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Abstract

This paper investigates whether people's satisfaction declines when the income of their peer group rises. We try to answer this question by applying an extensive panel data study covering the European Union. Our empirical model provides three main findings. First, we find that higher comparison income is associated with lower self-reported satisfaction, and that the effect is robust for various re-specifications of the model. Second, we find that the income externality is asymmetric. Third, we find suggestive evidence that the effect is only significant for people who socialize frequently.

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1 Introduction

Most people pursue 'the good life'. We want a pleasant family life, we want an interesting job, we want to be able to buy goods, we want recognition. In short, we want to be happy. Although economists recognize this fact by studying utility, most attention is given solely to maximize the consumption possibilities of the members of society. However, important insights might be overlooked and flawed policy recommendations might be given if one fails to study people's self-perceived happiness.

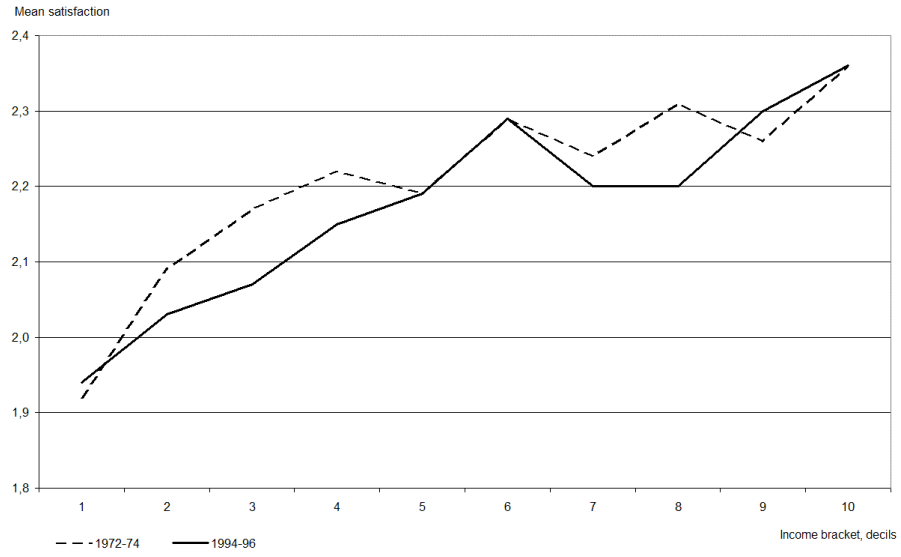
It has become a well-established finding that at a given point in time within a country, higher income is associated with higher well-being (e.g., see Frey & Stutzer 2002). As seen from figure 1, there is a clear correspondence between satisfaction and location in the income distribution on US-data. People with incomes in the highest income bracket report an average satisfaction of approx. 2.4 while the 10 percent poorest people report an average satisfaction of only approx. 1.9. Similar results hold for Europe, see figure 3 in the appendix. This is hardly surprising and in accordance with standard economic theory.

More strikingly, however, is the fact that people in general do not seem to have become happier during the 20 years from 1972-74 to 1994-96, despite the substantial rise in real incomes. In fact, the overall mean satisfaction even decreased slightly, from 2.21 to 2.17. The same result applies for Europe (Frey & Stutzer 2002), however it can not be found in the relatively short period covered in figure 3 in the appendix. The latter finding apparently contradicts the traditional hypothesis that higher consumption increases happiness. One possible explanation to this puzzle is simply that people may tend to report relative satisfaction rather than absolute satisfaction. That is, when people rate their satisfaction on a numerical scale, they may tend to compare their own well-being with the well-being of others and report an unchanged satisfaction level, even though their true satisfaction may have increased in an absolute sense (Luttmer 2003).

However, if the data does measure true, absolute satisfaction, a far more intriguing explanation is the *relative income hypothesis*, first formulated by Duesenberry (1949). According to this, people essentially care about their relative position rather than their income in absolute terms, and hence, do not get happier when all incomes grow at the same rate. The remainder of this paper will be devoted to empirically investigating this idea.

The paper proceeds as follows. In section 2, we discuss the formal theory behind the model. Our data source (ECHP) will be described and modifications to the data set will be discussed in section 3. Section 4 presents our empirical model. Furthermore, the statistical specification of the model will discussed and related to the theoretical model. In section 5 we will present the results from our model, including various specification-

Figure 1: Mean satisfaction in USA for different income brackets



Source: General Social Survey, National Opinion Research Center. Obtained from Frey & Stutzer (2002).
Based on scores 1-3 where 3 = 'very happy'

and robustness checks and three extensions. In section 6, possible policy implications will discussed. We summarize the conclusions of the paper in section 7.

This paper is the result of the authors' combined efforts. In order to comply with the formal requirements only, we state Claus as the author of section 2.1, 3.2, 4.1, 4.3, 5.2, and 7 while Jonas is stated as the author of section 1, 2.2, 3.1, 3.3, 4.2, 4.4, 5.1, 5.3, and 6. The data processing has been carried out by the authors in cooperation.

2 Theory

"Men do not desire to be rich, but richer than other men."

John Stuart Mill (1806 – 1873)

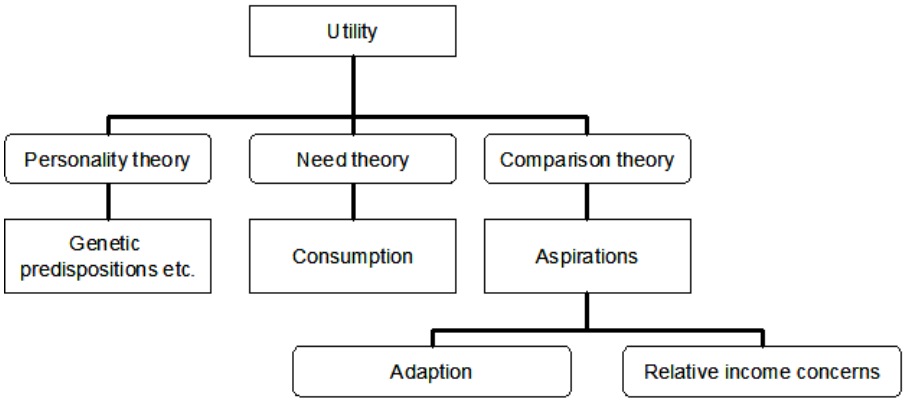
In traditional economic literature, an agent's utility depends only on his consumption measured in absolute terms. This view was challenged by Duesenberry (1949), who adopted the comparison theory from psychology and formulated the 'relative income hypothesis'; which states that people care about their relative income position. Your neighbours earnings thus induce a negative externality on your well-being. Duesenberry's hypothesis was picked up by Easterlin (1973), who ends his article;

"Each person acts on the assumption that more money will bring more happiness; and, indeed, if he does get more money, and others do not (or get

less), his happiness increases. But when everyone acts on this assumption and incomes generally increases, no one, on the average, feels better off."

In contradiction to traditional economic theory, where an agent's welfare only depends on his absolute consumption, psychologists deal with three different theories to explain happiness: *Personality*, *need*, and *comparison* theory (Schyns 2001), see figure 2. According to the *personality theory*, some people are more satisfied or dissatisfied with their lives due to genetics predispositions, chronic diseases, or mental illness. This implies that some people will be more likely to report high levels of satisfaction in surveys regardless to other characteristics of the person.

Figure 2: Overview of the Theoretical Model



The *need theory* states that a person has several basic needs such as food, shelter, clothing, etc. which can be satisfied through consumption. This idea is comparable with the standard microeconomic theory, where an agent's utility depends only on his absolute consumption. The agent's utility function in this case is described by $U_i(c) = f(c, S)$, where c is the agent's consumption, and S are agent specific characteristics such as sex, martial status, etc. The need theory can explain the differences within a country at a given time. Wealthy persons are more satisfied than poorer because of their larger consumption possibilities, and therefore reports higher levels of happiness (Frank 2000).

2.1 Aspirations

The need theory, however, does not explain the lack of differences *between* countries (Easterlin 1973) and within countries through time (Frank 2000). These differences may instead be explained by the *comparison theory*. According to the comparison theory, the satisfaction one gets from consumption depends not on the absolute amount of goods he gets, but on the gap between aspirations and achievements. The agent's utility function is hereby extended to $U_i(c) = f(c, \frac{c}{A}, S)$, where A is the agent's aspiration income, and

$\frac{\delta U}{\delta A} < 0$. The agent's aspiration are driven mainly by two sources, namely adaption and relative income concerns (Stutzer 2003).

2.1.1 Adaption

According to the adaption theory, people adapt to their previous income and consumption level. Additional income increases utility initially, but as times goes by the effect wears off, as the agent gets used to the new income level. Hence, the agent does not only care about his current income, but also about his current income compared to what he is 'used' to. The process where a permanent increase in income is not followed by an permanent increase in utility is called adaption.

2.1.2 Relative Income Concerns

As outlined in the introduction, the relative income hypothesis states that people make social comparisons and judge their own income against the income of the surrounding society. Hence, it is not the absolute level of consumption that matters, but the level compared to the agent's peer group. If the agent's absolute income is constant while his acquaintances' incomes are rising, the agent's happiness will decrease due to a lower relative income position. The neighbours' earnings thus exert a negative externality on the agent's well-fare and hence, the free market equilibrium will be sub-optimal.

To summarize, the utility function can thus be decomposed as

$$U_i(c) = f(c, \frac{c}{c'}, \frac{c}{\tilde{c}}, S) \tag{1}$$

where c' denotes the agent's adapted consumption and $\tilde{c}$ denotes his comparison consumption.

2.2 The Peer Group

The peer group includes all the people who interact on the agent's everyday life e.g. colleagues, neighbours, and friends (Kapteyn et al. 1997). To a lesser extent, also persons unknown to the agent might influence his expectations about wage (e.g. members of the agent's trade union), life expectancy (e.g. persons with similar health and habits in health statistics), and social life (e.g. characters in TV-series as 'Friends'). Naturally, the agent may be more influenced by close relations than relatively distinct relations.

It is also likely that people who socialize frequently are more influenced by the peer group's income than people who socialize less. Moreover, as posited by Duesenberry (1949), the income externality might be asymmetric. The agent might be more influenced by people with higher income and social status because he look up to them, and for that reason the negative externality may mainly be downward influencing (see Stutzer 2003).

3 Data

To be able to test wether the agent's utility is negatively influenced by his aspirations, we need a data set containing the agents income and some measure of the agent's welfare.[1] Moreover, we need a number of individual specific characteristics to create a useful peer group and a panel data structure to be able to remove the personality effect described in section 2. The European Community Household Panel (ECHP) is, to our knowledge, the most extensive European data source available with the above mentioned characteristics. Currently, the ECHP User Database contains eight waves from 1994 to 2001 with anonymized data[2] for all EU member states. The observations are based on yearly interviews of all adult members belonging to a selected sample of households. A measure of the individuals' welfare can be obtained from answers to the question:

> How satisfied are you with your present situation in the following areas?
> Please use a scale of 1 to 6, position '1' meaning you are not satisfied at all and '6' meaning that you are fully satisfied.

where the mentioned areas are *main activity*, *financial situation*, *housing situation*, and *amount of leisure time*.[3] The validity of these satisfaction variables will be discussed in section 4.1.

3.1 Refinement of Data Set

The raw data set from ECHP is not optimized for our purpose. For that reason, we need to make several adjustments to the data set.

3.1.1 Generating the Weighted Average Satisfaction Variable

Unfortunately there is no question regarding overall satisfaction with life in the ECHP. If the answers to the different satisfaction measures were highly correlated, we could use one of these as an approximation for overall satisfaction. In table 3.1.1, however, we see that the highest correlation (between satisfaction with main activity and satisfaction with financial situation) is only 0.55. Based on that we assess the correlation between the four satisfaction variables in data to be too low to use one of them as an overall satisfaction proxy.

Luttmer (2003) regresses self-reported overall satisfaction on self-reported satisfaction with eleven specific areas, of which four exist in the ECHP. Using his estimates on each of these four satisfaction measures, we construct a representative variable as a weighted

[1] Instead of measuring satisfaction to test the relative income hypothesis, an alternative approach is to use the concept of *revealed preferences*. Using this approach Neumark & Postlewaite (1998) find that women's decision to seek paid employment partly depend on the incomes of their sisters and sisters-in-law.

[2] For more details about the anonymization of the ECHP data, see Eurostat (2003b)

[3] Source: Survey Questionnaires, Wave 8, 2001. Eurostat DOC.PAN 161/00.

Table 1: Correlation Between Satisfaction Variables

Satisfaction with	Activity	Finances	Housing	Leisure
Main activity	1.00			
Financial situation	0.55	1.00		
Housing situation	0.42	0.46	1.00	
Amount of leisure time	0.29	0.27	0.34	1.00

Note: The table shows the correlation between the four satisfaction variables included in the ECHP data set.

average of the satisfaction data reported in ECHP.[4] The weighted average satisfaction (in the following *WAS*) is calculated as

$$\begin{aligned} WAS = (&0.139 \cdot \textit{satisfaction with financial situation} \\ &+ 0.095 \cdot \textit{satisfaction with housing situation} \\ &+ 0.069 \cdot \textit{satisfaction with main activity} \\ &+ 0.050 \cdot \textit{satisfaction with amount of leisure time})/0.353 \end{aligned} \quad (2)$$

By dividing by 0.353 we ensure that *WAS* is between 1 and 6 as the original variables. In section 5.2.3, we check that this particular specification of WAS is not driving our results.

3.1.2 Making Amounts Comparable Between Countries and Across Time

All incomes in the ECHP is measured in national currencies. In order to make the consumption possibilities for a given income comparable between countries, we divide every variable containing amounts with the corresponding PPP for the particular country and year. The PPPs are obtained from the ECHP. To make amounts comparable across waves, we deflate all amounts with the EU-15 inflation rate from Eurostat[5].

3.2 Discussion of Possible Biases

The ECHP is not a balanced panel. This is due to people dropping out when they die, and children entering when they turn 16 years old. If unhappy people are more likely to die (they may be unhappy due to bad health or the like – in extremum, very unhappy people are more likely to commit suicide), there might be survivorship bias (see for example Luttmer (2003) and McBride (2001)). In our regressions we control for health and mental problems, which might reduce this selection problem, but it will not be resolved completely (Woolridge 2002). However, we consider the bias on the estimates of our interest to be limited, because chronically ill people might as well care about relative income and adapt to previous income levels and therefore will not drive the estimates on these parameters in a specific direction.

[4]The four satisfaction variables in the ECHP are all among the seven satisfaction variables with significant estimates in Luttmer (2003)

[5]See http://europa.eu.int/comm/eurostat

In the ECHP, people moving to another country drop out of the data set. If the person moves because he chooses his own peer group as described in section 2.2, this will result in a selection bias. However, this problem is considered to be almost non-existing.

Table 2: Number of Observations Split by Country and Wave

COUNTRY	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8	**Total**
Austria	0	7,437	7,271	6,999	6,561	6,246	5,801	5,605	45,920
Belgium	6,710	6,454	6,145	5,741	5,339	5,021	4,713	4,299	44,422
Denmark	5,903	5,503	4,994	4,628	4,187	3,983	3,833	3,789	36,820
Finland	0	0	8,173	8,068	7,381	7,109	5,614	5,637	41,982
France	14,333	13,306	13,051	12,143	11,209	10,682	10,328	10,119	95,171
Germany	12,233	12,542	12,295	12,059	11,562	11,288	10,987	10,624	93,590
Germany*	9,490	9,002	8,746	0	0	0	0	0	27,238
Greece	12,492	12,271	11,602	10,968	9,985	9,574	9,437	9,419	85,748
Ireland	9,904	8,531	7,487	6,868	6,324	5,451	4,528	4,023	53,116
Italy	17,729	17,780	17,736	16,594	15,934	15,401	14,585	13,392	129,151
Luxembourg	2,046	1,968	1,915	0	0	0	0	0	5,929
Luxembourg*	0	6,786	5,613	5,805	5,410	5,294	4,883	4,916	38,707
Netherlands	9,407	9,151	9,277	9,089	8,826	8,917	8,866	8,608	72,141
Spain	17,893	16,263	15,640	14,819	13,779	13,104	12,317	11,964	115,779
Portugal	11,621	11,858	11,702	11,625	11,412	11,250	11,054	10,915	91,437
Sweden	0	0	0	9,597	9,461	9,314	9,354	9,291	47,017
United Kingdom	9,028	8,825	8,949	8,932	8,868	8,738	8,637	8,521	70,498
United Kingdom*	10,517	8,386	6,940	0	0	0	0	0	25,843
Total	149,306	156,063	157,536	143,935	136,238	131,372	124,937	121,122	1,120,509

** Data is based on national surveys*

Source: The European Community Household Panel (ECHP)

Note: The table presents the total number of observations in the ECHP, before imposing any restrictions.

As the ECHP only includes the period 1994 to 2001, it does not cover a full business cycle in all countries. In a period with high growth, the signals from media and politicians might be more positive and people might tend to report higher satisfaction. Since the macroeconomic conditions is expected to be positively correlated with peer group earnings, this could possibly disturb the results. To address this issue, we control for the macroeconomic environment by including the unemployment rate in the regressions.

3.3 Selection of Grand Data Set

The ECHP contains 1,120,509 observations divided into 15 countries (18 surveys) and eight waves (see Table 2). For each of the countries Germany, Luxembourg, and United Kingdom we have two sets of data — a set based on original ECHP surveys and a set based on national surveys. We exclude the ECHP based surveys for these countries, as they only cover the waves 1 to 3. In addition, we exclude the national surveys from Germany and Luxembourg, and the ECHP survey from Sweden, as they do not contain satisfaction data. Also we exclude the national survey from UK, because it only reports satisfaction data for three non consecutive years. As we mainly want to include persons who do not depend on their parents, only people of at least 25 years of age are included in the regressions. However, to preserve data for calculation of peer group income (see section 4.2.2), only observations where the person is 21 years or younger are excluded (76,456 observations; between 7 and 13 percent for each country). After imposing these

exclusions, our grand data set contains 735,235 observations in 11 countries, covering 138,883 individuals.

4 Empirical Model

> *"Utility seems to be to economists what the Lord is to theologians. Economists talk about utility all the time, but do not seem to have hope of ever observing it this side of heaven".*
>
> Wansbeek & Kapteyn (1983)

This section presents and discusses our empirical model. First, we argue that using self-reported satisfaction is a satisfactory proxy for utility. Second, our income measures are discussed and our definition of the individual's peer group are introduced. Finally, we discuss the statistical approach and set up our baseline regression. We will test the relative income hypothesis in a regression of the form *WAS = f(Present Income, Previous Income, Peer Group Income, Controls).*

4.1 Dependent Variable

In this paper we use self-reported satisfaction as a proxy for utility and thereby attempt to estimate a utility function directly. Although psychologists have used measures of subjective well-being for a long time, the method has only very recently been adopted by economists.[6] A vast number of studies confirm that self-reported satisfaction is indeed correlated with the underlying 'true' happiness. For instance, happy people tend to smile more often and show fewer signs of stress (Blanchflower & Oswald 2004). Clark & Oswald (1996) list a number of studies that reports strong correlations between satisfaction and observable events such as length of life, poor mental health, and absenteeism. As noted by Clark & Oswald; probably the best defence of using self-reported satisfaction is its widespread use in the psychology literature, as psychologists are likely to be more skilled than economists at judging the quality of such data.

As mentioned in the introduction, people might answer the satisfaction question in relative rather than absolute terms. Luttmer (2003) investigates this issue by using proxies for utility with a more objective definition such as the frequency of financial worries or the frequency of marital disagreements. Luttmer concludes that this concern is not driving the results. We note his findings, and do not investigate this issue further.

Another potential problem is that the scale used when asking about satisfaction impose a lower and upper limit on the reported level of well-being. This censoring is a possible

[6] See for example the excellent overview in Frey & Stutzer (2002) section 2. A thorough survey can be found in D'Addio et al. (2003).

source of bias. Nevertheless, the problem is considered to be small, as only 3.3 percent of the respondents report the lowest or the highest level of satisfaction (see table 7 in the appendix).

In order to use satisfaction data for our purpose, interpersonal comparability of the individual statements of well-being as well as cardinality has to be assumed. However, recent literature suggest that this may be more a theoretical problem than a practical one and that self-reported well-being is a satisfactory approximation to individual utility (Frey & Stutzer 2002). For instance, self reported happy people are also rated as happy by friends and relatives. The cardinality assumption will be tested by comparing the estimation results from the baseline regression with an ordered probit estimation.

We exclude observations carried out as proxy interviews from the regression, as they may be less reliable than personal interviews. In particular they may be biased towards higher satisfaction, as the proxy might be reluctant to report low levels of happiness. As described in section 3, the ECHP data set contains several measures of self-reported happiness. Following the previous discussion, we will use weighted average satisfaction (WAS) as a proxy for utility.

4.2 Explanatory Variables

4.2.1 Income

Few economists probably doubt that utility is increasing in consumption. According to the need theory described in section 2, the fulfilment of material needs through consumption raises well-being. Unfortunately, the ECHP data set does not include any useful consumption variables. Instead, we include *total net personal/household income, prior to the year of the survey* as a proxy for consumption. Intertemporal consumption theory suggests that current consumption depend on total lifetime expected income (Romer 2001). In consequence, a higher present income will raise current consumption ceteris paribus, although the effect may not by one-to-one. Introducing departures from the first-best world, such as imperfect capital markets or limited foresight, is likely to strengthen the correlation between current income and current consumption. Hence, the current income proxy seems satisfactory.

Following the discussion in section 2.1.1, lagged income is included as a proxy for adaption. We would have liked to include parents' income as a proxy for adaption, but this was not possible given the data available.[7] In line with previous studies we take the logarithm to amounts to take into account diminishing returns to income. We will run the regression with both personal and household income, as it is not a priori clear which

[7]The 'Relationship File' in ECHP only reports relationships *within* each household. Hence, it is only possible to identify the parents of individuals who have lived with their parents during the sample period 1994-2001.

type of income is the relevant one.

Some of the reported incomes are very low. Therefore, when regressing on *personal incomes* we exclude all individuals with personal incomes below a 'subsistence level' of 3,500 euros.[8] There are three possible explanations to observing these very low incomes: *i)* The reported income is simply too low; perhaps because the respondent is reluctant to report income from the informal sector. In this case, the observation should be excluded not to disturb the estimation. *ii)* The respondent really is extremely poor. Since the relative income effect is mostly expected to matter for people living above the subsistence limit, the observation should be excluded. *iii)* The respondent is supported by his or her spouse's income. We partly control for this by including spouse's income in the regression, however respondents with very low incomes will probably put higher emphasis on the spouse's income than the average respondent. Furthermore, they will disturb the peer group income measure, and hence should be excluded.

When regressing on *household income* we also exclude the low incomes. Naturally, only problem *i)* and *ii)* apply here. To make sure that these restrictions are not driving our results, we will estimate the model without the restrictions in section 5.2.4.

4.2.2 Peer Group

One of the most difficult tasks in testing the relative income hypothesis is how to define the relevant peer group. Who are the relevant others? Using data from the USA, Blanchflower & Oswald (2004) define the comparison income as the average income in the same state. As the other extreme, Neumark & Postlewaite (1998) use sisters and sisters-in-law as women's peer group. Our approach is somewhere in the middle of these two extremes. In line with Kapteyn et al. (1997) and Bonke & Browning (2003) we define a person's reference group as the person's *social group*, that is a group of people that share some objective measurable characteristics (sex, age, education etc.).[9] We would have liked to include the income of people with whom the individual with certainty have social relations, such as colleagues, neighbours, siblings etc., but this is not possible given the data available.

Suppose that the true comparison income $\tilde{y}_{it}$ for individual i at time t can be described as a weighted average of the incomes of all other individuals in the economy:

$$\tilde{y}_{it} = \sum_{k=1}^{N-1} w_{ikt} y_{kt} \quad , \qquad t = 1, \ldots, T \tag{3}$$

[8] At 1992, the official annual subsistence level in Belgium for cohabiting persons was 149,832 Belgian francs; about 3,625 euros (PPP units). Source: The European Foundation for the Improvement of Living and Working Conditions (an EU body). See http://www.eurofound.eu.int/emire/BELGIUM/SUBSISTENCELEVEL-BE.html

[9] Kapteyn et al. examines how the individual's consumption choice is affected by the choices of their reference group. They do not measure utility directly. Bonke & Browning estimate a wage equation instead of taking the average of the peer group.

where w_{ikt} denotes the weight individual i attach to the income of of individual k, y_k. It seems plausible that individuals will on average attach a higher weight to the income of individuals who share the same characteristics. Hence, given certain assumptions[10], Kapteyn et al. (1997) show that $\tilde{y}_{it}$ can be estimated by the average income in the individal's social group, $\bar{\tilde{y}}_{it}$:

$$\hat{\tilde{y}}_{it} = \bar{\tilde{y}}_{it} = E(\tilde{y}) \tag{4}$$

In this paper, we define an individual's peer group as persons of the same *sex*, who live in the same *region* (of different sizes; Denmark is one region while Finland is divided into 5 regions) and have the same level of *education* (3 levels). In Kapteyn et al. (1997), people are divided into 5 different *age* groups. This, however, is not optimal, as it will be almost arbitrary for individuals on the borderline between two age groups which group they will be placed in. To solve this problem, McBride (2001) assumes that an individual compares himself to everyone from 5 years younger to 5 years older than himself (but do not contingent on sex, education and geographical location). We take it one step further. In contrast with the existing literature, we assume that individuals compare themselves with people no younger or older than 15 percent of their own age. Applying this specification, we ensure that the age span widens as people grow older, what seems to be realistic. The 15 percent limit is chosen somewhat arbitrarily but seems appropriate. For instance, at age 25 the peer group consists of people aged 22 to 28, while at age 55, the relevant age group is 47 to 63 years.

Having established the peer groups, we calculate the comparison income as the average income in the group.[11] Care have been taken to exclude the individual's own income from the peer group average. In order to have a sufficient reliable estimate of the comparison income, only individuals with a peer group of at least four people in the database are included. This excludes 137,446 and 234,916 when looking at household incomes and personal incomes, respectively (see figure 4). Again, the limit is set somewhat arbitrarily. A higher limit would increase the precision of the estimate but reduce the number of observations significantly. As a robustness check, we also run the regression with other constraints on the number of people in the peer group, see section 5.2.4.

An alternative approach, adopted by Stutzer (2003), Schyns (2001) and others, is to measure people's aspiration levels directly by simply asking them[12]. This makes it possible to separate the effect from comparison income to satisfaction into two parts: *i)* The expected positive effect from comparison income on aspirations, and *ii)* the expected neg-

[10]For instance that the income of each individual within a social group are random drawings from a probability distribution with mean equal to the the social group mean. See Appendix A in Kapteyn et al. (1997)

[11]Observations based on proxy interviews are included in the calculations.

[12]For example: *"Please try to indicate what you consider to be an appropriate amount [...]. Under my conditions, I would call a net household income of about XX/YY very bad/very good".* (Stutzer 2003)

ative effect from high aspirations on satisfaction. Stutzer (2003) finds empirical evidence for both of these effects. Schyns (2001) reports similar results.

In the ECHP database, the only variable suitable as an aspiration level proxy is *"Lowest monthly income to make ends meet"*. As this variable only describes the lowest part of the 'aspirations distribution' and may simply measure the household's fixed expenses plus basic purchases, we consider it to be a poor proxy for aspirations. Therefore, we will not make use of this variable.

4.2.3 Controls

Besides consumption and relative income, a number of factors can possibly affect satisfaction. If these variables are omitted the estimates may be biased. To address this issue, we include control variables for sex, age, education, health, labour force status, and more (see table 9 in the appendix). To address people's concerns about the macroeconomic environment, we include the unemployment rate within each country. All time-invariant variables such as sex will drop out when using the fixed effects estimator.

4.3 Statistical Approach

4.3.1 The Personality Effect

In line with the personality theory described in section 2, recent research suggest that people's inherent satisfaction may differ between individuals. For instance, one study on twins reported that 40-55 % of the variation in current subjective well-being can by explained by genetic dispositions (Schyns 2001).

Suppose that some part $\boldsymbol{P}$ of the parameter $\boldsymbol{S}$ in the utility function (1) is unobservable, so that $\boldsymbol{S} = [\boldsymbol{P}\ \boldsymbol{X}]$, where $\boldsymbol{X}$ is the observable part consisting of our controls. In line with the studies mentioned above, suppose further that some of this unobservable heterogeneity is individual specific and time invariant, and possibly correlated with the explanatory variables. For instance, people who are inherently happy may have higher wage earnings. Then it would be appropriate to apply a fixed effects estimator; hereby removing the individual specific effects by taking advantage of the panel structure of the data and thus avoiding the possible bias arising from this source.

In addition, applying a fixed effects estimator partially solves the problems that would occur if satisfaction levels are not comparable between individuals (see section 4.1). Since the within-estimator only cares about deviations from the mean within each individual, differences between individuals in their interpretation of the satisfaction *level*, although not satisfaction *changes*, will not matter. Therefore, we will take use of the longitutional structure in the baseline regression.

4.3.2 OLS vs. Ordered Probit

As described in section 3, self reported satisfaction is ranked in numbers between 1 and 6. By using *WAS*, the number of response categories increases to $6^4 = 1,296$, but this does not alter the discrete nature of the raw satisfaction variables.

Discreteness of the dependent variable does not in itself mean that a linear model is inappropriate, but it may have several drawbacks (Johnston & DiNardo 1997). For instance, the linear model does not constrain the predicted value to lie between 1 and 6. The model could in fact predict negative values of happiness. Furthermore, because of the limited number of response categories, the linear model is heteroscedastic. The latter problem can be dealt with using White's robust standard errors, and the former might not be a problem in practice.

A more serious drawback is that by using the linear model, it is implicitly assumed that utility is cardinal; e.g. that a fall in satisfaction from 5 to 3 is twice as bad as a fall from 4 to 3. If one applies the ordered probit estimator, only ordinality has to be assumed (Frey & Stutzer 2002, D'Addio et al. 2003).

However, it is not without cost to implement the ordered probit. When used with panel data, only the random effects estimator is available due to the lack of suitable econometric methods (D'Addio et al. 2003).[13] As will be shown in section 5.1, a Hausmann test clearly rejects the random effects estimator in favour of the fixed effects estimator when using OLS. Because of this, our baseline regression will not make use of the ordered probit. Furthermore, using *WAS* makes the dependent variable closer to being continuous. The cardinality assumption will be investigated in section 5.2.2.

4.4 Baseline Regression

Equation (5) below summarizes our discussions. y_{it} measures income, y_{it-1} lagged income and $\bar{y}'_{it}$ estimated comparison income for individual i at time t. $\boldsymbol{X}_{it}$ is a vector containing the control variables discussed in section 4.2.3.

$$WAS_{it} = \underbrace{ln(y_{it})\delta_1}_{\text{Absolute income effect}} + \underbrace{\underbrace{ln\left(\frac{y_{it}}{y_{it-1}}\right)\delta_2}_{\text{Adaption effect}} + \underbrace{ln\left(\frac{y_{it}}{\bar{y}'_{it}}\right)\delta_3}_{\text{Relative income effect}}}_{\text{Aspirations effect}} + \underbrace{\boldsymbol{X}_{it}\boldsymbol{\gamma}}_{\text{Controls}} + \epsilon_{it} \qquad (5)$$

We take the logarithm of both fractions to take into account diminishing returns on earnings above one's aspirations. Furthermore, taking the logarithm ensures that the expression will be negative if personal income is below aspiration income (the fraction

[13] D'Addio et al. make use of two recently proposed estimators (the latest from 2004) for the fixed effects approach with an ordered discrete response variable. They clearly reject the random effects estimator in favour of the fixed effects in a model similar to ours. Applying these new estimators is beyond the scope of this paper, as they have not yet been widely adopted.

is between zero and one), thereby contributing to reduce satisfaction. A fundamental assumption behind this specification is its underlying causal structure: That satisfaction is determined by income etc., and not the other way around. In line with most of the literature (among others, see Stutzer 2003, Luttmer 2003, McBride 2001 and, Clark & Oswald 1996), we will not embark further on this subject and assume that a specification like the above is valid.

Following the discussion above, we will take use of the panel data structure by applying the fixed effects estimator. Assuming cardinality allows us to use OLS instead of ordered probit. Rearranging equation (5), we can write the final baseline regression model as

$$WAS_{it} = ln(y_{it})\beta_1 + ln(y_{it-1})\beta_2 + ln(\bar{y}'_{it})\beta_3 + \boldsymbol{X}_{it}\boldsymbol{\gamma} + \epsilon_{it} \quad , \epsilon_{it} = \alpha_i + \eta_{it} \tag{6}$$

where $\beta_1 = \delta_1 + \delta_2 + \delta_3$, $\beta_2 = -\delta_2$ and $\beta_3 = -\delta_3$. α_i is the individual time-invariant effect, while η_{it} is the error term, which is assumed to be independently and identically distributed. According to the theory on income aspirations, β_2 (adaption) and β_3 (relative income) are expected to have a negative sign, while β_1 is expected to be positive, capturing the increased consumption possibilities from higher income. As discussed above, we expect the α_i's to be correlated with the explanatory variables, i.e. $E[(y_{it}\ y_{it-1}\ \bar{y}'_{it}\ \boldsymbol{X}_{it})\alpha_i] \neq 0$.

One might argue that the coefficients on the explanatory variables should be allowed to differ between countries, since, for instance, the average Greek probably has different cultural values than the average Finn. On the other hand, one might as well argue that metropolitans from cities like Paris or London might be more alike than a farmer and a metropolitan within the same country; or that the slope coefficients should depend on average income or gender.

To avoid a huge number of interaction dummies and the corresponding loss of degrees of freedom, and given that we are mostly interested in the sign of the income externality rather than the size; we cut to the bone and only allow such differences to affect the *level* of satisfaction, not the slopes. This is in line with Luttmer (2003) who does not allow for state differences in the slope coefficients when using data for the entire USA. Hence, our estimate will be an average of the European effect, covering up the possible differences between countries. If we find a significant relationship between satisfaction and relative income, this is not likely to be caused by our missing specification of country effects.

Equation (6) will be estimated using the standard fixed effects procedure in STATA; which is capable of handling unbalanced data. Since the discreteness of the explanatory variable is likely to cause heteroscedasticity (see section 4.3.2), we will use White's procedure to calculate robust standard errors. In the following section, we will perform several specification- and robustness tests of the baseline regression.

5 Results

5.1 Results from Baseline Regression

Table 3 below contain the results from the baseline regressions on personal and household income respectively. The model explains about 66 percent of the variation in satisfaction. This is quite more than the 29 percent in Luttmer (2003), who follows a similar empirical approach; although one should be cautious when comparing R^2-values from regressions based on different data sources.

In line with standard economic theory, there is a clear and positive effect on satisfaction from own or household income as well as spouse's income. People seem to care more about their own income than their spouse's, although the coefficients are not that different. This result is in line with Bonke & Browning (2003) who find that satisfaction rises with total household income, but that it decreases in spouse's share of income. Hence, it seems to be a reasonable approximation to treat total household income as one.

Far more interesting is the second row in table 3. When using household income, there is a significant negative effect from peer group income on satisfaction. With personal income the sign is still negative albeit not significant. This result supports the relative income hypothesis. People *do* seem to care about their relative position. The results suggest that people's relevant comparison income is total household income, not personal income, of the peer group.

The results in table 3 seems to suggest that the relative income effect does not completely erode the absolute income effect. If all incomes rise by the same percentage, satisfaction should increase. Hence, our results does not provide a complete explanation to the satisfaction puzzle outlined in the introduction, although one should be cautious when interpreting the size of the coefficients, as discussed in section 4.4.

In contrast with our expectations, lagged income – the measure of adaption – contributes positively to satisfaction, although insignificantly when using household income. This may be due to the high degree of correlation (0.74) between current and lagged income, which makes it hard to separate the effects.[14] Hence, instead of measuring the adaption effect, lagged income might simply act as a proxy for current income.[15] An alternative explanation derives from the life cycle theory mentioned in section 4.2.1. Because of consumption smoothing, higher income in the past tends to increase current consumption, thereby raising satisfaction. Hence, we might measure the positive effect from consumption smoothing rather than the negative effect from adaption. Therefore, in the remains of the paper we will focus on testing the robustness of the relative income effect; however we will still include lagged income to avoid omitted variable bias, as the

[14] See the correlation matrix, table 8 in the appendix

[15] Lagged income stays insignificant when comparison income is excluded from the regression, while the relative income effect becomes even more significant when lagged income is omitted (not shown).

Table 3: Results from Baseline Regressions

Model	1	2
Income measure	Personal	Household
Ln(1+ income)	0.012	0.134
	[0.001]	[0.005]
	***	***
Ln(1+ comparison income)	-0.009	-0.030
	[0.009]	[0.009]
		***
Ln(1+ lagged income)	0.002	0.003
	[0.001]	[0.003]
	**	
Ln(1+ other household income)	0.008	
	[0.001]	
	***	
Observations	282,168	356,466
Categories	78,417	92,335
Adjusted R^2	0.66	0.66

Robust standard errors in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table shows the estimates on selected income variables from table 9. Fixed effects estimation has been applied.

theory suggest that a measure for adaption should be included.

A Hausmann test clearly rejects a Random Effects model in favour of Fixed Effects with a χ^2 value of 3,737 with 42 degrees of freedom (on a 0.1 percent significance level, the critical value is 76.09).

5.1.1 Signs on Control Variables

A look on the complete table, table 9 in the appendix, confirms that the effects from the control variables are mostly in line with intuition. This support our belief that WAS is an appropriate measure of people's well-being. Married people are happier that unmarried ones. If one's spouse passes away, satisfaction falls slightly but are still higher than people that have never been married. However, one should avoid getting divorced as this lowers satisfaction below the level of unmarried, although the effect is insignificant in most specifications. Satisfaction declines if you or your spouse's health worsen, while satisfaction rises if you socialize more.

Being out of the labour force does not affect satisfaction significantly, but as expected, even when controlling for income, being unemployed is associated with low satisfaction, maybe because of the negative psychological effects. Working hours have an inverse U-shaped effect: To begin with, working more hours (and consuming less leisure) raises satisfaction, but eventually satisfaction will begin to fall. Public employees are happier than the average, while self-employed are less satisfied. This may be due to the higher degree of job security in the public sector, while being self-employed is connected with a high degree of uncertainty. In contrast with what one might expect, satisfaction seems to be falling with duration of current employment. An explanation could be that a long relationship with the same company could indicate lack of career progress.

5.2 Specification and Robustness Checks

The above results may be subject to several questions regarding estimation bias, the cardinality assumption, and the robustness of the *WAS* as dependent variable. In the following we will investigate these matters to see wether our results are useful and interpretable.

5.2.1 Problems With Fixed Effects Estimation

Using the panel structure of the data to deal with the individual specific effects, unfortunately, is not costless (Johnston & DiNardo 1997). As the data is based on questionnaires it is possible that some of our explanatory variables (e.g. variables containing amounts) contain measurement errors. Under standard cross section OLS such measurement errors lead to attenuation of the estimates, i.e. the estimates is biased toward zero. By using fixed effects, this bias is enhanced considerably – especially when the explanatory variables is correlated across time. The reason is that high correlation across time implies that most real variation is between individuals, while variation across time to a higher degree is caused by measurement errors. By throwing away the variation between individuals, the problem with measurement errors is aggravated.[16]

We investigate this problem by running a simple OLS regression on the last wave in the data set.[17] We include country dummies to control for country specific effects. The results of the cross section OLS is reported in table 4, model 3 and 4. First, we notice, that adjusted R^2 is about 0.30 lower in both models when using cross section rather than panel data. This is somewhat in correspondence with other surveys, which estimate the individual specific to account for approximately 40-55 percent of a person's self-reported satisfaction, see section 4.3.1. Second, we notice that the sign of the estimates on income, comparison income, and lagged income are the same as when using fixed effects, except for the personal comparison income in model 3. In contradiction to the panel data model, this estimate is now positive, though still highly insignificant. Last, we see that all other estimates is now numerical larger than before. This could indicate, that attenuation might be a problem in the fixed effects model. However, this could also be a result of omitted person specific variables. We conclude that using fixed effects may weaken our results, but accept this attenuation in order to control for person specific effects. When utilizing the panel structure of the ECHP, this should be kept in mind.[18]

[16] For a further explanation of this problem see section 12.8 in Johnston & DiNardo (1997)

[17] We do not use pooled OLS, as assuming no correlation between observations clearly is too strong an assumption.

[18] Johnston & DiNardo discuss a few methods to measure the size of the bias towards zero. Nevertheless, we will not embark further upon this subject.

Table 4: Different Estimation Methods on cross-section data from 2001

Model	3	4	5	6
Estimation method	OLS	OLS	Ordered Probit	Ordered Probit
Income measure	Personal	Household	Personal	Household
Dependent variable	*WAS*	*WAS*	$WAS_{finance}$	$WAS_{finance}$
Ln(1+ income)	0.021	0.247	0.025	0.380
	[0.003]	[0.012]	[0.004]	[0.015]
	***	***	***	***
Ln(1+ comparison income)	0.025	-0.029	0.017	-0.104
	[0.020]	[0.017]	[0.025]	[0.021]
		*		***
Ln(1+ lagged income)	0.005	0.084	0.008	0.119
	[0.003]	[0.011]	[0.004]	[0.014]
	*	***	**	***
Ln(1+ other household income)	0.010		0.018	
	[0.001]		[0.002]	
	***		***	
Country dummies	*YES*	*YES*	*YES*	*YES*
Observations	35,693	44,696	35,780	44,806
Adjusted R^2	0.342	0.342		
Pseudo R^2			0.1051	0.1182

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The table show OLS and Ordered Probit regressions of satisfaction variables on a cross-section sample from ECHP wave 8 (2001), including an extensive set of variables and dummies (only income variables are shown). Model 3 and 4 use *WAS* (see section 3) as the dependent variable, while model 5 and 6 use *Satisfaction with financial situation* as dependent variable.

5.2.2 The Cardinality Assumption

We now turn to investigating the cardinality assumption. If the assumption does not hold, we will not be able to use the absolute difference between self-reported satisfaction levels, but only the order of the reported levels. In order to test the robustness of our assumption, we run an ordered probit regression. Since the number of response categories exceed the maximum number allowed in an ordered probit estimation in STATA, we use satisfaction with financial situation as our dependent variable. Again, we include country dummies and run the regression on the last wave in ECHP.[19] When doing this, we do not need to assume cardinality.

The results are reported in table 4, model 5 and 6. First, we see that the estimate on the effect from the peer group's personal income is still insignificant, while all other income effects is significant on at least a 5 percent significance level. The effect from the lagged income is still positive with regards to both household and personal income in contradiction with the theory. Second, we notice that the signs of the estimates using this ordered probit model are the same as when using the fixed effects model. Hence, a rise in a persons income increases the probability that the person reports higher levels of satisfaction, and, a rise in the person's peer group's income decreases the probability that the person reports a higher level of satisfaction. This implies that assuming cardinality

[19] As mentioned in section 4.3.1, the fixed effects estimator is not available in an ordered probit regression. Using random effects is likely to lead to biased estimates due to collinearity between the explanatory variables and the individual specific error term.

might not be a strong assumption since regressions without the assumption returns similar results, even though individual specific effects may again lead to biased estimates.

On the basis of the results in section 5.2.1 and 5.2.2 we conclude that our baseline models seem to be properly specified. The comparison theory does not specify whether the agent care about relative personal income or relative household income. Our results indicate that household income is the relevant comparison income. As a consequence, we will concentrate on the specifications, which include the peer group's household income in the following.

5.2.3 Different Specifications of *WAS*

Could our results be driven by the weights chosen to construct *WAS*? We address this issue by defining four additional overall satisfaction variables as:

$$WAS_i = \left((\alpha_i + \sigma_i) \cdot satisfaction_i + (\alpha_{-i} - \sigma_{-i}) \cdot satiscation_{-i}\right) / \Sigma \tag{7}$$

where α_i and σ_i are the estimates and standard deviation, respectively, from Luttmer (2003)'s estimation of overall satisfaction, with $i = \{$financial, housing, main activity, amount of leisure time$\}$. Σ are the sum of the weights, so WAS_i is normalized to being between 1 and 6 as usual. We run the baseline regression on each of the newly generated variables. The results presented in table 10 confirm the robustness of the *WAS* variable. Thus, the estimates and significance levels on all income variables are approximately the same for the models 7 to 10 as in model 2. These findings suggest that our specification of *WAS* is robust, and hence an appropriate estimation of the persons' overall satisfaction.

5.2.4 Other Constraints on Household Income and Peer Group

In the previous sections we have constrained both the persons' and their peer group's household income to be equal or larger than 3,500 euros (PPP units). If our assumptions about extremely low incomes in section 4.2.1 does not hold, our results may suffer from selection bias. Also, the limit of 3,500 euros is somewhat arbitrarily set, which may drive our results.

We examine this by applying three additional regressions: First, we tighten up the constraint, so people only are included in the regression, if their household income is larger or equal to 10,000 euros. The similar constraint on the peer group is still 3,500 euros. Second, we omit the constraints on both the individual and his peer group's income. As this may lead to unrealistically low peer group incomes if, for instance, a person with 0 income drops into a peer group with only 4 other members, we increase the constraint to number of persons in a peer group to be 8. Third and lastly, we check our normal peer group by including a new peer group, where only sex, region, and age group have to be

like the person's characteristics. The results of these regressions are shown in table 11, model 11 to 14.

We find that the estimate on the peer group income is still negative and significant. This implies that our results are not dependent on the constraints we – based on theoretical arguments – have imposed to our baseline regression. Thus, our results are robust to changes in peer group and other constraints on income.

5.2.5 Unmarried People as Robustness Check

When we regress on household incomes, the income measure tend to overestimate the consumption possibilities for cohabitants. In particular, cohabitants do not profit fully from the reported household income, because it has to be shared with their spouse. On the other hand, cohabitants can utilize economics of scale, e.g. by buying only a slightly more expensive home than a non-cohabitant would do, while still obtaining the same utility. At the same time, the household income for couples tend to be higher than the household income for singles because of the extra wage earner. Although we control for civil status by including dummies, this may cause estimates to be biased.

To investigate this possible source of bias, we run the regression on a subsample containing only people who live alone. The results are shown in table 11 in the appendix, model 15. First, we notice that the signs of the estimates are the same as in the baseline regression, although the estimate on peer income is only significant on a 10 percent significance level. Second, we notice that using only non-cohabitating individuals exclude 283,130 observations from the data set, equal to 141,565 couples.

We conclude that our results may partly be due to the above mentioned bias, but as we have to exclude a substantial part of the sample to avoid it, we consider the cure to be worse than the disease. Hence, we will continue with our baseline regression, but keep this finding in mind.

5.3 Extensions of the Model

5.3.1 Asymmetric Income Externality

As mentioned in section 2.2, Duesenberry (1949) suggested that the income externality might mainly be downward influencing. If this is the case, the negative effect from comparison income should primarily be observed for individuals with incomes below their comparison incomes. In table 5 we test this hypothesis. The data set has been divided into two subsamples dependent on weather the individal's household income is below or above the peer group income, and the model have been estimated on each of these samples.

In line with expectations, the coefficient on comparison income becomes more negative for relatively poor individual's in comparison with the baseline regression, although the effect becomes less significant. More strikingly, the relative income effect is much smaller

Table 5: Asymmetric Income Externality

Model	16	17
Subsample	*Household income compared to peer group*	
	Lower or equal to	Higher than
Ln(1+ income)	0.1489745	0.118393
	[0.008]	[0.011]
	***	***
Ln(1+ comparison income)	-0.0358236	-0.0105911
	[0.013]	[0.018]
	***	
Ln(1+ lagged income)	-0.0015462	-0.0024455
	[0.004]	[0.007]
Observations	207,103	149,363
Categories	68,390	55,132
Adjusted R^2	0.663	0.658

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The characteristics of the subsamples appear from the first rows. For each subsample, the table shows the results of regressing *WAS* (see section 3.1.1) on household income and an extensive number of variables and dummies using fixed effects. The control variables are not shown.

and clearly insignificant for relatively rich individuals. This suggests that people do not compare themselves to poorer persons; or put differently: That the income externality is asymmetric.

This finding has two possible implications: *i)* Either relatively rich people do not care about relative income or else *ii)* our specification of the peer group is simply wrong for this group of people. If the latter holds, our model should be modified to take into account the change in peer group as relative income rises. Doing this, however, is beyond the scope of this paper.

5.3.2 Effect from Socialization

If people engage in social comparisons, we would expect a stronger negative effect from relative income for those with more frequent social contacts (Stutzer 2003, Luttmer 2003). Table 6 sheds light on this hypothesis. Again, we have divided the data set in subsamples dependent on how frequent people engage in different kinds of socialization and estimated the model on each subsample.

People who frequently meet with friends or relatives or talk to their neighbours are significantly negatively impacted by higher comparison income, while the effect is not significant for those who socialize less. This is in line with the findings by Stutzer and Luttmer, and underpins our main result that relative income do matter. However, the insignificant estimates in model 19 and 21 might be caused by the fact that the number of observations per individual are considerably lower in these models; hence, the results may not be that clear.

Opposed to the results above, the relative income effect are not significant for people who are member of a club, while non-club members do seem to care about relative income.

Table 6: The Effect from Socializing

Model	18	19	20	21	22	23
Subsample	*Talk with neighbourgs*		*Meet with friends*		*Member of a club*	
	At least once a week	Less than once a week	At least once a week	Less than once a week	Yes	No
Ln(1+ income)	0.141	0.107	0.138	0.106	0.088	0.147
	[0.005]	[0.016]	[0.005]	[0.015]	[0.010]	[0.006]
	***	***	***	***	***	***
Ln(1+ comparison income)	-0.023	-0.040	-0.027	-0.017	-0.014	-0.036
	[0.010]	[0.031]	[0.01]	[0.028]	[0.017]	[0.011]
	**		***			***
Ln(1+ lagged income)	0.002	0.006	0.004	-0.008	-0.005	0.001
	[0.004]	[0.012]	[0.004]	[0.011]	[0.007]	[0.004]
Observations	299,126	57,340	291,854	64,612	109,466	247,000
Categories	83,375	29,680	84,793	33,295	41,446	75,149
Adjusted R^2	0.661	0.714	0.653	0.747	0.675	0.640

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The characteristics of the subsamples appear from the first rows. For each subsample, the table shows the results of regressing *WAS* (see section 3.1.1) on household income and an extensive number of variables and dummies using fixed effects. The control variables are not shown.

This is in contrast with our hypothesis, since club members are assumed to have more frequent social interactions. Again, however, we notice that the number of observations per individual is relatively low in the insignificant subsample, and thus support our critique above.

To summarize, our results suggest that the relative income concern might be strongest for people who socialize frequently, although the available data does not provide a sufficient basis to make a final conclusion.

6 Policy Implications

What are the policy implications, if people *do* care about relative income, as the results in this paper indicate? When an agent acts in the economy, he seeks to maximize his own utility; in part by choosing a work effort, and hence income, that enables him to consume a desired amount of goods. However, when choosing income he do not take the negative income externality he applies to other agents in the economy into consideration. Hence, without taxes his income tend to be too large compared to the *first best*. The microeconomic theory suggests various ways to solve externality problems. An extreme solution to the income externality would be to create a market for income rights. This, of course, is however an Utopian answer to the problem. A more realistic way to diminish the problem is through income taxes.

How should the taxes then be constructed? If there is a negative effect from relative income, the income tax should be larger than zero. If the positive effect from income is larger than the negative effect from income comparison, as our results suggest, then the marginal tax should still be positive but less than 100 percent. If furthermore the

externality is asymmetric as our results in section 5.3.1 induce, then the tax system should be progressive, as the externality from high incomes are larger than the externality from low incomes.

In the extreme case when the income externality is equal to or larger than the positive effect from income, the politicians should not care about economic growth at all. The size of the economic cake would not be important (above a minimum size), but only how it is shared. However, none of the existing literature find such estimates on relative income concerns. Stutzer (2003) finds that the total effect from aspirations, including both relative income concerns and adaption, erodes the positive effect from income completely. However, the policy implications are quite different if adaption is important, since only growing incomes can elude the adaption effect.

Personal taxes are generally believed to confront politicians with a trade-off between efficiency and equality. High taxes on income are economical inefficient because it reduces people's incentive to work, while too low taxes are considered unfair by most people on distributional grounds. Our results implies that even in the presence of a feasible lump-sum tax to reduce inequality, there is still an argument for having positive (progressive) income taxes.

7 Conclusion

It has become a well-established finding that while satisfaction seems to be rising in income within a country at a given point in time, there does not seem to be an upward trend in satisfaction over time, despite substantial income growth. Although the latter finding might partly be due to measurement problems, it can not be explained by conventional microeconomic theory.

According to the comparison theory from psychology, people's satisfaction depends on the gap between aspirations and achievements. Aspirations are formed partly by one's past experiences (adaption) and partly by social comparisons (relative income concerns). Thus, the comparison theory provides a possible explanation to the satisfaction puzzle.

Numerous studies have confirmed that self-reported satisfaction is a satisfactory proxy for utility. Based on the results from an earlier study, we construct a weighted average satisfaction variable on a large European panel data set (the ECHP). This allow us to estimate an utility function directly and thereby test the explanatory power of the comparison theory. In particular, lagged income is included as a proxy for utility and average peer group income is included as a measure of comparison income. We define an individual's peer group as the group of people with whom he shares certain characteristics. In contrast to earlier studies, we allow the individuals' comparison age group to widen as he grows older. To control for personality effects, we apply a fixed effects estimator.

As expected, satisfaction is highly correlated with own income. In line with the relative income hypothesis, we find clear evidence that higher peer group earnings is associated with lower satisfaction. We are not able to identify the adaption effect, probably due to the high degree of collinearity between current and lagged income. The fact that the signs of the control variables are mostly in line with intuition supports the validity of the satisfaction variable. The results are robust for various re-specifications of the model.

We find evidence that income externality is asymmetric. Hence, while people's satisfaction is reduced by others having higher incomes than themselves, people do not seem to gain satisfaction from having a higher income than their peer group. Furthermore, our results suggest that the relative income effect might be more important to people who socialize frequently.

Our results suggest that the negative effect from higher peer group income does not outweigh the positive effect from own income; i.e. that a simultaneous increase in all incomes by the same percentage will increase satisfaction. Hence, our results does not provide the full explanation to the satisfaction puzzle; maybe because of our failure to identify the adaption effect. Nevertheless, the relative income effect provides an argument for positive marginal income taxes.

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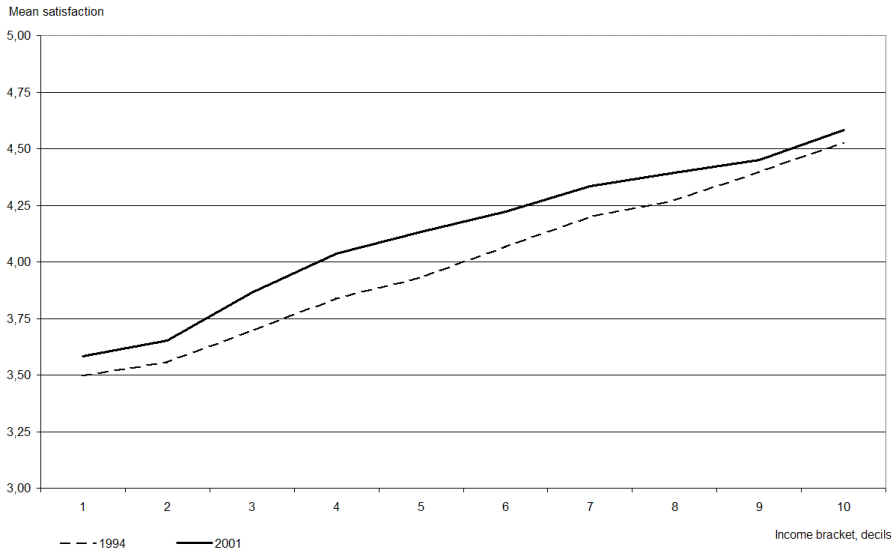
9 Appendix

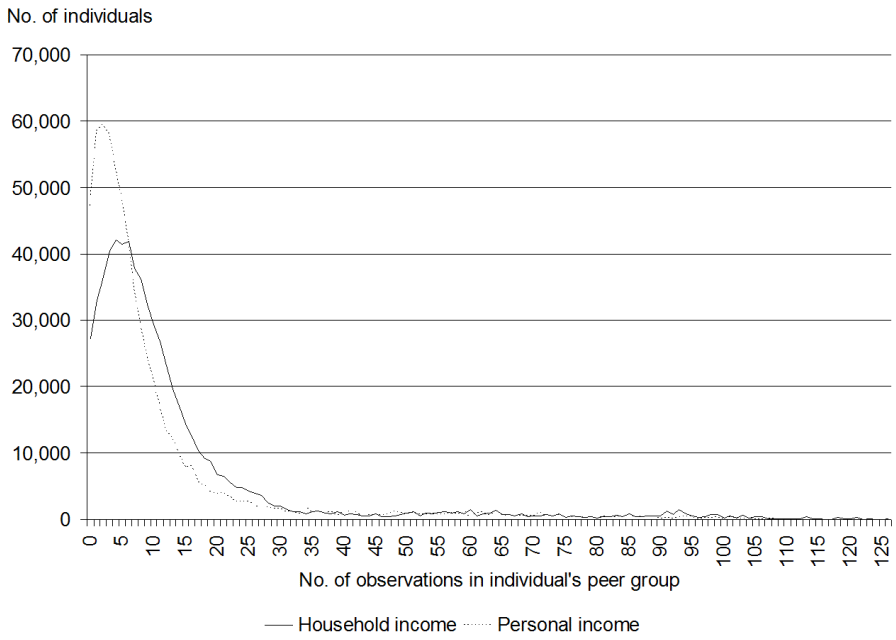
9.1 Figures

Figure 3: Mean Weighted Average Satisfaction (WAS) in EU for different income brackets



Source: Own calculations on ECHP data. Individuals are divided in income brackets based on household income. The figure includes all EU-15 countries. WAS has been constructed as described in section 3.1.1.

Figure 4: Distribution of number of observations on peer group size



Source: Own calculations on ECHP data. Individuals are divided in groups with similar sex, age, education and geographical ares. The figure shows the number of observations distributed on peer group size.

9.2 Tables

Table 7: Distribution of Weighted Average Satisfaction (*WAS*). 2001

WAS	No. of observations	Mean	Percentage
=1	168	1.00	0.2
1> - <2	1,451	1.67	1.8
2 - <3	9,242	2.56	11.8
3 - <4	23,188	3.51	29.5
4 - <5	28,478	4.43	36.3
5 - <6	13,523	5.26	17.2
=6	2,467	6.00	3.1
Total	78,517	4.02	100.0

Source: Own calculations on ECHP data. The table shows the number of individuals with *WAS* in the specified groups. WAS has been constructed as described in section 3.1.1.

Table 8: Correlation matrix for income variables

	Personal inc.	Peer's pers inc	Lag inc	Hhold inc	Peer's hh inc	Lag hh inc
Personal income	1.000					
Peer group's average personal income	0.278	1.000				
Lagged personal income	0.736	0.281	1.000			
Household income	0.625	0.213	0.446	1.000		
Peer group's average household income	0.245	0.676	0.238	0.279	1.000	
Lagged household income	0.444	0.210	0.628	0.708	0.270	1.000

Note: The table is based on data from ECHP, and shows the correlation between six income measures.

Table 9: Results from Baseline Regressions. Fixed Effects

Model	1	2
Income measure	Personal	Household
Income variables		
Ln(1+ income)	0.012	0.134
	[0.001]	[0.005]
	***	***
Ln(1+ comparison income)	-0.009	-0.030
	[0.009]	[0.009]
		***
Ln(1+ lagged income)	0.002	0.003
	[0.001]	[0.003]
	**	
Ln(1+ other household income)	0.008	
	[0.001]	
	***	
Demographical info		
Age	0.039	0.036
	[0.003]	[0.003]
	***	***
$(\text{Age})^2$	-2.74E-04	-2.57E-04
	[2.75E-05]	[2.37E-05]
	***	***
Still under education	0.067	-0.003
	[0.063]	[0.045]
Secondary level education	0.002	0.003
	[0.007]	[0.007]
Third level education	0.020	0.028
	[0.01]	[0.009]
	**	***
Recently bereavement	-0.001	0.011
	[0.015]	[0.013]
Recently childbirth	-0.002	-0.006
	[0.008]	[0.007]
Kids under 12 years	-0.052	-0.049
	[0.008]	[0.007]
	***	***
Kids between 12 and 15 years	-0.035	-0.029
	[0.007]	[0.007]
	***	***
Married or cohabiting	0.055	0.062
	[0.016]	[0.014]
	***	***
Divorced	-0.042	-0.019
	[0.02]	[0.018]
	**	
Widowed	0.041	0.068
	[0.024]	[0.02]
	*	***
Health variables		
Hampered by physical or mental health problem	-0.040	-0.038
	[0.008]	[0.007]
	***	***
Illness during the last two weeks	-0.131	-0.122
	[0.01]	[0.009]
	***	***
Ln(1+ number of doctor visits the past 12 months)	-0.028	-0.030
	[0.002]	[0.002]
	***	***
Employment		
Working hours per week	0.008	0.008
	[0.001]	[0.001]
	***	***
$(\text{Working hours per week})^2$	-8.84E-05	-8.58E-05
	[8.30E-06]	[7.40E-06]
	***	***
Working part time	-0.031	-0.036
	[0.012]	[0.01]
	***	***
Feeling overqualified for present job	-0.030	-0.026
	[0.005]	[0.004]
	***	***
Years in current employment	-0.008	-0.008
	[0.002]	[0.001]
	***	***
$(\text{Years in current employment})^2$	-8.66E-05	-5.09E-05
	[7.59E-05]	[6.93E-05]
Public employed	0.046	0.052
	[0.009]	[0.009]
	***	***
Self employed	-0.042	-0.040
	[0.011]	[0.009]
	***	***
Unemployed	-0.272	-0.267
	[0.022]	[0.019]
	***	***
Not in labour force	0.011	0.003
	[0.02]	[0.018]
⋮	⋮	⋮

Table 9 continued

⋮	⋮	⋮
Spouse data		
Self-reported health	-0.041	-0.043
	[0.009]	[0.008]
	***	***
(Self-reported health)^2	-0.003	-0.003
	[0.002]	[0.002]
	*	**
Still under education	0.055	0.099
	[0.036]	[0.033]
		***
Less than secondary education	0.123	0.143
	[0.016]	[0.015]
	***	***
Secondary level education	0.135	0.154
	[0.017]	[0.015]
	***	***
Third level education	0.119	0.136
	[0.018]	[0.016]
	***	***
Neighbourhood and social relations		
Socialize with friends	0.055	0.055
	[0.005]	[0.004]
	***	***
Socialize with neighbourghs	0.048	0.046
	[0.005]	[0.005]
	***	***
Crime or vandalism in neighbourhood	-0.060	-0.065
	[0.005]	[0.005]
	***	***
Unemployment rate in country	-0.005	-0.001
	[0.003]	[0.003]
(Unemployment rate in country)^2	-2.61E-05	-2.72E-04
	[1.30E-04]	[1.09E-04]
		**
Questionaire answered between december and february	0.014	0.014
	[0.004]	[0.003]
	***	***
Ln(Amount won in lottery (if any))	0.066	0.064
	[0.013]	[0.013]
	***	***
Constant	2.801	1.855
	[0.122]	[0.118]
	***	***
Observations	282,168	356,466
Categories	78,417	92,335
Adjusted R^2	0.66	0.66

Robust standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The table show fixed effects regressions of *WAS* (see section 3.1.1) on an extensive number of variables and dummies.

Table 10: Different Specifications of *WAS*

Model	7	8	9	10
Dependent variable	WAS_{work}	WAS_{finans}	$WAS_{houseing}$	$WAS_{leisure}$
Ln(1+ income)	0.134	0.149	0.133	0.131
	[0.005]	[0.005]	[0.005]	[0.005]
	***	***	***	***
Ln(1+ comparison income)	-0.031	-0.031	-0.029	-0.029
	[0.009]	[0.009]	[0.009]	[0.009]
	***	***	***	***
Ln(1+ lagged income)	0.003	0.003	0.004	0.003
	[0.003]	[0.003]	[0.003]	[0.003]
Observations	356,466	356,466	356,466	356,466
Categories	92,335	92,335	92,335	92,335
Adjusted R^2	0.662	0.664	0.662	0.659

Robust standard errors in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The table show fixed effects regressions of different specifications of *WAS* on household incomes and an extensive number of variables and dummies (not shown). WAS_i has been constructed using estimates from Luttmer (2003) and adding one standard deviation to the weight on satisfaction variable i and subtraction one standard deviation from the other weights (see section 5.2.3.

Table 11: Other Constraints on Income

Model	11	12	13	14	15
Constraints on					
Household income	≥10,000 euros	≥0 euros	≥0 euros	≥3,500 euros	≥3,500 euros
Peer group's household income	≥3,500 euros	≥3,500 euros	≥0 euros	≥3,500 euros	≥3,500 euros
Number of persons in peer group	≥4	≥4	≥8	≥4	≥4
Peer group contingent on education	*YES*	*YES*	*YES*	*NO*	*YES*
Couples included	*YES*	*YES*	*YES*	*YES*	*NO*
Ln(1+ income)	0.132	0.134	0.093	0.137	0.122
	[0.007]	[0.005]	[0.004]	[0.004]	[0.011]
	***	***	***	***	***
Ln(1+ comparison income)	-0.036	-0.03	-0.032	-0.032	-0.023
	[0.012]	[0.009]	[0.012]	[0.01]	[0.012]
	***	***	***	***	*
Ln(1+ lagged income)	0.001	0.003	0.009	0.003	-0.001
	[0.005]	[0.003]	[0.004]	[0.003]	[0.008]
			**		
Observations	237,487	356,466	242,874	427,429	73183
Categories	71,335	92,335	65,163	105,448	24859
Adjusted R^2	0.653	0.663	0.683	0.653	0.6626

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Note: The table is based on data from ECHP. The table show fixed effects regressions of *WAS* (see section 3.1.1) on household income and an extensive number of variables and dummies (not shown). Each model are subject to different constraints reported in the first rows of the table.