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Income Satisfaction Inequality and its Causes

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Income Satisfaction Inequality and its Causes

Abstract

In this paper, the concept of Income Satisfaction Inequality is operationalized on the basis of individual responses to an Income Satisfaction question posed in the German Socio-Economic Panel (GSOEP). Income satisfaction is the subjective analogue of the objective income concept and includes objective income inequality as a special case. The paper introduces a method to decompose Income Satisfaction Inequality according to the contributions from variables such as income, education, and the number of children. Given the panel structure of the data, inequality may be attributed partly to permanent individual circumstances and partly to transitory changes. The paper shows that permanent income explains the largest part of Income Satisfaction Inequality; for non-working individuals, the age distribution is very relevant as well. Additionally, other variables such as number of adults, education, and having a partner explain most of the remaining Income Satisfaction Inequality.

Keywords: Equivalent Income, Financial Satisfaction, Income Satisfaction, Inequality, Variance Decomposition, Welfare.

JEL Classification: D63, I32.

1. Introduction

Since Gini (1912) and Dalton (1920), the distribution and inequality of income has been an important subject of study for economic and social scientists. Recent surveys are offered in the handbooks edited by Atkinson and Bourguignon (1999) and Silber (1999). The study of income inequality entails two main issues. First, the income concept has to be operationalized and measured. Second, a definition of inequality has to be agreed upon and consequently an index of inequality, namely a measure of the dispersion of income or welfare, has to be chosen.

The basic question underneath is why we are so interested in income inequality. It is not just an administrative statistic. The reason is that income or 'equivalent income' is taken as a proxy for welfare. It follows that income inequality is seen as synonymous to welfare inequality, a performance index of society. The literature bears witness that there is no generally accepted measure of welfare. This is caused among others by a certain uneasiness about whether income on itself is a suitable measure of welfare. This is especially true for modern welfare states where a considerable part of our consumption is provided by the state and not through the market. Additionally, income has to be corrected for individual and household characteristics if it aims at measuring *welfare*. For example, it is evident that two households with the same income but different family sizes will need different incomes to be equally satisfied. Hence, income should be 'corrected' for family size, which would lead to what is known as 'equivalent income'. In this paper we try a new approach by not looking at objective income as our basic variable but at satisfaction derived from income. We call this income satisfaction and we measure it by means of individual answers to an income satisfaction question.

It is possible to define and measure an ordinal index for income satisfaction. The income satisfaction concept used in this paper does implicitly incorporate the necessary corrections. Income satisfaction is *empirically* defined through the analysis of individual responses to an income satisfaction question. The paper aims at explaining the individual's income satisfaction by objective variables *x*, such as income, education, and number of individuals in the household. We denote that satisfaction by $f(y;x,q)$, where y stands for income, x for other individual circumstances, and θ for a vector of parameters to be estimated. If $f(y;x,q) \equiv y$, the subjective perception coincides with nominal income. Hence, usual income inequality is embedded in the income satisfaction inequality concept as a special case.

The income satisfaction inequality (I_{sub}) is here measured as the log-variance of the estimated individual income satisfaction. The variance of the logarithm is one of the most frequently used measures of inequality, together with the relative mean deviation, the variance, the coefficient of variation, the Atkinson index, the Gini coefficient, and Theil's entropy measure (see Atkinson, 1970; Sen, 1973). All those inequality measures are functions of moments of the income distribution. When the income distribution is (approximately) log–normal $\Lambda(m, s^2)$, they are functions of the two distribution parameters. The log-variance (s^2) as a measure of inequality has the advantage that it does not depend on the money unit. Other measures are simple functions of s^2 and m. Theil (1967, chapter 4; 1979) shows that the Theil Entropy measure equals $(\frac{1}{2})\, s^2$ in the case of log-normality. Van Praag (1978) derived a similar result for the Atkinson index, and Aitchison and Brown (1960) for the Gini index. Given the one-to-one relationship between such indexes, there is not much

gained by considering more indices simultaneously and thus we will exclusively focus on the variance of the logarithm. This choice is clearly a subjective one, but it lends itself very well for looking at the causes of inequality.

The paper focuses on the study of the causes of income satisfaction inequality (I_{sub}). This is equivalent to examining which are the objective variables that contribute the most to the existing income satisfaction variance. For that, the variance of the estimated income satisfaction is decomposed into its various components. Since individual income satisfaction can be partly explained by differences in income, the number of children, age, and education, income satisfaction inequality can be decomposed along the same lines. Thus, I_{sub} is, to a certain extent, explained by the underlying inequalities in those objective variables. Income satisfaction inequality can be further decomposed according to individual *permanent* differences in objective factors and individual *transitory* changes. Finally, income satisfaction inequality can also be decomposed into within- and between –group inequalities. We consider the inequality between East and West Germany and between the groups of workers and non-workers.

The advantage of the present approach to measure income inequality is twofold. First, if individual satisfaction with own income depends not only on income but also on other individual characteristics, such as age and family size, the income satisfaction concept does implicitly include the corrections to make individual welfare equivalent and comparable. Second, the empirical estimation of income satisfaction allows for testing different specifications of the relationship between income and income satisfaction. Thus, one can empirically estimate which function of income and other variables gives the best description of individual income satisfaction.

This paper is organized as follows. Section 2 introduces the data and the income satisfaction question. Section 3 presents the estimation results for the income satisfaction question. Section 4 discusses the income satisfaction inequality concept, the decomposition method, and presents the empirical findings on the causes of inequality. Section 5 concludes.

2. Income satisfaction

The empirical analysis is based on the German Socio-Economic Panel (GSOEP) data. The GSOEP is a longitudinal household panel that started in the Federal Republic of Germany in 1984. After the reunion, (former) East-German households have been included (see Wagner *et. al*, 1993). This paper is based on the waves 1992 to 1997, including more than 20,000 individuals of which about 30% are Eastern individuals. Given that the two regions of the country have lived separately under very different regimes for 45 years, they are taken as different sub-samples. Further, the sample is divided between workers and non-workers. Since the numbers of individuals who switch from East to West, or from 'non-working' to 'working', and vice versa are very small, they are treated as new respondents in the new group (see Hunt, 1999, 2000; Pannenberg, 1997).

The Income Satisfaction question is asked to all respondents of the GSOEP. Next to income satisfaction, individuals are asked about their satisfaction with life as a whole and with various specific domains of life, such as job and health. Satisfaction questions have been posed in questionnaires for over more than three decades starting with Cantril (1965) and Likert (1932). The income satisfaction question posed in the GSOEP and used in this paper runs as follows

'How satisfied are you today with the following areas of your life?
(Please answer by using the following scale, in which 0 means totally unhappy and 10 means totally happy)
How satisfied are you with your
household income ……’

The answer to this question is termed the individual's Income Satisfaction (*IS*) level. In this module the discrete answers vary from 0 to 10, where 0 stands for 'totally unhappy' and 10 for 'totally happy'. Satisfaction questions have been amply used by economists, psychologists and sociologists. Economists have used answers to satisfaction questions as a proxy measure of the individual's welfare in order to study individual preferences, behavior, welfare, and poverty (see, for example, DiTella *et al*., 2001; Easterlin, 2000; Ferrer-i-Carbonell and Van Praag, 2001; Frijters, 2000; Frey and Stutzer, 2000; Ng, 1997; Van Praag, 1971; Van Praag *et al.*, 2001).

In order for *IS* questions to be meaningful, one needs to assume that respondents are able to understand and to answer subjective questions and that they evaluate and respond to such questions in a similar manner, such that individual answers can be compared. The literature on satisfaction, which is large and growing (for an overview see Kahneman et al. 1999), shows clear consistencies across studies. This may be interpreted as empirical evidence of the meaningfulness of questions on satisfaction and of the capacity and willingness of individuals to respond to such questions. The assumption of interpersonal comparability has been long discussed in the literature (see, for example, Sen, 1999 and Van Praag, 1991). In this paper, we start from the working hypothesis that individual answers to satisfaction questions are (ordinally) comparable among individuals. Thus, it is assumed that two individuals, answering a '5', experience the same level of income satisfaction, although their

material circumstances may differ. Obviously, this identity is approximate as the discrete scaling implies a rounding – off error for each response.

Objective variables are not the only determinants of individual satisfaction. Personal traits, such as extroversion, optimism, or capacity to adapt to adverse situations, are also important determinants of individual's welfare. In fact, it is argued that only about 8 to 20% of individual life satisfaction, which is a broader concept than income satisfaction, is explained by objectively measurable variables (Argyle, 1999; Diener and Lucas, 1999; Diener et al., 1999; Kahneman et al., 1999). It is also important to bear in mind that the individual is subject to adaptation phenomena and the relative income hypothesis. Adaptation theory suggests that individuals adapt their satisfaction norms to new situations (Helson, 1964). This phenomenon is called 'the hedonic treadmill' by Brickman and Campbell (1971), while Van Praag (1971) coined it 'preference drift'. The relative income hypothesis says that the individual's satisfaction with income depends on how its income compares to that of others (Kapteyn and Van Herwaarden, 1980). Thus, changes in one's income or in the income distribution of a society will not necessarily be reflected into changes in income satisfaction . This has an ethical dimension that is not further discussed in this paper.

Table 1 presents the distribution frequencies of *IS* in the total sample.

Table 1. Frequency distributions of responses to Income Satisfaction, GSOEP 1992- 1997

IS	West Workers	East Workers	West Non-Workers	East Non-Workers
0	170	67	160	113
1	149	59	166	105
2	354	245	400	265
3	756	478	753	534
4	1237	699	924	658
5	3330	2047	2534	1640
6	3488	1888	2142	1178
7	6338	2641	3669	1451
8	8371	2304	5085	1653
9	3868	647	2482	529
10	2478	285	2296	375
Total observations	30539	11360	20611	8501

3. Estimation of Income Satisfaction

3.1 Estimation procedure

Satisfaction questions are usually explained by means of latent variable models because *IS* is an ordered categorical variable. In our case it takes the values 0, 1,…, 10. We assume the usual Ordered Probit model. The real axis is partitioned in intervals $(-\infty, m_0], ..., (m_{10}, \infty)$, such that the latent variable $IS^* \in (m_i, m_{i+1}]$ iff $IS = i$. We assume that the latent variable IS^* obeys the equation

$$Ln(IS_{it}^*) = C_t + a_z Z_{it} + a_x X_{it} + b\ \overline{X}_i + e_{it} + n_i \qquad (1)$$

where *i* stands for individual and *t* for time. Given the panel structure of the data, the estimation procedure includes an individual random effect, n_i, and a time fixed effect C_t. The individual random effect n_i and the error term e_{it} are assumed to be normally distributed and to be correlated neither with each other nor with the explanatory

variables *X* and *Z*. The total residual variance equals $s^2(n)+1$, where $s^2(n)$ has to be estimated and $s^2(e)$ is normalized at one. The individual random effect may be thought to stand for those individual psychological traits that are not observed in the data set. Some of the explanatory variables are included in two ways, viz. as their mean value, $\bar{x}_i$, over the six observation periods and at their annual values x_{it}. In this way we make a distinction between the permanent and the transitory effects. Equation (1) shows that the explanatory variables *X* are both included as yearly value and as the mean over the 6 years, while the *Z* variables are included at their yearly value only. This specification was introduced by Mundlak (1978) who interpreted the $\overline{X}_i$ as picking up the correlation between observed individual characteristics and the individual unobserved effects. In this way, Mundlak aimed at ensuring orthogonality between X and n_i.

Equation (1) can be rewritten as

$$Ln(IS^*_{it}) = C_t + (a_x)(X_{it} - \overline{X}_i) + (a_x + b\ )\ \overline{X}_i + a_z Z + e_{it} + n_i \qquad (2)$$

For the *X- variables*, we distinguish between a *transitory* and a *permanent* effect. The *permanent* effect is (a + b), and the *transitory* effect is a. For some variables, the permanent effects have a clear interpretation. For example, the effect of mean income is the permanent income effect (Friedman, 1957). This economic interpretation makes the Mundlak specification even more attractive (see Van Praag *et al.*, 2001).

Additionally, a dummy for missing information about savings has been added to equation (2) (see Greene, 2000). The estimation results show that this coefficient is non-significant.

3.2 Estimation results

Table 2 presents the estimation results for equation (1) as estimated by an Ordered Probit model with individual random effects. Table 2 shows that we allowed for the inclusion of a permanent effect and a transitory effect for four variables, i.e. income, savings, number of children in the household, and number of adults.

From Table 2, it is clear that income satisfaction does not only depend on objectively measurable income but also on other variables, such as children, education, age, and having a partner. The income effects are all positive and significant. The permanent income effect for West-German workers equals 0.519 (0.362+0.157), while we find 0.157 for the transitory income effect. For Western non-workers, the effects are very similar. For Eastern workers the permanent and transitory income coefficients are much larger and equal 0.757 and 0.362, respectively. For Eastern non-workers they are 0.466 and 0.248, respectively. The income effect also depends on the number of children via the interaction term income-children. This interaction term has a slight additional positive effect for Westerners and is non-significant for Easterners.

The age coefficients are all significant, where $Ln(IS^{*})$ has a U-shape with respect to age. Western workers reach a minimum income satisfaction at the age of 44 and Eastern workers at 56. For non-workers, income satisfaction attains its minimum at around 37. Savings, which are correlated with income, have a positive effect on income satisfaction. The education effect is positive in the West, non-significant for Eastern workers, and negative for Eastern non-workers. The presence of more adults or children has a negative effect on income satisfaction for all four sub-samples. If one lives together with a partner in one household, this increases individual income satisfaction. Male respondents are less content than females. The individual random

Table 2. Income Satisfaction Regression

Ordered Probit with individual random effects, GSOEP 1992- 1997

	West Workers		East Workers		West Non-Workers		East Non-Workers	
	Estim.	Est/StErr	Estim.	Est/StErr	Estim.	Est/StErr	Estim.	Est/StErr
Constant	5.654	4.883	5.280	2.694	14.324	14.389	16.319	11.023
Dummy for 1992	0.300	11.845	-0.115	-2.794	0.091	2.850	-0.326	-6.252
Dummy for 1993	0.307	11.639	0.152	3.579	0.292	8.991	-0.078	-1.631
Dummy for 1994	0.244	10.564	-0.314	-8.120	0.380	13.837	0.058	1.379
Dummy for 1995	0.214	8.075	0.107	2.543	0.302	9.501	0.103	1.999
Dummy for 1996	0.287	9.224	0.213	4.582	0.273	7.149	0.112	1.966
Ln(age)	-4.012	-6.077	-4.099	-3.655	-9.029	-16.692	-9.142	-11.514
Ln(age) ^ 2	0.530	5.698	0.508	3.187	1.245	16.829	1.251	11.520
Minimum age reached at	44.136		56.369		37.578		38.576	
Ln(net family income)	0.157	5.510	0.362	6.978	0.155	4.619	0.248	3.877
Ln(years of education)	0.164	2.886	-0.053	-0.521	0.190	2.635	-0.325	-3.307
Ln(number of adults)	-0.119	-4.202	-0.224	-4.041	-0.027	-0.673	-0.081	-1.045
Ln(number of children+1)	-0.605	-2.208	-0.162	-0.321	-0.658	-2.271	-0.525	-0.919
Ln(net fam.inc.) *Ln(child.+1)	0.066	1.996	-0.006	-0.097	0.068	1.914	0.052	0.725
Male	-0.034	-1.516	-0.070	-2.051	-0.193	-6.820	-0.107	-2.846
Ln(Savings)	0.020	6.085	0.032	5.789	0.022	5.000	0.031	4.486
Living together	0.139	5.148	0.187	3.253	0.187	7.425	0.065	1.455
Two Earners	-0.019	-0.762	-0.086	-1.826	XXX	XXX	XXX	XXX
Dummy for missing Savings	0.045	1.334	0.056	1.014	0.010	0.259	0.080	1.265
Mean (Ln(net family inc.)	0.362	8.439	0.395	5.323	0.376	7.458	0.218	2.601
Mean (Ln(savings)	0.059	10.085	0.053	5.403	0.067	8.98	0.057	5.129
Mean (Ln(children+1))	-0.087	-2.164	0.077	1.125	-0.145	-2.638	-0.333	-3.337
Mean (Ln(adults))	-0.117	-2.7	-0.257	-3.173	-0.270	-4.804	-0.032	-0.358
Mu (1) *	0.262	13.251	0.276	7.851	0.329	14.088	0.326	10.538
Mu (2)	0.605	23.946	0.829	17.771	0.771	26.636	0.775	20.201
Mu (3)	1.018	37.224	1.331	27.106	1.235	41.094	1.282	31.479
Mu (4)	1.422	50.458	1.776	35.489	1.605	51.675	1.695	41.143
Mu (5)	2.075	70.808	2.582	50.455	2.281	71.996	2.437	56.490
Mu (6)	2.553	86.961	3.155	61.369	2.712	84.661	2.895	66.793
Mu (7)	3.270	110.826	3.953	76.655	3.360	104.283	3.484	79.409
Mu (8)	4.287	143.827	5.018	95.119	4.321	131.286	4.422	95.670
Mu (9)	5.050	167.393	5.737	104.017	5.008	149.527	5.003	102.849
$s(n)$	0.773	74.277	0.721	42.817	0.819	64.419	0.640	33.481
% of variance due to v	37.4%		34.2%		40.1%		29.1%	
Number of Observations	30356		11256		20510		8501	
Log Likelihood	-56119		-20888		-38891.55		-16902.4	
Number of Individuals	8130		3191		6361		2690	

** Mu(o) is set at 0 by the procedure.*

effect explains between 30 and 40% of the total unexplained variance, being somewhat higher for Westerners than for Easterners.

4. Income satisfaction inequality

4.1 The income satisfaction inequality concept

This section presents the concept of income satisfaction inequality (I_{sub}), which is derived by generalizing the objective income inequality concept. Let us assume two individuals *A* and *B* with incomes y_A and y_B and personal circumstances X_A and X_B, respectively, where *X* stands for the vector of all relevant variables except income. Then the incomes y_A and y_B are *equivalent* satisfaction-wise, iff

$$IS^*(y_A, X_A) = IS^*(y_B, X_B) \tag{3}$$

Or in words, incomes y_A and y_B are equivalent if individuals A and B are equally satisfied financially, given their different background circumstances. The case $IS^*(y, X) \equiv Ln(y)$, where income satisfaction inequality and objective income inequality coincide, is a special case of the income satisfaction concept. From Table 2, it is clear that other variables than income influence income satisfaction, i.e. populations with the same objective income distributions may have a different distribution of income satisfaction.

Instead of correcting income according to what the researcher believes to be relevant (e.g. by application of an exogenous household equivalent scale), this approach takes into account observed individual perceptions as a basis to make

incomes comparable. In other words, individuals are compared on basis of their income satisfaction instead of on their objective income.

In this paper, we consider $Var(Ln(IS^*)) = s^2_{sub}$ as our inequality measure.[1] We may just as well take a function of $\left(m_{sub}, s^2_{sub}\right)$ like Theil's entropy, or Atkinson index, but within the scope of this paper, this does not add new information. Table 3 presents estimates for income satisfaction inequality, which we compare with the corresponding objective income inequality. The income satisfaction inequality is defined as the variance of the structural part, namely as the variance of the estimated income satisfaction.

We might add the variance of the error term ($s^2(n)+1$). This would show that the larger part of satisfaction inequality is caused by the error variance. Obviously, such errors are also present in the objective income inequality as income is also measured with considerable errors. Given the fact that we do not know the error variance component of the objective income inequality, we abstain from comparing objective and satisfaction inequalities, although we calculated the former for completeness.

This comparison of the income satisfaction inequality among sub-samples requires a re-normalization. It is well known that identification in the Probit model is only possible by a normalizing condition, for which we traditionally take $\sigma^2(\varepsilon)=1$. This implies that the value of the income satisfaction inequality index depends on the specific variance normalization chosen. In order to make the satisfaction index comparable between different samples, we renormalize by multiplying the Probit estimates with the factor *1/* $[1 + \sigma^2(\nu)]^{1/2}$. For the variances used in the following

tables this implies a multiplication by *1/* $[1 + \sigma^2(\nu)]$. By applying this normalization we ensure that the structural parts of income satisfaction estimated with different error variances, may be compared.

Table 3: Objective and income satisfaction inequalities

	West Workers	East Workers	West-Non Workers	East-Non Workers
Variance of objective Log-incomes	0.218	0.173	0.284	0.218
Variance of Log- income satisfactions	0.078	0.097	0.159	0.146
Number of Observations	30356	11256	20510	8501

Table 3 shows that both, income and subjective income inequality indexes are larger for non-workers than for workers. The inequality differences between Easterners and Westerners, however, do not exhibit the same pattern for both measures. The objective income inequality implies that objective inequality is larger in the West than in the East. The income satisfaction inequality for non-workers is also larger in the West than in the East. For workers, however, we find a reversed pattern: income satisfaction inequality for workers is larger in the East than in the West.

4.2 The income satisfaction inequality decomposition

Next, we present an income satisfaction inequality decomposition. In that way, one may disentangle what is the contribution of each observable variable *X* and *Z* to income satisfaction inequality. Since the income satisfaction inequality is defined in terms of variance, studying the causes of this inequality is equivalent to decomposing the variance of the income satisfaction.

[1] The variance of *Ln*(*IS*) was calculated using individual weights as available in the GSOEP data. The weights represent the inverse probability of selection.

The variance decomposition we apply is the well–known Gram–Schmidt orthogonalization procedure (see, for example, Rao, 1973).[2] For simplicity, we start with the assumption that income satisfaction depends on two variables only. Let us write income satisfaction as $Ln(IS^*) = a_1 X_1 + a_2 X_2$. Then, the variance can be written as: $s^2(Ln(IS^*)) = a_1 s^2(X_1) + a_2 s^2(X_2) + 2a_1 a_2 \operatorname{cov}(X_1, X_2)$. The objective is to look at the separate contributions of X_1 and X_2 in the total income satisfaction variance. If the explanatory variables would have zero covariance, a simple additive variance decomposition would be possible. This seems clearly not to be the case here. Thus, we need to decompose the variance by defining two new uncorrelated variables $\tilde{X}_1, \tilde{X}_2$ as follows:

$$\begin{aligned} \tilde{X}_1 &= X_1 \\ \tilde{X}_2 &= X_2 - b_{21}\tilde{X}_1 \end{aligned} \tag{4}$$

where b_{21} is defined such that $Cov(\tilde{X}_1, \tilde{X}_2)$ is zero. Hence the two new variables $\tilde{X}_1$ and $\tilde{X}_2$ are non–correlated. Obviously, b_{21} is just the regression coefficient when X_2 is regressed on $\tilde{X}_1$. Hence $\tilde{X}_2$ may be interpreted as that part of X_2, which cannot be explained by $\tilde{X}_1$. We may rewrite the system (4) as

$$T\tilde{X} = X \tag{5}$$

[2] An alternative decomposition would be by principal components. However, here we have the disadvantage that principal components are not well-interpretable.

where *T* stands for a triangular matrix, consisting of the elements of $\hat{a}$. Then it follows that *Ln(IS*)* can be rewritten as a combination of two non-correlated variables

$$Ln(IS^*) = \tilde{a}_1 \tilde{X}_1 + \tilde{a}_2 \tilde{X}_2 \quad (6)$$

The variance is now

$$s^2(Ln(IS^*)) = \tilde{a}_1^2 \; s^2(\tilde{X}_1) + \tilde{a}_2^2 s^2(\tilde{X}_2) \quad (7)$$

Thus, by applying this transformation, it is possible to decompose the inequality into two terms. This procedure can be generalized to any number of explanatory variables. This decomposition has an element of arbitrariness, since the order of the initial variables has an effect on the shares in explaining the variance of *Ln(IS)*. We tried various orders of the variables and the impact of the ordering appeared to be minor.

4.3 Empirical findings for the decomposition of income satisfaction inequality

In this section, the empirical findings of the inequality decomposition as described in Section 4.2. are presented. Table 4 presents the results for this decomposition. The order of the variables for the decomposition corresponds to that presented in the table.

Table 4. Variance decomposition of income satisfaction inequality in percentages.

	West Workers	East Workers	West Non-Workers	East Non-Workers
Ln(age)	0.03%	3.92%	10.08%	7.79%
Ln(age) ^ 2	0.96%	1.20%	18.53%	44.47%
Ln(family income) - Mean (Ln(family inc.)	1.80%	5.09%	1.03%	2.96%
Ln(years of Education)	14.09%	7.61%	3.26%	0.00%
Ln(number of adults) - Mean (Ln(adults))	0.46%	0.23%	0.07%	0.00%
Ln(numb. Children+1) - Mean (Ln(child.+1))	0.16%	0.90%	0.24%	0.17%
Ln(fam.inc.)*Ln(child.+1)	3.46%	1.52%	1.17%	1.19%
Ln(savings) - Mean (Ln(savings)	0.09%	1.51%	4.00%	0.82%
Male	1.03%	2.00%	0.55%	1.28%
Living together?	9.57%	3.43%	11.09%	1.61%
Earners	0.90%	0.46%	XXX	XXX
Missing Savings	1.85%	1.57%	2.52%	0.92%
Mean (Ln(family inc.)	37.96%	39.73%	31.10%	17.57%
Mean (Ln(savings)	8.42%	16.19%	5.92%	9.27%
Mean (Ln(children+1))	0.31%	0.10%	0.28%	0.22%
Mean (Ln(adults))	18.91%	14.54%	10.16%	11.73%

Differences in mean (permanent) income explain a large percentage of income satisfaction inequality. For workers, this percentage is clearly the largest of all. For Eastern workers, the income deviations from the mean (transitory income fluctuations) also explain a relatively large percentage of I_{sub} , i.e. about 5%. This percentage is much lower for the three other groups, especially for Westerners. The reader will notice that I_{sub} is already 'corrected' for the age profile.

For Eastern non-workers, age explains more than 50% of I_{sub}. For Western non-workers the percentage is lower but still very large, i.e. about 28%. Thus, for non-workers inequalities in income and age are the two principal causes of $I_{sub.}$ The non-workers are a fairly heterogeneous group, which includes unemployed people, retired individuals, and people who do not look for a job. Therefore, it is understandable that age plays a considerable role in explaining the variance of I_{sub}. For workers, the role of age in explaining the inequality is much less important. For

Eastern workers, however, the age does have a significant contribution, i.e. above 5%. This may be related to the, in principle, better capacity that young people have to adapt to rapidly changing situations as occurred in Eastern Germany.

Next to age and income, the number of adults in the family explains most of the remaining I_{sub}, i.e. around 10 to 18%. For Western workers, education plays an important role in explaining the income satisfaction inequality, i.e. about 14%. For Eastern workers, education is less important but still large, i.e. about 8%. The variable 'mean savings' explains about 5.9% to 16% of the total, being more relevant for Easterners than for Westerners. Family income and savings are obviously correlated. For Westerners, living together or not contributes between 9.5% to 11% to I_{sub}. This percentage is lower for Easterners, it equals 1.6% for non-workers and 3% for workers. Gender differences explain between 0.5% and 2% of the total I_{sub}.

4.4 Between and within -group inequalities.

Finally, we may take a look at income satisfaction inequality in the whole of Germany (G) by adding the income satisfaction inequality of West (W) and East (E) Germans as

$$I_{sub}(G) = p_w I_{sub}(W) + p_E I_{sub}(E) + I_{sub}(BetweenEandW) \qquad (10)$$

where the *p's* stand for the relative population shares. The last term is calculated by taking the variance of the mean Western log-income satisfaction and the mean Eastern log-income satisfaction with respect to the overall mean log-income satisfaction. In a similar way we decompose $I_{sub}(W)$ and $I_{sub}(E)$ with respect to workers and non–

workers. That decomposition is tabulated in Table 5. The results are comparable to those presented in Table 3.

Table 5. Between group decompositions for Income Satisfaction Inequality

Population Shares	Group	Group		Variance of log-income satisfaction
$P_W = 0.803$	**West**			**0.117**
$P_{WW} = 0.549$		West Workers (WW)	0.078	
$P_{WNW} = 0.451$		West Non-Workers (WNW)	0.159	
		Between WW and WNW	0.0022	
$P_E = 0.197$	**East**			**0.135**
$P_{EW} = 0.528$		East Workers (EW)	0.097	
$P_{ENW} = 0.472$		East Non-Workers (ENW)	0.146	
		Between EW and ENW	0.0150	
	Between E and W		0.0054	
	Germany			**0.126**

Table 5 shows that the income satisfaction inequality in Germany is 0.126, the inequality in the East being larger than in the West.

The same exercise is done for the objective income inequality. The results are presented in Table 6. Again, the reader can compare these results with the ones presented at Table 5. Table 6 illustrates that the objective income inequality is 0.259, which is much larger than the income satisfaction inequality. Now, the Westerners suffer from a larger inequality.

Table 6. Between group decompositions for Income Inequality

Population Shares	Group	Group	Variance of objective Log-incomes	
$P_W = 0.803$	**West**			**0.261**
$P_{WW} = 0.549$		West Workers	0.218	
$P_{WNW} = 0.451$		West Non-Workers	0.284	
		Between WW and WNW	0.0132	
$P_E = 0.197$	**East**			**0.219**
$P_{EW} = 0.528$		East Workers	0.173	
$P_{ENW} = 0.472$		East Non-Workers	0.218	
		Between EW and ENW	0.0248	
	Between E and W		0.0063	
	Germany			**0.259**

5. Conclusions

In this paper a definition of income satisfaction inequality (I_{sub}) is derived. The I_{sub} measure differs from objective measures of inequality in that individual subjective satisfaction with income is used instead of *objective* income. In other words, the paper presents estimates for feelings of income inequality. The measure I_{sub} includes objective income inequality as a special case, namely, when subjective income satisfaction and income are identical.

The paper has proceeded as follows. First, subjective income satisfaction has been explained by objectively measurable variables such as income, age, and education. Second, the variance of income satisfaction has been used as a measure of I_{sub}. Any other specification could also be brought in. Third, and last, I_{sub} has been decomposed into its various components, yielding the separate contributions of the distributions of the underlying objective variables.

This study finds that only a relatively small part of I_{sub} can be attributed to observed factors. This does not necessarily imply that there would be no other observable causes of inequality, it may be that the specification presented in Table 2 omitted relevant observable variables. Nevertheless, this is hardly probable, given the large range of variables available in the GSOEP and the extensive research we did trying different possible specifications. Even if the variance due to observable factors is rather small, it is interesting to look at it, given that the objective variables are the only ones which policy makers can take into account. The observable factors that contribute most to the variance of income satisfaction are the long term mean of household income and, for non-workers, also age. The role of income in explaining income satisfaction inequality is not insignificant but it is not the only cause. Thus, even if objective income inequality remains certainly an important statistic to monitor the societal distribution process, this exercise shows that psychological feelings of inequality are relevant as well. Evidently, this research should be repeated for other populations, before we may generalize the findings of this paper.

This paper contributes to the literature of inequality by presenting an income satisfaction concept, which can be compared to objective measures of inequality. Income satisfaction inequality differs from the established measures of inequality by using individual perceptions as a basis to make incomes comparable. The traditional measures of inequality introduce subjectivism via intuition or introspection by, for example, imposing family equivalence scales (such as the Oxford scale) or choosing a concrete welfare function specification (Atkinson, 1970). The introduction of income satisfaction does not imply that objective measurement should be replaced by subjective concepts throughout, but only that both measures have a different role to

play. The subjective concept is in our opinion a valuable addition to the family of inequality measures.

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