A Summary Indicator Providing a Snapshot of Political Opinions when Variables are Ordinal

Deutsch, Joseph; Silber, Jacques

A Summary Indicator Providing a Snapshot
of Political Opinions when Variables are Ordinal

Joseph Deutsch

Department of Economics, Bar-Ilan University
Ramat Gan 5290002, Israel

Faculty of Economics, Ashkelon Academic College
Ben Tzvi 12, Ashkelon 78211, Israel
jdeutsch@biu.ac.il

Jacques Silber*

Department of Economics, Bar-Ilan University
Ramat Gan 5290002, Israel

Luxembourg Institute of Socio-Economic Research (LISER) Belval
L-4366 Esch-sur-Alzette, Luxembourg

Centro Camilo Dagum/Tuscan Universities Research Centre — Camilo Dagum
on Advanced Statistics for Equitable and Sustainable Development
Dipartimento di Economia e Management, Università di Pisa
Via C. Ridolfi 10, 56124 Pisa, Italy

Global Labor Organization (GLO)
Leimkugelstr. 6, 45141 Essen, Germany
jsilber_2000@yahoo.com

This paper deals with the evaluation of the relative performance of different groups when the achievements of the members of a group are summarised by the relative distribution of

---

*Corresponding author.

these achievements across various ordered categories. After reviewing a previous attempt by Herrero and Vilar to deal with this issue, we propose to adopt an approach introduced recently by Apouey, Silber and Xu who derived a measure of achievement that, in the case of ordinal variables, takes account of both the inequality and the location of a distribution. Their approach is then applied to the analysis of political opinions, using the International Social Survey Programme for the year 2009. We compare questions dealing with respectively the need for the government to reduce income inequality, the duty of the government to help poor and unemployed individuals and the inequality of opportunity in health and education. It appears that the correlations obtained for our summary indicator of political opinions, based on the data covering 41 countries, reflect quite well the distinction we made between the three types of questions on political opinions. In addition, regression results show that generally the higher the inequality in a country, the more likely it is that people will approve government intervention aimed at reducing inequality and poverty.

Keywords: Achievement; Gini index; International Social Survey Programme; ordinal variables; political opinion.

JEL Classification: D39, D63, I38

Introduction

Evaluating the relative performance of groups when the achievements of the members of a group are summarised by the relative distribution of these achievements across various ordered categories is an issue that has been discussed in several papers in recent years. Assume, for example, that individuals are asked to state to what extent they believe that income differences in their country are too large and that the possible answers are as follows: 1: Strongly agrees; 2: Agrees; 3: Neither agrees nor disagrees; 4: Disagrees; 5: Strongly disagrees. How can we then summarise with one number the distribution of the individuals between the five possible answers?

One simple solution one may think of is to give weights to each of the five categories distinguished. One could, for example, give a weight of 5 to 'Strongly agrees', of 4 to 'Agrees', of 3 to 'Neither agrees nor disagrees', of 2 to 'Disagrees' and of 1 to 'Strongly disagrees'. Using these weights one can then compute a weighted average of the answers given by the individuals, but the results obtained will clearly depend on the weights selected. Schröder and Yitzhaki (2017) and Bond and Lang (2019) have shown how problematic such a solution is. Bérenger and Silber (2022) have however shown that if one uses the mean happiness as an overall measure of happiness and chooses the rank of the ordered variables as weight, one implicitly assumes that the overall level of happiness obeys the axioms of normalisation, independence, anonymity and weak Pareto principle which will be shortly described in the third section.

Another solution that has been proposed is to use stochastic dominance and compare the cumulative distributions of two groups, but in such a case we will

obtain only a partial order because stochastic dominance often does not allow one to conclude that one distribution is better than another.

Lieberson (1976) proposed a procedure that can be applied to any pair of distributions. The idea is to compute, for example, the probability for an individual belonging to group *A* to belong to a higher category than an individual belonging to group *B*. However, as stressed by Herrero and Vilar (2013), this evaluation procedure is not transitive when there are more than two groups. One may then end up with cycles and not be able to rank the distributions of the different groups. This is the reason why Herrero and Vilar (2018), following a previous paper of them on this topic (Herrero and Vilar, 2013), proposed a new method called 'balanced worth' which has the advantage of being a cardinal, complete and transitive evaluation procedure. This approach is also based on the probability for a group to obtain better results when compared to another group.

In this paper, we propose to compare the results obtained when using the measure introduced by Herrero and Vilar (2018) with those observed when adopting the approach proposed recently by Apouey *et al.* (2020). The latter introduced a measure of achievement that, in the case of ordinal variables, can take account of both the inequality and the location of a distribution.

We apply these two measures to the analysis of political opinions when the variables under study are ordinal, using the International Social Survey Programme (ISSP) for the year 2009. We compare questions dealing with respectively the need for the government to reduce income inequality, the duty for the government to help poor and unemployed individuals and the inequality of opportunity in health and education. It appears that the correlations obtained for our summary indicator of political opinions, based on the data covering 41 countries, reflect quite well the distinction we made between the three types of questions on political opinions.

The second section describes previous attempts of summarising the answers to statements, when these answers can be ordered, with particular attention being given to the concept of 'balanced worth' introduced by Herrero and Vilar (2018). The focus of the third section is on the approach of Apouey *et al.* (2020). The fourth section presents an empirical illustration based on the data of the International Social Survey Programme for the year 2009. The values of the measure of balanced worth and that of the index of Apouey *et al.* (2020) are given for each question examined and each country. Correlations are then computed both between these two measures and, for the index of Apouey *et al.*, between the values observed for this index on the various questions examined. Finally, regressions are estimated, where the dependent variable is either the measure of Herrero and Vilar or that of Apouey *et al.*, while the explanatory variables are the Gini index, a measure of the extent of democracy, the per-capita GDP [at purchasing power parity (PPP)] and the growth

rate in each of the countries for which the ISSP collected data. The fifth section gives concluding comments.

Previous Attempts of Summarising the Answers to Statements, when these Answers can be Ordered

We will not review here the vast literature dealing with the measurement of public opinion. The reader is referred to Berinsky (2017) for a recent thorough survey, and to previous studies by, for example, Durr (1993), Stimson (2012), Mulligan *et al.* (2013) and Klar (2014).

We will rather focus our attention on the issue of comparing group performance when only ordered categorical data are available. Lieberson (1976) was probably the first to study this problem [see also Cuhadaroglu, 2013], but his paper is limited to the comparison of two groups. Herrero and Vilar (2013) showed that Lieberson's approach may face a problem of non-transitivity when more than two groups are considered and proposed a solution to this issue. Herrero and Vilar (2018) then extended the analysis by taking account of the possibility of ties between groups.

Let n_{ir} refer to the number of individuals who in population i have a performance level r (with r varying from 1 to R) and we define a_{ir} as: $a_{ir} = (n_{ir} / \sum_{r=1}^{R} n_{ir})$. If the performance levels are ordered from the best to the worst, following Lieberson (1976), the probability p_{ij} that a member chosen at random from population i has a higher level of performance than a member chosen at random from population j, will be expressed as

$$p_{ij} = a_{i1}(a_{j2} + \cdots + a_{jR}) + a_{i2}(a_{j3} + \cdots + a_{jR}) + \cdots + a_{i,(R-1)}a_{jR}. \quad (1)$$

Let now $c_{ij} = c_{ji}$ be the probability for a member of group i to have the same level of performance as a member of group j. In other words, we write that

$$c_{ij} = a_{i1}a_{j1} + \cdots + a_{iT}a_{jT}. \quad (2)$$

We therefore derive that

$$p_{ij} + p_{ji} + e_{ij} = 1. \quad (3)$$

If there are only two groups, i and j, the probability of group i to be better than group j will be expressed as $p_{ij} + (\frac{e_{ij}}{2})$, while that of group j to be better than group i will be $p_{ji} + (\frac{e_{ij}}{2})$.

Let w_i and w_j refer to the 'values' of groups i and j and assume that these values are proportional to the probability of being a 'winner'. The ratio of these values will

then be expressed as

$$\frac{w_i}{w_j} = \frac{p_{ij} + (\frac{e_{ij}}{2})}{p_{ji} + (\frac{e_{ij}}{2})}.$$ (4)

If there are more than two groups, we extend (4) by taking the expectations and write that

$$\frac{w_i}{w_j} = \frac{\frac{1}{G-1}\sum_{j\neq i}(p_{ij} + (\frac{e_{ij}}{2}))}{\frac{1}{G-1}\sum_{i\neq j}(p_{ji} + (\frac{e_{ij}}{2}))}, \quad ij = 1, 2, \ldots, G,$$ (5)

where G refers to the number of groups.

To derive the values of each element $w_g (g = 1 - G)$ of the vector $w = \{w_1, \ldots, w_g, \ldots, w_G\}$, we have to solve the following set of simultaneous equations:

$$\sum_{j\neq 1}\left[p_{j1} + \left(\frac{e_{j1}}{2}\right)\right]w_1 = \sum_{j\neq 1}w_j\left[p_{j1} + \left(\frac{e_{1j}}{2}\right)\right],$$

$$\cdots$$

$$\sum_{j\neq G}\left[p_{jG} + \left(\frac{e_{jG}}{2}\right)\right]w_G = \sum_{j\neq G}w_j\left[p_{jG} + \left(\frac{e_{jG}}{2}\right)\right].$$

Taking the Variation of Political Opinions into Account when Deriving a Summary Measure of Political Opinions

In a recent paper, Apouey *et al.* (2020) introduced a measure of achievement adapted to the case of ordinal variables. They derived axiomatically an index which is sensitive to both the average level of achievement and the inequality of the distribution of these achievements. The measure proposed by Apouey *et al.* (2020) may clearly be also applied to analyse the distribution of answers to the questions asking individuals to choose among different potential answers that can be ordered [see Deutsch and Silber (2022) for more details]. Such a measure should therefore be also useful to analyse the distribution of political opinions when the latter can be ranked.

Suppose that there are N individuals. As in the previous section, assume that r is the political opinion of some individual with $1 \leq r \leq R$, where R is the number of potential ranked opinions. Each opinion reflects a given level of agreement with a political statement. We will assume that these opinions are ranked by decreasing level of agreement with the political statement which people are asked to evaluate. Let O be the vector of the political opinions of the different individuals so that $O = \{o_1, \ldots, o_i, \ldots, o_N\}$. Call IO the index summarizing the distribution of these political opinions with $IO = g(O)$ Let f_r be the relative frequency of political opinion r and let β be a parameter with $0 < \beta < 1$.

Borrowing the measure derived by Apouey *et al.* (2020), we propose to define IO as

$$IO = g(O) = \sum_{r=1}^{R} f_r \frac{1 - \beta^{R-r}}{1 - \beta^{R-1}}. \tag{6}$$

When $\beta \to 1$, IO will be expressed as

$$IO = \sum_{r=1}^{R} f_r \frac{R - r}{R - 1}. \tag{7}$$

Note that expression (7) implies that the index IO when $\beta \to 1$ turns out to be a linear function of the arithmetic mean of the answers (of $\sum_{r=1}^{R} f_r r$), assuming the potential answers have the values of $1, \ldots, r, \ldots R$.

Apouey *et al.* (2020) have shown that the measure given in (6) satisfies the properties of normalisation, independence, weak Pareto principle, anonymity, equity principle and proportional equality.

The axiom of *normalisation* implies that, whatever the value chosen for the parameter β, when everyone selects political opinion 1, which is assumed to correspond to the highest level of agreement with the political statement under study, the index IO will be equal to 1. Similarly, whatever the value of β, when everyone selects as answer a political opinion R, which is assumed to correspond to the lowest level of agreement with the political statement under study, the index IO will be equal to 0.

The *equity* principle implies that changes in the political opinions of two individuals, from two further-apart to two 'closer' political opinions, will raise the level of overall agreement with the political statement under study, whatever the value of the parameter β that is selected.

Another interesting property of IO is that when the inequality of opinions is maximal, i.e. when 50% of the individuals choose political opinion 1 and 50% political opinion R, the index IO will be equal to 0.5, whatever the value of the parameter β that is selected.

Another point that should be stressed is that for a given distribution of political opinions, the higher the value of the parameter β, the lower the aversion to inequality since we saw that when $\beta \to 1$ inequality is ignored, the expression for the index IO becomes that given in (7). Similarly, for a given distribution of political opinions, the lower the value of the parameter β, the higher the aversion to inequality and hence the higher the value of the index IO, since the answers are ranked by decreasing values of the degrees of agreement with the political statement under study.

According to the *weak Pareto principle*, if everyone selects the same answer r, the index IO will take a higher value than if everyone chooses the same answer r' with $r' > r$.

The property of *anonymity* implies that the value of the index IO depends only on the political opinion of each individual and not on any other characteristic of these individuals.

According to the axiom of *independence*, when there is a change in the political opinion of a given individual that is not accompanied by any change in the political opinion of the other individuals, the variation in the value of the index IO will not depend on the initial political opinion of the other individuals.

Empirical Illustrations

Data sources

The database for this study is the International Social Survey Programme. We analysed the survey of 2009 which focussed on Social Inequality. We focussed our attention on the following questions:

(1) Differences in income are too large.
(2) It is the responsibility of the government to reduce the differences in income between people with high incomes and those with low incomes.
(3) High-income people should pay a larger share of income in taxes.
(4) The government should provide a decent standard of living for the unemployed.
(5) The government should spend more on benefits for the poor.
(6) It is not just that high-income people can buy better healthcare.
(7) It is not just that high-income people can buy better education for their children.

For each question, the possible answers were: 1: Strongly agrees; 2: Agrees; 3: Neither agrees nor disagrees; 4: Disagrees; 5: Strongly disagrees. We dropped from the sample the observations where the individual could not choose between the answers or did not answer.

Note that questions (1)–(3) deal with income inequality, while questions (4) and (5) focus more on the need for a minimum standard of living. Finally, questions (6) and (7) concern the issue of inequality of opportunity. In other words, the questions deal with three quite different issues. First, many people do not care too much about income inequality but believe strongly in the importance of equality of opportunity. Second, people favouring free markets will often be against government intervention aiming at reducing income inequality, but will not oppose government intervention if its goal is to give a minimum standard of living to the poor. They might be less in favour of helping the unemployed because they may believe that such government intervention may favour unemployment. The link between the issue of equal opportunity and that of granting a minimum standard of living is probably less clear-cut.

At the light of what was just mentioned, we may predict a relatively high correlation between the values of the index IO for questions (1)–(3) and a lower correlation between the values of the index IO for questions (1)–(3) and its values for questions (6) and (7) and probably also questions (4) and (5). The link between the values of the index IO for questions (4) and (5) and its values for questions (6) and (7) is probably not very clear.

We also expect to observe a high correlation between the index w_g of Herrero and Vilar (2013) and the index IO of Apouey *et al.* (2020) when the parameter $\beta \to 1$ since in such a case the index of Apouey *et al.* ignores the extent of inequality of the distribution of answers, a feature which is clearly shared by the index w_g of Herrero and Vilar. But for a value of β different from 1 (e.g. $\beta = 0.5$, as in the empirical illustration below), we expect a lower correlation since, as was mentioned before, the index w_g ignores inequality.

Summarising the answers to the various questions

For each question, we summarise the distribution of the answers by computing for each country the measure w_g and the index IO. For the latter index, we took two scenarios into account. In the first case, we assumed that the index IO depended on both the location and the dispersion of the political opinions, as explained in the second section, and supposed that the parameter β was equal to 0.5. In the second case, the value of β was assumed to be equal to 0.999 which corresponds to the case ($\beta \to 1$), then the index IO depends only on the location of the distribution of political opinions. Tables 1(a)–1(c) and 2 show the results obtained.

In Table 1(a), we examine three questions related to income differences. In the first one, individuals were asked to say to what extent they agree with a statement saying that income differences were too large in their country. When applying the index IO that was defined in (1) with a parameter α equal to 0.5, it turns out that the index is highest in Hungary (IO = 0.979), Ukraine (IO = 0.976), Italy (IO = 0.964), Portugal (IO = 0.963) and Latvia (IO = 0.962). It is lowest in the Philippines (IO = 0.732), Denmark (IO = 0.797), Norway (IO = 0.833), Cyprus (IO = 0.840) and the United States (IO = 0.845). If we assume that the parameter α is equal to 0.999, which is the case of Eq. (2) where the dispersion between the answers of the individuals is ignored, we observe that the index is highest in Hungary (IO = 0.935), Ukraine (IO = 0.926), Italy (IO = 0.897), Estonia (IO = 0.890) and France (IO = 0.890). The index is lowest in the Philippines (IO = 0.569), Norway (IO = 0.639), Denmark (IO = 0.649), New Zealand (IO = 0.673) and Cyprus (IO = 0.683).

We then examine the question where individuals were asked to what extent they agree with a statement saying that it is the responsibility of the government to

Table 1(a). Summary measures [Apouey *et al.*'s (2020) index] of agreement with political statements on income differences (ranking of the countries in parentheses).

	Income differences too large	Income differences too large	Government has to reduce these differences	Government has to reduce these differences	High-income people should pay a larger share of income in taxes	High-income people should pay a larger share of income in taxes
Country	$\beta = 0.5$	$\beta = 0.999$	$\beta = 0.5$	$\beta = 0.999$	$\beta = 0.5$	$\beta = 0.999$
Argentina	0.934 (22)	0.813 (25)	0.908 (13)	0.766 (15)	0.914 (18)	0.749 (19)
Australia	0.884 (31)	0.729 (32)	0.755 (38)	0.577 (38)	0.904 (25)	0.724 (28)
Austria	0.935 (20)	0.826 (21)	0.868 (24)	0.722 (22)	0.914 (18)	0.743 (22)
Belgium	0.874 (33)	0.716 (34)	0.860 (25)	0.699 (25)	0.891 (33)	0.705 (34)
Bulgaria	0.958 (8)	0.875 (11)	0.911 (11)	0.799 (11)	0.941 (4)	0.851 (3)
Chile	0.922 (27)	0.797 (28)	0.879 (21)	0.707 (24)	0.896 (28)	0.729 (25)
China	0.938 (16)	0.817 (24)	0.911 (11)	0.757 (17)	0.901 (27)	0.729 (25)
Taiwan	0.929 (25)	0.822 (22)	0.831 (28)	0.651 (30)	0.926 (12)	0.774 (15)
Croatia	0.949 (13)	0.867 (12)	0.928 (10)	0.820 (8)	0.928 (10)	0.780 (12)
Cyprus	0.840 (38)	0.683 (37)	0.847 (27)	0.677 (27)	0.875 (39)	0.683 (39)
Czech Rep.	0.922 (27)	0.820 (23)	0.827 (29)	0.674 (28)	0.892 (32)	0.711 (31)
Denmark	0.797 (40)	0.649 (39)	0.715 (40)	0.575 (39)	0.889 (37)	0.689 (38)
Estonia	0.954 (12)	0.890 (4)	0.892 (17)	0.775 (14)	0.908 (22)	0.741 (24)
Finland	0.872 (34)	0.720 (33)	0.873 (22)	0.732 (20)	0.927 (11)	0.777 (14)
France	0.955 (10)	0.890 (4)	0.897 (15)	0.789 (12)	0.937 (6)	0.811 (6)
Germany	0.938 (16)	0.842 (14)	0.823 (30)	0.670 (29)	0.926 (12)	0.780 (12)
Hungary	0.979 (1)	0.935 (1)	0.936 (6)	0.838 (4)	0.905 (24)	0.747 (21)
Iceland	0.937 (18)	0.830 (20)	0.872 (23)	0.713 (23)	0.906 (23)	0.716 (30)
Israel	0.933 (23)	0.832 (18)	0.902 (14)	0.782 (13)	0.876 (38)	0.676 (40)
Italy	0.964 (3)	0.897 (3)	0.932 (8)	0.838 (4)	0.949 (3)	0.831 (5)
Japan	0.899 (29)	0.778 (29)	0.800 (34)	0.637 (32)	0.933 (7)	0.802 (7)
S. Korea	0.937 (18)	0.831 (19)	0.882 (20)	0.730 (21)	0.952 (1)	0.855 (2)
Latvia	0.962 (5)	0.880 (9)	0.931 (9)	0.816 (9)	0.915 (17)	0.750 (18)
Lithuania	0.940 (15)	0.836 (17)	0.936 (6)	0.816 (9)	0.926 (12)	0.782 (11)
New Zealand	0.850 (36)	0.673 (38)	0.721 (39)	0.526 (40)	0.875 (39)	0.665 (41)
Norway	0.833 (39)	0.639 (40)	0.793 (36)	0.589 (37)	0.896 (28)	0.697 (37)
The Philippines	0.732 (41)	0.569 (41)	0.766 (37)	0.590 (36)	0.860 (41)	0.702 (35)
Poland	0.935 (20)	0.839 (15)	0.892 (17)	0.763 (16)	0.891 (33)	0.707 (32)
Portugal	0.963 (4)	0.886 (6)	0.945 (2)	0.847 (3)	0.924 (15)	0.786 (10)
Russia	0.961 (6)	0.886 (6)	0.944 (4)	0.850 (2)	0.938 (5)	0.834 (4)
Slovakia	0.958 (8)	0.881 (8)	0.890 (19)	0.755 (18)	0.910 (21)	0.748 (20)
Slovenia	0.959 (7)	0.878 (10)	0.942 (5)	0.837 (7)	0.931 (9)	0.788 (9)
South Afr.	0.943 (14)	0.838 (16)	0.849 (26)	0.697 (26)	0.896 (28)	0.718 (29)
Spain	0.931 (24)	0.798 (27)	0.894 (16)	0.741 (19)	0.923 (16)	0.764 (16)

Table 1(a). (*Continued*)

	Income differences too large	Income differences too large	Government has to reduce these differences	Government has to reduce these differences	High-income people should pay a larger share of income in taxes	High-income people should pay a larger share of income in taxes
Sweden	0.881 (32)	0.733 (31)	0.810 (32)	0.636 (33)	0.903 (26)	0.725 (27)
Switzerland	0.926 (26)	0.801 (26)	0.805 (33)	0.626 (34)	0.932 (8)	0.793 (8)
Turkey	0.955 (10)	0.858 (13)	0.945 (2)	0.838 (4)	0.894 (31)	0.760 (17)
Ukraine	0.976 (2)	0.926 (2)	0.954 (1)	0.879 (1)	0.951 (2)	0.862 (1)
The UK	0.894 (30)	0.743 (30)	0.822 (31)	0.641 (31)	0.913 (20)	0.743 (22)
The USA	0.845 (37)	0.690 (36)	0.606 (41)	0.424 (41)	0.890 (35)	0.700 (36)
Venezuela	0.853 (35)	0.692 (35)	0.796 (35)	0.613 (35)	0.890 (35)	0.706 (33)

reduce the differences in income between people with high incomes and those with low incomes. When it is assumed that the parameter α is equal to 0.5, we observe that the index is highest in Ukraine (IO = 0.954), Portugal (IO = 0.945), Turkey (IO = 0.945), Russia (IO = 0.944) and Slovenia (IO = 0.942). For this value of α, the index is lowest in the United States (IO = 0.606), Denmark (IO = 0.715), New Zealand (IO = 0.721), Australia (IO = 0.755) and the Philippines (IO = 0.766). If we assume that the parameter α is equal to 0.999 (no account is taken of the dispersion in the answers of the individuals), it turns out that the index is highest in Ukraine (IO = 0.879), Russia (IO = 0.850), Portugal (IO = 0.847), Hungary (IO = 0.838), Italy (IO = 0.838) and Turkey (IO = 0.838). The index is lowest in the United States (IO = 0.424), New Zealand (IO = 0.526), Denmark (IO = 0.575), Australia (IO = 0.577) and Norway (IO = 0.589).

In Table 1(a), we finally examine the following statement: 'High-income people should pay a larger share of income in taxes'. When $\beta = 0.5$, the highest values of the index IO are observed in South Korea (0.952), Ukraine (0.951), Italy (0.949), Bulgaria (0.941) and Russia (0.938). The lowest values are observed in the Philippines (0.860), Cyprus and New Zealand (0.875), Israel (0.876) and Denmark (0.889). When the parameter β is equal to 0.999, the countries with the highest values of the index IO are, respectively, Ukraine, South Korea, Bulgaria, Russia and Italy, while the lowest values of the index IO are observed in New Zealand, Israel, Cyprus, Denmark and Norway.

Table 1(b) considers the following two statements: 'The government should provide a decent living to the unemployed' and 'The government should spend more on the benefits to the poor'. When the parameter β is equal to 0.5, we note for the first question that the highest values of the index IO are observed in Estonia

Table 1(b). Summary measures [Apouey *et al.*'s (2020) index] of agreement with political statements on whether the government should help the unemployed and poor (ranking of the countries in parentheses).

	Government should provide decent living to unemployed	Government should provide decent living to unemployed	Government should spend more on benefits to poor	Government should spend more on benefits to poor
Country	$\beta = 0.5$	$\beta = 0.999$	$\beta = 0.5$	$\beta = 0.999$
Argentina	0.876 (25)	0.713 (26)	0.669 (38)	0.471 (39)
Australia	0.791 (37)	0.587 (38)	0.874 (17)	0.701 (24)
Austria	0.791 (37)	0.626 (36)	0.865 (20)	0.732 (18)
Belgium	0.765 (39)	0.549 (39)	0.863 (23)	0.675 (26)
Bulgaria	0.910 (11)	0.784 (9)	0.804 (32)	0.645 (29)
Chile	0.895 (20)	0.728 (22)	0.868 (19)	0.715 (23)
China	0.927 (5)	0.782 (10)	0.631 (40)	0.442 (40)
Taiwan	0.869 (28)	0.694 (31)	0.889 (10)	0.728 (20)
Croatia	0.906 (14)	0.774 (13)	0.869 (18)	0.733 (17)
Cyprus	0.888 (23)	0.724 (23)	0.921 (1)	0.816 (1)
Czech Rep.	0.828 (35)	0.655 (33)	0.803 (33)	0.628 (33)
Denmark	0.914 (9)	0.821 (4)	0.901 (6)	0.799 (3)
Estonia	0.947 (1)	0.867 (1)	0.915 (3)	0.808 (2)
Finland	0.903 (16)	0.763 (15)	0.892 (8)	0.749 (11)
France	0.862 (30)	0.707 (28)	0.666 (39)	0.526 (38)
Germany	0.832 (33)	0.651 (34)	0.886 (11)	0.732 (18)
Hungary	0.914 (9)	0.786 (8)	0.783 (35)	0.629 (32)
Iceland	0.902 (17)	0.740 (20)	0.920 (2)	0.770 (7)
Israel	0.871 (27)	0.708 (27)	0.886 (11)	0.756 (9)
Italy	0.888 (23)	0.731 (21)	0.910 (5)	0.791 (5)
Japan	0.866 (29)	0.723 (24)	0.880 (15)	0.744 (14)
S. Korea	0.906 (14)	0.769 (14)	0.892 (8)	0.772 (6)
Latvia	0.930 (4)	0.800 (6)	0.886 (11)	0.746 (13)
Lithuania	0.907 (13)	0.757 (17)	0.748 (37)	0.587 (37)
New Zealand	0.748 (40)	0.541 (40)	0.797 (34)	0.596 (36)
Norway	0.892 (22)	0.716 (25)	0.895 (7)	0.737 (16)
The Philippines	0.895 (20)	0.781 (11)	0.514 (41)	0.373 (41)
Poland	0.852 (31)	0.698 (29)	0.825 (28)	0.669 (28)
Portugal	0.924 (6)	0.791 (7)	0.805 (31)	0.671 (27)
Russia	0.918 (7)	0.801 (5)	0.876 (16)	0.747 (12)
Slovakia	0.845 (32)	0.660 (32)	0.816 (30)	0.630 (31)
Slovenia	0.915 (8)	0.778 (12)	0.843 (26)	0.683 (25)
South Afr.	0.898 (19)	0.758 (16)	0.761 (36)	0.620 (35)
Spain	0.908 (12)	0.752 (18)	0.864 (22)	0.716 (22)
Sweden	0.902 (17)	0.749 (19)	0.865 (20)	0.717 (21)

Table 1(b).   (*Continued*)

	Government should provide decent living to unemployed	Government should provide decent living to unemployed	Government should spend more on benefits to poor	Government should spend more on benefits to poor
Switzerland	0.876 (25)	0.695 (30)	0.912 (4)	0.758 (8)
Turkey	0.946 (2)	0.850 (3)	0.862 (24)	0.755 (10)
Ukraine	0.941 (3)	0.852 (2)	0.885 (14)	0.795 (4)
The UK	0.801 (36)	0.599 (37)	0.821 (29)	0.623 (34)
The USA	0.731 (41)	0.539 (41)	0.828 (27)	0.645 (29)
Venezuela	0.830 (34)	0.650 (35)	0.862 (24)	0.738 (15)

(0.947), Turkey (0.946), Ukraine (0.941), Latvia (0.930) and China (0.927), while the lowest values are observed in the United States (0.731), New Zealand (0.748), Belgium (0.765), Australia and Austria (0.791). When the parameter β is equal to 0.999, the highest values of IO for the first question are observed in Estonia, Ukraine, Turkey, Denmark, and Russia and the lowest in the US, New Zealand, Belgium, Australia and the UK. For the second question, when the parameter β is equal to 0.5, we see that the highest values of IO are observed in Cyprus (0.921), Iceland (0.0920), Estonia (0.915), Switzerland (0.912) and Italy (0.880), while the lowest values are observed in the Philippines (0.514), China (0.631), France (0.666), Argentina (0.669) and Lithuania (0.748). When the parameter β is equal to 0.999, the highest values are observed in Cyprus, Estonia, Denmark, Ukraine and Italy and the lowest in the Philippines, China, Argentina, France and Lithuania.

In Table 1(c), we examine two statements. The first statement was: 'It is not just that high-income people can buy better healthcare'. We then observe, when the parameter β is equal to 0.5, that the highest values of the index IO are observed in France (0.933), Belgium (0.921), Croatia (0.919), Iceland (0.917) and Slovenia (0.912), and the lowest values in the Philippines (0.474), South Africa (0.506), China (0.564), the UK (0.637) and Venezuela (0.663). When the parameter β is equal to 0.999, the index IO is highest in the following countries: Croatia, France, Iceland, Slovenia and Belgium, and it is lowest in the Philippines, China, South Africa, Venezuela and the UK.

Finally, concerning the statement 'It is not just that high-income people can buy better education for their children', we observe, when the parameter β is equal to 0.5, that the countries with the highest values of the index IO are Belgium (0.913), Croatia (0.853), Slovenia (0.909), Hungary and Iceland (0.905). The countries with the lowest scores are the Philippines (0.462), South Africa (0.506), China (0.530), Taiwan (0.599) and the UK (0.642).

Table 1(c).   Summary measures [Apouey *et al.*'s (2020) index] of agreement with political statements concerning the equality of opportunity (ranking of the countries in parentheses).

	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better education for their children	Not just that high-income people can buy better education for their children
Country	$\beta = 0.5$	$\beta = 0.999$	$\beta = 0.5$	$\beta = 0.999$
Argentina	0.781 (28)	0.618 (28)	0.781 (28)	0.608 (30)
Australia	0.749 (31)	0.581 (31)	0.769 (30)	0.610 (29)
Austria	0.874 (11)	0.732 (12)	0.874 (13)	0.721 (16)
Belgium	0.921 (2)	0.805 (5)	0.913 (1)	0.783 (6)
Bulgaria	0.886 (9)	0.783 (7)	0.889 (6)	0.789 (5)
Chile	0.812 (22)	0.677 (18)	0.818 (22)	0.683 (20)
China	0.564 (39)	0.348 (40)	0.530 (39)	0.324 (40)
Taiwan	0.716 (35)	0.535 (35)	0.599 (38)	0.386 (38)
Croatia	0.919 (3)	0.853 (1)	0.912 (2)	0.838 (1)
Cyprus	0.897 (8)	0.795 (6)	0.883 (7)	0.782 (7)
Czech Rep.	0.768 (29)	0.611 (30)	0.789 (26)	0.637 (26)
Denmark	0.824 (20)	0.680 (17)	0.866 (15)	0.738 (12)
Estonia	0.791 (26)	0.642 (24)	0.788 (27)	0.636 (27)
Finland	0.790 (27)	0.642 (24)	0.838 (21)	0.688 (19)
France	0.933 (1)	0.832 (2)	0.882 (9)	0.755 (9)
Germany	0.870 (12)	0.723 (15)	0.882 (9)	0.738 (12)
Hungary	0.900 (6)	0.778 (8)	0.905 (4)	0.790 (4)
Iceland	0.917 (4)	0.821 (3)	0.905 (4)	0.791 (3)
Israel	0.731 (33)	0.570 (33)	0.745 (31)	0.587 (31)
Italy	0.862 (14)	0.754 (10)	0.877 (12)	0.776 (8)
Japan	0.741 (32)	0.579 (32)	0.707 (34)	0.544 (32)
S. Korea	0.802 (24)	0.626 (27)	0.731 (32)	0.537 (34)
Latvia	0.875 (10)	0.743 (11)	0.883 (7)	0.755 (9)
Lithuania	0.762 (30)	0.617 (29)	0.775 (29)	0.630 (28)
New Zealand	0.710 (36)	0.514 (36)	0.698 (35)	0.499 (35)
Norway	0.832 (19)	0.669 (20)	0.847 (19)	0.690 (18)
The Philippines	0.474 (41)	0.316 (41)	0.462 (41)	0.312 (41)
Poland	0.840 (17)	0.671 (19)	0.840 (20)	0.668 (22)
Portugal	0.868 (13)	0.720 (16)	0.818 (22)	0.650 (24)
Russia	0.810 (23)	0.656 (22)	0.810 (24)	0.664 (23)
Slovakia	0.833 (18)	0.666 (21)	0.851 (18)	0.693 (17)
Slovenia	0.912 (5)	0.815 (4)	0.909 (3)	0.815 (2)
South Afr.	0.506 (40)	0.364 (39)	0.506 (40)	0.371 (39)
Spain	0.798 (25)	0.628 (26)	0.804 (25)	0.639 (25)

Table 1(c). (*Continued*)

	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better education for their children	Not just that high-income people can buy better education for their children
Sweden	0.858 (16)	0.730 (13)	0.864 (16)	0.737 (14)
Switzerland	0.824 (20)	0.644 (23)	0.860 (17)	0.683 (20)
Turkey	0.899 (7)	0.755 (9)	0.882 (9)	0.736 (15)
Ukraine	0.859 (15)	0.725 (14)	0.869 (14)	0.742 (11)
The UK	0.637 (38)	0.467 (37)	0.642 (37)	0.480 (36)
The USA	0.726 (34)	0.561 (34)	0.715 (33)	0.544 (32)
Venezuela	0.663 (37)	0.459 (38)	0.672 (36)	0.472 (37)

When the parameter β is equal to 0.999, it appears that the highest values of the index IO are observed in Croatia, Slovenia, Iceland, Hungary and Bulgaria and the lowest values in the Philippines, China, South Africa, Taiwan and Venezuela.

We observe that some countries are very often classified among those with high values of the index IO and some other frequently appear among the countries with low values of IO. For example, given that we examined seven questions and took two values of the parameter β into account, the highest number of times a country may appear among those classified with the five highest values of the index IO, or among those classified with the five lowest values of IO, is 14. We then observe that Ukraine appeared nine times among the countries with the highest values of IO, Italy seven times, Estonia, Slovenia and Hungary five times and Hungary, Portugal and Croatia four times. Among the countries that appeared most among those with the lowest values of IO, we observe that the Philippines appeared 10 times, New Zealand seven times, Denmark six times, the United States five times and Cyprus, Australia, the UK and South Africa four times. It seems therefore that there are countries where people favour the type of government intervention examined in this paper and there is a different set of countries where people seem to dislike this type of government intervention.

In Table 2, we present the results obtained for the index w_g of Herrero and Vilar (2018).

In Table 3, we compute the coefficient of correlation between the index IO and the index w_g. When the parameter β of the index IO is equal to 0.5, the Pearson coefficient of correlation is equal to at least 0.8. As expected, when the parameter $\beta \to 1$, the Pearson coefficient of correlation is even higher and never below 0.9.

Table 2. Summary measures [Herrero and Vilar's (2018) index of balanced worth w_g] of agreement with political statements on the role of the government (ranking of the countries in parentheses).

Country	Income differences too large	Government has to reduce these differences	High-income people should pay larger share of income in taxes	Government should provide decent living to unemployed	Government should spend more on benefits to poor	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better education for their children
Argentina	0.88331	1.05563	0.92035	0.86612	0.39889	0.78067	0.75827
Australia	0.61765	0.53059	0.79040	0.49500	0.90755	0.69467	0.78883
Austria	0.99402	0.92133	0.88059	0.64724	1.14670	1.17943	1.12751
Belgium	0.57651	0.80994	0.72029	0.40763	0.79209	1.57602	1.44715
Bulgaria	1.29642	1.32131	1.80979	1.25766	0.79845	1.53127	1.59750
Chile	0.84272	0.78997	0.84845	0.88620	1.01898	1.01022	1.05379
China	0.89273	0.98545	0.83831	1.15048	0.37026	0.26184	0.24305
Taiwan	0.98927	0.66611	1.06669	0.78730	1.02685	0.58271	0.32106
Croatia	1.30114	1.42810	1.09809	1.19641	1.12305	2.12527	2.01748
Cyprus	0.53814	0.72765	0.65064	0.87794	1.63044	1.59070	1.55299
Czech Rep.	1.04030	0.78572	0.74591	0.70211	0.72448	0.78088	0.86588
Denmark	0.51823	0.58779	0.64300	1.61385	1.56535	1.01353	1.27058
Estonia	1.52467	1.21529	0.88501	1.99107	1.57789	0.87843	0.86567
Finland	0.62651	0.97094	1.07639	1.11208	1.16124	0.87288	1.01817
France	1.53746	1.32418	1.34294	0.88602	0.56463	1.78588	1.32697
Germany	1.11984	0.77708	1.11077	0.67556	1.05524	1.12398	1.20206
Hungary	1.94658	1.58687	0.94849	1.24937	0.76939	1.43184	1.53786
Iceland	1.02019	0.85764	0.73963	0.95092	1.19713	1.75303	1.54546
Israel	1.08293	1.23372	0.61017	0.86065	1.25054	0.68759	0.73745
Italy	1.52153	1.62482	1.50224	0.95135	1.41824	1.36152	1.51328

Table 2. (*Continued*)

Country	Income differences too large	Government has to reduce these differences	High-income people should pay larger share of income in taxes	Government should provide decent living to unemployed	Government should spend more on benefits to poor	Not just that high-income people can buy better healthcare	Not just that high-income people can buy better education for their children
Japan	0.84081	0.65950	1.27663	0.96430	1.17263	0.70058	0.63701
S. Korea	1.01649	0.91772	1.78595	1.15002	1.34622	0.78572	0.57590
Latvia	1.31779	1.38105	0.92393	1.29992	1.15782	1.25500	1.33349
Lithuania	1.03874	1.34247	1.12908	1.04983	0.66029	0.81350	0.86195
New Zealand	0.47604	0.41353	0.55627	0.41441	0.60251	0.51814	0.49598
Norway	0.38450	0.49144	0.66225	0.82459	1.06386	0.93094	1.02451
The Philippines	0.38283	0.54745	0.81448	1.30346	0.32283	0.25863	0.26230
Poland	1.12203	1.12306	0.73341	0.86498	0.86863	0.91638	0.91316
Portugal	1.37897	1.61550	1.16951	1.24146	0.95719	1.11811	0.87920
Russia	1.40709	1.67594	1.58112	1.37506	1.21589	0.90406	0.96205
Slovakia	1.37762	1.06153	0.92124	0.67505	0.70463	0.91120	1.02376
Slovenia	1.32456	1.53085	1.15960	1.17802	0.88021	1.74381	1.78412
South Afr.	1.02548	0.83985	0.77953	1.09506	0.79503	0.33772	0.35902
Spain	0.79148	0.94015	1.00250	1.00591	1.03957	0.80207	0.84842
Sweden	0.65207	0.63828	0.79899	1.00611	1.03106	1.21096	1.25834
Switzerland	0.85947	0.60777	1.19453	0.76518	1.14751	0.81478	0.93973
Turkey	1.13434	1.50629	1.08660	1.75775	1.33397	1.24019	1.19020
Ukraine	1.84021	2.00758	1.89285	1.82993	1.59577	1.17657	1.28605
The UK	0.64681	0.63156	0.87740	0.51756	0.66058	0.46487	0.50289
The USA	0.56821	0.29048	0.69346	0.43823	0.74136	0.64941	0.61556
Venezuela	0.54430	0.57787	0.73252	0.67823	1.20506	0.42503	0.45536

Table 3. Correlations between the balanced worth measure and the index of Apouey *et al.* (2020).

Variable under study	Pearson correlations between the measure of balanced worth and Apouey *et al.*'s index when $\alpha = 0.5$	Pearson correlations between the measure of balanced worth and Apouey *et al.*'s index when $\alpha = 0.999$	Rank correlations between the measure of balanced worth and Apouey *et al.*'s index when $\alpha = 0.5$	Rank correlations between the measure of balanced worth and Apouey *et al.*'s index when $\alpha = 0.999$
Income differences too large	0.850	0.938	0.718	0.982
Government has to reduce these differences	0.876	0.949	0.898	0.957
High-income people should pay larger share of income in taxes	0.873	0.976	0.765	0.848
Government should provide decent living to unemployed	0.858	0.943	0.723	0.988
Government should spend more on benefits to poor	0.824	0.935	0.531	0.850
Not just that high-income people can buy better healthcare	0.876	0.942	0.919	0.908
Not just that high-income people can buy better education for their children	0.885	0.947	0.819	0.820

There is hence no point of looking in detail at the results of Table 2: they are similar to those presented in Tables 1(a)–1(c).

In Table 3, we also compute the rank correlation between the index IO and the measure w_g. The rank correlations between w_g and IO when $\beta \rightarrow 1$ are higher than 0.8. When the parameter β is equal to 0.5, the rank correlations between IO and w_g are lower but generally higher than 0.7, except for one question for which the rank correlation is equal to 0.53.

In Appendix 1, we give the correlations between all the IO indices computed previously in Tables 1(a)–1(c). Above the diagonal we give the correlations between the IO indices themselves, while below the diagonal we present the rank correlations derived from the values of these IO indices. First, we note that, for a given question,

the correlation between an index IO computed with a parameter β equal to 0.5 and the one derived assuming that this parameter is equal to 0.999 is always very high (it is equal to at least 0.94). Second, we observe a high correlation between the index IO derived from the answers to the statement according to which income differences are too large (variables A and B), the index IO derived from the answers to the statement according to which the government should reduce these differences (variables C and D) and the index IO derived from the answers to the statement according to which high-income people should pay a larger share of income in taxes (variables E and F). This is true whether we use regular correlations or rank correlations. Third, we also observe a high correlation between the answers to the statement according to which it is not just that high-income people can buy better healthcare (variables K and L) and the answers to the statement according to which it is not just that high-income people can buy better education for their children (variables M and N).

Otherwise, we see that the correlations are much lower, although there is also a relatively high correlation between the statement according to which the government should provide a decent living to the unemployed (variables G and H) and the statement according to which the government should reduce income differences (variables C and D).

It is therefore quite clear that although all the statements under study deal with some aspects of inequality, the reactions of the individuals depend on the type of inequality discussed. Some statements deal with inequality in results (variables A–F), while some other variables clearly concern inequality of opportunity (variables K–N). And these are two different notions of inequality.

Looking at possible determinants of the answers to the statements examined

In the last stage of the analysis, we attempt to estimate regressions where the dependent variable was either the index IO of Apouey *et al.* (2020) or the measure w_g of Herrero and Vilar (2018). In both cases, the explanatory variables are respectively the actual Gini index, the per-capita GDP, the annual growth rate and an index measuring the extent of democracy in the country.

There are in fact quite a few studies that looked at the impact of actual inequality on the feeling of individuals towards redistributive policies (e.g. Wlezien, 1995; Kenworthy and McCall, 2008; Ura and Ellis, 2008; Kelly and Enns, 2010; Luttig, 2013). For a survey of the literature on attitudes towards inequality, see Clark and D'Ambrosio (2015). More generally, there is quite a vast literature on the determinants of preferences for redistribution (e.g. Corneo and Gruner, 2002; Benabou and Tirole, 2006; Alesina and Giuliano, 2011). There are also many studies on the link

between democracy and redistribution [for a thorough survey, relatively recent, see Acemoglu *et al.* (2015)].

Our empirical analysis was based on data covering only 32 countries. Since the regressions we estimated used four explanatory variables, the overall results of a regression can be considered as significant at 5% only if the F-value is higher than 2.9. Quite a few regressions had a lower F-value, and we present only the results of the regressions where the F-value was at least 2.9. Table 4 gives the results when the dependent variable is the index IO, while Table 5 presents the regression results when the dependent variable is the measure w_g. The two first columns of Table 4 present regression results when the statement examined deals with the need for the government to reduce income differences. The next two columns give regression results when the statement examined concerns the need for the government to help the unemployed and the poor. Finally, the last two columns of Table 4 show regression results when the question under study is the extent of equality of opportunity. More precisely, the dependent variable in this case is Apouey *et al.*'s (2020) index derived from the answers to a statement saying that it is not just that high-income people can buy better education for their children.

Let us now look at the regression results. We have first to remember that the dependent variable was derived by assuming that a score of 1 for the question asked meant that the individual agrees with the statement, while a score of 5 implies that the individual does not agree at all with the statement. Looking first at whether the government should reduce income differences, we observe that, whether the parameter β is equal to 0.5 or 0.99, the higher the Gini index, the more likely it is, *ceteris paribus*, that people are in favour of a reduction in income differences. Similarly, the higher the per-capita GDP, computed at PPP, the more people want the government to reduce income differences. Note that the coefficients of the Gini index and the per-capita GDP are higher, in absolute value, when β is equal to 0.999, i.e. when Apouey *et al.*'s (2020) measure ignores inequality in the distribution of the answers. We may also observe that the coefficient of the democracy index may not be significant at 5% but it certainly is at 10%. We can hence conclude that, *ceteris paribus*, the more democratic a country is, the more likely it is that people will want the government to reduce income differences. The third column of Table 4 shows that higher the per-capita GDP, the stronger the desire of people to see the government provide a decent living to the unemployed. In this regression, this explanatory variable is the only significant variable. The fourth column of Table 4 indicates that the higher the inequality (the Gini index), the more likely it is that people want the government to spend more on benefits to the poor. Here also, there is only one significant coefficient in the regression. Finally looking at the last two columns of Table 4, we can conclude that the higher the Gini index, the more people feel that it is not just that high-income people can buy better education for

Table 4. Regression results where the dependent variable [Apouey *et al.*'s (2020) index] measures the degree of agreement with specific political statements.

Explanatory variables	Government has to reduce income differences	Government has to reduce income differences	Government should provide decent living to unemployed	Government should spend more on benefits to poor	Not just that high-income people can buy better education for their children	Not just that high-income people can buy better education for their children
	$\beta = 0.5$	$\beta = 0.999$	$\beta = 0.999$	$\beta = 0.5$	$\beta = 0.5$	$\beta = 0.999$
Constant	1.28 (8)	1.40 (7.05)	1.0085 (5.73)	1.08 (5.53)	1.19 (5.85)	1.130 (4.71)
Gini index	−0.0050	−0.00798	−0.0033	−0.00589	−0.00904	−0.011
	(−2.24)	(−2.897)	(−1.348)	(−2.16)	(−3.183)	(3.24)
Democracy index	−0.020	−0.0356	−0.00309	−0.0152	−0.0129	−0.012
	(−1.2)	(−1.732)	(−0.169)	(−0.746)	(−0.608)	(−0.467)
Growth rate 2008–2009	−0.00058	−0.00268	−0.00944	−0.00681	0.00261	0.00241
	(−0.113)	(−0.422)	(−1.67)	(−1.085)	(0.400)	(0.313)
Per-capita GDP at PPP	−0.00267	−0.00367	−0.00412	0.00232	0.00107	0.00025
	(−2.087)	(−2.308)	(−2.918)	(1.474)	(0.655)	(0.130)
Adjusted R-square	0.339	0.443	0.284	0.229	0.230	0.216
F-value for regression	4.98	7.16	4.08	3.30	3.31	3.13

Table 5. Regression results where the dependent variable [Herrero and Vilar's (2018) index of balanced worth] measures the degree of agreement with specific political statements.

Explanatory variables	Income differences are too large	Government has to reduce income differences	Government should provide decent living to unemployed
Constant	3.99 (4.67)	4.36 (5.71)	3.10 (4.02)
Gini index	−0.039 (−3.26)	−0.037 (−3.49)	−0.21 (−1.99)
Democracy index	−0.165 (1.86)	−0.211 (−2.66)	−0.090 (−1.13)
Growth rate 2008–2009	−0.019 (−0.68)	−0.22 (−0.89)	−0.070 (−2.83)
Per-capita GDP at PPP	−0.011 (−1.57)	−0.12 (−1.99)	−0.018 (2.86)
Adjusted R-square	0.36	0.51	0.40
F-value for regression	5.30	9.05	6.24

their children. Here also, the Gini index is the only significant variable. But note that the coefficient of the Gini index is higher in absolute value when inequality in the distribution of answers is ignored (i.e. when β is equal to 0.999).

In Table 5, we present regression results when the dependent variable is the measure w_g of Herrero and Vilar (2018). These regressions results were significant only for three questions. Concerning the question where individuals were asked whether they feel that income differences are too large, it appears that the individuals feel so, the higher the Gini index in the country and the more democratic the country is. For the question where people were asked to say whether they think that the government should reduce income differences, three variables have a significant impact: the higher the inequality (Gini index) in the country, the more democratic the country is and the higher its per-capita GDP (at PPP), the more likely it is that people will want the government to reduce income differences. Finally, a similar impact of these three variables is observed as far as the question examined is whether the government should provide a decent living to the unemployed.

Concluding Comments

In this paper, we discussed the issue of comparing the answers given in different countries to questions related to the role of government in dealing with income inequality, granting a minimum standard of living and facing inequality of opportunity, when the possible answers to these questions can be ordered. To examine

the diversity of political opinions we used two measures: the index of balanced worth w_g introduced by Herrero and Vilar (2018), and the achievement index IO of Apouey *et al.* (2020). While both measures were developed for the case of ordinal variables, the latter measure at the difference of that of Herrero and Vilar (2018) can take account of both the inequality and the location of a distribution. We applied these measures to the analysis of political opinions, using the International Social Survey Programme for the year 2009.

First, we found that there is a high degree of correlation between the values observed for the indices w_g and IO, especially when the parameter β of the index IO is equal to 1 (tends towards a value of 1), which is the case when the index IO ignores the inequality of distribution of the answers given to a question.

Second, as stressed already by Bérenger and Silber (2022), the index IO, when it ignores inequality (when the parameter $\beta \to 1$), is a linear function of the arithmetic mean of the answers given to a question (provided the value given to a question by an individual corresponds to the rank of his/her answer in the set of ordered possible answers). There is hence some justification for using such a cardinal approach to the analysis of political opinions, but at the condition that one is aware of the axioms that underlie the use of the index IO when ignoring inequality, namely the axioms of normalisation, independence, weak Pareto principle and anonymity that were explained in the third section.

Third, it appears that there is quite a high correlation between the values of IO observed for various questions dealing with the need for the government to reduce income inequality, or between the values of IO observed for the two questions concerning inequality of opportunity in health and education. Correlations were much lower when comparing the answers given to two questions belonging to two different categories of questions among the three types of questions previously distinguished.

Fourth, when the regression results can be considered as significant, it appears, whether we use the index IO or the measure w_g that the higher the inequality observed in a country, the more likely it is that people will favour government intervention aiming at reducing these differences and helping the unemployed and the poor. When significant, the variables measuring the extent of democracy and the per-capita GDP (at PPP) have a similar influence.

Finally, although there is a high correlation between the values of the measures w_g and IO, when the latter index ignores the extent of inequality in the distribution of answers to a question, the index IO of Apouey *et al.* (2020) has the advantage of allowing one to take this diversity of opinions into account.

Appendix 1. Correlation Matrix Between the Vectors of Different Indicators

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	1	0.97	0.77	0.78	0.64	0.6	0.35	0.32	0.18	0.18	0.43	0.41	0.36	0.35
B	0.97	1	0.78	0.82	0.63	0.63	0.42	0.41	0.12	0.16	0.43	0.43	0.37	0.37
C	0.86	0.81	1	0.98	0.49	0.54	0.65	0.59	−0.0039	0.071	0.39	0.42	0.35	0.37
D	0.88	0.86	0.99	1	0.51	0.58	0.65	0.63	−0.00037	0.094	0.43	0.46	0.4	0.43
E	0.6	0.58	0.48	0.51	1	0.94	0.32	0.3	0.25	0.26	0.39	0.38	0.32	0.31
F	0.68	0.64	0.59	0.6	0.96	1	0.41	0.42	0.1	0.17	0.32	0.32	0.25	0.25
G	0.53	0.46	0.66	0.63	0.31	0.4	1	0.97	0.014	0.17	0.15	0.19	0.14	0.19
H	0.5	0.46	0.61	0.61	0.27	0.37	0.97	1	−0.011	0.17	0.14	0.18	0.12	0.18
I	−0.12	−0.06	−0.15	−0.1	0.18	0.048	0.12	0.09	1	0.97	0.51	0.47	0.53	0.49
J	0.024	0.08	0.042	0.089	0.18	0.13	0.3	0.29	0.93	1	0.51	0.48	0.52	0.49
K	0.45	0.46	0.45	0.48	0.29	0.3	0.25	0.23	0.23	0.29	1	0.98	0.97	0.94
L	0.43	0.44	0.44	0.49	0.3	0.29	0.29	0.27	0.27	0.33	0.99	1	0.95	0.96
M	0.39	0.38	0.39	0.43	0.24	0.23	0.24	0.22	0.27	0.32	0.97	0.97	1	0.98
N	0.38	0.38	0.37	0.42	0.27	0.24	0.26	0.25	0.3	0.34	0.94	0.96	0.99	1

Notes: Numbers above the diagonal refer to correlations between the values of the index I_R in different countries, while those below the diagonal refer to correlations between the rankings of the countries. *Symbols*: *A*: Income differences too large (β = 0.5); *B*: income differences too large (β = 0.999); *C*: government has to reduce these differences (β = 0.5); *D*: government has to reduce these differences (β = 0.999); *E*: high-income people should pay larger share of income in taxes (β = 0.5); *F*: high-income people should pay larger share of income in taxes (β = 0.999); *G*: government should provide decent living to unemployed (β = 0.5); *H*: government should provide decent living to unemployed (β = 0.999); *I*: government should spend more on benefits to poor (β = 0.5); *J*: government should spend more on benefits to poor (β = 0.999); *K*: not just that high-income people can buy better healthcare (β = 0.5); *L*: not just that high-income people can buy better healthcare (β = 0.999); *M*: not just that high-income people can buy better education for their children (β = 0.5); and *N*: not just that high-income people can buy better education for their children (β = 0.999).

References

Acemoglu, D, S Naidu, P Restrepo and JA Robinson (2015). Democracy, redistribution, and inequality. In *Handbook of Income Distribution*, AB Atkinson and F Bourguignon (eds.), Vol. 2B, pp. 1885–1966. Amsterdam: Elsevier.

Alesina, A and P Giuliano (2011). Preferences for redistribution. In *Handbook of Social Economics*, J Benhabib, A Bisin and MO Jackson (eds.), pp. 93–131. Amsterdam: Elsevier.

Apouey, B, J Silber and Y Xu (2020). On inequality-sensitive and additive achievement measures based on ordinal data. *The Review of Income and Wealth*, 66(2), 267–286.

Benabou, R and J Tirole (2006). Beliefs in a just world and redistributive politics. *The Quarterly Journal of Economics*, 121(2), 699–746.

Bérenger, V and J Silber (2022). On the measurement of happiness and of its inequality. *Journal of Happiness Studies*, 23, 861–902.

Bond, TN and K Lang (2019). The sad truth about happiness scales. *Journal of Political Economy*, 127(4), 1629–1640.

Clark, AE and C D'Ambrosio (2015). Attitudes to income inequality: Experimental and survey evidence. In *Handbook of Income Distribution*, AB Atkinson and F Bourguignon (eds.), Vol. 2A, pp. 1147–1208. Amsterdam: Elsevier.

Corneo, G and PH Gruner (2002). Individual preferences for political redistribution. *Journal of Public Economics*, 83, 83–107.

Cuhadaroglu, T (2013). My group beats your group: Evaluating non-income inequalities. Discussion Paper, School of Economics and Finance, University of St-Andrews, the UK.

Deutsch, J and J Silber (2022). A summary measure of answers to statements (*SMAS*) in the case of ordered rating scales. *Economics Bulletin*.

Durr, RH (1993). What moves policy sentiment? *American Political Science Review*, 87(1), 158–170.

Herrero, C and A Vilar (2013). On the comparison of group performance with categorical data. *PLoS ONE*, 8(12), e84784.

Herrero, C and A Vilar (2018). The balanced worth: A procedure to evaluate performance in terms of ordered attributes. *Social Indicators Research*, 140, 1279–1300.

Kelly, NJ and PK Enns (2010). Inequality and the dynamics of public opinion: The self-reinforcing link between economic inequality and mass preferences. *American Journal of Political Science*, 54, 855–870.

Kenworthy, L and L McCall (2008). Inequality, public opinion and redistribution. *Socio-Economic Review*, 6, 35–68.

Klar, S (2014). A multidimensional study of ideological preferences and priorities among the American public. *Public Opinion Quarterly*, 78(S), 344–359.

Lieberson, S (1976). Rank-sum comparisons between groups. *Sociological Methodology*, 7, 276–291.

Luttig, M (2013). The structure of inequality and Americans' attitudes towards redistribution. *Public Opinion Quarterly*, 77(3), 811–821.

Mulligan, K, T Grant and D Bennett (2013). The dynamics of public opinion on cultural policy issues in the US, 1972–2010. *Political Behavior*, 35(4), 807–829.

Schröder, C and S Yitzhaki (2017). Revisiting the evidence for cardinal treatment of ordinal variables. *European Economic Review*, 92, 337–358.

Stimson, JA (2012). On the meaning and measurement of mood. *Daedalus*, 141(4), 23–34.

Ura, JD and CR Ellis (2008). Income, preferences, and the dynamics of preferences for spending. *PS*: *Political Science and Politics*, 41, 785–794.

Wlezien, C (1995). The public as thermostat: Dynamics of preferences for spending. *American Journal of Political Science*, 39(4), 981–1000.