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NEIGHBORS' INCOME, PUBLIC GOODS, AND WELL-BEING

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How does neighbors' income affect individual well-being? Our analysis is based on rich U.S. local data from the Behavioral Risk Factor Surveillance System, which contains information on where respondents live and their self-reported well-being. We find that the effect of neighbors' income on individuals' self-reported well-being varies with the size of the neighborhood included. In smaller areas such as ZIP codes, we find a positive relationship between median income and individuals' life satisfaction, whereas it is the opposite at the county, MSA, and state levels. We provide evidence that local public goods and local area characteristics such as unemployment, criminality, and poverty rates drive the association between satisfaction and neighbors' income at the ZIP code level. The neighbors' income effects are mainly concentrated among poorer individuals and are as large as one quarter of the effect of own income on self-reported well-being.

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1. Introduction

How does neighbors' income affect individual well-being? Neighbors' income may be related to neighborhood amenities and higher income may translate into better public goods. However, neighbors' income can also be negatively correlated with well-being. The idea is that people compare their income to the income of others and are concerned by their relative position. There is by now a large literature in economics on income comparisons. One notable implication is

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that income comparisons have been held responsible for the failure of growing countries to achieve higher well-being over time (Layard, 1980; Easterlin, 1995).

Hence, whether neighbors' income has a positive or negative impact on well-being is not straightforward. Several existing studies analyze this relationship and find conflicting evidence. For instance, Luttmer (2005), Blanchflower and Oswald (2004), and Helliwell and Huang (2011) use neighbors' income at a very aggregated level and provide empirical support for a negative relationship between neighbors' income and individual well-being. A major hurdle of those studies, however, is that neighbors' income within a large area may capture other confounded effects than income comparisons such as local amenities and local labor-market conditions. By contrast, other studies rely on more disaggregated data and find opposite results (e.g. Knies *et al*., 2008; Clark *et al*., 2009; Dittmann and Goebel, 2010).

In this paper, we rely on local data to answer this question. We appeal to rich U.S. data from the Behavioral Risk Factor Surveillance System (BRFSS), which contains information on where respondents live, on their socioeconomic characteristics, and on their self-reported well-being. We conduct a multi-scale approach by looking at median incomes at the state, county, Metropolitan Statistical Area (MSA), and ZIP code levels simultaneously to shed some light on whether the association between neighbors' income and well-being changes as the scale of neighborhood changes.

The rationale for this is that the notion of neighborhood can refer to various geographic scales. Individuals are engaged in social relationships within their immediate neighborhood (e.g. block/street peers), the local community (e.g. schools, hospitals, parks and restaurants' consumers in their ZIP code of residence), and a broader metropolitan area (e.g. potential co-workers in their county or MSA of residence). The challenge for empirical research on neighborhood effects is hence to take into account these multiple scales simultaneously and understand at which scale and how neighbors' income effects operate (Galster, 2008).

Neighbors' income may affect well-being through many channels (relative deprivation, social capital, amenities, and fellow-feeling) and the strength of those channels may depend on the scale of neighborhood; for example, as the definition of the reference group is broadened. Arguably, we tend to care more about individuals close to us and less about those further away. Feelings of relative deprivation or fellow-feeling may than be stronger at more disaggregated levels such as the local community than at the metropolitan area level. Similarly, the effects of public goods and amenities might be stronger within our local community level since we are more likely to share them with close neighbors. Having a single framework with multiple reference neighbors' income can allow us to (i) investigate whether the relative size of the income spillovers varies with the different levels of aggregation and (ii) reconcile seemingly divergent results from the literature.

Our analysis suggests some interesting results. We first test whether neighbors' income and self-reported well-being are positively or negatively related at the county, MSA, and state levels. Luttmer (2005) provides evidence that subjective well-being is positively associated with own income and negatively

correlated with average/median income at the Public Use Microdata Areas (PUMAs). PUMAs have on average 150,000 inhabitants and represent travel-to-work areas. Luttmer (2005) argues that this negative relationship between income and well-being is consistent with individuals having utility functions that depend on relative consumption; that is, the relative income hypothesis. Using the BRFSS, we find that self-reported well-being is positively related to own income and negatively associated with median income at the county, MSA, and state levels.

We then use more disaggregated data to test whether the relationship between median income and subjective well-being varies as we use a smaller level of aggregation (ZIP code). We rely on proprietary data from the BRFSS identifying the ZIP code of residence of respondents. In our sample, ZIP codes have on average 24,000 inhabitants. Residents of a similar ZIP code may thus share similar public goods and amenities. By contrast, conditional on own and county median incomes, we find a *positive* relationship between median income and well-being at the ZIP code level. This result suggests that the negative income effects identified at the PUMA and county levels might be counterbalanced at the ZIP code level by positive spillovers. We also distinguish between individuals below and above ZIP code median income. We provide evidence that the positive effect of neighbors' income on well-being at the ZIP code level is larger for poorer individuals (Ferrer-i-Carbonell, 2005; Clark and Senik, 2010).

We test explicitly whether local public goods and amenities drive the association between ZIP code median income and subjective well-being. We include in our specifications local area variables such as the economic environment, poverty rate, neighbors' socioeconomic characteristics, and the number of school and health establishments. The addition of these variables into our model makes the relationship between ZIP code median income and respondents' satisfaction statistically insignificant. The estimate is a well-estimated zero when the full set of controls is included. We then test whether only a subset of public goods explain the positive effect of neighbors' income. We show that neighbors' income affects well-being through environmental and geographic public goods such as local unemployment, criminality, and poverty rates. On the other hand, institutional variables such as the number of school and health establishments, the number of childcare services, and local government expenditures do not seem to explain the positive income spillovers.

Overall, our findings suggest that the direction of the relationship between others' income and well-being depends on the geographic reference group that is included; for example, local community at the ZIP code level, broader metropolitan area at the county and MSA levels, and state of residence. At the most disaggregated level (ZIP code), we find that social and economic features of the local environment drive the association. The ZIP code income effect is as large as one quarter of the effect of own income on self-reported well-being. At the different levels of aggregation, however, we cannot conclude on whether relative deprivation and income comparisons vary with the literal distance from people.

The next section reviews the literature on neighbors' income and well-being. Section 3 provides a conceptual framework. In Section 4, we discuss the empirical

strategy. Section 5 details the BRFSS and presents the findings. Section 6 concludes.

2. Previous Literature

An important and debated theme in the literature is the link between income and subjective well-being.[1] We are more interested in the idea that life satisfaction may depend on others' income. Various researchers argue that continuous income growth does not lead to ever-happier individuals. Easterlin (1974, 1995, 2001) claims that while, within most societies, richer people are happier than poorer people, over time the population does not become happier on average when the country's income rises. To reconcile these two facts, Easterlin proposes, among other explanations, the relative income hypothesis. People compare themselves with other people: it is relative income rather than absolute income that matters. If own income rises, but the income of people with whom we compare increases as well, then the ratio may stay unchanged. These results have been challenged by Stevenson and Wolfers (2008) and Sacks *et al.* (2012), who find that economic growth is associated with rising well-being. A recent paper by Proto and Rustichini (2013) finds a positive relationship between growth and satisfaction for countries with a GDP below $15,000, but shows that this relationship is approximately flat in richer countries, suggesting a gap between aspiration and realized income.

The economic analysis of relative income effects can be traced back to at least Veblen (1899) and Duesenberry (1949). There is by now a substantial empirical literature regarding this relationship (Van Praag, 1971; Frank, 1985; Kapteyn *et al*., 1985; Easterlin, 1995; Clark and Oswald, 1996; Ferrer-i-Carbonell, 2005; Card *et al*., 2012). In support of the importance of relative income, Knight *et al*. (2009) note that two thirds of respondents in a survey of Chinese households report that their main comparison group consists of residents in their own village. On the other hand, Clark and Senik (2010) find that the large majority of Europeans compare with their work colleagues and also their friends. This is confirmed by Mayraz *et al*. (2010), who report that comparisons are mainly generic or work-related.

There are few papers that address how neighbors' income affects well-being. Blanchflower and Oswald (2004), Helliwell and Huang (2011), and Luttmer (2005) report that subjective well-being is positively associated with own income and negatively associated with average/median income in the region of residence. They argue that the negative effect of neighbors' earnings on well-being is due to relative consumption. Luttmer (2005) used the 1987–8 and 1992–4 waves of the National Survey of Families and Households and matched this dataset to the PUMAs. Blanchflower and Oswald (2004) provided a similar analysis using the General Social Survey and state income per capita, while Helliwell and Huang (2011) relied

[1]Investigating the impact of income on self-reported well-being is difficult because of reverse causality. Income affects a person's well-being but well-being also affects the ability to succeed. There is some evidence that the positive correlation between money and well-being goes from the former to the latter (Frijters *et al*., 2004; Gardner and Oswald, 2007; Pischke, 2011; Pischke and Schwandt, 2012; De Neve and Oswald, 2012). See, among others, Clark *et al*. (2008), Di Tella and MacCulloch (2006), and Frey and Stutzer (2002) for an overview of the relevant papers.

on county-level data. In each of these papers, the lack of large and rich datasets and finely disaggregated data makes the identification of the presence of income comparisons difficult, and subject to potential omitted variable bias.

Other studies rely on more disaggregated data from Europe. Clark *et al*. (2009), Dittmann and Goebel (2010), Knies *et al*. (2008), and Knies (2012) use, respectively, Danish and German data. Knies *et al*. (2008) rely on German ZIP codes (roughly 9,000 inhabitants on average) and find no statistically significant associations between neighbors' income and life satisfaction. Clark *et al*. (2009) rely on a geographic grid of 10,000 m^2 and provide evidence that respondents are more satisfied when their neighbors are richer, which is consistent with a public goods interpretation. Dittmann and Goebel (2010) use micro-geographic data on the households' immediate neighborhoods. The building level covers eight households on average and the street section level 25 households on average. They find that respondents living in a neighborhood with a higher socioeconomic status report higher levels of life satisfaction.[2] Last, Knies (2012) relies on very disaggregated data at the street level in Germany. The author provides evidence that neighborhood income effect for the former West Germany is negative. In contrast, the effect is not statistically significant for respondents living in the former East Germany. While it is possible that Americans and Europeans are affected differently by neighbors' income, our intuition is that the disparities in those results are driven by the size of the geographic reference group, the definition of the neighborhood income, and omitted variable bias; that is, local public goods.

The main contribution of our paper is to look at the relationship between neighbors' income and satisfaction in the United States (U.S.) for different geographic levels: state, MSA, county, and ZIP code. The use of different geographic areas simultaneously will give us the possibility of testing whether this association is driven by the size of the locality that is included; that is, whether income spillovers vary with geographic distance. In addition, we specifically test some of the mechanisms behind this relationship. The correlation between well-being and neighbors' income may be driven by omitted variables or selection. Moreover, there could be interpretations other than income comparisons, such as public goods or social proximity (see Section 3). In this paper, we try to overcome some of these complications by controlling for potentially omitted factors such as differences in local prices and public goods. An alternative approach would be to identify fairly random shocks to incomes in particular neighborhoods. Unfortunately, this method requires information on migration status and on whether or not the respondent is affected by the shocks (Galster, 2012; Ludwig *et al*., 2012).

Two other studies similar to ours are Kingdon and Knight (2007) and Barrington-Leigh and Helliwell (2008).[3] Kingdon and Knight (2007) use 366 randomly selected clusters covering 2,900 people on average and districts in South Africa. Their findings indicate a positive relationship for clusters and a negative association between neighbors' income and household satisfaction at the district

[2]Socioeconomic status is measured using a nine-point scale index based mainly on education and income.

[3]In a recent working paper, Ifcher *et al*. (2015) replicate our analysis at the ZIP code level using data from the U.S. Gallup–Healthways Well-Being Index. Their estimates are also positive when using ZIP code median income as the reference income.

level. Their results suggest evidence of empathy for close neighbors and comparisons for those further away. Note that their paper analyzes a particularly segregated society in a developing country. Their results could thus differ from ours. In an unpublished paper, Barrington-Leigh and Helliwell (2008) rely on different Canadian surveys and show the relationship between measures of well-being and income spillovers for different geographic scales. Their findings suggest that the overall spillover effect is negative.

These studies, however, do not test directly whether the positive relationship at the most disaggregated level is due to public goods. We will revisit their results by showing a positive and statistically significant partial correlation between well-being and median income at the ZIP code level and a negative association at the county level. We will argue that the former result cannot be explained only by income comparisons. Arguably, the strength of income comparisons should be decreasing with distance. Nearby neighbors are more likely to compare their earnings with each other than with faraway neighbors.

3. The Conceptual Framework

The effect of neighbors' income on well-being is, *a priori*, ambiguous since many channels are at work (Galster, 2008, 2012). In this section, we present different mechanisms which could explain the relationship between neighbors' spillovers and self-reported well-being. We then derive specific hypotheses about the strength of the mechanisms captured in the different aggregations; that is state, MSA, county, or ZIP code.

3.1. *Mechanisms*

Galster (2012) reviews the literature and identifies 15 potential pathways of neighborhood effects. He regroups these pathways into four broad rubrics: social-interactive, environmental, geographic, and institutional mechanisms. We focus on the "economic" pathways in what follows and regroup the last three rubrics for space considerations.

The Social-Interactive Mechanism

This rubric includes feelings of relative deprivation (Veblen, 1899; Duesenberry, 1949; Stigler, 1950a,b). Well-being depends partly on individuals' absolute income and, arguably, partly on individuals' relative income; that is, the gap between own income and some reference benchmark. One reason for feelings of relative deprivation could be a sense of unfairness, envy, or jealousy toward others in the reference group. Moreover, Galster (2008) points out that neighbors may also compete for local resources such as public parks.

Another pathway proposed in the literature is the "tunnel effect" (Hirschman and Rothschild, 1973). The income of others contains potential information about own social status, but also about future prospects.[4] The relative increase of

[4]Hirschman and Rothschild (1973) put forward the idea that societies experiencing economic development may show, at the beginning of the process, more tolerance toward inequality.

others' income is seen as promising evidence about the individual's own chance of success. Note that both the tunnel effect and relative deprivation could also be affected by (social) distance to others. There would thus be an interaction effect between the different channels.

Proximity in a social network or psychological distance due to class distinctions may also matter. The social distance channel may work through altruism toward individuals close to us or through prestige from how well people socially close do.[5] Social networks may also affect individuals through interpersonal communication of resources and information or social norms (Galster, 2012).

Hence, the social-interactive mechanism suggests that neighbors' income may have negative effects on individuals' well-being through relative deprivation, competition, and "bad" future prospects. On the contrary, the social-interactive mechanism may affect positively well-being through altruism, prestige, communication, and "good" future prospects. We come back in the next subsection to whether the strength of these pathways is related to the size of the neighborhoods.

Environmental, Geographic, and Institutional Mechanisms

Environmental and geographic mechanisms include exposure to violence, public infrastructure, job opportunities, and toxic exposure. We test this channel explicitly by including in our model variables such as the local unemployment, criminality, and poverty rates. On the other hand, the institutional pathway includes the quality of private or public institutions such as day care, restaurants, hospitals, and schools. We test this pathway by including in our model the number of school and health establishments, the number of childcare services, and the number of physicians' and dentists' offices.

It is possible that we do not necessarily want to have rich neighbors *per se*, but we like to have neighbors who have specific demographic characteristics; for example, young and parents. Note that our empirical framework will control for a broad range of demographic characteristics of the area that we study (see Section 4). We thus test separately the demographic composition of the neighborhood and the local public goods mechanisms; that is, the environmental, geographic, and institutional mechanisms.

Overall, the net effect of neighbors' income may be negative or positive depending on the relative size of these mechanisms (Knies, 2007). Note that there are other plausible interpretations which do not involve neighborhood effects. For example, there could be a negative correlation between neighbors' income and well-being because of differences in prices. In this case, the negative effect of neighbors' income would simply reflect that higher housing prices reduce well-being. One may also worry that neighbors' income simply proxies for respondents' income. The positive correlation between neighbors' income and well-being would reflect the positive association between own income and happiness. We will address these complications in the next sections.

[5]Many researchers, including Helliwell (2001), argue that social capital can have a positive effect on well-being.

3.2. *Aggregations*

One critique of the economic literature on neighbors' income and well-being is the use of large neighborhood units (Knies, 2007). This is often the result of relying on datasets with statistically defined neighborhood units. For instance, Luttmer (2005) relies on PUMAs which have on average 150,000 inhabitants. In this study, we rely on the following statistical units: states, MSAs, counties, and ZIP codes. We believe that studying the impact of neighbors' income on well-being requires disaggregated and multi-scaled data to dig out whether the net effect of neighbors' income varies with (i) the scale of neighborhood included and (ii) the relative size of the mechanisms discussed above.

Table A.2 (in the Online Supporting Information) provides descriptive statistics on the statistical units. ZIP codes cover about 61 square miles on average against 2,298 square miles for counties. ZIP codes have on average 24,000 inhabitants, while counties have approximately 394,000 inhabitants in our sample.[6] In Table A.3, we provide evidence that the median ZIP code household income is highly correlated with many public goods included in the environmental, geographic, and institutional mechanisms. In our sample, the median ZIP code household income is negatively correlated with unemployment and poverty rates and positively associated with the number of schools and dentists' offices. The percentage of married couples and residents with a high school diploma is also much higher in richer ZIP codes. Moreover, there is a positive correlation between the median *county* household income and unemployment rate, although the magnitude is much smaller. These correlations suggest that the median ZIP code income is more likely to capture the quality of public goods and amenities than the median county income.

Controlling for the ZIP code median income, we argue that the median county and MSA household incomes are proxies for the travel-to-work area characteristics. An MSA represents a core area having a high degree of economic integration. MSAs have at least one urbanized area of 50,000 or more inhabitants. About 81 percent of the respondents in our dataset work in their county residence and solely 4 percent work outside of their state of residence. Similarly, only 16 percent of the respondents in our dataset work in their state of residence but outside their county of residence (see Table A.2). Residents of a similar county or MSA may be potential co-workers. A county or MSA is a geographic areas with a relatively high population density and close economic ties throughout.

We derive two hypotheses concerning the strength of the mechanisms captured in the four aggregations:

1. Arguably, we tend to care more about individuals close to us and less about those in a faraway city (i.e. literal distance from people). Residents of our ZIP code have similar social characteristics, or at least closer characteristics than those of individuals in our county or state. We thus assume that feelings of relative deprivation, altruism, prestige,

[6]Five-digit ZIP codes are a system of postal codes. The main city in a region typically has the first ZIP codes. Note that the vast majority of ZIP codes in our sample do not span across states. ZIP codes that span across states are usually remote areas and are thus not included in our analysis. See Section 5 for more information on the sample restrictions.

and future prospects (i.e. social-interactive mechanisms) are stronger at the ZIP code level than at the county, MSA, and state levels. In other words, we hypothesize that relative deprivation or income comparisons should decrease with distance since individuals are more likely to observe the consumption of close neighbors.

2. Similarly, we assume that the effect of public goods—that is, environmental, geographic, and institutional mechanisms—should also be stronger at the ZIP code level, since we are more likely to share hospitals, childcare establishments, and public schools with closer neighbors than with faraway neighbors. Moreover, crime and poverty rates are likely to affect individuals' well-being at the ZIP code level, since we tend to care more about the degree of public safety and deprivation in our immediate neighborhood than in faraway cities.

4. The Empirical Strategy

In order to test these different mechanisms, we conduct a multi-scale approach at the state, MSA, county, and ZIP code levels. Traditionally, the effect of income spillovers on well-being is tested through the coefficient of $\bar{y}$, the mean or median reference group income. In our contextual framework, $\bar{y}$ is the place of residence median income. We follow the literature by using median household income since it is less sensitive to outliers than the mean (Clark *et al.*, 2008). Note that using the mean instead yields similar findings.

The following relation is assumed:

$$U_i = U(y_i, \bar{y}, X), \tag{1}$$

where U is the economic concept of utility which depends on y, the household income, and $\bar{y}$, the place of residence median income. X is a set of individual covariates.

The discussion so far has focused on a general notion of well-being, which is different than the notion of utility. In economics, utility is a device for representing revealed preferences. This paper does not intend to give a survey of research on the link between utility and well-being (Frey and Stutzer, 2002). We propose to use self-reported well-being data as proxies for utility. Note that many issues remain unresolved regarding self-reported measures of well-being. For instance, Bertrand and Mullainathan (2001) discuss how cognitive factors may affect the way in which people answer survey questions (for a more detailed discussion, see Benjamin *et al.*, 2012, 2014; Deaton and Stone, 2013).

Our econometric model is as follows:

$$SWB_{iszt} = \alpha + \delta \ln(y_{it}) + \theta \ln(\bar{y}_{zt}) + \lambda \ln(\bar{y}_{ct}) + \mu \ln(\bar{y}_{st}) + \gamma X_{it} + \varepsilon_{iszt}, \tag{2}$$

where SWB is the outcome variable (life satisfaction) for respondent i in year t living in ZIP code z, county c, and state s, and δ is the coefficient associated with

household income.[7] θ, λ, and μ are the coefficients of interest in this framework. The well-being function is believed to be concave in household income, which explains our choice to introduce income in logarithmic form (Stevenson and Wolfers, 2013).[8] We rely throughout on ordered probit response models where the dependent variable life satisfaction is discrete and defined on a finite ordinal scale. We cluster the standard errors at the county level.[9]

We are aware that the association between well-being and neighbors' income may be spurious due to omitted socioeconomic and local area variables. We thus include in the basic econometric model region*year fixed effects in order to absorb most of the cross-region variations and month*year dummies to control for seasonal influences. We provide robustness checks where we include county– and state–year fixed effects and replace the household income variable by the household income per equivalent adult.[10]

We include individual covariates in our basic model and a broad set of local area characteristics at the ZIP code, county, and state levels. The individual covariates include gender, age, employment, marital status, education, number of children, and race of respondent. Note that the area characteristics at the ZIP code, county, and state are the percentage of non-Hispanic black, the percentage of Hispanic, the percentage of elderly, and the percentage of children (less than 19 years old).[11] The basic model also includes the percentage of rural population and the natural log of the total population, since it is possible that social interactions are more prevalent in smaller cities. Last, we include the natural log of the area.

We examine whether the inclusion of housing prices and additional variables at the ZIP code and county levels affects our estimates. At the ZIP code level, we further include the unemployment rate, the poverty rate, the percentage of high school graduates (among individuals older than 25), the percentage of married people, and the percentage of women 15–50 years old who had a birth in the past 12 months. We also include the number of health establishments, the number of child day care services, the number of physicians' offices, the number of dentists' offices, and the number of schools. At the county level, we include other controls such as the number of murders and non-negligent manslaughters known to police per capita, local government direct expenditures on health, education, welfare, and total expenditures.

[7]Note that we do not include MSA median income in the main specification, as the correlation between county and MSA median income is very high (0.794).

[8]Note that using a dummy for each income category in the data instead of the log of own income yields similar findings (available upon request). There are eight income categories in the BRFSS.

[9]We cluster at the county level and not at the county–year level because the error for a given county in 2010 is likely to be correlated with the error for the same county in 2009.

[10]This measure, proposed by the OECD, takes into account the number of individuals in the household. We limit the number of other adults and kids to three. Household income per equivalent adult is equal to the real family income divided by (1 + 0.5 (other adults) + 0.3 kids).

[11]Poterba (1997) finds that a larger fraction of elderly in a jurisdiction leads to lower public spending on education.

5. BRFSS: Data and Analysis

5.1. *Data*

In our econometric analysis, we rely on the Behavioral Risk Factor Surveillance System (BRFSS), which was established in 1984 by the Centers for Disease Control and Prevention, but did not include a question on life satisfaction before 2005.[12] The time period covered by this dataset is thus 2005–10. The BRFSS contains repeated cross-sections, has a total sample of around 1,750,000, and contains information on state, county, household income, and life satisfaction. It covers more than two thirds of the counties in the U.S.: county codes are suppressed for counties with fewer than 10,000 residents for confidentiality reasons and statistical reliability.[13]

The public version does not identify ZIP codes of residence. We obtained this information from the BRFSS state coordinators. We managed to gather ZIP codes for respondents of eight states: Arizona, Maine, Ohio, Rhode Island, South Dakota, Texas, Utah, and Wyoming. Fortunately, there is at least one state per region (Northeast, Midwest, South, and West). The period covered is 2005–10 for all these states, except for Texas (2007–10). For statistical reliability, we follow the recommendation of the BRFSS coordinators and restrict the sample to ZIP codes where the number of respondents is greater than 50. We combine all years when doing such an exercise, which increases the number of ZIP codes that we may use. This technique gives us a sample size of 216,546 respondents and, respectively, 364, 399, 1160, 70, 381, 1866, 278, and 169 ZIP codes for Arizona, Maine, Ohio, Rhode Island, South Dakota, Texas, Utah, and Wyoming.[14] We present descriptive statistics in Table 1.

In our sample, counties do not span across states. On the other hand, some ZIP codes span across counties. ZIP codes that span across counties are usually remote areas. Remote areas are not included in our analysis since the BRFSS do not report the ZIP code of residence if there are fewer than 50 respondents per wave.

In the BRFSS, subjective well-being is assessed through the following question: "In general, how satisfied are you with your life?" Respondents have four choices (4 = very satisfied, 3 = satisfied, 2 = dissatisfied, and 1 = very dissatisfied). Table A.1 presents means and standard deviations of the variables coming from the BRFSS and shows the distribution of life satisfaction: 46 percent of the respondents reported that they were very satisfied with their life, while on the other hand, 1 percent answered that they were very dissatisfied. Figure 1 illustrates the average life satisfaction for each county for which we have ZIP code data.

[12]Other economic papers using the BRFSS include Brodeur (2013), Glaeser *et al.* (2014), and Oswald and Wu (2010).

[13]States have different rules for the data files. It seems, though, that states report county/ZIP code level data when the number of respondents in a given geographic location is greater than 50.

[14]The remaining states were excluded for three reasons. First, some states did not answer our request. The second reason is simply that many states refused to provide the data in order to protect the confidentiality of respondents. Last, we did not have the funding to pay for the fees asked by a few states.

TABLE 1

DESCRIPTIVE STATISTICS: COUNTIES AND ZIP CODES

State	Number of Cities	Number of Cities (Sample)	Respondents per City (Sample)	Average City Area (m^2) (Sample)	Number of ZIP Codes	Number of ZIP Codes (Sample)	Respondents per ZIP Code (Sample)	Average ZIP Area (m^2) (Sample)
Arizona	15	15	1,804	8,132	364	156	242	74.4
Maine	16	16	2,241	1,848	399	211	208	61.9
Ohio	88	87	2,551	576	1,160	343	147	37.3
Rhode Island	5	5	9,661	384	70	59	554	15.8
South Dakota	66	66	1,315	1,421	381	155	529	136.8
Texas	254	106	1,190	1,283	1,866	269	147	49.9
Utah	29	25	4,898	1,878	278	127	424	69.3
Wyoming	23	23	2,087	4,874	169	75	839	43.9

Notes: Only states for which we have the ZIP codes are included in this table. Columns 1 and 2 show, respectively, the number of counties per state and the number of counties for which data is available (our sample). Columns 3 and 4 present the average number of respondents per county and the average county area for the counties in our sample. Columns 5–8 do the same as columns 1–4 but using ZIP codes instead.

Source: Data from the Behavioral Risk Factor Surveillance System (BRFSS).

The question on household income is the following: "What is your annual household income from all sources?" where respondents have eight different choices ranging from "Less than 10,000" to "75,000 or more." Respectively, 5 percent and 26 percent report having less than $10,000 and more than $75,000. We linearized these income categories by dividing/multiplying bottom-/top-coded categories by standard factors. We use different factors at the end of this paper in order to test the robustness of our results (for more details, see Table A.5). The BRFSS also contains information on gender, age, employment status, education, marital status, number of children, and race of respondents (see Table A.1).

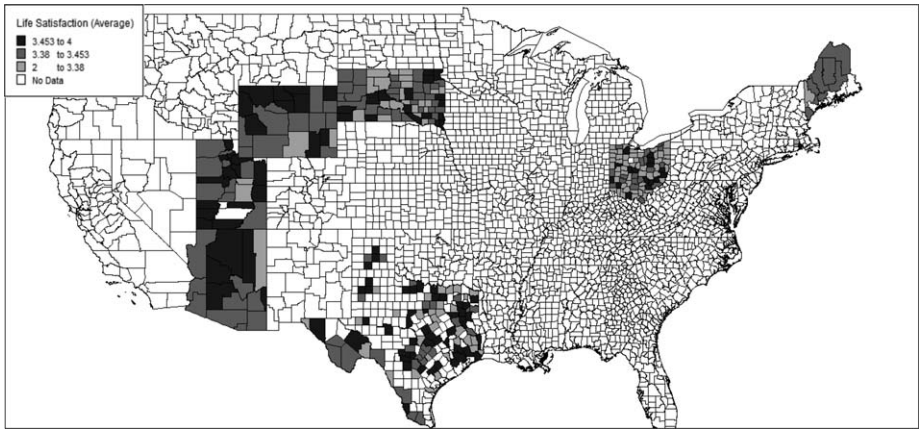

Figure 1. The BRFSS County Life Satisfaction Distribution

Notes: Note that we restrict the sample to counties for which we have ZIP code data. A blank means that there were no data for this county or ZIP code. This figure illustrates the BRFSS county life satisfaction distribution. We report the average life satisfaction for each county.

Source: Data from the Behavioral Risk Factor Surveillance System (BRFSS), 2005–10.

We match this dataset with administrative data from the U.S. Census Bureau.[15] Our method has the advantage of combining a rich survey and reliable administrative data. U.S. counties collect thousands of data items from a variety of sources such as the Bureau of Economic Analysis, the Department of Education, the Federal Bureau of Investigation, and the 2010 Census of Population and Housing. The Appendix gives a definition of the county and ZIP code level variables used in the analysis coming from this source.

Note that the U.S. Census Bureau does not provide statistics at the ZIP code level (five-digit) since the land area covered is not always well identified. Instead, the 2010 Census reports statistics for ZIP Code Tabulation Areas (ZCTAs). ZCTAs are "generalized area representations of U.S. Postal Services (USPS) ZIP code service areas."[16] There are 33,120 five-digit ZCTAs and 3,033 counties in the U.S. as of 2010. Summary statistics for the eight states are presented in Table 1.

Our main variables coming from the U.S. Census Bureau are the state, MSA, county, and ZIP code median household incomes. The time period covered for the state, MSA, and county median household incomes is 2005–10. Additionally, we obtain ZIP code median household income from the 2010 Census. The state, MSA, county, and ZIP code median household income is total money income before deductions by all household members 15 years and over. Total money income is the sum of amounts for income from wages, self-employment, social security, public assistance, and pensions.[17] The maximum value for the ZIP code median household income is $250,000. We use different multiplication factors throughout. When not specified, we multiply $250,000 by 1.5. We check that this has no effect on our findings by using the following factors: 1, 2, and 2.5.

5.2. *Main Results*

This section reports the empirical results for the BRFSS. We rely on data at the state, county, and ZIP code levels and simultaneously present the associations between neighbors' incomes and well-being in Table 2. We show ordered probit regressions, where the dependent variable is self-reported life satisfaction. Note that the regressions presented here include region–year fixed effects, month–year fixed effects, and state, county, and ZIP code controls, which are the percentage of non-Hispanic black, the percentage of Hispanic, the percentage of elderly, and the percentage of children (less than 19 years old). We present standard errors clustered at the county level.

We also control for local housing prices. Note that housing prices vary because of the price and the quantity of housing services (Luttmer, 2005). To isolate the quantity and the quality at the ZIP code level, we use the 2011 American Community Survey five-year estimates to run a hedonic regression of the log

[15]http://censtats.census.gov/usa/usa.shtml. There are, on average, 62 counties per state. The states with, respectively, the smallest and greatest number of counties are Delaware (three) and Texas (254).

[16]ZCTAs represent the most frequently occurring five-digit ZIP codes found in a given area (http://www.census.gov/geo/ZCTA.html). In most cases, the ZCTA is the same as the ZIP code for an area. We thus rely on the ZCTAs and obtain the median household income at the ZCTA level from the Census.

[17]See http://www.census.gov/support/USACdata.html for more details.

TABLE 2

Life Satisfaction and Income Spillovers at the State, County, and ZIP Code Levels

	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit
	(1)	(2)	(3)	(4)	(5)	(6)
Life Satisfaction	All	All	All	All	All	All
ln(real household income)	0.273	0.271	0.273	0.273	0.271	0.271
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ln(median ZIP code household income)		0.043			0.064	0.064
		(0.016)			(0.018)	(0.018)
ln(median county household income)			−0.014		−0.067	−0.067
			(0.026)		(0.029)	(0.029)
ln(median state household income)				−0.087		−0.095
				(0.155)		(0.155)
Control variables						
Individual controls	✓	✓	✓	✓	✓	✓
ZIP code controls	✓	✓	✓	✓	✓	✓
County controls	✓	✓	✓	✓	✓	✓
State controls	✓	✓	✓	✓	✓	✓
Quantity adjusted housing price	✓	✓	✓	✓	✓	✓
Region–year fixed effects	✓	✓	✓	✓	✓	✓
Month–year fixed effects	✓	✓	✓	✓	✓	✓
$P(\theta \neq \lambda)$					0.001	0.001
Observations	216,546	216,546	216,546	216,546	216,546	216,546
Pseudo R^2	0.072	0.072	0.072	0.072	0.072	0.072

Notes: Robust standard errors are in parentheses, clustered by county. The period covered is 2005–10, except for Texas (2007–10). Life satisfaction is assessed through the following question: "In general, how satisfied are you with your life?" where respondents have four choices (4 = very satisfied, 3 = satisfied, 2 = dissatisfied, and 1 = very dissatisfied). All columns include region–year fixed effects, month–year fixed effects, and socioeconomic controls (described in the text). Household income has eight categories. The log of the real household income is calculated using the middle point of each category (see the Appendix). We include the following variables at the ZIP code, county, and state levels: natural log of population, natural log of area, percentage of rural population, percentage of elderly (more than 65 years old), percentage of children (less than 19 years old), percentage of non-Hispanic black, and percentage of Hispanic (fractions of other ethnicities omitted).

Source: Data from the Behavioral Risk Factor Surveillance System (BRFSS).

home value on a set of ZIP code housing characteristics.[18] We then include the ZIP code housing prices adjusted for housing characteristics to control directly for some components of local prices.

The first column shows the relationship between own household income and respondents' well-being, controlling for socioeconomic characteristics. As expected, the coefficient of own household income is positive and statistically significant at the 1 percent level. We include the following socioeconomic characteristics: age, age-squared, gender, eight dummies for employment status, five education dummies, six dummies of marital status, four child dummies, and seven

[18]We include the following housing variables: total housing units, urban housing units, percentage of vacant units, home ownership vacancy rate, rental vacancy rate, eight dummies of construction dates (e.g. percentage built between 1940 and 1949), eight dummies of the average number of rooms, three dummies for vehicles, nine dummies for the type of heating fuel, one dummy for mortgage status, and one dummy for whether a telephone service is available.

race dummies. We display the coefficients for these variables in Table A.6. They attract signs that are consistent with those of the literature. For instance, there is a positive relationship between life satisfaction and being employed or married (Stevenson and Wolfers, 2012).

In columns 2, 3, and 4, we include, respectively, the natural log of the "median ZIP code household income," the natural log of the "median county household income," and the natural log of the "median state household income." The second column shows that ZIP code median income is positively correlated with well-being, suggesting that respondents report higher levels of satisfaction when their ZIP code neighbors are richer. On the other hand, columns 3 and 4 report a negative relationship between satisfaction and county and state median incomes, but the estimates are not statistically significant. These results indicate that the association between well-being and income spillovers depends on the size of the reference group; that is, the local area considered.

Column 4 shows the baseline specification where both median ZIP code and median county income variables are included simultaneously. The coefficient of our variables of interest "median household income" at the county and ZIP code levels are statistically significant at the 5 percent level, but they attract different signs. First, there is a negative relationship between satisfaction and county median income. In other words, controlling for demographic factors and ZIP code median income, individuals living in richer counties report being less satisfied. This result is consistent with previous findings reported by Luttmer (2005). Second, the natural log of the "median ZIP code household income" remains positively related to respondents' satisfaction. The coefficient of this variable is approximately one quarter of the coefficient of the variable own income.

Interestingly, the coefficients of interest are larger in column 4 than in columns 1 and 2 and the coefficient of the variable "median ZIP code household income" is now slightly smaller than the coefficient of the variable "median county household income." This means that if county and ZIP code median incomes were all to rise by the same percentage, a person would be slightly less satisfied. Yet the overall impact of neighbors' income is not significantly different from zero when considering both median incomes.[19]

Column 5 confirms these results by presenting the baseline specification with the three median income variables included simultaneously. The estimates for "median household income" at the county and ZIP code levels are very similar to those in column 4 and remain statistically significant. On the other hand, "median state household income" is negative and statistically insignificant.

Robustness Checks

Table 3 provides robustness checks. In column 1, we turn to presenting OLS estimates instead of relying on an ordered probit response model. This specification check confirms that "median ZIP code household income" is positively correlated with self-reported life satisfaction, while "median county household

[19]We calculate the standard error on the coefficient sum, and find that it is not significantly greater than zero.

TABLE 3

Robustness Checks: Life Satisfaction and Income Spillovers

	OLS	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Life Satisfaction	Baseline	with MSA	with State-year FE	with County-year FE	Equivalent income	Poorer median	Richer median
ln(real household income)	0.137	0.271	0.271	0.274		0.223	0.337
	(0.003)	(0.005)	(0.005)	(0.005)		(0.007)	(0.016)
ln(real equivalent household income)					0.264		
					(0.005)		
ln(median ZIP code household income)	0.030	0.071	0.064	0.073	0.071	0.105	0.047
	(0.008)	(0.016)	(0.018)	(0.016)	(0.018)	(0.022)	(0.026)
ln(median county household income)	−0.037		−0.068		−0.071	−0.117	0.021
	(0.014)		(0.029)		(0.029)	(0.033)	(0.046)
ln(median MSA household income)		−0.138					
		(0.047)					
ln(median state household income)	−0.042	−0.101			−0.100	−0.017	−0.244
	(0.073)	(0.154)			(0.154)	(0.195)	(0.233)
Control variables							
Individual controls	✓	✓	✓	✓	✓	✓	✓
ZIP code controls	✓	✓	✓	✓	✓	✓	✓
County controls	✓	✓	✓	✓	✓	✓	✓
State controls	✓	✓			✓	✓	✓
Quantity adjusted housing price	✓	✓	✓	✓	✓	✓	✓
Region–year fixed effects	✓	✓			✓	✓	✓
State–year fixed effects			✓				
County–year fixed effects				✓			
Month–year fixed effects	✓	✓	✓	✓	✓	✓	✓
$P(\theta \neq \lambda)$	0.005	0.000	0.001		0.000	0.000	0.677
Observations	216,546	216,546	216,546	216,546	216,546	130,111	86,426
Pseudo R^2		0.073	0.073	0.078	0.072	0.061	0.037
R^2	0.129						

Notes: Robust standard errors are in parentheses, clustered by county. The period covered is 2005–10, except for Texas (2007–10). Life satisfaction is assessed through the following question: "In general, how satisfied are you with your life?" where respondents have four choices (4 = very satisfied, 3 = satisfied, 2 = dissatisfied, and 1 = very dissatisfied). Columns 1–2 and 5–7 include region–year fixed effects, month–year fixed effects, and socioeconomic controls (described in the text). Column 3 includes state–year fixed effects and column 4 includes county–year fixed effects. In column 5, we replace the natural log of the real household income by the natural log of the real household income per equivalent adult. Columns 6 and 7 restrict the sample, respectively, to respondents having a household income smaller and larger than the median income in their ZIP code of residence. Household income has eight categories. The log of the real household income is calculated using the middle point of each category (see the Appendix). We include the following variables at the ZIP code, county, and state levels: natural log of population, natural log of area, percentage of rural population, percentage of elderly (more than 65 years old), percentage of children (less than 19 years old), percentage of non-Hispanic black, and percentage of Hispanic (fractions of other ethnicities omitted).

Source: Data from the Behavioral Risk Factor Surveillance System (BRFSS).

income" is negatively related to satisfaction. In column 2, we replace the variable "median county household income" by the variable "median MSA household income." The correlation between county and MSA median incomes is very high (0.794) and we thus prefer not to include these two variables simultaneously. The coefficient estimate for "median household income" at the MSA level is negative and statistically significant at the 1 percent level. The coefficient of this variable is approximately twice the coefficient of the variable "median county household income" and our estimate for the ZIP code median income remains positive and significant at the 1 percent level.

In columns 3 and 4, we include, respectively, state*year fixed effects and county–year fixed effects in order to absorb most of the cross-state and cross-county variations. These specification checks confirm the positive and statistically significant relationship between ZIP code median income and self-reported life satisfaction. Last, we show in column 5 that replacing the household income variable by the household income per equivalent adult has no effect on our main results.

In columns 6 and 7, we examine if the economic position of the respondent affects the relationship between well-being and income spillovers. The last two columns of Table 3 restrict the sample, respectively, to respondents having a household income smaller and larger than the median income in their ZIP code of residence. We find that respondents poorer than the median enjoy living in richer ZIP codes and poorer counties. Moreover, the size of the coefficients of interest is much larger than for the whole sample, with coefficients of interest that are half the size of the coefficient of own income. On the other hand, the relationship between life satisfaction and ZIP code neighbors' income is much smaller for individuals having a household income larger than the median income. The estimates in columns 6 and 7 (sample of respondents poorer and richer than the median) are significantly different at the 5 percent level for the effects of ZIP code neighbors' income on respondents' life satisfaction.

These results are consistent with the idea that neighborhood effects are more important for poorer individuals, as they cannot get away from their neighborhood (Chetty *et al*., 2016). Another plausible explanation is that richer people spend less time in their neighborhood and their social capital investment with their neighbors is supposedly lower. Alternatively, individuals having higher incomes could substitute environmental goods by private goods if they are not publicly provided in their neighborhood. The next subsection will examine whether local public goods and amenities could explain the pattern observed so far.

Local Public Goods and Amenities

Table 4 investigates whether public goods could be driving our previous results. We upgrade our basic model (equation (2)) by including additional ZIP code and county-level variables. Column 1 includes the following environmental and geographic ZIP code variables: the unemployment rate, the poverty rate, and neighbors' socioeconomic characteristics. Adding these controls in the model does affect the size of the coefficients of interest substantially. Controlling for

TABLE 4

Life Satisfaction and Local Public Goods

	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit	Ordered Probit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Life Satisfaction	All	All	Alll	Alll	Alll	Alll	Alll
ln(real household income)	0.271	0.271	0.271	0.271	0.272	0.272	0.272
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
ln(median ZIP code household income)	−0.008	0.064	−0.006	0.066	0.067	0.069	−0.003
	(0.027)	(0.019)	(0.027)	(0.018)	(0.018)	(0.018)	(0.028)
ln(median county household income)	−0.049	−0.074	−0.049	−0.101	−0.074	−0.107	−0.072
	(0.026)	(0.029)	(0.027)	(0.031)	(0.028)	(0.031)	(0.030)
ln(median state household income)	−0.088	−0.097	−0.088	−0.100	−0.078	−0.082	−0.072
	(0.155)	(0.155)	(0.155)	(0.156)	(0.152)	(0.153)	(0.152)
Additional ZIP code controls							
Environmental and geographic mechanisms:							
Unemployment rate	✓		✓				✓
Poverty rate	✓		✓				✓
Percentage of high school graduates	✓		✓				✓
Percentage of married people	✓		✓				✓
Percentage with baby in past 12 months	✓		✓				✓
Institutional mechanisms:							
Number of health establishments		✓	✓				✓
Number of child day care services		✓	✓				✓
Number of physicians' offices		✓	✓				✓
Number of dentists' offices		✓	✓				✓
Number of school establishments		✓	✓				✓
Additional county controls							
Environmental and geographic mechanisms:							
Unemployment rate				✓		✓	✓
Percentage of high school graduates				✓		✓	✓
Criminality				✓		✓	✓
Institutional mechanisms:							
Government direct expenditure							
Education, health, and welfare					✓	✓	✓
Revenue and direct expenditure					✓	✓	✓
Baseline control variables							
Individual controls	✓	✓	✓	✓	✓	✓	✓
ZIP code controls	✓	✓	✓	✓	✓	✓	✓
County controls	✓	✓	✓	✓	✓	✓	✓
State controls	✓	✓	✓	✓	✓	✓	✓
Quantity adjusted housing price	✓	✓	✓	✓	✓	✓	✓
Region–year fixed effects	✓	✓	✓	✓	✓	✓	✓
Month–year fixed effects	✓	✓	✓	✓	✓	✓	✓
$P(\theta \neq \lambda)$	0.359	0.001	0.346	0.001	0.001	0.001	0.158
Observations	216,546	216,546	216,546	216,546	213,375	213,375	213,375
Pseudo R^2	0.073	0.072	0.073	0.072	0.073	0.073	0.073

Notes: Robust standard errors are in parentheses, clustered by county. The period covered is 2005–10, except for Texas (2007–10). Life satisfaction is assessed through the following question: "In general, how satisfied are you with your life?" where respondents have four choices (4 = very satisfied, 3 = satisfied, 2 = dissatisfied, and 1 = very dissatisfied). All columns include region–year fixed effects, month–year fixed effects, socioeconomic controls (described in the text), and ZIP code, county, and state controls (see Table 2). Household income has eight categories. The log of the real household income is calculated using the middle point of each category (see the Appendix).

Source: Data from the Behavioral Risk Factor Surveillance System (BRFSS).

environmental and geographic amenities decreases the size of the effect of ZIP code neighbors' income on well-being. The estimate is now statistically insignificant and the coefficient is very close to zero. This is an indication that richer ZIP code neighbors have a positive effect on residents' well-being not because they are rich *per se* but because they bring in public goods and amenities that are valuable. Note also that the variables "median ZIP code household income" and "median county household income" are not significantly different from each other.

In column 2, we include the institutional ZIP code variables: the numbers of schools, dentists' offices, physicians' offices, health establishments, and childcare establishments. Including these variables has no effect on the size and magnitude of the variable of interest, "median ZIP code household income." These results suggest that the positive association between well-being and median income at the ZIP code level is driven entirely by public goods in the rubrics environmental and geographic mechanisms. Column 3 includes simultaneously the environmental, geographic, and institutional ZIP code variables. The coefficient of interest is a well-estimated zero, confirming that ZIP code neighbors' income affects life satisfaction through public goods and amenities.

In columns 4, 5, and 6, we include public goods and amenities at the county level instead. Column 4 controls for the unemployment rate, the number of murders, and non-negligent manslaughters known to police per capita and the percentage of high school graduates. Only the coefficient of the variable "median county income" changes when we include those controls. We find that the negative effect becomes more negative, suggesting a positive role for public goods also at the county level.

In column 5, we include the following public goods in the rubric institutions: local government direct expenditures on health, education, public welfare, total revenue, and general expenditures per capita. The coefficients of interest "median ZIP code household income" and "median county household income" remain unchanged, suggesting that these public goods do not affect well-being through neighbors' income. We include all the county controls in our model in column 6. The estimate is similar to that in column 4, indicating that the negative impact of median county income on satisfaction goes through the environmental and geographic variables.

Last, in column 7, we include the full set of amenities at the ZIP code and county levels. The coefficient of the variable "median ZIP code household income" is very small and statistically insignificant. This is suggestive evidence that local area characteristics such as unemployment and poverty explain the positive relationship between the variable "median ZIP code household income" and self-reported well-being presented in Table 2.

6. Conclusion

This paper shows that the effect of neighbors' income on individuals' self-reported well-being varies with the size of the neighborhood. In smaller areas such as ZIP codes, we find a positive relationship between median income and individuals' life satisfaction, whereas it is the opposite at the county, MSA, and

state levels. The size of these effects is not negligible. The neighbors' income effects are mainly concentrated among poorer individuals and are as large as one quarter of the effect of own income on self-reported well-being.

We provide evidence that public goods in the local area drive the positive association between satisfaction and neighbors' income at the ZIP code level. Our findings suggest that neighbors' income affects well-being mainly through local area characteristics such as unemployment, criminality, and poverty. On the other hand, institutional variables such as schools, hospitals, and local government expenditures do not seem to explain the positive income spillovers at the ZIP code level. These findings suggest that such externalities have important implications. A better understanding of these externalities would help us, for example, to improve optimal policies in income taxation and public goods provision.

We believe that further research is needed in at least two dimensions. From our results, we cannot conclude on whether relative deprivation and income comparisons have a negative effect on well-being. In order to answer this question, more disaggregated data at the street level may be better suited (Knies, 2012; Brodeur and Flèche, 2013). In addition, future research should try to identify random income shocks in particular neighborhoods in order to obtain the causal effect of neighbors' income on well-being.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix A.1: Creation of the Variable *ln(household income)*
Appendix A.2: List of Variables Coming from US Census and USA Counties
Appendix A.3: ZIP Code
Appendix A.4: Housing
Table A.1: Summary Statistics
Table A.2: Selected ZIP Code, County and State Characteristics
Table A.3: Correlation between Median Income and Other Characteristics at the County and ZIP Code Levels
Table A.4: Correlation Matrix between the State, MSA, County and ZIP Code Median HH Incomes
Table A.5: Top- and Bottom-Coded Income Categories
Table A.6: Life Satisfaction and Covariates
Table A.7: Life Satisfaction and Income Spillovers at the State, County and ZIP Code Levels, 2010