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Absolute vs Relative Income and Life Satisfaction

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Abstract: This paper examines whether subjective life-satisfaction is most strongly related to absolute or relative income in terms of either proximal neighbors or a wider aggregated region. The analysis utilizes two unique datasets - survey data on happiness in combination with fine-level income data for postal codes and municipalities. We find a significant relationship between happiness and both personal income and relative income position among nearby neighbors and more remote neighbors. Hence, being rich as well as being richer than others in the area increases the likelihood of being more satisfied with life. Above all, we find individuals' level of life-satisfaction to be more strongly related to the income of people in the larger municipality than to the income of nearby neighbors.

Keywords: Life-satisfaction, Happiness, Subjective well-being, Absolute income, Relative income,

JEL: I31, R10, O15, P46

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Introduction

Economic growth has long been the major goal for countries and an important means to increase social welfare. Recently, however, researchers have challenged the belief that income growth invariably leads to increased societal well-being. The debate has revolved around increasing income inequality argued to have arisen as a consequence of, inter alia, rapid economic growth. Income disparities, both across and within countries, have become greater than ever (Credit-Suisse, 2015, Oxfam, 2016). In the U.S, where income inequality is relatively high, there has been no remarkable increase in national happiness for approximately 30 years although real income per capita increased prominently during this period (Easterlin, 1974; 1995). In other words, the rising tide lifting all boats, albeit unequally, did not appear to make people happier. One explanation why income growth does not necessarily lead to greater life-satisfaction is that individuals may base their evaluations of life-satisfaction not on their absolute income and wealth but rather on relative standing and social comparisons with other people (see for example Duesenburry, 1949; Easterlin, 1974; 1995; Frank 1985).

If relative standing matters for life-satisfaction, increases in income inequality can lead to depreciated happiness. But to develop a complete understanding of the phenomenon of relative standing, it is desirable to examine individual happiness rather than regional or national averages of happiness. This allows for a consideration of other individual factors and personal characteristics that may influence well-being. Also, in order to conduct a valid empirical analysis, we have to ascertain what group of people individuals compare themselves with when evaluating their own life situation – i.e., the individual's reference group.

The purpose of this paper is to examine the relationship between absolute and relative income and life-satisfaction by utilizing survey data in combination with micro-data aggregated on two different regional levels: postal codes and municipalities. These data help develop a deeper understanding of individuals' reference norms and individuals' relative income level. We study the time period 2009-2011 and use a heteroscedastic ordered logistic model to assess the relation between life satisfaction on one hand and absolute and relative income on the other. Our findings confirm that both absolute and relative household income are related to life-satisfaction. An increase in both absolute or relative income increases the likelihood of reporting "Very satisfied" while it decreases the likelihood of reporting any of the lower life-

satisfaction categories (e.g., Rather Satisfied, Not Very Satisfied, Not At All Satisfied). Hence, having a higher income and/or a higher relative position in society increases the likelihood of being more satisfied with life. However, while previous literature imply that individuals compare themselves most with others in their close proximity, our results suggest that one's relative position in a larger regional context is more important than relative standing among nearby neighbors. In addition, when controlling for relative position on a postal code level, individuals are also more likely to be happier if their neighbors are richer – i.e., when living in a wealthier neighborhood.

Theory and Concepts

The belief that happiness is of importance for a society goes way back. Early intellectuals and philosophers as long ago as Plato and Aristotle emphasized the importance of happiness for society. Happiness and life-satisfaction lead to a wide series of benefits, not only for the individual herself, but for the entire society. Higher life-satisfaction results in, for instance, higher performance and productivity (Lyubomirsky et al., 2005, Oswald et al., 2009), improved creativity (meta-analysis by (Baas et al., 2008)), as well as better academic results for children (meta-analysis by (Durlak et al., 2011)). Furthermore, research has found happier people to be in better health (meta-analysis by Diener and Chan (2011) including more than 160 studies); to be better citizens by having a higher desire to vote, performing more volunteer work, showing higher respect for law and order, and to be more helpful towards others (Guven, 2011); and to be more financially responsible by saving more and exerting better control over their consumption and financial situation (Guven, 2012).

The role income plays in determining personal happiness has been widely debated since Easterlin introduced his paradox on relative income in 1974, suggesting that relative income matters for life-satisfaction – and not absolute income. The paradox originates from the following main findings. First, comparisons of rich and poor individuals within a country yield greater happiness differences than comparisons between wealthier and poorer countries. Within a country, income and happiness levels are correlated and a higher income is, on average, associated with a higher degree of happiness. Second, when examining the association between average income and happiness levels *across* countries therelation between wealth and well-

being is neither general nor robust. Furthermore, over time, countries show no clear pattern between changes in income (GDP per capita) and changes in happiness (Easterlin, 1974; 1995), suggesting that absolute income changes do not affect happiness.

Easterlin's explanation for this paradox is based on Duesenberry's relative income hypothesis derived from relative preference theories (Duesenberry, 1949, Frank, 1985, Veblen, 1909). It opposes the 'standard economic theory' and the theory of absolute utility (Veenhoven, 1991, Marshall, 1920).

More recent time series studies on the relationship support both arguments. They either confirm the existence of an Easterlin paradox, hence they find happiness levels to either stay constant or decline even in periods of income growth when one might expect them to rise (see for example Blanchflower and Oswald (2004); Diener et al. (2013)); or they find no support for its existence, such as Hagerty and Veenhoven (2003) and Stevenson and Wolfers (2008) both of which find a positive relationship between economic growth and happiness for most countries in Europe which during the examined time span experienced periods of high economic growth. Similarly, Oishi and Kesebir (2015) analyze time series on happiness and income, taking into account income inequality in their work and find "the Easterlin paradox to be not so paradoxical anymore" in that happiness rises with absolute increases in income when economic growth is evenly distributed. But when income inequality is very high, and economic growth is concentrated among a small portion of the population. In that context, the Easterlin paradox is more likely to emerge, when economic growth will not result in higher life-satisfaction (Oishi and Kesebir, 2015). However, examining only time trends for happiness and broad economic growth throughout a nation using bivariate correlations is not enough to distinguish the individual income-happiness relationship and probably less so to discuss whether it is absolute, relative, or both.

Since the beginning of the 2000s, the number of micro-level studies that aim to investigate the individual happiness-income relationship has significantly increased. These studies commonly include a variable on relative income or average reference group income in the utility model. Relative income is commonly defined as the income of an individual relative to the mean income of a reference group (see for example (Deaton, 1999)). The reference group is defined as whoever people refer to and compare themselves with when evaluating their own relative position, qualities, behaviors, etc. (Frank, 1985). So what is the ideal size of the reference group

to assess the (true) relationship between relative income and life satisfaction? Theory suggests a reference group consists of people in an individual's close proximity, e.g., people whom he/she often sees, such as neighbors or coworkers (Clark et al., 2009, Frank, 1985, Luttmer, 2004, Wolbring et al., 2013), though other reference groups have also been examined. Clark and Senik (2010) find that comparisons between colleagues and friends are made more frequently than comparisons between neighbors and family members. But culture may play a role; Knight et al. (2009) find that two-thirds of the respondents in their analysis on Chinese households primarily compare themselves to residents in their own village.

Some previous studies have examined the happiness-income relationship using individual data and various geographically-sized reference groups – including variables on both absolute and relative income. Clark et al. (2009) examine satisfaction with economic conditions in small neighborhoods in Denmark and find that, conditional on their own household income, individuals report higher satisfaction levels when their neighbors are rich, i.e., when they live in wealthier neighborhoods. However, Clark et al. (2009) include an income rank-variable specifying the individual's relative position in the neighborhood, and this variable is statistically stronger than variables on personal income and neighborhood median income, suggesting that relative standing matters more than own absolute income level. Similarly, a study conducted by Wolbring et al. (2013) examines the relation between absolute and relative income and life-satisfaction in Germany using two different geographic levels as reference groups. When looking at the whole country of Germany divided into large spatial regions which were used as reference groups, they find both income variables to be significant. However absolute income is stronger in determining life-satisfaction than relative income, which shows a weak significance. But when examining Munich at a finer regional level, divided into city districts, relative income has a stronger effect on happiness than absolute income has. These findings suggest that less-distanced reference norms matter more for life-satisfaction.

Yet, previous studies on the happiness-income relationship on a country-level have found relative income to be significant on this level of measurement as well. Ball and Chernova (2008) and Tsui (2014) study the happiness-income relationship on a country-level and include variables on both absolute and relative income in their empirics. These studies find both income components to be important determinants of well-being. While Ball and Chernova (2008) find changes in relative income to show larger positive effects on happiness than comparable

changes in absolute income, Tsui (2014) finds the absolute income component to be the most influential of all included explanatory variables.

Other studies have been conducted, which control for personal income as well as neighborhood income, but do not control for relative position in the neighborhood per se. Most of these find that having richer neighbors is associated with lower levels of reported happiness; e.g., in the U.S. (Blanchflower and Oswald, 2004, Luttmer, 2004), Latin America (Graham and Felton, 2006) and in South America (Kingdon and Knight, 2007). In his study, Luttmer (2004) includes a variable on neighborhood interaction and finds that the negative effect on happiness of an increase in neighbors' income is smaller for individuals socializing less with their neighbors and for new residents. The less you know your neighbors, the lower impact their wealth has on your happiness. In contrast to these studies, Aslam and Corrado (2011) find average regional household income to be positively related to well-being in Europe and in the countries in accession to the EU-countries. When examining only the EU-15 countries, no significant relationship between regional income and well-being was found. Diener et al. (1993) find no evidence for influence of neighborhood income on happiness in the U.S. and the same level of absolute income was accompanied with the same levels of happiness in poorer and wealthier areas.

A disadvantage of some of the above discussed studies is their use of large regional units as reference groups in their empirical analyses, like cities or larger city districts (Wolbring et al., 2011), states/ counties (Luttmer, 2005; Wolbring et al., 2011) or countries (Ball and Chernova, 2008), with the exception of Clark et al. (2009), who do not actually examine life-satisfaction per se but satisfaction with economic conditions. Since theory and previous research have suggested reference groups to consist of people in an individual's close proximity which he/she sees often, it seems unlikely that statistical averages in these large regions reflects individual resident's frame of reference.

Other determinants of happiness

Although income influences happiness, its impact has been shown to be relatively small when comparing it with other factors (Ball and Chernova, 2008, Easterlin, 2001), such as employment status, marital status and health condition. It has also been argued that income matters a lot more when an individual has little of it, referring to the phenomena of diminishing marginal utility to proportional increases in income (see for example Hagerty and Veenhoven (2003),

Helliwell (2003)). Lane (1998) argues that when an individual rises above the so-called subsistence level, enough to fulfill his basic needs, the prime source of happiness is rather family, friends and equivalent factors. Similarly, Kahneman and Deaton (2010) argue that there is a ceiling of "buying" extra emotional well-being, and when it is reached, higher income seems to have no extra impact.

Other factors found to affect well-being and happiness are, for example, age (Gerdtham and Johannesson, 2001, Horley and Lavery, 1995, Kingdon and Knight, 2007, Wolbring et al., 2013), gender (Clark and Oswald, 1994, Gerdtham and Johannesson, 2001, Tsui, 2014), health (Gerdtham and Johannesson, 2001, Ball and Chernova, 2008, Kingdon and Knight, 2007), marital status (Diener and Eunkook Suh, 1997, Tsui, 2014), having children (Diener and Eunkook Suh, 1997), employment status (Ball and Chernova, 2008), and educational level (Florida et al., 2013, Gerdtham and Johannesson, 2001, Tsui, 2014). Also, social trust has been found to influence well-being (Wolbring et al., 2013). Furthermore, population density is found to be of importance in studies by Lawless and Lucas (2011) and Kingdon and Knight (2007) who find that individuals living in metropolitan areas are less likely to report as high life-satisfaction as people who live in rural dwellers. On the other hand, Florida et al. (2013) find no significant effect of population density on regional happiness levels in the U.S.

Model, Data, Variables and Method

To be able to answer the research question, the following three hypotheses are formulated based upon theories and previous empirical work:

H1. The Absolute Income Hypothesis: Self-perceived life-satisfaction is positively related to absolute income,

H2. The Relative Income Hypothesis: Self-perceived life-satisfaction is positively related to relative standing, and

H3. The Reference Norm Hypothesis: Individual's compare themselves more with people in their close proximity when evaluating their life-situation. Hence relative standing among

neighbors is more related to life-satisfaction than relative standing among other (more remote) municipal inhabitants.

Models

The empirical applications of the models examined in this paper are based on a combination of the standard individual utility function and the relative preference utility function. The empirical analyses are various restricted versions of the functional specification presented below,

$$\mathrm{LS_{ijk}} = U\left\{u_1(\mathrm{Y_{ijk}}), u_2(\mathrm{Y_{ijk}} - \mathrm{Y}*_{\mathrm{j}}), u_3(\mathrm{Y_{ijk}} - \mathrm{Y}*_{\mathrm{k}}), u_4(\ln(\mathrm{Y}*_{\mathrm{j}})), u_5(\ln(\mathrm{Y}*_{\mathrm{k}})), u_6(\mathrm{Controls_i})\right\}$$

where LS_{ijk} is the self-reported life-satisfaction measure for individual *i* in postal code *j* and in municipality *k*. Y_{ijk} is the absolute income of individual *i* in postal code *j* and in municipality *k*. $Y*_j$ is the median income in postal code *j* and $Y*_k$ is the median income in municipality *k*. C_i is a vector of control variables for individual *i*. ε is the error term.

Due to multicollinearity problems between the three income variables of interest (absolute income, relative income on a postal code level, and relative income on a municipal level) these are examined in different regressions. Additional regression analyses are also run including variables on median household income in the individual's postal code and municipality respectively. This to test for potential positive or negative externalities from living in a wealthier area.

Variables, data and methods

Next, we move on to the empirical analysis of this paper. We use a series of statistical techniques to examine the relationship between relative and absolute income on one hand, and life satisfaction on the other. This section outlines the major variables, data, sources and methods used in the analyses.

Variables

Dependent variable – Life Satisfaction

This variable is based upon the survey question "How satisfied are you with your life as a whole?" with the following response options; "Not at all satisfied," "Not very satisfied," "Rather satisfied," and "Very satisfied." The response options are given a numerical order where "Not at all satisfied" is 1 and "Very satisfied" is 4. The variable comes from the SOM Institute survey and is for the period 2009-2011. The total sample size is approximately 9,200 individuals. The SOM Institute data and survey are presented in more detail in Appendix 1.

Independent variables:

Income variables

The analysis includes five different income variables. These variables are based on household income.

Absolute income

This is the total yearly income in Swedish kronor. The variable has nine response options ranging from "100,000 SEK or less" to "More than 800,000 SEK." This variable is measured simply as the chosen categorical number. The variable captures the household income for the individuals who took the SOM Institute survey for the years 2009-2011.

Relative income postal code

This variable is based on the Absolute income variable stated by the respondent in the survey and the median household income in the neighborhood (postal code) for individuals in the age group 20-64, based on data from Statistics Sweden for the same years. The median household income is then recoded to cohere with the response options for the survey question on Absolute income. Hence, both absolute income and median income can take on values between 1 and 9. The Relative income variable is then calculated by taking the absolute income option minus the recoded postal code median income option; $(Y_{\text{Own income category}} - Y_{\text{Median income postal code category}})$. A positive number indicates that the individual's Absolute income is larger than the neighborhood median income; the value 0 indicates that an individual's income is in the same range (category) as his/her postal code median income.

Relative income municipality level

This variable is derived exactly as the variable on Relative income postal code, except that for this variable, the respondent's absolute household income category is reduced by the median household income category in the respondent's municipality; ($Y_{\text{Own income category}} - Y_{\text{Median income municipality category}}$).

Median income

The variables on median income are the natural logarithm of the median household income in the individual's postal code and municipality respectively. These variables are also based on register data from Statistics Sweden, including individuals in the age span 20-64.

Control variables

In addition to the income variables, the analysis includes a range of variables for factors which in previous research were shown to affect life-satisfaction. In Table 1 below, all independent variables are summarized and defined (descriptive statistics for all variables are presented in Appendix 2).

(Table 1 about here)

Table 1: Description of explanatory variables

Variable	Description
Absolute income	Yearly household income, 9 categories
Relative income post.	The respondent's absolute household income level minus the median household income level in his/her postal code (consists on average of approx. 750 inhabitants)
Relative income munic.	The respondent's absolute household income level minus the median household income level in the his/her municipality (consists of approx. 2,500-900,000 inhabitants, with an average of 34,400)
Median income post.	Ln median household income in the respondent's postal code
Median income munic	Ln median household income in the respondent's municipality
Gender	Dummy = 1 if the respondent is a woman
Age	The age of the respondent
Age2	The respondent's age squared.[3]
Education	Dummy = 1 if the respondent has at least a university degree.
Employment status	Several dummy variables on employment status are included in the analysis; Employed, Unemployed, Student, and Retired. Base category: Employed
Marital status.	Several dummy variables on marital status are included in the analysis; Single, Domestic partner, Married, and Widow/widower. Base category: Domestic partner
Child	Dummy = 1 if the individual has at least one child.
Health	A variable on self-perceived health is included in the analysis. It ranges from 0 to 10, where 0 is the worst possible health condition, and 10 is the best possible condition

[3] Included in the analysis since the relationship between age and life-satisfaction in previous work is found to be curvilinear.

Trust in neighborhood	A variable on social trust is included. It ranges from 0 to 10 where 0 is "You cannot trust people in the area where I live," and 10 is "You can trust people in the area where I live"
Public service	A dummy variable on public service is included, = 1 if the respondent thinks the public service has been "Rather good" or "Very good" in his/her municipality the last 12 months
Small city/ rural area	Dummy = 1 for respondents who answered that they live in a small city, town or in rural areas
Year	Year dummies for the year during which the respondent participated in the survey; y2009, y2010 and y2011. Base category: y2011

Method

In this paper, a cross-section regression analysis is conducted. The data spans the time period 2009-2011, but the survey samples include different individuals from year to year. These years are therefore examined as one instance in a cross-sectional analysis. Using a period of three years increases the number of observations and hence the degrees of freedom without adding too much time fluctuation possibilities in the relationship between life-satisfaction and the independent variables. The main model thus assumes that this happiness-income relationship is approximately the same over the examined time period. Year dummies are included to control for possible differences in life-satisfaction between the years due to factors not included in the analysis.

The dependent variable on life-satisfaction is of a categorical ordered nature. Therefore, a non-linear model is applied. A Brant test was conducted which was significant, implying that the data is violating the proportional odds assumption. To correct for this violation, and in order to utilize the ordinal nature of the dependent variable, we use a heteroscedastic generalized ordered logistic model (OGLM). The independent variables that show significant heteroscedasticity in the Brant test are then specifically analyzed in the OGLM regressions. The OGLM adds a variance equation that takes into account the differences in residual variability for these independent variables (Williams, 2010). Apart from these differences, the OGLM is very similar to the ordered logit model (OLOGIT) – in fact, the OLOGIT model is nested in the OGLM model, i.e., it is a restricted version of the OGLM model.

Clustered standard errors are used to correct for possible violations of independence between individuals in the same postal code, i.e., factors that do not vary across individuals in the same cluster, but do vary across clusters.

Empirical findings and analysis

In this paper, we test the absolute and relative income hypotheses, and the reference norm hypothesis. The three income variables of interest are highly correlated, explaining why we test them in separate regressions. We have, however, run OGLM regressions including two and all three of them together to see what results we obtain (we only present the income variables in Table 2 - full regression results available in Table B in the Appendix):

(Table 2 about here)

Table 2: Regressions for life satisfaction and income variables combined

Model:	1	2	3	4
Absolute income	0.007	0.045***	0.008	
	(0.025)	(0.014)	(0.025)	
Relative income Postal -code	0.0055	0.012		0.007
	(0.012)	(0.011)		(0.014)
Relative income Municipal	0.044*		0.048*	0.059***
	(0.026)		(0.025)	(0.017)
Controls	Yes	Yes	Yes	Yes
Number of Observations	9,202	9,202	9,202	9,202
Clustered standard errors	Yes	Yes	Yes	Yes
Number of clusters	5,375	5,375	5,375	5,375
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.1625	0.1624	0.1625	0.1625

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In Model 1 all three income variables are included. In Models 2-4 we test two of the income variables together – Absolute income and Relative income postal-code in Model 2, Absolute income and Relative income municipality in Model 3 and the two Relative income variables in Model 4. When we include all three income variables in the same regression (Model 1) – the variable on relative income on a municipality level is positive and significant while the other two are positive but not significant. Further, the variable on relative income on a municipal level is positive and significant in all Models where it is included (Model 1, 3 and 4) unlike the others. This may suggest that this variable shows a stronger relationship with life-satisfaction than the other two. When we test the other two income variables together – the variable on absolute income and the variable on relative income in the postal code (Model 2) – absolute income is significant but not relative income in the postal code. However, since a correlation analysis suggests that the variables are highly correlated, these variables must be examined separately.

When doing so, we obtain the OGLM results presented in Table 3 (full regression results in Table C in Appendix). The pseudo R2s for the models are around 0.16 which is an acceptable level. We test the absolute (Models 5 and 8) and relative income variables (Models 6 and 9, and 7 and 10) separately; however, in Models 8–l0 we include additional variables on median income.

(Table 3 about here)

Table 3: OGLM Regression results for life satisfaction and income variables separately*

Model:	5	6	7	8	9	10
Income variables						
Absolute income	0.055***			0.058***		
	(0.012)			(0.012)		
Relative income Postal -code		0.045***			0.055***	
		(0.010)			(0.0117)	
Relative income Municipal			0.064***			0.065***
			(0.013)			(0.014)
Ln Median income Postal-code				-0.015	0.142***	-0.016
				(0.038)	(0.047)	(0.043)
Ln Median income Municipal				-0.208**	-0.163	-0.015
				(0.100)	(0.106)	(0.116)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	9,218	9,202	9,202	9,200	9,200	9,200
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	5,379	5,375	5,375	5,374	5,374	5,374
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.1622	0.1598	0.1625	0.1626	0.1611	0.1625

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Both variables on relative income and the variable on absolute income are positive and significant in all regressions, implying that happiness and income are related. A higher absolute and/or relative income increases the likelihood of higher life-satisfaction. Hence both own income and others' income matter for happiness.

In model 8, when absolute income but not relative income is controlled for, living in a wealthier municipality decreases the likelihood of higher happiness – hence, if people around you (in your municipality) earn more, you are less likely to be happy. In the same model, the coefficient for median income in the postal code also shows a negative sign but the coefficient is not significant. This may imply that relative standing to people in general (in a larger regional context) is more important than income relative to just one's nearby neighbors.

In Model 9, when we control for relative income in the postal code, we can see that a higher median income level in the postal code increases the likelihood of higher life-satisfaction. Hence, taking into account one's own relative position, living in a wealthier postal code comes with positive externalities. Presumably, these are not found on a municipal level as the coefficient on median income in the municipality is neither significant nor positive in Model 9 and 10, and negative and significant in Model 8. When controlling for relative position on a municipal level (Model 10), neither median income in the postal code nor the median income in the municipality are significant, and both show negative signs.

When running the heteroscedastic ordered logistic regressions, we correct for the variables that in Brant tests and in regressions appear to have heteroscedastic error variances. Doing this adds a variance equation which includes the variables under "lnsigma" in the full version of the regression, Table C in Appendix. In the models, the variance parameters for the included income variables are negative and significant. This means that the standard deviation of the residuals is smaller for higher absolute income categories than for lower income categories. Hence lower-income individuals are more widely spread between the different life-satisfaction options, while higher-income individuals more commonly report to be either rather satisfied or very satisfied with life.

We also conducted several robustness checks and tested our results using various estimation specifications. The results obtained by the OGLM specification are robust and similar to the results obtained by Ordered logit and OLS specifications. We also ran regressions for each year separately, as well as for all absolute income levels but the highest, and the results are robust (the results can be obtained from the authors upon request).

Ordered logit results are easier to interpret when presented as marginal effects. In Table 4, the marginal effects for the income variables (Models 5-10) are shown.[4] The marginal effects are evaluated at the mean of all other variables, meaning that the effects are calculated keeping all other variables constant at their mean values. Dummy variables are evaluated by using the finite-difference method.

(Table 4 about here)

[4] Results on the marginal effects for the control variables can be obtained from the authors upon request.

Table 4: Marginal effects at mean, Heteroscedastic ordered logistic model

Life-satisfaction:	Not at all satisfied dy/dx (1)	Not very satisfied dy/dx (2)	Rather satisfied dy/dx (3)	Very satisfied dy/dx (4)
Model 5				
Absolute income	-0.000740***	-0.00608***	-0.00423	0.0110***
	(0.000124)	(0.000854)	(0.00332)	(0.00320)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,218			
Model 6				
Relative income Postal -code	-0.000525***	-0.00419***	-0.00467	0.00938***
	(0.000120)	(0.000774)	(0.00314)	(0.00292)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,202			
Model 7				
Relative income Municipal	-0.000743***	-0.00614***	-0.00458	0.0115***
	(0.000122)	(0.000818)	(0.00326)	(0.00314)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,202			
Model 8				
Absolute income	-0.000753***	-0.00624***	-0.00506	0.0120***
	(0.000125)	(0.000855)	(0.00335)	(0.00325)
Ln Median income Postal-code	5.29e-05	0.000670	0.00395	-0.00467
	(0.000138)	(0.00174)	(0.0103)	(0.0121)
Ln Median income Municipal	0.000759**	0.00962**	0.0567**	-0.0671**
	(0.000368)	(0.00449)	(0.0263)	(0.0311)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,200			
Model 9				
Relative income Postal -code	-0.000566***	-0.00468***	-0.00734**	0.0126***
	(0.000122)	(0.000803)	(0.00332)	(0.00320)
Ln Median income Postal-code	-0.000524***	-0.00626***	-0.0362***	0.0430***
	(0.000177)	(0.00198)	(0.0113)	(0.0134)
Ln Median income Municipal	0.000604	0.00721	0.0417	-0.0495
	(0.000393)	(0.00461)	(0.0265)	(0.0315)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,200			
Model 10				
Relative income Municipal	-0.000743***	-0.00614***	-0.00475	0.0116***
	(0.000123)	(0.000826)	(0.00331)	(0.00322)
Ln Median income Postal-code	5.05e-05	0.000640	0.00377	-0.00446
	(0.000137)	(0.00174)	(0.0102)	(0.0121)
Ln Median income Municipal	4.77e-05	0.000604	0.00356	-0.00421
	(0.000369)	(0.00467)	(0.0275)	(0.0325)
Controls	*Yes*	*Yes*	*Yes*	*Yes*
Number of observations	9,200			

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

An increase in Absolute income, Relative income postal-code, or Relative income municipality decreases the probability of choosing "Not at all satisfied," "Not very satisfied" and "Rather

satisfied" but increases the probability of choosing the alternative "Very satisfied." This is intuitive, since the mean value of life-satisfaction is 3.28 and hence falls between the options "Rather satisfied" and "Very satisfied," explaining why an increase in absolute or relative income increases the likelihood of choosing the higher option of the two, and decreases the probability of choosing any of the lower options. These results support both the absolute utility theories and the relative preference theories.

In Models 5-7, where we do not control for the median household income in the individual's postal code and municipality, relative income on a municipality level shows the largest marginal effects (model 7). In contradiction to what theory suggests, relative standing compared to others in an individual's "very" close proximity is not necessarily more important than relative standing in a larger regional context. Hence, while relative preference theories (see for example Frank, 1985) and previous research (Clark et al., 2009; Wolbring et al., 2013) suggest reference groups to be small, our results imply that individuals' reference norms are not to be too small. Instead, individuals seem to compare themselves more with others in their region in general than with their nearby neighbors in particular.

It is important to note that the variables on relative income and absolute income are highly correlated at the extreme levels. This is logical. If an individual has a very high absolute income, she cannot have a very low relative income, which implies that the variables on relative income to some degree reflect possible absolute income levels as well – and equally that absolute income reflects to some degree possible relative income levels.

In Models 8-10 where we control for median household income in the individual's postal code and municipality respectively, we can examine the happiness-income relationship from a different approach. In model 8, where absolute, but not relative position is controlled for, living in a wealthier municipality decreases the likelihood of higher life-satisfaction; just a 1 percent increase in median income in the municipality decreases the likelihood of reporting "Very satisfied" by 6.7 percent. However, when controlling for relative position in one's postal code (Model 9), living in a wealthier postal code increases the likelihood of higher life-satisfaction; here a 1 percent increase in median household income in one's postal code increases the likelihood of higher life-satisfaction by 4.3 percent. However, since postal codes are small regional units and exposed to housing segregation, a higher median income in the postal code may rather reflect a higher absolute income. But it is not unlikely that living in a wealthier

postal code comes with positive externalities in terms of, for instance, better public services and less crime (see for example (Clark et al., 2009, Mellander et al., 2011)). These positive externalities are not found on a municipal level in any of the models.

Considering the control variables, various factors were found to significantly increase or decrease the likelihood of greater life-satisfaction. Previous research gives inconclusive findings regarding gender and age. Findings in this paper imply that women are more likely to be more satisfied with life than men, and that age shows a U-shaped relationship with life-satisfaction. Moreover, being retired increases the probability of reporting higher life-satisfaction. In consensus with previous findings, being married and having at least on child increase the likelihood of reporting higher life-satisfaction, while being single, widow/widower and/or unemployed decreases it. Considering the impact of one's health condition, previous work has repeatedly found health status to have a strong positive relation with well-being, and this paper is no exception. Furthermore, individuals who "trust people in the area where they live" and individuals who are "satisfied with the public service where they live" as well as individuals who live in smaller cities are more likely to have a higher life-satisfaction. Surprisingly, the dummy variable for having a university degree is not significant in our results, though various prior papers have found education to have a significantly positive effect on life-satisfaction. Other factors which are not significant in the OGLM regressions are the dummy variable for being a student and the year dummies.

Conclusion

This paper has tested the Absolute and Relative income hypotheses vis à vis life-satisfaction, as well as the reference norm hypothesis. The principal method used is a heteroscedastic ordered logistic model, however, the results are robust across different specifications. The results in this paper support both the Absolute and the Relative income hypotheses on happiness. The findings indicate that both one's own and its relation to other's income are significantly related to life-satisfaction. A higher absolute income or a higher relative income (relative to others in the postal code and municipality respectively) increases the likelihood of reporting higher life-satisfaction. Causality between absolute and relative income, and life-satisfaction is not determined. Essentially, theory suggests that income positively affects well-

being, explaining why this causality direction is assumed throughout this paper. However, causality in both directions likely has a self-perpetuating effect.

The findings in this paper do not support the third hypothesis, the reference norm hypothesis. This hypothesis states that individuals compare themselves more with others in their proximity/neighborhood than with more remote municipal residents, and hence that relative income in the postal code should be stronger related to life-satisfaction than relative income on a municipal level. While relative preference theories (for example Frank, 1985) and previous research (for example Clark et al., 2009; Wolbring et al., 2013) suggest reference groups to be small (such as neighbors and work peers), our results suggest that individual's reference norms are not to be too small. In fact, we find the relationship between relative income and life-satisfaction to be stronger in a larger regional context. This means that the point of comparison most likely is broader than one's specific closest neighborhood.

One reason why our results contradict previous research may be due to the fact that previous studies have not been able to test this relationship at a finely granular level as we have done here, given that postal codes consists of, on average, only 750 individuals. However, the findings herein may also be a result of obvious housing segregation because incomes tend not to vary as much between households in the same postal code as they do between households in the larger municipality. Noticeably, people tend to settle down nearby other individuals who have approximately the same income, affording the same types of property. Having a higher absolute income may thus benefit individuals in two ways. First, higher income individuals are better off due to their higher purchasing power. Secondly, they can afford to live in wealthier neighborhoods, which may come with positive externalities in terms of better schools and public services, less crime and so on. And as this paper finds, conditional on one's relative position in the postal code, living in a wealthier postal code (smaller neighborhood) increases the likelihood of higher life-satisfaction.

However, considering the social comparison aspect, living in a wealthier neighborhood may also come with negative externalities. The results in this paper show that, conditional on one's absolute income, living in a richer municipality significantly decreases the likelihood of being more satisfied with life. This implies that the richer the rest of one's municipality is, the less likely you are to report that you have a high level of life-satisfaction. This negative relationship between personal happiness and others' income indicates that happiness is relative, and that

individuals take into account others' life situation when evaluating their own, as suggested by relative preference theories. Hence, large increases in income inequality can reduce national life-satisfaction. These results are possibly driven by feelings such as injustice, deprivation, envy and jealousy. With regards to policy implications, potential income effects should not be ignored in decisions regarding improving national life-satisfaction. This study suggests that policies directed towards increasing average income, while trying to avoid a subsequent increase in income inequality in the regions, can improve national life-satisfaction.

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Appendix

Yearly data for the time period 2009 – 2011 is used in this paper, collected from the SOM Institute and Statistics Sweden. The *survey data* is collected from the survey; "National SOM" which is a yearly survey conducted by the SOM Institute, Gothenburg University, since 1986. It consists of random samples of the Swedish population (aged 16 years and older), and are representative for the Swedish population for this age span (SOM-Institute, 2015). However, the propensity to respond to the surveys varies slightly with gender, age and geographical location. Women respond to a slightly higher extent than men, and individuals living in more rural areas respond more often than city residents. The largest differences in propensity to respond is age-related, were younger individuals are less willing to respond. By taking these deficiencies into account, and controlling for them, the survey is representative for analyses of the Swedish adult population (Venersdotter, 2015). The response rate during the period, 2009-2011 is on average 54 percent, and 59 percent when considering natural shortfall (59 percent in 2009, 60 percent in 2010 and 57 percent in 2011). The total sample size during the period is 14,653 individuals. However, all surveys (3 per year) do not include all relevant questions, so the sample is reduced to consist of approximately 9200 individuals after the selection of variables to include in the analysis is made. Individuals are further removed from the sample that are physically or mentally unable to respond to the survey, have passed away, are abroad during the major part out of the response period, have emigrated, have language difficulties or do not at all speak Swedish. More information on the survey construction, the data collection,

and the shortfall analysis can be found in the SOM report (Venersdotter, 2015) or on the SOM Institute website: http://som.gu.se/som_institute/methodology.

Table A: Descriptive Statistics

Variable	*N*	Minimum	Maximum	Mean	Std. Deviation
Life-satisfaction	11908	1	4	3.28	0.62
Absolute income	9669	1	9	4.93	2.29
Relative income Postal -code	9650	-8	8	0.558	2.22
Relative income Municipal	9650	-6	6	0.832	2.29
Median income Postal-code (1000SEK)	11887	0	1189.90	386.80	141.29
Median income Municipal (1000SEK)	11887	230.30	673.50	353.15	59.65
Gender	11908	0	1	0.53	0.50
Age	11908	20	85	52.09	16.76
Age2	11908	400	7225	2994.82	1748.71
Education	11908	0	1	0.267	0.442
Unemployed	11714	0	1	0.04	0.20
Retired	11715	0	1	0.28	0.45
Sick leave	11715	0	1	0.04	0.20
Student	11715	0	1	0.05	0.22
Employed	11714	0	1	0.60	0.49
Married	11725	0	1	0.53	0.50
Single	11725	0	1	0.22	0.41
Widow/widower	11725	0	1	0.05	0.21
Domestic partner	11725	0	1	0.21	0.41
Child	11738	0	1	0.76	0.43
Health condition	11714	0	10	7.35	2.09
Social trust	11663	0	10	7.16	2.23
Public service	11908	0	1	0.30	0.46
Small city	11908	0	1	0.38	0.48
y2009	11908	0	1	0.378	0.48
y2010	11908	0	1	0.38	0.49
y2011	11908	0	1	0.24	0.43

Table B: Full regressions for life satisfaction and income variables combined

Model:	1	2	3	4
Income variables				
Absolute income	0.007	0.045***	0.008	
	(0.025)	(0.014)	(0.025)	
Relative income Postal -code	0.005	0.012		0.007
	(0.012)	(0.011)		(0.013)
Relative income Municipal	0.044*		0.048*	0.059***
	(0.026)		(0.025)	(0.017)
Control variables				
Gender	0.131***	0.130***	0.131***	0.151***
	(0.035)	(0.035)	(0.035)	(0.040)
Age	-0.061***	-0.060***	-0.061***	-0.070***
	(0.010)	(0.010)	(0.010)	(0.012)
Age2	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Education	0.041	0.041	0.041	0.0492
	(0.0356)	(0.036)	(0.035)	(0.041)
Unemployed	-0.498***	-0.497***	-0.497***	-0.574***
	(0.108)	(0.108)	(0.108)	(0.125)
Retired	0.157**	0.157**	0.155**	0.179**
	(0.067)	(0.067)	(0.066)	(0.077)
Student	0.125	0.125	0.125	0.145
	(0.085)	(0.085)	(0.085)	(0.098)
Married	0.128***	0.128***	0.127***	0.149***
	(0.042)	(0.043)	(0.042)	(0.049)
Single	-0.338***	-0.341***	-0.338***	-0.391***
	(0.069)	(0.069)	(0.068)	(0.081)
Widow/widower	-0.225**	-0.225**	-0.225**	-0.262**
	(0.088)	(0.088)	(0.088)	(0.102)
Child	0.129***	0.128***	0.127***	0.150***
	(0.045)	(0.045)	(0.045)	(0.052)
Health condition	0.307***	0.308***	0.307***	0.355***
	(0.041)	(0.041)	(0.041)	(0.048)
Social trust	0.088***	0.089***	0.088***	0.102***
	(0.014)	(0.014)	(0.014)	(0.016)
Public service	0.136***	0.136***	0.136***	0.159***
	(0.0389)	(0.039)	(0.039)	(0.045)

Small city	0.084**	0.081**	0.084***	0.096**
	(0.033)	(0.033)	(0.033)	(0.038)
y2009	-0.023	-0.018	-0.029	-0.026
	(0.037)	(0.037)	(0.037)	(0.042)
y2010	-0.051	-0.050	-0.050	-0.058
	(0.039)	(0.039)	(0.039)	(0.045)
Ln sigma				
Absolute income	-0.037***	-0.037***	-0.037***	
	(0.008)	(0.008)	(0.008)	
Relative income Municipal				-0.037***
				(0.008)
Gender	0.002	0.001	0.002	0.002
	(0.029)	(0.029)	(0.029)	(0.029)
Age	-0.002	-0.002	-0.002	-0.002
	(0.006)	(0.006)	(0.006)	(0.006)
Age2	5.11e-06	4.90e-06	5.57e-06	7.65e-06
	(5.43e-05)	(5.43e-05)	(5.43e-05)	(5.42e-05)
Education	0.071**	0.072**	0.071**	0.070**
	(0.035)	(0.035)	(0.035)	(0.035)
Social trust	-0.024***	-0.024***	-0.024***	-0.024***
	(0.007)	(0.007)	(0.007)	(0.007)
Public service	-0.056*	-0.054	-0.056*	-0.059*
	(0.033)	(0.033)	(0.033)	(0.033)
Number of Observations	9,202	9,202	9,202	9,202
Clustered standard errors	Yes	Yes	Yes	Yes
Number of clusters	5,375	5,375	5,375	5,375
Log pseudolikelihood	-6948.732	-6950.146	-6948.842	-6948.892
Wald chi2	3926.11	3911.16	3934.12	3178.55
Prob > chi2	0.000	0.000	0.000	0.000
Pseudo R2	0.1625	0.1624	0.1625	0.1625

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C: Full regressions for life satisfaction and income variables separately

Model:	5	6	7	8	9	10
Income variables						
Absolute income	0.055***			0.058***		
	-0.012			-0.012		
Relative income Postal -code		0.045***			0.057***	
		-0.010			-0.012	
Relative income Municipal			0.064***			0.065***
			-0.013			-0.014
Ln Median income Postal-code				-0.015	0.142***	-0.016
				-0.038	-0.047	-0.043
Ln Median income Municipal				-0.208**	-0.163	-0.015
				-0.100	-0.106	-0.116
Control variables						
Gender	0.130***	0.136***	0.151***	0.132***	0.140***	0.151***
	-0.035	-0.036	-0.040	-0.035	-0.037	-0.040
Age	-0.060***	-0.060***	-0.070***	-0.061***	-0.064***	-0.070***
	-0.010	-0.010	-0.012	-0.010	-0.011	-0.012
Age2	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	0.000	0.000	0.000	0.000	0.000	0.000
Education	0.041	0.058	0.049	0.039	0.050	0.049
	-0.036	-0.037	-0.041	-0.035	-0.038	-0.041
Unemployed	-0.507***	-0.543***	-0.573***	-0.500***	-0.531***	-0.575***
	-0.109	-0.113	-0.125	-0.108	-0.115	-0.125
Retired	0.161**	0.141**	0.177**	0.157**	0.154**	0.177**
	-0.067	-0.069	-0.077	-0.067	-0.071	-0.077
Student	0.129	0.116	0.145	0.121	0.149*	0.141
	-0.085	-0.085	-0.097	-0.085	-0.091	-0.097
Married	0.127***	0.153***	0.147***	0.128***	0.149***	0.148***
	-0.042	-0.045	-0.049	-0.042	-0.046	-0.049
Single	-0.342***	-0.378***	-0.391***	-0.337***	-0.359***	-0.391***
	-0.069	-0.072	-0.080	-0.069	-0.073	-0.081
Widow/widower	-0.234***	-0.248***	-0.263***	-0.225**	-0.244***	-0.263***
	-0.089	-0.091	-0.102	-0.088	-0.094	-0.102
Child	0.125***	0.143***	0.148***	0.129***	0.143***	0.150***
	-0.045	-0.047	-0.052	-0.045	-0.049	-0.052
Health condition	0.309***	0.320***	0.354***	0.307***	0.327***	0.354***
	-0.041	-0.042	-0.048	-0.041	-0.044	-0.048
Social trust	0.089***	0.096***	0.101***	0.088***	0.095***	0.102***
	-0.014	-0.014	-0.016	-0.014	-0.015	-0.016

Public service	0.134***	0.142***	0.159***	0.137***	0.146***	0.159***
	-0.039	-0.040	-0.045	-0.039	-0.041	-0.045
Small city	0.081**	0.072**	0.097***	0.087***	0.079**	0.098***
	-0.033	-0.033	-0.038	-0.033	-0.034	-0.038
y2009	-0.016	-0.027	-0.025	-0.028	-0.027	-0.027
	-0.037	-0.038	-0.042	-0.037	-0.040	-0.043
y2010	-0.049	-0.063	-0.057	-0.056	-0.059	-0.058
	-0.039	-0.041	-0.045	-0.039	-0.042	-0.045
Ln sigma						
Absolute income	-0.037***			-0.038***		
	-0.008			-0.008		
Relative income Postal -code					-0.024***	
					-0.008	
Relative income Municipal			-0.037***			-0.037***
			-0.008			-0.008
Gender	9.65E-05	1.06E-02	2.26E-03	1.40E-03	7.85E-03	1.76E-03
	-0.029	-0.028	-0.029	-0.029	-0.029	-0.029
Age	-0.001	-0.008	-0.002	-0.002	-0.005	-0.002
	-0.006	-0.005	-0.006	-0.006	-0.005	-0.006
Age2	3.59E-06	7.38E-05	8.13E-06	5.14E-06	4.20E-05	8.28E-06
	-5.42E-05	-5.08E-05	-5.41E-05	-5.43E-05	-5.27E-05	-5.42E-05
Education	0.073**	0.030	0.070**	0.072**	0.053	0.070**
	-0.035	-0.034	-0.035	-0.035	-0.035	-0.035
Social trust	-0.024***	-0.027***	-0.024***	-0.024***	-0.028***	-0.024***
	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
Public service	-0.055*	-0.049	-0.060*	-0.056*	-0.055*	-0.059*
	-0.033	-0.033	-0.033	-0.033	-0.033	-0.033
Number of Observations	9,218	9,202	9,202	9,200	9,200	9,200
Clustered standard errors	Yes	Yes	Yes	Yes	Yes	Yes
Number of clusters	5.379	5.375	5.375	5.374	5.374	5.374
Log pseudolikelihood	-6962.19	-6971.05	-6949.01	-6947.39	-6959.26	-6948.26
Wald chi2	3881.64	3701.28	3184.87	3925.87	3560.32	3185.96
Prob > chi2	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.1622	0.1598	0.1625	0.1626	0.1611	0.1625

Robust standard errors in parentheses. *** p<0.01. ** p<0.05. * p<0.1.