Keeping up with the Schmidt's –
An Empirical Test of Relative Deprivation Theory
in the Neighbourhood Context

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Abstract

We test empirically whether people's life satisfaction depends on their relative income position in the neighbourhood, drawing on a unique dataset, the German Socioeconomic Panel Study (SOEP) matched with micro-marketing indicators of population characteristics. Relative deprivation theory suggests that individuals are happier the better their relative income position in the neighbourhood is. To test this theory we estimate micro-economic happiness models for the years 1994 and 1999 with controls for own income and for neighbourhood income at the zip-code level (roughly 9,000 people). There exist no negative and no statistically significant associations between neighbourhood income and life satisfaction, which refutes relative deprivation theory. If anything, we find *positive* associations between neighbourhood income and happiness in all cross-sectional models and this is robust to a number of robustness tests, including adding in more controls for neighbourhood quality, changing the outcome variable, and interacting neighbourhood income with indicators that proxy the extent to which individuals may be assumed to interact with their neighbours. We argue that the scale at which we measure neighbourhood characteristics may be too large still to identify the comparison effect sought after.

JEL Classifications: I31, C23, Z1

1. Introduction

Research in the field of happiness has shown that people are happier the more income they have, and that, more importantly, they care about how this income compares to that of others (Clark / Oswald, 1996; Easterlin, 1974; Frey / Stutzer, 2002; Layard, 2005). On the other hand, social scientists placed growing emphasis on geography as an explanatory factor for social inequalities between individuals (for literature reviews see, e.g., Dietz, 2002; Durlauf, 2003; Jencks / Mayer, 1990; Sampson / Morenoff / Gannon-Rowley, 2002). In this paper we integrate these two strands of research by an empirical investigation of whether levels of and changes in happiness depend on one's financial position within one's neighbourhood. We estimate micro-economic happiness

models with controls for the neighbourhood context and systematically test the neighbourhood effects theory of relative deprivation (see Buck, 2001; Dietz, 2002; Jencks / Mayer, 1990).

Neighbourhood effects research is flawed by econometric and conceptual challenges, which we address in as much as is feasible. Using very rich matched individual and neighbourhood level panel data for Germany the research makes controls for the endogeneity of the neighbourhood choice and for unobserved individual and neighbourhood level heterogeneity. Adding in variables that measure the distance to local public infrastructure does not only attenuate possible biases on the effect of neighbourhood income on happiness but it also provides empirical evidence that other aspects of the neighbourhood, which are not usually included in neighbourhood effects studies, affect life satisfaction (and thereby possibly other outcomes). The study is the first using German longitudinal data and uses very immediate scales of the neighbourhood.

1.1 Literature Review

The theory of relative deprivation is distinct among the theories that have been put forward to explain the mechanisms through which neighbourhood context impacts on people's life chances (see Buck, 2001; Dietz, 2002; Jencks / Mayer, 1990) in that it suggests negative outcomes of living in a better-off neighbourhood. Relative deprivation concepts (see Stouffer, 1949) have been employed, for instance, to explain rioting (e.g., Canache, 1996; Gurr, 1970), schooling outcomes (e.g., Davis, 1966; Meyer, 1970), and emotional and behavioural outcomes (Lopez Turley, 2002).

Runciman defines relative deprivation as „a psychological effect deriving from comparison with others who have achieved something that would be feasible to achieve for oneself, that one desires but does not have himself" (Runciman, 1966, 9). Empirically, this effect has been shown to exist with respect to happiness, a heavily researched area in psychology, sociology and more recently in economics (see Diener / Suh / Lucas / Smith, 1999 for a review). Under the umbrella of testing the relative income hypothesis[1] a strand of happiness research looks at how individuals react to objectively existing or perceived differences in their own life circumstances compared to those of others (e.g., Blanchflower / Oswald, 2004; Clark / Oswald, 1996; Ferrer-i-Carbonell, 2005). Popular examples of comparison groups drawn on in the happiness literature are the society as a whole and people from the same profession.

While an impact of neighbourhood and community contexts has been suggested in the happiness literature (e.g., Layard, 2005), few empirical studies

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[1] This hypothesis states, in brief, that individual utility is derived not so much from one's absolute income position but from one's income position within a relevant group.

have actually considered the neighbourhood context as a relevant variable in the prediction of happiness.[2] In particular, neighbours have not typically been chosen as a comparison group in happiness research that addresses the relative income hypothesis. However, there are good reasons to assume that it also holds for this reference group. In the local housing market, for instance, it may not be some absolute amount of money that will ensure that the richest individual gets the best-quality land and property, but rather that income position of all people with a demand for land and property in the city or town will determine who gets what and how much it costs to get the best spot.[3] The implications for happiness are that if we observe two individuals that are statistically identical apart from living in different neighbourhoods where the incomes of the neighbours in one neighbourhood are higher and lower in the other, the individuals in the richer neighbourhood will be unhappier with their lives (assuming that satisfaction with housing and the home affects life satisfaction, see Sirgy / Cornwell, 2002), because their income will not have allowed them to find as nice a place as would have been possible in the neighbourhood with less affluent competitors.[4] Luttmer (2005) discusses the role which the neighbours' income position plays for overall life satisfaction in this argument. The author uses income as a proxy for consumption and argues that „if utility depends on relative consumption, one person's increase in consumption has a negative externality on others because it lowers the relative consumption of others" (964). Using socio-economic panel data linked with Census data for the US, Luttmer finds a strong negative association between neighbour's earnings and self-reported levels of happiness that is robust to a wide range of model specifications (including controlling for individual fixed effects, individual relocations, and interaction effects).[5]

Our empirical strategy is very similar to Luttmer, however, we use German data and draw on longitudinal neighbourhood data which are measured at the same time as the characteristics of the individual that affect happiness, our neighbourhood units are more immediate and the time interval we look at is shorter and more recent.

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[2] Examples include Sirgy / Cornwell (2002) and Shields / Wooden (2003).

[3] This argument builds on the assumption that individuals have a preference for living in some given neighbourhood, say the area of a particular city, for instance, because all their family and friends live there, or their workplace is in this town. Gaarder (2002) argues that it is this mechanism which determines who gets exposed to air pollution.

[4] This is true at least if we believe that the type and quality of houses that makes people (dis-)satisfied is the same for everyone.

[5] The only analysed case where no effect of neighbour's earnings could be found is when individual- and neighbourhood level fixed-effects were controlled for.

2. Methodology

We undertake an empirical test of the relative deprivation theory in the neighbourhood context applying it to the outcome of self-reported levels of happiness.[6] Veenhoven (1984, 10) defines life satisfaction „as the degree to which an individual judges the overall quality of his life-as-a-whole favourably". A judgement of the overall quality of one's life is the result of a process that involves an assessment of one's objective living conditions but also of interpersonal and intertemporal comparisons. If feelings of relative deprivation are present we expect this to show in lower happiness scores.

However, not all lower happiness scores should be regarded as deriving from not being as well off as people think they deserve to be. In the absence of a dataset that observes objective and subjective deprivations at the same time, we need to operationalise relative deprivation on the basis of some measure of how people match up to others. In our study, this is the relative income position that individuals occupy in their neighbourhood. We define that people who have less income than their average neighbour are relatively deprived and *assume* that relatively deprived people will be unhappier.

Our empirical analyses unfold as follows. We first provide descriptive tables and graphs that show the mean life satisfaction by classes of household and neighbourhood income at two points in time, 1994 and 1999. We proceed to a multivariate model where we predict life satisfaction controlling for other aspects that are regarded to influence how satisfied people are with their lives.

2.1 Multivariate Predictions

We include in our models controls for five domains of life that have been shown to impact on subjective well-being. These spheres are family context, financial situation, work, community and friends (which we proxy with neighbourhood characteristics), and health, respectively.[7] In addition, we include basic characteristics such as age and gender.

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[6] We use the terms 'happiness', 'subjective well-being' and 'life satisfaction' interchangeably throughout the paper.

[7] Layard (2005) refers to two more aspects that have been argued to impact on subjective well-being. These are personal values and personal freedom. There are no direct measures of personal values available in the large-scale dataset we employ. Variables relating to personal freedom are mostly employed in cross-country analyses when the focus is on the impact of living in democratic political systems versus living under dictatorship. In our single country study, this aspect is mostly redundant. We do, however, employ a dummy for German nationality. The citizenship rights tied to the German citizenship might proxy for higher personal freedom and should be positively correlated with happiness.

A source for heterogeneity that is not usually considered in the international research on happiness is regional differences. In the German context, it has been shown that people in East Germany are unhappier with their lives than people living in West Germany (e.g., Ferrer-i-Carbonell, 2005). In addition, average personal incomes in East Germany are lower than in West Germany. This does not necessarily mean that all neighbourhoods in the East are poorer than neighbourhoods in West Germany. In fact, research by Knies / Krause (2006) has shown that some regions within West Germany are on average poorer than regions in East Germany. Also, it has been shown that the levels of happiness in the two regions converged over time and that most of the increase in East German's happiness cannot be attributed to increases in personal income (Frijters / Haisken-DeNew / Shields, 2004).

We estimate the impact of these characteristics on subjective well-being employing a so-called bottom-up approach. The bottom-up approach builds on the philosophical assumption that there are universal needs which have to be met in order for people to be happy.[8] The settlement of needs is thought to be dependent upon external factors, and people who find themselves in a 'good situation' for the fulfilment of needs are happy, while those who find themselves in a 'bad situation' are unhappy (see, e.g., Diener / Suh / Lucas / Smith, 1999). The context in which individuals can be happy is implicitly thought to be the same for everybody, and people will be happier the more happy moments they experience. It follows from this that the independent variables employed in bottom-up models are objective life circumstances.

Our statistical approach is as follows. We start off with a standard microeconomic life satisfaction function (Clark / Oswald, 1996; Frey / Stutzer, 2002)

$$LS_i = \alpha + \beta' X_i + \varepsilon_i \qquad i = 1, \ldots, n$$

where LS_i is a continuous measure of life satisfaction[9] for individual i, X is a vector of objective characteristics that are held to influence the life satisfaction of individual i, and ε is a randomly distributed error term. As our model is

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[8] An alternative philosophical theory to understanding happiness is the so-called top-down approach. These models assume that subjective well-being is influenced by characteristics that are internal to the individual. Among the factors that these models include are personality traits like determination, optimism and self-confidence. While some characteristics like employment, health and marital status will play a role in these models it is the subjective evaluations of these states that the focus is on rather than the objective states. A third type of models acknowledges the multiple interactions between the internal and external context in which individuals operate. The so-called interactionist models recognise, for instance, that married people are happier than non-married people but also that more optimistic and happier people are more likely to get married. See: Brief / Butcher / George / Link (1993).

[9] Empirically, this is often measured on a cardinal scale. Ferrer-i-Carbonell / Frijters (2004) show that the difference is negligible.

after identifying neighbourhood effects on subjective well-being, we rewrite the model as

$$LS_i = \alpha + \beta' X_i + \gamma' Z_i + \varepsilon_i \qquad i = 1, \ldots, n$$

where LS_i denotes life satisfaction for individual i, X is a vector of objective characteristics that are held to influence the life satisfaction of individual i, Z is a vector of neighbourhood characteristics in which individual i lives, and ε is a randomly distributed error term.

We include the own income and neighbourhood income variables in the logged form. Mathematically,

$$LS_i = \beta_1 \log x_{1i} + \gamma_1 \log z_{1i} + \ldots + \varepsilon_i$$

where LS_i denotes life satisfaction for individual i, x_{1i} is the income of individual i, z_{1i} is the income in the neighbourhood of individual i, and ε is a randomly distributed error term. This allows us to look at two different hypotheses about the effect of neighbourhood income on happiness at the same time. The more general relative income hypothesis will be supported if the coefficient on neighbourhood income is negative. In addition, the more specific relative deprivation hypothesis will be supported if γ_1 is negative and its absolute value is greater or equal the coefficient on household income.

2.2 Robustness Tests

2.2.1 Measurement of Relative Deprivation

The first robustness test that we undertake is that we look at the relationship between peoples' income position and a more direct measure of relative deprivation. In our multivariate model we try to identify feelings of relative deprivation in the form of lower life satisfaction. That is, we argue that objectively deprived people feel deprived and will thus report to be not as happy as people who are not relatively deprived, ceteris paribus. However, relative deprivation theory concedes that not all the deprivations that we can objectively identify necessarily imply feelings of relative deprivation.

In this robustness test, we first investigate whether our objective measure of deprivation is associated with the degree to which people feel that they have not achieved what they should have achieved in comparison to others. Our indicator of subjective feelings of deprivation does not directly relate to specific others, but if neighbours are a relevant comparison group we expect a significant relationship between this variable and our objective indicator of relative deprivation in the neighbourhood. We then need to show that if we replace the outcome variable 'self-reported happiness' by our indicator of subjective

deprivation, the β_1 and γ_1 coefficients in the models go in the same direction. If our theory is right that feelings of relative deprivation can be measured in the form of reduced happiness, the signs of the coefficients should be significant and in the same direction as in the baseline regressions.

2.2.2 More Neighbourhood Quality Controls

In our baseline models we include a rather limited number of controls for the neighbourhood context within which individuals operate. Apart from controlling for neighbourhood income, we only control for the type of community in which individuals live. The latter variable picks up the effects of living in villages or cities, in residential areas or business districts, in a detached house or in a multiunit property, but the indicator does not tell us anything about the quality of the neighbourhoods.

The quality of the neighbourhood is important, however. If we observe a positive effect of neighbourhood income on happiness, one might argue that it is upward-biased because we do not control for other things that are correlated with on-average higher neighbourhood incomes. Residents in these richer neighbourhoods may have access to institutions to which the residents of poorer neighbourhoods do not have access, or the quality of the institutions may be better. Children may get better education because the teachers are more qualified and use more up-to-date teaching methods. Sick people may get better treatment because the general practitioner in the richer neighbourhood has better medical equipment.

Similarly, if we observe a negative impact of neighbourhood income on happiness, one might argue that this is not due to the neighbours' better financial position but due to some unobserved characteristics of the neighbourhood which reduce happiness. Higher housing prices in the neighbourhood might be one reason to be unhappy with living in richer neighbourhoods (compare our relative consumption example in the literature review).

Our data allows us to include in our regressions a number of indicators of the availability of public facilities in the neighbourhood. The list of facilities includes basic day-to-day infrastructure (i.e., doctors, banks, and public transport), recreational facilities (i.e., parks, gyms, bars), and institutions such as primary schools, kindergartens, and clubs for the youth or the elderly.

If unobserved neighbourhood characteristics are driving our baseline results, we would expect our neighbourhood income effect to change significantly when we control for the presence of the abovementioned facilities. In addition, these controls allow us to investigate whether the availability of local public infrastructure has an impact on people's life satisfaction. They are proxies for neighbourhood quality, however, do not provide us with information about the quality of the particular services and amenities available, which is a draw-

back.[10] Generally, accessibility might be regarded as something good. However, living next to an amenity of low quality might have an outweighing negative effect on the level of happiness. While in general people may, for instance, be assumed to be happy about having green space right in front of their doorstep, if the public park is cluttered with rubbish they may wish there was no park at all.

2.2.3 People's Interaction with the Neighbourhood

Comparison effects can only be present if neighbours are indeed a relevant group for comparison. This is the case when the particular neighbourhood indicator we employ is socially structured (Merton / Rossi, 1968, 296). The neighbourhood property should also be observed by the individuals – otherwise we can not expect to find significant comparison effects. We have no direct means of testing whether this requirement is met. However, we hypothesise that for some groups of the population the neighbourhood effect is more robust.

Neighbourhood effects should be stronger for individuals that may be assumed to interact on a more regular basis with their neighbourhood because these persons may know their neighbours better. We test for interaction terms of neighbourhood income with whether or not an individual lives in a household with a child below the age of 7 (Interaction 1), with whether or not the individuals have a dog as a pet (Interaction 2), with whether or not individuals interact socially with their neighbours (Interaction 3), and with whether or not individuals work in their town of residence (Interaction 4).[11]

Individuals living in households with young children may be assumed more likely to interact with their neighbourhood and to know people in the neighbourhood because they make use of institutions that are placed in proximity to the place of residence (i.e., playgrounds, kindergartens, and local doctors' practices). They also go for a walk with their youngest and by this means may get to know the neighbourhood and, so we argue, they may get to talk to people they meet in the streets. The same is true for dog owners. Walking the pet, on the one hand, facilitates having a look around the neighbourhood and, so we argue, seeing how much prosperity there is. On the other hand, the pet might attract other people's interest which is why dog owners, we argue, have a higher propensity of getting to talk to their neighbours.

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[10] SOEP also surveys neighbourhood quality by means of asking respondents to the study how much they are affected by noise pollution, atmospheric pollution and lack of accessible green space. Accounts of the quality of personal relationships among the neighbours are also available. However, in our study we want to control only for objective context measures and disregard these qualitative indicators.

[11] Not employed individuals are treated like individuals who are working and living in the same neighbourhood.

The relationship between our direct measure of whether or not individuals interact socially with their neighbours, neighbourhood income and happiness is less straightforward. While we may assume that individuals who socialize with their neighbours have a better knowledge of their neighbours' financial circumstances – which should deserve for feelings of relative deprivation if the neighbours are better off – utility maximising individuals may avoid interaction with individuals that cause unhappiness. In other words, whether or not individuals interact with their neighbours is endogenous.

As to the fourth interaction term, we may assume that individuals who work in the town where they live have a better knowledge than others of the financial position of the people in their environment because of interaction with colleagues and knowledge of the local salaries at least in their employment sector.

Finally, the neighbourhood income effect might be driven less by how much individuals may be assumed to interact with their neighbours than by how much pressure is exerted on individuals to keep up with their neighbours' incomes. Young children may want to have the same toys as their peers in the neighbourhood and parents may not want their children to go without them. If this is true, we might be able to see the same effect for individuals in households with teenagers, i.e., individuals aged $12 - 16$.[12] Young and financially dependent people may exert pressure on their parent(s) to be able to keep up with their peers in the neighbourhood and this may lead to reduced happiness for all members of households with teenagers. The fifth interaction term captures this effect.

2.2.4 Unobserved Heterogeneity

A common critique on cross-sectional models is that it cannot be controlled for unobserved heterogeneity at the level of observations, which results in biased estimates. In the field of happiness research it is known, for instance, that the genes people have defines their ability to feel happy (e.g., Layard, 2005, 55). Genetic codes, however, are not available in surveys and thus cannot be employed as independent variables. Surveys also do not usually collect information on personality traits that determine how a person establishes how happy she is.

An advantage of the longitudinal structure of our dataset is that we can make some controls for those unobserved characteristics of the individual, and of the neighbourhood (i.e., when we select on individuals that did not relocate) that do not change over time. We expect our neighbourhood and own income

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[12] The age brackets for this group have been thus defined because children of this age will be in secondary school and will not usually have started vocational training. This implies that the money the children can draw upon must come from within the household.

effects to work in the same direction as in the cross-sectional level models when we isolate from our model those unobserved fixed characteristics. The size of the effects, however, can be expected to be smaller in the change model since biases in the cross-sectional estimates will be lessened due to the inclusion of more controls (i.e., time-invariant individual characteristics). An additional source of bias is measurement error, which can be assumed to be rather high on both our dependent variable life satisfaction and on our key independent variables (i.e., neighbourhood income and household income). If these errors are time-invariant, they will downwardly attenuate the coefficients in the fixed effects model.

3. Data

This research uses data derived from the German Socio-Economic Panel Study (SOEP). SOEP is a longitudinal survey representative of the German population living in private households, and contains data on a wide range of economic and social topics. SOEP provides information on all household members, and covers persons living in the Old and New German States, foreigners, and recent immigrants to Germany. The salient features of the survey include data on household composition and occupational biographies, as well as employment and earnings, health and satisfaction indicators. The panel was started in 1984, and since then the same households, persons and families have been surveyed annually. Our analysis focuses on the 1994 and 1999 waves of the survey. In these years, the special focus of the study is on neighbourhood infrastructure and social networks.

Our key dependent variable is a measure of life satisfaction derived from the following question addressed to SOEP respondents in every wave of the survey: „How satisfied are you at present with your life, all things considered?" There are eleven response categories running from 0 (completely dissatisfied) to 10 (completely satisfied). As controls we employ characteristics that have been shown to impact on happiness in other research on subjective wellbeing (compare Appendix 1 and 2 for variable descriptions and summary statistics). We divide the controls into six blocks, namely basic characteristics (age, gender, number of years in education and nationality), health (here: disability status), family (marital status and number of children in the household), financial situation (annual per capita household income, change in annual per capita household income from previous year to current year, homeownership), work (employment status), and last but not least neighbourhood context (annual per capita neighbourhood income – as described below – and type of community). All control variables apart from the annual per capita neighbourhood income are derived from SOEP.

A lesser known feature of SOEP, which we explore in this study, is that it contains geographical references that allow matching the study with geo-

coded data.[13] We linked SOEP data of 1994 and 1999 with context data at the zip-code level. The zip-code level is the smallest entity at which external geographical context variables can be matched with SOEP.[14] Out of 8,256 zip-code areas in Germany[15] 2,256 are represented in SOEP.

To illustrate how sensibly zip-code areas may be used as a proxy for 'neighbourhood', we ordered all German zip-code areas by their population size and created deciles. We report the minimum, the mean and the maximum population size in each of these deciles to get some idea about the number of people living in these zip-code areas (Table 1).

Table 1

**Distribution of population size of zip-code areas
in Germany 1995 and 1998 (*N* = 8,256)**

Deciles of populatio size in zip-code area	1995			1998		
	mean	*min*	*max*	*mean*	*min*	*max*
Bottom decile	967	9	1,370	1,009	10	1,442
2	1,756	1,371	2,169	1,859	1,444	2,297
3	2,638	2,170	3,152	2,778	2,298	3,317
4	3,770	3,153	4,443	3,955	3,320	4,642
5	5,271	4,444	6,235	5,512	4,642	6,506
6	7,579	6,237	9,133	7,843	6,508	9,399
7	11,058	9,140	13,027	11,237	9,408	13,138
8	15,272	13,029	17,455	15,296	13,144	17,637
9	19,869	17,457	22,875	20,071	17,637	22,970
top decile	29,940	22,896	63,005	29,801	22,987	59,852
Mean population size		9,810			9,934	

Source: SOEP 20. Neighbourhood indicator dataset. Authors' calculations.

In 1995, the average population size in German zip-code areas was 9,810 individuals (1998: 9,934). The smallest zip-code area had just 9 inhabitants (1998: 10) and the largest had 63,005 (1998: 59,852). The population size in half of the zip-code areas is less than 6,235 in 1995 (1998: 6,506). This figure

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[13] See Knies / Spiess (2007) for detailed information.

[14] Due to data protection legislation SOEP data at zip-code level can only be matched and analysed with special permission and at DIW Berlin. A special data user contract has to be concluded.

[15] This figure refers to only those zip-code areas that existed in both years of observation. We employ population figures for 1995 as a proxy for population figures in 1993.

may be thought of as the population of an average-sized German village. More populated zip-code areas, on the other hand, are most often found in cities and are spatially confined to small areas with a high population density. These zip-code areas may be thought of as representing the geographical scale of a neighbourhood.

Matching SOEP with neighbourhood indicators for 1993 and 1998 resulted in a unique data set that has not been employed before. The neighbourhood data for the years 1993 and 1998 have been purchased by the SOEP Group from a commercial data provider, Infas Geodaten (Infas). They are defined for all zip-code areas that existed in Germany in these years. The indicators are *estimates* of neighbourhood characteristics that the data supplier obtained analysing commercial telephone surveys, local statistics, and mail-order data.

We draw in our analyses on an *estimate* of the average purchasing power of the population in the area in the respective year. The currency is DM (1 DM equals 0.5113 Euro). The term 'purchasing power' relates to „disposable household income" as used by German Federal Statistical Office (compare Infas Geodaten, 2004). The originally available measure has been re-based in order to make it comparable to annual per capita household incomes derived from the SOEP. This exercise is undertaken to establish whether or not an individual is objectively relatively deprived in his / her neighbourhood.

We have indicators of the total per capita purchasing power and the population count for all German zip-code areas enabling us to calculate Germany's total purchasing power. This total is replaced by a measure of total national annual income yielded from SOEP, and is then proportionally reassigned to the zip-code areas. The neighbourhood income that we use in the analysis is the re-based income divided over the population in the zip-code area. We call this 'annual per capita neighbourhood income'.

We calculated the total national income available to households in Germany on the basis of annual household incomes and household weighting factors provided in the SOEP. The annual household income information is taken from the Cross-National-Equivalent-File (CNEF) instrument of the SOEP.[16] It refers to household income in the previous calendar year. In our multiple regression models, we employ the measure of annual household income divided over the size of the household at the time of the interview. This way the household and neighbourhood incomes are at the same units.

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[16] Compare http: // www.human.cornell.edu / pam / SOEP / equiv / g-equiv2.pdf, 9 ff.

4. Empirical Results

4.1 Bivariate and Three-dimensional Associations between Household Income, Neighbourhood Income and Happiness

Most empirical research on the association between income and happiness suggests that people are happier the higher their income is. Income does not only make possible the consumption of more goods and services. Having money serves for greater utility than not having it: whereas one is free to give money away if one does not like to have much of it, for the poor, in contrast, it is not realistic to just get money from somewhere. However, „people are really seeking nonmaterial goods such as personal fulfilment or the meaning of life and are disappointed when material things fail to provide them" (Dittmar, 1992 in: Frey / Stutzer, 2002, 81), thus leaving the correlation subject to empirical investigation.

We start our empirical investigation by looking at the average life satisfaction of individuals in different classes of own income and neighbourhood income. We vary the definitions of income bands so as to see whether findings are robust to these definitions. Table 2 presents the results for 1999 (1994: see Appendix 3).

Table 2

Average life satisfaction by classes of income 1999

Class	Household income class definition by			Neighbourhood income class definition		
	household income	*weighted neighbourhood income*	*neighbourhood income across Germany*	*weighted neighbourhood income*	*neighbourhood income across Germany*	*quintiles of household income*
1	6.6	6.6	6.6	6.6	6.5	6.3
2	6.7	7.0	6.8	7.0	6.9	6.7
3	7.0	7.0	6.9	7.0	7.0	7.0
4	7.2	7.1	7.0	7.0	7.0	7.1
5	7.3	7.2	7.2	7.1	7.1	7.0

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

In the first (fourth) column we defined classes of household income drawing on the distribution of annual per capita household incomes (weighted using SOEP individual weighting factors). In the second (fifth) column, we built classes of household income on the distribution of annual per capita neighbourhood incomes that is yielded when the neighbourhood incomes of SOEP respondents are weighted using SOEP individual weighting factors. In the third (sixth) column, income quintiles were built on the basis of the distribu-

tion of annual per capita neighbourhood incomes across all zip-code areas in Germany. The income distributions of the two latter would be equal if the neighbourhoods in which respondents to SOEP live were representative of all neighbourhoods in respect to neighbourhood income (compare Appendices 4 and 5 for upper class limits of income classes using different definitions). The happiness measure is on a scale from 0 (very dissatisfied) to 10 (very satisfied).

Table 2 shows that people in Germany are more satisfied with their life the more income they have and that they also are happier if they live in a neighbourhood where the average neighbourhood income is higher. While there is a linear increase in average happiness by classes of household income, average happiness seems to be relatively unaffected by the level of neighbourhood income, however, is markedly higher in the second neighbourhood income class compared to the first neighbourhood income class.

The simple bivariate association between happiness and neighbourhood income class is in line with what most neighbourhood effect theories suggest. If people observe that they are living in a neighbourhood where people, on average, are more affluent they may value this positively, for instance, because they think that they will benefit from affluent neighbours. Another explanation might be that living in a neighbourhood with financially better-off neighbours provides access to better or higher quality services and local amenities. However, as long as we do not control for own income at the same time, we can also not be sure whether those living in the richer neighbourhoods are just happier than those in the poorest neighbourhoods because they are richer.

In a next step we thus focus on individuals' mean life satisfaction broken down by classes of own income and neighbourhood income using the same income bands for both. This way, individuals that are in the same income class on both measures are in a financial situation that is very similar to that or their neighbours. Individuals that are in a higher class of income on any of these measures are either relatively deprived (i.e., if neighbourhood income greater is than household income) or relatively advantaged (i.e., if household income is greater than neighbourhood income). Being relatively advantaged in the neighbourhood should translate into greater happiness, and vice versa.

To illustrate the effect of controlling not only for own income but also for neighbours' income we report – along with mean life satisfaction scores of people in household income classes 1 – 5 differentiated by neighbourhood income classes 1 – 5 (denoted nb y 1- nb y 5) – mean satisfaction scores of people in household income classes 1 – 5 (see Figure 1). If individuals in richer neighbourhoods were only happier because they are richer themselves, all lines would overlap.

Figure 1 shows the empirical results. Reading the lines vertically, we can see that average life satisfaction increases with own income at every level of

neighbourhood income. Furthermore, regardless of own income life satisfaction is also higher the higher the level of neighbourhood income is (reading the graphs horizontally).

In line with relative deprivation theory we would expect that the lines representing mean happiness differentiated by neighbourhood income class and household income class cross the bold line, i.e., they should be below the bold line when people are relatively deprived in their neighbourhood and above it when they are relatively advantaged.
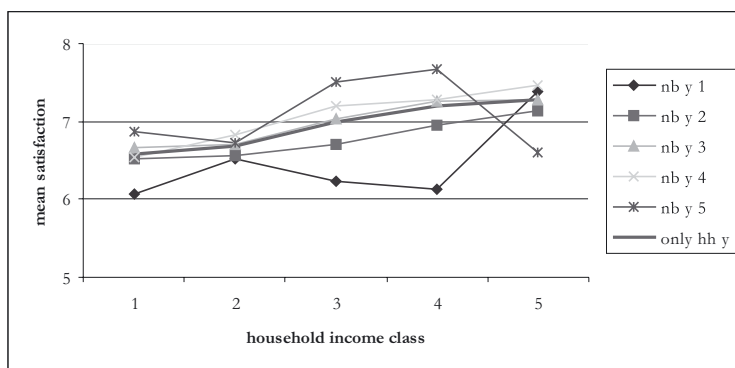
Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

Figure 1: Average life satisfaction of individuals in different classes of neighbourhood income by quintiles of household income 1999

The empirical results tell a different story. On average, happiness is lower for people living in neighbourhoods with an income in the bottom two classes irrespective of their own income. Vice versa, it is higher for *all* individuals that live in neighbourhoods with an income in the top three classes of the neighbourhood income distribution. This is first suggestive evidence that relative deprivation theory may not be right.

4.2 Results of Multivariate Regressions

In addition to own income and neighbourhood income a number of other aspects of life have been shown to impact on life satisfaction. We therefore investigate whether the positive relationships we find between own income and happiness, neighbourhood income and happiness and also between household income, neighbourhood income and happiness are also supported when we control for other characteristics at the individual-, household- and neighbourhood-level.

Tables 3 and 4 present the results of a regression of neighbourhood context, basic characteristics, family, health, financial situation, and work characteristics on levels of life satisfaction for 1994 and 1999, respectively.[17] The structure of the regression output is such that we can observe the impact of adding in further (blocks of) controls on the size of the effects of our neighbourhood context variables (i.e., the coefficients reported in the first column apply when only neighbourhood context is controlled and those in the last column when all our dependent variables are controlled for). The sample remains the same across all six models.

Table 3

Predictions of life satisfaction 1994

Independent variables	Satisfaction with life at present (nested models)					
	Neighbourhood only	*+ Basic*	*+ Family*	*+ Health*	*+ Finances*	*+ Work*
Annual per capita neighbourhood income (log)	0.48**	0.47**	0.47**	0.43**	0.21	0.16
Type of community (comparison group: single occupancy in village or small town)						
village / small town (not single occupancy)	–0.34**	–0.32**	–0.30**	–0.28**	–0.17*	–0.14*
mid-size town, single occupancy	0.06	0.06	0.05	0.06	0.05	0.05
mid-size town (not single occupancy)	–0.29**	–0.26**	–0.25**	–0.22**	–0.11	–0.1
city, single occupancy	0.06	0.05	0.05	0.07	0.06	0.07
city, old building (not single occupancy)	–0.39**	–0.37**	–0.36**	–0.34**	–0.21**	–0.17*
city, new building (not single occupancy)	–0.38**	–0.36**	–0.35**	–0.32**	–0.20**	–0.19**
city, mixed housing stock, other	–0.31**	–0.31**	–0.29**	–0.28**	–0.18*	–0.17*
West Germany	0.62**	0.66**	0.66**	0.71**	0.62**	0.57**
Female		–0.02	0	–0.03	0	0.01
Age		–0.04**	–0.05**	–0.04**	–0.06**	–0.04**
Age^2 / 100		0.04**	0.04**	0.04**	0.06**	0.03**
Number of years of education		0.03**	0.03**	0.03**	0	–0.01
German		0.1	0.11*	0.13*	0.01	–0.02

[17] The nature of the dependent variable suggests fitting an ordered logit or probit model. However, the proportional odds and parallel regression assumptions were violated and the general ordered logit, the alternative in this case, did not converge. In line with Oswald (1997) and DiTella / MacCulloch / Oswald (2001) we estimate standard OLS, which is the most parsimonious of imperfect models for our data.

Marital status (comparison group: never married)						
married			0.11	0.1	0.12	0.08
divorced			–0.27**	–0.28**	–0.24*	–0.25**
widowed			–0.07	–0.12	–0.18	–0.21
Number of children in the household			–0.04*	–0.05*	0.09**	0.06*
Disabled				–0.67**	–0.64**	–0.66**
Annual per capita household income (log)					0.56**	0.47**
Change in annual per capita household income (log) $t – t – 1$					0	0.01
Homeowner					0.13**	0.14**
Employment status (comparison group: employed)						
registered unemployed						–0.96**
student						–0.27
pensioner						0.30**
not employed (not student or pensioner)						–0.06
not employed / supplementary employed						0
Constant	2.11*	2.69*	2.78**	3.10**	0.53	1.75
Observations	11408	11408	11408	11408	11408	11408
R^2	0.05	0.06	0.06	0.07	0.09	0.11

Notes: * significant at the 0.05 level. ** significant at the 0.01 level.

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

Table 4

Predictions of life satisfaction 1999

Independent variables	Satisfaction with life at present (nested models)					
	Neigh-bourhood only	+ Basic	+ Family	+ Health	+ Fi-nances	+ Work
Annual per capita neighbour-hood income (log)	0.47**	0.44**	0.45**	0.40**	0.23*	0.21*
Type of community (comparison group: single occupancy in village or small town)						
village / small town (not single occupancy)	–0.38**	–0.38**	–0.34**	–0.32**	–0.18**	–0.17**
mid-size town, single occupancy	0.01	0	0	0.02	0.02	0.03
mid-size town (not single occupancy)	–0.31**	–0.29**	–0.27**	–0.25**	–0.11	–0.09

Continued Table 4

Independent variables	Satisfaction with life at present (nested models)					
	Neigh-bourhood only	*+ Basic*	*+ Family*	*+ Health*	*+ Fi-nances*	*+ Work*
city, single occupancy	0.08	0.06	0.05	0.06	0.05	0.05
city, old building (not single occupancy)	–0.38**	–0.38**	–0.34**	–0.30**	–0.14	–0.13
city, new building (not single occupancy)	–0.32**	–0.32**	–0.29**	–0.25**	–0.1	–0.1
city, mixed housing stock, other	–0.30**	–0.33**	–0.29**	–0.26**	–0.14*	–0.12
West Germany	0.39**	0.44**	0.45**	0.49**	0.44**	0.40**
Female		0.04	0.05	0.03	0.05	0.05
Age		–0.05**	–0.06**	–0.06**	–0.07**	–0.06**
Age^2 / 100		0.04**	0.05**	0.06**	0.07**	0.05**
Number of years of education		0.05**	0.05**	0.05**	0.02**	0.01
German		0.07	0.1	0.13*	0.03	0.01
Marital status (comparison group: never married)						
married			0.25**	0.24**	0.25**	0.23**
divorced			–0.29**	–0.31**	–0.25**	–0.26**
widowed			0.02	-0.04	-0.08	-0.11
Number of children in the household			–0.05*	–0.06**	0.07**	0.05*
Disabled				–0.75**	–0.74**	–0.74**
Annual per capita household income (log)					0.53**	0.47**
Change in annual per capita household income (log) $t – t – 1$					–0.15*	–0.15*
Homeowner					0.12**	0.12**
Employment status (comparison group: employed)						
registered unemployed						–0.84**
student						0.23
pensioner						0.12
not employed (not student or pensioner)						–0.04
not employed / supplementary employed						0
Constant	2.43*	3.20**	3.32**	3.75**	0.96	1.65
Observations	12251	12251	12251	12251	12251	12251
R^2	0.03	0.04	0.05	0.07	0.08	0.1

Notes: * significant at the 0.05 level. ** significant at the 0.01 level.

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

The results in both years are very similar and, in addition, for all controls, they are in line with what has been shown elsewhere in empirical studies on happiness (see Dette, 2005 for an extensive review). The starkest differences in the effects over time are observed for regional differences. In 1994, the coefficient on living in West Germany amounts to 0.57. In 1999 the correlation is 0.4. We focus our discussion on the effects of the personal financial position and of the neighbourhood context.

Financial Situation

One's financial situation, like one's health status, is a very good predictor of life satisfaction. All indicators in this sphere of life show a highly significant impact on happiness. A linear relationship between life satisfaction and own income, as suggested in the bivariate findings, is, however, not supported with the multivariate model. We find a positive relationship between annual household income in log form and happiness, which has been shown in a number of other studies on the economics of happiness. Individuals value gains in income more the less money they start off with (see, e.g., Frey / Stutzer, 2002). The effect of income on happiness is stable over time. It amounts to 0.47 in both years (compare Tables 3 and 4, respectively).

The negative impact of a change in own income from the previous year to the current year is contra-intuitive, but has been found elsewhere (e.g., Burchardt, 2005). We would expect individuals to appreciate positive changes in income. However, as we do not measure incomes in real terms, the income change may not have been a real one, i.e., individuals might not be able to consume more, perhaps even less, despite a nominal increase of income because prices have increased more. Another possible reason might be that the change in income is triggered by a change in the household composition that is perceived as negative by the individuals. The negative impact of a change in income on happiness would then in fact be due to a confound correlation between household composition change and happiness. If, for instance, a child has just moved out of the household this technically implies that the household-size adjusted income measure increases from $year_{t-1}$ to $year_t$ since the income is divided over a smaller adult equivalent. But the moving-out of a child might also leave parents behind threatened because they now have to define the relationship to each family member new ('fill the gap'). To investigate in which direction these muddled-up effects go we run an alternative version of the happiness model where we split up the change in annual per capita household income from $year_{t-1}$ to $year_t$ into the log of change in household income and the log of change in household size. This showed that there is a strong positive association between increases in the number of members of the household and happiness in both years of observation. Though the association between changes in household income and happiness remains negative, it gets less significant which lends some support for our argument (results not reported).

Neighbourhood Effects

In contrast to most neighbourhood effects studies, the neighbourhood effects we identify are sizeable even when other individual and family characteristics are controlled for. For instance, Table 3 and Table 4 show that the inclusion of further controls in the model halves the independent impact of neighbourhood income on happiness (1994: 0.48 to 0.16; 1999: 0.47 to 0.21), but the effect remains statistically significant in 1999. In 1994, the neighbourhood income effect becomes statistically insignificant when controls for own economic circumstances are being added into the regression equation. However, in this year, other neighbourhood characteristics – which are mostly statistically insignificant in 1999 – show an effect on life satisfaction: most of the community type controls are statistically significant.

Our hypothesis that individuals are unhappier than otherwise would be the case when they are financially relatively deprived in their neighbourhood is not supported by the multivariate models. In both years of observation the value of the coefficient on neighbourhood income is positive (and statistically significant in 1999).

4.2.1 Results of Robustness Tests

Table 5 reports the effects of neighbourhood income and personal income on life satisfaction for both years and for all robustness tests.

Table 5

**Effects of neighbourhood income and personal income
on happiness, robustness tests**

	Neighbourhood income (in log form)		Household income (in log form)		Adj. R^2	N
	Coeff.	*S.E.*	*Coeff.*	*S.E.*		
Baseline model 1994	0.16	1.41	0.47**	9.96	0.11	11408
relatively deprived individuals	0.22	0.16	0.59	0.08	0.12	6412
relatively advantaged individuals	0.15	0.19	0.26	0.10	0.10	4996
Baseline model 1999	0.21*	1.97	0.47**	10.15	0.1	12251
relatively deprived individuals	0.36	0.15	0.53	0.08	0.10	6596
relatively advantaged individuals	0.00	0.17	0.39	0.09	0.09	5671

Robustness tests 1994						
Full set of neighbourhood controls	0.06	0.52	0.45**	8.92	0.12	9340
Interactions						
young children in household	0.1	0.21	0.46**	10.71	0.11	11562
dogowners	0.08	0.6	0.51**	10.85	0.11	10282
socialising with neighbours	0.29	1.28	0.48**	10.92	0.11	11399
work in the neighbourhood	0.01	1.17	0.37**	6.3	0.07	6595
teenager in the household	0.58	2.68	0.47**	10.74	0.11	11432
Robustness tests 1999						
Feelings of relative deprivation	0.02	0.05	0.28	0.02	0.09	12123
Full set of neighbourhood controls	0.08	0.68	0.51**	9.94	0.11	10113
Interactions						
young children in household	–0.07	1.73	0.46**	11.40	0.10	12438
dogowners	0.46	1.82	0.47**	10.63	0.10	10868
socialising with neighbours	0.27	0.48	0.47**	11.31	0.10	12224
work in the neighbourhood	–0.01	1.45	0.43**	7.74	0.06	7173
teenager in the household	0.09	0.76	0.47**	11.34	0.10	12280
Fixed effect model	0.42	1.84	0.33**	5.77	0.03	8491
movers	0.52	1.62	0.11	0.89	0.04	1340
non-movers	0.39	1.07	0.40**	6.21	0.03	7151

Notes: * significant at the 0.05 level. ** significant at the 0.01 level.

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

Relatively Deprived versus Relatively Advantaged Individuals

Estimation of our happiness model separately for relatively deprived and relatively advantaged persons does not change the size and direction of the neighbourhood effect, and it remains statistically insignificant. This differentiation by deprivation status does also not alter markedly any of the coefficients in the model (results not reported). This suggests that both groups of the population react to their local environment and to external circumstances in the same way. If anything, people who have a lower personal income than their neighbours are happier than relatively advantaged people with their lives the richer the neighbours are.

Changing the Measurement of Relative Deprivation

Individuals' subjective account of whether or not they feel they deserve better compared to others is related to the income position they have within their

neighbourhood: a higher share of people who are relatively deprived in their neighbourhood report to 'totally agree' or 'agree slightly', 'disagree slightly' and 'totally disagree' with the statement „Compared to others I did not achieve what I deserve" (Table 6).

Table 6

Feelings of relative deprivation broken down by the financial position in the neighbourhood 1999

Compared to others, I did not achieve what I deserve	All		
	Not deprived	*Deprived*	*Total*
totally agree	5.4	9.3	7.4
agree slightly	20.6	28.0	24.4
disagree slightly	46.1	40.4	43.2
totally disagree	27.9	22.3	25.0
Total	100	100	100

Source: SOEP 20. Authors' calculations.

If we further differentiate between individuals that are poor and those that are not, the former are more inclined to feeling deprived than the latter regardless of the financial position in the neighbourhood (Table 7). Feelings of relative deprivation are most marked among poor and relatively deprived people. All associations are statistically significant.

Table 7

Feelings of relative deprivation broken down by the financial position in the neighbourhood and poverty status 1999

Compared to others, I did not achieve what I deserve	Non-poor			Poor		
	Not deprived	*Deprived*	*Total*	*Not deprived*	*Deprived*	*Total*
totally agree	4.7	7.6	6.1	8.9	(11.4)	10.9
agree slightly	21.9	26.7	24.2	20.9	32.8	30.3
disagree slightly	47.0	43.3	45.2	43.1	37.5	38.7
totally disagree	26.5	22.5	24.5	27.2	18.2	20.1
Total	100	100	100	100	100	100

Note: (–) less than 50 cases.
Source: SOEP 20. Authors' calculations.

This suggests that our rather technical definition of who is deprived and who is not bears some credibility. The actual correlation between life satisfac-

tion and our direct measure of relative deprivation (i.e., being more in disagreement with the statement) is 0.29, which is rather low. In other words, though there is a tendency that people who report lower levels of feeling deprived are more satisfied with their life, low happiness and feeling relatively deprived are not identical things. When we substitute self-reported happiness by the direct measure of subjectively felt deprivation the direction of the income effects is in the same direction as in the happiness model, but the estimated coefficients are not statistically significant. This suggests that feelings of relative deprivation are not related to one's own income and neighbours' income.

Taken together this is evidence that our approach to measure feelings of relative deprivation as reduced life satisfaction is tolerable. Our hypothesis that better-off neighbours present a negative externality, however, remains not supported. The results suggest that the income effects are positive, but the estimated coefficients are not statistically significant.

Inclusion of More Neighbourhood Characteristics

We can see that inclusion of more neighbourhood controls does not significantly increase the prediction power of the model and that it also does not change the sign of the neighbourhood income effect. The neighbourhood income effect reduces to less than 0.1 and becomes statistically insignificant in both years. This suggests that access to local public facilities is correlated with neighbourhood income. Most of the effects of distance to local facilities are negative but not statistically significant (results reported in Appendix 6). There only exists a negative association between living further away from sports grounds, gyms and the like, which is in line with what we would expect in a society that enjoys physical activities.

People's Interaction with the Neighbourhood

We hypothesised that neighbourhood is more important for individuals that may be assumed to be more in touch with their neighbours. On the dimensions that we measure, the empirical findings do not lend much support for our hypothesis. The interactions are statistically insignificant and there is an inconsistency of the effects over time.

Effects of Unobserved Heterogeneity

The explained variance for the prediction of changes in life satisfaction from 1994 to 1999 controlling for unobserved heterogeneity (fixed effects models) is only three percent, which is low. However, it is difficult to predict changes in such variables. In addition, we have to bear in mind that some of

the changes that we observe may only affect happiness at the time the change occurred. It is known, for instance, that marital transitions have a tendency to have a measurable impact on happiness in the short run, but that effects disappear in the longer run since individuals' happiness returns to baseline levels (see Lucas / Clark / Georgellis / Diener, 2003). The changes we pick up are those that occurred at any time between the 1994 and the 1999 surveys of the SOEP.[18] We thus expect effects to be smaller than would be the case if we looked at changes that occurred in adjacent years. As a consequence, the effects we do identify in our model – though in line with what we would expect – are often not significant. However, despite the identification difficulties in the prediction of changes, we find a number of variables significant. Among these are the life events becoming disabled or unemployed that are associated with changes in life satisfaction to the negative (see Appendix 7). We furthermore find changes in own income positively and highly significantly associated with changes in life satisfaction. The association between changes in the annual change of household income is also negative (and insignificant) in the panel model. Splitting-up the sample into movers and non-movers so as to reduce the extent to which neighbourhood selection effects and unobserved fixed neighbourhood characteristics might be driving the results, does not offer any more insights either – the effect of neighbourhood income is also positive and insignificant for those individuals that have not moved.

These findings back up the results of our cross-sectional baseline models. In those models we also found individuals unhappier when they were in rather undesirable states like unemployment, or disability, or when their income was low. We still find a positive coefficient on neighbourhood income when we control for unobserved individual characteristics, but this effect is highly insignificant. This suggests that the relationship between neighbours' income and happiness that we identified in the level model for 1999 is to some extent indeed picking up things to do with living in a better-off neighbourhood that we do not control for.

5. Conclusions

Relative deprivation theory suggests that people are unhappier than otherwise would be if they are living in a neighbourhood where the average neighbour is financially better off than they are.

Our empirical results suggest that this is not the case. We find a strong positive correlation between both neighbourhood incomes and household incomes

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[18] For a number of respondents more than one change might have occurred on one indicator in the five year period, for instance a divorce might have been followed by a new marriage, or, in terms of neighbourhood changes, individuals might have moved away from their 1994 neighbourhood to take up an apprenticeship but have moved back by 1999. In both cases the change would be confound.

with levels of subjective well-being in our two-and three-dimensional analyses. In particular, people living in the poorest neighbourhoods are much unhappier than others. However, our more detailed multivariate analyses suggest that this effect is driven by living in East Germany where, on average, people are unhappier, and neighbourhoods are poorer.

In the multivariate predictions of life satisfaction we find that people living in Germany are happier the more income they have but also the better off their average neighbour is. But the associations between neighbours' income and personal happiness are very weak and not statistically significant (only at the 5 percent level in 1999 – this might be due to a convergence of levels of happiness and neighbourhood incomes in West and East Germany).

Overall, given the robustness of the positive sign of the neighbourhood income effect in all models that we estimated, we conclude that if neighbourhood income effects exist they are positive. In other words, the empirical evidence lends no support for the relative deprivation hypothesis in the context of German neighbourhoods, when neighbourhoods are operationalised as zip-code areas.

There are a number of reasons why we might expect that there might be positive effects of living in better-off neighbourhoods. One of these is that people may expect to benefit from their neighbourhood at some point in the near future. The fact that the average neighbour has a high(er) income is, at least in parts, a reflection of favourable employment prospects in the area. It certainly signals to business people where the demand for their goods and services is: it is not a coincidence that the neighbourhood data we employ are purchased by companies to help them make their decision on where to start a business. Residents in the poorest neighbourhoods may also suffer from stigmatisation and discrimination in the labour market and in the educational sector, which is why living in a better- off neighbourhood is favourable despite of a low own income. On top of the economic prospect-aspects of having richer neighbours there are social and psychological aspects that may make living among richer people a better experience. Richer neighbours may use parts of their resources to maintain their property at a higher standard, which will make people feel better than living in a neighbourhood with run-down houses. In general people will feel less threatened in a neighbourhood that signals that people care about their social and physical environment.

Most of these effect mechanisms may be expected to operate at the level of the rather great scale of zip-code areas. On average, 9000 people live in German zip-code areas. One of the reasons why we do not find a negative comparison effect of neighbours' income on happiness may be that people do not compare themselves to that many people. There is a lack of data at more immediate neighbourhood scales for the 1994 and 1999 periods, so we cannot investigate this empirically.

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7. Appendix

Appendix 1

Description of variables used in the multivariate models 1994 and 1999

Variable Name	Description
Life satisfaction	The response to the question „How satisfied are you at present with your life, all things considered?" There are eleven response categories running from 0 (completely dissatisfied) to 10 (completely satisfied).
Feeling less relatively deprived	Respondent's agreement with the statement: „In comparison with others, I have not achieved what I deserve". The categories are coded from 1 (totally agree) to 4 (totally disagree).
Annual per capita neighbourhood income (log)	See detailed description in the data section.
Community typology	
village or small town (1 – 2 family home) village / small town (not single occupancy) mid-size town, single occupancy mid-size town (not single occupancy) city, single occupancy city, old building (not single occupancy) city, new building (not single occupancy) city, mixed housing stock, other	This typology that has been developed by researchers at Gesellschaft für wissenschaftliche Datenverarbeitung (GWGD).[19] It is informed by theoretical considerations by urban sociologists, regarding the built and social composite of (inner-city) areas in Germany and the impact thereof on neighbouring (in terms of facilitating interactions between neighbours and attracting people to live in these areas). It builds on the assumptions that (a) differentiation between old and new building stock is redundant in villages and small towns (i.e., settlements with less than 20,000 inhabitants), and also in mid-sized towns (i.e., settlements with 20,000 to 100,000 inhabitants), and (b) that – in cities with more than 100,000 inhabitants – subsections of the city are relatively homogenous in their housing stock. Note that the term 'single occupancy' used in the typology refers to detached houses that are occupied by just one or two households (*1 – 2 Familienhaus*).
West Germany	Dummy that is one if respondent lives in one of the old Federal States
Distance to local public institutions	
shopsbank / ATM doctors public transport kindergarten primary school youth club club for elderly people pubs, bars, restaurants park, green area sports ground, gym	The head of household is asked to give information on how long it takes to get on foot to a number of public facilities. The list of amenities includes (a) day-to-day infrastructure (shops for every day needs, doctors, banking facilities, station / stop for public transport), (b) institutions that serve particular age groups (kindergarten, primary school, youth club, day centre for elderly people), and (c) recreational facilities (pubs / bars / restaurants, public park / green space, sports and other leisure facilities). The answer categories are [under 10 minutes], [10 – 20 minutes], [more than 20 minutes], [not available / not accessible on foot].

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[19] The authors owe credit to Peter Bartelheimer of the GWGD for sharing syntax files and background information.

Annual per capita household income (log)	See detailed description in the data section.
Homeowner	Dummy that takes the value one if respondent lives in owner-occupied accommodation. Generated by the SOEP team. Provided in the wave-specific household-level generated-variables component of the SOEP data base (i.e., $hgen).
Number of years in education	Taken from the CNEF instrument of SOEP, internationally standardised definition. Inconsistencies over time 'corrected'. Time-inconsistent accounts were replaced with the most frequent, and if this did not exist, with the highest value provided in the 1994 – 1999 period.
German	Dummy that is one if respondent has the German nationality
Marital Status	
married *divorced* *widowed* *never married*	Compressed version of a typology generated by the SOEP team which is provided in the wave-specific household-level generated-variables component of the SOEP data base (i.e., $hgen).
Number of children in the household	Number of persons below the age of 18 in the household.
Employment typology	
employed *registered unemployed* *student* *pensioner* *not employed* *(not student or pensioner)*	The employment status typology has been generated for the purpose of this study drawing on wave-specific individual-level SOEP data sets. Assignment of the employment status was ordered. Priority was given to classifying pensioners (persons older than 64 in receipt of a pension). The group of individuals attending university classes is exclusive of pensioners who may attend university for the purpose of lifelong learning. The 'registered unemployed'-category is exclusive of pensioners and students and contains all individuals that report to be registered unemployed. Individuals are classified as 'employed' or 'not employed', respectively, when they claim to be just that and are in neither of the aforementioned categories. Finally, the 'not employed / supplementary employed'- category picks up not employed individuals who claim to have some sort of job they are getting paid for, if on a very irregular basis.
Disabled	A person is classified as disabled if his / her ability to work is limited and if this is legally recognised by means of a degree of disability of 30 percent or more. Taken from CNEF component of SOEP. We treat individuals reporting being legally disabled in 1994 and having a degree of disability of greater or equal 30 as disabled in 1999, irrespective of their account in 1999.
Movers	Dummy that takes the value one for individuals who live in another zip-code area in 1999 than in 1994.

Source: SOEP 20. Authors' calculations.

Appendix 2

Summary statistics of variables used in the multivariate analysis 1994 and 1999

	1994				1999			
	Mean / percent	*S.D.*	*Min*	*Max*	*Mean / percent*	*S.D.*	*Min*	*Max*
Life satisfaction	6.82	1.84	0	10	6.95	1.78	0	10
Feeling relatively deprived					2.84	0.86	1	4
Female	0.51	0.50	0	1	0.52	0.50	0	1
Age	45.33	16.48	18	98	46.94	16.21	19	96
Number of years in education	11.21	2.43	7	18	11.47	2.47	7	18
German	0.83	0.38	0	1	0.88	0.33	0	1
West Germany	0.70	0.46	0	1	0.72	0.45	0	1
Married	0.69	0.46	0	1	0.67	0.47	0	1
Divorced	0.06	0.23	0	1	0.07	0.26	0	1
Widowed	0.06	0.23	0	1	0.06	0.24	0	1
Never married	0.06	0.24	0	1	0.20	0.40	0	1
Number of children in the household	0.63	0.93	0	6	0.57	0.91	0	9
Employed	0.62	0.49	0	1	0.60	0.49	0	1
Registered unemployed	0.09	0.28	0	1	0.07	0.26	0	1
Student	0.01	0.10	0	1	0.01	0.09	0	1
Pensioner	0.12	0.32	0	1	0.15	0.36	0	1
Not employed (not student or pensioner)	0.17	0.37	0	1	0.17	0.37	0	1
Annual per capita household income (log)	9.13	0.51	3.65	11.77	9.27	0.51	3.81	11.75
Change in annual per capita household income (log) $t - t - 1$	0.06	0.30	−3.04	8.01	0.03	0.28	−4.66	5.63
Homeowner	0.40	0.49	0	1	0.45	0.50	0	1
Disabled	0.09	0.29	0	1	0.11	0.32	0	1
Annual per capita neighbourhood income (log)	9.22	0.22	8.69	10.14	9.34	0.22	8.81	10.08
Village or small town (1 – 2 family home)	0.31	0.46	0	1	0.33	0.47	0	1
Village / small town (not single occupancy)	0.11	0.32	0	1	0.12	0.32	0	1
Mid-size town, single occupancy	0.12	0.32	0	1	0.12	0.33	0	1

Mid-size town (not single occupancy)	0.15	0.35	0	1	0.14	0.34	0	1
City, single occupancy	0.05	0.21	0	1	0.05	0.23	0	1
City, old building (not single occupancy)	0.08	0.27	0	1	0.07	0.25	0	1
City, new building (not single occupancy)	0.09	0.28	0	1	0.08	0.28	0	1
City, mixed housing stock, other	0.10	0.30	0	1	0.09	0.28	0	1
Movers					0.16	0.36	0	1

Source: SOEP 20. Authors' calculations.

Appendix 3

Average life satisfaction by classes of income 1994

Class	Household income class definition by			Neighbourhood income class definition by		
	household income	*weighted neighbour-hood income*	*neighbour-hood income across Germany*	*weighted neighbour-hood income*	*neighbour-hood income across Germany*	*quintiles of household income*
1	6.4	6.6	6.5	6.4	6.3	6.2
2	6.7	6.8	6.7	7.0	6.8	6.4
3	6.9	7.0	7.0	6.9	6.9	7.0
4	7.2	6.9	7.0	7.0	7.0	7.0
5	7.2	7.2	7.2	7.1	7.0	7.0

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

Appendix 4

Upper class limits of neighbourhood income and household income quintiles 1994, in DM

Income Class Definition	Class			
	1	*2*	*3*	*4*
household income (weighted)	6,731	8,833	11,542	15,514
neighbourhood income (weighted)	8,826	10,036	11,003	12,183
neighbourhood income (all areas)	8,091	9,290	10,381	11,672

Notes: Incomes are at the same scales and refer to annual incomes.
Source: SOEP 20. Authors' calculations.

Appendix 5

Upper class limits of neighbourhood income and household income quintiles 1999, in DM

Income Class Definition	Class			
	1	*2*	*3*	*4*
household income (weighted)	7,665	10,196	13,049	17,489
neighbourhood income (weighted)	9,903	11,216	12,400	14,014
neighbourhood income (all areas)	9,235	10,500	11,694	13,295

Notes: Incomes are at the same scales and refer to annual incomes.
Source: SOEP 20. Authors' calculations.

Appendix 6

Controlling for neighbourhood infrastructure 1994 and 1999

Control variable	Life Satisfaction	
	1994	*1999*
Annual per capita neighbourhood income (log)	0.06	0.08
Type of community (comparison group: single occupancy in village or small town)		
village / small town (not single occupancy)	–0.12	–0.19**
mid-size town, single occupancy	–0.02	0.02
mid-size town (not single occupancy)	–0.08	–0.15*
city, single occupancy	0.08	–0.02
city, old build., (not single occupancy)	–0.18*	–0.07
city, new build., (not single occupancy)	–0.1	–0.14
city, mixed housing stock, other	–0.15	–0.08
Distance to the next bigger city	0.01	0.03*
… Day-to-day infrastructure		
shops	–0.04	–0.02
bank / ATM	–0.02	–0.03
doctors	–0.02	—0.03
public transport	0	–0.06
… Institutions for different age groups		
kindergarten	0.02	0.04
primary school	–0.04	0.05*
youth club	–0.01	–0.03
club for elderly people	0.01	–0.02
… Recreational facilities		
pubs, bars, restaurants	0.04	–0.01
park, green area	–0.01	–0.04*
sports ground, gym	–0.11**	–0.07**

West Germany	0.57**	0.42**
Annual per capita household income (log)	0.45**	0.51**
Change in annual per capita household income (log) $t - t - 1$	0	−0.20**
Homeowner	0.19**	0.12**
Constant	3.15**	2.80*
Observations	9340	10113
R^2	0.12	0.11

Notes: Models also control for financial situation, health, family, work and basic characteristics.
* significant at the 0.05 level. ** significant at the 0.01 level.

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.

Appendix 7

Panel estimations of life satisfaction differentiated by moving status

Control variable	**all**	**non-movers**	**movers**
Annual per capita neighbourhood income (log)	0.42	0.39	0.52
Type of community (comparison group: single occupancy in village or small town)			
village / small town (not single occupancy)	−0.05	−0.11	0.07
mid-size town, single occupancy	0.05	0	0.26
mid-size town (not single occupancy)	0.16	0.34*	0.06
city, single occupancy	0.18	0.38	0.05
city, old build., (not single occupancy)	0.11	0.01	0.25
city, new build., (not single occupancy)	−0.07	0.25	−0.09
city, mixed housing stock, other	0.14	0.34	0.13
West Germany	0.11	0	0.08
Year	−0.02**	−0.03*	0
Marital status (comparison group: never married)			
married	0.12	0.1	0.08
divorced	0.13	0.03	0.18
widowed	−0.21	−0.26	−0.03
Number of children in the household	0.08**	0.08*	0.05
Disabled	−0.40**	−0.44**	−0.08
Annual per capita household income (log)	0.33**	0.40**	0.11
Change in annual per capita household income (log) $t - t - 1$	−0.07	−0.08	−0.05
Homeowner	0.15*	0.15	0.16
Employment status (comparison group: employed)			
registered unemployed	−0.74**	−0.68**	−0.94**
student	0.11	0.12	0.06
pensioner	−0.14	−0.1	−0.27
not employed (not student or pensioner)	−0.12*	−0.08	−0.22
not employed / supplementary employed	−0.46*	−0.29	−1.40*

Continued Appendix 7

Control variable	all	non-movers	movers
Constant	40.20**	50.16**	1.92
Observations	16982	14302	2680
Number never changing person id	8491	7151	1340
R^2	0.03	0.03	0.04

Notes: *significant at the 0.05 level. ** significant at the 0.01 level.

Source: SOEP 20 and neighbourhood indicator data set. Authors' calculations.