Income Inequality Is Associated with Stronger Social Comparison Effects:

The Effect of Relative Income on Life Satisfaction

Felix Cheung

Michigan State University

University of Hong Kong

Richard E. Lucas

Michigan State University

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Author Note

Felix Cheung, Department of Psychology, Michigan State University; Department of Psychology, University of Hong Kong; Richard E. Lucas, Department of Psychology, Michigan State University.

Correspondence concerning this article should be addressed to Felix Cheung, Department of Psychology, Michigan State University, East Lansing, MI 48823. Email: felixckc@msu.edu

Abstract

Previous research has shown that having rich neighbors is associated with reduced levels of subjective well-being, an effect that is likely due to social comparison. The current study examined the role of income inequality as a moderator of this relative income effect. Multilevel analyses were conducted on a sample of over 1.7 million people from 2,425 counties in the United States. Results showed that higher income inequality was associated with stronger relative income effects. In other words, people were more strongly influenced by the income of their neighbors when income inequality was high.

Keywords: life satisfaction, income inequality, social comparison

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Life satisfaction is a subjective evaluation of whether one is happy, content, and satisfied with his or her life. Research shows that people high in life satisfaction experience many positive outcomes in their lives, such as better social relationships (see Lyubomirsky, King, & Diener, 2005 for review) and better health (see Pressman & Cohen, 2005 for review). Economists and psychologists have increasingly called for the use of well-being measures (including life satisfaction) to help guide public policy because these measures captures important information about citizens' quality of life that is not typically captured by conventional measures (Diener, Lucas, Schimmack, & Helliwell, 2010).

Although the association between income and life satisfaction is robust, the mechanisms underlying this association are not yet clear. Money could fulfill basic as well as idiosyncratic needs, so income might have a direct effect on the satisfaction that people experience. However, evidence also suggests that absolute levels of income may not always drive the association. Instead, relative income—whether a person has more or less income than others—may be at least as important as, if not more important than, absolute income when predicting life satisfaction. Understanding relative income effects and the factors that influence it is important both for theoretical and applied reasons. In the current paper, we test the relative income hypothesis using a very large U.S. sample and investigate the role of income inequality as a moderator of the relative income effect across different income levels.

Absolute Income and Relative Income

The association between income and life satisfaction could be explained by at least two underlying mechanisms: absolute income and relative income. Absolute income refers to the idea

that money buys things that lead to happiness (including material goods, experiences, and even feelings of security). Indeed, past research has consistently found the small to moderate positive association between income and life satisfaction (e.g., Blanchflower & Oswald, 2004; Boes & Winkelmann, 2010; Diener, Ng, Harter, & Arora, 2010; Kahneman & Deaton, 2010; Lelkes, 2006; Luhmann, Schimmack, & Eid, 2011; Tao & Chiu, 2009). For example, Diener and his colleagues (2010), drawing from a representative sample of the entire planet, showed that household income was positively associated with life satisfaction. Multiple reviews (Clark, Frijters, Shields, 2008; Diener & Biswas-Diener, 2002; Howell & Howell, 2008; Lucas & Dyrenforth, 2006; Pinquart & Sorensen, 2000) have also shown that the positive association between income and life satisfaction is robust and replicable. Howell and Howell (2008) meta-analytically combined 56 studies that included 111 independent samples from 54 different countries and concluded that economic status (e.g., household income, personal income, etc.) was positively related to life satisfaction. They estimated the effect size of the relation between economic status and life satisfaction to be .18 - .20. Importantly, Howell and Howell's (2008) meta-analysis showed that the association was strongest in developing countries and in samples with less education, and it was weakest in more developed countries and samples with high education. These findings support the absolute income hypothesis, suggesting that in developing countries, increases in income allow people to acquire resources that are essential and improve safety and security, which in turn increase their life satisfaction.

Researchers have also used quasi-experimental designs to study the relation between absolute income and life satisfaction. For instance, Gardner and Oswald (2007) tested whether income change, in the form of lottery prize, was associated with change in well-being. Using a sample from the British Household Panel Study, they found that participants who won medium-

size prizes (i.e., over £1000) reported significantly higher levels of well-being two years after the

win compared to two years before the win. This increase in well-being among those with

medium-size wins was greater than that for participants with no win and participants with small

wins (less than £1000). This study provided evidence for the causal influence of increase in

income and well-being. Taken together, these studies showed clear support for the absolute

income hypothesis. However, in addition to absolute income, could income of others influence

well-being as well?

Relative income—whether a person has more or less income than others—may be at least

as important as absolute income when predicting life satisfaction. Research on *perceived* relative

income has shown that one's subjective ranking of income compared to others reduces well-

being, and the effect of perceived relative income was comparable in size to the effect of

absolute income (Layard, Mayraz, & Nickell, 2010; Mayraz, Wagner, & Schupp, 2009). For

example, Layard, Mayraz, and Nickell (2010) compared the effect of perceived relative income

to the effect of household income. They analyzed data from the General Social Survey conducted

in the United States, in which participants reported their perception of how their income

compared to other U.S. families (well above average, above average, average, below average, or

well below average). Controlling for participants' household income, participants' perceived

relative income predicted life satisfaction, and the association was comparable in size to the

association between household income and life satisfaction. Relatedly, Solnick and Hemenway

(1998) tested the importance of relative income by asking participants to choose between two

hypothetical scenarios. Participants were asked to choose between two options: "A: Your current

yearly income is $50,000; others earn $25,000" and "B: Your current yearly income is $100,000;

others earn $200,000." They found that 56% of participants chose option A, suggesting that these

participants were willing to give up a substantial amount of absolute income in favor of gaining

relative income.

The studies described above suggest that people are concerned about relative income and

that their subjective evaluation of their income compared to others has strong implications on

their satisfaction with life. However, the designs of these studies are limited in a number of

ways. For instance, in studies that rely on people's perceptions of relative income, it is possible

that the perceptions of relative standing are in fact affected by a person's feelings of well-being.

Happy people may, in general, believe that they are better off than they really are (Taylor &

Brown, 1994). In addition, studies that rely on relatively vague scenarios describing relative

position may communicate information about additional hypothetical factors such as cost of

living. Thus, these may not reflect pure manipulations of relative income. Partly as a result of

these limitations, researchers have turned to studies that allow them to look at people's actual

standing relative to salient comparison standards.

Research using *actual* income has more mixed evidence, with findings showing negative,

null, and positive effects of relative income (e.g., Blanchflower & Oswald, 2004; Boyce, Brown,

& Moore, 2010; Budria & Ferrer-i-Carbonell, 2012; Di Tella & MacCulloch, 2003; Luttmer,

2005). In a study that found support for the relative income hypothesis, Luttmer (2005) examined

the extent to which life satisfaction ratings are predicted by the income of one's neighbors.

Specifically, he predicted individual life satisfaction scores both from one's own absolute income

and from the average income of that person's neighbors[1]. Luttmer found that the coefficient for

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1   "Neighbors" were defined as individuals living within the same Public Use Microdata Area
[PUMA], which consist of counties or cities that are aggregated or subdivided to contain at least 100,000
individuals.

the "neighborhood" income effect was significant and negative. In other words, people who lived in rich neighborhoods reported lower life satisfaction than people with the same income living in poor neighborhoods. This finding held even after controlling for an index of the cost of living of the regions, which led Luttmer to interpret this effect as being due to social comparison. Other researchers have found similar effects with different geographical units such as states (Blanchflower & Oswald, 2004) or nations (Di Tella & MacCulloch, 2003). In addition, researchers have replicated the effects using other techniques for identifying "similar others" who might serve as comparison standards (e.g., Boyce, Brown, & Moore, 2010; Budria & Ferrer-i-Carbonell, 2012).

However, not all studies found support for the relative income hypothesis (e.g., Deaton & Stone, 2013; Diener, Tay, & Oishi, 2013; Helliwell, Barrington-Leigh, Harris, & Huang, 2010; Hirschman & Rothschild, 1973; Tay, Morrison, & Diener, 2014). Most notably, using data from over one million respondents in the United States, Deaton and Stone (2013) found that that relative income at the city-, county-, and state-levels had little to no effect on life satisfaction. Moreover, ZIP code income was positively associated with life satisfaction, which led them to the interpretation that having richer neighbors in the local area could mean better public goods (e.g., more green space, better school system). This finding stands in contrast to the earlier finding that having richer neighbors was associated with lower life satisfaction (Luttmer, 2005). At the country level, recent research (Tay, Morrison, & Diener, 2014) using the Gallup World Poll found national income is associated with greater life satisfaction controlling for personal income – an effect the authors called positive spillover.

In sum, research on perceived relative income has yielded generally consistent findings, suggesting subjective ranking of income compared to others is associated with life satisfaction.

However, existing research on the association between actual relative income and life satisfaction have resulted in inconsistent findings. The current study tested the relative income hypothesis using actual income.

The Importance of Income Inequality

Contemporary events, such as Occupy Wall Street and the slogan "We are the 99%," point to the possibility that higher level of income inequality may increase the salience of the discrepancy in income among people, which may in turn lead to stronger social comparison effects. Indeed, income inequality has been shown to play an important role in a variety of psychological phenomena.

Population-level income inequality has been linked to population-level physical as well as psychological well-being (e.g., Kawachi & Kennedy, 1999; Kennedy et al., 1998; Oishi, Kesebir, & Diener, 2011). For example, Oishi, Kesebir, and Diener (2011) found that at the population-level, income inequality in the United States was associated with lower level of life satisfaction, and this link was explained by perceived unfairness and lack of trust. While past research has studied how income inequality relate to population-level well-being, recent research (e.g., Lucas, Cheung, & Lawless, 2013) has called for a multi-level approach to understand the predictors and consequences of subjective well-being. The current paper aimed to elucidate the association between income inequality and life satisfaction and its individual- and regional-level moderators.

We hypothesized that income inequality will increase the effect of relative income. A mechanism through which income inequality contributes to dissatisfaction is through social comparison. From a social comparison perspective, income inequality may increase social

comparison by increasing both the *frequency* and the *consequence* of comparison.[2] Schor (1998) suggested that the increase in income inequality has bred a culture of upward comparison, in which people make status-oriented purchases to "keep up" with their neighbors. Recent research (Walasek & Brown, 2015) found that at the population level, states with higher income inequality showed a higher frequency of Google searches related to status-oriented goods (e.g., luxury goods). At the individual level, it is plausible that income inequality increases the salience of the small number of people with very high incomes, which in turn leads to stronger effects of upward social comparison (Schor, 1998). In sum, the negative effect of relative income should be more pronounced in regions with greater income inequality.

Moreover, the social comparison of income associated with income inequality may be particularly strong for individuals with low income. Low-income individuals tend to experience more negative outcomes when income inequality is high. For instance, Kawachi and Kennedy (1999) showed that higher income inequality was associated with worsened self-reported health, and "the deleterious effects of inequality were most evident among individuals with the lowest income" (Kawachi & Kennedy, 1999, p. 219).

Overview of the Current Study

The goals of the current study were to test the absolute and relative income hypothesis in an extremely large US sample and to examine the role of income inequality as a moderator of the absolute and relative income effects. Understanding the role income inequality plays in the absolute and relative income hypotheses for low-income and high-income individuals advances our understanding of the relation between income inequality and life satisfaction.

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[2] We thank an anonymous reviewer for suggesting that income inequality may increase both the frequency and consequence of income inequality.

In the current study, we used data from over 1.7 million residents of the U.S. to determine 1) whether higher household income is associated with higher life satisfaction, 2) whether higher neighborhood income is associated with lower life satisfaction, 3) whether individuals who live in neighborhoods with high income inequality show a stronger relative income effect, and 4) whether the moderating effect of income inequality on relative income is particularly strong for low-income individuals.

Method

Participants

The data came from the Behavioral Risk Factor Surveillance System (BRFSS), an annual telephone survey conducted by the U.S. Center for Disease Control and Prevention and states' health departments (Center for Disease Control and Prevention, 2005 – 2010). The BRFSS tracks health information in the United States, including all 50 states, the District of Columbia, Puerto Rico, U.S. Virgin Islands, and Guam. Although the BRFSS started in 1986, life satisfaction was not measured until 2005, and thus, six waves between 2005 and 2010 were included in the current study.

Participants from U.S. Virgin Islands and Guam were excluded because county income data was missing for these regions in the American Community Survey (ACS; details regarding ACS are included in a following section). Furthermore, participants were excluded if they did not report their residing county or if existing datasets did not contain information for the county in which they lived. As a result, 1,751,843 participants (out of 2,440,925 participants) from 2,425 counties were matched with county information, and statistical analyses were conducted on this group of participants. Participants (61% female) had a mean age of 53.70 ($SD = 16.32$; range: 18-99). The sample consisted of 91.2% high school graduates and 36.1% college graduates. The

majority of participants were married (56.6%). Forty eight percent of participants were employed. The racial composition was 79.9% White, 7.9% African American, 1.7% Hispanic, 0.2% Asian, 1.1% Native Hawaiian or other Pacific Islander, 0.5% American Indian or Alaska Native, 1.8% "Not sure," and 7.0% Others.

Measures

Life satisfaction was measured in the BRFSS with an item that asked "In general, how satisfied are you with your life?" using a 4-point scale (1 = *Very Satisfied*, 2 = *Satisfied*, 3 = *Dissatisfied*, and 4 = *Very dissatisfied*). This item was reverse coded such that higher values represented higher levels of life satisfaction. Previous research has shown that single-item measures of life satisfaction —including this particular single-item measure— perform well psychometrically. For example, Lucas and Donnellan (2012) estimated the reliability of the single-item life satisfaction scale using four nationally representative panel studies, and their results showed that reliability estimates ranged from .68 - .74. In addition, Cheung and Lucas (2014) examined the validity of single-item measures of life satisfaction (one of which is identical to the one used in the current study) and found that single-item measures performed extremely similar to the Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) - a measure that is considered the current gold standard of measuring life satisfaction. In sum, single-item life satisfaction measures showed satisfactory reliability and validity.

Participants reported their household income as part of the BRFSS survey using income brackets (1 = *Less than $10,000*, 2 = *$10,000 to less than $15,000*, 3 = *$15,000 to less than $20,000*, 4 = *$20,000 to less than $25,000*, 5 = *$25,000 to less than $35,000*, 6 = *$35,000 to less than $50,000*, 7 = *$50,000 to less than $75,000*, and 8 = *$75,000 or more*). Participants'

household income was estimated as the mid-point of each income bracket, except for participants

who reported an income of $75,000 or over. Based on the Current Population Survey conducted

by the Census Bureau, the median household income for households with an annual income over

$75,000 fell between $110,000 and $114,999. Thus, the midpoint of the range (i.e., $112,500)

was used as an estimate of the income for participants with over $75,000 annual household

income. Prior research has used similar procedures to estimate income based on income brackets

(e.g., Dowd, Palermo, & Aiello, 2012; Hargerty, 2000). These translated incomes then

underwent a logarithmic transformation to be compared with county income (which is also

logarithmically transformed because the distribution of county income is positively skewed;

skewness of county income: $S = .82$, $SE = 0.002$).

In the BRFSS, participants also self-reported their gender (male and female), marital

status (married, divorced, widowed, separated, never married, a member of an unmarried

couple), educational attainment (never attended school, elementary school, some high school,

high school graduate, some college, college graduate), race (White, African American, Hispanic,

Asian, Pacific Islander, Native American, Other), and employment status (Employed, self-

employed, unemployed, homemaker, student, retired, unable to work), age, number of children

in the household, and number of adults in the household. These variables were included as

covariates in the current study.

County income and income inequality were retrieved from the 2010 ACS 5-year

estimates (American Community Survey). The ACS is an ongoing annual survey conducted by

the Census Bureau. The ACS collects information regarding a wide range of variables, such as

population and housing characteristics. In addition to releasing data of the annual survey, the

Census Bureau also released a 5-year estimates that utilized information from 2006 – 2010 to

provide more reliable and precise data than the estimates based on one year of data (U.S. Census Bureau, 2008). More importantly, the ACS 5-year estimates contain county income data for most of the counties in the US, compared to the ACS 1-year estimate in which county income is only available for counties with populations of more than 65000 people. As a major purpose of the current study was to study the association between regional income and life satisfaction, including as many counties as possible was paramount to provide a good test of the effect of contextual income.

County income was measured as median household income. Income inequality is indexed by Gini coefficient, which is a measure of income inequality that ranges from 0 to 1, where higher number indicates higher level of income inequality. Median housing cost, county population, county population density (from ACS), and county size (from Census 2010) were included as covariates. Because higher cost of living may be associated with lower life satisfaction, median housing price was included to control for cost of living. Prior research has also used housing price to control for cost of living (e.g. Luttmer, 2005). County population, county size, and population density were also included as covariates because population density may co-vary with income inequality and life satisfaction.

Analytical Procedure

Statistical analyses based on a multilevel modeling framework were conducted using the lme4 package in the R statistical program (R Core Team, 2013). The main goal of the current study was to examine the association between county income and life satisfaction and income inequality as a moderator of this association. In order to disentangle the association between household income and life satisfaction and the association between county income and life satisfaction, household income and county income were centered around the grand means of

household income and county income, respectively. This centering procedure allowed for the estimation of the association between county income and life satisfaction *controlling* for household income (Enders & Tofighi, 2007). In addition, Gini coefficients and continuous covariates (i.e. Level 1: age, number of adults in household, and number of children in household; Level 2: county population, county area, and population density) were centered around their respective grand means. Gender, race, education, employment status, and marital status were dummy-coded with the largest group as the reference group (i.e., female, white, college-educated, employed, and married). These coding procedures improved the interpretability of the intercept.

   Assessing the Evidence for Using Multilevel Modeling. Prior to testing multilevel models, methodologists have recommended three approaches to justify for the use of multilevel model: 1) structure of the data, 2) intraclass correlation, and 3) average deviation (Cohen, Doven, & Nahum-Shani, 2009). The current data comprised of participants nested within counties, and thus, multilevel modeling is needed to account to the clustering of individual data at the county level. Past research (e.g., Lawless & Lucas, 2010; Lucas, Cheung, & Lawless, 2013) has demonstrated that differences in life satisfaction across counties co-vary with meaningful objective characteristics (e.g., marital status, education), thus supporting the validity of aggregating the data at the county level. Intraclass correlation was calculated using an one-way ANOVA predicting life satisfaction from county membership. Average deviation (AD) is a measure of homogeneity that can be calculated for each group (i.e., county), and it refers to the average distance of individuals' life satisfaction from the county mean. Lower number indicates greater homogeneity. AD and its significance were computed using the multilevel package in R (Bliese, 2013).

Analysis 1: The Effect of Relative Income. To test the relative income hypothesis, a multilevel model was fitted with life satisfaction as the outcome variable, household income as an individual-level (Level-1) predictor, and county income as a county-level (Level-2) predictor. In this model, county was used as the grouping variable, and a random intercept was modeled to account for the interdependence of the observations that came from the same county. Random slopes of household income and county income were also estimated to assess the heterogeneity of the association between these variables and life satisfaction across counties. Random slopes were tested using likelihood ratio tests as implemented in the lmerTest package (Kuznetsova, Brockhoff, & Christesen, 2014). To the extent that these random slopes are significant, it is appropriate to examine moderators that explain the heterogeneity of slopes across counties.

Age, gender, education, marital status, employment status, number of adults in the household, number of children in the household (Level-1), Gini, median housing value, county population, county size, and population density (Level-2) were included as covariates. One may reasonably argue that if we found that higher county income was associated with lower satisfaction, this association may stem from higher cost of living in richer counties, which may reduce well-being. A commonly used index for cost of living is median housing value, and thus, we included median housing value (retrieved from ACS) as a covariate. These predictors were treated as fixed.

Analysis 2: Income Inequality as a Moderator of the Effects of Relative Income. The primary hypothesis in the current study was to test whether greater income inequality strengthens the association between county income and life satisfaction. This moderating effect of income inequality was tested by adding the interaction term between Gini and county income as predictors. Moderation is often tested as the interaction between a predictor and a moderator, and

a significant interaction indicates a moderating effect. For example, if the current study found a

significant negative interaction between county income and income inequality, it would suggest

that the association between county income and life satisfaction would be more negative in

counties with high income inequality.

Analysis 3: The Associations between Relative Income and Life Satisfaction for

Individuals with Low vs. High Income. Finally, we tested whether the moderating effect of

income inequality on the association between county income and life satisfaction may be

strongest for low-income individuals. All two-way and three-way interactions between

household income, county income, and income inequality were entered into the model to test for

this possibility.

Results

Unless otherwise noted, all inferential statistics reported are significant at .05 levels using

two-tailed tests. Table 1 and Table 2 present descriptive statistics and bivariate correlations for

the variables used in the current analyses. Using an one-way ANOVA approach (predicting life

satisfaction from county membership), a statistically significant intraclass correlation of .01 was

obtained, $F(2424, 1751842)=5.513$, meaning that about 1% of the variance in life satisfaction can

be attributed to the county-level. AD was calculated for each county, and its significance was

tested using the procedure outlined in Cohen (2009) implemented in the multilevel package in R

(Bliese, 2013). In 2417 out of a total of 2425 counties (99.8%), the null hypothesis of

heterogeneity was rejected, providing substantial evidence for homogeneity. The average AD

across all counties was 0.55. One proposed rule of thumb for interpreting AD is to examine

whether average AD is smaller than c/6, where c is the number of response options (Burke &

Dunlap, 2002). In the current study, life satisfaction was measured on a 4-point scale, and the

average AD across of counties (0.55) is smaller than 4/6= 0.67, suggesting significant

homogeneity within counties. In sum, these different techniques converged to support the use of

multilevel modeling to examine the current dataset.

Analysis 1: The Effect of Relative Income

As a first step, we examined a simple main effect model that predicted life satisfaction

from household income and county income, ignoring income inequality. Table 3 presents the

results of Analysis 1 with and without covariates, and Table 4 presents the results on the random

effects of household and county income. Since the pattern of results was largely the same with

and without covariates, the following focused on the model with covariates. The associations

between covariates and life satisfaction were comparable with prior research. For example,

married and highly educated individuals reported greater satisfaction, replicating earlier research

(e.g., Cheung & Lucas, 2014). This model tested whether the relative income effect found in

some previous studies also exists in this much larger sample. Results showed that higher

household income was significantly associated with higher levels of life satisfaction ($b = .31$, *SE*

$= .002$). This is consistent with a large body of research that shows that one's own income is

positively correlated with life satisfaction (e.g., Howell & Howell, 2008). More importantly,

controlling for household income, county income was negatively associated with life satisfaction

($b = -.06$, *SE* $= .015$). This finding replicates past research on the effect of relative income (e.g.,

Boyce et al., 2010; Luttmer, 2005). Based on this model, people living in richer counties (those

that are 1SD above mean) would have to earn about $4,400 more per year in order to match the

levels of life satisfaction reported by people living in poorer counties (those that are 1SD below

mean). In addition, the random effects for household income and county income were significant

(Table 4), suggesting that there were heterogeneity in the slopes of household income and county

income across counties. These findings justified for examining income inequality as a moderator of the association between county income and life satisfaction.

Analysis 2: Income Inequality as a Moderator of the Effect of Relative Income

Next, we tested an interaction model to assess whether the association between relative income and life satisfaction varies depending on income inequality (Table 3). Similar to the main effect model, household income and county income significantly predicted life satisfaction. Most importantly, consistent with our hypothesis, Gini significantly moderated the association between county income and life satisfaction, such that higher levels of Gini were associated with a stronger negative association between county income and life satisfaction (Figure 1). The coefficient for the association between county income and life satisfaction increased in magnitude from $b = -0.01$ in counties with low income inequality to $b = -0.10$ in counties with high income inequality. Among counties with lower income inequality (1SD below the mean), people with average income (about $41,500) living in richer counties would only have to earn about $1,000 more (or 2.5% more) in order to match the levels of life satisfaction of people living in poorer counties. Among counties with higher income inequality (1SD above the mean), people with average income living in richer counties would have to earn about $7,700 more (or 18.5% more) in order to match the levels of life satisfaction of people living in poorer counties. These results indicate that income inequality moderates the association between relative income and life satisfaction, and the difference in the association between relative income and life satisfaction for counties with high income inequality and counties with low income inequality translates into thousands of dollars in annual income.

Analysis 3: The Associations between Relative Income and Life Satisfaction for Individuals with Low vs. High Income

Next, we tested whether the association between relative income and life satisfaction may be strongest among low-income individuals. To test this, we fitted a model with all the two-way and three-way interactions for household income, county income, and income inequality in the full sample (see Table 3). Importantly, the three-way interaction was statistically significant ($b =$ 0.81, $SE = 0.31$), suggesting that the moderating effect of income inequality on the association between county income and life satisfaction was qualified by household income. Specifically, the negative association between county income and life satisfaction was more pronounced for respondents with lower household income living in counties with higher income inequality. Among counties with higher income inequality (1SD above the mean), people with low income (1SD below the mean; about $17,800) living in richer counties would have to earn about $5,200 more (or 29.1% more) in order to match the levels of life satisfaction of people living in poorer counties.

Discussion

The link between income and life satisfaction is one of the most studied associations in the field of subjective well-being, yet the mechanisms through which income influences life satisfaction (if the causal arrow does indeed go in this direction) remain unclear. Although income may have a direct effect on subjective well-being, some researchers have proposed that one's income relative to others is also (and perhaps especially) important. However, past studies examining such effects showed considerable inconsistencies. Some studies (e.g., Blanchflower & Oswald, 2004; Layard, Mayraz, & Nickell, 2010; Luttmer, 2005) have shown that controlling for personal income, the income of one's neighbors or of other similar comparison standards is associated with that person's life satisfaction. However, some studies (e.g., Deaton & Stone, 2013; Diener, Tay, & Oishi, 2013; Helliwell, Barrington-Leigh, Harris, & Huang, 2010) have

also shown that neighborhood income is not associated with life satisfaction, and in some

instances (e.g., Deaton & Stone, 2013; Hirschman & Rothschild, 1973; Tay, Morrison, & Diener,

2014), neighborhood income is even positively associated with life satisfaction. The goals of this

paper were to test the relative income hypothesis and investigate whether income inequality

moderates the association between relative income and life satisfaction. The current study is the

largest investigation of the relative income hypothesis to date. Specifically, we matched county

income data produced by the Census Bureau with income and life satisfaction data of over 1.7

million respondents from the United States. Three general findings emerged from the current

study.

First, results from the current study supported the relative income hypothesis - controlling

for household income, county income was negative associated with life satisfaction. This

analysis adds to the literature by confirming the relative income effect using an extremely large

and diverse sample. Although the focus of the current study was not to resolve the

inconsistencies surrounding previous research on relative income, the current study nonetheless

provided new supportive data regarding the relative income hypothesis. It is noteworthy that

most of the studies that did not found the effect of relative income used data collected from the

Gallup Poll (Deaton & Stone, 2013; Diener, Tay, & Oishi, 2013; Helliwell, Barrington-Leigh,

Harris, & Huang, 2010). Future research that aims at resolving the mixed evidence for relative

income may consider differences in measures or sampling technique between the Gallup Poll and

other data sources (e.g., the BRFSS).

Second, the most novel finding from the current study was that income inequality (which

may affect the salience of income and income comparison standards) moderates the association

between relative income and life satisfaction. Specifically, the negative association between

relative income and life satisfaction was stronger in counties with higher level of income inequality compared to counties with lower level of income inequality. Based on our model, social comparison of income in counties with high income inequality translates into a significant amount of income. The current study suggests that social comparison of income may play a role in the association between relative income and life satisfaction. Past research (e.g., Kawachi & Kennedy, 1999; Kennedy et al., 1998) has shown that income inequality is associated with psychological well-being. Oishi et al. (2011) showed that the association between income inequality and life satisfaction is mediated by perceived unfairness and lack of trust. Therefore, it is plausible that income inequality makes the discrepancy in income salient, which leads to higher levels of social comparison. Higher levels of social comparison in turn lead to perceived unfairness and lack of trust, which lead to lower life satisfaction. Future research should seek to identify the casual chain that leads income inequality to life satisfaction.

Third, the moderating effect of income inequality was more pronounced for low-income individuals compared to high-income individuals. In other words, low-income individuals tended to report lower satisfaction when they lived in richer counties with higher income inequality compared to high-income individuals. This finding suggested one potential pathway of how income inequality may be particularly detrimental to the well-being of low-income individuals.

By demonstrating the link between income inequality and relative income, the current study shed light on the on-going debate about whether economic growth at the societal level promotes societal happiness. On one hand, Easterlin and his colleagues published a series of paper suggesting that economic growth over time has little to no effect on life satisfaction (Easterlin, 1974, 1995; Easterlin, McVey, Switek, Sawangfa, & Zweig, 2010; Easterlin, Morgan, Switek, & Wang, 2012). On the other hand, some researchers have offered a different account,

arguing that economic growth does indeed predict increase in life satisfaction (Diener, Tay, &

Oishi, 2013; Hagerty & Veenhoven, 2003; Stevenson & Wolfers, 2008). These inconsistent

findings could indicate that there is a lot of cross-regional variability in the association between

GDP and well-being. The cross-regional variability can be partly explained by increased income

inequality that sometimes accompanied economic growth. In a country where income inequality

is high, economic growth may only benefit the well-being of a small group of wealthy

individuals through absolute income, but decrease the well-being of poorer individuals through

social comparison of income, thus resulting in a net null effect of economic growth. The current

study provided three pieces of evidence for this explanation: 1) higher neighborhood income was

associated with lower life satisfaction, 2) higher income inequality was associated with increased

social comparison of income, and 3) this moderating effect of income inequality was particularly

strong for low-income individuals. Future research should use country-level data and test

whether economic growth may have a stronger positive influence on well-being in societies

where economic growth is more equally distributed (i.e., low income inequality).

Strengths and Limitations

The current study utilized an extremely large and diverse nationally representative

sample from the United States. The BRFSS is *the* largest on-going telephone survey in the world.

Using a large sample not only increased statistical power to detect associations of theoretical

relevance, but also provided precise estimates of the associations between life satisfaction and

other variables. One of the challenges with having a large sample size is that sometimes

statistical significant associations can be practically insignificant due to very high power.

However, this is not the case in the current study. For example, based on our model, the

difference in the effect of relative income between counties with high income inequality and

counties with low income inequality converted into substantial amount of annual income. Moreover, data on county income and income inequality were drawn from datasets created and maintained by the Census Bureau. These data sources contain arguably the most accurate and reliable estimates of county income and county income inequality.

In addition to these strengths, the current study also has some limitations. Notably, respondents in the BRFSS reported their household income using income brackets. BRFSS data are sometimes used to calculate poverty level and understand health disparity in low-income individuals compared to wealthier individuals. Thus, the income brackets cover primarily the lower end of income. For instance, 4 out of 8 income brackets measured respondents who made less than $25,000 annually, and the top income bracket covered an annual income of $75,000 or higher. This limitation of range could produce biased (and most probably *conservative*) estimates of the associations found in the current study (Fritz, Morris, & Richler, 2012). To gain a more precise picture of how household income may interact with county income and income inequality to predict life satisfaction, future research should use an income measure that covers the entire range of possible value.

Moreover, the BRFSS is a cross-sectional dataset and do not follow individuals over time. Future research should examine the causal chain between income inequality and well-being using longitudinal dataset. For example, using longitudinal data, researchers can study relative income for individuals who move residency. It could be the case that the effect of relative income is positive for an individual who is very rich compared to her neighbors. However, the coefficient of relative income may become negative once this individual moved to a rich neighborhood where her income now compares less favorably, especially if she moves to a

neighborhood with high income inequality. This kind of research will strengthen our understanding of the relative income effect.

Conclusion

In summary, the current paper examined an extremely large dataset from the United States and provided evidence that controlling for household income, higher regional income was associated with lower satisfaction and that higher income inequality is associated with stronger social comparison of income, especially for low-income individuals.

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Table 1

Descriptive Statistics

Continuous Variables	M	SD	Range
Individual-level variables			
1. Life Satisfaction	3.39	0.63	1-4
2. Household Income	55775	37998	5000-1125000
3. Age	53.65	16.31	18-99
4. Number of Adults	1.84	0.77	1-18
5. Number of Children	0.61	1.06	0-50
County-level variables			
6. County Income	51722	13500	10930-115600
7. Gini	0.44	0.04	0.21-0.65
8. Housing Value	212783	124653	18600 - 868000
9. Population	481448	890027	82-9818605
10. County Size	1356	1889	2-147804
11. Population Density	1125	3789	0-69468

Table 2

Correlations between Predictors and Life Satisfaction

	1	2	3	4	5	6	7	8	9	10	11
					Correlations						
Individual-level variables											
1. Life Satisfaction		.27	.03	.08	.02	.04	-.01	.03	-.01	.01	-.02
2. Household Income			-.17	.24	.11	.26	-.05	.19	.12	.01	.10
3. Age				-.24	-.49	-.04	.01	-.03	-.04	.01	-.04
4. Number of Adults					.15	.04	-.04	.04	.02	.03	.003
5. Number of Children						.04	-.04	.01	.02	.03	.003
County-level variables											
6. County Income							-.26	.77	.47	.05	.37
7. Gini								.08	.31	-.25	.41
8. Housing Value									.55	.03	.48
9. Population										.01	.82
10. County Size											-.54
11. Population Density											

Note: All correlations were significant at $p < .05$.

Table 3

Estimates and Standard Errors of the Multilevel Models

	Analysis 1a (without covariates)		Analysis 1b (with covariates)		Analysis 2		Analysis 3	
	b	SE	b	SE	b	SE	b	SE
Intercept	3.39*	.001	3.42*	.013	3.42*	.013	3.41*	.013
Main Predictors								
Level-1								
Household Income (HI; log)	0.48	.002	0.31*	.002	0.31	.002	0.31*	.002
Level-2								
County Income (CI; log)	-0.19	.009	-0.06*	.015	-0.06*	.015	-0.08*	.015
Gini			0.26*	.029	0.25*	.028	0.19*	.034
Gini:CI					-1.22*	.237	-0.32*	.016
Cross-level Interaction								
Gini:HI							-0.41*	.062
CI:HI							0.15*	.018
Gini:HI:CI							0.81*	.312
Covariates								
Level-1								
Age			0.001*	.0001	0.001*	.0001	0.001*	.0001
Number of adults in			-0.002*	.0007	-0.002*	.0007	-0.002*	.001
Number of children			0.00	.001	0.00	.0005	0.00	.001
Female			0.03*	.001	0.03*	.001	0.03*	.001
Ethnic Background								
Black			0.04*	.002	0.04*	.002	0.04*	.002
Asian			-0.05*	.004	-0.05*	.004	-0.05*	.004
Hawaiian or Pacific			0.03*	.010	0.03*	.010	0.03*	.010
Native American			0.01*	.004	0.01*	.004	0.01*	.004
Other			-0.04*	.006	-0.04*	.006	-0.04*	.006
Multiracial			-0.04*	.003	-0.04*	.003	-0.04*	.003
Hispanic			0.04*	.002	0.04*	.002	0.05*	.002
Marital Status								
Divorced			-0.17*	.002	-0.17*	.002	-0.17*	.002
Widowed			-0.11*	.002	-0.11*	.002	-0.11*	.002
Separated			-0.26*	.003	-0.26*	.003	-0.26*	.003
Never married			-0.15*	.002	-0.15*	.002	-0.15*	.002
Unmarried couple			-0.10*	.003	-0.10*	.003	-0.10*	.003
Education								
Never attended			-0.06*	.013	-0.06*	.013	-0.06*	.013

Elementary	-0.08*	.003	-0.08*	.003	-0.08*	.003
Some high school	-0.08*	.002	-0.08*	.002	-0.08*	.002
High school	-0.06*	.001	-0.06*	.001	-0.06*	.001
Some college	-0.06*	.001	-0.06*	.001	-0.06*	.001
Employment						
Self-employed	0.03*	.002	0.03*	.002	0.03*	.002
Out of work > 1 year	-0.24*	.003	-0.24*	.003	-0.24*	.003
Out of work < 1 year	-0.19*	.003	-0.19*	.003	-0.19*	.003
Homemaker	0.04*	.002	0.04*	.002	0.04*	.002
Student	0.09*	.004	0.09*	.004	0.09*	.004
Retired	0.07*	.001	0.07*	.001	0.07*	.001
Unable to work	-0.33*	.002	-0.33*	.002	-0.33*	.002
Level-2						
Housing value (log)	0.01	.006	0.01	.006	0.01*	.007
Population (log)	-0.03*	.008	-0.03*	.008	-0.02	.010
Size of county (log)	0.03*	.008	0.03*	.008	0.01	.010
Population density (log)	0.01	.008	0.01	.008	-0.01	.010
Model Comparison						
$\Delta\chi^2$				42.06*		156.70*
p				<.001		<.001

Note: * = p <.05

Table 4

Random Effects of the Multilevel Models

| Random Effects	SD	Variance	Chi-square	p-value
Analysis 1a (without covariates)				
Household Income	0.07	0.004	$\chi^2(3) = 1164$	<.001
County Income	0.06	0.003	$\chi^2(3) = 25$	<.001
Analysis 1b (with covariates)				
Household Income	0.05	0.002	$\chi^2(3) = 237$	<.001
County Income	0.26	0.067	$\chi^2(3) = 1070$	<.001
Analysis 2				
Household Income	0.05	0.003	$\chi^2(3) = 214$	<.001
County Income	0.25	0.065	$\chi^2(3) = 1002$	<.001
Analysis 3				
Household Income	0.03	0.001	$\chi^2(3) = 494$	<.001
County Income	0.02	0.001	$\chi^2(3) = 5.65$	.10
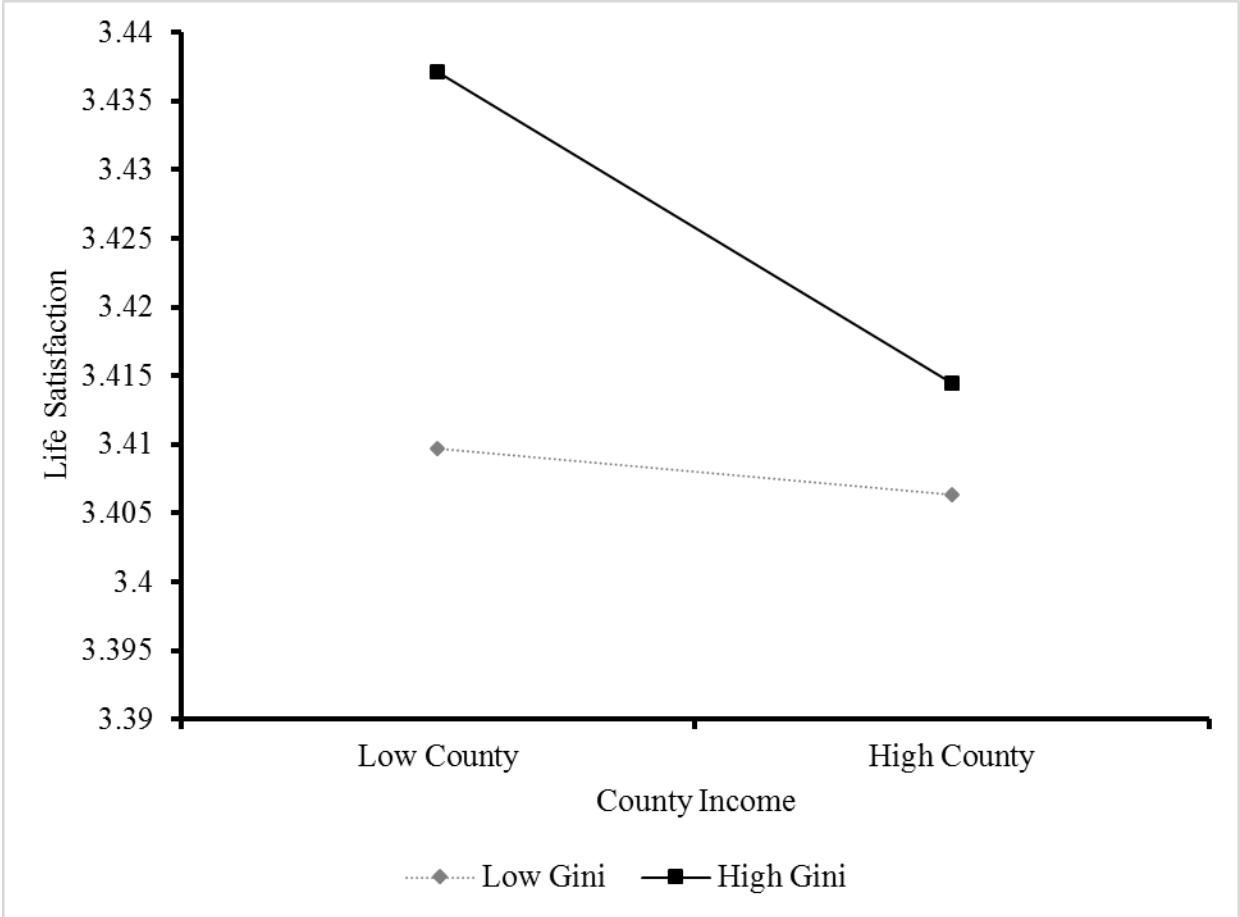
Figure 1. The Interaction between County Income and Income Inequality.