previous research has speculated whether the relationship between health (especially self-reports) and subjective SES could be spurious, as both could be affected by an unmeasured individual characteristic like a personality trait (Singh-Manoux et al., 2005). A recent experimental study was able to show that the relationship between subjective SES and SRH was not affected by an experimental mood induction (Kraus et al., 2013), giving support to the notion that negative mood is not a confounder of the subjective SES–SRH relationship, yet other unmeasured confounders cannot be ruled out in our study.

In conclusion, we were able to show that the subjective SES–health association can be universally observed across a wide range of countries, even when a comprehensive set of objective SES indicators are accounted for, providing further evidence for the importance of psychosocial factors for health inequalities. Also, the subjective SES–health association appears to vary in strength between countries, however existing theoretical approaches are not able to explain this variation. We suggest that future research on the subjective SES–health association should progress in two directions. Firstly, in terms of substantive progress that tries to understand variation in the subjective SES–health gradient across countries could consider examining cultural differences, for instance the distinction between 'tight' and 'loose' cultures (Gelfand et al., 2011). 'Tight' cultures are characterized by strong social norms and formal hierarchies, which might buffer the negative health effects of low subjective SES. Secondly, in terms of

methodological progress, it would be desirable to collect data of objective and subjective SES over long spans of the life course, revealing variation in subjective SES within individuals and allowing to study the health effects of these within-person changes. Particularly when these directions could be combined, progress on understanding the subjective SES–health association can be made.

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Appendix (electronic supplementary material)

A.1. Descriptive statistics

Table A.1 presents individual-level descriptive statistics across all countries. Table A.2 reports country-level descriptive statistics for income inequality and GDP per capita, gives individual-level sample sizes per country, and reports the response rates.

Table A.1: Descriptive statistics of individual-level variables, N = 33,342

Variable	Mean	Std. dev.	Min.	Max.
Self-rated health (SRH)	2.03	1.00	0	4
Psychological wellbeing	3.10	0.91	0	4
Subjective SES (centered)	0.00	1.81	-4.26	4.74
Education				
Low Education	0.37	—	0	1
Medium Education	0.37	—	0	1
High Education	0.26	—	0	1
ISEI				
ISEI (centered)	0.00	1.60	-2.69	4.70
Never worked	0.08	—	0	1
Household income quintiles				
Q 1 (lowest)	0.14	—	0	1
Q 2	0.16	—	0	1
Q 3	0.15	—	0	1
Q 4	0.17	—	0	1
Q 5 (highest)	0.18	—	0	1
Income missing	0.19	—	0	1
Age (centered)	0.00	13.5	-23.3	25.7
Female	0.55	—	0	1
Marital status				
Married/cohabiting	0.72	—	0	1
Divorced	0.08	—	0	1
Widowed	0.06	—	0	1
Single	0.13	—	0	1

Table A.2: Descriptive statistics of country-level variables, sample sizes, and response rates, $N = 29$

Country	Gini coefficient	GDP per capita	Sample size	Response rate
AU (Australia)	33.9	36,504.1	1,287	31.2 %
BE (Belgium)	25.1	37,913.8	1,013	30.2 %/50.1 %
BG (Bulgaria)	35.8	4,680.0	776	49.8 %
CH (Switzerland)	30.2	58,533.3	930	53.9 %
CL (Chile)	49.7	9,029.0	1,158	83.3 %
CN (China)	39.7	3,150.2	3,366	75.8 %
CZ (Czech Republic)	25.6	14,897.0	1,402	57.9 %
DE (Germany)	30.3	38,470.8	1,254	35.7 %/37.7 %
DK (Denmark)	27.0	48,143.9	1,062	56.1 %
ES (Spain)	32.7	25,937.9	1,954	75.8 %
FI (Finland)	25.5	40,531.1	1,045	53.7 %
FR (France)	28.9	35,775.4	664	35.9 %
HR (Croatia)	27.6	10,830.6	826	47.0 %
IL (Israel)	37.0	23,755.7	876	66.7 %
JP (Japan)	30.5	36,203.4	885	73.9 %
KR (South Korea)	31.4	22,883.8	1,284	61.4 %
LT (Lithuania)	36.4	9,704.9	912	35.8 %
NL (The Netherlands)	26.8	44,196.3	1,027	33.7 %
NO (Norway)	22.2	65,897.2	1,411	48.5 %
PH (Philippines)	41.3	1,430.1	998	34.7 %
PL (Poland)	29.7	10,540.7	868	42.6 %
PT (Portugal)	33.2	18,917.0	781	58.6 %
RU (Russia)	45.2	6,631.5	1,076	48.2 %
SE (Sweden)	21.9	45,727.0	827	59.8 %
SI (Slovenia)	24.2	19,405.5	766	64.7 %
SK (Slovak Republic)	24.0	14,957.9	846	47.1 %
TR (Turkey)	37.5	8,413.4	1,071	51.8 %
TW (Taiwan)	30.5	37,719.6	840	50.1 %
ZA (South Africa)	63.5	6,010.4	2,137	85.9 %
Average	32.7	25,406.6	1,150	53.4 %
SD	8.9	17,775.5	—	—

Notes: Gini from Solt (2009), GDP per capita from World Bank (2014). GDP per capita for Taiwan taken from IMF (2012). Response rates in Belgium and Germany refer to the Wallonian and the Flemish and the Western and Eastern parts, respectively.

A.2. Country-level correlations

Figure A.1 presents descriptive findings on the country-level for the two health outcomes, subjective SES, as well as income inequality and GDP per capita. As already reported for the micro-level, the two health outcomes are related to one another, however, the relationship appears to be rather modest (Pearson's $r = .38$). We can also see that subjective SES aggregated to the country-level predicts the two outcomes, but to varying degrees: While the relationship to SRH is sizable ($r = .60$), the relationship to average psychological

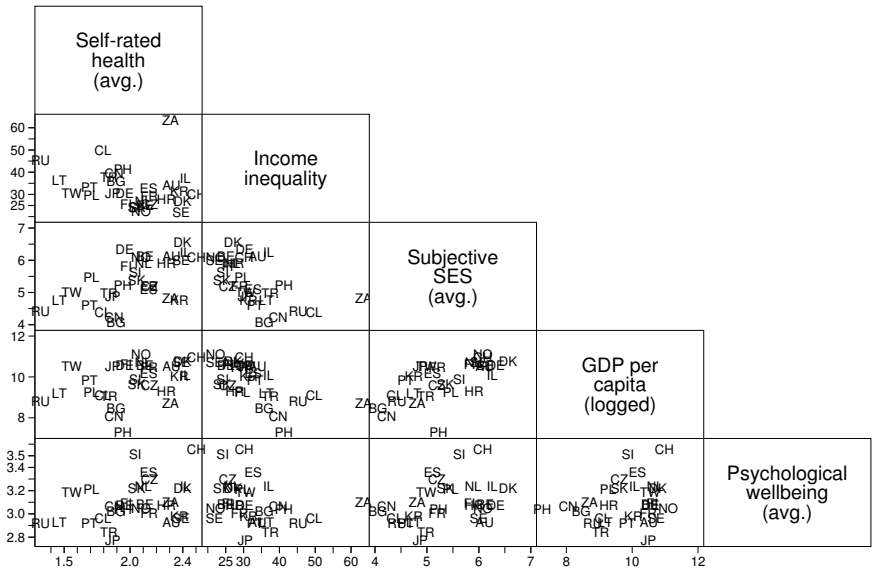

Figure A.1: Scatterplot matrix of self-rated health, income inequality, subjective SES, GDP per capita, and psychological wellbeing on the country level

wellbeing in a country is more modest ($r = .38$). GDP per capita is positively correlated to average SRH ($r = .40$), but not so much to psychological wellbeing ($r = .22$). The positive correlation between GDP per capita and subjective SES is substantial ($r = .65$). Income inequality is to a limited extent negatively correlated to SRH ($r = -.22$) and psychological wellbeing ($r = -.27$), but the negative association with subjective SES is substantial ($r = -.55$)

A.3. Null models and random intercept-only models

Models A0a and A0b of Table A.3 are so-called null models—models without any predictor variables—to obtain the intraclass correlation (*ICC*; Snijders & Boskers, 2012, section 4.4) of the outcome variables self-rated health and psychological wellbeing. The *ICC* gives the proportion of the total variance in the dependent variable that is accounted for by the clustering in countries. Put differently, the *ICC* is a measure of the extent to which respondents living in the same country are more similar to one another than to respondents living in

other countries. For self-rated health, we find an intraclass correlation coefficient (ICC) of $0.0841/(0.0841 + 0.920) = .08$. For psychological wellbeing, ICC equals $0.0318/(0.0318 + 0.813) = .04$.

Models A1a and A1b are so-called random intercept models that differ from the models 1a and 1b in Table 1 of the main text with respect to the fact that the coefficient of subjective SES is fixed, that is, it is not allowed to vary across countries. Comparing the model fit—as expressed in the model deviance in the table—reveals that the random slope models, which allow the slope of subjective SES to vary across countries, provide significantly better model fit. For self-rated health $\chi^2 = 41.33, df = 2, p < .001$ and for psychological wellbeing $\chi^2 = 75.16, df = 2, p < .001$. Substantively, these tests indicate that there is variation across countries in the size of the association between subjective SES and the two health outcomes of SRH and psychological wellbeing. A comparison of the fixed parameters of the models shows that they are not substantively affected by allowing the slope of subjective SES vary.

A.4. Subjective SES–health association based on country-specific ordinary least squares (OLS) regression models

In this section, we conduct a robustness check of our findings from the main text using an alternative specification, namely the two-step regression approach (Kedar & Shively, 2005; Wooldridge, 2010).

A.4.1. Method: Two-step regression approach to multilevel data

The two-step regression approach (Kedar & Shively, 2005; Wooldridge, 2010) is an estimation strategy for multilevel models when the size of clusters is large and the number of clusters is comparatively low, as is typically the case in analyses of cross-national survey data (Bryan & Jenkins, 2015). In the first step, separate OLS regression models for each cluster are estimated, including all relevant individual-level control variables in the equation. From these models, the parameter of interest is retained, which in our case is the subjective SES

Table A.3: Self-rated health and psychological wellbeing regressed on several predictors—null models and random intercept models (parameter estimates from random intercept models, t-statistics in parentheses)

	(A0a) Self-rated health	(A0b) Psychological wellbeing	(A1a) Self-rated health	(A1b) Psychological wellbeing
Subjective SES			0.130***	0.123***
			(43.29)	(42.74)
Age			-0.0174***	-0.00123**
			(-42.91)	(-3.14)
Female (*ref.* male)			-0.0691***	-0.169***
			(-6.87)	(-17.42)
Marital status (*ref.* married/cohabiting)				
Divorced			-0.0344	-0.207***
			(-1.85)	(-11.56)
Widowed			-0.0953***	-0.216***
			(-4.38)	(-10.32)
Single			-0.0364*	-0.131***
			(-2.32)	(-8.70)
Intercept	2.024***	3.098***	2.072***	3.230***
	(37.38)	(92.37)	(45.04)	(102.62)
Variance(intercept)	0.0841***	0.0318***	0.0594***	0.0269***
Variance(residual)	0.920***	0.813***	0.808***	0.751***
Deviance	91968.3	87811.4	87639.8	85173.6
N countries	29	29	29	29
N individuals	33,342	33,342	33,342	33,342

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

coefficient. In the second step, these parameters of interest are then regressed on the cluster-level covariates.

The two-step regression approach serves as an important robustness check for multilevel analyses for two reasons. Simulations suggest that estimates of variance components in random effects models are unreliable when the number of countries is small (Bryan & Jenkins, 2015). Further, fitting country-specific models amounts to including random slopes for all predictor variables in our models. The implicit assumption of the Models presented in Table 1 of the main text is that subjective SES is the only predictor variable which varies in the strength of its relationship to the outcomes across countries. This assumption is unlikely to be tenable, but introducing more variance components and covariance terms in our models leads to convergence problems. Thus, the two-step OLS regression approach also tests the robustness of our results when these assumptions are violated.

A.4.2. Results

Figure A.2 tests Hypotheses 1A and 1B using country-specific OLS regression models instead of random coefficient models for the entire sample. The panels in the upper row of Figure A.2 present the unstandardized regression coefficients of subjective SES along with their 95 per cent confidence intervals, stemming from country-specific OLS models which additionally controlled for age, sex, and marital status. It shows that the subjective SES coefficients are greater than zero at conventional levels of statistical precision in all countries of our sample for both outcome variables, thus supporting Hypothesis 1A. A comparison with the panels in the middle row of Figure 3 show that the ordering of countries is similar regardless of the estimation procedure.

The panels at the bottom of Figure A.2 report the same parameters as those in the top row, however, they are now derived from models additionally controlling for objective indicators of SES education, occupational prestige, and household income. Again, the 95 per cent confidence intervals indicate that the subjective SES–health association can be found in all countries in our study,

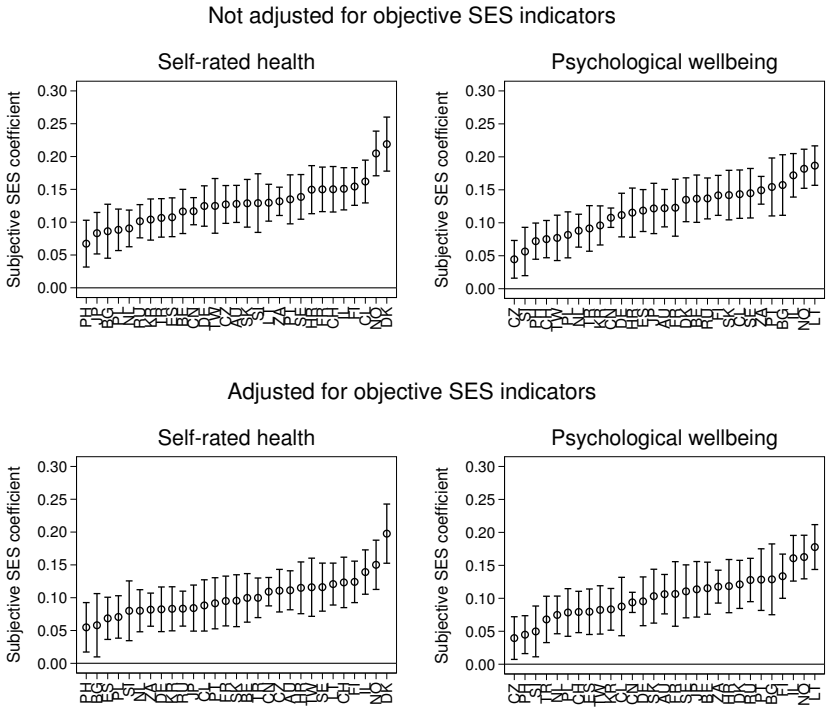

Figure A.2: Association between subjective SES and health outcomes across countries, based on country-specific OLS regression models. *Upper* row: not adjusting for objective SES indicators. *Lower* row: adjusting for objective SES indicators.
Notes: Error bars denote 95% CI's of OLS coefficients. All models control for age, sex, and marital status.

even when objective indicators of SES are accounted for. This finding supports Hypothesis 1B. Also, a comparison with the corresponding panels at the bottom of Figure 2 in the main text reveals that country order is similar for both approaches.

Figure A.3 reports tests of Hypotheses 2 and 3 using the two-step OLS regression approach. For each country sample and each outcome variable, an OLS regression model including subjective SES and controlling for the objective SES indicators, as well as age, sex, and marital status, was estimated. The unstandardized subjective SES coefficients were then regressed on GDP per

capita and on the Gini coefficient. Results are reported in the scatterplots displayed in Figure A.3. The panels in the top row of Figure A.3 confirm the findings reported in Models 4a and 4b of Table 1, as well Figure 2 from the main text. There is a positive correlation between country affluence and the strength of the subjective SES–SRH correlation, but not for psychological wellbeing, thus Hypothesis 2 is not supported. The positive association between country affluence and the strength of the subjective SES–SRH correlation also holds when excluding seeming outliers Denmark ($b = .001, p = .007$) and the Philippines ($b = .001, p = .008$).

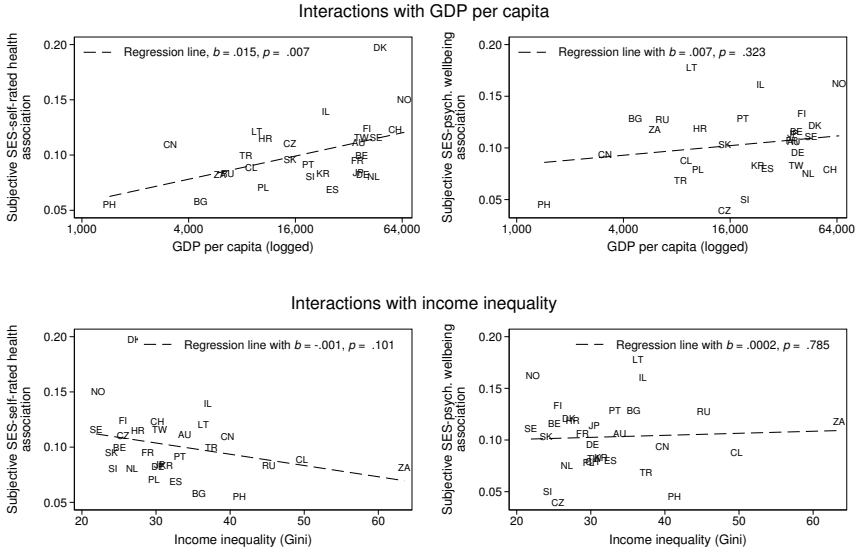

Figure A.3: Scatterplots of subjective SES–health associations against country-level predictors, based on country-specific OLS models. *Upper* row: logged GDP per capita. *Lower* row: income inequality.
Note: All models control for education, occupational prestige, household income, age, sex, and marital status.

The panels in the bottom row of Figure A.3 display another test of Hypothesis 3, which had suggested that the subjective SES–health relationship is stronger in less egalitarian countries. Identical to the results reported in Models 4a and 4b of Table 1 in the main text, no support for Hypothesis 3 is found,

as no clear pattern emerges from the plots.