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I. ARTICLES

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INCOME DISTRIBUTION, GROWTH AND WELL-BEING: EVIDENCE OF A QUANTITATIVE APPROACH FOR SELECTED OECD COUNTRIES [**]

In this paper we provide evidence on the cross-country and intertemporal dynamics of aggregate welfare. Firstly, we apply and compare alternative inequality indexes to have an insight on the actual within-country income distribution. The same measures, combined with information on average incomes, are then used to quantify the impact of inequality on social welfare and to obtain a comparative assessment of well-being levels, determined according to Bernoulli's hypothesis, across space and time.

The empirical application has been carried out on 10 selected OECD countries for the period 1970-2000, using a dataset that combines comparable data on per capita incomes from Penn World Tables with income distribution information drawn from the World Income Inequality Database.

The results obtained highlight how inequality-accounting welfare measures significantly modify the perception of well-being, affecting both the within-country evolution of aggregate welfare and inter-countries well-being levels. Finally, for selected sub-periods, the issue of progressivity of income growth process has been considered to evaluate whether or not income growth leads to lower inequality over time.

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1. INTRODUCTION

Despite wide agreement that real national income per capita or mean household income, and the corresponding growth rates, are inadequate measures of aggregate social welfare, they are still the most widely used indicators for cross-country and intertemporal comparisons of economic well-being.

The necessity of overcoming the complete disregard for the welfare implications of income inequality, implicit in such measures, has received a

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broad and growing consensus in theoretical and empirical studies (Jenkins, 1997; Gruen and Klasen, 2007). In particular, cross-national studies on real income levels have shown how economic well-being not only depends on the size of national income but also on distributional considerations, suggesting that, *ceteris paribus*, high income inequality reduces aggregate welfare. Moreover, the huge debate on the relationship between economic growth and income inequality (Deininger and Squire, 1998; Dollar and Kraay, 2002) has not only highlighted the complexity of the interpretation of the growth-inequality causality nexus, but has also renewed, through the analysis of income production and distribution processes, the debate on the central topic of the existing links between the quantitative and qualitative aspects of economic growth.

Since Pigou's (1912) contribution, the proposition that economic well-being depends upon the size, distribution and variability of national income has been at the basis of the economic analysis of social welfare: "…*the economic welfare of the country is intimately associated with the size of the national dividend, and changes in economic welfare with changes in the size of the dividend*"; … "*any cause which increases the absolute share of real income in the hands of the poor, provided that it does not lead to a contraction in the size of the national dividend from any point of view, will, in general, increase economic welfare*".

However, only recently theoretical and empirical studies have been concerned with considering distribution-weighted measures, which goes beyond aggregate income statistics by explicitly incorporating distributional components, to appraise the levels of economic well-being in different countries and their evolution over time.

Cross-country differences or changes over time in real per capita income can be interpreted as differences in social welfare only under stringent assumptions, requiring that either all consumers are identical and consume the same commodity bundle or the distribution of income is optimal or constant (Samuelson, 1947; Graaff, 1957). One way of overcoming these limitations is to directly assess income distribution in welfare evaluation, rather than treating growth and distribution as two separate issues. Most theoretical and empirical studies (Atkinson, 1970; Sen, 1976) have highlighted the importance of including a distributional component that penalizes rising income inequality in defining well-being indexes.

In this paper, we propose an integrated approach to real welfare measurement, which incorporates both size and distributional considerations,

and introduce and compare alternative measures of well-being. Alternative real income indexes are proposed, which combine mean per capita incomes and measures of income inequality along the line of the approach proposed by Atkinson (1970), Kolm (1969) and Sen (1973). In particular, following Lovell (1998) and Araar and Duclos (2003, 2005), we consider a class of inequality indexes that extends the features of the Atkinson index to derive alternative measures of social welfare, which account for both income and rank inequality aversion and explicitly incorporate interpersonal comparisons of utility in the assessment of social welfare. These indexes complement quasi-ordering methods such as generalized Lorenz dominance criterion, by providing cardinal measures of social welfare, and allow us to carry out cross-country comparisons and to trace well-being dynamics over time, exploiting the recent availability of internationally comparable data on per capita incomes and their distribution across countries and time (Heston *et al.*, 2002; WIID, 2007).

The rest of the paper is organized as follows. Section 2 focuses on the theme of income distribution and its relationships with well-being in the history of economic thought. Section 3 discusses theoretical and methodological issues connected to measurement and comparisons of social welfare levels across countries and time. Specific attention is devoted to the analysis of different measures of well-being proposed, which account for different types of inequality in income distribution. The dataset used for the empirical application, based on internationally comparable data on income distribution taken from the World Income Inequality Database (WIID, 2007), is presented in Section 4. Section 5 presents the results of the empirical analysis, focusing on both international and intertemporal trends in aggregate well-being. In particular, besides measuring and comparing welfare levels by means of alternative cardinal indexes, we also focus on the relationship between real income growth and welfare dynamics. Section 6 concludes the paper.

2. THE RELATIONSHIPS BETWEEN WEALTH, INCOME DISTRIBUTION AND WELL-BEING IN THE HISTORY OF ECONOMIC THOUGHT

After the publication of the "Wealth of Nations", Malthus wrote that Adam Smith's work dealt not only with the nature and causes of nations' wealth, but also with the nature and causes of nations' happiness. In particular, this work

was focused on the happiness and welfare of the lower classes, being then the largest social classes in every nation ["*The professed object of Dr Adam Smith's inquiry is the nature and causes of the wealth of nations. There is another inquiry, however, perhaps still more interesting, which he occasionally mixes with it, I mean an inquiry into the causes which affect the happiness of nations or the happiness and comfort of the lower orders of society, which is the most numerous class in every nation"* (Malthus, 1826)]. Malthus point of view is certainly very interesting, because it shows the interest of economic science in distributional problems connected to the relationship between the amount of goods available for the community and the satisfaction of individual needs, which is the conclusion of the economic activity.

Therefore, right from the historical beginning of economic science, the topic of income distribution and population well-being was one of the main themes, but long before this subject had been studied by Aristotle from both a social and political side. Indeed it is obvious that individual well-being derives from the satisfaction of needs through the consumption of the available amount of real income, but, if we trace back the causes of aggregate welfare, the social and political aspects of this topic become apparent, showing the relevance of the way in which income is distributed among individuals in determining social well-being.

Indeed Aristotle writes (Aristotle, *Politics,* Book V): "*Since we analyse the causes of revolutions, it is necessary to trace them* [1302, 17-19]…*Beyond violence and unconstrained desire of wealth, changes in States constitutions occur when the poor's number increases unboundedly, because the biggest conflicts are those between wealth and poorness* [1303b, 13-17]". From these words one derives the existing connection between income distribution, happiness of nations and social cohesion, as observed also by Malthus, who underlines how the well-being of a community is not only based on the *quantity* of produced and available income, but also on its *quality*, that is, in the way it is shared among citizens.

This kind of relationship is at the very basis of socialist thought; concerning this point, it is enough to quote De Sismondi, according to whom *"…the whole of available goods has to be distributed among people in proportions that cannot be changed without causing serious dangers*" (De Sismondi, 1847, p. 118).

The thought of Pigou can be linked to these considerations. The author, after defining the general principle according to which the starting point of

welfare economics consists in the analysis of real per capita income of a country, claims that real income can be linked to and affect social welfare in three different ways: "*First, it is linked by its size; the bigger real income is, the bigger a community's welfare is likely to be. Secondly, it is linked through the way in which is shared out among people; the more evenly the cake is shared out, when its total size is given, the more welfare it is likely to yield.* […] *Lastly, there is a linkage by way of time incidence. The more evenly real income is distributed over time, the bigger welfare is likely to be; large and violent fluctuations are obviously hurtful"* (Pigou, 1952, pp. 66-67).

Analyzing Pigou's claims, the first concerns the link between income and welfare, i.e., the utility function, and involves the issues connected to the specification of the functional form of both individual and aggregate utility functions. The second claim relates to distributional issues, because an identical amount of overall income can provide different aggregate well-being depending on its distribution. Thirdly, the topic is studied under a dynamic perspective, linking income and welfare changes over time, further emphasizing the relationship between the quantitative and qualitative aspects of economic science.

According to the author's thought, this topic is strictly connected to the relationship between inequality in income distribution and the functionality of the economic system. Assuming that the existence of a balanced distribution of incomes among individuals is fundamental to assure the effectiveness and efficiency of markets, then inequality of income distribution may damage economic development. This consideration leads the author to conclude that, in order to ensure an adequate and balanced growth path for the economic system, it is necessary to reach the lowest possible inequality of income distribution.

The study of the relationship between wealth and well-being is therefore referred to the topic of personal income distribution. On the basis of available statistics, the works of Lorenz (1905), Gini (1912) and Pareto (1920) provide the first outstanding contribution to the quantitative analysis of income distribution, relating both to the shape of the curves that specify the distributive assets and the determination of concentration and inequality indexes.

In this context, the issue of an ordinal approach to the utility and welfare measuring becomes relevant: referring to Pareto the utility is not liable to cardinal measuring and a distributive system can be defined as better than another only when it is possible to increase the welfare of an individual

without damage to anybody else. This statement is absolutely substantial, but we think that we cannot leave out the use of quantitative measures to explain the welfare dimension through the level of individual or collective real income.

The present research deals with the topic of the relationship between income distribution and economic well-being by considering both ordinal and cardinal approaches, in order to provide an assessment of economic welfare both across countries and over time, and so to bring the economic research closer to the ultimate purpose of economic activity, which the classical economists define as satisfaction of needs.

3. THEORETICAL FRAMEWORK

3.1. Social choice and welfare comparisons

One of the main aims of welfare economics is the ordering of alternative social states in terms of social welfare. Welfare rankings of different income distributions inevitably involve comparisons of gains and losses of utility of different income groups.

However, as pointed out by Sen (1973), "traditional" welfare economics has focused on issues that involve no conflict between individuals, and offers very little help when distributional issues have to be concerned. Following Robbins's (1932, 1938) critique of the utilitarian and neoclassical welfare theory, welfare economics should avoid interpersonal comparisons of utilities and refrain from yielding any distributional judgment. The basic theorems of welfare economics addressed the relationship between competitive equilibria and Pareto optimality and was therefore deemed the only acceptable criterion as it involves only considerations on efficiency of income distribution among individuals and cut out any distributional judgement.

The inadequacy of the Pareto principle and the necessity of extending the Paretian social welfare judgements beyond the unlikely cases of non-conflicting situations have generated a huge debate. The Bergson-Samuelson social welfare function approach (Bergson, 1938; Samuelson, 1947) went in this direction and was partly motivated by the necessity of going beyond the Pareto optimality. The social welfare function (SWF) is a real value function defined over a set of alternative social states. If X is the set of social states, the SWF is then an ordering defined over X and can be numerically defined

as a functional relation that assigns a welfare value $W(x_i)$ to each social state x_i belonging to X. The most general Bergson-Samuelson SWF can be expressed as:

$$W(x) = W\left[U_1(x_1), U_2(x_2), \ ..., U_n(x_n)\right] \tag{1}$$

where $U_i(x_i)$ is the utility of individual i with respect to his/her social state x_i (with $i = 1, 2, ..., n$). This formulation rests on the assumption that social welfare is a function of individual utilities (individual SWF). Assuming that social welfare increases if the utility of any of the individuals increase and none decrease, the Pareto optimality can be obtained by maximizing W. However, the Bergson-Samuelson SWF has a more general purpose, which is to go beyond the Pareto principle by ranking all the Pareto optimal states (Sen, 1973). The distributional judgments will then depend on the form of the welfare function chosen.

Despite the definition of the function $W(\cdot)$ allows using cardinal measures of individual utilities and assuming interpersonal comparability, welfare economists have usually avoided such assumptions and focused on ordinal measures of W, aiming at defining social welfare exclusively on the basis of the set of individual orderings of X. However, Arrow (1951) demonstrated in his fundamental "impossibility" theorem that, under ordinal measurability and without interpersonal comparability, no procedure for aggregating individual utilities into collective preference orderings, satisfying minimal conditions, exists. Sen (1970) further extended this result, by showing that the conclusion of Arrow's theorem remains true if ordinal non-comparability is replaced by a cardinal interpretation of individual utility without interpersonal comparisons of well-being. In order to avoid these impossibile results, richer informational environments have to be considered (see, Sen, 1970, 1977; D'Aspremont, 1985). Moreover, if the approach of social welfare functions has to be profitably adopted in measuring inequality and judging alternative distributions of income, the framework must be extended to include interpersonal comparisons of welfare.

In this sense, the line of research proposed by Atkinson (1970) and Kolm (1969), which basically consists in the reconsideration and generalization of an essentially utilitarian perspective in evaluating welfare and inequality, as earlier anticipated by Pigou (1912) and Dalton (1920), proved to be very

effective. The welfare economics of utilitarianism is however very limited since it ranks alternative social states on the basis of the sum of individual utilities. A utilitarian approach, pioneered by Bentham (1789), focuses only on maximizing the sum of individual utilities and is therefore completely unconcerned with the distribution of this sum. In particular, the indifference to the distribution of individual utilities rests entirely on this "sum ranking" hypothesis, but despite this limitation, the utilitarian framework can be broadened and appropriately generalized by dropping the dependence on simple summation of untransformed utilities. The possibility of going beyond simple utilitarianism, by dropping "sum ranking" while keeping "consequentialism" and "welfarism" (see Sen, 1973), was therefore at the basis of the Atkinson-Kolm-Sen approach to the analysis of social welfare, based on a distributional-sensitive evaluation of individual utilities, which gave rise to a new strand of literature on the analysis of social well-being and its connections to inequality evaluation.

In the next sub-section, we illustrate Atkinson's approach to social welfare and income inequality, highlighting the differences with respect to the purely utilitarian approach by Dalton (1920). In Section 3.3 we discuss ordinal and cardinal approaches to the analysis of inequality and welfare. In Section 3.4 we present an extended framework for ranking alternative social states that generalizes Atkinson's approach by including non-utilitarian elements in the SWF. Following recent works by Ebert (1988), Lovell (1998) and Araar and Duclos (2003, 2005), this formulation differs from both the traditional utilitarian and Atkinsonian approaches by explicitly including interpersonal comparisons of utility in social welfare analysis.

3.2. Social welfare and income inequality

As previously discussed, the pure utilitarian approach is considered to be unsuitable for welfare economics, given its substantial indifference to the distribution of individual utilities. However, by generalizing utilitarian principles it is possible to include distributional considerations in the assessment of social welfare.

In his pioneering work, Dalton (1920) followed Bernoulli's 1738 statement ("*Now it is highly probable that any increase in wealth, no matter how insignificant, will always result in an increase in utility which is inversely proportionate to the quantity of goods already possessed.*")

and assumed that individual utility (or welfare) equals the logarithm of income:

$$U(y_i) = \ln y_i \tag{2}$$

thus hypothesizing a strictly concave function (i.e., with diminishing marginal utility of income). The base of the logarithm should reflect the particular utility function of each individual. In this sense, the natural base reflects the choice of an average value for the individual utility function (see: Crosara, 1959). In addition, Dalton defined a purely utilitarian separately additive social welfare function:

$$W = \sum_{i=1}^{N} U(y_i) = \sum_{i=1}^{N} \ln y_i \tag{3}$$

with aggregate social welfare adding up individual utilities. Dalton argued that inequality could be defined by comparing actual social welfare, specified by equation (3), with the level of social welfare that would be attained if the same total were to be equally distributed (Lovell, 1998). In the two extreme cases of highest inequality (lowest welfare) and lowest inequality (highest welfare) the social welfare function is equal to:

$$W^{\min} = \ln Y \quad \text{and} \quad W^{\max} = \sum_{i=1}^{N} U(\mu) = N \ln \mu \tag{4}$$

where Y is the overall income of a community assigned to the richest individual (lowest welfare) and $\mu = \sum_i y_i \big/ N$ is the arithmetic mean income assigned to every individual (highest welfare). So in the two extreme cases, total income is either possessed only by the richest individual or is equally distributed among individuals, respectively. Obviously, every intermediate welfare value corresponds to a specific level of income inequality; in this respect. Dalton defined inequality as:

$$I_D = W^{\max} / W = N \ln \mu / \sum_i \ln y_i = \ln \mu / \ln \mu_g \tag{5}$$

that is, as the ratio of the logarithm of the arithmetic mean of income μ to the logarithm of the geometric mean μ_g. Atkinson (1970) pointed out that

the main limitation of this measure is that it is not invariant with respect to positive linear transformations of the utility function. Income inequality is then as low as the value of $\ln \mu_g$ is close to $\ln \mu$.

The merit of the approach of Dalton is that it shows that any inequality measure must be concerned with economic welfare, thus highlighting the close connection between social welfare and distribution of incomes (and vice versa). However, it is restrictive in assuming a strictly utilitarian framework.

Atkinson (1970) extended Dalton's analysis by introducing the concept of *equally distributed equivalent income* (y_{EDE} or *EDEI*), which is the level of per capita income which, *if it were equally distributed*, would give the same level of social welfare generated by the actual income distribution y_{EDE} is the level of per capita income such that:

$$W = \sum_{i=1}^{N} U(y_i) = NU(y_{EDE}) \;\Rightarrow\; y_{EDE} = U^{-1}\left(\sum\nolimits_{i=1}^{N} U(y_i) \Big/ N\right) \qquad (6)$$

A similar approach to that of Atkinson, but less focused on the distributional analysis of incomes, has been also developed by Kolm (1969). An earlier use of the "equally distributed equivalent income" approach can be found in Champernowne (1952).

Based on the Arrow-Pratt approach to risk aversion, Atkinson considered a class of symmetric, additively separable, increasing and strictly concave functions $U(\cdot)$ characterized by constant relative inequality aversion:

$$U(y_i) = \begin{cases} a + b\dfrac{y_i^{1-\varepsilon}}{1-\varepsilon}, & \text{for } \varepsilon \geq 0 \text{ and } \varepsilon \neq 1 \\ a + b\ln(y_i), & \text{for } \varepsilon = 1 \end{cases} \qquad (7)$$

The ε parameter, which can be interpreted as a measure of the degree of social aversion to income inequality, is the elasticity of marginal utility with respect to y_i and defines the degree of concavity of $U(y_i)$. The SWF proposed by Dalton can be then considered as a particular case of that proposed by Atkinson, when $a = 0$, $b = 1$ and $\varepsilon = 1$ (i.e. $U(y_i) = \ln y_i$. From equations (6) and (7), these restrictions imply that the EDE income equals the geometric mean of individual incomes

$\ln(y_{EDE}) = 1/N \sum_{i=1}^{N} \ln(y_i) = \ln(\mu_g) \rightarrow y_{EDE} = \mu_g$. It is worth remarking that the logarithmic utility function can not only be justified by appealing to the Bernoulli hypothesis, but also because the logarithmic scale, as pointed out by Lovell (1998), is used in measuring many natural phenomena and may have a psychological basis in the concept of "just-noticeable difference".

From the definition of y_{EDE}, Atkinson proposed a measure of inequality, defined as the percentage reduction in income that would be sufficient, if equally distributed, to yield the same total welfare of the actual income distribution:

$$I_A = \frac{\mu - y_{EDE}}{\mu} = 1 - \frac{y_{EDE}}{\mu} \tag{8}$$

and can be interpreted as the proportion of total income that is lost because income is not equally distributed. When $U(y_i) = \ln(y_i)$, this inequality index is $I_A = 1 - \mu_g / \mu$ and corresponds to the I_3 index discussed in Champernowne (1974).

Obviously, the index I_A has the convenient property of laying between 0 (complete equality, when $y_{EDE} = \mu$) and 1 (maximum inequality). Moreover, Atkinson's measure clearly depends on the utility function, i.e., on the value of ε. In particular, I_A would necessarily equal zero if there is no aversion to income inequality ($\varepsilon = 0$), regardless of how income were distributed, and rises as the value of ε grows ($\partial I_A / \partial \varepsilon > 0$).

However, it is worth remarking on the subtle but essential difference between Dalton's and Atkinson's approaches. Dalton, anticipated by Pigou (1912), used a strictly utilitarian approach to welfare economics that is basically unconcerned with the inequality in utility distribution. He expressed the idea that income inequality could be measured as the distance between the actual distribution and the equal distribution. But his measure is primarily concerned with the inefficiency of income inequality in generating aggregate utility, which only reflects the loss of total utility sum due to the unequal distribution of individual incomes. On the other hand, Atkinson's approach is not exclusively utilitarian, even though it invoked an additively separable framework, with total social welfare expressed as the sum of the

individual values of U_i. Such a framework can be restrictive in imposing additive separability, but it does not require the SWF to be completely utilitarian in taking U_i to be individual utility. That would be one possible interpretation, and Atkinson himself does not define U_i as a utility function. In general, it is the individual component of social welfare and can be thought as a strictly concave transformation of individual utility (Sen and Foster, 1997).

This general approach to inequality and welfare measurement developed by Atkinson has the merit of allowing to base inequality evaluation not only on efficiency considerations, but also to take into account the equity implications of inequality of incomes, thus reflecting the loss of social welfare due to inequality in individual utilities.

In particular, the Atkinsonian perspective makes the relationship between social welfare and inequality evident. In welfare economics, as previously discussed, several approaches, including utilitarian welfarism with declining marginal utility of incomes, Sen's capability approach or the Rawlsian framework suggest that aggregate welfare reduces as (income) inequality rises, all other things being equal. With respect to this point, Atkinson's approach provides a simple method of converting welfare functions into inequality measure and vice versa. A convenient feature of the Atkinson index is that it allows to directly derive a social evaluation function in abbreviated terms. By solving (8) for y_{EDE} we obtain:

$$y_{EDE} = \mu(1 - I_A) = W \tag{9}$$

which highlights how the EDE income can be interpreted as a direct measure of social welfare.

This formulation shows an alternative way of representing the SWF, which is referred to as the abbreviated social welfare function (Lambert, 1989), and expresses social welfare W as a function of both mean income and inequality ($W = f(\mu, I)$), increasing as mean income rises ($\partial W / \partial \mu > 0$) and decreasing with higher inequality ($\partial W / \partial I < 0$). This reveals how social welfare depends on both efficiency and equity considerations. Equation (9) represents a specific form of abbreviated SWF, which is valid for inequality measures ranging from zero to one, and clearly

states that the existing degree of inequality corrects mean income downwards reflecting the welfare loss associated with the unequal distribution of income. In particular, when all incomes are equal, $I = 0$ and $W = \mu$, while when total income is held by the richest individual only, $I = 1$ and $W = 0$; in all the other intermediate situations $I > 0$ and $W < \mu$. Welfare can be then increased by either increasing mean income μ or by increasing income equality $1 - I$. In this setting, inequality I provides a measure of the per capita proportion of income that is lost in social welfare terms because of its unequal distribution among individuals. Moreover, it is worth noting that two distributions of income can be characterized by the same level of social welfare even when their average incomes differ, provided that income differences are offset by differences in inequality.

Within this framework several inequality measures can be considered, differing in either the intensity of welfare penalty they impose or in the way they account for different types of inequality. An interesting example is the social welfare measure proposed by Sen (1976), which incorporates inequality by means of the Gini coefficient *G*:

$$W = \mu(1 - G) \tag{10}$$

Yitzhaki (1979) and Dagum (1990) have shown that this social evaluation function can be derived from an interdependent view of income distribution according to which individuals consider not only their own income, but the entire income distribution, thus indirectly incorporating interpersonal comparisons of utility in the assessment of social welfare.

3.3. Partial and complete orderings

The approach to welfare and inequality analysis advanced by Atkinson (1970) and Kolm (1969) has the further merit to establish a close connection between the statistical concept of the Lorenz curve (Lorenz, 1905), inequality indexes and the principle of progressive transfer (Dalton, 1920), shedding light on the welfare implication of statistical inequality measures and promoting the use of dominance rankings.

The Lorenz curve $L(p)$ is one of the most common tools used for visualizing, describing and comparing income distributions; it is defined as

the relationship between the cumulative percentage of total income held by a cumulative proportion *p* of the population, when individuals are ordered in increasing income values.

In his fundamental theorem, Atkinson (1970) showed how the Lorenz ranking can be interpreted as a welfare ranking and proved that if the Lorenz curve of an income distribution dominates (i.e., lies above) that of another distribution with the same mean income, then the distribution with the dominating Lorenz curve has a higher level of per capita social welfare (first order welfare dominance). Formally, given two income distributions X_1 and X_2 with the same mean income μ, then $L_{X_1}(p) > L_{X_2}(p) \Leftrightarrow W_{X_1} > W_{X_2}$, for any symmetric, monotonically increasing, strictly concave and additive social welfare function *W*. The Atkinson theorem states that the Lorenz dominance is a necessary and sufficient condition to detect welfare superiority in the dominating distribution, provided that it has the same (or higher) mean income than that of the dominated one. The relevance of this result lies in the fact that it explicitly links distributional dominance and social welfare-based measures, providing a unifying framework for ordinal and cardinal approaches to inequality and well-being analysis. Dominance approach, being independent of the exact functional form of the SWF, provides an ordinal ranking of distribution, without aiming at quantifying the differences between distributions. Because of their lower information requirement, the robustness of dominance rankings is stronger than that of SWF-based measures, since they remain valid for wider classes of measurement assumptions.

The main limitation of Lorenz curves for inequality and welfare analysis is that they only provide a partial ranking of income distributions, as it only records unambiguous comparisons and may be silent on many cases. If two Lorenz curves intersect it is not possible to rank one distribution as more equal than another distribution by the dominance criterion and it is always possible to find different concave social welfare functions that rank two social states differently. In social welfare analysis, the Lorenz dominance criterion prevents the comparison of income distributions with different mean incomes, thus making cross-country and/or intertemporal comparisons of well-being impossible. Moreover, the Lorenz dominance criterion is completely unconcerned with the efficiency/growth aspect of a social welfare analysis.

In order to overcome these issues, Shorrocks (1983) extends Atkinson's approach by introducing the generalized Lorenz curve $GL(p)$, defined as the Lorenz curve $L(p)$ scaled by the mean income μ, i.e., $GL(p) = \mu L(p)$.

Generalized Lorenz dominance can be then defined similarly to standard Lorenz dominance: if the generalized Lorenz curve of one state lies above that of another distribution, the social welfare of the first is higher than the latter (second-order welfare dominance). More formally, Shorrocks' theorem (1983) states that, given two distributions X_1 and X_2, $GL_{X_1}(p) > GL_{X_2}(p)$ $\Leftrightarrow$ $W_{X_1} > W_{X_2}$, for any social welfare function W satisfying the condition mentioned earlier. Thus, two income distributions have an unambiguous social welfare ranking only if the generalized Lorenz curves do not intersect, and the distribution with the higher curve is socially preferred.

Even though the generalized Lorenz criterion significantly extends welfare comparisons by removing the requirement of equal means, it still provides only a partial ordering of social states. As it can be easily checked, a generalized Lorenz criterion may not succeed in resolving all the ambiguities of the Lorenz dominance and it may also generate new crossings. Then, as for the Lorenz dominance, if generalized Lorenz curves cross it is always possible to find two increasing and concave social welfare functions which will rank the two income distributions differently. In order to arrive at a complete ordering of all possible social states, and to quantify the distance between income distributions in terms of their welfare content, however, further structure has to be imposed and a cardinal social evaluation function that assigns numerical values to all possible social states is needed. Obviously, this can be done by specifying the exact form of the SWF adopted and comes at the cost of tightening the informational requirements and of weakening the robustness of welfare measures.

3.4. Social welfare and relative deprivation

In this Section, we present a generalization of the Atkinsonian SWF, which captures both income inequality aversion, by means of decreasing marginal utility, and rank inequality aversion, by assuming rank-dependent weights on individual utilities.

Both the approaches of Bernoulli-Dalton and Atkinson are based on additively separable and individual social welfare functions: individual well-

being is completely unaffected by the utility enjoyed by others and therefore aggregate welfare does not directly reflect interpersonal comparisons of utility. An explicit evaluation of such interpersonal comparisons would allow to introduce the effect of relative economic and social distances in welfare analysis.

This subject has always received specific attention in welfare economics, highlighting the relative nature of welfare evaluation; in particular, according to Pigou (1912) "*…the satisfaction a man obtains from his economical environment is, in great part, derived not from the* absolute*, but from the* comparative *magnitude of his income*". Pigou in this respect, cites Mill (1907) who asserted that "*…men do not desire merely to be rich, but to be richer than other men, or than certain other men*", and Rignano (1901) who noted that, considering the quality of revenue distribution it is necessary to regard not only the quantity of revenues but its quality: "*…a social system, which does not promise an increase of total production, but ensures an improvement of distribution, is preferable to another that, although provides higher production, gives rise to a more unequal distribution*" and "*…data shows, that the social question is not at all only a* production *question*, *but really a* distribution *one"* (Rignano, 1901, pp. 234 and 276).

Moreover, there is a broad socio-psychological literature on interpersonal comparisons of well-being, which shows that interpersonal differences have a significant impact on individual well-being and as well as on social cohesion and welfare. In particular, the theory of relative deprivation suggests that people compare their individual fortune with that of others in establishing their own degree of satisfaction. Runciman (1966) emphasized that relative deprivation involves the comparison of one's own position with the "*situation of some other person or group*" taken as the comparative reference group.

As underlined in Section 3.1, because of the general tendency to avoid cardinal measurements and interpersonal comparisons of utility, attempts to consider interpersonal comparisons of well-being in inequality measurement and in social welfare evaluation have only recently been developed. In particular, Sen (1973), Yitzhaki (1979) and Hey and Lambert (1980), following Runciman's suggestion, propose an indicator of relative deprivation for each individual, which measures the distance between his income and the incomes of those to whom he feels deprived (namely those who have a higher rank in the income distribution) and show that the aggregation of such relative deprivation measures allows to obtain the family

of single-parameter Gini indexes of inequality. However, the comparative approach to welfare evaluation can be also profitably carried out by appropriately extending a cardinal social welfare function, as that in equation (5), to directly include comparisons of utility among individuals and to account for aversion to rank inequality.

The hypothesis that individual welfare is reference-dependent has met increasing acceptance and has recently found support in experimental and empirical studies (see Hopkins (2008) for a survey on these works). The welfare of individuals is not solely determined by their own income levels but is also judged relative to socially determined benchmarks and strictly depends on their relative position in the society (Rablen, 2008).

A growing body of economic analyses considers the implications of relative concerns on human behaviour and their relation to inequality, assuming that social comparisons arise as agents care about their ranked position in the income distribution (Becker *et al.*, 2005; Frank, 1985; Robson, 1992). Following these authors, we define a model of cardinal welfare based on the notion of social comparison, by assuming that the individual component of social welfare has the form:

$$U(y_i, y_{-i}) \tag{11}$$

where $y_{-i} = (y_1, ..., y_{i-1}, y_{i+1}, ..., y_N)$ represents the incomes of the remaining $N-1$ individuals. Within this framework, the effect of one's own income y_i is obviously positive, while we assume that the effect of an increase in income of those who are richer than *i* is negative ($U(y_i, y_{-i})/\partial y_j < 0$ for $y_j > y_i$). On the other hand, the effect of changes in income of those who are poorer, provided that this does not alter the positioning of individual *i* in income distribution, is assumed to be equal to zero ($U(y_i, y_{-i})/\partial y_j = 0$ for $y_j < y_i$).

In order to make the functional form of (11) explicit, we express individual welfare as an increasing function not only of own income but also of the rank one holds in income distribution:

$$U(y_i, y_{-i}) = U(y_i, F(y_i)) \tag{12}$$

where $F(y_i)$ is the distribution function of individual incomes.

Given the framework defined by (12), the typical "utilitarian-looking" SWF proposed by Atkinson can be extended by introducing an additional term that measures the relative distances between individual utilities. For the discrete setting, assuming that there are *N* individuals in the population, with incomes y_i ordered such that $y_1 \leq y_2 \leq ... \leq y_N$, we have:

$$\begin{aligned} U_d(y_i) &= U(y_i, F(y_i)) = U(y_i) - d(U(y_j) - U(y_i)) \\ &= a + b\frac{y_i^{1-\varepsilon}}{1-\varepsilon} - \frac{N-i}{N}\frac{\sum_{j=1}^{N}\max[U(y_j) - U(y_i), 0]}{N} \end{aligned} \tag{13}$$

where *i* and *j* indicate individual positions in income ranking (with $j > i$) and $d(\cdot)$ measures the welfare loss experienced by individual *i* when he/she compares his condition with that of those individuals richer than him/her. In this formulation, $d(\cdot)$ thus coincides with the concept of relative deprivation, defined by Runciman (1966) as "the extent of the difference between the desired situation and that of the person desiring it". Following Sen (1973), Yitzhaki (1979), Lovell (1998) and Araar e Duclos (2005), it is therefore possible to define for each individual an indicator of relative deprivation measuring the distance between his welfare and that of those towards whom he feels deprived (i.e. those who are better off than him). Thus, no relative deprivation is therefore felt by individual *i* when he compares himself to an individual *j* that is less well-off then him. This is a particular type of asymmetric interdependence, originally considered by Duesenberry (1952), where "*low-income groups are affected by the consumption of high-income groups but not vice versa*".

Considering the logarithmic hypothesis, equation (13) becomes:

$$U_d(y_i) = \ln y_i - \frac{N-i}{N}\frac{\sum_{j=1}^{N}\max[\ln y_j - \ln y_i, 0]}{N} \tag{14}$$

In this case, the measure of relative deprivation is proportional to the distances between the logarithms of individual incomes. The per capita welfare evaluation function corresponding to (14) can be then written as:

$$W_d = \frac{1}{N}\sum_{i=1}^{N} \ln y_i - \frac{1}{N}\sum_{i=1}^{N} d(\ln(y_j) - \ln(y_i)) = \ln(\mu_g) - D(\ln(y_j) - \ln(y_i)) \tag{15}$$

where $D(\cdot)$ is obtained by averaging relative deprivation measures over all the *N* individuals. Social welfare in (14) is then equal to average utility corrected by average relative distances in utility levels (Araar and Duclos, 2005). More precisely, the difference between the log of income levels in the case of equal distribution ($\ln(\mu)$), which corresponds to the level of maximum welfare, and the log of the actual income distribution ($\ln(\mu_g)$) measures the loss of welfare due to inequality. If we further account for differences in the logarithms of individual levels (second term in the right-hand side of (15)), it is possible to obtain a comparison of individual welfare levels, expression of social distances, that contributes to affect social welfare besides changes in income levels.

In terms of well-being measures, from specification (15) it is possible to derive the social evaluation function in abbreviated terms as:

$$W_d = \mu(1 - I_d) = y_{EDE_d} \tag{16}$$

where $I_d = 1 - [U^{-1}(W_d)/\mu] = 1 - (y_{EDE_d}/\mu)$. Expression (16) provides a class of cardinal measures of well-being that accounts for income inequality and explicitly assesses the issue of interpersonal comparisons of welfare. Moreover, it clearly shows how the class of social welfare functions considered measures well-being by penalizing mean income for both income inequality (by assuming increasing and strictly concave functions $U(y_i)$) and rank inequality (by accounting for relative differences in individual welfare).

4. DATA

The recent availability of comparable statistical data on personal income distribution provides useful information for a cross-country analyses and intertemporal comparisons of well-being. For the aims of the present research, the necessity to improve data comparability both under qualitative

and quantitative aspects is a fundamental issue. The use of good quality data enables us to reach a better level of comparability among them.

Unlike national accounts data, which is homogeneous in general, data on income distribution are collected and estimated according to different criteria which influence results of distributional analyses and significantly affect their comparability across space and time.

Several assumptions are necessary for determining a usable dataset, which primarily concern the individualization of the more suitable statistical source to analyse the distributional phenomenon and the definition of the reference unit of income receivers. Further problems concern the existing lack of homogeneity on data quality, and most of all, on their reliability and on the way statistical information is collected gathering statistical data, and on their comparability in space and time. Basically, the available statistics on inequality include observations that may differ on measured concepts (expenditures, consumption, gross or net income), reference units (individuals, household or family) and sources, and all these differences should be appropriately taken into account when dealing with international and intertemporal comparisons of inequality and welfare measures.

The data used in the present analysis is derived from different sources. The main source of distributional data is the *World Income Inequality Database* version 2.0b (UNU-WIDER, 2007; henceforth WIID). This database is the essential basis of our research since it provides data on income distribution across countries and over time. The WIID is a data collection that is sourced from different household level surveys, mainly of a micro-aggregate type. The distributional information provided by this database consist basically of standard Gini indexes, average and median incomes, and, particularly important for our aims, income shares by deciles or quintiles of population.

Through the use of this information, it is possible to explore the connection between income growth, distribution and inequality within an international and intertemporal contest. The feasibility of this kind of analysis, which is the focus of our research, strictly depends on the availability of comparable data and it is for this reason that only recent empirical literature has investigated, in an international dimension, the relationships between income distribution and economic well-being and their evolution over time (Deininger and Squire, 1996; Gruen and Klasen, 2003, 2007; Sala-i-Martin, 2006).

The WIID database has the advantage of providing an extensive data coverage, but as already anticipated the comparability of inequality measures

both across countries and over time may be seriously undermined by the varying quality and reliability of the data and by the measurement concepts adopted. All these limitations, connected to the use of such "secondary datasets", are extensively discussed in Atkinson and Brandolini (2001).

The empirical analysis has been carried out considering data for 10 OECD countries: Australia, Canada, Finland, France, Germany, Italy, Mexico, Norway, the United Kingdom and the United States. These countries are a representative sample of the main geographical area of the world. Their choice has been also influenced by the necessity of observing the evolution of income distribution in an extended time series. Especially in order to correctly represent the distributive dynamics of income over time, we have considered only countries with available data for the period of 1970-2000.

In order to obtain homogeneous and comparable information, we have introduced further selection criteria. In particular, we have restricted our attention only to data drawn from surveys that sampled the entire population of the country, without any ex ante restrictions on geographical coverage, or on the age or other demographic characteristics of the respondent. In the WIID there is a variable that describes the data quality and reliability. This variable assumes different values from 1, for the best quality data, to 4 for the worst quality. In this research we have considered only data with quality equal to 1 or 2. Most of the data considered have been adjusted for household composition by using an equivalence scale and then take account of the size and the composition heterogeneity of the family unit. With respect to the underlying income concept, data must be based on after tax disposable income.

Despite these restrictions, some differences in the selected data still remain. According to the dominant literature (Gruen and Klasen, 2007; Lundberg and Squire, 2003; Dollar and Kraay, 2002) we have also made a regression-based adjustment to deal with the inconsistencies in terms of measurement concepts and reference units. The income shares per decile have been regressed on several variables reflecting the various measurement concepts, while controlling for country and temporal fixed effects. The coefficients of this regression are then used to correct all the information on country data that differs from the excluded reference unit considered (i.e., income data on disposable income, deflated by equivalence scale to correct for household heterogeneity).

The WIID database provides only the percentage shares of income by quantile of population, but it does not give any information on income levels. We therefore merge WIID data with data on real per capita Gross

Domestic Product in purchasing power parity (2000 international US$) from *Penn World Table* version 6.2 (PWT, Heston, Summers and Aten, 2006). The data for each of the ten countries considered are then assembled for seven benchmark years (1970, 1980, 1985, 1990, 1995 and 2000). In case of no data point for a particular benchmark year, the closest available information is chosen, as shown in Table A1.

Finally, the WIID dataset gives a simplified representation of income distribution. Using quintile or deciles grouped data (as shown in Table A2) does not allow to correctly compute the inequality indexes discussed in Section 2, leading to an underestimation of actual income concentration. For these reasons, some authors have emphasized the opportunity to interpolate data from quantile information to get a better assessment of income distribution. In order to do that, two different approaches are usually considered: the first approach relies on the parametric estimation of the density function and/or the Lorenz curve (Datt, 1998; Chen and Ravallion, 2001; Bhalla, 2002). A second approach involves the nonparametric estimation of income density (e.g., kernel density) functions (Sala-i-Martin, 2006; Ackland et al., 2004; Dhongde, 2004). In the empirical literature the software POVCAL, developed and distributed by the World Bank (Chen, Datt and Ravallion, 2001) is widely used to implement the first of the above mentioned approaches and to parametrically interpolate the Lorenz curve (Minoiu and Reddy (2007) evaluate the performance of the POVCAL software in estimating Lorenz curves from grouped data, and find that the interpolation techniques employed by the software provide a good fit to the Lorenz curve for a wide range of income distribution. Moreover, Minoiu and Reddy (2006) also find that the parametric interpolation provided by POVCAL often outperforms kernel density methods in the estimation of poverty and inequality). In our study, POVCAL has been used to estimate income distributions by percentiles for all the considered countries and reference years, allowing us to obtain different and more accurate inequality measures. In order to assess the effect of our adjustments on inequality measures, in Table A1 we present the Gini coefficients reported by the WIID and the same indexes computed from our elaborations on interpolated income data by percentile of population. It should be remarked that the traceable differences between the values are mainly due to the *regression based* correction described before.

5. EMPIRICAL APPLICATION

In this Section we present the results of the application of the social welfare measures discussed in Section 2 to the analysis of levels and rankings of well-being in the ten selected OECD countries for the period 1970-2000.

We start discussing the issues connected with the use of ordinal and cardinal measures, by comparing the welfare orderings that can be obtained using the (Generalized) Lorenz Dominance approach and the SWF normative approach. In Section 5.2 we present cross-country welfare comparisons and their evolution over time, based on the two cardinal measures of well-being considered. Finally, we focus on the analysis of the growth-inequality nexus.

5.1. Lorenz dominance and SWF approaches

As already discussed, a partial order may be very valuable in its own right as it serves to locate the areas of disagreement. For the aims of the present analysis, the generalized Lorenz dominance criterion represents one of the possible approaches to analyse the levels and rankings of well-being across countries and to track their evolution over time.

In the first two panels in Figure 1, the generalized Lorenz curves for all the ten countries considered in two reference years (1970 and 2000) are represented. As can be noted, this dominance approach provides few unambiguous cross-country comparisons of absolute welfare levels. In both the years considered, Mexico is generalized Lorenz-dominated by all the other countries, resulting as the country with the lowest level of well-being. On the other hand, in 1970 welfare is unambiguously higher in the United States than in all other countries. However, in 2000 the generalized Lorenz curve of the USA is lower than that of Norway up to the 95^{th} percentile and then the two curves cross, indicating that welfare is higher in the USA than in Norway only for the richer 5 percent of the population. The crossings of the generalized Lorenz curves are much more frequent when welfare levels for the remaining countries are compared, with intersections often occurring in the middle part of the distribution. In Table A3 in the Appendix we report the full set of pair wise welfare comparisons between the countries in 2000: only in 36% of the cases (32 out of 90 pairwise comparisons) the generalized Lorenz curves do not cross and lead to unambiguous welfare comparisons.

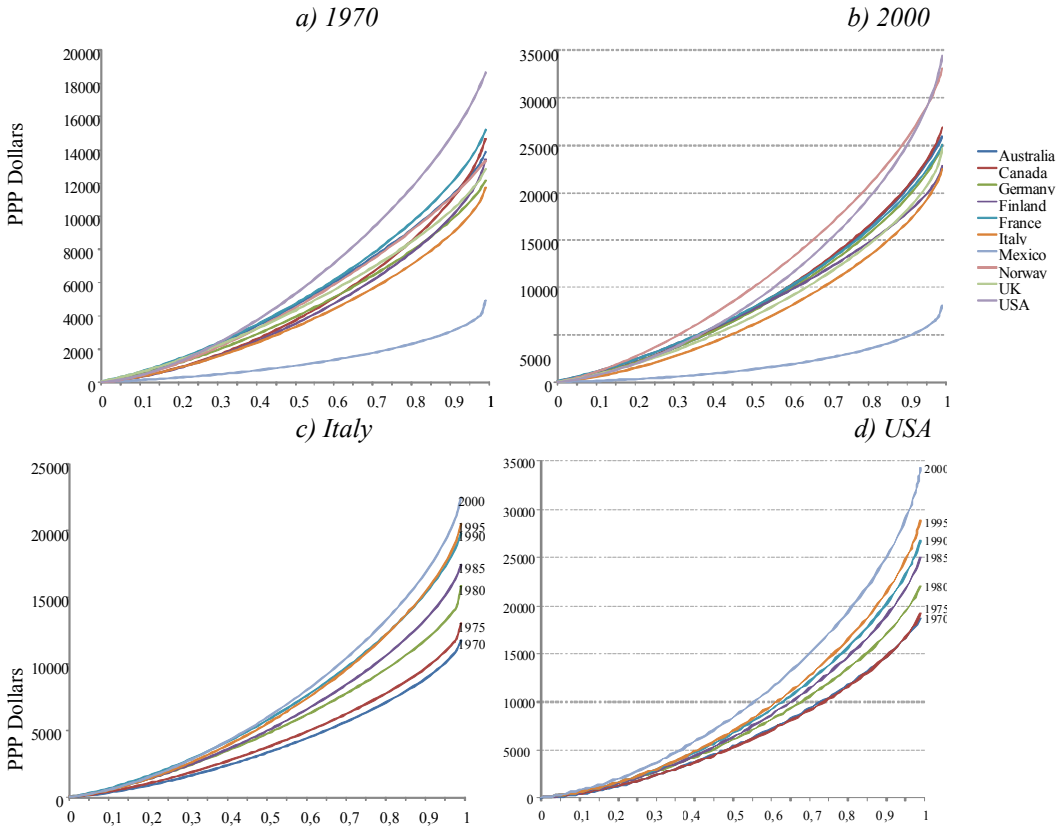

Figure 1. Generalized Lorenz curves: cross-country and intertemporal comparisons

Source: autors' own

The last two panels of Figure 1 show intertemporal welfare comparisons for two countries of the sample, namely Italy and the USA. As can be noticed, crossings are much more infrequent, because of the positive growth rates of average national income. However, in Italy the curves for 1990 and 1995 intersect at the 8th decile, and in comparing 1980 and 1985 we also notice a crossing. For the USA, the generalized Lorenz curves of 1970 and 1975 and that of 1980 and 1985 intersect in the first and the last part of the distributions, respectively. This evidence suggests that the generalized Lorenz dominance does not provide complete welfare orderings even in intertemporal comparisons of well-being.

Therefore, in our empirical analysis we find that the generalized Lorenz dominance approach still generates several crossings, in both cross-country and intertemporal welfare comparisons, and provides only a partial ordering of social states. For this reason, in order to obtain complete orderings, we proceed by using the cardinal SWF-based approach, by appropriately specifying the form of the social welfare function along the lines discussed in Section 2. The use of different types of social evaluation functions, which account for different types of income inequality, allows us to assess the robustness of the empirical evidence obtained.

5.2. Welfare comparison across countries and over time

The impact of including distributional considerations in the assessment of economic well-being across space and time is analysed by firstly comparing welfare levels across countries for the selected benchmark years and by analysing how the alternative measures considered affect welfare rankings.

Table 1 shows mean per capita incomes and distribution adjusted welfare levels both in levels and as a proportion of per capita GDP (i.e., as the ratio of the corresponding equally distributed equivalent income to mean income) using different measures for each country in year 1970, 1980, 1990 and 2000.

Given the approach to welfare measurement illustrated in the Section 2, the inequality-adjusted welfare measures are obviously smaller than mean incomes. In particular, the size of the inequality penalty imposed on mean income is assumed to vary according to level and rank-inequality. In Table 1 we present and compare alternative welfare measures, starting from standard GDP per capita and considering two measures based on the logarithmic version of Atkinson index (i.e., with $\varepsilon = 1$): the first accounting for inequality in income distribution EDEI1, corresponding to y_{EDE} in the abbreviated SWF (9), and the other accounting for both inequality and social distances EDEI2, corresponding to y_{EDE_d} in equation (16). As previously introduced, this choice depends on how we assume that society evaluates inequality and weights income and rank dispersions.

Table 1

Per capita GDP and inequality-adjusted welfare measures

Year	Country	Welfare measure: Equally Distributed Equivalent Income			Ranked by:		
		(1) GDP (per capita)	(2) Accounting for inequality (EDEI1)	(3) Accounting for inequality and social distances (EDEI2)	(1)	(2)	(3)
1970	**Australia**	13,861	12,062 (87.02)	11,202 (80.81)	4	3	3
	Canada	14,686	11,446 (77.94)	10,125 (68.94)	3	6	6
	Finland	12,136	10,799 (88.98)	9,929 (81.81)	8	7	7
	France	13,429	10,537 (78.46)	9,410 (70.07)	5	8	8
	Germany	15,218	13,269 (87.19)	12,118 (79.63)	2	2	2
	Italy	11,732	9,648 (82.24)	8,718 (74.32)	9	9	9
	Mexico	4,930	3,322 (67.38)	2,898 (58.79)	10	10	10
	Norway	13,352	11,489 (86.05)	10,587 (79.29)	6	5	5
	UK	12,849	11,568 (90.03)	10,716 (83.40)	7	4	4
	USA	18,647	15,129 (81.13)	13,590 (72.88)	1	1	1
1980	**Australia**	17,975	15,420 (85.79)	13,950 (77.61)	4	5	6
	Canada	19,000	15,935 (83.87)	14,357 (75.56)	3	3	3
	Finland	16,141	15,018 (93.04)	14,077 (87.21)	7	6	5
	France	17,514	14,982 (85.55)	13,523 (77.21)	5	7	7
	Germany	17,457	15,521 (88.91)	14,230 (81.52)	6	4	4
	Italy	15,828	13,232 (83.60)	12,156 (76.80)	8	9	9
	Mexico	6,127	4,359 (71.15)	3,793 (61.91)	10	10	10
	Norway	19,708	17,110 (86.82)	15,742 (79.88)	2	2	2
	UK	15,395	13,896 (90.26)	12,830 (83.34)	9	8	8
	USA	22,042	17,803 (80.77)	15,863 (71.97)	1	1	1
1990	**Australia**	20,806	17,261 (82.96)	15,501 (74.50)	6	7	7
	Canada	20,896	17,796 (85.17)	16,110 (77.10)	4	5	5
	Finland	20,000	18,741 (93.71)	17,609 (88.05)	7	3	3

	France	20,873	17,484 (83.76)	15,824 (75.81)	5	6	6
	Germany	21,307	18,452 (86.60)	16,815 (78.92)	3	4	4
	Italy	19,802	16,777 (84.72)	15,176 (76.64)	9	8	8
	Mexico	6,658	4,177 (62.74)	3,564 (53.53)	10	10	10
	Norway	23,958	21,082 (88.00)	19,136 (79.88)	2	1	1
	UK	19,849	16,482 (83.03)	14,824 (74.68)	8	9	9
	USA	26,688	20,737 (77.70)	18,225 (68.29)	1	2	2
2000	**Australia**	25,835	22,092 (85.51)	19,866 (76.90)	4	4	5
	Canada	26,821	22,443 (83.68)	20,260 (75.54)	3	3	3
	Finland	22,741	20,258 (89.08)	18,803 (82.69)	8	7	7
	France	25,045	22,074 (88.14)	20,098 (80.25)	6	5	4
	Germany	25,061	21,428 (85.50)	19,425 (77.51)	5	6	6
	Italy	22,487	17,950 (79.82)	16,020 (71.24)	9	9	9
	Mexico	8,082	4,818 (59.61)	4,063 (50.27)	10	10	10
	Norway	33,092	28,210 (85.25)	25,629 (77.45)	2	1	1
	UK	24,666	20,170 (81.77)	18,217 (73.85)	7	8	8
	USA	34,365	26,078 (75.89)	22,926 (66.72)	1	2	2

Source: autors' own

Notes: sorted in descending order, from highest to lowest welfare levels.

In parentheses we report the ratio (in %) of the respective adjusted income to GDP per capita.

On the right side of the table we report the changes in countries rankings in terms of economic well-being levels, while on the left side the welfare measures previously described are shown for each country and year.

Analyzing rankings by levels of per capita GDP and considering the overall sample period (1970-2000) we can see that the rank changes are not so evident. The majority of countries keep their position stable with the exception of France (which moves from position 5 to 6), Germany which falls from 2 to 5, and Norway which increases its level of individual income reaching the top of the rankings (from 6 to 2).

Focusing the attention on the distributional-weighted welfare measures, we can see that the rank changes across the benchmark years are much more frequent than GDP changes. In this case only three countries remain stable on their position: Finland which holds steady at 7th; Italy in 9th place and Mexico which is always in last place.

Through a closer inspection and aside from the different benchmark years and countries, the analysis of welfare rankings shows that the largest shifts are downwards. Some evidence of this statement is: Canada (1970) from 3rd position, according to GDP ranking falls for all other welfare measures; France (1970) ranked 5th by GDP and 8th in ranking for the other measures. On the other hand sizable upward shifts concern Finland (1980 and 1990) and France (2000).

Turning to the comparison over time, we can observe that the number of countries with three or more rank changes for all the three measures is higher in the second decade than in any other period. It is interesting to note that the largest rank changes appear for the accounting for inequality and social distance, and that they have become more frequent in richer countries. Taking into account rank changes for EDEI1 in 1970-1980, inequality increases in the UK, Germany and Australia, while it decreases in Canada, Finland and France and Norway and it remains largely unchanged in Italy, Mexico and the USA, over the same period. For the period, 1980-1990 rank shifts (one or two changes) are more evident than in the previous period while significant rank changes (three or more rank changes) appear less frequently in both the 1980-1990 and 1990-2000 periods. Moreover, it is worth noting that the two distributional-weighted measures provide almost the same rankings of countries in all the benchmark years, suggesting that the two sources of inequality considered (income dispersion and social distances) are positively correlated.

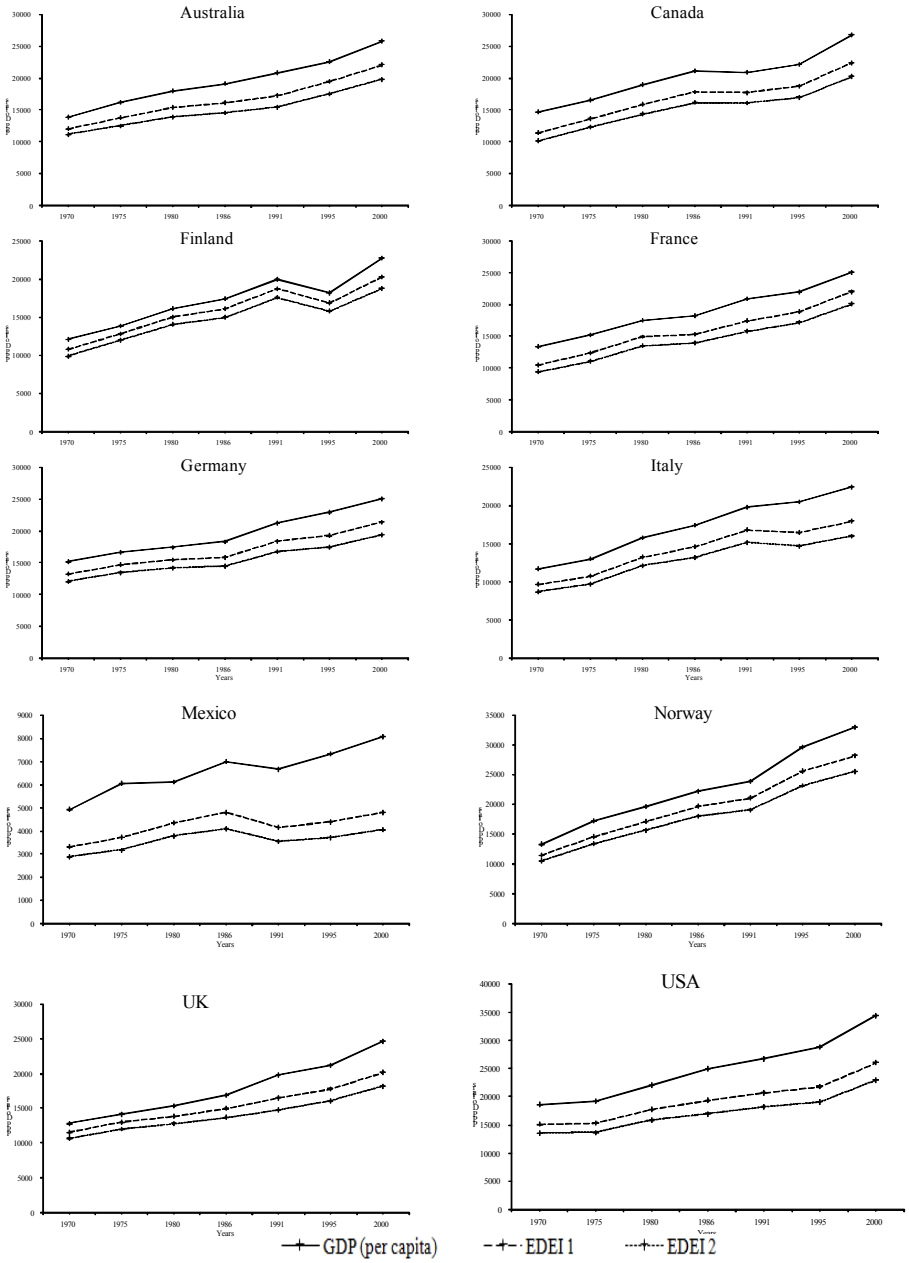

Figure 2. Time patterns of alternative per capita measures of well-being
Source: autors' own

In order to better explain changes in well-being measures, in Figure 2 we have represented levels and trends in per capita GDP and two aggregate welfare measures for each benchmark year from 1970 to 2000.

Thanks to this figure the comparison of aggregate welfare between countries is easier and clearer. When examining per capita income levels, we see that for all the selected countries there is a constant increase over time with a slowdown between 1985 and 1995 for some countries. This is particularly clear for Finland, Mexico and Canada and the same fluctuations are reflected in the trend of the other welfare measures.

For all countries, with the exception of France, we see a substantial divergence between per capita income levels and the other measures of well-being. The increase in distances proves that for all the analysed countries there is a growth of inequality due to increasing social distances. There is only a slight catch up on GDP for all two indexes in France, but in general, differences between per capita incomes and economic well-being are higher in 2000 than in 1970. This result is alarming especially for Mexico, which is not only characterized by the lowest per capita incomes (five times smaller than all the other countries), but also shows the greatest divergence between welfare measures.

However, some countries with high levels of GDP, as Italy, the United Kingdom and the USA, are characterized by large and widening differences in inequality-adjusted social welfare levels. Overall then it would seem that for these countries the increase in GDP does not completely convert into higher levels of aggregate well-being.

The same evidence is shown in Table 2 and in Figure 3, where we present welfare losses. In particular, total welfare loss $L = 1 - (y_{EDEd} / \mu)$ has been calculated as the sum of the welfare loss due to inequality in income levels $L_1 = 1 - (y_{EDE} / \mu)$ and to social distances $L_2 = [(y_{EDE} - y_{EDE_d}) / \mu]$. As pointed out by Lovell (1998), under the logarithmic hypothesis, the loss of utility ($\ln(y_{EDEd}) - \ln(\mu)$) and the relative loss of income ($1 - (y_{EDEd} / \mu)$) are approximately the same, as the latter is the first term in the Taylor's series expansion of the utility loss. These results support the previous remarks. In particular, the percentage welfare loss in Mexico is the highest and, moreover, for all the benchmark years, except 1980, this country reports a progressive worsening in inequality. We can observe an analogous situation for Australia, Italy, Norway, the United Kingdom and the USA, although with significantly lower welfare losses.

The percentage welfare loss has increased for the greater part of the countries considered since 1970, while only Canada, Finland and France show a positive trend in well-being, but the increase of welfare is not always reflected in both the income and rank dispersion components.

Table 2

Welfare loss due to inequality (in percentage)

Year	Country	Welfare loss			Ranked by		
		(1) Lost Utility 1	(2) Lost Utility 2	(3) Total lost utility	(1)	(2)	(3)
1970	**Australia**	12.98	6.20	19.19	7	10	8
	Canada	22.06	9.00	31.06	2	1	2
	Finland	11.02	7.17	18.19	9	7	9
	France	21.54	8.39	29.93	3	3	3
	Germany	12.81	7.57	20.37	8	6	7
	Italy	17.76	7.92	25.68	5	5	5
	Mexico	32.62	8.59	41.21	1	2	1
	Norway	13.95	6.76	20.71	6	8	6
	UK	9.97	6.63	16.60	10	9	10
	USA	18.87	8.25	27.12	4	4	4
1980	**Australia**	14.21	8.18	22.39	6	5	6
	Canada	16.13	8.30	24.44	4	4	3
	Finland	6.96	5.83	12.79	10	10	10
	France	14.45	8.33	22.79	5	3	5
	Germany	11.09	7.40	18.48	8	6	8
	Italy	16.40	6.80	23.20	3	9	4
	Mexico	28.85	9.24	38.09	1	1	1
	Norway	13.18	6.94	20.12	7	7	7
	UK	9.74	6.93	16.66	9	8	9
	USA	19.23	8.80	28.03	2	2	2
1990	**Australia**	17.04	8.46	25.50	3	3	3
	Canada	14.83	8.07	22.90	7	7	7

	Finland	6.29	5.66	11.95	10	10	10
	France	16.24	7.95	24.19	5	8	5
	Germany	13.40	7.68	21.08	8	9	8
	Italy	15.28	8.08	23.36	6	6	6
	Mexico	37.26	9.21	46.47	1	2	1
	Norway	12.00	8.12	20.12	9	5	9
	UK	16.97	8.35	25.32	4	4	4
	USA	22.30	9.41	31.71	2	1	2
2000	**Australia**	14.49	8.62	23.10	8	3	6
	Canada	16.32	8.14	24.46	5	5	5
	Finland	10.92	6.39	17.31	10	10	10
	France	11.86	7.89	19.75	9	8	9
	Germany	14.50	7.99	22.49	7	6	8
	Italy	20.18	8.58	28.76	3	4	3
	Mexico	40.39	9.34	49.73	1	1	1
	Norway	14.75	7.80	22.55	6	9	7
	UK	18.23	7.92	26.15	4	7	4
	USA	24.11	9.17	33.28	2	2	2

Source: autors' own

Notes: ranked in descending order, from the highest welfare loss (highest inequality) to the lowest (lowest inequality).

Lost Utility 1 = $100 \times [1 - (EDEI1 / GDP)]$, is welfare loss due to inequality in income levels

Lost Utility 2 = $100 \times [(EDEI1 - EDEI2) / GDP]$, is welfare loss due to social distance

Total Lost Utility = $100 \times [1 - (EDEI2 / GDP)]$, is overall welfare loss (Lost Utility 1 + Lost Utility 2)

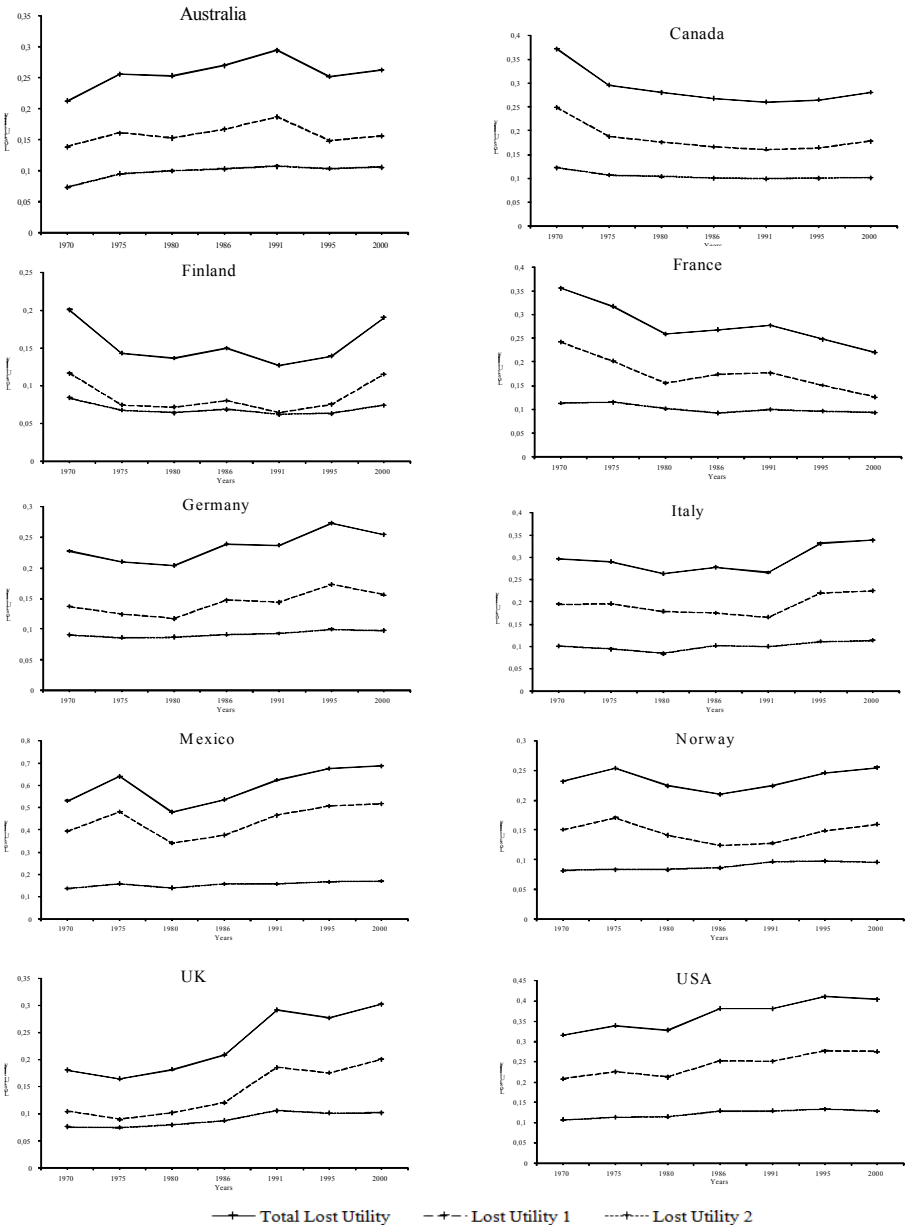

Figure 3. Welfare loss due to inequality and social distance measures
Source; author's own

5.3. Intertemporal analysis of economic well-being: income growth and inequality

In this Section we analyse to what extent the inclusion of distributional considerations in welfare measurement affects the impression of changes in economic well-being in the selected countries. The theoretical framework presented in Section 3 can be profitably used not only to compare welfare levels across countries, but also to assess the impact of changes in inequality on economic growth.

Following Ahluwalia and Chenery (1974), Klasen (1994) and Gruen and Klasen (2001, 2007), in order to improve on the growth rate of per capita GDP as an indicator of changes in economic well-being, alternative composite indexes of growth and income distribution are introduced and compared. From equation (16) it is possible to account for distributional issues by defining welfare growth rates in terms of equally distributed equivalent levels of income; formally, the average welfare growth rate can be defined as:

$$\bar{R}_{W_d}^{t,t+k} = \frac{1}{k-1}\frac{W_d^{t+k} - W_d^t}{W_d^t} = \frac{1}{k-1}\frac{\mu^{t+k}(1-I_d^{t+k}) - \mu^t(1-I_d^t)}{\mu^t(1-I_d^t)} \qquad (17)$$

Expression (17) highlights how distributional-accounting growth rates are themselves functions of the inequality penalties considered. In particular, by assuming $\varepsilon = 0$ and $D = 0$ (i.e., $I_d = 0$) we obtain standard per capita GDP growth, while in all the other cases growth rates of distribution-sensitive welfare measures are obtained.

The calculations of standard income-based average annual growth rates and inequality adjusted growth rates, for the whole sample period (1970-2000) and for three sub-periods, are presented in Table 3. We have considered average annual rates instead of cumulate rates to obtain a standardized measure of growth. The observation periods diverge between countries (as an example Australia is observed between 1968 and 2000, while the period of analysis for the USA goes from 1972 to 2000) and therefore is not correct to compare cumulate growth rate. The distribution-weighted growth rates are obtained from the welfare measures already considered in the international comparison discussed in

the previous Section, and capture the dispersion of incomes and ranks. The two measures considered are to be preferred to the standard GDP growth rate since the combination of income growth and changes in the income distribution provides a better representation of changes in well-being. Moreover, comparisons between such measures and the standard growth rate enable to infer changes in income distribution and the beneficiaries of economic growth. In fact, situations in which the average growth rate of per capita GDP is higher (lower) than those of distribution-weighted welfare measures indicates that inequality has increased (decreased) over the period considered. Analyzing the growth rates for the period 1970-2000, it is possible to notice that welfare growth rates are higher than income growth rates only for Canada and France, while Finland has roughly the same growth rates, indicating that in these three countries the increase in mean income levels has been accompanied by diminishing level and rank inequality. In these cases, the growth process has increased the economic well-being for those individuals in the lowest part of the income distribution and can be considered to be "pro-poor" (Ravallion and Chen, 2003). These results are confirmed by analysing the "growth incidence curves" (Ravallion and Chen, 2003), which gives rates of growth by quantiles of the distribution of income, for each country in the entire period. These graphs are not presented here, but are available from the authors. For all the remaining countries the inclusion of inequality considerations leads to lower rates of growth. Such welfare decreases are particularly significant for Mexico, the UK and the USA, where inequality lowers the growth of economic well-being by almost one percentage point.

Table 3

Per capita welfare measures: annual average growth rates (in percentage)

	1970-2000			1970-1980			1980-1990			1990-2000		
Country	**GDP**	**EDEI 1**	**EDEI 2**	**GDP**	**EDEI 1**	**EDEI 2**	**GDP**	**EDEI 1**	**EDEI 2**	**GDP**	**EDEI 1**	**EDEI 2**
Australia	2.70	2.60	2.42	2.28	2.14	1.89	1.97	1.49	1.39	2.20	2.54	2.56
Canada	2.85	3.31	3.45	2.94	3.92	4.18	1.00	1.17	1.22	3.15	2.90	2.86
Finland	3.01	3.02	3.08	3.30	3.91	4.18	2.66	2.75	2.79	1.37	0.81	0.68
France	2.88	3.65	3.79	2.76	3.83	3.97	2.40	2.09	2.13	1.82	2.39	2.46
Germany	2.40	2.28	2.23	1.84	2.12	2.18	2.45	2.10	2.02	1.76	1.61	1.55
Italy	3.06	2.87	2.79	3.49	3.71	3.94	2.28	2.44	2.26	1.51	0.78	0.62
Mexico	2.00	1.41	1.26	2.70	3.47	3.43	0.72	-0.35	-0.50	1.94	1.39	1.27
Norway	4.93	4.85	4.74	3.97	4.08	4.06	2.70	2.90	2.70	3.81	3.38	3.39
UK	3.07	2.48	2.33	1.98	2.01	1.97	2.89	1.86	1.55	2.43	2.24	2.29
USA	3.01	2.58	2.45	2.60	2.53	2.39	1.76	1.37	1.24	3.20	2.86	2.87

Source: authors' own

The analysis of growth rates of well-being can be further deepened by considering changes in sub-periods: longer-term analysis may in fact hide heterogeneity in welfare dynamics (Atkinson and Brandolini, 2001). Sub-period analysis shows several interesting pieces of evidence. Firstly, it is interesting to note that almost all the countries, with the exception of Canada, Germany, the UK and the USA, are characterized by the highest average GDP growth rates between 1970 and 1980, compared to the other sub-periods. In the 1970s to these high GDP growth rates correspond even higher increases in inequality-adjusted welfare changes in seven countries, which shows a general decreasing trend in income inequality. Only Australia, the UK and the USA experienced increasing welfare losses. On the other hand, we can notice an evident growth slowdown in the other two decades especially for the European countries in the 1990s, with the exception of France, which has been accompanied by even lower rates of growth in economic well-being. This phenomenon is particularly evident for Finland and Italy, where the average annual growth of the inequality accounting welfare measures is lower than that of per capita GDP by one percentage point (passing from 1.37% to 0.68% in Finland and from 1.51% to 0.62% in Italy). In these two countries, the 1990-2000 period has been characterized not only by a sharp slowdown with respect to the previous decade (with per capita GDP growth reduced from 2.66 to 1.37 and from 2.28 to 1.51 in Finland and Italy, respectively), but also by rising welfare losses. This suggests that richer individuals have received greater benefits from the growth process and that there has been a widening in social distances.

Table 4 shows changes in the estimated well-being loss implied by the three welfare measures considered. The information reported in this Table is the complement to that of Table 3 and isolates the inequality component of the rate of growth of welfare, measuring to what extent distribution-weighted and income-weighted growth rates differ. The analysis of the table allows to capture the income distribution dynamics across countries. Moreover, as previously highlighted, significant heterogeneities among sub-periods can be picked out, with a continuous worsening of welfare levels particularly evident in the 1990s, when all the countries with the exception of Australia and France experienced

significant reductions in economic well-being. The data reported in this table is then used in the following Figure 4 to distinguish the causes of changes in inequality and separate the effects of inequality due to income dispersion from that due to social distances.

From our elaborations we can highlight three main groups of countries. The first group (Group A) relates to those "virtuous" countries that show a fall in both income levels dispersion and rank dispersion over the whole selected period. Group B is characterized by moderate increases in inequality in income levels and by a considerable growth of social distance. In the last group (Group C) there are countries with the worst inequality dynamics, displaying a significant growth in both rank and income dispersions, which is particularly evident for the UK.

Table 4

Loss in social welfare: annual mean percentage variations (in percentage)

Country	1970-2000			1970-1980			1980-1990			1990-2000		
	Lost Utility 1	Lost Utility 2	Total lost utility	Lost Utility 1	Lost Utility 2	Total lost utility	Lost Utility 1	Lost Utility 2	Total lost utility	Lost Utility 1	Lost Utility 2	Total lost utility
Australia	0.36	1.21	0.64	0.73	2.45	1.28	2.48	0.43	1.73	-1.36	0.17	-0.85
Canada	-0.90	-0.33	-0.73	-2.69	-0.77	-2.13	-0.81	-0.28	-0.63	1.12	0.09	0.75
Finland	-0.03	-0.37	-0.17	-3.69	-1.86	-2.97	-1.06	-0.33	-0.73	7.35	1.30	4.49
France	-1.50	-0.20	-1.13	-2.99	-0.07	-2.17	1.54	-0.57	0.77	-2.45	-0.07	-1.67
Germany	0.49	0.21	0.38	-1.68	-0.28	-1.16	2.32	0.43	1.56	0.82	0.40	0.67
Italy	0.45	0.28	0.40	-0.76	-1.42	-0.97	-0.62	1.72	0.06	3.56	0.68	2.57
Mexico	0.74	0.27	0.65	-1.28	0.84	-0.84	2.43	-0.02	1.83	0.76	0.12	0.64
Norway	0.19	0.51	0.30	-0.46	0.23	-0.24	-1.11	2.12	0.00	2.29	-0.39	1.21
UK	2.76	0.65	1.92	-0.23	0.44	0.04	7.42	2.06	5.19	0.74	-0.52	0.33
USA	0.99	0.40	0.81	0.27	0.95	0.48	1.33	0.58	1.09	0.90	-0.28	0.55

Source: authors' own

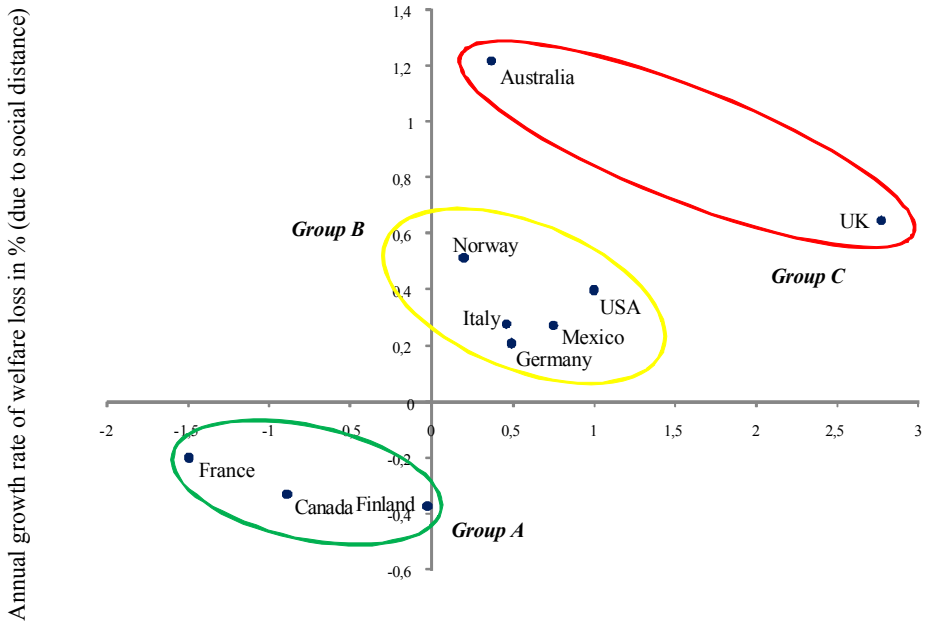

Figure 4. Chustering of countries by mean annual growth rate of welfare loss (1970-2000)

Source: autors' own

Finally, Figures 5 and 6 provide a summary of the relationship between income-based growth and changes in inequality of incomes, and further highlight how the framework proposed in this paper can be very effective in illustrating the efficiency and equity implications of the growth process. The welfare loss measure considered in the Figures is the EDEI2 measure, accounting for both types of inequality.

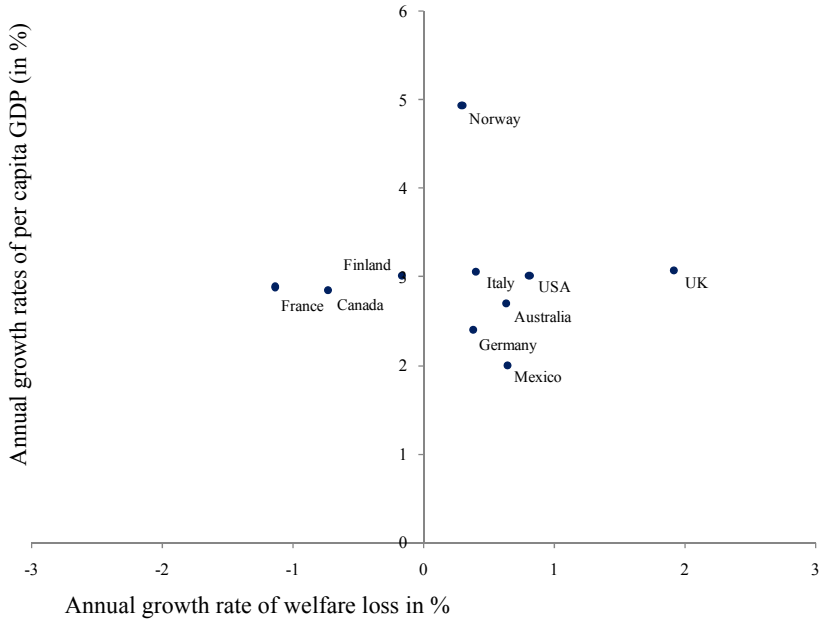

Figure 5. Sorting of countries by annual growth rates and of GDP and welfare loss (1970-2000)

Source: authors' own

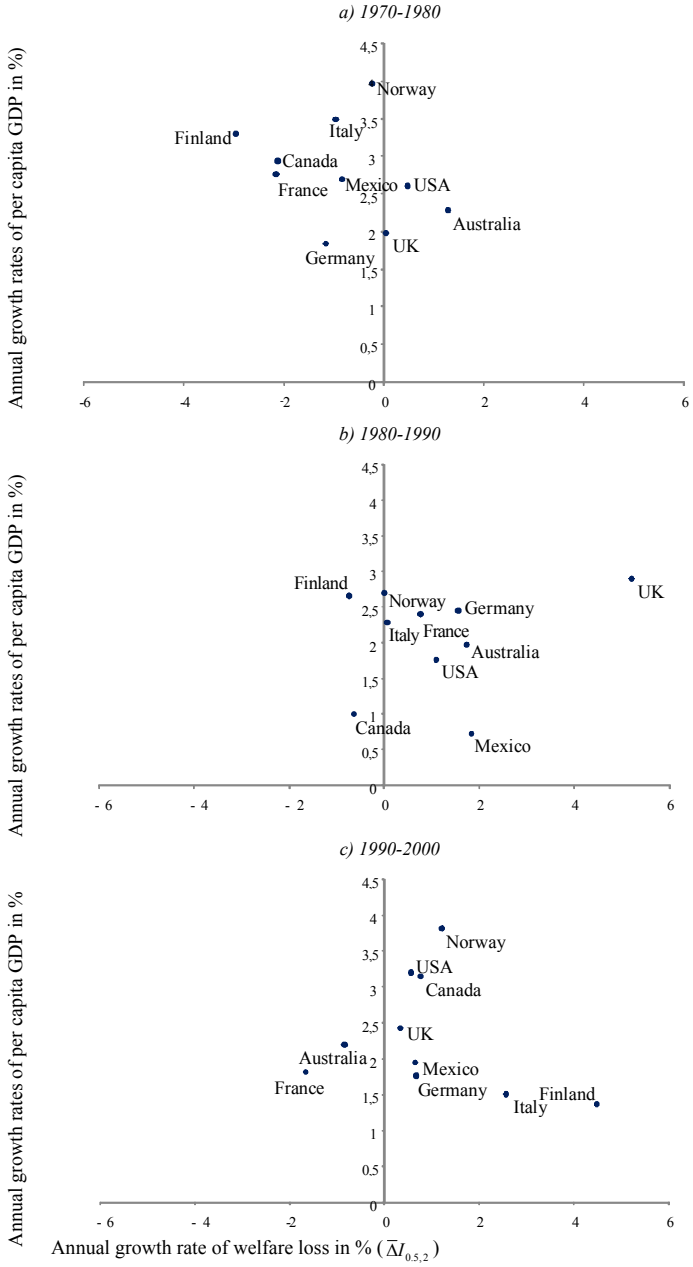

Figure 6. Countries by annual GDP growth rates and mean annual changes in welfare loss for different sub-periods;
Source: autors' own

Analyzing Figure 5, no clear relationship between income growth and changes in inequality can be seen. The three countries with decreasing inequality in both income levels and social distances (France, Canada and Finland) line up on the same mean growth rate of the other industrialized countries, but their resulting growth in welfare levels is much higher due to rising distribution equity. Five countries out of ten are characterized by "pro-poor" growth over the entire period of analysis. Regarding the remaining countries, Norway has the highest per capita GDP growth rate, and its increasing inequality does not reduce welfare noticeably. Among the industrialized countries, the UK experienced the highest income inequality growth, which is mainly due to the sharply rising inequality in the eighties (panel b of Figure 6), confirming the findings of Jenkins (1997).

Annual growth rates of per capita GDP (in %) disaggregated by sub-periods reveal several interesting findings. It is confirmed that the relationship between income and inequality growth rates does not show any clear pattern. However, heterogeneous dynamics can be detected among the sub-periods. In particular, while the 1970s are characterized by rising incomes and decreasing inequality in almost all the countries, the situation significantly changes in the other two decades, when only Finland and Canada in 1980 and Australia and France in the 1990s reveal a modest decrease in income inequality, which indicates that the growth process has favoured individuals in the lowest part of the distribution, thus increasing aggregate economic well-being.

The analysis carried out in this Section clearly highlights that combining income growth with levels and changes in inequality leads to very large differences in the evaluation of the dynamics of economic well-being. From a policy perspective, the approach considered in the present study suggests that interventions aimed at increasing the incomes of the poor, realizing a more even distribution of incomes, may yield higher growth in aggregate economic welfare.

6. CONCLUDING REMARKS

The topic of the relationship between wealth and economic well-being is grounded on the analysis of income distribution and is concerned with relevant nature of social, psychological, political and ethical aspects. It gives back the worthiness of human science to economics, and at the same time it highlights not only the quantitative aspects on economic development, but also the qualitative

ones, as an expression of social cohesion, environmental compatibility and responsibility with respect to future generations (Boulding, 1970).

In this paper, we have investigated how inequality-adjusted welfare measures would change the impression of aggregate well-being in both cross-country and intertemporal dimensions. A generalized approach to inequality measurement has been applied to incorporate distributional components in the evaluation of economic well-being. This framework has allowed to obtain alternative welfare measures that penalize mean income for inequality in income levels and for relative distances in individual incomes.

Using plausible adjustments for inequality that are consistent with the literature on both inequality aversion and relative deprivation, the corresponding inequality-adjusted measures of economic well-being obtained, compared to per capita incomes, significantly change the picture of aggregate welfare across countries and over time.

As clearly emerges from our results, inequality matters for welfare comparisons. The ranking of countries for the selected reference years is significantly affected by adjustments for income inequality, measured not only in terms of income levels, but also in terms of social distances, suggesting that relative income may be much more important for individual and aggregate welfare than absolute income.

Moreover, with respect to the evidence obtained in the intertemporal analysis, the methodology presented in the paper has allowed to account for distributional issues by defining welfare changes over time in terms of equally distributed equivalent levels of income for each year. The results obtained highlighted that combining income growth with levels and changes in inequality lead to very large differences in the evaluation of economic well-being growth. The move from a simple income-weighted growth rate to distribution-weighted measures, which evaluate the observed growth in the distribution-sensitive welfare measures, proved to be very effective. Such measures may lead to a re-evaluation of economic policy priorities in favour of interventions aimed at increasing the incomes of the poor, which not only provide a more even distribution of incomes but also yield higher growth in aggregate economic well-being.

Despite the fact that this analysis does not offer a clear-cut solution to the issues connected to the measurement of economic welfare, it provides significant insights on the relevance of including both size and distribution considerations in the assessment of economic well-being and growth, suggesting that improvements in understanding well-being are not only feasible but also relevant for economic policy.

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Appendix

Table A1

Sample composition: availability of income data and Gini indexes

	1970			1975			1980			1985			1990			1995			2000		
Country	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**	**Year**	**Gini**	**Index**
Australia	1968	26.1	(31.8)	1976[a]	30.3	(30.3)	1981	30.1	(31.0)	1985	31.6	(32.5)	1989	33.2	(33.2)	1995[a*]	30.0	(30.0)	2000[a*]	30.7	(30.7)
Canada	1971	37.3	(37.3)	1975	33.0	(33.1)	1981	32.3	(32.3)	1987	31.5	(31.5)	1991	30.9	(30.9)	1994	31.3	(31.3)	2000	32.4	(32.4)
Finland	1971	26.6	(26.7)	1976	21.4	(21.4)	1981	20.5	(20.5)	1985	22.4	(22.4)	1990	20.1	(20.1)	1995	21.6	(21.7)	2000	26.4	(26.4)
France	1970	36.7	(42.5)	1975	35.1	(35.2)	1981	30.5	(31.4)	1984[b*]	31.0	(37.6)	1989	31.8	(32.7)	1995	30.1	(30.2)	2000	28.2	(28.2)
Germany	1973	29.0	(29.9)	1978	27.8	(28.7)	1981	27.1	(28.0)	1985	30.0	(30.0)	1990	29.7	(29.7)	1995	31.8	(31.8)	2000	30.7	(30.7)
Italy	1970	33.4	(39.0)	1975	33.6	(39.2)	1980	31.9	(37.5)	1986	32.4	(32.5)	1991	31.6	(31.6)	1995	35.4	(35.4)	2000	35.7	(35.8)
Mexico	1968	48.3	(53.6)	1975	51.9	(57.4)	1977	44.8	(50.4)	1984	46.9	(46.9)	1989	51.6	(51.3)	1994	53.8	(53.6)	2000	53.7	(53.5)
Norway	1970	24.9	(30.7)	1976	26.0	(31.7)	1982	25.7	(32.5)	1985	26.0	(31.8)	1990	27.0	(32.8)	1996	29.6	(35.4)	2000	30.7	(36.5)
UK	1970	25.4	(25.4)	1975	23.7	(23.7)	1980	25.2	(25.2)	1985	27.6	(27.7)	1990	33.5	(33.5)	1995	32.8	(32.9)	2000	34.7	(34.6)
USA	1972	32.1	(38.8)	1974	35.0	(35.9)	1979	34.2	(34.3)	1986	37.2	(37.2)	1991	37.3	(37.4)	1994	39.0	(39.0)	2000	39.4	(39.4)

Source: authors' own

Notes:data is taken from WIID (2006) if not otherwise indicated. Gini indexes are computed from income data by population percentiles interpolated from decile shares where available. For comparison purposes, we present Gini indexes reported in WIID in round brackets.

a) Data taken from Australian Bureau of Statistics (ABS)

b) Data taken Luxembourg Income Study (LIS)

* Quintile income distribution

Table A2. Data: Cumulative shares of income by population decile (%)

	a) 1970	**Population decile**								
Country	**First**	**Second**	**Third**	**Fourth**	**Fifth**	**Sixth**	**Seventh**	**Eight**	**Ninth**	**Tenth**
Australia	2.9	5.5	7.1	8.1	8.9	9.8	10.7	12.0	14.1	20.9
Canada	1.8	3.8	5.2	6.4	7.5	8.8	10.4	12.7	16.4	26.9
Finland	3.7	5.4	6.5	7.5	8.5	9.6	10.7	12.2	14.4	21.4
France	2.1	3.9	5.1	6.4	8.0	9.2	9.6	12.5	15.5	27.6
Germany	3.5	5.2	6.2	7.1	8.2	9.2	10.5	12.2	14.8	23.1
Italy	2.6	4.2	5.8	6.9	8.1	9.2	10.2	12.1	15.1	25.7
Mexico	1.9	3.2	4.0	4.9	5.7	6.8	8.2	10.8	15.3	39.3
Norway	3.0	4.8	5.9	7.1	8.1	9.4	10.8	12.4	14.4	24.1
UK	4.0	5.7	6.8	7.7	8.5	9.4	10.6	11.9	14.0	21.3
USA	2.2	4.1	5.5	7.1	8.5	10.0	11.3	12.9	15.2	23.1
	b) 2000	**Population decile**								
Country	**First**	**Second**	**Third**	**Fourth**	**Fifth**	**Sixth**	**Seventh**	**Eight**	**Ninth**	**Tenth**
Australia*	7.7	12.6	17.6	23.7	38.4	-	-	-	-	-
Canada	2.7	4.6	5.8	6.9	8.0	9.1	10.6	12.4	15.1	24.8
Finland	4.3	5.7	6.6	7.5	8.3	9.3	10.3	11.5	13.4	23.2
France	4.0	5.0	6.0	7.0	8.0	9.0	11.0	12.0	15.0	22.0
Germany	3.0	5.0	6.0	7.0	8.0	9.2	10.7	12.4	15.1	23.7
Italy	2.2	4.1	5.3	6.5	7.7	9.1	10.4	12.4	15.3	26.9
Mexico	1.2	2.2	3.1	4.1	5.2	6.6	8.4	10.9	16.0	42.3
Norway	2.3	3.8	5.0	6.3	7.5	9.1	10.9	12.9	15.3	26.9
UK	2.8	4.6	5.6	6.5	7.6	8.7	10.0	11.8	14.5	27.9
USA	1.8	3.5	4.8	6.0	7.3	8.7	10.3	12.5	16.1	29.0

Source: authors' own. Notes: data is taken from WIID (2006) and then corrected by means of the regression based approach discussed in Section 3
*Quintile income data

Table A3

Generalized Lorenz dominance: cross-country comparisons in 2000

	Australia	**Canada**	**Finland**	**France**	**Germany**	**Italy**	**Mexico**	**Norway**	**UK**	**USA**
Australia		x	x	x	x	x	+	-	x	x
Canada	x		x	x	x	x	+	-	x	x
Finland	x	x		x	x	x	+	x	x	x
France	x	x	x		x	x	+	x	x	x
Germany	x	x	x	x		x	+	-	x	x
Italy	x	x	x	x	x		+	-	-	-
Mexico	-	-	-	-	-	-		-	-	-
Norway	+	+	x	x	+	+	+		+	x
UK	x	x	x	x	x	+	+	-		x
USA	x	x	x	x	x	+	+	x	x	

Source: authors' own

Notes: + stands for "dominates"; - stands for "is dominated by"; x indicates crossing generalized Lorenz curves.

90 pair-wise comparisons: 36 unambiguous dominances (36%) and 58 ambiguities (64%).