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Abstract

The paper aims to study individual contributions to income inequality. The role of individual positions in the analysis of inequality is considered at various levels. The utility of inequality analysis in analysing the variation across a given income distribution is also recognised. The paper elaborates on this perspective and proposes a definition of individual contributions to inequality within a given income distribution. The concept of such an individual contribution is proposed, and its properties are discussed. The paper presents and tests the hypothesis that given the concept of individual contributions, patterns of influence associated with the determinants of inequality can be identified across a given income distribution. An empirical method of investigation and testing is proposed based on the *Survey on Household Income and Wealth* carried out by the Bank of Italy. The results support the hypothesis and show that the patterns identified are useful in the analysis of inequality.

1. Introduction

Inequality reflects the unequal distribution of an element of interest within a given population. A central characteristic of the concept of inequality is thus the focus on the relative—essentially individual-positions within the distribution (Cowell, 1995). To analyse inequality requires one to circumscribe the object of investigation, usually by synthesising the significant features of the distribution using the appropriate inequality index. Because the distribution investigated relates to a given economic system, the inequality index is treated as a macroeconomic aggregate feature. Scholars have developed theoretical constructs explaining the influence of selected determinants of inequality (causes) on inequality levels

(effects) within a given socio-economic system. Such constructs and theoretical frameworks provide a foundation for empirical investigation and for causal explanations and inferences based on data reflecting the determinants and inequality levels at play. The causal inferences are based on efforts to explain the variance in the inequality measures (Atkinson, 1996, pp. 20 ff.). The individual and system levels are usually connected in the analytical framework through rules of aggregation (Blundell and Stoker, 2005).

As a result, determining causal explanations and inferences requires us to establish the coherence of these two levels of analysis. This paper addresses a particular aspect of the relationship between causal explanation and inference within this specific field of inquiry: namely, we examine some implications of the relationship between the positions within the distribution and the overall index of inequality. The approach that we have chosen is practical and is intended to create opportunities for empirical investigation.

In this study, individual position is determined by each person's level of access to the attribute examined (e.g., income). A person's income establishes her at a certain level (position) within the reference group or population. This position can be identified by jointly taking into account the individual and the reference group. Usually, the relationship between individual conditions and the inequality measure at some level of the socio-economic system is taken for granted; all individual positions are summarised by focusing on the distribution of the attribute at stake, and attention is directed toward the differences between alternative distributions (Lambert, 1989). However, scholars have elaborated on the influence of institutions on individual endowments and opportunities, highlighting the influence of individual socio-economic characteristics (Piraino, 2007; Isaac, 2007) and emphasising the role of each individual as an economic agent or family member, also suggesting that family economic position may remain constant through time because of inheritance (Bowles and Gintis, 2002). Additionally, the debate about the international income distribution and its

relationship to globalisation (Bourguignon and Morrison, 2002; Sala-i-Martin, 2006) underlines the need to study inequality across comparable economic systems (States and/or Regions) using individual units of analysis. In particular, Milanovic (2005, 2006) analyses the implications of competing measures of inequality worldwide and shows how they imply different perspectives, which in turn give rise to different (and sometimes complementary) findings.

In this paper, we contend that the individual position should be considered on a person-by-person basis to compare income distributions (Howes, 1996; Sen 1973). In empirical studies about inequality, the patterns of influence of the determinants of inequality are investigated at the system level, the overall inequality index is used to summarise the individual-level effects of the distributive conditions. A direct focus on individual position is interesting for two essential reasons: (a) individual position directly indicates the influence of the determinants of inequality in the context of the remaining characteristics; (b) using this technique makes it possible to investigate how the determinants of inequality act across the distribution of income. Conversely, when the analysis is based on an overall inequality measure used to summarise the individual positions, it is difficult to study the influence of the determinants at play (Champernowne, 1973). In fact, depending on the sensitivity of the inequality index chosen, part of the information originally conveyed by the distribution may not be accounted for by the inequality measures, making the causal explanation provided by the empirical investigation less rigorous.

To address this issue, we introduce an index that reflects each individual's contribution to overall income inequality in a given distribution. We use conceptual analysis (Mair, 2008; Sartori, 1984, 2009a) to frame the object and the properties of the proposed index. The aim of this study is to contribute to the existing literature by proposing an index that reflects the person-by-person perspective (Howes, 1996; Sen, 1973) in analysing the determinants of

inequality and thereby to adopt an approach that, to our knowledge, has not previously been used in this field of inquiry. Our methodological approach involves two steps. First, we address the individual contribution to inequality via conceptual analysis (Sartori, 1984, 2009a) to determine the basic characteristics of the object on which we are focusing. Then, we begin our empirical investigation. This paper is divided in two parts. First, having introduced our method (section 2), we propose the problem to be addressed (section 3), which is mainly defined in terms of the consequences of neglecting the person-by-person perspective by using overall measures of inequality. In section 4, we characterise the person-by-person perspective, present a conceptual analysis of the index of individual contributions to inequality and discuss its properties. The second part of this paper is dedicated to an empirical analysis of the empirical qualities of the index proposed (section 5). The last section presents some final remarks.

2. Method of the study

In the analysis of macroeconomic variables, aggregation is recognised as essential because, through there is much to be learned from rational individual behaviour, "there must be an explicit bridge to economic aggregates because real people and their situation are so very heterogeneous" (Blundell and Stoker, 2005, p. 384). Both empirical investigation and theoretical explanation are largely based on assumptions allowing to deal with adequate aggregates of individuals (Aghion *et al.*, 1999; Bertola, 2000; Benabou, 1996; Barro, 2000; Forbes, 2000; Tempe, 1999).

The main objective of this study is to indicate that when the sensitivity of the inequality index is high, focusing on individual positions in analysing personal income inequality and maintaining the person-by-person perspective allows one to make causal inferences without considering the effects of aggregation. Toward this end, we first consider the relationship

between causal explanation and causal inference. We develop this analysis by examining a specific portion of the literature and conclude that the effort to determine causal effects may be problematised by the sensitivity of the inequality index. To address this issue, we introduce the concept of individual contributions to inequality and apply it in an empirical context. This methodology weights qualitative analysis developed using natural language, above quantification (Sartori, 2009b) and thus privileges conceptual analysis. A concept is a basic unit of thought (Sartori, 2009a; Gerring, 1999) and includes (Fig. 1) a meaning, a term and an object (Sartori, 1984, 2009a).

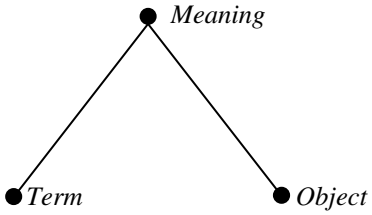


Figure 1. The basic scheme: intension and extension

The intension of a concept joins together the characteristics and/or properties associated with or included in it, whereas the extension of a concept is the class of all objects to which the concept correctly applies (Sartori, 2009a, p.103). The characteristics of an object must be separated into "non-(or least) observable properties" (which are mainly of interest in theoretical studies) and the observable characteristics that are normally of interest in empirical investigations (Sartori, 2009a, pp. 104-105). The intention and the extension of a concept are inversely correlated Sartori, (2009a, pp. 118-119); one can climb the "ladder of abstraction" to achieve a more inclusive concept, with three levels of abstraction useful for comparison (Sartori, 2009b, pp. 22-24). The individual contribution to inequality is an empirical concept in the sense that it can be rendered in terms of testable propositions that confirm or invalidate it (Sartori, 2009a). Our analytical strategy is based on identifying the defining properties - achieved via a denotative definition (section 4)- and then exploring a set of accompanying

characteristics that are presumed to be meaningful in the context of the analysis of inequality. The discussion is also intended to ensure that our concept is univocally comprehensible (Sartori, 2009a, pp. 107-109). Finally, we assess the goodness of the concept formation using the eight criteria introduced by Gerring (1999) and briefly presented in Table 1.

Table 1. Criteria for conceptual goodness

Labels	Content
Familiarity	How familiar is the concept (to a lay or academic audience)?
Resonance	Does the chosen term ring (resonate)?
Parsimony	How short is (a) the term and (b) its list of defining attributes (the intension)?
Coherence	How internally consistent (logically related) are the instances and the attribute?
Differentiation	How differentiated are the instances and the attributes (from other most similar concepts)? How bounded, how operationalisable, is the concept?
Depth	How many accompanying properties are shared by the instances under definition?
Theoretical utility	How useful is the concept within a wider field of inference?
Field utility	How useful is the concept within a field of related instances and attributes?

To our knowledge, no conceptual analyses of inequality have been carried out using a structured approach. Nevertheless, given the extent to which the research about inequality considers its intension and the foundations of the measures, this research is well suited to conceptual analysis. (Sen, 1973; Lambert, 1989; Champernowne and Cowell, 1998; Cowell 2000). Finally, Milanovic (2005) compares three concepts of inequality but does not explicitly discuss the analytical organisation of the characteristics taken into account.

3. The "person-by-person perspective" and the investigation of determinants of inequality

The empirical investigation of the determinants of inequality at the level of given economic systems is usually intended to explain the variance in the inequality index based on determinants drawn from economic theories and chosen as covariates. This diffused approach follows Atkinson's view of inequality and provides increasing information about patterns of

influence. It can help to support theories and increase understanding regarding the complex phenomenon of inequality. Nevertheless, it seems that under specific conditions, it can be problematic to construct rigorous causal explanations. In particular, it can be problematic to deviate from the person-by-person perspective that should be adopted in comparing the distributions comparison and then in the empirical analysis. In the following, we investigate the potential consequence of the sensitivity of an inequality index on developing a causal explanation. We have two premises. First, an explanation of variance focuses on estimating the causal effect of the determinants and highlights the relationship between causal effects and causal explanation. Second, we can contextualise the problem addressed here by analysing issues related to the deviation from a person-by-person perspective. Based on these premises, we propose that the sensitivity of an inequality index may complicate the construction of a rigorous causal explanation.

3.1. *A premise: causal effect, causal inference and causal explanation*

Explaining the variance in an inequality index involves two steps: (a) estimating the effects on the inequality of variables drawn from theoretical models; and (b) constructing a causal explanation based on the effects estimated. From this perspective, the determinants of inequality are thought of as causes, i.e., events or conditions that increase the probability of some outcome's occurring (Gerring, 2005, p. 169). The starting point involves considering each determinant as a cause of the level of inequality observed. Examining the causal effects makes it clear that the usual approach entails such estimates.

In a given a population U of units u, a *cause* is the variable x to which each unit is exposed (e.g., an estimate regarding the rate of growth of the economy). In the simplest case, there are two possible levels, $x=t$ (the *treatment group*) and $x=c$ (the *control group*) (Holland, 1986, p. 946). In studies of inequality, the variable to be explained (the *response variable*) is an

inequality index $I(y_j)$ that indicates the distribution of the attribute of interest y_j (e.g., personal income). It is important to note that the response variable is measured using the pairs (u,t) and (u, c). The effect of the cause $x=t$ on u as measured by $I(y_j)$ and relative to the cause $x=c$ is the difference (Holland, 1986):

$$\beta = I_t\left(y_j\right) - I_c\left(y_j\right) \tag{1}$$

Nevertheless, it is impossible to observe the values $I_t(y_j)$ and $I_c(y_j)$ for the same units. For instance, it is impossible to observe the effect of a positive and of a null rate of growth on the same unit during the same time period. Therefore, it is impossible to observe the causal effect of t on u (the *fundamental problem of causal inference*). Furthermore, King *et al.* (1994) emphasise the need to distinguish between systematic and non-systematic components of the phenomenon investigated. One of the goals of inference is to learn about the systematic features of the random variables characterising the phenomena (King *et al.*, 1994, pp. 56-57). This makes the fundamental problem of inference more complex (King *et al.*, 1994, p. 82) but still makes it possible to derive the *mean causal effect* (see also Holland, 1986, p. 947). An unbiased estimation of the mean causal effect is based on the following relationship:

$$E\left[I\left(y_j\right)\right] = \beta x_j \tag{2}$$

and can be achieved via a least square regression estimate (King *et al.*, 1994; see also Mahoney, 2008). According to (2), most of the empirical analysis intended to explain the variance in the inequality index involves estimating the causal effects of the determinants.

The second step in the explanation is based on theoretical interpretation. This step is connected to the first: while causal explanation is related to theory, the associated causal inferences are related to data (Holland, 1986; West and Thoemmes, 2010), and causal effects are centrally associated with causal inference (Holland, 1986, p. 947). As a result, a rigorous causal explanation will also be based on the causal effect estimation.

In causal models of explanation (Runde, 1998), explanations are intended as answers to *why questions*, and a very common type of answer provides information about the causes associated with the model. The factors singled out as causes and the information about them help to ensure the accuracy and informativeness of the description of the causes, which in turn helps to sustain the causal explanation (Runde, 1998). Accordingly, theoretical inquiry on inequality can be thought of as research on the causal explanation for phenomena, and the attempt to answer typical "why questions" (e.g., why does growth increase inequality?) is intended to provide information about the cause of the phenomenon at hand (e.g., the connection between growth and inequality).

In constructing rigorous causal explanations, we test both the factors singled out and the information about the cause by investigating four characteristics based on answers to four specific questions (Runde, 1998, pp. 158 ff.): the pertinence, effectiveness, sufficiency and depth of the potential causes. Gerring (2005) argues that the empirical testing for causal arguments is strictly linked to the theoretical explanation of causation and identifies seven factors that help to determine the goodness of a research design. Among them, *variation* refers directly to causal inference (Holland, 1986). It addresses the covariational, regular nature of empirical evidence of a causal relationship (Gerring, 2005, pp. 187-188). Variation is related to causal inference because the causal effect (see below), which is central to causal inference, is estimated using a statistical approach that takes into account variation in both the response (effect) and the treatment variable (cause). King *et al.* (1994), West and Thoemmes (2010) and Shadish (2010) point out that a key feature of causal inference is external validity: the extent to which it pertains to the population level (Shadish, 2010, p.4). External validity is also related to representativeness, an additional factor that indicates the comparability of the sample and the population (Gerring, 2005; p. 186). Furthermore, Runde (1998, pp. 164 ff.) shows how competing causal explanations can be developed and then eliminated via an

assessment process to achieve an acceptable explanation. The elimination process is based on (a) *a priori* principles (e.g., logical principles); (b) the nature of the available data; (c) and principles governing the identification of causes and the comparison of causal explanations. A further connection between casual inference and causal explanation is established by through the nature of the data, which in economics entail empirical regularities (Runde, 1998, p. 163). *Variation* and *representativeness* are central to estimating causal effects and reflect the *nature of the data*. Therefore, the analysis of causal effects helps to create a basis for causal explanation. We aim to argue in the following that this idea is relevant to the study of inequality. To develop this point, it is necessary to contextualise the problem that we aim to address in considering the sensitivity of the inequality index.

3.2. *The person-by-person perspective*

To analyse overall measures of inequality by studying the influence of given determinants requires us to deviate from the person-by-person perspective and consider different income distributions in the same economic system at different points in time or in different economic systems within the same time period. It is necessary to adopt a point of view centred on the individual position because of the comparison being made.

The comparison between the distributions is always made with some degree of reference to the question of dominance[1]. Howes (1996) highlights Sen's suggestion that the dominance theorem applies to Lorenz curves drawn on a person-by-person perspective basis (Sen, 1973, p. 58, cited by Howes, 1996, p. 257). The departure from a person-by-person perspective

[1] A distribution A Lorenz dominates a distribution B if every cumulative proportion of the population p has a greater share of the total income than do the corresponding group in population B (Lambert, 1989, p. 34). The theorem of Atkinson (1970) was the first to give terms under which such Lorenz inequality comparison has a normative significance (Lambert, 1989, p. 61; Atkinson and Bourguignon, 2000, p. 43).

introduces a number of difficulties associated with investigating patterns of inequality, two of which can be drawn from literature and the third of which is addressed in this study.

The first example is the problem caused by aggregation. Howes (1996) focuses on aggregation achieved by ordering the original disaggregated distribution from poorest to richest, dividing the ordered units into a number of groups and using the means of these groups[2] for his analysis. He considers whether an increase in aggregation will result in an increase or decrease in the probability of ranking the distribution and, furthermore, whether an increase in aggregation will result in an increase or decrease in the reliability of inferences made about dominance. Howes (1996, p. 269) suggests that one must consider the level of disaggregation to conduct welfare analysis using dominance criteria and that aggregation can lead to an unacceptable increase in the probability of wrongly inferring dominance (Howes, 1996, p. 269). The departure from a person-by-person perspective in such a case would lead us to question the outcome of the comparison because of the deviation from its theoretical requirements. The second challenge is indicated in the literature on global inequality, which has progressively focused on the need to calculate inequality measures using global distribution rather than country-based income distributions. Sala-i-Martin (2006) argues that using countries as the unit of analysis in investigating inequality requires one to take into account population-weighted distributions of per capita income. Milanovic (2005, 2006) introduces the distinction between three concepts of inequality used in the empirical analysis and indicates the need to focus on individual positions to investigate the true inequality observable across countries. He recognises the need to construct a worldwide income distribution to analyse the evolution of global inequality patterns. This approach is implicitly related to the person-by-person perspective because it focuses on information from the

[2] What Howes (1996) means when he uses the term "aggregation" is of course different from what Blundell and Stoker (2005) mean.

income recipients within the distribution. The point is that the person-by-person perspective allows one to capture income differences on the appropriate geographical scale. Conversely, making a comparison using country-based distributions would mean applying a correct criterion to an unclear target because differences in personal income would be accounted for by considering individuals with the same income at different positions indicated in the country-based distribution. The failure to use a person-by-person perspective also causes an additional problem related to the degree of sensitivity of inequality indexes. We will address this problem below.

3.3. *Inequality determinants and sensitivity of inequality index*

For comparative purposes, it is convenient to use a single number to represent the inequality inherent in a single distribution (Lambert, 1989, p. 35; Atkinson, 1996). In the empirical context, analysing the inequality index in conversation with the determinants at play requires single-number comparisons. In other words, the search for an empirical explanation of the variation of inequality measures is usually based upon empirical relationships between specific inequality indexes and the appropriate specifications for the possible determinants of inequality. To illustrate this idea, it is worth considering the following:

- X_{ij} = determinants acting at the level of the *j.th* unit in the *i.th* system;
- Y_{ij} = response variables at the level of the *j.th* unit in the *i.th* system;
- $M(Y_{ij})$ = index of the determinant X_{ij} calculated at the level of the the *i.th* system;
- $I(Y_{ij})$ = index of inequality calculated on Y_{ij} at the level of the the *i.th* system.

In investigating causal inference at the level of economic systems, we consider a sample of N systems and determine measures based on the following causal relationship:

$$M\left(X_{ij}\right) \rightarrow I\left(Y_{ij}\right) \tag{3}$$

According to King *et al.* (1994) , the mean causal effect β is then:

$$E\left[I\left(y_{ij} \right) \right] = \beta M\left(x_{ij} \right) \tag{4}$$

Nevertheless, the causal relationship that the economic theory emphasises considers the individual agents in the economic system:

$$X_{ij} \rightarrow Y_{ij} \tag{5}$$

Therefore, the mean causal effect, which will contribute to the causal inference, is

$$E\left[Y_{ij} \right] = bX_{ij} \tag{6}$$

Figure 2 provides a broad picture of the relationship between the influence of the determinants of inequality and the search for empirically grounded causal explanations.

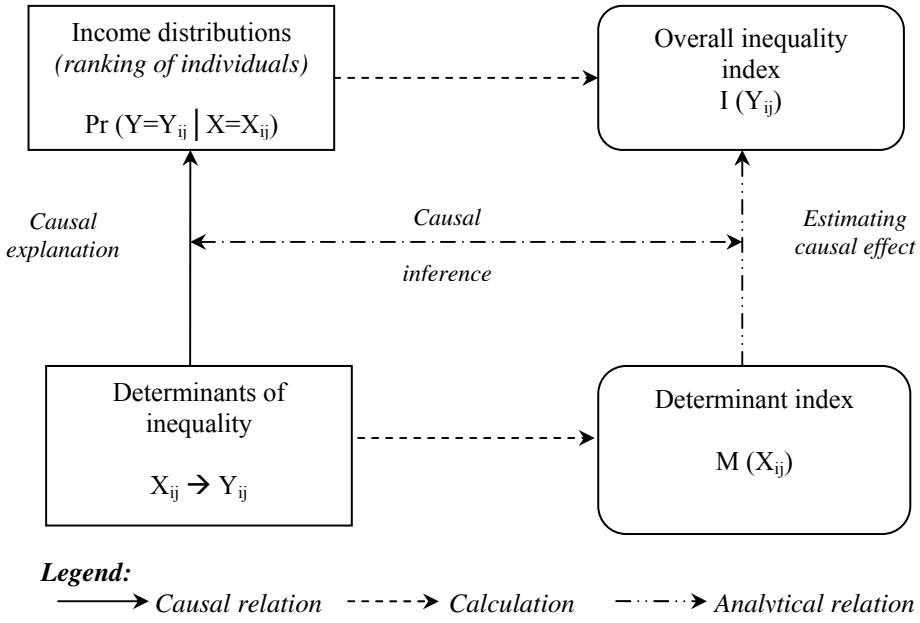


Figure 2. A broad structure of the empirical investigation on inequalities

This illustration suggests that the estimated causal effects (at the system level) must take into account the individual level for us to develop or support a causal explanation. We can address the relationship between the coefficients β and b in terms of aggregation; the rules of aggregation allow us to estimate the system-level parameters that are coherent with the individual level (Blundell and Stoker, 2005; Lippi and Forni, 2003). Furthermore, analysing

the structure of inequality is seen as illuminating personal or social characteristics that determine the economic conditions of an individual, household, or particular group (Champernowne and Cowell, 1998, p.188). Nonetheless, when we are considering the sensitivity of the inequality index, two conditions must be met:

a) we must verify the capacity of the aggregation hypothesis to address all of the relevant information from the overall measure of inequality;
b) we must test whether or not the hypothesis holds in the empirical context.

To explore this point further, we should examine the implications of sensitivity[3]. If technological progress is occurring, according to the traditional model, an increase in the supply of capital should create an increase (decrease) in the proportion of the total reward of the capital if the elasticity of substitution for capital and labour is larger (smaller) than one (Champernowne and Cowell, 1998, p. 126). The elasticity of substitution will not usually be constant across different economic systems or throughout the time for the same system. Therefore, changes in the income of some groups in a population within a given economic system (say, workers and capitalists) may occur that may be not accounted for by the inequality index if it does not accurately capture income changes for such groups. Assume for example that a portion of the capitalists are clustered in the upper tail of the personal income distribution and that the inequality index chosen is sensitive and does not correctly capture the income changes occurring at the upper end of the distribution. Suppose that the inequality index is calculated for the given country across time and regressed on an index of technological progress. It is clear that the variance in the inequality index cannot account for the changes of income occurring at the upper end of the income distribution during each year. As a result, if the elasticity of substitution is constant over time, the index of technological

[3] The sensitivity of the inequality indexes implies that they may vary inconsistently based on income changes (Champernowne and Cowell, 1989, pp. 82-84).

change will not provide any information about the distributive consequences of the change in income. If the elasticity if substitution varies across time, the distributive consequences of technological progress vary, and the technological index becomes even less sufficient. When the influence of a determinant affects patterns of change that are variable across a distribution, the sensitivity of the inequality index may keep us from developing a correct explanation of the observed variability in the inequality measure based on such a determinant. Of course, investigating the structure of inequality can require attention to control variables in exploring the patterns of influence of the determinants at play, which will create a more accurate association between the inequality overall measure and the variation in the determinants. Nonetheless, dissimilar economic systems may require different ways of explaining the development of inequality (Champernowne and Cowell, 1998, p. 137); there is no unified theory of economic inequality as of yet (Atkinson and Bourguignon, 2000). Hence, it seems less likely that we can reduce the effect of sensitivity and the variable influence of the determinants of inequality. However, the difficulties posed by the sensitivity of the index can be addressed via a direct focus on individual position. In the following, we briefly consider the attention paid to individual position in the literature and introduce the index of individual contributions to inequality.

4. The individual contribution to the income inequality

As discussed in section 3.1, individual position with regard to inequality is considered in the literature from various standpoints. In a basic approach to the study of inequality, Atkinson (1970) identifies the theoretical foundations of inequality measures by comparing two different distributions. While the concept of equally distributed equivalent income levels creates an inequality index with desirable properties, it clearly does not account for individual characteristics. Furthermore, ranking the distributions based on social welfare function means

deriving social preference rankings over income distributions based on the order of personal preference (Lambert, 1989, pp.91-93). Moran (2003, p.365) has pointed out that the magnitude of and change in inequality must be interpreted using subjectively defined criteria. More specifically, based on the measures associated with the Lorenz curve, an area of the same size underlying the curve can be associated with different shapes (statistical effect) (Moran, 2003, p. 357). Furthermore, the Gini index cannot distinguish between "convergence" to the global mean and "clustering" around local means. As a result, differences among societal groups may be obscured (Moran, 2003, p. 357). The validity of summary measures remains indubitable, but they cannot provide information about real patterns of inequality (Moran, 2003) and do not reflect individual positions as necessary in the study of inequality. In this section, we consider how to characterise individual positions in terms of their contribution to inequality within a distribution. Analytical frameworks are drawn from economic theory to identify the relationship between individual positions and inequality measures and to provide a basis for the normative interpretation of inequality. The analysis carried out at the individual level seems able to facilitate this approach. Because the relationship between the individual positions and the inequality measure is known (as with measures of concentration, for example), analysing the relationship between the factors affecting inequality and individual position may provide us with additional information related to patterns of influence within the distribution at stake (e.g., the distribution of income). As "heterogeneity is a pervasive and indisputable fact of the economic life" (Blundell and Stoker, 2005, p.384), the individual contribution to inequality allows to take it directly into consideration. We define the individual contribution to inequality below to elaborate on this proposition.

4.1. *Defining properties of the individual contribution to inequality*

4.1.1. Denotative definition

"A denotative definition is intended to seize the object and entails the following problems: a) establishing boundaries; b) sorting out the membership of any given denotatum; c) deciding the cut-off point *vìs-a-vìs* marginal entities (Sartori, 2009a; 1984)".We define the individual contribution to inequality as the degree to which the $i.^{th}$ recipient in a distribution, according to the resources she has at stake (e.g., personal income), adds to the measure of inequality. The contribution of the $i.^{th}$ individual to the overall income inequality is the degree to which this individual adds to the overall income inequality. This contribution depends jointly upon the level of income of the individual and her position within the distribution. On the other hand, income *per se* does not fully indicate the individual contribution because it does not provide any information about the person in comparison with other individuals, whereas individual position *per se* (e.g., as indicated by ranking the individuals in terms of their income) is not informative because it does not include any quantitative information about the "marginal addition" caused by the $i.^{th}$ individual.

4.1.2. Precising definition

The precising definition helps to solve the membership problem by precisely demarcating the boundaries of the group in which the object in question must be included (Sartori, 2009a, p. 108). The individual contribution is required to connect the attribute at stake with the overall measure of inequality at the individual level. The individual contribution does not tell us anything about overall inequality, only how the $i.^{th}$ position and income contribute to it. It is not an inequality index; thus, it does not have the properties of an inequality index (Champernowne and Cowell, 1998) but rather provides individual quantities that indicate how the overall measure is formed along the distribution.

4.1.3. Operational definition

The operational definition allows one to solve the measurability problem. Consider the income distribution provided in appendix (A.1) where y_i is the income of the *i.th* poorest person in a society comprised of *n individuals*. A straightforward way to account for individual contributions to overall inequality can be derived from the Lorenz curve.

Let P_i equal the fraction of the population made of the *first i poorest persons* and Q_i the amount of income associated with that fraction. The contribution arising of that fraction of the population P_i to inequality can be defined as follows:

$$c_i = P_i - Q_i \tag{7}$$

which is a basic element of the simplest concentration measure:

$$G_i = \sum_{i=1}^{n-1} \left(P_i - Q_i \right) \tag{8}$$

The difference:

$$\Delta c_i = \left(P_i - Q_i \right) - \left(P_{i-1} - Q_{i-1} \right) \tag{9}$$

directly corresponds to the *i.th* individual and indicates to what degree the overall measure of concentration G varies when the *i.th* individual is considered. Equation (9) thus expresses the individual contribution to inequality. The relative index (Δc_i) can be formulated simply, indicating its connection to relative mean deviation and measures of individual disadvantage. After preliminary manipulation, equation (9) yields the following (Appendix A.1):

$$\Delta c_i = \frac{1}{n}\left(1 - \frac{y_i}{\bar{y}} \right) \tag{10}$$

where the term in brackets is just an element of the calculation of the well-known relative mean deviation (Cowell, 1995). On the other hand, Jayaraj and Subramanian (2006) introduce an index of inequality at the group level (horizontal inequality) and considered vertical

measures of inequality that refer to atomistic groups including just one component. One of the indexes proposed is as follows:

$$d_i^1 = \left(\frac{m(j)}{n} - \frac{Y(j)}{Y} \right) m(j) \tag{11}$$

where m(j) is the number of individuals in *group j* and Y(j) is the total income of the individual of the group (Jayaraj and Subramanian, 2006, pp. 125-126). For an atomistic group, the index becomes:

$$d_i^1 = \left(1 - \frac{y_i}{\bar{y}} \right) \tag{12}$$

which directly refers to (10), indicating that the individual contribution to inequality is also associated with the concept of horizontal inequality. A way of characterising individual contributions is proposed in terms of defining and accompanying characteristics.

4.2. *Accompanying properties*

Two accompanying characteristics of the individual contribution to inequality can be identified with respect to two specific aspects of individual position: relative poverty and deprivation. The relationship between poverty and inequality is to some extent controversial and complex because poverty and inequality are differently understood and have different roots (Cowell, 1995, p. 10; Ravallion, 2001; Atkinson, 2004). However, because individual contributions are negatively associated with personal income, they are expected to be positively associated with the poverty index based on income. The second characteristic to consider is the relationship between individual contributions and deprivation (Ruciman, 1966). A person is thought to be relatively deprived of a good X when (a) he does not have the good X; (b) he sees some other person or persons who have the good X; (c) he wants X; and (d) he sees it as feasible that he could have the good X (Ruciman, 1966, p.10). Scholars

have identified a direct relationship between individual position and inequality measures through the concept of deprivation (Yitzhaki, 1979). Wang and Tsui (2000) show that the elements of the Gini index can be interpreted as having a marginal effect on the aggregate deprivation index. However, deprivation and individual disadvantage (Jayaraj and Subramanian, 2006) are different concepts. Therefore, even though a positive relationship is expected to exist between individual contributions and deprivation, whereas individual contributions indicate the objective position of the individual within the distribution, deprivation reflects her perceptions regarding her personal position in terms of income.

4.3. *Level of abstraction and assessment of the concept information*

The ladder of abstraction reflects the structure of a concept, and considering it can help us to understand how to make gains, "climbing the ladder", without an unnecessary decrease in precision or empirical testability (Sartori, 2009b, p. 22). Table 2 compares three concepts related to individual position *(income, rank or position in the income distribution, and contribution to inequality)*, drawing from Sartori (2009a, 2009b) to propose a relative characterisation of the individual contribution to inequality in term of the ladder of abstraction.

Table 2. Income individual position: ladder of abstraction

Concepts	Logical properties *(comparison)*		Comparative purpose	Level of abstraction
Individual income	Intension Extension	+ 0	Income comparison for pairs of groups	Configurative conceptualisation
Individual rank or position in the income distribution	Intension Extension	+ +	Distributional ordering	General conceptualisation and taxonomies
Individual contribution to inequality	Intension Extension	++ ++	Formation of overall inequality	General conceptualisation and taxonomies

The extension of the individual contribution is larger than that of the remaining two indexes because it entails not only the absolute or relative condition of an individual as a recipient but, also individual conditions as a factor that directly influences overall inequality. Its intension is

also larger than those of the other indexes because it involves the manipulation of original income levels and is connected with poverty and deprivation. According to Sartori (2009b, p. 23), the high level of abstraction can be seen as the "ultimate genus which cancels all its species". Thus, the intension is at the minimum level when the extension is at the maximum. At the low level of abstraction, the extension is sacrificed to preserve the accuracy of the intension. The medium level lies between the two above. We suggest that with regard to inequality, the differences between the three concepts are related to difference on the level of abstraction, with rank ordering and individual contributions apparently able to provide a medium level of conceptualisation. The conceptual analysis ends with an assessment of concept formation. The *familiarity* of the concept is based on its degree of conformity with the concept of inequality. The index of individual contributions is clearly not an inequality index but rather determines the amount of inequality in a given distribution. Reasonableness seems important because it points out that an overall measure of inequality is the result of quantities associated with individual positions. The basic properties of the individual contribution are summarised parsimoniously in the definition provided. The properties are coherent because they pertain to individual position in terms of income. Poverty is related to socially defined characteristics of the income recipient, whereas deprivation entails the personal assessment of individual rank. This concept is also different from both inequality and the other elements of individual position. The depth of the concept is not great given its low number of properties. Whereas the concept is only helpful on a theoretical level in that it may assist us in integrating theories of inequality, it is also applicable in the field because it can help us to determine the influence of determinants of inequality determinants unaffected by the sensitivity issue.

5. Empirical analysis

5.1. *Drawing a hypothesis from the individual contribution to inequality concept*

The individual contribution to inequality has two defining characteristics. First, the index increases if individual income decreases, whereas it decreases if income increases (Appendix A.2). Therefore, there is an association between measures of poverty and inequality based on personal income: the poorest units in a population are expected to exhibit the larger contribution to inequality. The second property is that the larger the individual contribution is, the larger the degree of overall inequality is as measured in terms of concentration (Appendix A.3) or mean relative variance. This property provides a conceptual basis for investigating how the determinants of inequality exert their influence within the distribution. In other words, if we assume that a factor *X* will have an influence on the inequality measure *G* associated with the distribution or just on Δc_i, then the second property allows us to create the causal sequence $X \rightarrow \Delta c_i \rightarrow G$, which indicates that the influence of the factor *X*, ceteris paribus, contributes on the individual level to the degree of inequality. Table 3 delineates the index.

Table 3. Basic characterisation of Δc_i

Defining properties	*Accompanying properties*
Negative correlation with individual income	Positive correlation with relative poverty index
Positive association with the overall measure of inequality	Positive association with measures of deprivation

Given that many factors are expected to have an influence on inequality (Audet *et al.*, 2008; Praveen Parbteeah and Cullen, 2003), two competing conjectures are proposed concerning the distribution of personal income:

H1: If the influence of the j^{th} determinant of inequality does not vary across the distribution, then the relationship between the j^{th} determinant and the overall measure of inequality *G* will be fully informative.

H2: If the influence of the j^{th} determinant of inequality varies across the distribution, then patterns of influence can be identified and analysed within the distribution.

H1 and **H2** are tested via empirical analysis.

5.2. *Model and data*

The empirical analysis is intended to test the two hypotheses. The quantile regression approach (Koenker, 2005) has been used to identify patterns of influence associated with the selected determinants of inequality. For this purpose, both individual and system variables were considered. The individual characteristics were related to the capacity to enhance personal income (Audet *et al.*, 2008; Forbes, 2000). The data were collected from the Survey on Household Income and Wealth (SHIW, Bank of Italy) and from Istat (Italian Central Bureau of Statistics). Table 4 shows the variables considered.

Table 4. List of variables

Variables	Symbol	Codes	Source
Individual level variables			
Gender	*Gender*	1= male, 2=female	SHIW
Skills (degree)	*Study*	From 1=no diploma to 8=PhD	SHIW
Age	*Age*	n. of years	SHIW
Professional level	$apqcod_{(year)}$	1=unemployed, 2=temporary employment; 3=dependent employment; 4=independent employment	SHIW
Sector of activity	*Sett*	1=agriculture, 2=industry 3=public services, 4=other services, 5=no sector	SHIW
System level variables			
Geographic area	*Area5*	1=Northwest, 2=Northeast; 3=Centre; 4=South, 5=Islands	SHIW
Social capital	*Capsoc*	Principal components	Sabatini (2005)
Productivity of labour in manufacturing	$Prod_{(year-1)}$	Average GDP per unit of labour in manufacturing during the period	Istat
Level of GPD per capita at the beginning	*Lgdp*	Log of average GDP per capita in 1990-1991	Istat
Rate of growth of GDP per capita in the period 1991-2001	*Rgdp*	Rate of growth of GDP per capita in the period 1990/1992-1999/2001	Istat

The data on social capital were collected from Sabatini (2005); this is a principal component involving several subfactors (family networks; friendship networks; rates of social and political participation). The system variables *capsoc*, $prod_{(year-1)}$, *lgdp* and *rgdp* were

measured at the regional level. The analysis was carried out in two steps. First, the relationships between individual contributions and the index of deprivation and relative poverty were investigated to provide examples of the accompanying characteristics. Then, the two alternative hypotheses were tested by estimating five quantile regression models for the whole period considered. The seminal contribution of Kuznets (1955) created a long-running debate about the relationship between growth and inequality. Competing theoretical approaches and conflicting evidence emerge in this field. On the one hand, the direction of causality is unclear. Persson and Tabellini (1994), Alesina and Rodrik (1994), Garcia-Peñalosa (1995) and many others consider the influence of inequality on growth, suggesting the existence of a positive or negative relationship between inequality and growth. There are various theoretical explanations used to account for contrasting empirical evidence (Alesina and Rodrik, 1994; Benabou 1996; Barro, 2000; Forbes, 2000). On the other hand, the idea of reverse causality -which in this case would indicate the influence of growth on inequality- has been also studied (Deininger and Squire, 1996; Dollar and Kraay, 2002; Ravallion and Chen, 1997. Recently, Assane and Grammy (2003) and Pèrez-Moreno (2009) have addressed the issue using the Granger causality analytical approach with outcomes that seem to sustain the idea of a negative relationship between growth and inequality levels. This paper focuses on the relationship between growth (*Lgdp, Rgdp*) and individual contributions (Δc_i), considering the direction of causality to run from growth to inequality (Pèrez-Moreno, 2009).

5.3. *Results*

The variable Δc_i was calculated based on net total disposable income. The descriptive statistics of Δc_i are presented in Table 5 (1998-2006). First, the relationship between deprivation and the individual contribution to inequality is considered. For the sake of simplicity, we examine just the year 2006. The pattern of the relationship between Δc_i and

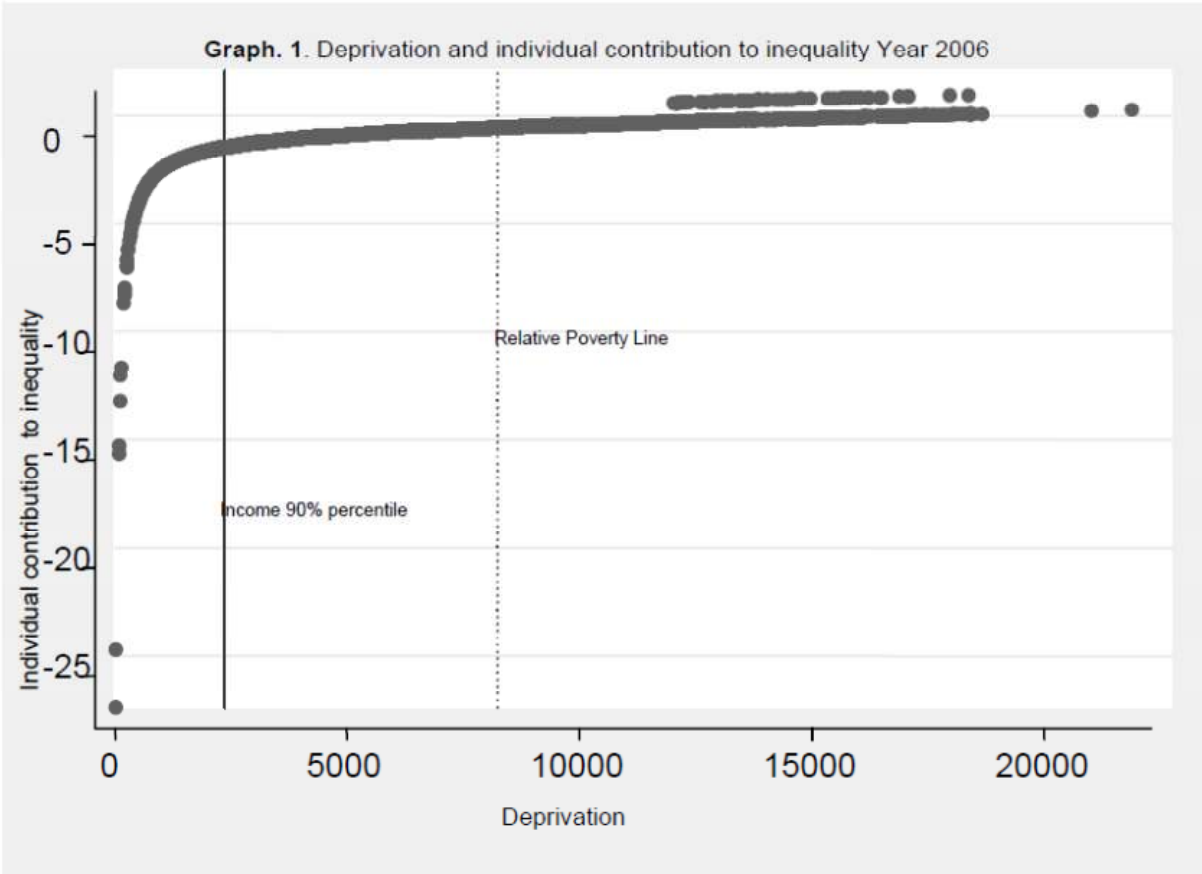
income is directly predictable by definition (Wang and Tsui, 2000) but must still be interpreted.

Table 5. Descriptive statistics for the individual contribution to inequality 1998-2006

Statistics	Δc_i 98	Δc_i 00	Δc_i 02	Δc_i 04	Δc_i 06
Mean	3.61E-10	9.52E-08	1.22E-09	-8.59E-10	5.50E-11
C.V.	224513.5	660.3117	50862.86	-91282.98	1450902
Skewness	-9.4257	-6.2772	-5.9531	-18.3770	-20.2710
Quantile 25	-1.78E-05	-1.60E-05	-1.58E-05	-1.44E-05	-1.78E-05
Quantile 50	1.41E-05	1.15E-05	1.32E-05	1.25E-05	5.92E-06
Quantile 75	4.00E-05	3.42E-05	3.35E-05	3.40E-05	3.33E-05
Kurtosis	215.1518	100.6421	84.8895	757.2981	795.1238

Source: our calculations based on data of the SHIW (Banca d'Italia)

We examine the relationship between marginal deprivation and income. The coefficient of correlation between net disposal income and individual "per Euro" deprivation, defined according to Wang and Tsui (2000), is -0.5890. The relationship between Δc_i and deprivation is more complex and difficult to interpret (Graph 1).



First, note that Δc_i increases rapidly only for large income: according to (3), income larger than the net disposable income. This is the approximate threshold beyond which the rate of growth of Δc_i drastically changes. It is also easy to see how the new rate of growth is very low and does not change very much within the very large range of deprivation (the dotted vertical line indicates the level of deprivation corresponding to relative poverty of 12500 Euro/year). Individual disadvantage and deprivation are both connected to individual income, but an income threshold exists at which deprivation is substantiated by individual relative disadvantage Δc_i. The disjunction between Δc_i and deprivation underlines the subjective nature of deprivation compared with Δc_i, which in turn indicates aspects of income availability. Considering individual disadvantage allows one to identify a range of deprivation values that are not related to significant income differences (on the left side of the 90th percentile line) but rather appear just to express positional perceptions (Hirsch, 1977) regarding personal income. We can now also consider the second accompanying characteristic: the positive association between inequality and the poverty index. Sala-i-Martin (2006) points out that the analysis of poverty can be affected by subjective choices about the poverty lines used. In this study, four different measures of relative poverty have been used to examine the relationship between Δc_i and poverty (5000, 7500, 12000 Euro/year per capita). Table 6 shows the Pearson correlation coefficients with Δc_i (the Spearman correlation coefficients are larger).

Table 6. Individual contribution and poverty
Correlation matrix (year 2006)

	POV_5000	POV_7000	POV_12000
Δc_i1998	0.24	0.27	0.37
Δc_i2000	0.23	0.28	0.41
Δc_i2002	0.31	0.40	0.54
Δc_i2004	0.24	0.31	0.41
Δc_i2006	0.11	0.15	0.21

Source: Elaboration of SHIW 2006 data

The positive relationship between poverty (each variable takes the value of 1 if the observed unit has net disposal income lower than the poverty line assumed) and Δc_i indicates that poor individuals suffer larger relative disadvantage than richer ones. The tests for hypotheses **H1** and **H2** were carried out by estimating a quantile regression model for each year in the time period considered. The OLS models are presented in Table 7.

Table 7. OLS regression - Year 1998–2006

Variables	Year = 1998		Year = 2000		Year = 2002		Year = 2004		Year = 2006	
	Coef.		Coef.		Coef.		Coef.		Coef.	
Gender	0.0000404	***	0.0000322	***	0.0000309	***	0.0000311	***	0.0000069	***
	(1.28e-06)		*(9.81e-07)*		*(9.33e-07)*		*(1.25e-06)*		*(1.35e-06)*	
Study	-0.0000159	***	-0.0000151	***	-0.0000154	***	-0.000015	***	-0.0000128	***
	(4.20e-07)		*(3.19e-07)*		*(3.13e-07)*		*(4.19e-07)*		*(4.49e-07)*	
Age	-0.0000016	***	-0.0000012	***	-0.0000011	***	-0.0000011	***	-0.0000005	***
	(4.57e-08)		*(3.45e-08)*		*(3.47e-08)*		*(4.46e-08)*		*(5.05e-08)*	
$Apqcod_{(year)}$	-0.0000170	***	-0.0000064	***	-0.0000043	***	-0.0000015	***	-0.0000038	***
	(9.09e-07)		*(6.24e-07)*		*(6.09e-07)*		*(5.42e-07)*		*(9.24e-07)*	
Area5	0.0000034	***	0.0000022	***	0.0000016	***	0.0000021	***	0.0000034	***
	(7.70e-07)		*(5.70e-07)*		*(5.26e-07)*		*(7.30e-07)*		*(6.81e-07)*	
Sett	n.s.		0.0000028	***	0.0000043	***	0.0000078	***	0.0000031	***
			(5.85e-07)		*(5.67e-07)*		*(6.08e-07)*		*(8.41e-07)*	
Capsoc	-0.0000024	***	-0.0000032	***	-0.0000033	***	-0.0000035	***	0.0000011	***
	(5.62e-07)		*(4.19e-07)*		*(3.77e-07)*		*(5.48e-07)*		*(3.65e-07)*	
$Prod_{(year-1)}$	-0.0000004	***	n.s.		-0.0000003	***	n.s.		n.s.	
	(1.18e-07)				*(8.13e-08)*					
Lgdp	0.0043620	*	0.0045363	***	n.s.		0.0075911	***	n.s.	
	(0.0022693)		*(0.0017341)*				*(0.0021469)*			
Rgdp	0.0022529	**	0.0022626	***	n.s.		0.0037316	***	n.s.	
	(0.0011215)		*(0.0008583)*				*(0.0010607)*			
cons.	0.0001310	***	0.0000683	***	0.0000693	***	0.0000305	***	0.0000600	***
	(8.45e-06)		*(6.34e-06)*		*(6.05e-06)*		*(7.34e-06)*		*(9.57e-06)*	
N. obs	12717		14321		14031		13937		13428	
F(10, N.)	410.82		454.40		459.91		260.45		119.35	
Prob > F	0.0000		0.0000		0.0000		0.0000		0.0000	
R-Sq.	0.2443		0.2410		0.2470		0.1576		0.0817	
Adj R-Sq	0.2437		0.2405		0.2465		0.1570		0.0810	

*Standard errors in bracket; Sig.: 1% ***, 5% **, 10% *, n.s. not significant.*

Most of the coefficients estimated are very significant. The signs of the individual variables are as expected: Δc_i increases with gender (the males are in a better position than the females); the higher individual skill and age are, the lower the value of Δc_i is. The variable $Apqcod_{(year)}$ indicates that unemployed persons or those engaged in temporary employment are in a worse position than employed individuals. *Sett* indicates that individuals employed in industry and services are in a better position than those employed in the primary sector. The quantile

regression results are illustrated in Table 8. The coefficients of the variable *Capsoc* are not statistically significant in the models for quantile 25 and 50 for the year 2006. In all of the remaining models, the coefficients are significant and negative. This indicates that social capital reduces the individual contribution to inequality. Furthermore, there is evidence that the size of the coefficients varies across quantiles such that the intensity of the influence is larger when we move from the first to the third quantile.

Table 8. Quantile regression - 1998-2006

Quantile	Variables	Year = 1998 Coef.		Year = 2000 Coef.		Year = 2002 Coef.		Year = 2004 Coef.		Year = 2006 Coef.	
q25	Gender	0.0000409 *(1.19e-06)*	***	0.0000337 *(1.01e-06)*	***	0.0000329 *(9.98e-07)*	***	0.0000321 *(1.32e-06)*	***	0.0000057 *(8.94e-07)*	***
	Study	0.0000014 *(6.73e-07)*	***	0.0000015 *(5.07e-07)*	***	0.0000011 *(5.48e-07)*	*	0.0000017 *(5.48e-07)*	***	0.0000032 *(4.92e-07)*	***
	Age	-0.0000011 *(3.68e-08)*	**	-0.0000006 *(4.24e-08)*	***	-0.0000006 *(3.45e-08)*	***	-0.0000002 *(3.98e-08)*	***	n.s. *(5.13e-08)*	
	$Apqcod_{(year)}$	-0.0000209 *(4.92e-07)*	***	-0.0000102 *(4.81e-07)*	***	-0.0000106 *(6.01e-07)*	***	-0.0000013 *(5.02e-07)*	**	-0.0000065 *(6.53e-07)*	***
	Area5	0.0000024 *(5.35e-07)*	***	0.0000022 *(5.08e-07)*	***	0.0000014 *(6.46e-07)*	**	0.0000024 *(7.35e-07)*	***	0.0000027 *(4.75e-07)*	***
	Capsoc	-0.0000020 *(3.89e-07)*	***	-0.0000038 *(3.09e-07)*	***	-0.0000039 *(4.06e-07)*	***	-0.0000038 *(5.01e-07)*	***	n.s.	
	$Prod_{(year-1)}$	-0.0000005 *(6.44e-08)*	***	n.s.		-0.0000004 *(1.23e-07)*	***	-0.0000004 *(1.04e-07)*	***	-0.0000005 *(1.03e-07)*	***
	Lgdp	n.s.		n.s.		n.s.		0.003773 *(0.0019932)*	*	n.s.	
	Rgdp	n.s.		n.s.		n.s.		0.0018133 *(0.0009908)*	*	n.s.	
	cons.	0.0000403 *(3.09e-06)*	***	-0.0000186 *(4.78e-06)*	***	n.s.		-0.0000412 *(7.86e-06)*	***	n.s.	
q50	Gender	0.0000257 *(9.96e-07)*	***	0.0000230 *(7.70e-07)*	***	0.0000221 *(7.29e-07)*	***	0.0000252 *(7.66e-07)*	***	0.0000060 *(7.95e-07)*	***
	Study	0.0000020 *(4.72e-07)*	***	0.0000007 *(3.22e-07)*	**	0.0000008 *(3.40e-07)*	**	n.s.		0.0000016 *(2.51e-07)*	***
	Age	-0.0000008 *(3.40e-08)*	***	-0.0000005 *(2.20e-08)*	***	-0.0000005 *(2.73e-08)*	***	-0.0000001 *(1.96e-08)*	***	-0.0000001 *(3.37e-08)*	**
	$Apqcod_{(year)}$	-0.0000177 *(4.02e-07)*	***	-0.0000117 *(4.02e-07)*	***	-0.0000112 *(4.86e-07)*	***	-0.0000019 *(3.05e-07)*	***	-0.0000086 *(4.98e-07)*	***
	Area5	0.0000028 *(3.71e-07)*	***	0.0000022 *(2.79e-07)*	***	0.0000020 *(3.99e-07)*	***	0.0000024 *(3.59e-07)*	***	0.0000029 *(2.50e-07)*	***
	Capsoc	-0.0000014 *(3.28e-07)*	***	-0.0000028 *(2.24e-07)*	***	-0.0000025 *(2.76e-07)*	***	-0.0000028 *(2.29e-07)*	***	n.s.	
	$Prod_{(year-1)}$	-0.0000002 *(6.82e-08)*	***	n.s.		-0.0000001 *(6.34e-08)*	**	-0.0000001 *(7.29e-08)*	*	-0.0000004 *(6.72e-08)*	***
	Lgdp	0.0031800 *(0.0010649)*	***	n.s.		n.s.		n.s.		n.s.	
	Rgdp	0.0016038 *(0.0005201)*	***	n.s.		n.s.		n.s.		n.s.	
	cons.	0.0000521 *(3.93e-06)*	***	0.000023 *(3.00e-06)*	***	0.0000318 *(5.30e-06)*	***	-0.0000144 *(4.37e-06)*	***	0.0000297 *(4.30e-06)*	***

Table 8. *Cont'd*

q75	Gender	0.0000192	***	0.0000180	***	0.0000177	***	0.0000231	***	0.0000059	***
		(8.47e-07)		*(5.72e-07)*		*(5.38e-07)*		*(5.00e-07)*		*(8.57e-07)*	
	Study	0.0000006	*	n.s.		-0.0000008	**	-0.0000011	***	-0.0000019	***
		(3.28e-07)				*(3.68e-07)*		*(3.15e-07)*		*(2.21e-07)*	
	Age	-0.0000006	***	-0.0000004	***	-0.0000004	***	-0.0000001	***	-0.0000002	***
		(2.20e-08)		*(1.59e-08)*		*(1.82e-08)*		*(1.72e-08)*		*(3.21e-08)*	
	$Apqcod_{(year)}$	-0.0000143	***	-0.0000105	***	-0.0000101	***	-0.0000012	***	-0.0000092	***
		(4.06e-07)		*(3.98e-07)*		*(3.75e-07)*		*(3.75e-07)*		*(6.42e-07)*	
	Area5	0.0000032	***	0.0000023	***	0.0000022	***	0.0000023	***	0.0000051	***
		(6.00e-07)		*(2.49e-07)*		*(3.30e-07)*		*(4.22e-07)*		*(3.31e-07)*	
	Capsoc	-0.0000012	***	-0.0000019	***	-0.0000014	***	-0.0000022	***	-0.0000005	***
		(3.90e-07)		*(1.99e-07)*		*(2.32e-07)*		*(2.11e-07)*		*(1.66e-07)*	
	$Prod_{(year-1)}$	n.s.		n.s.		-0.0000001	**	n.s.		-0.0000001	*
						(3.60e-08)				*(6.78e-08)*	
	Lgdp	0.0043939	***	0.0034400	**	n.s.		0.0048109	***	0.0055758	***
		(0.0010414)		*(0.0013783)*				*(0.0012898)*		*(0.0017257)*	
	Rgdp	0.0022183	***	0.0016748	**	n.s.		0.0023319	***	0.0027565	***
		(0.0005198)		*(0.0006844)*				*(0.000642)*		*(0.0008602)*	
	cons.	0.0000610	***	0.0000405	***	0.0000465	***	n.s.		0.0000445	***
		(4.77e-06)		*(2.97e-06)*		*(2.97e-06)*				*(4.64e-06)*	
	N. obs	12717		14321		14031		13937		13428	
q25	Pseudo R-sq	0.1511		0.1044		0.0912		0.0725		0.0326	
q50	Pseudo R-sq	0.1416		0.1130		0.0987		0.0703		0.0441	
q75	Pseudo R-sq	0.1407		0.1299		0.1173		0.0856		0.0448	

*Standard errors in bracket; Sig.: 1% ***, 5% **, 10% *, n.s. not significant.*

This would indicate that an individual with a larger contribution (i.e., the poorest) exploits the opportunities provided by social capital less fully. The coefficient productivity index, intended here to proxy the development of regional economic systems, is generally significant and negative. In our view, this indicates that the level of development of regional economic systems helps to decrease individual contributions to inequality. Nonetheless, the coefficients are not statistically significant in many cases, and therefore, the relationship is not fully proven. Economic growth influences individual contributions to inequality in a way that changes across the samples. First, it must be pointed out that the coefficients of *Lgdp* and *Rgdp* are not statistically significant in many models but that the influence of quantiles 50 and 75 for the year 1998 is clear, as is that of the last quantile for the years 2000, 2004 and 2006. The signs are positive. The evidence suggests that economic growth expressed in terms of *Lgdp* and *Rgdp* increases the individual contribution of the persons above quantile 75 (the poorest).

The two alternative hypotheses were evaluated by testing for the equality of the coefficients across the models of quantile regression (Koenker and Basset, 1982). The results are presented in Table 9 and show that most of the coefficients are really different across the models.

Table 9. Test of the equality of the parameters across the quantiles

Quantile	Year	Gender	Study	Age	$Apqcod_{(year)}$	Area5	Capsoc	$Prod_{(year-1)}$	Lgdp	Rgdp
q25 vs q50		269.00 ***	n.s.	146.02 ***	64.78 ***	n.s.	n.s.	11.86 ***	n.s.	n.s.
q25 vs q75	1998	359.47 ***	n.s.	179.63 ***	139.59 ***	n.s.	n.s.	19.67 ***	n.s.	n.s.
q50 vs q75		79.40 ***	12.21 ***	41.65 ***	54.36 ***	n.s.	n.s.	4.11 **	n.s.	n.s.
q25 vs q50		232.60 ***	n.s.	4.21 **	28.96 ***	n.s.	8.17 ***	n.s.	4.18 **	4.29 **
q25 vs q75	2000	315.15 ***	13.61 ***	20.20 ***	n.s.	n.s.	24.14 ***	n.s.	5.09 **	5.09 **
q50 vs q75		97.00 ***	14.02 ***	35.13 ***	27.98 ***	n.s.	19.29 ***	n.s.	n.s.	n.s.
q25 vs q50		122.12 ***	n.s.	3.51 ***	13.57 ***	n.s.	24.66 ***	5.48 ***	n.s.	n.s.
q25 vs q75	2002	253.93 ***	15.08 ***	36.07 ***	n.s.	n.s.	45.46 ***	6.74 ***	n.s.	n.s.
q50 vs q75		36.36 ***	27.02 ***	38.64 ***	1.55 ***	n.s.	32.07 ***	n.s.	n.s.	n.s.
q25 vs q50		39.44 ***	8.24 ***	4.07 ***	4.90 ***	n.s.	4.63 **	8.03 ***	n.s.	n.s.
q25 vs q75	2004	43.78 ***	19.18 ***	4.17 ***	0.00 ***	n.s.	12.03 ***	9.85 ***	n.s.	5.69 **
q50 vs q75		14.06 ***	19.73 ***	n.s.	2.74 *	n.s.	5.20 **	n.s.	5.23 **	n.s.
q25 vs q50		n.s.	7.90 ***	7.68 ***	1.69 *	n.s.	n.s.	n.s.	n.s.	n.s.
q25 vs q75	2006	n.s.	94.29 ***	23.57 ***	16.90 ***	n.s.	12.55 ***	2.56 *	11.74 ***	11.36 ***
q50 vs q75		n.s.	145.59 ***	30.99 ***	12.81 ***	24.27 ***	20.70 ***	2.04 *	11.63 ***	11.67 ***

This corroborates hypothesis **H2** and confirms that (a) the patterns of influence of determinants of inequality varies within the distribution and that (b) information about inequality can be drawn from these patterns.

6. Concluding remarks

The paper assumes that individual contribution to inequality is of interest to researchers both looking to corroborate theories and seeking to identify the consequences of changing levels of inequality. A measure for the individual contribution to inequality is proposed based on the coordinates of the Lorenz curves that can be interpreted in terms of measures of concentration and individual relative disadvantage according to Jayaraj and Subramanian (2006). The relationships between individual contributions and other distinctive individual aspects of inequality are empirically examined and interpreted based on existing theories. In particular,

our empirical analysis provides evidence that the Δc_i index helps to highlight possible differences between deprivation index values that are not due to income differences. Furthermore, our analysis of the relationship between Δc_i and poverty indicates that the poor are more disadvantaged. We also find confirmation that studying individual contributions can reveal patterns of influence of determinants of inequality. Our index is clearly influenced by gender, skills, age, occupational status and social capital, though the expected relationships between inequality and productivity, GDP level and GDP growth were not fully proved. Finally, based on the quantile regression, we can see that these patterns are highly informative and that they vary within the distribution. Because we can analyse these patterns, we can also investigate inequality by focusing on individual positions within the distribution using limited data. One possible strand of future research might focus on the influence of technological change and credit markets on the individual contribution to inequality.

APPENDIX

A.1. *Definition of the individual contribution to inequality*

Consider an income distribution (i.e., a non-negative, non-decreasingly *ordered n-vector* $y=(y_1 \ldots y_i \ldots y_n)$ in which y_i is the income of the i^{th} poorest person in a society comprised of *n individuals* and $0 \leq y_i \leq y_i+1$. Let Pi equal the fraction of the population made of the *i poorest persons*, and make $Q_i = Y_i/Y$ the amount of income belonging to this fraction, with $Y_i = y_1 + y_2 + \ldots + y_i$ and Y equal to total income. Then the individual contributions to inequality can be calculated using the difference

$$\Delta c_i = \left(P_i - Q_i\right) - \left(P_{i-1} - Q_{i-1}\right) \tag{A1.1}$$

In reality,

$$\Delta c_i = \left(P_i - P_{i-1}\right) - \left(Q_i - Q_{i-1}\right) \tag{A1.2}$$

$$\Delta c_i = \left(\frac{i}{n} - \frac{i-1}{n}\right) - \left(\frac{y_1 + y_2 + \ldots + y_{i-1} + y_i}{n} - \frac{y_1 + y_2 + \ldots + y_{i-1}}{n}\right) \tag{A1.3}$$

$$\Delta c_i = \frac{1}{n} - \left(\frac{y_i}{Y}\right) \tag{A1.4}$$

$Y = n\bar{y}$ where $\bar{y}$ is the mean income; then,

$$\Delta c_i = \frac{1}{n} - \left(\frac{y_i}{n\bar{y}}\right) \tag{A1.5}$$

$$\Delta c_i = \frac{1}{n} - \frac{1}{n}\left(\frac{y_i}{\bar{y}}\right) = \frac{1}{n}\left(1 - \frac{y_i}{\bar{y}}\right) \tag{A1.6}$$

which is the definition reported in the text.

A.2. *Individual contribution to inequality and income*

Assume that the personal income of the i^{th} changes from y_i to y_i*. The individual contribution to inequality changes as well, and the difference between the two values is as follows:

$$\Delta \dot{c}_i = \frac{1}{n}\left(1 - \frac{y_i}{\bar{y}}\right) - \frac{1}{n}\left(1 - \frac{y_i^*}{\bar{y}}\right) \tag{A2.1}$$

$$\Delta \dot{c}_i = \frac{1}{n} - \frac{y_i}{n\bar{y}} - \frac{1}{n} + \frac{y_i^*}{n\bar{y}} \tag{A2.2}$$

$$\Delta \dot{c}_i = -\frac{1}{n\bar{y}}\left(y_i - y_i^*\right) \tag{A2.3}$$

$\Delta \dot{c}_i < 0$ if $y_i > y_i^*$. Δc_i increases if individual income decreases.

$\Delta \dot{c}_i > 0$ if $y_i < y_i^*$. Δc_i decreases if individual income increases.

A.3. ***Individual contribution to inequality and concentration***

Let:

$$G = \sum_{i=1}^{n-1}\left(P_i - Q_i\right) \tag{A3.1}$$

a measure of the concentration of the attribute y. G can also be written as

$$G = \sum_{i=1}^{n-1}\left(P_i - Q_i\right) + \left(P_k - Q_k\right) \tag{A3.2}$$

Assume that the income of the k^{th} unit changes from y_k to y_k^*; then,

$$G^* = \sum_{i=1}^{n-1}\left(P_i - Q_i\right) + \left(P_k - Q_k^*\right) \tag{A3.3}$$

$$G^* - G = -Q_k^* + Q_k \tag{A3.4}$$

$$G^* - G = -\frac{y_1 + y_2 + \ldots + y_k^*}{Y} + \frac{y_1 + y_2 + \ldots + y_k}{Y} \tag{A3.5}$$

$$G^* - G = -\frac{y_k^*}{Y} + \frac{y_k}{Y} \tag{A3.6}$$

The concentration and individual contribution decrease when individual income increases.

$$G^* - G < 0 \text{ if } y_k^* > y_k \Rightarrow \Delta c_i < 0 \tag{A3.7}$$

The concentration and individual contribution increase when individual income decreases.

$$G^* - G > 0 \text{ if } y_k^* < y_k \Rightarrow \Delta c_i > 0 \qquad \text{(A3.8)}$$

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