Inequality aversion and risk attitudes

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Abstract

Risk aversion is one of the main reasons that have been put forward to explain why individuals may dislike inequality. In theoretical and applied work the dislike for inequality is linked to the curvature of the utility function and thus to the degree of risk aversion. However, the relationship between risk and inequality aversion has not been empirically tested for large representative population samples. Using a representative socio-economic panel for Germany (SOEP), this paper empirically estimates this relationship by linking self-reported subjective well-being, which is taken as a proxy measure for utility, inequality, and a self-reported subjective measure of risk aversion. The empirical results confirm that inequality and risk aversion are strongly related: more risk averse individuals are the more inequality averse. The most risk averse individuals (about 4.5% of the sample) would be indifferent between a 10% inequality increase and a household income increase of 650 per month. For the modal respondent (about 20%) this amount equals 161 euros per month. The most risk averse individuals (21% of the sample) like inequality. 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.

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JEL-codes: D3; D63; I31.

1. Introduction

In recent years there has been an accumulation of empirical evidence suggesting that individuals dislike inequality. 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 empirical evidence has 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. All these studies examine whether inequality aversion is different in countries with different (perceived) social mobility, whether it depends on the political views or income levels of the respondent, and whether it is 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 study whether the correlation between inequality and utility depends on individuals' risk attitudes by using a self-reported measure of satisfaction as a proxy for utility. Although the relation between inequality and risk aversion is theoretically appealing, there is only very few empirical evidence on this respect, all of which is based on a laboratory setting and not on a general sample population. 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 a strong relationship between risk and inequality aversion. This is, we find that more risk averse individuals are also more inequality averse. 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 seems nonetheless too simplistic to explain the distaste

[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.

individuals may have for inequality. Indeed, individuals' preference for inequality are thought to be 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 (Piketty, 1995; Bénabou and Ok, 2001; Ravallion and Lokshin, 2000; Alesina and La Ferrara, 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. Nevertheless, and 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 strongly positive. In the paper we empirically test whether inequality aversion and risk aversion 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, in accordance with previous literature, 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 whether there were elections that year. We also include a set of dummy variables that indicate in which of the 16 federal states the respondent lives (F) and pick up region specific effects, such as institutional or unemployment differences among states. The inclusion of time and region variables will allow us to distinguish the inequality effect from that of other regional and time characteristics, such as unemployment rate, economic growth, and inflation, which we do not specifically control for. The regional and time dummy variables collapse all characteristics that can be correlated with both, inequality and life satisfaction. The most important variable is regional unemployment, as it correlates with life satisfaction and is usually correlated with inequality as well[3].. As a robustness check we have

[3] Unemployment shapes inequality over the business cycle.

regressed equation (4) controlling for regional unemployment separately but this does not change the results and, when also controlling for own unemployment, regional unemployment does not even affect life satisfaction significantly. Therefore, and for reasons of simplicity, the results presented in the paper will not include specific regional and time characteristics (such as unemployment, inflation or regional GDP) and instead their effects will be captured by the regional and time dummy variables.

Since we have longitudinal data, we can include an individual effect (η_i) that captures individual traits that are unobservable and time persistent (e.g. optimism, intelligence, and neuroticism). 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 (2004 and 2006). Although this is not an important limitation, as risk attitudes tend to be invariant over time (see section 3.2 for a discussion), it does imply that there is not much variation over time in the term "$\beta_3 R_{it}$". Thus, besides the individual fixed effect specification, and as a robustness check, 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_i) and the explanatory variables imposed by the individual random effects estimation may not hold in the data. In order to relax the assumption of no correlation between the covariates and the individual random effect, we will follow Mundlak (1978) and introduce the individual mean across time for those variables for which we suspect that correlation may exist. 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), as it is usually done in the literature.

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)[4].

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:

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

How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?

Please tick a box on the scale, where the value 0 means: 'risk averse' and the value 10 means: 'fully prepared to take risks'. You can use the values in between to make your estimate.

0_____1_____2_____3_____4_____5_____6_____7_____8_____9_____10
Risk averse

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 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[5], 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 the two years in which it is measured is 0.30. In the paper, and due to data limitations, 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.

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. Alternately, and to see whether the results are sensitive to this transformation method, we can assume that, as for life satisfaction, the answers to the willingness to take risks are cardinal, i.e. assume that, say, an individual answering a 6 is twice as much willing to take risks as an individual answering a 3. In this case, the regression analysis uses the 0 to 10 willingness to risk answers as explanatory variables. Although the point estimates differ, the conclusions are identical with the two methods.[6]

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

[5] 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).

[6] The results presented in the paper uses the transformed the willingness to take risks answers. The results with the 0 to 10 measure are available upon request.

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)[7], 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.

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

[7] A detailed description of the German SOEP can be found in Wagner et al. (1993). 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.

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 together, the two years in which the question was asked. The average of the two years is 4.475. 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 every year. 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).

In order to assess the importance of individuals' dislike for inequality, we can compare its effect on life satisfaction with that of other variables of interest (e.g. income).For

example, and using the results of Table 2, we can compute the equivalent income of a change in inequality. This is the income change equivalent, in terms of life satisfaction, to a percentage change in inequality. A 0.05 drop in the gini coefficient (which represents about an 18% reduction from the current level) would be equivalent to a 7.84% income increase. Similarly, a 10% reduction in the average gini is equivalent to a 4.3% household income increase. At sample mean, this is 112 Euros per month.

Our inequality aversion estimates are in line with previous empirical evidence. Using the same data for Germany (SOEP) for a time period previous to ours (1985-1998), the same regression-based approach, and estimation method, Schwarze and Haerpfer (2007) find a similar estimate of inequality aversion: a 5.5% income increase offsets the negative effect on life satisfaction of a 10% increase in average inequality.[8]

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,[9] being disabled,[10] 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 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

[8] The effect of the gini coefficient and of log household income on life satisfaction is estimated to be -0.362 and 0.319 respectively.
[9] This is not statistically significant with random effects.
[10] Fixed effects estimates of disability are half the size of random effects estimates because disability does not change much over time for each individual.

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			
	Fixed Effects		*Random Effects*		*Fixed Effects*		*Random Effects*	
	Coeff	*t*	*Coeff*	*t*	*Coeff*	*t*	*Coeff*	*t*
Constant	4.184	20.70	11.380	18.55	4.207	20.82	11.892	19.37
Gini (year/federal)	-0.568	-1.95	-0.607	-2.11	-0.531	-1.83	-0.578	-2.01
Willing. to take risk * gini					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			-5.809	-17.39
Ln(age)^2			0.714	15.63			0.751	16.42
Male			-0.044	-2.79			-0.068	-4.29
German origin			0.048	1.73			0.040	1.45
Ln(household income)	0.348	25.74	0.337	24.96	0.347	25.60	0.335	24.82
Individual has a partner	0.191	10.68	0.229	15.91	0.189	10.56	0.232	16.13
Individual is unemployed	-0.534	-29.65	-0.604	-35.22	-0.535	-29.72	-0.607	-35.38
Individual does not work	-0.028	-2.12	0.001	0.09	-0.027	-2.07	0.002	0.17
Individual is disabled	-0.252	-12.68	-0.460	-27.78	-0.250	-12.59	-0.457	-27.59
Ln(number of adults)	-0.247	-8.84	-0.260	-9.36	-0.245	-8.76	-0.260	-9.36
Ln(number of children +1)	0.045	2.87	0.066	4.23	0.046	2.96	0.067	4.31
Ln(years of education)	0.052	0.87	0.236	3.88	0.041	0.68	0.230	3.78
Mean(Ln(household inc.))			0.549	22.34			0.533	21.71
Mean(Ln(yearseducation))			0.003	0.03			-0.011	-0.15
Mean(LN(nbradults))			-0.546	-10.64			-0.530	-10.34
Mean(Ln(nbrchildren+1))			-0.022	-0.79			-0.019	-0.67
Time & Region dummies	Yes		Yes		Yes		Yes	
R2: Within	0.039		0.036		0.039		0.036	
Number of Observations	170789		170789		170789		170789	
Number of Individuals	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 ($\beta_2 * I * R$, equation (4)) and also allow risk attitudes to have an independent effect on life satisfaction (β_3, equation (4)). The results are shown in specification 2,

Table 2 with both, random and fixed effects. The results of this second specification show that fixed and random effects give almost identical estimates, which are not statistically significantly different.

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 larger the value of the risk measure, the less risk averse the individual is. 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%. 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. 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.

To interpret the role of risk attitudes, we examine how inequality aversion changes with reported risk attitudes. The results show that the effect that inequality has on life satisfaction decreases with increasing willingness to take risks.[11] For the most risk averse individuals (reporting a 0 on the 0 to 10 scale, which corresponds to a -0.189 on the transformed scale) the coefficient of inequality on life satisfaction is -1.952 [= -0.531+(-1.89*0.752)] with fixed effects and -2.011 with random effects. For the least risk averse (reporting a 10, which corresponds to 2.66) the effect is 1.469 [-0.531+(2.66*0.752)] with individual fixed effects and 1.437 with random effects. For an individual responding a willingness to take risks equal to 5 (modal response, which corresponds to a 0.157 on the transformed scale), the effect of the gini coefficient on life satisfaction is -0.413 [-0.531+(0.157*0.752)] with individual fixed effects and -0.459 with random effects. These results imply that for most individuals in our sample the overall effect of the gini coefficient is negative. Notwithstanding this, inequality exerts a

[11] Notice that the average of the transformed risk measure is 0 by construction and therefore at sample means the interaction term takes value zero and the gini coefficient is, as expected, equal in both specifications.

positive effect for 21% of the individuals, those reporting a 7 or more (on the 0 to 10 scale) on their willingness to take risks. Carlsson et al.'s (2005) find that 7% of their subjects in the experiment were inequality lovers and were willing to give up income to have a more unequal society.

We can claim that risk attitudes have a very important role on shaping inequality even to the degree that non risk averse individuals like inequality. In order to assess the importance of risk attitudes in shaping individuals' inequality aversion, we calculate the equivalent income of a 5% gini increase for the different levels of reported risk attitudes. We present the results in Table 3.

While for an individual reporting a 5 on the 0 to 10 scale (the average is 4.5 and the mode is 5) the equivalent income of a 5% gini increase is about 6% (i.e., 161 euros a month at sample means), this amount is about 25% (650 Euros at sample means) for those reporting a 1 on the 0 to 10 risk scale (6.67% of the sample). Those individuals who like inequality (about 23% of the sample) would be willing to give up part of their household income (3 to 23%) to live in more unequal societies (by 5%). As Table 3 shows, for individuals who dislike inequality, the equivalent income to a 5% gini increase ranges (at average income) from 37 to 650 Euros a month. The variations in equivalent income are substantial.

Table 3: Equivalent income to a 5% change in the gini.

	In %	**Euros/month** (average income)
Overall	7.84%	204
By risk attitude: 0 (risk averse) to 10 (risk lover)		
0	24.92%	650
1	20.00%	522
2	16.97%	443
3	13.44%	351
4	10.35%	270
5	6.16%	161
6	1.42%	37
7	-2.94%	-77
8	-9.03%	-236
9	-15.67%	-409
10	-23.11%	-603

In sum, the results using self reported life satisfaction as a proxy for utility indicate that risk attitudes and inequality aversion are strongly related in the sense that more risk averse individuals are also more inequality averse, i.e. risk attitudes determine the effect that inequality has on life satisfaction.

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 specification 2 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 none of the specifications the interaction with gender was statistically significant, we do not present the results here. Table 4 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 after including the other interaction terms. The coefficient for the gini coefficient however becomes statistically insignificant. The impact that this results has on 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. Similarly, the interaction term between risk and inequality remains statistically the same. 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 4: Life Satisfaction. German SOEP, 1997-2004

	FE		**RE**	
	Coeff	***t-value***	***Coeff***	***t-value***
Constant	3.872	6.88	11.039	14.03
Gini (year/region)	0.620	0.32	2.415	1.35
Willingness to take risk	-0.167	-5.20	-0.145	-4.85
Willg. to take risk * gini	0.752	6.68	0.773	7.28
Ln(housd.income) * gini	-0.411	-1.93	-0.661	-3.30
Ln(years education) * gini	0.830	1.40	0.870	1.57
Ln(age)			-5.813	-17.40
Ln2(age)			0.751	16.44
Male			-0.068	-4.30
German origin			0.040	1.46
Ln(household income)	0.460	7.59	0.517	9.07
Individual has a partner	0.190	10.58	0.232	16.16
Individual is unemployed	-0.535	-29.66	-0.605	-35.26
Individual does not work	-0.027	-2.05	0.003	0.21
Individual is disabled	-0.251	-12.60	-0.457	-27.62
Ln(number of adults)	-0.247	-8.84	-0.263	-9.49
Ln(number of children +1)	0.045	2.85	0.064	4.15
Ln(years of education)	-0.180	-1.07	-0.002	-0.01
Mean(Ln(houseincome)			0.539	21.89
Mean(Ln(yearseducation))			-0.023	-0.30
Mean(LN(nbradults))			-0.533	-10.40
Mean(Ln(nbrchildren+1))			-0.015	-0.53
Time & Region(Federal) dummies	yes		yes	
R2: Within	0.039		0.036	
Number of Observations	170789		170789	
Number of Individuals	24168		24168	

The results presented in Table 4 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 these 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) and may partly explain the difference of our results with those of Alesina and La Ferrara (2005) and Alesina and Giuliano, 2009).

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, risk aversion has been said to help explain why individuals may dislike inequality, since it influences the weight that individuals give to the risk of having a worse social or income position in the future. Only until recently, researchers have started to elicit individual preferences for equality separately from individuals' attitudes towards risk and have explored the relationship between the two. So far, this has been only done by means of experiments.

This paper employs two direct measures of utility and risk attitudes from a large and representative panel data set for Germany (SOEP) to identify and estimate risk aversion and inequality aversion, separately. To the best of our knowledge these are the first

estimates ever obtained from representative survey data. We explore the relationship between inequality and risk aversion and find that risk attitudes have an important role in shaping individual preferences for equality: inequality and risk aversion appear to be strongly 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.

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 4 (Table A3).

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

	Specification 1		**Specification 2**	
	Coeff	***t-value***	***Coeff***	***t-value***
Constant	4.184	20.70	4.207	20.82
Time dummy (ref. 2007)				
Time dummy year 1997	0.333	14.31	0.337	14.46
Time dummy year 1998	0.424	19.41	0.428	19.58
Time dummy year 1999	0.449	20.57	0.453	20.75
Time dummy year 2000	0.399	21.36	0.403	21.57
Time dummy year 2001	0.415	21.86	0.419	22.09
Time dummy year 2002	0.248	18.03	0.254	18.47
Time dummy year 2003	0.160	12.14	0.166	12.59
Time dummy year 2004	-0.029	-2.17	-0.022	-1.68
Time dummy year 2005	0.108	8.12	0.108	8.11
Time dummy year 2006	-0.006	-0.51	-0.007	-0.54
gini (year/federal)	-0.568	-1.95	-0.531	-1.83
Willing. to take risk * gini			0.752	6.79
Willingness to take risk			-0.167	-5.29
Ln(household income)	0.348	25.74	0.347	25.60
Individual has a partner	0.191	10.68	0.189	10.56
Individual is unemployed	-0.534	-29.65	-0.535	-29.72
Individual does not work	-0.028	-2.12	-0.027	-2.07
Individual is disabled	-0.252	-12.68	-0.250	-12.59
Ln(number of adults)	-0.247	-8.84	-0.245	-8.76
Ln(number of children +1)	0.045	2.87	0.046	2.96
Ln(years of education)	0.052	0.87	0.041	0.68
Berlin	0.034	0.32	0.030	0.27
Schleswig-Holstein	0.259	2.29	0.256	2.27
Hamburg	0.267	2.15	0.262	2.11
Lower Saxony	0.414	4.86	0.411	4.83
Bremen	0.368	2.41	0.354	2.32
Hesse	0.524	5.59	0.509	5.44
Rhinel.-Palatinate, Saarl.	0.299	3.02	0.306	3.10
Baden-Wuerttemberg	0.160	1.86	0.165	1.93
Bavaria	0.214	2.40	0.218	2.44
Berlin East	-0.164	-1.40	-0.151	-1.28
Mecklenburg-West Pomerania	0.082	0.88	0.091	0.99
Brandenburg	0.037	0.41	0.047	0.52
Saxony - Anhalt	0.067	0.79	0.084	0.98
Thuringia	0.076	0.89	0.091	1.05
Saxony	0.055	0.65	0.071	0.84
Std. dev. Individual fixed effect	1.324		1.322	
Std. dev. Error term	1.205		1.205	
R^2: Within	0.039		0.039	

R^2: Between	0.099	0.104
R^2: Overall	0.083	0.086
Corr(regresors, ind. fixed efft.)	0.100	0.105
Number of Observations	170789	170789
Number of Individuals	24168	24168

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

	Specification 1		**Specification 2**	
	Coeff	***t-value***	***Coeff***	***t-value***
Constant	11.380	18.55	11.892	19.37
Time dummy (ref. 2007)				
Time dummy year 1997	0.197	8.43	0.214	9.13
Time dummy year 1998	0.301	13.71	0.317	14.42
Time dummy year 1999	0.334	15.29	0.349	15.96
Time dummy year 2000	0.310	16.56	0.324	17.31
Time dummy year 2001	0.334	17.64	0.348	18.36
Time dummy year 2002	0.180	13.12	0.195	14.18
Time dummy year 2003	0.100	7.58	0.113	8.61
Time dummy year 2004	-0.078	-5.96	-0.065	-4.95
Time dummy year 2005	0.070	5.30	0.072	5.46
Time dummy year 2006	-0.016	-1.24	-0.015	-1.18
gini (year/federal)	-0.607	-2.11	-0.578	-2.01
Willg. to take risk * gini			0.758	7.25
Willg. to take risk			-0.141	-4.79
Ln(age)	-5.576	-16.71	-5.809	-17.39
Ln2(age)	0.714	15.63	0.751	16.42
Male	-0.044	-2.79	-0.068	-4.29
German origin	0.048	1.73	0.040	1.45
Ln(household income)	0.337	24.96	0.335	24.82
Individual has a partner	0.229	15.91	0.232	16.13
Individual is unemployed	-0.604	-35.22	-0.607	-35.38
Individual does not work	0.001	0.09	0.002	0.17
Individual is disabled	-0.460	-27.78	-0.457	-27.59
Ln(number of adults)	-0.260	-9.36	-0.260	-9.36
Ln(number of children +1)	0.066	4.23	0.067	4.31
Ln(years of education)	0.236	3.88	0.230	3.78
Berlin	-0.222	-4.38	-0.220	-4.35
Schleswig-Holstein	0.169	3.80	0.166	3.74
Hamburg	0.199	3.35	0.190	3.20
Lower Saxony	0.104	3.51	0.102	3.47
Bremen	0.202	2.55	0.181	2.30
Hesse	0.035	1.05	0.029	0.87
Rhinel.-Palatinate, Saarl.	0.062	1.77	0.067	1.91
Baden-Wuerttemberg	-0.105	-3.79	-0.104	-3.74
Bavaria	0.013	0.48	0.015	0.58
Berlin East	-0.484	-8.52	-0.482	-8.50
Mecklenburg-West Pomer.	-0.357	-8.77	-0.361	-8.87
Brandenburg	-0.446	-11.67	-0.449	-11.79
Saxony – Anhalt	-0.402	-10.98	-0.403	-11.02
Thuringia	-0.421	-11.52	-0.424	-11.61
Saxony	-0.394	-11.78	-0.396	-11.86
Mean(Ln(household income))	0.549	22.34	0.533	21.71

Mean(Ln(yearseducation))	0.003	0.03	-0.011	-0.15
Mean(LN(nbradults))	-0.546	-10.64	-0.530	-10.34
Mean(Ln(nbrchildren+1))	-0.022	-0.79	-0.019	-0.67
Std. dev. Ind. Rdm effect	1.092		1.088	
Std. dev. Error term	1.205		1.205	
R^2: Within	0.036		0.036	
R^2: Between	0.187		0.191	
R^2: Overall	0.134		0.136	
Number of Observations	170789		170789	
Number of Individuals	24168		24168	

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

	FE		**RE**	
	Coeff	***t-value***	***Coeff***	***t-value***
Constant	3.872	6.88	11.039	14.03
Time dummy (ref. 2004)				
Time dummy year 1997	0.339	14.51	0.219	9.31
Time dummy year 1998	0.430	19.62	0.322	14.59
Time dummy year 1999	0.455	20.78	0.354	16.11
Time dummy year 2000	0.405	21.63	0.328	17.47
Time dummy year 2001	0.421	22.15	0.352	18.51
Time dummy year 2002	0.255	18.51	0.196	14.25
Time dummy year 2003	0.167	12.62	0.114	8.65
Time dummy year 2004	-0.022	-1.65	-0.064	-4.90
Time dummy year 2005	0.108	8.11	0.072	5.45
Time dummy year 2006	-0.007	-0.55	-0.015	-1.20
gini (year/region)	0.620	0.32	2.415	1.35
Willingness to take risk	-0.167	-5.20	-0.145	-4.85
Willg. to take risk * gini	0.752	6.68	0.773	7.28
Ln(housd.income) * gini	-0.411	-1.93	-0.661	-3.30
Ln(years education) * gini	0.830	1.40	0.870	1.57
Ln(age)			-5.813	-17.40
Ln2(age)			0.751	16.44
Male			-0.068	-4.30
German origin			0.040	1.46
Ln(household income)	0.460	7.59	0.517	9.07
Individual has a partner	0.190	10.58	0.232	16.16
Individual is unemployed	-0.535	-29.66	-0.605	-35.26
Individual does not work	-0.027	-2.05	0.003	0.21
Individual is disabled	-0.251	-12.60	-0.457	-27.62
Ln(number of adults)	-0.247	-8.84	-0.263	-9.49
Ln(number of children +1)	0.045	2.85	0.064	4.15
Ln(years of education)	-0.180	-1.07	-0.002	-0.01
Berlin	0.029	0.27	-0.223	-4.41
Schleswig-Holstein	0.257	2.28	0.165	3.73
Hamburg	0.262	2.11	0.189	3.18
Lower Saxony	0.413	4.85	0.102	3.47
Bremen	0.352	2.30	0.178	2.26
Hesse	0.507	5.41	0.030	0.88

Rhinel.-Palatinate, Saarl.	0.310	3.14	0.067	1.92
Baden-Wuerttemberg	0.168	1.96	-0.104	-3.76
Bavaria	0.220	2.46	0.016	0.60
Berlin East	-0.135	-1.15	-0.471	-8.29
Mecklenburg-West Pomerania	0.100	1.08	-0.355	-8.72
Brandenburg	0.056	0.62	-0.442	-11.58
Saxony – Anhalt	0.097	1.12	-0.393	-10.72
Thuringia	0.102	1.18	-0.416	-11.35
Saxony	0.083	0.98	-0.386	-11.55
Mean(Ln(houseincome)			0.539	21.89
Mean(Ln(yearseducation))			-0.023	-0.30
Mean(LN(nbradults))			-0.533	-10.40
Mean(Ln(nbrchildren+1))			-0.015	-0.53
Std. dev. Ind. fixed effect	1.322		1.087	
Std. dev. Error term	1.205		1.205	
R2: Within	0.039		0.036	
R2: Between	0.104		0.191	
R2: Overall	0.086		0.136	
	0.105			
Number of Observations	170789		170789	
Number of Individuals	24168		24168	