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Explaining and measuring tolerant behavior

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Abstract

In recent studies, there has been a growing interest towards tolerance and its implications in the socio-economic system. This paper aims to contribute to this flourishing research area into two directions. First, we develop a theoretical framework to explain individual's tolerant attitudes without necessarily resorting to altruistic preferences. Second, this paper addresses the issue of measuring tolerance when information about several dimensions of tolerance is available and data are of Likert's scale type. To show how our new measure of tolerance works in practice, we carry out a case study using an Italian recent survey asking the opinion of university students about different subjects, such as interreligious dialogue, women/religion relationship, religion/death relationship, multicultural society, and homosexuality. We, finally, highlight the key policy implications arising from our study.

Keywords: Economic behavior, social interactions, methodology.

JEL Classification: A13, C43

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1 Introduction

In recent years, the topic of tolerance has been receiving increased interest in the economic literature. A number of studies have found a positive relationship between tolerance and several economic outcomes, including foreign direct investment, sovereign debt ratings, and GDP growth (Noland 2005; Berggren and Elinder 2012). Moreover, tolerant societies act as a magnet for people with talent and for people endowed with high levels of human capital. The concentration of such people contributes to the rise of entrepreunership, innovation and local development Florida and Gates 2001; Florida 2003; Florida et al. 2008). In most of these works, tolerance is seen as openness, inclusiveness, and diversity to all ethnicities, races and walks of life (Florida 2003, p.10). Although the importance of tolerance for its positive effects on the economic system is widely recognized, the existing literature has not yet formalized the concept of tolerance in a theoretical model. The only exception is Corneo and Jeanne (2009), in which a two-generation model is developed to identify the circumstances under which parents have an incentive to transmit a value system that attaches relatively equal worth to different traits and lifestyles. In this model, tolerance is considered as a proxy of the value system endorsed by people.

In the present paper, we aim to contribute to this flourishing research area in two directions. First, we make a first attempt to develop a model able to explain individual's tolerant attitudes. The model is inspired by the literature about the welfare analysis of existence values, in which a lexicographic ordering for personal income and environmental assets is used to describe the intrinsic value of wildlife and future geneations Edwards (1986). Moreover, the model relies on the definition of tolerance provided by Berggren and Elinder (2012), according to which "a tolerant person is assumed to accept the presence and the participation of all kinds of people in society, regardless of what he thinks or feels about them" (Berggren and Elinder 2012, p.284). Individual's preferences are described using a lexicografic ordering for tolerance and a composite good, assumed

to be the numeraire. Second, we develop an index of tolerance in the case of Likert-scale data. In empirical studies about tolerance mentioned above and surveyed in Section 2, the analysis is usually based on surveys with questions such as "*Would you like to have homosexuals as your neighbors?*" or "*Would you like to have people of a different race as your neighbors?*"[1] They are simple yes/no questions, formally known as polar questions, which give a clear-cut understanding of people attitudes. The fraction of respondents giving a positive answer is the measure of tolerance (see, for example, Berggren and Elinder 2012). In this paper, we adopt a wider perspective and look at tolerance as a concept involving several different social domains, so that attitudes towards homosexuals and foreign-born people are only a partial aspect of this phenomenon.

To show how this measure of tolerance works in practice, we carry out a case study using an Italian survey asking the opinion of university students about different subjects, such as interreligious dialogue, women/religion relationship, religion/death relationship, multicultural society, and homosexuality.[2]

The rest of the paper is organised as follows. Section 2 reviews the economic literature on tolerance. Section 3 introduces the theoretical model. The index of tolerance is set out and discussed in Section 4. Section 5 presents the empirical application. The last section concludes the paper with suggestions for further developments.

2 Economic Related Literature

Among previous studies about tolerance, we distinguish between those looking at the effects of tolerance on the economic system and those that investigate the relative importance of economic factors in determining tolerance.

[1] Both questions are from the World Value Survey (2015).

[2] The survey is part of an ongoing interdisciplinary research project carried out within the framework of the *Framework Convention (FC) Gender and Religions*, that has been developed to enhance knowledge sharing and research collaboration on the complex relationship between women, men and interreligious dialogue. For further details, see Decataldo et al. 2019

As regard to the first strand of literature, Noland (2005) shows that tolerance has important implications for some macro-economic financial variables, and entrepreunership. The author integrates Pew Global Attitudes data[3] into a series of economic models on foreign direct investment, sovereign debt ratings,and entrepreneurship. Two of the Pew questions ask whether local culture should be protected from foreign influence and whether homosexuality should be tolerated. The analysis consider 44 countries and the results show strongly significant correlations between Pew responses and the economic variables mentioned above. In particular, accepting homosexuality and opening local culture to foreign influence contribute to attract more foreign direct investment, to obtain better debt ratings, and to exhibit more local entrepreunership. The analysis has important policy implications. It suggests that government could change public perception towards globalization undertaking public campaigns against xenophobia and intolerance.

Florida in his works and those with coauthors emphasizes all the positive effects of tolerance on the economic development at the local level (city or region). Using almost exclusively data from American cities, he shows that cities or regions with low entry barriers to newcomers are characterized by higher concentrations of talents, higher rates of innovation, and higher rates of regional development. To evaluate to what extent entry barriers are low, i.e. how much a place is open to new ideas and new people, Florida and colleagues use different indicators, such as *(i)* the prevalence of gay males in the local population (Florida and Gates, 2001); *(ii)* the Melting Pot Index, which is the percentage of the foreign-born population in a city/region (Florida 2002); *(iii)* the Gay-Bohemian index, measuring the concentration of homosexuals and people in the arts, design, and similar occupations. The results show that tolerance is positively related to human capital and to the share of people belonging to the *creative class*,[4] and to both regional wages

[3] A detailed presentation of the survey is available in The Pew Global Attitudes Project (2003).

[4] Florida identifies in the creative class workers strongly involved in creative activities.

and incomes (Florida, 2008).

Berggren and Elinder (2012) adopt Florida's definition of tolerance to analyze how tolerance affects economic growth in 54 countries, using data from the World Value Survey.[5] Tolerance is defined as openess, inclusiveness, and diversity to all ethnicities, races and walks of life (Florida 2003, p.10). In their paper, tolerance is measured by two variables: the share of population that does not dislike to have homosexuals as neighbors, and the share of population that does not dislike to have people of a different race as neighbors. The results show a relatively robust negative effect of tolerance towards homosexuals on growth, while the effect of tolerance towards people of other races is not statistically significant. Three possible mechanisms are put forward to explain the negative relationship: first, tolerance towards homosexuals reduces the productivity of intolerant but productive and innovative people; second, tolerance reduces the average productivity of homosexuals by affecting choices of education and occupation, and by reducing the felt need to work hard to prove one's worth; third, homosexuals have, on average, less strict and less future-oriented values, which disseminate easier with increased tolerance (Berggren and Elinder 2012, p. 285).

As for the second strand of studies focusing on the determinants of tolerance, Andersen and Fetner (2008) investigate the relationship between tolerance and economic prosperity and the relationship between tolerance and income inequality. They consider data from the World Values Survey (Inglehart et al. 2001) and restrict the analysis to 35 countries (Europe, Australia, Canada and United States). Tolerance is measured looking at the individual attitudes towards homosexuality. As for economic prosperity, the results show that national-level economic prosperity does not affects all members within a country in a similar manner. Those who benefit least from economic development, namely the working class, tend to be less tolerant regardless of the wealth of the community in which they live. On the contrary, those who benefit more from economic development, i.e. professionals

[5]http://www.worldvaluessurvey.org/wvs.jsp last access 10-10-2017

and managers, are generally more tolerant. As for income inequality, it turns out that, within a country, tolerance tends to decline as national income inequality rises.

Berggren and Nilsson (2016) argue that tolerance is favoured by economic freedom. They look at the relationship between tolerance and economic freedom considering 41 U.S. states over the period 1982-2008. The measure of economic freedom is the index of Economic Freedom of North-America (Ashby et al. 2011), which synthesizes in a single value the size of government, the tax burden and the degree of labor-market regulation. The measure of tolerance is from the General Social Survey (2014) and covers attitutes towards four minorities: racists, atheists, communists and homosexuals. The main hypothesis is that economic freedom and tolerance are linked through two channels: the first channel is related to government activities (taxation, public expenditures, regulation); the second one is related to market activities (market integration, commercial exchange, market-oriented economy). The results show a statistically significant effect of economic freedom on overall tolerance. Considering tolerant attitudes separately, while economic freedom increases tolerance towards homosexuals, communists and atheists, tolerance towards racists seems to be unaffected by the size and character of government activities and by the scope of market activities (Berggren and Nilsson 2016, p. 61).

3 The theoretical background

Consider a representative individual with preferences for a numeraire of consumption goods, denoted by M, and tolerance, denoted by T. Usually, the individual choice behavior is described by a utility optimization model. We assume that the optimization criterion in our model relies on the definition of tolerance provided by Berggren and Elinder (2012) and claimed in the Introduction. This definition implicitly assumes that the attitude to be tolerant towards someone or something does not necessarily imply a gain in utility from that someone or that something. The individual could also dislike a group of people

and nevertheless decide to be tolerant of them.

We could wonder, as Berggren and Elinder (2012) do, why would someone be tolerant towards a group he dislikes? They mention as possible explanations the fact that tolerance may be considered as a virtue to cultivate, or as an established social norm, or again tolerance lets everyone to be part of social life and this is beneficial for the individual himself and for society.

In our model, individual preferences for tolerance and the composite good are assumed to be lexicographic. More specifically, we assume that, among several bundles, the individual will choose the bundle that offers the most composite good, no matter how much tolerance there is. Let M^* be a threshold below which preferences for the composite good supercede preferences for tolerance. M^* can be interpreted as a standard of living below which only an increase in M matters for the individual. Only when there is a tie between bundles with regard to the number of units of the composite good, will the individual start comparing the level of tolerance across bundles. Figure 1 shows three alternative bundles below M^*. The worst bundle is C since it contains the smallest quantity of composite good. Bundle A is preferred to C since more M is always preferred to less. B is the best choice since it provides more tolerance for the same quantity of composite good provided by A.

The definition of tolerance we consider does not exclude the possibility that an individual is tolerant because of an unselfish interest in the welfare of others. According to Sen (1973; 1977; 1979), altruistic interests for others may be explained by two separate concepts, sympathy and commitment, which are very effectively discussed by Edwards (1986). Simpathy corresponds to the case in which the concern for others directly affects one's own welfare. "If the knowledge of torture of others makes you sick, it is a case of sympathy. If it does not make you feel personally worse off, but you think it is wrong and you are ready to do something to stop it, it is a case of committment" (Sen 1977, p. 326). Choices based on sympathy alone are in an important sense egoistic, since personal welfare

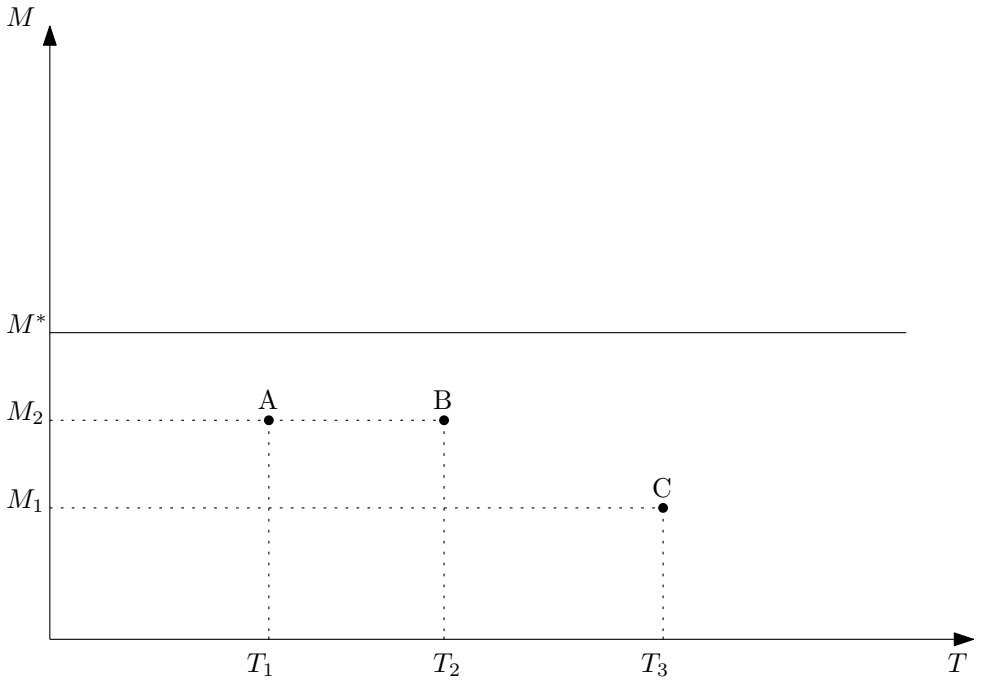

Figure 1: Preferences for tolerance under the hypothesis of $M \leq M^*$

is psychologically dependent on other's well-being. Choices based on committment are dictated by an ethical principle regardless of how one's own welfare might be affected. Preferences of such individuals may be always represented by a lexicographic ordering modifying the underlying hypothesis: more tolerance is always preferred to fewer regardless of what happens to income. Preferences are shown in figure 2 where M^* demarcates a satisfactory standard of living above which preferences for tolerance supercede preferences for income. Notice that M^* does not necessarily have to be high. The hypothesis simply requires that, above M^*, tolerance is preferred to the other goods since either it positively affects the individual's utility or it is the priority in the value system. This hypothesis implicitly assumes that the individual would renounce to M for an increase in tolerance. D is the worst alternative since it contains the lowest level of tolerance. F is preferred to D, while E is the best choice since it provides more M for the same level of tolerance T_3 provided by F.

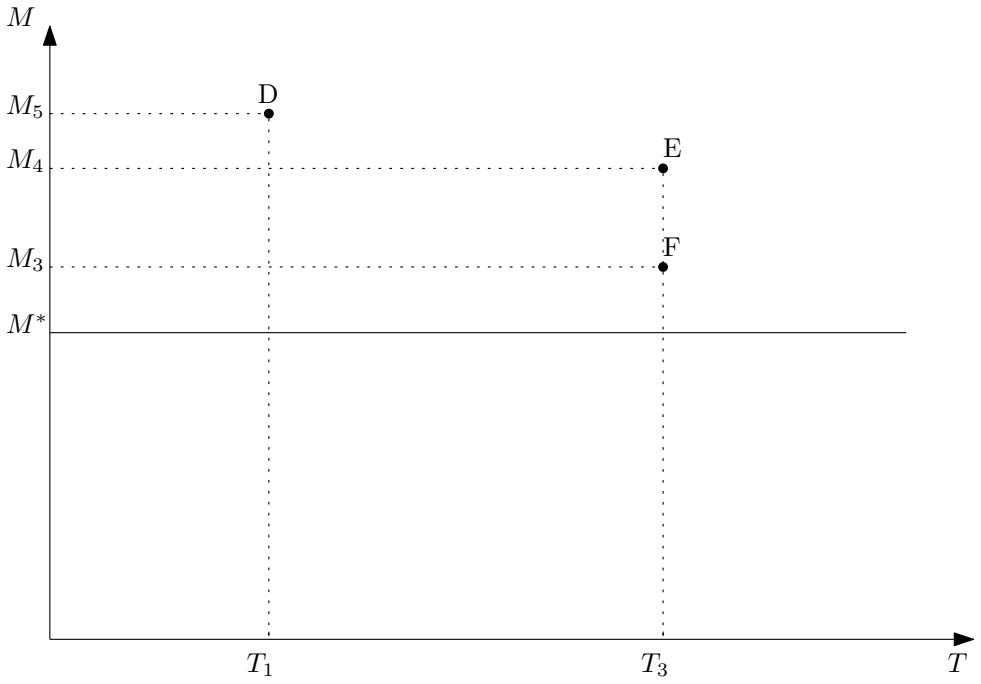

Figure 2: Preferences for tolerance under the hypothesis of $M > M^*$

4 Tolerance Index

In this section, we develop a statistical measure of tolerance for Likert scale data. Likert items are used to measure respondents' attitudes to a particular question or statement. For example, survey questions, used in our case study and devoted to detect individuals' attitudes towards some topics including homosexuality, immigrants and women's emancipation, have been measured by a five-point Likert scale.

We introduce two main assumptions to use the survey's questions in order to elicit individual preferences.[6] First, we assume that responses provided by different individuals are interpersonally comparable at an ordinal level. This implies that individuals who select the same point on the Likert scale have a similar attitude. Second, we assume that there is a correspondence between what we measure and the abstract concept we are interested in. In other terms, it is reasonable to assume a strong positive relationship between high

[6]These two hypothesis were originally introduced by van Praag et al. (2003) in a different theoretical framework aiming to explain the concept of subjective well-being.

rate (low rate) assigned to survey's questions and individual's positive (negative) attitudes towards a topic.

The setup considers a population of n individuals indexed by $i = 1, ..., n$. Tolerance is assessed through a questionnaire composed of M items. Let $it_m(i)$ denote the answer to a generic item it_m measured by a J-point Likert-scale. The Likert-scale has several formulations. In our case we consider a rating scale $j = 1, .., J$, where J is an odd number of response options.[7] Moreover, the semantic differential version (Osgood 1964) of the Likert scale is considered in order to be symmetric with respect to zero and to range between $(-\frac{J-1}{2}, +\frac{J-1}{2})$. In this way, we obtain a scale ranging from negative to positive values giving, at the same time, the direction and the intensity of respondents' attitudes. The zero value reflects the neutral position of the individual towards a topic.

Let $\boldsymbol{it}_m$ a column vector $(n \times 1)$ composed of the individual's score in rating item m. Let $\boldsymbol{X} = [\boldsymbol{it}_1, \boldsymbol{it}_2, ...\boldsymbol{it}_M]$ a $(n \times M)$ matrix, representing the distribution of the M items across n individuals.

The matrix $\boldsymbol{X}$ is decomposed in $K < M$ sub-matrices $\boldsymbol{X}_k$ $(k = 1, ..K)$, where K is the number of tolerance dimensions. Formally, the matrix $\boldsymbol{X} = [\boldsymbol{X}_{1(n\times p_1)}, \boldsymbol{X}_{2(n\times p_2)}, ...\boldsymbol{X}_{K(n\times p_K)}]$, with $\sum_{k=1}^{K} p_k = M$. Notice that the dimension of sub-matrices, in particular the number of columns, may not be the same for all of them. This because a survey may have a different number of questions related to each topic.

The idea behind our index is sketched in Figure 3.

The index is obtained following a two-step procedure: in the first step the K sub-matrices are reduced to K column vectors $(n \times 1)$ denoted by $\boldsymbol{F}_k$. The elements of $\boldsymbol{F}_k$ are the rows' median of sub-matrix $\boldsymbol{X}_k$. In formal terms:

$$F_k(i) = Me(X_k(i)), \quad i = 1, ..., n \tag{1}$$

[7] The case wih J even is discussed in Appendix.

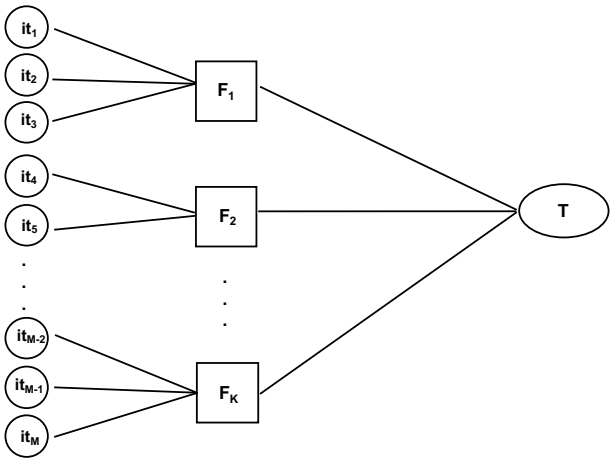

Figure 3: Tolerance Index: the basic idea

The median has been preferred to other measures of central tendency (as, for example, the arithmetic mean) in order to preserve the original Likert-scale graduation.[8]

In the second step, the $\boldsymbol{F}_k$ vectors are reduced into a scalar value (denoted by T in figure 3), which corresponds to the assessment of tolerance for the observed population.

Formally, the elements $F_k(i)$ are summed up, as follows: $\mathcal{F}_k = |\sum_{i=1}^{n} F_k(i)|$. We obtain K numerical values that are, in turn, aggregated using the following weighting formula:

$$T = (\mathcal{F}_1 + 1)^{(\theta_1)\beta_1} \cdot (\mathcal{F}_2 + 1)^{(\theta_2)\beta_2} \cdot ...(\mathcal{F}_K + 1)^{(\theta_K)\beta_K} \tag{2}$$

where

- $\beta_k \in [0, 1]$ is the ones' complement of L_k, which denotes the normalized Leti's heterogeneity index (Leti, 1965) computed on the relative frequency distribution

[8] If $X_k(i)$ is composed of an even number of items, we could have a pair of middle Likert scale values. The median is either the left middle number or the right middle number. The choice can be made randomly. (Piccolo, 1998, p. 106).

(f) of $\boldsymbol{F}_k$:

$$\beta_k = 1 - \frac{L_k - 1}{J - 1} \tag{3}$$

$$L_k = \prod_{j=1}^{J} (f_{jk})^{-f_{jk}} \tag{4}$$

- θ_k is an indicator function:

$$\theta_k = \begin{cases} -1 \text{ if } \sum_{i=1}^{n} F_k(i) < 0 \\ +1 \text{ if } \sum_{i=1}^{n} F_k(i) \geq 0 \end{cases} \tag{5}$$

The composite index T (eq. 2) is obtained via a geometric aggregation of the different tolerance dimensions.This aggregation method has been preferred to the linear method, which is perhaps the most commonly used in composite indicators (Greco et al. 2018, and references therein). However, the linear method is based on the following two strong assumptions: first, the preferential independence among dimensions, i.e. any tolerance dimension is preferentially independent of the other tolerance dimensions (OECD 2008; Fusco 2015); second, a constant compensability between dimensions (Decancq and Lugo 2013). Thus a higher score in one of the tolerance dimensions compensates for the loss in another dimension. The geometric aggregation assumes only some degree of compensability (OECD 2008, p. 28). Hence, a lower score in a given dimension is not able to compensate fully in other dimensions (Greco et al. 2018).

Without loss of generality, we can rewrite the T index in logarithmic form as follows:

$$\log(T) = (\theta_1)\beta_1 \log(\mathcal{F}_1 + 1) + (\theta_2)\beta_2 \log(\mathcal{F}_2 + 1) + ... + (\theta_K)\beta_K \log(\mathcal{F}_K + 1) \tag{6}$$

On the right-side of eq. 6, the parameter β_k measures the degree of homogeneity of the relative frequency distribution f_k associated with factor $\boldsymbol{F}_k$. The higher the value of β_k, the higher homogeneity in individuals' attitudes towards topic k. If $\beta_k = 1$, all individuals provide the same answer. Viceversa, if $\beta_k = 0$, there is maximum distribution heterogeneity then the individuals' answers are equally distributed across the J Likert-scores. This means that no attitude prevails in society.[9] The weight β_k associated with $\mathcal{F}_k$ is then proportional to the strength of agreement among individuals about topic k.

The parameter θ_k specifies the direction of the intensity of $\mathcal{F}_k$, which is defined in absolute value. Looking at eq. 5 and recalling the definition of $\mathcal{F}_k$, $\theta_k = +1$ if the sum of $F_k(i)$ over the n individuals is non negative; $\theta_k = -1$ otherwise.

The index $\log(T)$ reaches its minimum when all individuals reply to survey questions assigning the minimum score to all the K tolerance dimensions. In such a case, $\mathcal{F}_k = |\sum_{i=1}^{n} j| = \frac{J-1}{2}n$, $\beta_k = 1$ and $\theta_k = -1$, $\forall k$. The index formula reduces to:

$$\begin{aligned} \min(\log(T)) &= \underbrace{(-1)1\log(\frac{J-1}{2}n+1) + ... + (-1)1\log(\frac{J-1}{2}n+1)}_{\text{K times}} \\ &= -K\log(\frac{J-1}{2}n+1) \end{aligned} \tag{7}$$

The index $\log(T)$ reaches its maximum when all individuals assign the maximum score to all the considered dimensions. In such a case, $\mathcal{F}_k = |\sum_{i=1}^{n} j| = \frac{J-1}{2}n$, $\beta_k = 1$ and $\theta_k = +1$, $\forall k$. So, the index formula is simplified as follows:

$$\begin{aligned} \max(\log(T)) &= \underbrace{(+1)1\log(\frac{J-1}{2}n+1) + ... + (+1)1\log(\frac{J-1}{2}n+1)}_{\text{K times}} \\ &= K\log(\frac{J-1}{2}n+1) \end{aligned} \tag{8}$$

[9] These two cases are further discussed in Appendix.

Notice that the T index is equal to zero in two different cases. The first case occurs when all individuals reply to all questions survey selecting the zero score in the rescaled Likert scale. This means that society is indifferent towards all tolerant dimensions, so the distribution of $\boldsymbol{F}_k$ is concentrated on the zero value of the normalized scale. If that happens for each $\boldsymbol{F}_k$ with $k = 1, ..K$, then $\log(T) = 0$.

The second case occurs when $\boldsymbol{F}_k$ has a uniform frequency distribution, i.e. individuals' responses are strongly heterogeneous. The value of β_k, which is a measure of homogeneity, is equal to zero, reflecting the fact that no attitude prevails on the others and this occurs for each dimension. Such responses do not contribute to determine the level of tolerance in the population. The index formula allows to identify which of two cases occurred when we observe a value of the T index equal to zero.

5 Case study

In this section, we employ the T-index to assess tolerance for a sample of 3,386 university students at the University of Milan-Bicocca located in the city of Milan. The data have been collected by means of a self-reported questionnaire. The list of items or questions are displayed in Table 1.

Statements are phrased in agreement/disagreement form, and respondents were asked to indicate a score between 1 (strongly disagreed) and 7 (strongly agreed). We normalized the values in order to shift the scale between -3 to +3 and grouped items into five groups representing tolerance dimensions as follows : the firsts three items are supposed to investigate the Interreligious dialogue; the 4th to 6th items are about Women/religion relationship; the 7th to 8th items are about Death/religion relationship; the 9th to 11th items investigate Multicultural society; the 12th to 13th items are on Homosexuality (Table 2) .

We calculated Cronbach's alphas to verify the internal consistency of item-categories

Item	Description	Likert scale						
		Strongly disagree						**Strongly agree**
		1	**2**	**3**	**4**	**5**	**6**	**7**
it_1	In your view, interreligious dialogue may help to mitigate conflicts and misunderstandings in Italian society?	1	2	3	4	5	6	7
it_2	Is there the same freedom of religious practice for all religions in Italy?	1	2	3	4	5	6	7
it_3	Is there the same freedom of religious practice for all religions in your city?	1	2	3	4	5	6	7
it_4	The Catholic Church should accept the ordination of women to ministerial or priestly office?	1	2	3	4	5	6	7
it_5	The Muslim women should not pray in separate areas from men in the mosque?	1	2	3	4	5	6	7
it_6	The Jewish women should become rabbis?	1	2	3	4	5	6	7
it_7	Voluntary interruption of pregnancy is socially acceptable within the fifth month after conception?	1	2	3	4	5	6	7
it_8	Eutanasia is socially acceptable in presence of a living will?	1	2	3	4	5	6	7
it_9	The marriage between people of different religions is socially acceptable?	1	2	3	4	5	6	7
it_{10}	The marriage between people of different ethnic communities is socially acceptable?	1	2	3	4	5	6	7
it_{11}	Italian society may be enriched by the presence of foreign people of different religions?	1	2	3	4	5	6	7
it_{12}	All States should legally recognize same-sex marriage	1	2	3	4	5	6	7
it_{13}	All States should legally recognize the child adoption by same-sex couples.	1	2	3	4	5	6	7

Table 1: Items of the Survey

(Table 2). Cronbach's alpha, indeed, is widely believed to indirectly indicate the degree to which a set of items measures a single unidimensional latent construct (Cronbach 1951; Cortina 1993). In this case, it evaluates the extent to which a group of items represents a specific dimension of tolerance. A high degree of internal consistency allows to interpret each composite score $\mathcal{F}_k$ as a unique construct. The results in Table 2 show a high degree of internal consistency for dimensions II, IV and V. The alpha values of Interreligious dialogue (I) and Death/religion relationship (III) can be still considered acceptable.

Looking at the $\boldsymbol{F}_k$ distributions (Figure 4), it turns out that students have a propensity to be tolerant especially as regards to dimensions II, III, IV, and V. Indeed, the responses tend to concentrate on the positive values of the Likert scale. This pattern is also confirmed by the β_k reported in Table 3. As we argued in Section 3, the values of

Tolerance dimensions	**Description**	**Cronbach's alpha**
I	Interreligious dialogue ($it_1 - it_3$)	0.5222
II	Women/religion relationship ($it_4 - it_6$)	0.7935
III	Death/religion relationship ($it_7 - it_8$)	0.5753
IV	Multicultural society ($it_9 - it_{11}$)	0.7334
V	Homosexuality ($it_{12} - it_{13}$)	0.7390

Table 2: Tolerance dimensions

parameters β_k measure not only the strength of agreement among individuals about tolerance dimension k, but also the weight assigned to that dimension in equation (6). Accordingly, the dimension IV enters the formula with a highest weight, whereas Interreligious dialogue, that actually shows the most heterogeneous distribution, has the lowest value. For this dimension, intolerant attitudes of some individuals are partially compensated by tolerant attitudes of other individuals.

Table 3 also displays the intensity of attitudes towards tolerance dimensions ($\mathcal{F}_k$) and the direction of such intensity (θ_k). As for the latter, tolerant attitudes prevail for each dimension since $\theta_k = +1$, for all $k = 1, ...5$. This result allows to establish that, even in the case of more heterogeneous distributions, tolerant attitudes more than offset intolerant attitudes. The intensity of tolerance is higher for the forth dimension (Multicultural society), followed by the second (Women/religion relationship), fifth (Homosexuality), and third (Death/religion relationship) dimensions.

Tolerance dimensions	$\beta_{\mathbf{k}}$	$\theta_{\mathbf{k}}$	$\mathcal{F}_{\mathbf{k}}$
I	0.0754	+1	805
II	0.4709	+1	6291
III	0.2554	+1	3633
IV	0.7350	+1	8328
V	0.3793	+1	4808

Table 3: Parameter values of T-index

Finally, $\log(T) = 16.5157$ and its range is $(-46.131; +46.131)$. The normalized version of the Tolerance index $\log(T)_{norm}$, with values between -1 and +1, can be obtained just

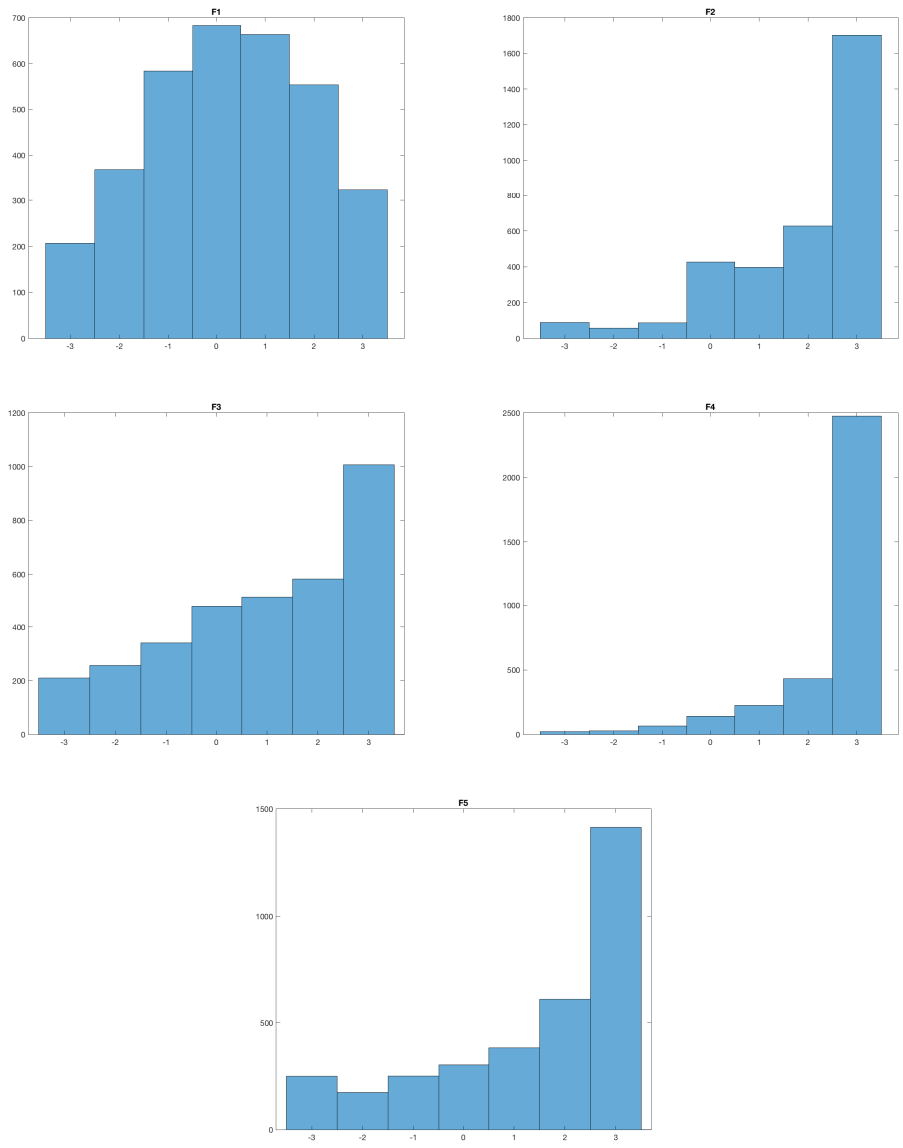

Figure 4: Graphical distribution of Tolerance dimensions $\boldsymbol{F}_k$

dividing $\log(T)/\max(\log(T))$. In our case, $\log(T)_{norm} = 0.3580$.

To sum up, students show a propensity to be tolerant. The index allows to establish by how much each dimension contributes to determine the degree of the overall tolerance. Most students are in favor of a multicultural society and agree about women's emancipation in the domain of religious authorities. They are open to homosexuality and respect the individual authonomy in the matters of life and death. The most controversial topic is about the interreligious dialogue. The index allows to establish that tolerant attitudes in this respect more than compensate for intolerant attitudes.

6 Conclusive remarks

So far, the literature about tolerance has tended to analyse the effects of tolerance in the economic system or to identify factors enhancing tolerant attitudes in society. On one hand, tolerance usually produces positive economic effects; on the other hand, the main determinants of tolerance are essentially of socio-political nature. The aim of this study has been twofold. We wanted to shed light on the individual's choice to be tolerant. One can decide to be tolerant both in the case of a gain in personal utility and in the case of no benefit from being tolerant. Besides describing individual's behavior, this paper addresses the issue of measuring tolerance when information about several dimensions of tolerance is available and data are of Likert's scale type.

Both the model with lexicographic preferences and the index to measure tolerance lead us to policy considerations. First, the government should promote economic policies able to guarantee an adeguate standard of living. This favors greater tolerance that, in turn, produces a number of positive socio-economic effects discussed in Section 2. Second, the empirical results allow to modulate some important aspects from the policy makers point of view, such as the relative importance of different dimensions of tolerance. This type of information is particularly relevant to inform the debate on gaps in tolerance in different

areas (city, region, country) or for specific groups of society.

Third, the empirical analysis highlights the importance for policy makers to establish information systems for monitoring attitudes towards the different dimensions of tolerance. This would significantly improve government's ability to detect disparities in tolerance dimensions and identify appropriate policy actions.

Finally, our study paves the way for further research in at least two directions. As for the first, our theoretical framework could be tested empirically investigating the relationship between living standards and tolerance across countries. As for the second, the tolerance index could be generalized for not Likert-scale type data.

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1 Appendix

The T index in the case of J even

In Section 4, we have considered a Likert scale with an odd number of response categories J in order to perfectly balance the scale points indicating positive and negative attitudes towards tolerance. Here we discuss the main implications for the Tolerance index when the Likert scale has an even number of categories. We will see that the T index is not substantially modified.

The first consequence of J even is that the scale does not have the middle or 'neutral' position, then the categories are no more equidistant as in the case of an odd number of scale points. The score chosen by the repondents could misrepresent their actual attitudes (Guy and Norvell, 1977; Ryan, 1980). The choice of adopting an even-numbered Likert-type scale could be made to press respondents to choose a sharp alternative instead of allowing refuge in a middle position (Lalla et al, 2004). Previous studies show that the percentage for the middle position in odd Likert scale decreases when the number of alternatives increases (Matell and Jacoby, 1971). However, it is not straightforward to generalize this result since respondents are also sensible the nature of questions.

The second implication is that the normalized response vector of individual i is as follows (see Brown, 1988):

$$it_m(i) = \left[\; -\tfrac{J}{2}, \;\; -\tfrac{(J-1)}{2}, \;\; . \;\; . \;\; . - 1, \;\; +1, \;\; . \;\; . \;\; + \tfrac{(J-1)}{2}, \;\; + \tfrac{J}{2} \; \right] \tag{9}$$

The single values of $F_k(i)$, defined as row median of each vector $X_k(i)$, are obtained just applying the definition of median recalled in Section 4.

Supplementary material on the computation of the T index.

As already shown in Section 4, the Tolerance index T (eq. 6) is obtained by computing the

values $\mathcal{F}_k$ that measure the intensity of the assessment of respondents towards a certain topic. The parameter θ_k entering the formula identifies the direction of individuals' attitudes towards a topic. The parameter β_k measures the degree of homogeneity in responses about a topic.

Consider the case of respondents who select all the same scale point, and this occurs for each topic k. The degree of homogeneity is maximum and it is associated with many possible data configurations. In the following, we discuss only one of these possible configurations since the other can be treated in the same way. In the second part of this Section, we will discuss a case of maximum heterogeneity.

In Figure A is depicted an example of maximum agreement among individuals in rating each Tolerance dimension F_k.

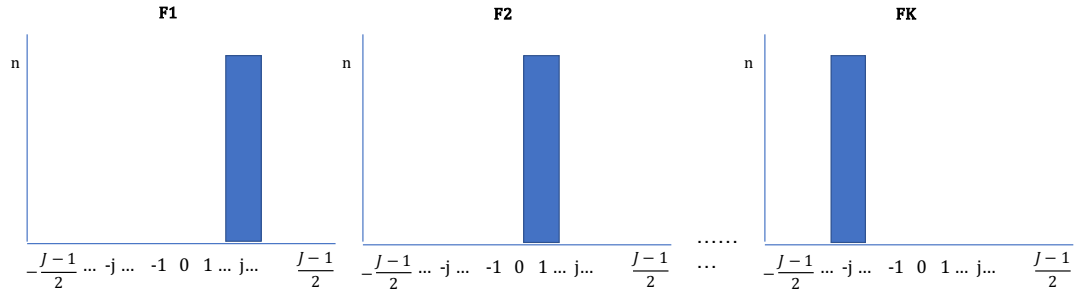

Figure A: Distribution of Tolerance dimensions $\boldsymbol{F}_k$ in case of maximum homogeneity

The absolute frequency is maximum at the selected point and this occurs for each tolerance dimension. The relative frequency distributions of the Likert-scale points chosen by the respondents can be reduced to a single value for each $\boldsymbol{F}_k$. This value is obtained summing up all the sample assessments (Tab. A).

The Leti's heterogeneity index is $L_k = 1$, $\forall k$. The parameter $\beta_k = 1 - \frac{1-1}{J-1} = 1$ $\forall k$, while the value of parameter θ_k is obtained according to the positive/negative sum of respondents' scores.

F_1			F_2			....	F_K		
Values	Count	Relative Frequency	Values	Count	Relative Frequency	....	Values	Count	Relative Frequency
j	n	1	1	n	1	....	-j	n	1

Table A: Frequency Distributions per dimensions: maximum homogeneity of assessments

The Tolerance index log(T) is as follows:

$$\begin{aligned} \log(T) &= (\theta_1)\beta_1 \log(\mathcal{F}_1 + 1) + (\theta_2)\beta_2 \log(\mathcal{F}_2 + 1) + ... + (\theta_K)\beta_K \log(\mathcal{F}_K + 1) \quad (10) \\ &= (+1)1 \log(j \cdot n + 1) + (+1)1 \log(1 \cdot n + 1) + ... + (-1)1 \log(-j \cdot n + 1) \end{aligned}$$

Consider now the case of individuals who assign a different score such that each tolerance dimension has the same absolute frequency n/J (see Fig. B).[10]. This a case of maximum heterogeneity of individual attitudes.

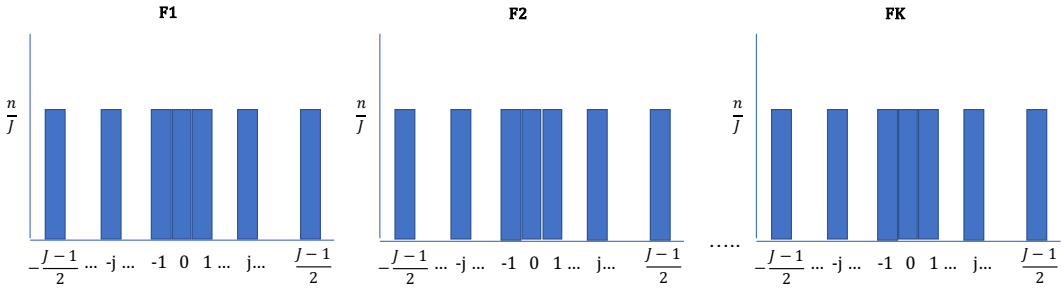

Figure B: Distribution of Tolerance dimensions $\boldsymbol{F}_k$ in case of maximum heterogeneity

Accordingly, Likert-scale scores have the same relative frequencies across different dimensions $\boldsymbol{F}_k$ (Tab. B). This implies that $f_{(-\frac{J-1}{2})} = .. = f_{(-j)} = ... = f_{(-1)} = f_{(0)} = f_{(1)} = .. = f_{(j)} = ... = f_{(\frac{J-1}{2})}$.

The Leti's heterogeneity index $L_k = J$, $\forall k$; the parameter $\beta_k = 1 - \frac{J-1}{J-1} = 0$; $\theta_k = +1$,

[10]Without lost of generality we can consider the value n/J as integer

F_1			F_2			....	F_K		
Values	Count	Relative Frequency	Values	Count	Relative Frequency	....	Values	Count	Relative Frequency
$-\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(-\frac{J-1}{2})}$	$-\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(-\frac{J-1}{2})}$	....	$-\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(-\frac{J-1}{2})}$
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
$-j$	$\frac{n}{J}$	$f_{(-j)}$	$-j$	$\frac{n}{J}$	$f_{(-j)}$	....	$-j$	$\frac{n}{J}$	$f_{(-j)}$
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
-1	$\frac{n}{J}$	$f_{(-1)}$	-1	$\frac{n}{J}$	$f_{(-1)}$	....	-1	$\frac{n}{J}$	$f_{(-1)}$
0	$\frac{n}{J}$	$f_{(0)}$	0	$\frac{n}{J}$	$f_{(0)}$	....	0	$\frac{n}{J}$	$f_{(0)}$
1	$\frac{n}{J}$	$f_{(1)}$	1	$\frac{n}{J}$	$f_{(1)}$	....	1	$\frac{n}{J}$	$f_{(1)}$
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
j	$\frac{n}{J}$	$f_{(j)}$	j	$\frac{n}{J}$	$f_{(j)}$	....	j	$\frac{n}{J}$	$f_{(j)}$
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
$\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(\frac{J-1}{2})}$	$\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(\frac{J-1}{2})}$	....	$\frac{J-1}{2}$	$\frac{n}{J}$	$f_{(\frac{J-1}{2})}$
$Total$	n	1	$Total$	n	1	....	$Total$	n	1

Table B: Frequency Distributions per dimensions: maximum heterogeneity of assessments

$\forall k$. Tolerance index log(T) in this case is obtained by computing:

$$\begin{aligned}\log(T) &= (\theta_1)\beta_1 \log(\mathcal{F}_1 + 1) + (\theta_2)\beta_2 \log(\mathcal{F}_2 + 1) + ... + (\theta_K)\beta_K \log(\mathcal{F}_K + 1) \quad (11)\\ &= (+1)0 \log(\frac{n}{J}(-\frac{J-1}{2} + ... + \frac{J-1}{2}) + 1) + ...\\ &\quad .. + (+1)0 \log(\frac{n}{J}(-\frac{J-1}{2} + ... + \frac{J-1}{2}) + 1) = 0\end{aligned}$$