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Illness and Health Satisfaction: The Role of Relative Comparisons

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Abstract

This paper investigates the role of relative comparisons in health status for individual health satisfaction. Previous research stresses the importance of interdependencies in subjective well-being and health arising from positional preferences and status effects, social health norms, and comparison processes. Using representative longitudinal data from a German population survey, we estimate empirical health satisfaction models that take these interrelations into account. We find that positional preferences and social status effects in the context of health are rather unimportant for individual health satisfaction. Furthermore, higher levels of reference-group illness can temporarily alleviate the adverse impact of one's own illness on health satisfaction. This is also the first study to show the relevance of health-related upward and downward comparisons for health perception in the general population. The results suggest that upward comparisons are more important than downward comparisons and that becoming sicker than the reference group worsens health satisfaction.

Keywords: Health satisfaction, physical illness, social status, social norms, social comparisons

JEL Classification Numbers: D03, I10

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1 Introduction

The importance of social comparisons for subjective well-being is reflected in the interest of various scientific disciplines in this issue. In sociology, for instance, inter-personal comparison processes play a vital role in the theory of relative deprivation, according to which a person is less satisfied if she has less (of a good or attribute) than others (Runciman, 1966). The analysis of social comparison processes has a long tradition in social psychology, and can be traced back to Festinger’s (1954) seminal paper on the self-enhancing effects of social comparisons. Economists often explain the so-called “Easterlin paradox”, that is the nil-relationship between improvements in living standards and happiness over time, by social comparison processes (Clark et al., 2008; Easterlin, 1995).

While there is much research dealing with comparisons in economic domains such as income or employment, less effort has been devoted by economists to the study of inter-personal comparisons of individual health status.¹ This is despite the long-standing recognition of interdependent preferences in economic models of well-being and health assessment. For example, economic analyses of health and health care acknowledge that concerns for other people’s health status often call for particular policy responses to improve public health (Culyer and Simpson, 1980). Furthermore, inter-personal comparisons are considered as one of the main sources of reporting heterogeneity in self-assessed health and quality of life (e.g., Groot, 2000; Jürges, 2008).

Gaining knowledge about the role of other people’s health problems for individual well-being and health perception is also important from a policy perspective, particularly with respect to the economic evaluation of health prevention and intervention programs. As shown by Christakis and Fowler (2007), poor health standards can be socially contagious, in the sense that individuals tend to adopt their peers’ (poor) health behavior. Public health interventions aimed at a sub-group of the population can have additional social benefits because other individuals that are not directly affected by the policy probably change their behavior as well. Factoring out such spillover effects in health-economic evaluations would thus underestimate the cost-effectiveness of interventions. Furthermore, the health of other people may act as a social norm or a standard against which the appropriateness of one’s own behavior and situation is evaluated. The subjective evaluation of own ailments therefore depends on whether they are widespread in the reference group, or the norm to be healthy is weak (Powdthavee, 2009). Hence, health policy programs can be more effectively designed if they also contain measures aimed at changing social health norms. Finally, the effectiveness

¹There is nevertheless an increasing number of papers that address adaptation to adverse health events. See Clark (2012) for a review of economic research on social comparisons in a variety of domains.

of one-size-fits-all health policies hinges on the extent of inter-individual comparisons of health status.

In this paper, we examine how the health of others influences individual health perception. This can happen in a variety of ways: First, individuals may have positional preferences in the health domain and derive higher social status from being in a better physical condition than other people (e.g. [Oswald and Powdthavee, 2007](#)). This is because healthier individuals tend to have higher income and wages, or find superior mating partners in terms of socioeconomic status and health. Second, as noted above, the average health status in a community may act as a benchmark against which people compare their situation. Third, comparisons with sicker or healthier persons brings along psychological effects, which could be positive or negative ([Buunk et al., 1990](#)). To test the influence of these mechanisms on health satisfaction, we use longitudinal data from the German Socio-Economic Panel (SOEP) study. Alongside a large set of demographic and socioeconomic variables, this survey also retrieves information on health-related quality of life and well-being for a number of years. This enables us to analyze the influence of one’s own illness and other individuals’ illness on the subjective value of health, while taking a large number of observable characteristics into account. Furthermore, by using linear panel-data regression models that account for the role of unobservable confounders, we can decompose the effect of explanatory variables into a transitory and a permanent component. In this way, we are able to disentangle short-run and long-run effects of own and other people’s illness on health perception. This has been rarely done in the past, even though significant health differences across time and between individuals can be expected.

Other people’s illness is approximated with the average physical condition in the respondent’s reference group. The reference group consists of individuals with the same demographic, socioeconomic and regional background in the same year. We find that the health of similar other individuals is rather unrelated to subjective health evaluations. This suggests that the status return from being healthier than the reference group is negligible. A higher rate of disease in the respondent’s reference group however alleviates the negative impact of their own illness on health satisfaction. In other words, own health problems appear less severe if the social norm to be healthy is weak. Finally, upward comparisons appear to be more important and becoming sicker than the reference group reduces health-satisfaction scores, while health improvements relative to the reference-group are unrelated to health satisfaction. Nevertheless, we find associational evidence for the notion that both upward and downward comparisons may have positive psychological effects.

The remainder is organized as follows: Section (2) reviews the literature on the role of other people’s health problems for own individual health and happiness. The focus primarily

lies on economic research, albeit we will also draw on insights from (social) psychological research. Section (3) discusses the empirical approach employed in this paper. It includes a description of the dataset and variables, followed by an exposition of the empirical method. Section (5) assesses the robustness of the results with respect to the discrete nature of the dependent variable and the inclusion of additional characteristics into the reference-group definition. Section (6) summarizes the main results, outlines limitations, and offers future research avenues.

2 Related Literature

2.1 Positional Concerns and Status Effects

Most studies on relative-health concerns implicitly or explicitly model an interdependent health production or utility function that depends on both the individual’s own illness and the illness of other people. A person’s subjective health can thus have the following determinants:

$$HS_i = HS(S_i, S_r, X). \quad (1)$$

Equation (1) relates individual i ’s health satisfaction (HS_i) to her own sickness S_i , the sickness of other people S_r , and other observable and unobservable factors X . Other people’s illness S_r is usually measured as the average illness of a person similar to i , or as the proportion of sick people in individual i ’s reference group. This approach assumes that individuals compare their health status to that of others who have the same background characteristics, and that the relative-health effect is the same for both sicker and healthier individuals.²

A positive association between higher morbidity in society and individual health perception potentially arises because individuals care about how their health status compares to other people’s physical condition. Being healthier than others with the same socioeconomic and demographic background can simply be psychologically rewarding. The better own health compares to that of others, the greater is the satisfaction with one’s own situation. Healthier individuals also enjoy the recognition by others of what they have achieved, which can lead to heightened self-esteem (e.g., [Wunder, 2009](#)).

There are also likely to be other factors that shape the degree to which the value of own health depends on the physical condition of others. The extent of positional or relative concerns is linked to the observability of a good or a characteristic possessed by other

²In Section 2.3. we explicitly allow the comparison effect to differ depending on whether the individual is sicker or healthier than the reference group.

individuals (Frank, 1985). It has been shown in several discrete choice experiments that individuals tend to prefer a “relative advantage” in comparison to others over a situation where they are better-off in absolute terms.³ This applies even more forcefully to goods that are easily observable, such as cars or houses, and less to illness and physical condition (e.g., Alpizar et al., 2005; Carlsson et al., 2007; Hillesheim and Mechtel, 2013; Solnick and Hemenway, 2005). Many health aspects like pain or psychiatric diseases are not easily observable, and the degree of relative comparison or the relationship between own well-being and other people’s health status seems rather weak. This does not preclude the possibility that particular attributes of an individual’s state of health are relevant for social status perceptions. As shown by Blanchflower et al. (2009), Carrieri and De Paola (2012), and Oswald and Powdthavee (2007), individuals care about their position in the societal weight and height distribution, and being thinner or taller than peers can increase their utility.

The tangible benefits that usually accompany good individual health can also make relative concerns more relevant in the context of health. These benefits mainly accrue on marriage and labor markets, and generally ensure a sustainable and high disposable income. For instance, health investments are seen as a critical precondition for marital success, and healthier individuals tend to find superior mating partners in terms of health and socioeconomic status (e.g. Wilson, 2002). As good health serves as an indicator of individual productivity, healthier individuals have also on average higher earnings than the less healthy.⁴ Moreover, several studies have found that there is an additional wage premium on labor markets for physical attractiveness and fitness. It is interesting to note that these attributes are rather unrelated to productivity, and wage differentials can be the result of discrimination according to an individual’s external appearance (e.g., Baum and Ford, 2004; Hamermesh and Biddle, 1994).

The potential labor and marriage market effects of good health status make positional health concerns appear rational from an economic perspective. The good medical condition of others imposes additional psychological and monetary costs on the worse-off (Frank, 2008). This negative externality stemming from the healthy requires less healthy individuals to invest in their physical and mental well-being to be able to compete with the former on the marriage and labor markets. When the health of relevant other people deteriorates, the incentive to invest in own health declines because mating or discrimination based on physical

³To be more specific, individuals are confronted with the decision between two states of the world (e.g., Solnick and Hemenway, 2005). The first state describes a situation where the individual is better-off in absolute terms of a certain good. In the other state, the individual has relatively more of a certain good than others, but is worse-off in absolute terms compared to the first state. Hence, a preference for being relatively better-off implies that individuals are willing to forgo resources to attain a higher rank in society.

⁴For a more detailed discussion on the relationship between health and labor market outcomes, see Currie and Madrian (1999) and Lindeboom (2006).

appearance and fitness is less important. This implies that a worsening of peer health status can improve subjective well-being and the value of own health.

It is also possible that other people's illness negatively affects individual health perceptions. This can be explained by altruistic preferences with respect to health status, meaning that altruistic individuals are willing to sacrifice their own well-being and resources to improve the health of others (e.g. [Hurley and Mentzakis, 2013](#)). This can give rise to a negative relationship between other individuals' health problems and subjective well-being and, possibly, health perception.

However, altruism is likely to be less relevant for the present analysis since we impose a rather broad definition of the respondents' reference group based on socioeconomic, demographic and local characteristics. The majority of empirical studies on health-related altruistic preferences examines the association between the ailments of family members and the respondents' subjective well-being or health assessment (e.g. [Carrieri, 2012](#); [Clark and Etilé, 2011](#); [De Mello and Tiongson, 2009](#); [Groot and Van Den Brink, 2003](#); [Powdthavee, 2009](#)). This indicates that individuals care more about their relatives or household members than about other persons, and that the degree of altruistic behavior is comparatively low in rather broadly defined reference groups (see also [Groot and Van Den Brink, 2003](#); [Viscusi et al., 1988](#)).

2.2 Social Health Norms

The health of other individuals may also alter the perception of own illness. Under certain circumstances, the adverse psychological effects of diseases are weaker the greater the perceived morbidity in a community. Similar reasoning has recently been applied to the domain of unemployment. Studies have shown that individual utility loss due to unemployment is less severe if the unemployment rate in the local environment is high (e.g., [Clark, 2003](#); [Clark et al., 2009](#)).

Social norms are generally defined as standards or behaviors against which individuals evaluate their own situation, and are considered as one of the most important external influences on human behavior (e.g. [Emmons et al., 2007](#)). The social norm approach has been incorporated into public campaigns that aim to promote healthier lifestyles. For example, the communication of behavioral standards regarding, among others, smoking, drinking or eating is regarded as a viable tool for reducing the extent of health-compromising behaviors ([Schultz et al., 2007](#)). From an economic perspective, norm-guided behavior may arise from rational considerations. On the one hand, the violation of social norms, such as overeating, may have devastating psychological effects such as feelings of embarrassment, anxiety, guilt

or shame (Elster, 1989). On the other hand, individuals have an incentive to follow social norms because they fear the threat of social sanctions, and want to avoid other people's disapproval.

A suitable framework for the analysis of social health norms is provided by the theory of social customs (Akerlof, 1980). While it was originally applied to the causes of unemployment persistence, it can also yield important insights into the relationship between health perception and health-related social standards.⁵ The defining characteristic of this theory is a utility function that depends on the reputation of the individual in a community. The reputation function includes as arguments both the individual's propensity to adopt the norm and the share of individuals following the norm. Under these conditions, the psychological costs associated with illness are lower the higher the proportion of unhealthy people in society, because the norm to be healthy is weak. Conversely, the decrease in well-being or health perception is greater the higher the proportion of healthy people. Hence, we can rewrite Equation (1) in the following way:

$$HS_i = HS(S_i, R_i, X), \quad (2)$$

where we include R_i as the reputation of individual i in the society as an argument. The variable R_i reflects the loss in well-being or health perception due to a decline in reputation, and can be expressed as follows:

$$R_i = S_i \times S_r. \quad (3)$$

For illustrative purposes, consider Equation (4) (see also Powdthavee, 2009):

$$HS_i = HS(1 - S_i^D, -S_i^D(1 - S_r^D), X), \quad (4)$$

where S_i^D is a dummy variable for physical illness, and S_r^D is the share of people with health problems in a reference group. Assume for simplicity that individual i lives in a community where the social health norm is observable and equals S_r^D . Hence, when the share of healthy people in the community decreases, the pressure on individual i to stay healthy weakens. Consider the case where individual i is sick, that is $S_i^D = 1$. According to Equation (4), the loss in health satisfaction due to own illness is greater the larger the share of healthy people (lower S_r^D).⁶ In other words, the health satisfaction gap between healthy and sick people is lower the higher the share of sick people, or the weaker the social health

⁵For a recent application to health problems, see Powdthavee (2009).

⁶If the norm is followed ($S_i^D = 0$), the health norm does not influence health perception. This would be in accordance with the theory (Akerlof, 1980, p. 762).

norm.

Empirical economic evidence concerning social health-norm effects is rather scarce and inconclusive. It is common practice in this area of research to estimate an empirical utility or health production function that includes an interaction term between the respondent's own health status and other people's ailments in addition to the main terms. Relying on data from a British population survey, [Powdthavee \(2009\)](#) examines health-norm effects in the household context. Using the number of self-reported ailments as a presumably objective illness indicator, he finds that the negative effect of own health problems on SAH decreases as the average number of conditions within the family increases. [Carrieri \(2012\)](#) uses cross-sectional individual-level data from Italy, but employs a much larger reference group defined by demographic, socioeconomic and regional characteristics. His results suggest that a higher prevalence in the reference group reinforces the adverse well-being impact of own illness. This could point to other mechanisms than social health-norm effects, for example the existence of sympathy or altruistic preferences. Nevertheless, he does not control for unobserved heterogeneity, and one cannot rule out that unobservable individual characteristics – such as a predisposition to interpret social health standards in a certain way – are responsible for this finding.

Similar evidence exists that examines the role of inter-spousal interactions in BMI for subjective well-being. [Clark and Etilé \(2011\)](#) find that the adverse well-being effect of own BMI declines when the BMI of the partner increases.

2.3 Upward and Downward Health Comparisons

As explained above, subjective well-being and health perception may depend on how one's own health status compares to that of other relevant individuals. An improvement in own health in relation to the peer group has important status effects attributable to the psychological and tangible benefits of better physical condition. The consequences of inter-personal comparisons, however, may differ depending on whether someone is healthier or sicker than the reference group. This line of reasoning is akin to the relative income literature in economics. For example, [Ferrer-i-Carbonell \(2005\)](#) and [Wunder \(2009\)](#) analyze the well-being effects of income comparisons and differentiate between those who are richer than their reference group on the one hand, and those who are worse-off on the other hand. We expect that the direction of comparison is also important in the health domain, and rewrite Equation (1) accordingly:

$$HS_i = HS(S_i, S_i^W, S_i^B), \quad (5)$$

where S_i is the individual illness index; the variable S_i^W indicates whether someone is sicker or worse-off (upward comparisons) and S_i^B whether someone is healthier or better-off (downward comparisons) than the reference group. In contrast to Equation (1), the comparison-effect depends on whether the individual is sicker or healthier than the reference group. As will be discussed below, it appears reasonable that upward comparisons are relatively more important for subjective well-being and health satisfaction than downward comparisons.

According to Festinger’s (1954) original formulation, social comparisons are a viable means to assess one’s own situation. In the absence of objective information, individuals use the performance of similar other people as a heuristic to evaluate their own standing. Such comparisons are not only restricted to income, but arise in a wide range of characteristics and abilities that affect individual self-value (e.g., Dakin and Arrowood, 1981). However, there is no consensus among researchers concerning the consequences of upward and downward health comparisons.

Useful guidance on the potential well-being effects of social comparisons is provided by Fehr and Schmidt (1999). They specify a utility function where individuals are assumed to have preferences for equitable outcomes. This implies that inequalities, be they to the advantage or disadvantage of the individual, are always harmful for subjective well-being. Relative health comparisons with both worse-off and better-off individuals could therefore produce negative health-perception effects. This conjecture, however, contradicts insights from social psychological research that assesses the role of social comparisons in the health domain. Social comparisons are generally regarded as a viable coping mechanism, allowing individuals to deal with health problems (Taylor et al., 1989). Hence, upward and downward comparisons may both have positive psychological effects.

However, upward and downward comparisons may not necessarily have the same effects, and there are good reasons to believe that both directions have positive and negative aspects. If individuals like to be better-off than others, or care about their relative status, being sicker than someone with a similar background may create distress or envy and worsen the perception of his or her own health status. We may call this a situation of *relative deprivation* in terms of health, that is the individual falls short of the prevailing health standard of his or her reference group (see also Yitzhaki, 1979). On the other hand, being worse-off than similar other people in terms of health may increase well-being and health satisfaction. Individuals appreciate the information provided by this situation, namely that their state of health can improve in the future.⁷ This is consistent with the notion that healthier individuals provide

⁷Note that there is an analogy to the *tunnel effect* in the income-comparison literature (e.g., Clark et al., 2009; Hirschman and Rothschild, 1973).

information that may assist them in problem-solving, for example where to find appropriate treatments (e.g. [Buunk et al., 1990](#); [Wood and VanderZee, 1997](#)). Hence, it is likely that individuals experience an increase in health perception when they learn that others from the same social background are healthier.

The psychological consequences of downward health comparisons are also ambiguous. Learning that the reference group is worse-off in terms of medical condition may increase health satisfaction. As discussed above, one could derive status from being healthier than similar other individuals, which presumably increases the value of one’s own health. In line with the income-comparison literature, we term this situation *relative satisfaction* (see [Wunder, 2009](#); [Yitzhaki, 1979](#)). Moreover, comparisons with less healthy individuals may have psychological benefits over and above status effects. As argued by [Wills \(1981\)](#), downward evaluations primarily serve to enhance mental well-being, because individuals derive utility from observing that there are other people with the same socioeconomic and demographic background who are worse-off. Nevertheless, downward comparisons could also produce negative psychological effects. People may simply have sympathy for others who are worse-off, adversely affecting their own health perception. The poor health status of similar other individuals could also act as a negative externality that could increase the perceived risk of contracting a disease or worse health conditions in the future, presumably reducing current health-satisfaction levels.

There is no general agreement on the relative importance of upward and downward comparisons. According to the literature discussed above, upward and downward comparisons are equally important predictors for well-being and subjective health. It is nevertheless conceivable that the effects of social comparisons are asymmetric, that is the adverse well-being effects of upward comparisons are greater than the beneficial effects of downward comparisons. This to some extent resembles the behavioral model underlying prospect theory ([Kahneman and Tversky, 1979](#)), which assumes that losses with respect to a reference standard loom larger than gains. One could therefore argue that individuals are loss averse in social comparisons.⁸

2.4 Summary and Hypotheses

Table (1) summarizes the main hypotheses analyzed in the empirical section of this paper. It details their underlying mechanisms and the expected impact on individual health satisfaction as outlined above. With respect to the independent effect of the level of reference-group illness, we expect a positive association with individual health satisfaction due to economic

⁸See also, [Fehr and Schmidt \(1999\)](#).

benefits on labor and marriage markets as well as psychological effects of better relative health. According to the social health-norms hypothesis, the overall impact of reference-group illness on individual health satisfaction is positive, as weaker social health standards decrease the negative well-being effects of diseases. This can be explained by lower psychological costs of individual illness when the average health of the reference-group worsens, or the societal pressure to stay healthy weakens.

As discussed in the previous section, the effects of upward and downward comparisons on health satisfaction are theoretically ambiguous. Upward comparisons worsen health-satisfaction levels when the individual is relatively deprived due to lower self-esteem, feelings of shame, regret or envy. Being or becoming sicker than the reference group is positively related to health satisfaction if the respondent focuses on the positive aspect of this situation and uses the information provided by better-off peers to cope with their illness and solve their problems. Downward comparisons have, on the one hand, positive consequences for the individual when they provide relative satisfaction. Being healthier than others can be psychologically rewarding due to higher social status, self-esteem, and regulation of emotions. On the other hand, comparisons with sicker individuals possibly reduce health satisfaction mainly because individuals have sympathy for persons who are worse off, or learning about the existence of sicker peers increases the perceived risk of becoming sick in the future.

[Table (1) about here]

3 Empirical Framework

3.1 Data and Variables

3.1.1 The sample

This paper uses longitudinal data from the German Socio-Economic Panel (SOEP) ([Wagner et al., 2007](#)). The SOEP study is a representative survey of about 11,000 households located in the Federal Republic of Germany and is particularly useful for our purposes, since it provides information on the individuals' health perceptions as well as rather objective health indicators for a number of years. The empirical analyses build on an unbalanced panel comprising 27,066 individuals (13,093 males; 13,973 females) and six survey years (2002, 2004, 2006, 2008, 2010, 2012), leading to 101,001 person-year observations.

3.1.2 Dependent variable

Individual health perceptions are measured with the satisfaction-with-health scale. In the SOEP, respondents are asked to answer the following question on a scale ranging from 0 (“totally unsatisfied”) to 10 (“totally satisfied”):

“How satisfied are you with your health?”

Responses to this question have been used, for example, by [Frijters et al. \(2005\)](#) and [Jones and Schurer \(2011\)](#) to study socioeconomic gradients in health and capture both psychological and physical aspects of overall health status. What is more, it is possible to interpret the satisfaction-with-health variable as the value attached to one’s own health status. Previous studies have employed the health satisfaction question to assess the relationship between diseases and individual health utility (e.g., [Cutler and Richardson, 1997](#); [Ferrer-i-Carbonell and van Praag, 2002](#); [Van Praag and Ferrer-i-Carbonell, 2008](#)). The role of relative health concerns for health satisfaction has nevertheless been largely ignored.

3.1.3 Independent variables

Own illness index We employ a generic measure of physical health, which is included every two years in the SOEP questionnaire since 2002. The short-form 12 questionnaire (henceforth SF-12 questionnaire) is a brief version of the SF-36 questionnaire, and is a widely accepted and validated instrument for the measurement of health-related quality of life (e.g., [Andersen et al., 2007](#)). It consists of twelve (self-reported) items that comprehensively measure the respondents’ physical and psychological health. These items are merged into eight subscales and summarized into two aggregate dimensions via exploratory factor analysis: “physical health” (*pcs*) and “mental health” (*mcs*). We rely on the physical component (*pcs*) of the SF-12 questionnaire and analyze how the respondent’s own and other people’s physical illness influences health satisfaction ratings. It consists of the following subscales: physical functioning, role physical, bodily pain, and general health.⁹

The main illness indicator used in this paper is the complement of the normalized *pcs* score. It ranges between 0 and 1, and higher values indicate worse physical health. For the ease of interpretation, this measure is standardized so that its mean equals 0 and the standard deviation is equal to 1 (*z*-standardization).

Figure (1) shows the distribution (kernel density estimate) of the standardized illness index, separately for men and women. The illness index follows a slightly right-skewed distribution, suggesting that most of the individuals are in a rather favorable physical condition.

⁹See Table (A.1) in the appendix for a detailed description of question wording and response scales in the SOEP.

A Kolmogorov-Smirnov test rejects the equal distribution hypothesis across gender. Women tend to report lower illness index scores less often, and higher illness index scores more often than men. In other words, women seem to be sicker than men.

[Figure (1) about here]

Reference group illness and social health norms Other people’s health problems are defined as the average illness index of all persons in the respondent’s reference group, denoted as S_r .¹⁰ This measure is also z -standardized. Following [Mujcic and Frijters \(2013\)](#), we included the level of reference-group illness S_r as an independent explanatory factor of individual health satisfaction.

An interaction term between the respondent’s own illness index and the average illness index of the reference group is included in the regression equation to test for social health norm effects ($S_i \times S_r$). This approach has recently been employed by [Carrieri \(2012\)](#) and [Powdthavee \(2009\)](#) to study health norm effects, and implies that the effect of an individual’s own physical condition on health perception can vary with the average illness level in the peer group.

Upward and downward comparisons It can also matter whether one is sicker or healthier than someone similar. To examine the effects of upward and downward comparisons, a third specification incorporates the distance between the individual illness index and the average illness index of the reference group, for both healthier and sicker individuals (see also [Ferrer-i-Carbonell, 2005](#)). We are thus able to assess the relative importance of being healthier or poorer for individual well-being and satisfaction. The variables read as follows:

$$\text{sicker} = S_i^W = \max\{S_i - S_r, 0\}$$

$$\text{healthier} = S_i^B = \max\{S_r - S_i, 0\}$$

The function representing upward comparisons, S_i^W , measures the difference between the respondent’s illness index and the average illness index for someone who is sicker than similar other persons. Downward comparisons are assessed with S_i^B , which indicates how much healthier a person is than the reference group. This specification strictly separates those individuals who are sicker from those who are healthier than their peers. Hence, we assume that there is only one single comparison group that is either better-off or worse-off

¹⁰Note that the individual’s contribution is excluded from the calculation of the average illness index.

than the respondent. We also calculate z -standardized versions of these variables to facilitate interpretation.

Further control variables We take into account additional regressors that are potentially important for health satisfaction. These are age, age squared, sex, equivalized net household income, years of education, number of adults and children in the household, employment status (*employed*, *not employed*, *unemployed*), marital status (*married*, *single*, *widowed*, *divorced*, *separated*), and dummy variables for East Germans¹¹, nationality (non-German) and survey year. All continuous variables are included in their logarithmic form. Table (2) summarizes the variables used in the analyses.

[Table (2) about here]

3.1.4 Definition of the Reference Group

One practical issue pertains to the construction of the reference group. It is well understood by social psychologists that individuals strategically choose their comparison targets (e.g., Buunk and Gibbons, 1997). They could, for example, intentionally seek contact with better-off or worse-off individuals to gain valuable information and to increase well-being, respectively. Thus, specific characteristics of the individual (for example health status or ability) likely determine the affective consequences of social comparisons, and with whom it compares. From an economic perspective, this creates a problem of endogeneity (e.g., Falk and Knell, 2004). There is no information in the general SOEP questionnaire on the respondents' relevant reference groups and comparison standards, and we assume that the reference group is exogenously given. If such information were available, and the choice of the reference standard is endogenous, we would need an instrumental variable that creates external variation in the level of reference-group health but is unrelated to individual health satisfaction. However, if the actual reference standard is not endogenous, we most likely measure the respondents' reference group with error. Therefore, our estimates are attenuated towards zero and represent a lower bound of the effect of reference-group illness on individual health satisfaction.

In this paper, each individual's reference group is characterized by a combination of attributes imposed by the researcher. We assume that the respondents compare their health with people of the same sex, the same age, and living in the same region. We construct seven age groups (< 25 , $25 - 34$, $35 - 44$, $45 - 54$, $55 - 64$, $65 - 74$, > 75), four education groups (*dropout/basic track*, *intermediate track*, *academic track*, *other*), and 16 regional groups

¹¹The dummy variable equals one in case the respondent had lived in East Germany in 1989.

based on states (“Bundesländer”). The focus of the analysis at hand is on contemporaneous, inter-personal health comparisons. Hence, the reference groups are created on an annual basis. After adjusting for missing values and dropping groups that consist of only one individual, we end up with 4001 different reference groups. The number of individuals in these groups ranges from 2 to 207.

3.2 Estimation Method

The starting point for the empirical analysis is the following latent variable specification of health satisfaction (HS) :

$$HS_{it}^* = \alpha S_{it} + \delta' X_{it} + u_i + \varepsilon_{it}, \quad (6)$$

where HS_{it}^* is the latent health satisfaction of individual i in year t , S_{it} is the illness index of individual i at time t , and X_{it} includes the control variables. Furthermore, u_i and ε_{it} capture unobserved factors that are time-invariant and time-varying, respectively. Equation (6) excludes the relative-health variables and represents a benchmark model for the effect of the respondents’ own illness on health satisfaction. We expect that health satisfaction falls with the extent of the individual’s sickness, such that the coefficient α is negative.

To test whether the level of reference-group illness has an independent effect on health satisfaction, the following extension of Equation (6) is estimated:

$$HS_{it}^* = \alpha S_{it} + \beta S_{rt} + \delta' X_{it} + u_i + \varepsilon_{it}. \quad (7)$$

Equation (7) includes the average illness index of individual i ’s reference group r in year t (S_{rt}). As discussed above, we expect that the coefficient β is positive, and that the status effect of relative health increases health satisfaction. Alternatively, we could include the difference between the respondent’s illness index and the reference-group illness index as an explanatory variable:

$$HS_{it}^* = \alpha S_{it} + \beta(S_{it} - S_{rt}) + \delta' X_{it} + u_i + \varepsilon_{it}. \quad (8)$$

If positional and status concerns are the relevant mechanism, we would expect that the coefficient β using this specification is negative.¹² This implies that individuals are less satisfied with their health when their health status deteriorates relative to the level of reference-group health, irrespective of whether they are healthier or sicker. As previously

¹²Note that this specification implies that $HS_{it}^* = (\alpha + \beta)S_{it} - \beta S_{rt} + \delta' X_{it} + u_i + \varepsilon_{it}$.

argued, however, we assume the the comparison-effect is the same for both healthier and sicker individuals.

The empirical counterpart of Equation (2) reads as follows:

$$HS_{it}^* = \alpha S_{it} + \beta S_{rt} + \gamma S_{it} \times S_{rt} + \delta' X_{it} + u_i + \varepsilon_{it}. \quad (9)$$

Equation (9) empirically assesses social health-norm effects by including the (average) reference-group illness index S_{rt} and an interaction term between S_{it} and S_{rt} . It is expected that the coefficient on the interaction term, γ , is positive.¹³ This means that, in accordance with social-norms theory, an increase in the reference-group illness index S_{rt} *ceterus paribus* reduces the adverse well-being effects of one's own illness S_{it} .

Finally, a third specification examines the role of upward and downward comparisons for health perceptions in the following way:

$$HS_{it}^* = \alpha S_{it} + \underbrace{\zeta \max\{S_{it} - S_{rt}, 0\}}_{\text{upward}} + \underbrace{\eta \max\{S_{rt} - S_{it}, 0\}}_{\text{downward}} + \delta' X_{it} + u_i + \varepsilon_{it}. \quad (10)$$

In fact, the sample is divided into individuals who are sicker than their reference group on the one hand and who are healthier on the other hand, and we assess how the distance between individual health and the level reference-group health influences the respondent's health satisfaction. From a theoretical perspective, the signs of the coefficients ζ and η and hence the effects of upward and downward comparisons are ambiguous. If the respondents dislike health inequalities, we would expect that both ζ and η are significant and negative. If, however, the focus is on the beneficial aspects of upward and downward comparisons and coping with illness, the coefficients ζ and β are positive. It is also conceivable that upward comparisons are detrimental and downward comparisons beneficial for health perception, implying that ζ is negative and η is positive. In the latter case, loss aversion in relative-health comparisons requires ζ to be greater than η in absolute terms.¹⁴

The latent variable HS_{it}^* is not directly observed, but rather the range in which it falls (Greene and Hensher, 2010):

$$HS_{it} = J \text{ if } \mu_{J-1} < HS_{it}^* \leq \mu_J, \quad (11)$$

where μ_J is the J th cut-off point or threshold parameter for the J different categories of the health satisfaction variable.

¹³In more technical terms, this means that the cross-partial derivative of Equation (9) with respect to S_{it} and S_{rt} is positive.

¹⁴In an extreme case, the coefficient ζ is negative and significant, while η is statistically insignificant.

The ordinal nature of the dependent variable requires the application of an ordered response model. This could cause various problems when it comes to the estimation of interaction effects.¹⁵ Compared to linear regression models, the interpretation of interaction effects is rather cumbersome in non-linear models such as logit or probit. As shown by [Ai and Norton \(2003\)](#) for binary outcomes and [Mallick \(2009\)](#) for ordered responses, the interaction effect is possibly dissimilar to the marginal effect of the interaction term. Since the marginal effect of the interaction term, they argue, hinges on the values of independent variables and individual coefficients, most interaction effects in non-linear regression models are therefore incorrectly interpreted.

To overcome these problems, we use the so-called probit-adapted ordinary least squares (POLS) approach by [Van Praag and Ferrer-i-Carbonell \(2008\)](#). The ordinal dependent variable is thus roughly cardinalized, by calculating the conditional expectation based on a standard normal distribution:

$$HS_{it}^c = E(HS_{it}^* | \mu_{J-1} < HS_{it}^* \leq \mu_J) = \frac{\phi(\mu_{J_{z-1}}) - \phi(\mu_{J_z})}{\Phi(\mu_{J_z}) - \Phi(\mu_{J_{z-1}})}, \quad (12)$$

where HS_{it}^c is the cardinalized health satisfaction variable, Φ is the standard normal cumulative distribution, and ϕ is the density function of the standard normal distribution. The cut-off points μ_{J_z} are retrieved by calculating the z -values of the cumulative frequencies that correspond to each value of the ordinal satisfaction-with-health scale. This procedure leads to a health-satisfaction variable that is no longer bound between 0 and 10, but ranges from -2.596 to 1.938. Table (3) illustrates how the ordinal satisfaction-with-health scale HS_{it} translates into the “quasi-cardinal” health satisfaction score HS_{it}^c .

[Table (3) about here]

We replace HS_{it} by the transformed variable HS_{it}^c in the specifications presented above, enabling us to use linear panel-data methods. The coefficients on explanatory variables are thus directly comparable with the results of an ordered probit model except for a multiplication factor. Moreover, since the transformed dependent variable is approximately standard normal, the estimated coefficients on the individual and reference-group illness measures can be interpreted as standard-deviation changes in the predicted “quasi-cardinal” health satisfaction score.

A random-effects (RE) model is used to estimate the empirical health satisfaction functions. A potential drawback of RE models is the assumption that the unobserved heterogeneity is uncorrelated with included variables. Nevertheless, it is quite conceivable that

¹⁵Computational problems associated with the estimation of ordered response models are extensively discussed in [Greene and Hensher \(2010\)](#).

unobserved individual differences that do not vary over time, such as genetics or personality traits, are responsible for the significant relationship between the explanatory variables and health satisfaction. Therefore, we follow [Mundlak \(1978\)](#) and allow for some correlation between unobserved factors and regressors by extending the regression equations with the individual panel-level averages of all time-varying variables (Mundlak terms). The individual effects u_i are thus modeled as a linear projection on the individual-specific averages of time-varying variables. Thus, the effect of individual and reference-group illness is identified under the assumption that there is no time-varying unobserved heterogeneity. What is more, the effects of time-invariant regressors represent between-individual variations and are identified under the assumption that they are uncorrelated with the individual effects.

According to the Mundlak approach, the distinction between FE and RE models is often unnecessary. In case the RE model is correctly specified, the RE estimator is always identical to the FE estimator. It is therefore important to examine whether the individual effects are orthogonal to the included time-varying regressors, which can be achieved by testing the joint significance of the Mundlak terms with a simple two-sided Wald test. This procedure is equivalent to a Hausman test, where a rejection of the null hypothesis indicates that the individual effects are related to time-variant explanatory variables ([Hsiao, 2003](#), pp. 49). The Mundlak terms are not simultaneously equal to zero in all our models, and should therefore be included.

With the Mundlak-adjusted RE model we are also able to introduce a dynamic component for the effects of one's own and other people's illness on health satisfaction. Following the decomposition method proposed by [Van Praag et al. \(2003\)](#), one can distinguish between short- and long-run effects in the following way:

$$\theta h_{it} + \kappa \bar{h}_i = \theta(h_{it} - \bar{h}_i) + (\kappa + \theta)\bar{h}_i \quad (13)$$

where h_{it} refers to the illness indicators of individual i in year t as discussed above, and \bar{h}_i represents the time-series average of h_{it} . The coefficient θ measures the impact of the within-individual effects of the respondent's and other individuals' health status and the deviations from the individual-specific averages, respectively. Furthermore, κ is an estimate of between-individual effects, or differences across individuals. The short-run effect is now calculated as θ and can be interpreted as the *transitory* or *shock* effect, while $(\kappa + \theta)$ identifies the *permanent* or long-run effect.

This approach seems appropriate for our purposes since changes in individual health conditions over time as well as health-related differences between respondents can be expected. What is more, previous research suggests that people adapt to specific life events, like the occurrence of a disease (e.g., [Oswald and Powdthavee, 2008](#)). Hence, separating transitory

from permanent effects makes it possible to isolate short-term effects of illnesses that are free from these psychological adjustments. Nevertheless, the between-effects part of the econometric model relies on cross-sectional information using the individual time-averages of the explanatory variables. It is therefore conceivable that omitted or unobserved variables could bias the impact of the mean values on health satisfaction.

4 Results

Own illness index and health satisfaction Table (4) shows the regression results of the benchmark model, for the total sample and broken down by sex. There is a significant (at the 99 percent level) and negative relationship between own physical illness and health satisfaction. In the total sample, a one standard deviation increase of the individual’s illness index decreases the “quasi-cardinal” health-satisfaction score by 0.468 standard deviations in absolute terms. A temporary worsening of the physical condition is thus associated with lower individual health perception. The same general pattern is observed in the male and female samples. If the illness index rises by one standard deviation, health satisfaction reduces by 0.475 standard deviations for men and 0.462 standard deviations for women, respectively.

We also find a negative, permanent effect of own illness on health satisfaction, which outweighs the transitory component of own illness. In aggregate, the permanent (negative) impact of own illness amounts to 0.728 ($0.468 + 0.260$). The estimates for men and women are quantitatively similar (men: 0.738, women: 0.720). The results on the permanent effects of physical illness are all significant at a 99 percent level.

[Table (4) about here]

Reference group illness and health satisfaction Table (5) reports the results for the level of reference-group illness, sub-divided by sex. We focus the discussion on the estimates based on Equation (7). The regression results including the distance between the individual illness index and the reference-group illness index (Equation (8)) provide substantially similar results and can be found in the appendix (Table (A.2)).

The estimates on the individual’s illness index are unaffected by the inclusion of the average illness index of the reference group. The coefficient on reference-group illness is positive but insignificant in all models, suggesting that a transitory shock in the level of reference-group health does not influence individual health satisfaction. In other words, satisfaction with health is unrelated to *within*-individual changes of other people’s health

over time, holding the individual’s illness index constant. Nevertheless, we find significant permanent effects of the average illness level in the respondent’s reference group. That is, differences *between* individuals with respect to reference-group illness are psychologically relevant. Holding all other factors constant, belonging to a reference group whose average illness is one standard deviation above that of other reference groups raises health satisfaction by 0.022 standard deviations. However, this result is only significant at the 90 percent level and unobserved individual differences could influence the magnitude and direction of the between effects.

Our results are therefore generally consistent with the notion that relative or positional concerns are rather less important than absolute performance in the context of health, at least in the short run. The within-estimates on the individual’s illness index and the reference-group illness index mirror the results of the discrete choice experiments on positional concerns discussed above. They suggest that individuals tend to prefer an absolute advantage over a relative advantage in the health domain. Furthermore, recent empirical research on social interactions in physical fitness tend to support the conjecture that transitory changes in the level of reference-group health are rather unrelated to subjective well-being. For example, [Blanchflower et al. \(2009\)](#) find that the level of reference-group BMI is unrelated to happiness in fixed-effects models.

[Table (5) about here]

Social health norms and health satisfaction Before discussing the regression results with respect to the social health-norm effects, it is useful to first take a look at the health satisfaction differential between healthy and sick people (see also [Powdthavee, 2009](#)). According to the theory of social norms, this gap should decline as the degree of morbidity in the reference group increases. Figure (2) graphs the difference in health-satisfaction scores between people in the lowest and the highest quintile of the illness index by quintiles of the average illness index (of the reference group). It shows that the health satisfaction gap between healthy and unhealthy people generally declines with the illness of the reference group. This is a descriptive result and should be interpreted cautiously because the effect is potentially biased by individual background characteristics.

[Figure (2) about here]

Whether the depicted relationship still exists once we control for observable and unobservable factors, can be inferred from Table (6). It displays the results from Mundlak-adjusted RE models including a product term between the standardized illness index and

the reference-group illness index, in addition to the main variables. The coefficient on the individual illness index now reflects the partial effect of individual sickness of a person who belongs to an average reference group in terms of morbidity, which is similar to the estimates of the benchmark model. The estimate for the reference group illness index measures the partial effect of other individuals' illness on health satisfaction for a person with an average level of health, and is still insignificant. Yet, the coefficient on the interaction term equals 0.0416 and is significant at the 99 percent level. The estimates in the male and the female sample are quantitatively similar (0.0409 vs. 0.0414). Thus, the adverse effect of own illness is attenuated when the level of reference-group health worsens, or the norm to be healthy weakens. The soothing impact of other people's health problems on health perception, however, seems to be rather short-lived, as it reflects only within-individual variations. In addition, the negative coefficient on the mean of the interaction term in the female sample suggests that the level effect of weaker social health standards can be lower than the transitory impact. Notwithstanding, it is only significant at the 10 percent level and omitted variables could bias the estimated differences across women.

[Table (6) about here]

We therefore focus on the within-effect, which is illustrated in Figure (3).¹⁶ It shows how the predicted health satisfaction score evolves for people in good and in poor health (low versus high illness index) with the average illness index of the reference group.¹⁷ The left panel of Figure (3) reveals that the health satisfaction of people with a poor physical health condition increases as the level of reference-group illness rises. A one standard deviation increase of the reference-group illness index evaluated at the mean of reference-group morbidity raises individual health satisfaction by approximately 7.5 percent. The right panel of Figure (3) indicates that healthy individuals are less satisfied with their health when the level of reference-group illness increases. Hence, as the respondent's reference group becomes sicker, the health-satisfaction gap between healthy and unhealthy individuals diminishes.

[Figure (3) about here]

These results are generally consistent with the social health-norms hypothesis, which suggests that weaker social health standards within a community can reduce the adverse well-being effects of one's own ailments. The health-norm effect is however rather small in

¹⁶The following discussion refers to the total sample. We obtain quantitatively similar results for men and women. The results are available upon request from the author.

¹⁷It is also conceivable to interpret Figure (3) in terms of a counterfactual analysis. It shows the predicted health-satisfaction scores for an average individual in good or poor health if it would belong to different reference groups.

magnitude as the corresponding reduction in the health-satisfaction gap between healthy and sick individuals approximately amounts to 8.8 percent for a representative person. Moreover, it appears that the psychological benefits of higher reference-group illness are only transitory, owing to little between-variation in the effect of reference-group illness on the association between individual health problems and health satisfaction. The affective consequences of individual-specific illness may dominate the health-norm effects of other people’s health status in the long run. As argued by [Powdthavee \(2009\)](#), individuals that are living together with others who have similar health problems could benefit directly from technical devices and disease management programs that assist in managing the condition. This could explain why a worsening of other people’s health has long-run psychological implications at the household level, but not in more aggregated reference groups.

Upward and downward health comparisons Table (7) reports the results for upward and downward health comparisons. It shows that transitory changes in upward comparisons (*sicker*) are related to changes in individual health satisfaction. A standard deviation increase, or a negative shock, in the difference between the respondent’s illness index and the reference-group illness index lowers individual health satisfaction by 0.0122 standard deviations. This effect is however mainly attributable to within-variations among females.

A different picture emerges for the between or level effects of upward (*sicker*) and downward comparisons (*healthier*) on health satisfaction. Those individuals who are more deprived in terms of their physical health display higher health satisfaction scores than the less deprived. In fact, the level effect of upward comparisons is positive in the aggregate sample ($-0.0122 + 0.0442 = 0.0320$), and in the male (0.0502) and female ($-0.0207 + 0.0340 = 0.0133$) sub-samples. With respect to the level effect of downward comparisons, we find significant (at the 99 percent level) and positive results. Those who are healthier than their reference group across all waves thus exhibit higher health satisfaction levels. Positive level effects of downward comparisons are found in the total and the sub-samples (total: 0.0628, men: 0.0539, women: 0.0680).

The between effects of upward and downward comparisons are assumed to be independent of individual effects. Yet, it could well be that the different social-comparison effects across individuals are linked to personality traits (e.g., [Van der Zee et al., 1998](#)). It is therefore likely that the between estimates are biased due to the existence of omitted or unobserved variables.

[Table (7) about here]

How do these results compare to previous findings and theoretical predictions? First, the within-individual estimates suggest that the comparison-effect is not the same for all

individuals. It appears to be important whether the individual is healthier or sicker than the reference-group. To be more precise, there is some evidence that upward and downward comparisons are asymmetric and that individuals are loss averse in social health comparisons, respectively. On the one hand, sicker individuals suffer from deteriorations of their physical health status relative to that of their peers. On the other hand, healthier respondents do not benefit in terms of higher health-satisfaction levels from improvements of their health relative to the reference-group. It could therefore be argued that health losses are psychologically more relevant than health gains of the same amount. Second, the between-individual estimates mirror the cornerstones of social psychological coping models that take relative comparisons as the main mechanism into account (Taylor et al., 1989). It seems that the individuals in our estimation sample rather focus on the positive aspects of social comparisons, and derive utility from both being healthier or sicker than similar others. As discussed above, upward comparisons may assist in problem-solving issues, whereas downward comparisons serve to regulate emotions. These factors can account for the positive association between social comparisons and health satisfaction.

5 Robustness Checks

5.1 Random-effects ordered probit models

To test the robustness of the results and the reliability of the POLS approach, we also estimated random-effects ordered-probit models. While relying on the same identifying assumptions, these models explicitly take the ordinal nature of the dependent variable into account. The ordered-probit estimates are not directly comparable to the POLS parameters, since the former represent changes in the underlying continuous latent index of the ordinal health-satisfaction scale and the latter variations in the transformed, “quasi-cardinal” health-satisfaction variable. It is nevertheless possible to assess whether the different estimation strategies provide qualitatively similar results.

Table (8) shows the estimation results using the random-effects ordered-probit model. It displays the within and between effects of the main explanatory variables for the models assessing the independent effect of the respondent’s illness (panel A), the level of reference-group illness (panel B), social health norms (panel C), and upward and downward health comparisons (panel D). The parameter estimates suggest that both the POLS approach and the ordered-probit model provide qualitatively similar results and that the effects, as argued by Van Praag and Ferrer-i-Carbonell (2008), are the same except for a multiplication factor.

[Table (8) about here]

5.2 Including labor force status in the reference group

To further assess the credibility of the relative-comparisons effects, we applied a refined definition of the respondent’s reference group. As already argued, individuals seek comparisons with similar others to evaluate their abilities. In the context of the present study, the subjective value or utility of individual health may depend on the labor market advantages and opportunities due to better relative health, as for example argued by [Mujcic and Frijters \(2013\)](#). It thus seems reasonable to assume that individuals compare their health status to others who share the same labor force status. We therefore also defined the reference-group by employment status (employed, unemployed, or not employed). Thus we assume that men and women compare their health status to other men or women of similar age, with the same educational level and labor force status, living in the same region in a given year.

Table (9) shows the random-effect estimates when the reference group is also defined according to labor force status. The results are qualitatively and quantitatively similar to the estimates obtained in Section (4).

[Table (9) about here]

6 Conclusion

Using panel data from the SOEP, this paper examines the role of relative-health comparisons for individual health satisfaction. We assume that individuals compare their health to others who are similar in terms of age, sex, education and location. Our findings suggest that positional concerns are rather unimportant in the health domain. While temporary changes in the level of reference-group illness are unrelated to individual health satisfaction, we find only weak support for the conjecture that belonging to a sicker reference group provides important status effects and improves health perceptions. Furthermore, the negative effect of own illness on health satisfaction diminishes as the average level of reference-group morbidity rises. This shows that subjective health evaluations are possibly affected by social health-norm effects. The soothing impact of other people’s health problems, however, is only short-lived and tends to diminish in the long run. We also find some asymmetry regarding the health-satisfaction effects of upward and downward comparisons. While becoming sicker than the reference group worsen individual health satisfaction, particularly among women, improvements with respect to the reference group are unrelated to health-satisfaction scores. Furthermore, the between-individual estimates suggest that upward and downward health comparisons are generally beneficial for health perception. These results underpin the assumption that social comparisons, be they upwards or downwards, are a suitable device to

cope with physical ailments. However, the between-effects might be confounded by unobserved time-variant and -invariant variables.

The following policy implications are based on the within-individual estimates, as they are presumably more reliable than the between-individual or level effects. The theory of social norms and our respective empirical results suggest that higher social health standards strengthen the negative impact of one's own illness on health satisfaction. Health promotion and communication programs that also convey certain health standards can therefore have negative psychological effects among particularly disadvantaged individuals, that are generally not able to keep up with the standard. Such policies would hence require accompanying measures to address the barriers to health improvements among this part of the population.

Both the results regarding social-health norms and upward-comparison effects furthermore indicate that health inequalities should be reduced. The implications for health policy are however ambiguous, depending on whether one adopts a welfarist or extra-welfarist perspective (for a review, see [Hurley, 2000](#)). From a welfarist perspective, measures aimed at improving the medical condition of some parts of the population are not necessarily Pareto improving. First, higher levels of reference-group health worsen individual health satisfaction, holding own health status constant. Second, improving levels of reference-group health or social health standards may reinforce the negative well-being effects of physical ailments. Hence, it appears that it is impossible to improve the health status of some people without making others psychologically worse-off. From an extra-welfarist perspective, however, public health programs should be evaluated according to their impact on population health rather than subjective well-being or utility. Thus, improving the health status of some people is beneficial since it *ceterus paribus* increases average population health.

The findings and implications are nevertheless subject to a number of limitations. First, we do not observe the true reference standard or comparison group of the individual. We rather impose an exogenous reference group based on demographic and socioeconomic characteristics. This is largely because there is no subjective information in the general SOEP questionnaire on the relevant reference group, perceived relative standing, or the intensity of social comparisons. As discussed above, using respondents' information on social comparisons can create endogeneity problems. However, the standard approach in the economic social-comparison literature of exogenously defining the reference group and the comparison standard is prone to measurement error. It would therefore be useful to estimate the effect of social health comparisons on health perception using both reference groups defined by the researcher and the respondent to check the sensitivity of the results to endogenous reference groups.

Second, while we take the effects of unobserved time-invariant factors into account, we

cannot rule out that there are other unobserved time-varying variables that are correlated with social comparisons. Future research should therefore attempt to create plausibly exogenous variation in the level of reference-group health to eliminate the remaining correlation of included variables and unobserved factors. This consists of finding an instrumental variable that is correlated with the level of reference-group health and unrelated to individual health perception.

Third, the illness index employed in this paper is still self-reported and thus vulnerable to reporting heterogeneity. For instance, [Ziebarth \(2010\)](#) finds evidence that there is substantial income-related heterogeneity in generic health measures like SF-12. Future research should therefore opt for health measures that are more reliable.

Fourth, as already discussed in the section on positional concerns in the context of health, the health status of peers can influence the individual's success on labor and marriage markets. These potential relationships are beyond the scope of this paper and future studies could investigate whether an association of social-health comparisons with the individual's employment situation, wages, or family status exists.

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Tables and Figures

Table 1: Summary of Hypotheses

Hypothesis	Effect on HS	Mechanism
Social status	+	Psychological rewards due to heightened self-esteem (e.g. Wunder, 2009) Tangible benefits on labor and marriage markets due to better relative health (e.g. Currie and Madrian, 1999 ; Hamermesh and Biddle, 1994 ; Wilson, 2002) Positional externalities that impose psychological and monetary costs on sick individuals (Frank, 2008)
Social health norms	+	Higher levels of reference-group illness or weaker social health standards reduce adverse psychological impact of health problems Psychological cost of illness (reputation loss) lower when the share of healthy people in the reference group decreases (Akerlof, 1980 ; Powdthavee, 2009)
Upward comparisons	–	Relative deprivation; lower self-esteem, shame, regret (e.g. Yitzhaki, 1979)
	+	Coping with illness; problem-solving; information effect (e.g. Buunk et al., 1990 ; Wood and VanderZee, 1997)
Downward comparisons	+	Relative satisfaction, higher social status, heightened self-esteem (e.g. Wunder, 2009 ; Yitzhaki, 1979); regulation of emotions (Wills, 1981)
	–	Sympathy, altruism; other people’s poor health status could act as a negative externality

Table 2: Summary of variables

Variable	Mean	Std. Dev.	Min.	Max.	N
Health satisfaction	6.535	2.195	0	10	101,001
Own illness index (S_i)	0	1	-2.867	3.866	101,001
Ref.-group illness index (S_r)	0	1	-3.626	5.362	101,001
Sicker (S_i^W)	0	1	-0.603	7.202	101,001
Healthier (S_i^B)	0	1	-0.771	6.954	101,001
ln(age)	3.863	0.36	2.833	4.625	101,001
ln(age) ²	15.055	2.713	8.027	21.39	101,001
Female	0.52	0.5	0	1	101,001
ln(income)	9.874	0.484	7.943	11.824	101,001
ln(years of education)	2.483	0.209	1.946	2.89	101,001
ln(adults)	0.694	0.385	0	2.197	101,001
ln(children + 1)	0.267	0.446	0	2.303	101,001
Employed	0.573	0.495	0	1	101,001
Not employed	0.366	0.482	0	1	101,001
Unemployed	0.061	0.239	0	1	101,001
Married	0.636	0.481	0	1	101,001
Single	0.198	0.399	0	1	101,001
Widowed	0.07	0.256	0	1	101,001
Divorced	0.078	0.268	0	1	101,001
Separated	0.017	0.13	0	1	101,001
East-German	0.282	0.45	0	1	101,001
Non-German	0.068	0.252	0	1	101,001

Table 3: Comparison of ordinal health satisfaction scale with “cardinalized” health satisfaction measure

Health satisfaction (ordinal)	Health satisfaction (cardinal)	N	Percent
0	-2.591912	1,195	1.18
1	-2.099142	1,179	1.17
2	-1.772578	3,076	3.05
3	-1.41041	5,467	5.41
4	-1.099852	6,155	6.09
5	-0.7290664	14,151	14.01
6	-0.3697686	10,910	10.80
7	-0.00764	18,107	17.93
8	0.5463133	24,051	23.81
9	1.185393	10,825	10.72
10	1.951825	5,885	5.83
Total		101,001	100

Table 4: Random-effects regressions of health satisfaction on own illness index with Mundlak extension

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Own illness index (S_i)	-0.468*** (0.00461)	-0.475*** (0.00679)	-0.462*** (0.00627)
Mean(S_i)	-0.260*** (0.00677)	-0.263*** (0.0101)	-0.258*** (0.00917)
P-value Mundlak terms	< 0.05	< 0.05	< 0.05
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. Dependent variable is measured using the “quasi-cardinal” measure of health satisfaction ranging from -2.59 to 1.95. Illness index measured using its z-standardized version with zero mean and standard deviation of one. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

Table 5: Random-effects regressions of health satisfaction on own illness and reference-group illness index with Mundlak extension

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Own illness index (S_i)	-0.468*** (0.00461)	-0.475*** (0.00679)	-0.462*** (0.00628)
Ref. group illness index (S_r)	0.00428 (0.00650)	0.000285 (0.00920)	0.00730 (0.00917)
Mean(S_i)	-0.261*** (0.00678)	-0.263*** (0.0101)	-0.259*** (0.00919)
Mean(S_r)	0.0220* (0.0122)	0.0138 (0.0180)	0.0260 (0.0169)
P-value Mundlak terms	< 0.05	< 0.05	< 0.05
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. Dependent variable is measured using the “quasi-cardinal” measure of health satisfaction ranging from -2.59 to 1.95. Own illness index and reference-group illness index measured using their z -standardized versions with zero mean and standard deviation of one. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

Table 6: Random-effects regressions of health satisfaction on own illness, reference-group illness index, and health norms with Mundlak extension

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Own illness index (S_i)	-0.472*** (0.00461)	-0.477*** (0.00676)	-0.469*** (0.00632)
Ref. group illness index (S_r)	-0.00241 (0.00654)	-0.00274 (0.00924)	-0.00264 (0.00927)
$S_i \times S_r$	0.0416*** (0.00398)	0.0409*** (0.00600)	0.0414*** (0.00535)
Mean(S_i)	-0.266*** (0.00690)	-0.270*** (0.0101)	-0.263*** (0.00948)
Mean(S_r)	0.0186 (0.0124)	0.00716 (0.0180)	0.0259 (0.0172)
Mean($S_i \times S_r$)	-0.00919 (0.00611)	0.00233 (0.00962)	-0.0138* (0.00813)
P-value Mundlak terms	< 0.05	< 0.05	< 0.05
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. Dependent variable is measured using the “quasi-cardinal” measure of health satisfaction ranging from -2.59 to 1.95. Own illness index and reference-group illness index measured using their standardized versions with zero mean and standard deviation of one. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

Table 7: Random-effects regressions of health satisfaction on upward and downward health comparisons with Mundlak extension

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Own illness index (S_i)	-0.457*** (0.0124)	-0.476*** (0.0177)	-0.443*** (0.0173)
Sicker (S_i^W)	-0.0122* (0.00742)	0.00106 (0.0106)	-0.0223** (0.0104)
Healthier (S_i^B)	-0.00162 (0.00554)	0.00102 (0.00785)	-0.00408 (0.00780)
Mean(S_i)	-0.250*** (0.0224)	-0.270*** (0.0333)	-0.238*** (0.0308)
Mean(S_i^W)	0.0442*** (0.0139)	0.0502** (0.0207)	0.0419** (0.0190)
Mean(S_i^B)	0.0628*** (0.0106)	0.0539*** (0.0155)	0.0680*** (0.0148)
P-value Mundlak terms	< 0.05	< 0.05	< 0.05
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. Dependent variable is measured using the “quasi-cardinal” measure of health satisfaction ranging from -2.59 to 1.95. The variables “own illness index”, “sicker” and “healthier” index are measured using their z -standardized versions with zero mean and standard deviation of one. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

Table 8: Random-effects ordered probit results

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Panel A: Illness			
Own illness index (S_i)	-0.836*** (0.00862)	-0.865*** (0.0130)	-0.812*** (0.0115)
Mean(S_i)	-0.250*** (0.0224)	-0.270*** (0.0333)	-0.238*** (0.0308)
Panel B: Reference-group illness index			
Own illness index (S_i)	-0.836*** (0.00862)	-0.865*** (0.0130)	-0.812*** (0.0115)
Ref.-group illness index (S_r)	0.00711 (0.0116)	-0.000176 (0.0167)	0.0126 (0.0161)
Mean(S_i)	-0.470*** (0.0125)	-0.484*** (0.0188)	-0.460*** (0.0166)
Mean(S_r)	0.0393* (0.0218)	0.0263 (0.0326)	0.0436 (0.0297)
Panel C: Social health norms			
Own illness index (S_i)	-0.845*** (0.00864)	-0.869*** (0.0129)	-0.825*** (0.0116)
Ref.-group illness index (S_r)	-0.00653 (0.0117)	-0.00753 (0.0168)	-0.00617 (0.0163)
$S_i \times S_r$	0.0746*** (0.00712)	0.0759*** (0.0109)	0.0718*** (0.00944)
Mean(S_i)	-0.479*** (0.0127)	-0.497*** (0.0189)	-0.465*** (0.0171)
Mean(S_r)	0.0345 (0.0221)	0.0147 (0.0326)	0.0455 (0.0303)
Mean($S_i \times S_r$)	-0.0169 (0.0110)	0.00548 (0.0176)	-0.0266* (0.0145)
Panel D: Upward and downward health comparisons			
Own illness index (S_i)	-0.817*** (0.0221)	-0.867*** (0.0323)	-0.778*** (0.0304)
Sicker (S_i^W)	-0.0232* (0.0133)	0.00398 (0.0193)	-0.0433** (0.0183)
Healthier (S_i^B)	-0.00476 (0.00990)	0.00228 (0.0143)	-0.0107 (0.0137)
Mean(S_i)	-0.448*** (0.0401)	-0.492*** (0.0604)	-0.424*** (0.0545)
Mean(S_i^W)	0.0758*** (0.0249)	0.0884** (0.0375)	0.0717** (0.0336)
Mean(S_i^B)	0.111*** (0.0190)	0.0987*** (0.0281)	0.116*** (0.0260)
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. The dependent variable is measured using the ordinal measure of health satisfaction ranging from 0 to 10. All illness indices are measured using their z -standardized versions with zero mean and standard deviation of one. Mundlak terms are jointly significant. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

Table 9: Random-effects regressions including employment status in the reference group

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Panel A: Illness			
Own illness index (S_i)	-0.467*** (0.00465)	-0.474*** (0.00683)	-0.461*** (0.00635)
Mean(S_i)	-0.259*** (0.00682)	-0.264*** (0.0101)	-0.256*** (0.00926)
Panel B: Reference-group illness index			
Own illness index (S_i)	-0.467*** (0.00465)	-0.474*** (0.00683)	-0.461*** (0.00636)
Ref.-group illness index (S_r)	0.00465 (0.00511)	0.00155 (0.00736)	0.00699 (0.00709)
Mean(S_i)	-0.260*** (0.00686)	-0.264*** (0.0102)	-0.257*** (0.00930)
Mean(S_r)	0.00509 (0.0105)	-0.00110 (0.0157)	0.00959 (0.0144)
Panel C: Social health norms			
Own illness index (S_i)	-0.471*** (0.00466)	-0.476*** (0.00682)	-0.466*** (0.00641)
Ref.-group illness index (S_r)	-0.000431 (0.00517)	-0.00283 (0.00744)	0.00143 (0.00719)
$S_i \times S_r$	0.0304*** (0.00366)	0.0280*** (0.00542)	0.0316*** (0.00498)
Mean(S_i)	-0.266*** (0.00702)	-0.273*** (0.0103)	-0.261*** (0.00964)
Mean(S_r)	-0.0000425 (0.0107)	-0.00796 (0.0158)	0.00685 (0.0147)
Mean($S_i \times S_r$)	0.00201 (0.00590)	0.0182** (0.00911)	-0.00671 (0.00793)
Panel D: Upward and downward health comparisons			
Own illness index (S_i)	-0.457*** (0.00953)	-0.474*** (0.0138)	-0.444*** (0.0132)
Sicker (S_i^W)	-0.0101* (0.00586)	0.00322 (0.00847)	-0.0205** (0.00812)
Healthier (S_i^B)	-0.000154 (0.00438)	0.00398 (0.00634)	-0.00379 (0.00604)
Mean(S_i)	-0.276*** (0.0181)	-0.289*** (0.0271)	-0.266*** (0.0246)
Mean(S_i^W)	0.0537*** (0.0118)	0.0498*** (0.0177)	0.0575*** (0.0160)
Mean(S_i^B)	0.0442*** (0.00921)	0.0318** (0.0135)	0.0538*** (0.0127)
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. The dependent variable is measured using the ordinal measure of health satisfaction ranging from 0 to 10. All illness indices are measured using their z -standardized versions with zero mean and standard deviation of one. Mundlak terms are jointly significant. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.

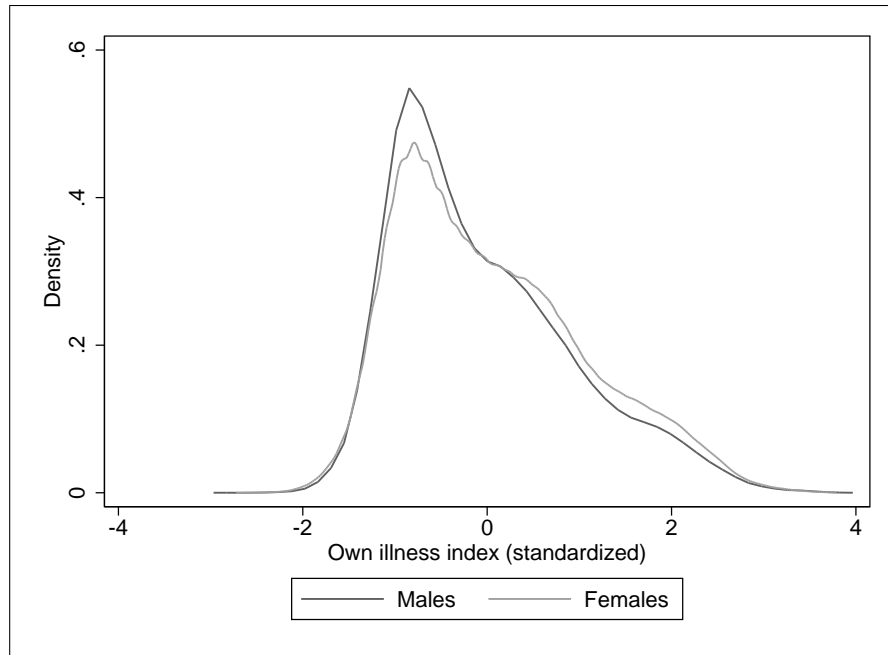


Figure 1: Distribution of the individual illness index by sex. Source: Own calculations based on SOEP 2002, 2004, 2006, 2008, 2010, 2012.

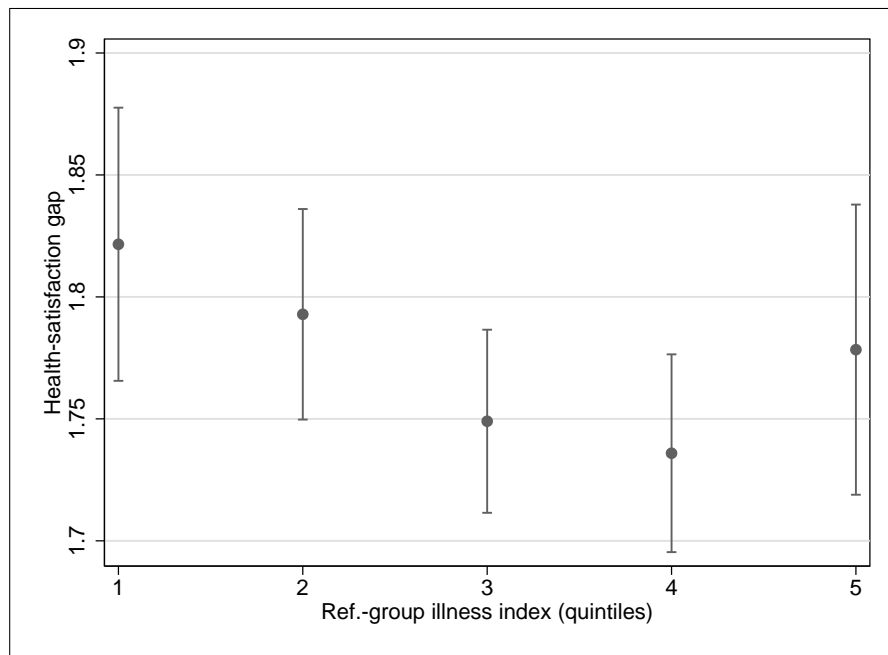


Figure 2: Health-satisfaction gap between healthy (first quintile of illness index) and sick (5th quintile of illness index) individuals by reference-group illness quintiles. Source: Own calculations based on SOEP 2002, 2004, 2006, 2008, 2010, 2012.

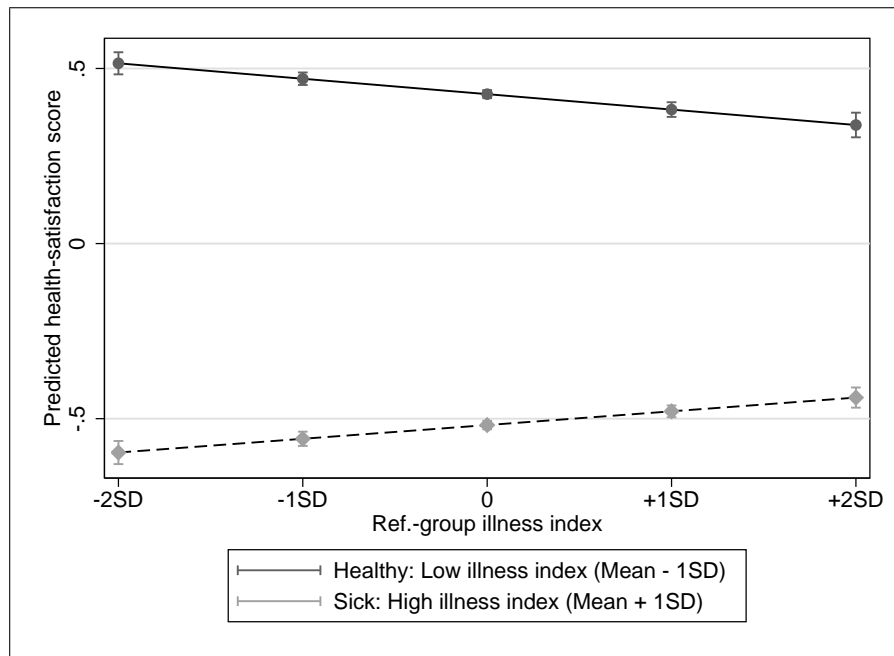


Figure 3: Predicted health-satisfaction score of a representative individual by average illness of other members in the reference group. Source: Own calculations based on SOEP 2002, 2004, 2006, 2008, 2010, 2012.

Appendix

Table A.1: Subscales of the physical component summary scale (*pcs*) in SOEP.

Subscale (# of items)	Response scale/Questionnaire wording
Physical functioning (2)	<i>Scale: 1 (greatly) to 3 (not at all)</i>
<i>State of health affects ascending stairs</i>	When you ascend stairs, i.e. go up several floors on foot: Does your state of health affect you greatly, slightly or not at all?
<i>State of health affects tiring tasks</i>	And what about having to cope with other tiring everyday tasks, i.e. when one has to lift something heavy or when one requires agility: Does your state of health affect you greatly, slightly or not at all?
Role physical (2)	<i>Scale: 1 (always) to 4 (never)</i>
	Please think about the last four weeks. How often did it occur within this period of time, that due to physical health problems ...
<i>Achieved less due to health last 4 weeks</i>	you achieved less than you wanted to at work or in everyday tasks?
<i>Limited due to health last 4 weeks</i>	you were limited in some form at work or in everyday tasks?
Bodily pain (1)	<i>Scale: 1 (always) to 4 (never)</i>
	Please think about the last four weeks. How often did it occur within this period of time, that due to physical health problems that you had strong physical pains?
General health (1)	<i>Scale: 1 (very good) to 5 (bad)</i>
	How would you describe your current health?
<i>Note:</i> The items on the physical component summary scale are included in waves 2002, 2004, 2006, 2008, 2010 and 2012 in SOEP.	

Table A.2: Random-effects regressions of health satisfaction on the distance between the individual illness index and the reference-group-illness index with Mundlak extension.

	(1)	(2)	(3)
	Total sample	Male sample	Female sample
Own illness index (S_i)	-0.461*** (0.0123)	-0.475*** (0.0175)	-0.449*** (0.0172)
$S_i - S_r$	-0.00653 (0.00992)	-0.000435 (0.0140)	-0.0111 (0.0140)
Mean(S_i)	-0.222*** (0.0223)	-0.239*** (0.0329)	-0.213*** (0.0307)
Mean($S_i - S_r$)	-0.0336* (0.0187)	-0.0211 (0.0275)	-0.0397 (0.0258)
P-value Mundlak terms	< 0.05	< 0.05	< 0.05
N	101,001	48,499	52,502

Note: Cluster-robust standard errors in parentheses. Significance denoted at the 10% (*), 5% (**), and the 1% (***) level. Dependent variable is measured using the “quasi-cardinal” measure of health satisfaction ranging from -2.59 to 1.95. Own illness index, the reference-group illness index and the distance between these two variables are measured using their z -standardized versions with zero mean and standard deviation of one. Further control variables include: age, sex, education, household size and composition, employment status, marital status, region and nationality.