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Inequality Aversion and Risk Attitudes

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Inequality aversion and risk attitudes

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Abstract

Using self reported measures of life satisfaction and risk attitudes, we empirically test whether there is a relationship between individuals inequality and risk aversion. The empirical analysis uses the German SOEP household panel for the years 1997 to 2007 to conclude that the negative effect of inequality measured by the sample gini coefficient by year and federal state is larger for those individuals who report to be less willing to take risks. Nevertheless, the empirical results suggest that even though inequality and risk aversion are related, they are not the same thing. The paper shows that the relationship between risk attitudes and inequality aversion survives the inclusion of individual characteristics (i.e. income, education, and gender) that may be correlated with both risk attitudes and inequality aversion.

Keywords: happiness; inequality aversion; risk attitudes; well-being.
JEL-codes: D3; D63; I31.

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1. Introduction

In recent years, there has been an accumulation of empirical evidence suggesting that individuals dislike inequality. One of the strategies has been to set up experiments in the laboratory (Dawes et al., 2007). The use of self-reported measures of satisfaction or well-being as a proxy for utility has been one of the empirical strategies used to this end. The few existing empirical studies have shown that inequality, usually measured as the gini coefficient in the region or country where the individual lives has a negative effect on self-reported well-being or life satisfaction. This means that other things being equal individuals in more unequal societies report on average a lower score in the satisfaction scale. There are two main reasons that have been put forward to explain why individuals may dislike inequality, notably risk aversion and lack of social mobility. It has been argued that risk aversion influences the weight that individuals give to the risk to have a worse social or income position in the future (Vickerey, 1945; Harsanyi, 1955). The link between social mobility and inequality aversion runs through expectations regarding own mobility and perceptions of social mobility in own country (Bénabou and Ok, 2001). The empirical literature is still scarce and while there is some evidence that social mobility relates to preferences for redistribution (e.g. Alesina and La Ferrara, 2005), the relationship between risk and inequality aversion has not been tested for general population samples. Using a representative survey, this paper empirically estimates this relationship by using a self-reported subjective well-being measure as a proxy for utility.

The first study using subjective measures to examine inequality aversion is Morawetz et al. (1977). They compare the self-rated happiness of two small Israeli communities that were similar in (almost) all respects except for their income distribution and conclude that individuals were happier in the more egalitarian community. More recently, the use of subjective measures to study inequality aversion has been extended to large representative samples. For Western Countries, Alesina, Di Tella and MacCulloch (2004) find that while European respondents' life satisfaction is negatively affected by inequality, the effect does not hold for American respondents. Similarly, Schwarze and Harpfer (2007) show a clear negative impact of inequality on reported life satisfaction of Germans. The two studies in European transition countries show that the effect of inequality on life satisfaction differs from the Western countries (Sanfey

and Teksoz, 2007; and Senik and Grosfeld, 2008), and according to the last authors it depends on the level of political trust in the country. These studies examined whether inequality aversion was different in various countries with different (perceived) social mobility, whether it depended on the political views or income levels of the respondent, and whether it was different for pre- or post-government income. None of them however examined whether, and to what extent, inequality aversion was related to individual risk aversion.

In this paper we examine whether inequality aversion is related to or can be explained by individual risk aversion. In contrast with the existing literature we focus on a general sample population and using a self-reported measure of satisfaction as a proxy for utility, we study whether the correlation between inequality and utility depends on individuals' risk attitudes. Although the relation between inequality and risk aversion is theoretically appealing, there is very few empirical evidence on this using a laboratory setting. Using experimental data, Carlsson, Daruvala, and Johansson-Stenman (2005) conclude that risk aversion and inequality aversion are related concepts to the extent that more risk averse people tend to be more inequality averse, although they found individuals to exhibit inequality aversion per se (see also Kroll and Davidovitz, 2003 and Brennan *et al*., 2008). In this paper we use a large representative panel data set with about 25,000 individuals living in Germany and corroborate the relationship between risk and inequality aversion. This is, we find that more risk averse individuals also are more inequality averse. However, our results also show that risk and inequality aversion are clearly not the same thing, i.e. estimates of the former can not be taken as proxy of the latter. These results are robust to different specifications, econometric methods, and to the inclusion of variables that correlate with individual risk attitudes and individual economic vulnerability.

The rest of the paper is organized as follows. Section 2 portraits the theoretical and conceptual link between inequality aversion and risk aversion. Section 3 explains the empirical strategy and describes the data and key variables, notably our direct measures of utility and risk as well as the measure of inequality. Section 4 presents our findings while the last section provides concluding comments.

2. Inequality and Risk aversion

Inequality and risk aversion are formally related since Atkinson's (1970) seminal contribution, where he derives inequality measures form a social welfare function described as an additive function of individuals' utilities that in turn depend on income. In order to compare income distributions he needs to make some assumptions on the form of utility and uses a constant relative risk aversion (CRRA) function borrowed from the literature of decision-making under uncertainty. Therefore, he formally derives a measure of inequality aversion that is early analogue to risk aversion. [1] The use of a CRRA function implies to equate the probability of an income (risk) with the distribution of income (inequality).

Beyond formal links, inequality and risk have been conceptually thought as closely related notions. In a hypothetical original position where individuals' endowments, abilities and other characteristics reveal no information about their future income, risk averse individuals will pay a premium to end up in a more equal society. In this context, redistribution acts as a mere insurance mechanism. That is, behind the veil of ignorance, ex-ante uncertain income prospects are easily linked with ex-post income inequality (Cowell and Schokkaert, 2001), and inequality and risk aversion are closely related. Taking an extreme view of the hypothetical original position, Harsanyi (1953) suggests that, behind the veil of ignorance, income inequality indices may be employed as measures of the riskiness of the income distribution, so that inequality aversion and risk aversion are the same thing. From an ethical perspective, the link between inequality and risk aversion can be related to the ethics of reciprocity, which does not require any assumption on the importance of individuals' endowments and abilities to determine income.

The situation behind the veil of ignorance is a useful hypothetical situation, which has been used to develop theories of distributive justice (notably Rawls (1971), but also Dworkin (1981)), but it is nonetheless too simplistic to explain the distaste individuals

[1] Actually Atkinson is very explicit about the parallelisms between risk and inequality that he is using to derive his results. For example, as he notes himself the Atkinson index of inequality is equal to the proportional risk premium as defined by Pratt (1964) and the concept of equally distributed equivalent income is simply the analogue of the certainty equivalent.

may have for inequality. Indeed, individuals' preference for inequality are shaped by many factors, the most relevant ones being:[2] (i) their own characteristics, such as endowments and abilities (current income, for instance, is a good predictor of preferences for redistribution; Roemer, 1975; Meltzer and Richard, 1981), (ii) their individual history, which in turn shapes subjective expectations on own economic position (Picketty, 1995; Bénabou and Ok, 2001; Ravallion and Lokshin, 2000; Alesina and La Ferrarra, 2005), and (iii) the social norms and fairness perceptions; e.g. in societies where individual effort, and not luck, is thought to determine economic success, individuals are likely to be less concerned about inequality (Alesina and Glaeser, 2004; Alesina and Angeletos, 2005).

The above arguments show that inequality and risk aversion are related but yet distinct concepts. To the extent that current income inequality may be informative about individual own future income uncertain prospects and that individuals' sense of justice relates to the ethics of reciprocity, we expect the relationship to be positive. Nevertheless, and in line with the existing literature, we expect individuals' dislike for inequality to depend on many factors. In the paper we empirically test whether: (i) inequality aversion and risk aversion are the same thing, and (ii) they are positively related, i.e. more risk averse individuals show a larger distaste for inequality.

3. Empirical strategy

3.1 The model and its estimation

We start from the premise that an individual utility (or satisfaction) depends, among others, on the inequality existing in the region and time where the individual lives. In other words

$$U = f(X, I) \tag{1}$$

where I is a measure of inequality and X describes the situation in which the individual lives. If we assume a concrete functional specification we can rewrite (1) as

[2] See Alesina and Giuliano (2009) for a recent comprehensive survey of the many determinants of individual preference for redistribution.

$$U = \alpha + \beta I + \gamma X \tag{2}$$

where we expect β to be negative. The objective of this paper is to try to disentangle whether there is a relationship between inequality aversion (β) and risk attitudes. To test for the relationship between disliking inequality and risk attitude, we use the following specification:

$$U = \alpha + \beta_1 I + \beta_2 I * R + \beta_3 R + \gamma X \tag{3}$$

where R represents the individual risk attitude, i.e. the degree of risk aversion. A statistically significant β_2 coefficient would indicate that the effect that inequality has on individual's satisfaction or utility depends on the individual risk attitude. If inequality aversion is, as often argued in the literature, related to risk aversion, one would find that more risk averse individuals experience an extra negative effect of inequality on happiness through β_2.

The empirical test of the specification presented in equation (3) consists on estimating

$$U_{it} = \alpha + \beta_1 I_{ft} + \beta_2 I_{ft} R_{it} + \beta_3 R_{it} + \gamma X_{it} + \delta_1 T + \delta_2 F + \eta_i + \varepsilon_{it} \tag{4}$$

where i indicates the individual, t the time, and f the federal state where the respondent lives. Equation (4) includes a set of time dummy variables (T), which capture all those unobservable variables that are time specific, such as inflation and whether there were elections. In addition, we include a set of dummy variables that indicate in which of the 16 federal states the respondent lives (F). The inclusion of time and region variables will allow us to distinguish the inequality effect from other regional and time characteristics (e.g., unemployment rate, economic growth) for which we do not specifically control. Since we have longitudinal data, we include an individual effect (η_i) that captures individual traits that are unobservable and time persistent (e.g. optimism and intelligence). Finally, the equation includes the usual error term (ε).

In the panel data set used in the paper, risk is only asked twice in the whole period. Although this is not an important limitation, as risk attitudes tend to be invariable over time (see section 3.2 for a discussion), it does imply that there is hardly any variation in

the term "$\beta_3 R_{it}$". Thus, besides the individual fixed effect specification, we present a second regression in which we specify the individual effects η_i as random. The individual random effect specification is problematic because, as the literature argues, the zero correlation assumption between the individual effect (η) and the explanatory variables imposed by the individual random effects estimation may not hold in the data. In order to accommodate this concern, we estimate equation (4) with both individual fixed and random effects. In order to relax the assumption of no correlation between covariates and the individual random effect, we will follow Mundlack (1978) and introduce the individual mean across time for those variables for which we suspect that correlation may exist (see also Ferrer-i-Carbonell and Frijters, 2004). These are: household income, years of education, number of children, and number of adults.

Since there is virtually no difference in terms of trade-offs between variables and statistical significance between estimating equation (4) by means of a linear or an ordered categorical estimator (Ferrer-i-Carbonell and Frijters, 2004), we estimate the equation using a linear estimator (OLS extensions).

3.2 Measuring strategy

Life satisfaction

The empirical strategy is based on using a self reported measure of life satisfaction as a proxy for the theoretical concept of utility (U in equation(4)). The use of these questions has considerably increased in recent years, accumulating evidence of its empirical validity and its many interesting applications. In the data set used in this paper individuals are asked the following question:

Please, answer according to the following scale: 0 means 'completely dissatisfied', 10 'completely satisfied'.

How satisfied are you with your life, all things considered?

0_____1_____2_____3_____4_____5_____6_____7_____8_____9_____10
completely dissatisfied

Figure 1: Life Satisfaction Question

The answer to such and similar questions is what is known in the literature as subjective life satisfaction. The three basic assumptions underlying such measures are: (i) individuals are able to evaluate their life satisfaction, (ii) there is a positive monotonic relationship between the answer to such questions and the theoretical concept we are interested in, and (iii) the answer to such questions are interpersonal comparable. A good account of such measures, the underlying assumptions, its applications, and its (empirical) validity can be found in Clark, Frijters, and Shields (2008), Ferrer-i-Carbonell and Frijters (2004), and Senik (2005)[3].

Risk attitudes

In 2004 and 2006 individuals responding to the SOEP panel data were asked to report their willingness to take risk, which we take as our measure of risk attitudes (*R* in equation(4)). The question runs as follows:

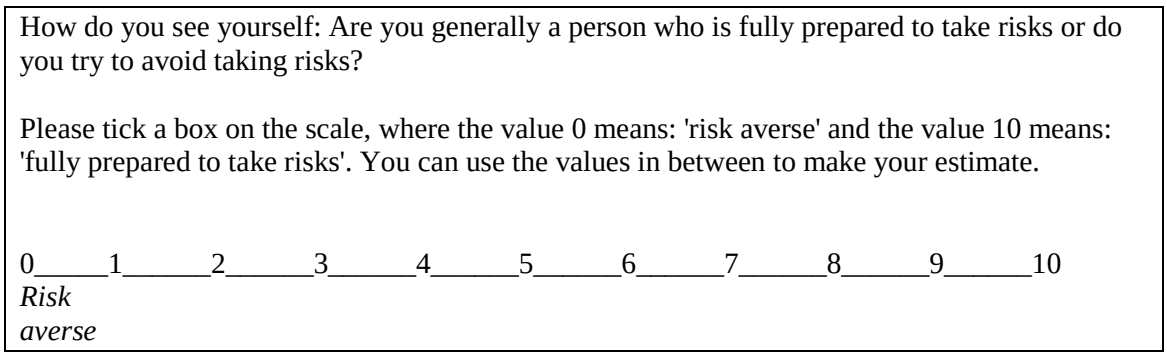

Figure 2: Direct measure of risk attitude

The answer to this question provides a direct measure of risk on an 11 point scale. Such measure contrasts with indirect approaches in which measures of risk attitudes are derived from observed behavior, such as playing the lottery or investing in risky assets. Direct measures of risk can be easily introduced in general large household panel questionnaires, as the present case proofs. This allows the researcher to test for new ideas in general large population surveys, which contrasts with the most experimental studies done with small groups of individuals, and that are often difficult to generalize to the whole population. In other words, the use of general measures of risk attitudes (or attitudes in general) opens up new lines of research in the same way that the subjective

[3] See also Dolan, Peasgood, and White (2008) and Van Praag and Ferrer-i-Carbonell (2004 and 2008) for other recent surveys.

satisfaction measures did. Nevertheless, it is important to validate this direct measure of risk. Fortunately, this has been done by a group of economists (Dohmen et al., 2005) involved in the introduction of this survey measure in the German SOEP. Their main result is that there is a relationship between the answer to the risk question (Figure 2) and individual behavior. To come to this conclusion, the authors perform a complementary experiment with a group of individuals that are comparable to the ones answering the German SOEP data. In addition, the authors show that there is a correlation between the reported willingness to take risk and self reported behavior in the questionnaire, such as holding stocks, smoking, and occupational choice. We have also examined the relationship between this measure of risk attitude and a set of individual characteristics that are known to correlate with risk attitudes and came to very consistent results, e.g. women are more risk averse, and years of education and income correlate negatively with risk aversion.

Since the risk attitude questions were only asked in 2004 and in 2006, we can only estimate the model described in section 3.1 if we assume that risk attitude is a rather persistent trait, i.e. individuals´ risk attitudes do not change often over time. Although the empirical evidence suggests that this is not a strong assumption[4], we check it by looking at the differences reported in the two years. In the data there are about 18,000 individuals who report their willingness to take risk in those two years. On the 0 to 10 scale, the difference between these two measures is only 0.30. In the sample, there are 25.3% of individuals who report the same number in the two waves, and 30% who report a 1 point difference (on the 0 to 10 scale) between the two years. That is, 55% of the sample has a variation in reported risk of 1 or less. Another 20% reports a 2 point difference, while about 25% of the sample reports a 3 or more difference points between the two years. The data therefore seems to indicate that risk attitude is a rather persistent trait even though some changes do seem to occur, at least in the reported risk attitude. In the paper we use the 2004 measure to proxy risk attitudes between 1997 and 2004 and the answers of 2006 to proxy the years 2005 to 2007. Using data prior to 1997 imposes risk attitudes to be constant for longer than 8 years and we therefore only use the 1997-2007 waves.

[4] This is true, for example, to the extent that risk behavior is related to personality traits (see, for example, Cooper, Agocha, and Sheldon, 2000; and Zuckerman and Kuhlman, 2000).

Risk is measured as an ordinal categorical variable that can take *k* different values. This complicates its use as an explanatory variable. Although a usual way to deal with this is by including (*k*-1) dummy variables, this makes the interpretation of the results difficult especially because in the estimation procedure risk is interacted with the gini coefficient. Therefore, we resort to two different methods. The main analysis will be done with a method first developed by Terza (1987), which transforms a categorical ordered variable into a continuous one by assuming a normal distribution of the answers. In addition, we will check whether the results are sensitive to this method by assuming that, as for life satisfaction, the answers to the willingness to take risks are cardinal. This means that the distance between the categories is identical and, for example, an individual answering a 6 is twice as much willing to take risks as an individual answering a 3.

Inequality: the gini coefficient

To examine the impact of inequality on life satisfaction or utility, we need to estimate a measure of inequality that is able to reflect individual's perceptions. To this end, we will measure inequality at the federal level, which is an area close to the individual. In order to capture yearly changes, the inequality measure will be allowed to change every year. This means that we distinguish among 16 different federal states in 11 different time periods. In line with the literature, inequality in the region will be measured by the gini coefficient using the household income information provided in the SOEP data as described in Section 3.3. The transformation from reported to equivalent household income is done by weighting the first adult by 1, the second and subsequent adults by 0.5, and each child by 0.3.

3.3 The data and the variables used in the analysis

The empirical analysis uses the German Socio-Economic Panel (SOEP)[5], a representative German household panel that started in 1984 in West Germany and includes East German respondents since 1990. In the present paper we use the years 1997 to 2007 (11 years). Table 1 presents the averages for the main variables used in the empirical analysis.

[5] A detailed description of the German SOEP can be found in Wagner et al. (2007). The SOEP is organized by the German Institute for Economic Research (Berlin). We are grateful to them and to the project director Prof. Dr. G. Wagner for making this data set available.

Table 1 shows that on average individuals are rather satisfied with their life, which is a usual finding in Western societies. Although the gini coefficient is calculated by using equivalent income, in explaining life satisfaction we use household income. The reason behind this decision is that if we were to use equivalent income we would be imposing the same transformation to all individuals and we would therefore ignore the different consumption patterns and preferences that households may have. In order to control for differences in household size, however, the regression equation for life satisfaction introduces the number of adults and children as explanatory variables. The regression analysis also includes other individual characteristics that are typically found important determinants of life satisfaction: age of the individual (introduced in logarithms and the squared of it), gender, whether the individual is of German origin, has a partner, is unemployed or does not work, and suffers from some disability. Table 1 shows, for example, that 92% of all respondents are of German origin and that the average age is 47 years old.

Table 1: Sample averages, German SOEP 1997-2007

Variable	***Average***	***St. Dev.***
Life Satisfaction 0 to 10	6.982	1.761
Household income (per month, after taxes)	2608	1778
Equivalent household income (per month, after taxes)	1429	1010
Individual age (>16)	46.848	16.972
Individual is a male [0,1]	0.477	0.499
Individual is of German origin [0,1]	0.919	0.273
Individual has a partner [0,1]	0.622	0.485
Individuals is unemployed [0,1]	0.063	0.244
Individual does not work [0,1]	0.422	0.494
Individual is disabled [0,1]	0.113	0.317
Number of adults in the household (1 to 11)	2.487	1.024
Number children in the household (0 to 9)	0.520	0.889
Years of education (7 to 18)	11.981	2.635
Risk 0 to 10	4.475	2.355
Gini of the Federal State	0.273	0.037

The average willingness to take risk is calculated using the observations for 2004 and 2006, the two years in which the question was asked. The average of the two years is 4.5. In 2004, most individuals (22%) were concentrated at 5 and 46% of them reported a 4 or less. Of the remaining individuals, the vast majority (91% of them) report a willingness to take risk equal to 6, 7 or 8. This means that only 2.7% of the total sample reported a 9 and a 10. In 2006, the average willingness to take risk was a bit larger than

in 2004, but the distribution of the answers is very similar in the two years (see section 3.2). The average gini coefficient across the sixteen federal states is 0.279. To calculate this coefficient we use the income distribution of each federal state. According to United Nations Human Development Report (2009), the gini coefficient for the whole Germany was 0.283.

4. Results

4.1 The effect of inequality on satisfaction

Table 2 shows the results when regressing equation (4) with individual fixed effects and random effects. In the first specification we do not allow risk attitudes to play any role on life satisfaction (i.e. we impose $\beta_2=\beta_3=0$). In this specification we find the expected negative relationship between inequality (measured by the gini coefficient) and life satisfaction and very similar coefficients —with a statistical significance at 5.1% with fixed effects and at 3.5% with random effects. This means that on average individuals dislike inequality. This finding is in line with the previous literature that has also used subjective measures to empirically test inequality aversion in Western European countries (Alesina, Di Tella and MacCulloch, 2004; and Schwarze and Harpfer, 2007).

The coefficient estimates for the control variables offer no surprises and are robust to the econometric method: we find the usual positive relationship between life satisfaction and household income, having a partner, and the number of children and the also common negative relationship between satisfaction and being unemployed, not working,[6] being disabled, and the number of adults in the household. In order to control for time and region characteristics and to distinguish them from the inequality in the region and year, we include a set of dummy variables indicating the region and year where the respondent lives. Many of these dummy variables are statistically significant, indicating the relevance of regional and time characteristics (see Appendix Tables A1 and A2).

When using individual fixed effects, all the effect of variables that are constant over time can not be identified. Besides gender and whether the individual is of German origin, we can also not include age, as its effect is difficult to identify when one

[6] This is not statistically significant with random effects.

includes a constant and time dummy variables. These effects can however be estimated with individual random effects. The estimates for the time-invariant covariates are also in line with the literature, notably, there is a u-shape relationship between age and life satisfaction with a minimum at about 50 years old.

Table 2: Life Satisfaction. German SOEP, 1997-2004 FE and RE estimators.

	Specification 1				Specification 2				Specification 3			
	Fixed Effects		*Random Effects*		*Fixed Effects*		*Random Effects*		*Fixed Effects*		*Random Effects*	
	Coeff	*t-value*	*Coeff*	*t-value*	*Coeff*	*t-value*	*Coeff*	*t-value*	*Coeff*	*t-value*	*Coeff*	*t-value*
Constant	4.184	20.70	11.380	18.55	4.182	20.69	11.708	19.11	4.207	20.82	11.892	19.37
Gini (year/federal)	-0.568	-1.95	-0.607	-2.11	-0.557	-1.92	-0.598	-2.08	-0.531	-1.83	-0.578	-2.01
Willing. to take risk * gini					0.181	7.26	0.267	13.26	0.752	6.79	0.758	7.25
Willingness to take risk									-0.167	-5.29	-0.141	-4.79
Ln(age)			-5.576	-16.71			-5.702	-17.10			-5.809	-17.39
Ln(age)^2			0.714	15.63			0.737	16.15			0.751	16.42
Male			-0.044	-2.79			-0.070	-4.40			-0.068	-4.29
German origin			0.048	1.73			0.039	1.42			0.040	1.45
Ln(household income)	0.348	25.74	0.337	24.96	0.348	25.73	0.336	24.95	0.347	25.60	0.335	24.82
Individual has a partner	0.191	10.68	0.229	15.91	0.191	10.70	0.232	16.11	0.189	10.56	0.232	16.13
Individual is unemployed	-0.534	-29.65	-0.604	-35.22	-0.534	-29.64	-0.607	-35.39	-0.535	-29.72	-0.607	-35.38
Individual does not work	-0.028	-2.12	0.001	0.09	-0.028	-2.13	0.003	0.26	-0.027	-2.07	0.002	0.17
Individual is disabled	-0.252	-12.68	-0.460	-27.78	-0.251	-12.63	-0.457	-27.60	-0.250	-12.59	-0.457	-27.59
Ln(number of adults)	-0.247	-8.84	-0.260	-9.36	-0.247	-8.85	-0.261	-9.41	-0.245	-8.76	-0.260	-9.36
Ln(number of children +1)	0.045	2.87	0.066	4.23	0.045	2.88	0.066	4.23	0.046	2.96	0.067	4.31
Ln(years of education)	0.052	0.87	0.236	3.88	0.050	0.84	0.235	3.86	0.041	0.68	0.230	3.78
Mean(Ln(household income))			0.549	22.34			0.531	21.61			0.533	21.71
Mean(Ln(yearseducation))			0.003	0.03			-0.021	-0.27			-0.011	-0.15
Mean(LN(nbradults))			-0.546	-10.64			-0.526	-10.26			-0.530	-10.34
Mean(Ln(nbrchildren+1))			-0.022	-0.79			-0.020	-0.73			-0.019	-0.67
Time & Region(Federal) dummies	Yes		Yes		Yes		Yes		Yes		Yes	
R2: Within	0.039		0.036		0.039		0.036		0.039		0.036	
Number of Observations	170789		170789		170789		170789		170789		170789	
Number of Individuals	24168		24168		24168		24168		24168		24168	

4.2 The role of risk on shaping inequality aversion

This section focuses on the main empirical test of this paper, namely to examine the role that individual's risk attitudes have on determining inequality aversion. We include, besides the gini coefficient, an interaction term between risk attitudes and inequality and we do not allow risk attitudes to have an independent effect on life satisfaction. In other words, we regress equation (4) setting β_3=0. The results are shown in specification 2, Table 2. In a second specification, in addition to the interaction term between risk attitudes and inequality ($\beta_2 * I * R$, equation (4)), we include risk attitude in the regression (β_3, equation (4)). Although this specification is regressed both with individual fixed and random effects, it is important to keep in mind that risk attitude is imposed to be fairly constant over the sample period (see section 3.2), which means that the fixed effects specification with $\beta_3 \neq 0$ must be taken with caution. Nevertheless, the results of this third specification show that fixed and random effects give almost identical estimates, which are not statistically significantly different. The results of this last specification are shown in specification 3, Table 2.

The risk attitude measure originally recoded in a 0 to 10 scale is transformed into a new variable that ranges from -1.89 to 2.66 (see Section 3.2). The lowest level represents individuals who reported a 0 in their willingness to take risks. The highest level corresponds to individuals who reported a 10, i.e. they are "fully prepared to take risks". In other words, the largest the value of the risk measure, the least risk averse the individual is. Although the magnitude differs, the coefficient of the interaction term between risk attitudes and the gini coefficient is positive for all specifications and all econometric approaches. This means that more risk averse individuals are also more inequality averse, i.e., β_2 in equation (4) is positive. Like in the first specification, the magnitude of the effect of the gini coefficient and of its interaction with risk attitudes on life satisfaction is very similar in the two econometric methods (i.e. fixed and random individual effects). It is important to notice that introducing the interaction term however does not change the impact of inequality on life satisfaction (with fixed effects the effect changes from -0.568 to -0.557).[7]

[7] Notice that the direct comparison of the two β_1s is meaningful since the mean transformed willingness to take risk is 0 (about 4.5 in the original scale).

To interpret the role of risk attitudes, we examine how inequality aversion changes with reported risk attitudes. The results show that for the most risk averse individuals (reporting a 0 on the 0 to 10 scale), the effect that the inequality has on life satisfaction is -0.900 [-0.557+(-1.89*0.181)] with individual fixed effects and -1.104 with random effects. For the least risk averse (reporting a 10), the effect is -0.075 [-0.557+(2.66*0.181)] with individual fixed effects and +0.112 with individual random effects. For an individual responding a 5 (modal response), the effect of the gini coefficient on life satisfaction is -0.569 [-0.557(+0.157*0.181)] with individual fixed effects and -0.556 with random effects. This effect (i.e. the total effect of inequality on life satisfaction) is only positive for individuals who report a 10 (about 1% of the sample) on their willingness to take risks. In sum, the effect of inequality on life satisfaction is negative for almost all individuals.

The third and last specification allows for risk attitude to have an independent effect on life satisfaction. Since risk attitudes are by construction fairly constant over time (it is only recoded in two of the eleven years), the results with individual fixed effects should be taken with caution, although they are very similar to the random effects ones. The results show that all three coefficients (β_1, β_2, and β_3) are statistically significant, although the gini coefficient with fixed effects only at 6.8%. In line with the results in specification 2, the effect that inequality has on life satisfaction decreases with increasing willingness to take risks. For the most risk averse individuals the coefficient of inequality on life satisfaction is -1.956 with fixed effects and -2.015 with random effects, both effects are larger than in specification 2. For the least risk averse the effect is 1.468 with individual fixed effects and 1.437 with random effect. For most individuals the gini coefficient is negative, as in specification 2. Notwithstanding this, with specification 3, inequality exerts a positive effect for 21% of the individuals (as opposed to about 1% in specification 2), those reporting a 7 or more on the 0 to 10 scale.

In sum, the results using self reported life satisfaction as a proxy for utility (stated method) indicate that risk attitudes and inequality aversion are related to the extend that risk attitudes determine the effect that inequality has on life satisfaction. In other words, the dislike for inequality is related to risk attitudes and most risk averse individuals are also more inequality averse. Nevertheless the two concepts are not identical, which

means that individuals' inequality aversion does not entirely come from their risk attitudes. This implies that risk attitudes are not a good proxy for inequality aversion.

4.3 Is it risk attitudes or is it something else?

The literature suggests that there is a relationship between risk attitudes and individual characteristics. Therefore, one could argue that the relationship we found between risk attitudes and inequality aversion is not due to risk attitudes themselves but rather to other personal characteristics that correlate with it, notably gender, education and income (Hartog, Ferrer-i-Carbonell, and Jonker, 2002). For example, since on average years of education is negatively correlated with risk aversion and lower educated individuals face greater income fluctuations, it could be that the stronger dislike for inequality of risk averse individuals runs through education. Similar arguments can be raised for women and low income people, both of whom are on average more risk averse and face larger income uncertainties. In order to examine this possibility, the regressions presented in specifications 2 and 3 of Table 2 are now augmented by introducing an interaction term between the gini coefficient, on the one hand, and the gender, years of education, and household income of the respondent, on the other. Since in any of the specifications the interaction with gender was statistically significant, we do not present the results here. Table 3 shows the results with random and fixed effects when we interact the gini coefficient not only with risk attitudes but also with years of education and household income. The interaction terms between gini, on the one hand, and household income and years of education, on the other, show statistically significant coefficients for some specifications.

The most important finding is that the interaction term between gini and risk attitudes remains statistically significant and of the same sign and magnitude as in Table 2. This means that the relationship found in section 4.2 between risk attitudes and inequality aversion remains. The coefficient for the gini coefficient however becomes statistically insignificant. The impact that this has for life satisfaction can not be evaluated independently of the interaction term between the gini and the logarithm of household income, which is negative, and years of education, which is positive. To evaluate the magnitude of the gini coefficient, we examine the effect of inequality for an individual with an average household income (2068 euros per month, or 7.71 in logarithms) and

average years of education (12 years, or 2.46 in logarithms). Ignoring the interaction between risk attitudes and the gini, the effect of inequality on life satisfaction for this individual ranges from -0.566 to -0.510 depending on the specification used. This means that the effect of inequality on life satisfaction is similar to the one described in Table 2. We can therefore conclude that the inclusion of the interaction terms between gini and individuals' income and years of education changes neither the effect of inequality on life satisfaction nor the relationship between inequality and risk attitudes.

Table 3: Life Satisfaction. German SOEP, 1997-2004

	Specif. 1, FE		**Specif. 2, FE**		**Specif. 1, RE**		**Specif. 2, RE**	
	Coeff	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***
Constant	4.294	7.71	3.872	6.88	11.256	14.33	11.039	14.03
Gini (year/region)	-1.042	-0.55	0.620	0.32	0.953	0.54	2.415	1.35
Willingness to take risk			-0.167	-5.20			-0.145	-4.85
Willg. to take risk * gini	0.181	7.25	0.752	6.68	0.268	13.29	0.773	7.28
Ln(housd.income) * gini	-0.331	-1.56	-0.411	-1.93	-0.588	-2.95	-0.661	-3.30
Ln(years education) * gini	1.241	2.11	0.830	1.40	1.227	2.24	0.870	1.57
Ln(age)					-5.702	-17.11	-5.813	-17.40
Ln2(age)					0.737	16.15	0.751	16.44
Male					-0.070	-4.41	-0.068	-4.30
German origin					0.040	1.44	0.040	1.46
Ln(household income)	0.439	7.26	0.460	7.59	0.499	8.76	0.517	9.07
Individual has a partner	0.191	10.67	0.190	10.58	0.232	16.12	0.232	16.16
Individual is unemployed	-0.533	-29.60	-0.535	-29.66	-0.606	-35.30	-0.605	-35.26
Individual does not work	-0.028	-2.09	-0.027	-2.05	0.004	0.30	0.003	0.21
Individual is disabled	-0.251	-12.62	-0.251	-12.60	-0.457	-27.61	-0.457	-27.62
Ln(number of adults)	-0.249	-8.90	-0.247	-8.84	-0.264	-9.51	-0.263	-9.49
Ln(number of children +1)	0.043	2.78	0.045	2.85	0.063	4.07	0.064	4.15
Ln(years of education)	-0.281	-1.67	-0.180	-1.07	-0.092	-0.58	-0.002	-0.01
Mean(Ln(houseincome)					0.536	21.78	0.539	21.89
Mean(Ln(yearseducation))					-0.036	-0.48	-0.023	-0.30
Mean(LN(nbradults))					-0.528	-10.30	-0.533	-10.40
Mean(Ln(nbrchildren+1))					-0.017	-0.60	-0.015	-0.53
Time & Region(Federal) dummies	yes		yes		yes		yes	
R2: Within	0.039		0.039		0.036		0.036	
Number of Observations	170789		170789		170789		170789	
Number of Individuals	24168		24168		24168		24168	

The results presented in Table 3 indicate that inequality aversion increases with income, as if inequality were a `luxury´ good. This finding is in line with some of the existing empirical evidence (Alesina, DiTella and MacCulloch, 2004 find that rich Americans care more for inequality than poor country fellows when splitting the sample into theses

two groups) but at odds with some other results (see Alesina and La Ferrara, 2005; and Alesina and Giuliano, 2009 for two recent contributions). For education, the effect is the opposite. This may be capturing the effect of prospects of upward mobility (see Alesina, Di Tella and MacCulloch, 2004 for a similar argument).

In sum, these results show that taking due account of the possible interactions between individual characteristics known to be correlated with risk attitudes and the gini coefficient does not change the role that risk attitudes play on shaping inequality aversion. Therefore, the conclusions reached in section 4.2 remains, i.e. risk averse individuals dislike inequality more than risk taking individuals.

5. Conclusions

Individual preference parameters are central to the modeling and understanding of individual behavior. The dislike people may have for inequality and their tolerance to accept or undertake risk are two such important parameters. Although these two attitudes are conceptually distinct from each other, inequality aversion has, for a long time, been proxied with estimates of risk aversion. Only recently, researchers have started to elicit individual preferences for equality separately from individuals' attitudes towards risk and have explored the relationship between the two. This has been mostly done by means of experiments.

This paper employs two direct measures of utility and risk from a large and representative panel data set for Germany (SOEP) to identify and estimate inequality aversion and risk aversion, separately. To the best of our knowledge these are the first estimates ever obtained from representative survey data. We also explore the relationship between inequality and risk aversion, and find that risk attitudes help shape individual preferences for equality: inequality and risk aversion appear to be related, so that more risk averse individuals are also found to be more inequality averse. These findings are in line with patterns found in experimental setups.

Even though our results indicate that these two preference parameters are related, the results also show that the two concepts are not identical. This indicates that individuals'

inequality aversion does not come from their risk attitude but probably from other parameters long discussed in the literature, such as perceptions of mobility and social norms and fairness perceptions. This means that inequality aversion can not be adequately proxy with risk attitudes.

Although risk attitudes are found to correlate with personal characteristics, our findings clearly suggest that these attributes do not hinder the role of risk attitudes in shaping preferences for equality. Finally, contrary to the predictions of basic models but also to some recent empirical evidence (Meltzer and Richards, 1981; Alesina and Giuliano, 2009)), we find that inequality aversion seems to be a luxury good: increases with income more than proportionally.

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APPENDIX

This appendix presents the complete regression results for Table 2 (Table A1 with fixed effects and Table A2 with random effects) and Table 3 (Table A3).

Table A1: Life Satisfaction. German SOEP, 1997-2004 FE estimator.

	Specification 1		**Specification 2**		**Specification 3**	
	Coeff	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***
Constant	4.184	20.70	4.182	20.69	4.207	20.82
Time dummy (ref. 2007)						
Time dummy year 1997	0.333	14.31	0.339	14.58	0.337	14.46
Time dummy year 1998	0.424	19.41	0.430	19.68	0.428	19.58
Time dummy year 1999	0.449	20.57	0.455	20.85	0.453	20.75
Time dummy year 2000	0.399	21.36	0.405	21.68	0.403	21.57
Time dummy year 2001	0.415	21.86	0.421	22.18	0.419	22.09
Time dummy year 2002	0.248	18.03	0.254	18.48	0.254	18.47
Time dummy year 2003	0.160	12.14	0.167	12.62	0.166	12.59
Time dummy year 2004	-0.029	-2.17	-0.022	-1.66	-0.022	-1.68
Time dummy year 2005	0.108	8.12	0.108	8.13	0.108	8.11
Time dummy year 2006	-0.006	-0.51	-0.007	-0.51	-0.007	-0.54
gini (year/federal)	-0.568	-1.95	-0.557	-1.92	-0.531	-1.83
Willing. to take risk * gini			0.181	7.26	0.752	6.79
Willingness to take risk					-0.167	-5.29
Ln(household income)	0.348	25.74	0.348	25.73	0.347	25.60
Individual has a partner	0.191	10.68	0.191	10.70	0.189	10.56
Individual is unemployed	-0.534	-29.65	-0.534	-29.64	-0.535	-29.72
Individual does not work	-0.028	-2.12	-0.028	-2.13	-0.027	-2.07
Individual is disabled	-0.252	-12.68	-0.251	-12.63	-0.250	-12.59
Ln(number of adults)	-0.247	-8.84	-0.247	-8.85	-0.245	-8.76
Ln(number of children +1)	0.045	2.87	0.045	2.88	0.046	2.96
Ln(years of education)	0.052	0.87	0.050	0.84	0.041	0.68
Federal State: (ref. North Rhine-Westphalia)						
Berlin	0.034	0.32	0.031	0.29	0.030	0.27
Schleswig-Holstein	0.259	2.29	0.256	2.27	0.256	2.27
Hamburg	0.267	2.15	0.262	2.11	0.262	2.11
Lower Saxony	0.414	4.86	0.413	4.84	0.411	4.83
Bremen	0.368	2.41	0.364	2.38	0.354	2.32
Hesse	0.524	5.59	0.522	5.57	0.509	5.44
Rhinel.-Palatinate, Saarl.	0.299	3.02	0.303	3.07	0.306	3.10
Baden-Wuerttemberg	0.160	1.86	0.162	1.90	0.165	1.93
Bavaria	0.214	2.40	0.216	2.41	0.218	2.44
Berlin East	-0.164	-1.40	-0.160	-1.36	-0.151	-1.28
Mecklenburg-West Pomerania	0.082	0.88	0.081	0.88	0.091	0.99
Brandenburg	0.037	0.41	0.036	0.40	0.047	0.52
Saxony - Anhalt	0.067	0.79	0.072	0.84	0.084	0.98
Thuringia	0.076	0.89	0.079	0.92	0.091	1.05
Saxony	0.055	0.65	0.060	0.71	0.071	0.84
Std. dev. Individual fixed effect	1.324		1.320		1.322	
Std. dev. Error term	1.205		1.205		1.205	

R^2: Within	0.039	0.039	0.039
R^2: Between	0.099	0.106	0.104
R^2: Overall	0.083	0.087	0.086
Corr(regresors, ind. fixed efft.)	0.100	0.105	0.105
Number of Observations	17078	17078	17078
	9	9	9
Number of Individuals	24168	24168	24168

Table A2: Life Satisfaction. German SOEP, 1997-2004. RE estimator.

	Specif. 1		**Specif. 2**		**Specif. 3**	
	Coeff	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***
Constant	11.380	18.55	11.708	19.11	11.892	19.37
Time dummy (ref. 2007)						
Time dummy year 1997	0.197	8.43	0.217	9.25	0.214	9.13
Time dummy year 1998	0.301	13.71	0.320	14.53	0.317	14.42
Time dummy year 1999	0.334	15.29	0.352	16.06	0.349	15.96
Time dummy year 2000	0.310	16.56	0.326	17.41	0.324	17.31
Time dummy year 2001	0.334	17.64	0.350	18.44	0.348	18.36
Time dummy year 2002	0.180	13.12	0.196	14.19	0.195	14.18
Time dummy year 2003	0.100	7.58	0.114	8.63	0.113	8.61
Time dummy year 2004	-0.078	-5.96	-0.065	-4.95	-0.065	-4.95
Time dummy year 2005	0.070	5.30	0.073	5.48	0.072	5.46
Time dummy year 2006	-0.016	-1.24	-0.015	-1.16	-0.015	-1.18
gini (year/federal)	-0.607	-2.11	-0.598	-2.08	-0.578	-2.01
Willg. to take risk * gini			0.267	13.26	0.758	7.25
Willg. to take risk					-0.141	-4.79
Ln(age)	-5.576	-16.71	-5.702	-17.10	-5.809	-17.39
Ln2(age)	0.714	15.63	0.737	16.15	0.751	16.42
Male	-0.044	-2.79	-0.070	-4.40	-0.068	-4.29
German origin	0.048	1.73	0.039	1.42	0.040	1.45
Ln(household income)	0.337	24.96	0.336	24.95	0.335	24.82
Individual has a partner	0.229	15.91	0.232	16.11	0.232	16.13
Individual is unemployed	-0.604	-35.22	-0.607	-35.39	-0.607	-35.38
Individual does not work	0.001	0.09	0.003	0.26	0.002	0.17
Individual is disabled	-0.460	-27.78	-0.457	-27.60	-0.457	-27.59
Ln(number of adults)	-0.260	-9.36	-0.261	-9.41	-0.260	-9.36
Ln(number of children +1)	0.066	4.23	0.066	4.23	0.067	4.31
Ln(years of education)	0.236	3.88	0.235	3.86	0.230	3.78
Federal State: (ref. North Rhine-Westphalia)						
Berlin	-0.222	-4.38	-0.219	-4.34	-0.220	-4.35
Schleswig-Holstein	0.169	3.80	0.166	3.74	0.166	3.74
Hamburg	0.199	3.35	0.191	3.21	0.190	3.20
Lower Saxony	0.104	3.51	0.103	3.48	0.102	3.47
Bremen	0.202	2.55	0.187	2.37	0.181	2.30
Hesse	0.035	1.05	0.032	0.95	0.029	0.87
Rhinel.-Palatinate, Saarl.	0.062	1.77	0.067	1.92	0.067	1.91
Baden-Wuerttemberg	-0.105	-3.79	-0.104	-3.77	-0.104	-3.74
Bavaria	0.013	0.48	0.015	0.58	0.015	0.58
Berlin East	-0.484	-8.52	-0.486	-8.57	-0.482	-8.50
Mecklenburg-West Pomer.	-0.357	-8.77	-0.364	-8.95	-0.361	-8.87
Brandenburg	-0.446	-11.67	-0.453	-11.88	-0.449	-11.79
Saxony – Anhalt	-0.402	-10.98	-0.407	-11.16	-0.403	-11.02

Thuringia	-0.421	-11.52	-0.428	-11.72	-0.424	-11.61
Saxony	-0.394	-11.78	-0.400	-12.00	-0.396	-11.86
Mean(Ln(household income))	0.549	22.34	0.531	21.61	0.533	21.71
Mean(Ln(yearseducation))	0.003	0.03	-0.021	-0.27	-0.011	-0.15
Mean(LN(nbradults))	-0.546	-10.64	-0.526	-10.26	-0.530	-10.34
Mean(Ln(nbrchildren+1))	-0.022	-0.79	-0.020	-0.73	-0.019	-0.67
Std. dev. Ind. Rdm effect	1.092		1.088		1.088	
Std. dev. Error term	1.205		1.205		1.205	
R^2: Within	0.036		0.036		0.036	
R^2: Between	0.187		0.191		0.191	
R^2: Overall	0.134		0.136		0.136	
Number of Observations	170789		170789		170789	
Number of Individuals	24168		24168		24168	

Table A3: Life Satisfaction. German SOEP, 1997-2004, interactions with income and education

	Specif. 1, FE		**Specif. 2, FE**		**Specif. 1, RE**		**Specif. 2, RE**	
	Coeff	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***	***Coeff***	***t-value***
Constant	4.294	7.71	3.872	6.88	11.256	14.33	11.039	14.03
Time dummy (ref. 2004)								
Time dummy year 1997	0.340	14.56	0.339	14.51	0.221	9.38	0.219	9.31
Time dummy year 1998	0.431	19.66	0.430	19.62	0.323	14.64	0.322	14.59
Time dummy year 1999	0.456	20.83	0.455	20.78	0.355	16.16	0.354	16.11
Time dummy year 2000	0.406	21.69	0.405	21.63	0.329	17.53	0.328	17.47
Time dummy year 2001	0.422	22.20	0.421	22.15	0.353	18.56	0.352	18.51
Time dummy year 2002	0.255	18.52	0.255	18.51	0.197	14.25	0.196	14.25
Time dummy year 2003	0.167	12.65	0.167	12.62	0.114	8.67	0.114	8.65
Time dummy year 2004	-0.022	-1.63	-0.022	-1.65	-0.064	-4.90	-0.064	-4.90
Time dummy year 2005	0.108	8.12	0.108	8.11	0.072	5.46	0.072	5.45
Time dummy year 2006	-0.007	-0.52	-0.007	-0.55	-0.015	-1.17	-0.015	-1.20
gini (year/region)	-1.042	-0.55	0.620	0.32	0.953	0.54	2.415	1.35
Willingness to take risk			-0.167	-5.20			-0.145	-4.85
Willg. to take risk * gini	0.181	7.25	0.752	6.68	0.268	13.29	0.773	7.28
Ln(housd.income) * gini	-0.331	-1.56	-0.411	-1.93	-0.588	-2.95	-0.661	-3.30
Ln(years education) * gini	1.241	2.11	0.830	1.40	1.227	2.24	0.870	1.57
Ln(age)					-5.702	-17.11	-5.813	-17.40
Ln2(age)					0.737	16.15	0.751	16.44
Male					-0.070	-4.41	-0.068	-4.30
German origin					0.040	1.44	0.040	1.46
Ln(household income)	0.439	7.26	0.460	7.59	0.499	8.76	0.517	9.07
Individual has a partner	0.191	10.67	0.190	10.58	0.232	16.12	0.232	16.16
Individual is unemployed	-0.533	-29.60	-0.535	-29.66	-0.606	-35.30	-0.605	-35.26
Individual does not work	-0.028	-2.09	-0.027	-2.05	0.004	0.30	0.003	0.21
Individual is disabled	-0.251	-12.62	-0.251	-12.60	-0.457	-27.61	-0.457	-27.62
Ln(number of adults)	-0.249	-8.90	-0.247	-8.84	-0.264	-9.51	-0.263	-9.49
Ln(number of children +1)	0.043	2.78	0.045	2.85	0.063	4.07	0.064	4.15
Ln(years of education)	-0.281	-1.67	-0.180	-1.07	-0.092	-0.58	-0.002	-0.01
Federal State: (ref. North Rhine-Westphalia)								
Berlin	0.030	0.27	0.029	0.27	-0.222	-4.40	-0.223	-4.41
Schleswig-Holstein	0.258	2.29	0.257	2.28	0.166	3.74	0.165	3.73

Hamburg	0.263	2.11	0.262	2.11	0.189	3.18	0.189	3.18
Lower Saxony	0.415	4.87	0.413	4.85	0.103	3.48	0.102	3.47
Bremen	0.361	2.36	0.352	2.30	0.183	2.33	0.178	2.26
Hesse	0.517	5.52	0.507	5.41	0.032	0.94	0.030	0.88
Rhinel.-Palatinate, Saarl.	0.307	3.11	0.310	3.14	0.067	1.92	0.067	1.92
Baden-Wuerttemberg	0.166	1.93	0.168	1.96	-0.105	-3.79	-0.104	-3.76
Bavaria	0.217	2.43	0.220	2.46	0.016	0.60	0.016	0.60
Berlin East	-0.144	-1.23	-0.135	-1.15	-0.475	-8.36	-0.471	-8.29
Mecklenburg-West Pomerania	0.090	0.97	0.100	1.08	-0.359	-8.82	-0.355	-8.72
Brandenburg	0.046	0.50	0.056	0.62	-0.446	-11.69	-0.442	-11.58
Saxony – Anhalt	0.084	0.98	0.097	1.12	-0.398	-10.87	-0.393	-10.72
Thuringia	0.091	1.05	0.102	1.18	-0.420	-11.48	-0.416	-11.35
Saxony	0.072	0.85	0.083	0.98	-0.392	-11.70	-0.386	-11.55
Mean(Ln(houseincome)					0.536	21.78	0.539	21.89
Mean(Ln(yearseducation))					-0.036	-0.48	-0.023	-0.30
Mean(LN(nbradults))					-0.528	-10.30	-0.533	-10.40
Mean(Ln(nbrchildren+1))					-0.017	-0.60	-0.015	-0.53
Std. dev. Ind. fixed effect	1.320		1.322		1.088		1.087	
Std. dev. Error term	1.205		1.205		1.205		1.205	
R2: Within	0.039		0.039		0.036		0.036	
R2: Between	0.106		0.104		0.192		0.191	
R2: Overall	0.087		0.086		0.136		0.136	
	0.106		0.105					
Number of Observations	170789		170789		170789		170789	
Number of Individuals	24168		24168		24168		24168	