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Is more health always better?
Exploring public preferences that violate monotonicity

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Abstract:

Abásolo and Tsuchiya (2004a) report on an empirical study to elicit public preferences regarding the efficiency-equality trade-off in health, where the majority of respondents violated monotonicity. The procedure used has been subject to criticisms regarding potential biases in the results. The aim of this paper is to analyse whether violation of monotonicity remains when a revised questionnaire is used. We test: whether monotonicity is violated when we allow for inequality neutral preferences and also if we allow for preferences that would reject any option which gives no health gain to one group; whether those who violate monotonicity actually have non-monotonic or Rawlsian preferences; whether the titration sequence of the original questionnaire may have biased the results; whether monotonicity is violated when an alternative question is administered. Finally, we also test for symmetry of preferences. The results confirm the evidence of the previous study regarding violation of monotonicity.

Key words: Health related social welfare functions; monotonicity; Rawlsian; equality-efficiency trade-off.

JEL: D39; D63; I10

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Is more health always better?
Exploring public preferences that violate monotonicity

1. Introduction

The two main objectives of publicly funded health care are, subject to resource constraints, to maximise population health and to reduce inequality in health across groups within the population, which leads to an interesting question regarding the relationship between these two objectives: what is the relevant efficiency-equality trade-off in health policy decisions. While there are several ways in which to address this issue, the approach we followed in Abásolo and Tsuchiya (2004a; A&T henceforth) was by exploring the trade-off supported by members of the public. This builds on Williams (1997), where the possibility of applying weights to health gains to different socio-economic groups to reflect the varying prospects of achieving a 'fair innings' is discussed.

A health related social welfare function (HRSWF) is proposed as a way to represent explicitly the trade-off between the total level of health (concern for efficiency) and its distribution (concern for equality) (see Dolan, 1998). The HRSWF would be defined not over individual utility levels but over health of subpopulations (Wagstaff, 1994). The relevant subpopulations *1* and *2* are of equal size and homogeneous. Therefore, social welfare would depend on the health of both groups:

$$W = W(H_1, H_2), \qquad \text{where } H_1, H_2 > 0 \qquad [1]$$

where W is the level of social welfare associated with the health distribution (H_1, H_2), and H_1 and H_2 represent the health of group *1* and *2* respectively.

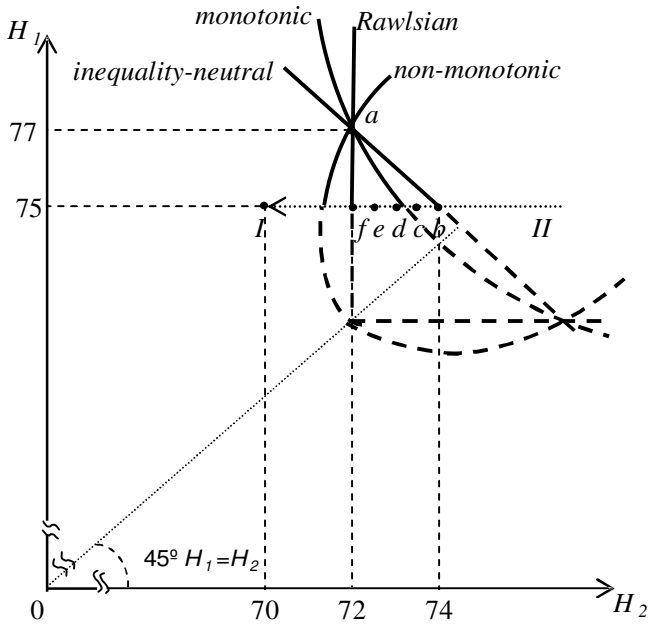
Within this framework, A&T proposed a HRSWF specification that fulfilled the main properties of conventional social welfare functions (i.e. individualism, comparability, cardinal measurability, additivity and monotonicity), but also allowed for non-monotonic preferences that might arise when health inequalities are regarded as being too large. This HRSWF specification was motivated by an empirical study that elicits social preferences regarding the efficiency-equality trade off in health, in a way that can be translated into the HRSWF space. This exercise was based on a interview questionnaire designed in a programme of research on this topic based at the Universities of York and Sheffield, UK (Shaw et al, 2001; Dolan and Tsuchiya, 2005; 2009; forthcoming).

The basic idea can be described as follows. In the questions, health is measured in terms of life expectancy at birth. Given the health of two socioeconomic groups, high class (H_1) and low class (H_2), the question presented to respondents showed a 5-year difference in life expectancy between higher and lower socio-economic groups (75 and 70 years, respectively): viz. point ***I***(75,70) in Figure 1. In the first question, the respondent was asked to choose between two health programmes which had exactly the same cost. Health programme A increased the life expectancy of both socio-economic groups by 2 years each (point *a*); and health programme B increased the life expectancy of the worse-off group by 4 years (point *b*). Let us denote the choice between these two programmes as "(+2,+2) versus (+0,+4)", indicating health gains for higher and lower socioeconomic groups, respectively. If the respondent chose programme A, then no further questions were asked.

Those respondents who answered B to the above were referred to a follow-up set of questions in which they were asked to choose between programme A and a modified programme B which gave smaller and smaller life expectancy gains to the lower class, in 6-month decrements. In other words, programme A was always *a* (+2,+2), while programme B changed from *c* (+0,+3.5), to *d*

(+0,+3), to *e* (+0,+2.5) and to *f* (+0,+2.0). The expectation is that the respondent would "switch" to programme A at some point. These choices represented different degrees of the equality-efficiency trade-off. The larger the sacrifice in terms of efficiency that one is ready to make, in order to reduce inequalities, the later would be one's switching point. Once the individual has switched, an indifference point can be worked out along the horizontal line ***I-II***. If, for instance, a respondent chose programme B when the choice (+2,+2) versus (+0,+3.5) was offered, but switched to programme A for the choice (+2,+2) versus (+0,+3), then it was assumed that the respondent was indifferent between (+2,+2) and (+0,+3.25) the mid-point between *c* and *d*. The interpretation is that we have identified two points lying on the same social welfare contour which in this case corresponds to the *monotonic* indifference curve drawn in Figure 1. Given [2] below the relevant values of the parameters can be worked out.

Figure 1: Types of indifference curves around *a*



To not switch at the very last question and to prefer a variant of programme B (+0, +2) over programme A (+2, +2) implies a violation of the *strong monotonicity* principle. *Strong monotonicity* requires that if the health of one group (i = 1, 2) of individuals increases, ceteris paribus, the level of social welfare also increases, i.e.:

$$\partial W/\partial H_i > 0 \text{ for all } i \qquad [2]$$

However, it should be noted that there could be two types of respondents within this group. The first type consists of those who have a non-monotonic preference and, thus, in terms of the HRSWF in Figure 1, support a social welfare contour with a positive slope at point *a*. In their view, increasing the health of the better off group at this point will decrease social welfare (and thus their preferences violate [2]). The second type consist of those who are Rawlsians, and are actually indifferent between the two programmes, but since there was no indifference option given in the questionnaire, they chose programme B over A (and there may have been other Rawlisans who chose A over B at the same junction). In terms of Figure 1, in their view, the social welfare

contour at point *a* has a vertical slope, and increasing the health of the better off group at this point will neither increase or decrease social welfare (and thus their preferences violate [2]).

As reported in A&T, a representative sample of the Spanish population (N=973 valid responses) was interviewed on a face-to-face basis in 1999 and the results showed the notable outcome that the majority (57%) of those with valid responses still preferred programme B when the choice (+2,+2) versus (+0,+2) was offered, i.e. they had preferences that violated the strong monotonicity principle.

The questionnaire design used in the original Spanish survey in 1999 had several drawbacks that cast some doubts on the results regarding violation of monotonicity (eg. Olsen 2004, Dutta 2006a, 2006b). Firstly, regarding the design of the first question, the respondent was forced to choose between programmes A and B, therefore, not allowing for *inequality neutral* preferences; insofar as these individuals had chosen programme B, the proportion of those who violate monotonicity may have been overestimated. In addition, programme B gave no health gain to the better off and if this was a reason to choose programme A over B, results would also be biased for this reason, in this case underestimating the proportion of individuals violating monotonicity. Secondly, regarding the follow-up set of questions, the last question offered to the respondents consisted of choosing between (+2,+2) and (+0,+2). Although the majority of respondents violated strong monotonicity by choosing (+0,+2) over (+2, +2), as is noted above, this last question was not sufficient to rule out Rawlsian preferences, as an indifference option was not given in the follow up page. Thirdly, the titration sequence in which the follow-up questions were presented, could have 'invited' respondents to delay switching to programme A beyond the point at which they are indifferent between the two programmes, resulting in more respondents appearing as if they violate the monotonicity principle. On the other hand, there may be a tendency for survey respondents to favour the first (or the left hand side) option over alternatives that they see subsequently, in what has been called a "response order effect" (eg. Krosnik 1999). Therefore, fourthly, there is the possibility that there was a bias towards (+2, +2), which always appeared on the left hand side, thus possibly leading to an *under*reporting of the extent of the violation of monotonicity. Finally, the questionnaire did not undertake any question to check whether preferences are symmetric.

In this paper, a new questionnaire is designed to address these issues of which the details are given in section 2 (methods). Section 3 reports the results of the new survey. Section 4 presents a general discussion of the results and the main conclusions are summarised in section 5.

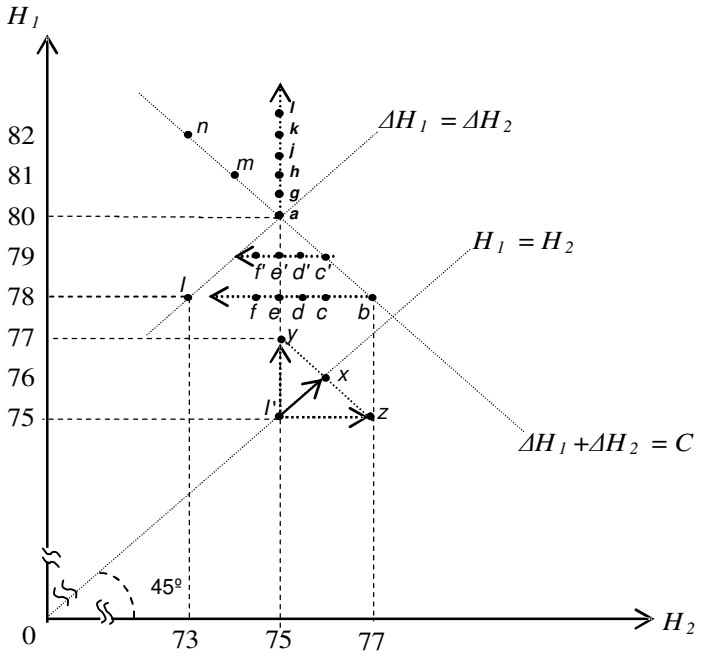
2. Methods and data

Methods

The revised questionnaire has been specifically designed to analyse the procedure by which public preferences were elicited. Figure 2 illustrates how the main questions of the new questionnaire work in the HRSWF framework (the actual diagrams accompanying the questions are reproduced in the appendices). Imagine there are two population groups (low socioeconomic class and high socioeconomic class), and their respective life expectancy at birth is represented as H_1 and H_2 along the vertical and horizontal axes respectively. Point ***I*** (78,73) represents the current situation, with a five year inequality in health across the two groups. As before, the question on the first page (see A.1.1 in the appendix) corresponds to a choice between a move from point ***I*** to point *a* "programme A" (+2,+2) and a move from point ***I*** to point *b* "programme B" (+0,+4). If the respondents prefer the latter, then they are directed to a follow-up page (see Q.4.1 in the Appendix), where in effect programme A remains constant (move from ***I*** to *a*) but programme B

becomes less attractive (move from ***I*** to points to the left of *b* on the horizontal line). The point at which the respondent "switches" from programme B to programme A will indicate where the indifference curve through point *a* (+2,+2) intersects the horizontal line ***I***-*b*. As mentioned above, if the respondent prefers *e* (+0,+2) to *a* (+2,+2) then this would violate the *strong monotonicity* principle.

Figure 2: Ordering health distributions into HRSWF framework with the new questionnaire



Now, several changes have been introduced in the questionnaire to further explore the violation of strong monotonicity:

1. Testing if inequality neutral preferences affects the proportion who violate strong monotonicity.

One of the concerns regarding the design of the first question in the original questionnaire is that since it did not allow for ties between the two programmes, there was no clear way of identifying those who are neutral to the distribution of health across the two population groups (i.e. simple health maximisers), who would have been forced to choose between programmes A and B. In order to address this issue, the questionnaire was amended to include an indifference option on the first page "A and B are equally good" (see Q.1.1). And in line with the follow-up page for those who select programme B, another follow-up page was designed for those who revealed themselves to be indifferent between programmes A and B in the first question (see Q.2.1). As with the original follow-up page, programme A continued to represent the move from ***I*** to *a* (+2,+2) and programme B represented the move from ***I*** to three points *c'* (+1,+3), *m* (+3,+1) and *n* (+4,+0) along the straight line $\Delta H_1 + \Delta H_2 = C$ (see Figure 2). We refer to this question as *inequality neutral*. Respondents can switch from programme A to B, or from programme B to A, but once switched, if they switched back, they were regarded as 'invalid' responses and excluded from all analyses.

2. Testing if "nobody should get nothing" is a strong concern that might affect the proportion of those violating strong monotonicity.

Another thing to note about the first question is that whereas under programme A both population groups receive something, under programme B the better-off will receive no health benefit, and there may be those who find it unacceptable that a public policy programme should exclude a whole population subgroup from benefiting. If so, this might be an invitation for some to choose programme A, therefore underestimating preferences that violate strong monotonicity. In order to explore this possibility, a follow-up page for those who choose programme A on the first page was designed (see Q.3.1). On this page, programme A represented the move from point *i* to *a* (+2,+2) as before, but programme B now represented moves from ***I*** to a series of points on the horizontal line along point *c′* (+1,+3) to *f′* (+1,+1.5) of Figure 2, so that the better-off will receive a small health benefit, and a trade-off exercise similar to the original follow-up page could be carried out (aimed just at those who are concerned with "everybody getting something"). In the follow-up page respondents can switch from B to A; if they switched back (from A to B), they were regarded as 'invalid' responses and excluded from all analyses. We refer to this question as *everybody gets something*.

3. Testing for the type of preferences of those who violate strong monotonicity: Rawlsian or non-monotonic preferences?

The last choice included in the follow-up of those who chose programme B in the main question of A&T was the one between *a* (+2,+2) and *e* (+0,+2). The majority chose (+0,+2) thus violating strong monotonicity. A&T interpreted this to indicate that all respondents with such preferences had non-monotonic preferences. However, given that the indifference option was not given, Rawlsian preferences could not be ruled out. In this new questionnaire, an additional choice between the options *a* (+2,+2) and *f* (+0,+1.5) has been included (see Q.4.1), so that it can be empirically tested, and not just inferred, whether non-monotonic preferences actually exist. We will refer to this question as the *main titration* question. In this follow up page, respondents can switch from programme B to A; if they switched back (from A to B), they were regarded as 'invalid' responses and excluded from all analyses. If the majority of individuals still preferred option *f* to option *a* in the last question, that would indicate that the median Spaniard has non-monotonic, rather than Rawlsian preferences.

4. Testing for bias due to the titration sequence of the questionnaire.

Given the way the follow-up page of the questionnaire is designed based on titration, there is the possibility that respondents may have been affected by a "boiling frog" [1] bias. This means that they would delay switching to programme A beyond the point at which they are indifferent between the two programmes, resulting in more respondents appearing as if they violate the strong monotonicity principle, but this would be an artefact of the questionnaire design, not their genuine preferences. In order to explore this possibility, in addition to the titration version of the follow-up page, an alternative variant was designed (*main random*), where the order of the programme pairs in the follow-up page appear randomly (see Q.1.2), in such a way that now the respondent faces a bigger gap between the successive programme B options (eg. from +0,+3 to +0,+1.5). The aim is to compare the proportion of individuals that choose programme B at corresponding stages of the

[1] The story of the boiling frog states that a frog can be boiled alive if the water is heated slowly enough — it is said that if a frog is placed in boiling water, it will jump out, but if it is placed in cold water that is slowly heated, it will never jump out (see for example, Scripture, 1897).

two variants and see if there are differences. Once the data are put in the titration ordering, the responses can switch from programme B to A as in the main titration variant; again, if they switched back (from A to B), they were regarded as 'invalid' responses and excluded from all analyses.

5. Testing for the effect of programme (+2, +2) always appearing on the left hand side.

In order to test the extent to which the results are affected by the location of the two programmes on the page, the first page with programme A (+2,+2) on the left hand side and programme B (+0,+4) on the right hand side (*original alignment*) was reproduced with (+2, +2) on the right hand side and labelled programme B, and (+0, +4) on the left hand side and labelled programme A (*flipped alignment*; see Q.5.1). Again, the indifference option was given. There was no follow up page under this format. We will refer to this question as the *left-right effect*.

6. An alternative question to test for violation of strong monotonicity.

An additional question was introduced in order to further explore whether or not the results of the A&T survey were robust regarding violation of strong monotonicity. Unlike the original question where the aim was to find people's attitudes when health gains to the worse-off are lower and lower keeping constant the health of the better-off, in this new question we aimed to find people's attitudes when health gains to the better-off are made larger and larger, while keeping the health of the worse-off constant (see Q.1.3). Respondents were asked in effect to compare on Figure 2 a move from ***I*** to a modified programme B which is located at points between *g* (+2.5,+2) and ***l*** (+4.5,+2), with reference to a fixed programme A at point *a* (+2,+2). This means that on the first page, where there is an indifferent option, we have a direct test of Rawlsian preferences. Furthermore, on the follow-up page, programme B becomes increasingly more attractive relative to the fixed reference programme A in terms of efficiency but increasingly less attractive in terms of equality. Respondents can switch from programme A to B, or from programme B to A, but once switched, if they switched back, they were regarded as 'invalid' responses and excluded from all analyses. This question is referred to as the *alternative monotonicity*. Monotonicity requires that points between *g* and *k* are more attractive than *a* regardless of its increased inequality.

7. Testing for symmetry of preferences

An interesting question that arises at this point is whether or not the HRSWF is symmetric. The better-off in terms of health are also better-off in terms of economic status, so if respondents thought this was a relevant consideration, then they may well have an asymmetric HRSWF for use in the determination of public health care resource allocation. In other words public preferences maybe not only non-monotonic, but also asymmetric. In order to test for symmetry of preferences, a new question was designed (see Q.2.3), which refers to two small subgroups of 100 individuals selected from two population groups (the rich and the poor), and these two groups have the same life expectancy at birth (i.e. 75 years). Small subgroups, as opposed to whole social class groups were chosen, since while it is unrealistic to assume that the outcomes involved in this question can apply to whole social class groups, it is quite realistic to select 100 individuals from each group, who have the health features described here. Now, in Figure 2, the initial point is ***I'*** on the 45 degree ray and any increments are related to this new ***I'*** point. In effect, the questions asked respondents to firstly compare a move from point ***I'*** to point *x* (+1,+1) with a move from ***I'*** to *y* (+2,+0) and secondly compare the move from ***I'*** to *x* (+1,+1) with a move from ***I'*** to *z* (+0,+2). We refer to this question as *symmetry*. If symmetry around point ***I'*** holds, then those who prefer *x* (+1,+1) to *y* (+2,+0) will prefer *x* (+1,+1) to *z* (+0,+2); and those who prefer *y* (+2,+0) to *x* (+1,+1) will prefer *z* (+0,+2) to *x* (+1,+1); in addition, symmetry requires that those who are indifferent in

one question should also be indifferent in the other question. Note that satisfying one of these is a necessary but not sufficient condition for an individual to support a symmetric HRSWF.

Data

A total of 1211 individuals over 18 years old were sampled randomly across Spain, and interviewed in their homes in December 2004, out of which 83.6% provided complete data (N=1013). This sample was representative of the Spanish general population in terms of age and sex; in general, 48% of the individuals were male, with average age of 45.15 (SD 18.10); and 52% female, with average age of 46.45 (SD 18.04). The overall questionnaire consisted of three different variants which were allocated to respondents randomly (N_1=327, N_2=345, N_3=341; see Table 1a). The first variant had the main question with the indifference option and the three follow-up pages: one to test inequality neutral preferences (*inequality neutral*), another to test whether everybody should get some health benefit (*everybody gets something*), another to test for non-monotonicity of preferences (*main titration*) and another one to test whether the results are affected by the location of the programmes in the first page (*left-right effect*). The second variant started with the alternative monotonicity question (*alternative monotonicity*) and then moved on to the symmetry question (*symmetry*). The third variant had the first page of the main question, followed by the random version of the main question (*main random*) followed by questions not addressed in this paper.

Table 1b presents the breakdown of excluded respondents by question. It can be seen that the percentage of invalid and missing cases varies across questions. The proportion of excluded cases goes from the 4.2% of the first page main question to the 38.5% of the *inequality neutral* follow-up. Regarding the reason of exclusion, for Q.3.1 the percentage of invalid cases is relatively high (20.9%) showing that a higher proportion of respondents have difficulties to understand the *everybody gets something* follow-up. Something similar happens with the percentage of missing cases in the *inequality neutral* follow-up: the proportion of missing cases is 28.5%.

Table 1a. Sample sizes and questionnaires

	VARIANT 1	VARIANT 2	VARIANT 3
QUESTION 1	FIRST PAGE MAIN QUESTION (Q.1.1)	MAIN RANDOM (Q.1.2)	ALTERNATIVE MONOTONICITY (Q.1.3)
QUESTION 2	Follow-up INEQUALITY NEUTRAL (Q.2.1)		SYMMETRY (Q.2.3)
QUESTION 3	Follow-up EVERYBODY GETS STH (Q.3.1)		
QUESTION 4	Follow-up MAIN TITRATION (Q.4.1)		
QUESTION 5	LEFT-RIGHT EFFECT (Q.5.1)		
TOTAL N = 1211	N_1 = 407	N_2 = 395	N_3 = 409
EXCLUDED (*)	80 (19.7%)	50 (12.7%)	68 (16.6%)
VALID N = 1013	N_1 = 327	N_2= 345	N_3 = 341

(*) Respondents were excluded if they had invalid responses to at least one question, or had missing values (i.e. did not respond to at least one question).

Table 1b. Break down of excluded respondents by question

VARIANT 1 (N=407)	INVALID (%)	MISSINGS (%)	TOTAL N
FIRST PAGE MAIN QUESTION (Q.1.1)	----	17 (4.2)	407
Follow-up INEQUALITY NEUTRAL (Q.2.1)	4 (10.3%)	11 (28.2)	39
Follow-up EVERYBODY GETS SOMETHING (Q.3.1)	14 (20.9)	7 (10.4)	67
Follow-up MAIN TITRATION (Q.4.1)	13 (4.6)	8 (2.8)	283
LEFT-RIGHT QUESTION (Q.5.1)	----	21 (5.2)	407
TOTAL	31 (7.6)	49 (12.0) *	407
VARIANT 2 (N= 395)	**INVALID**	**MISSINGS**	**TOTAL N**
MAIN RANDOM QUESTION (Q.1.2)	20 (5.1)	30 (7.6)	395
VARIANT 3 (N= 409)	**INVALID**	**MISSINGS**	**TOTAL N**
ALTERNATIVE MONOTONICITY QUESTION (Q.1.3)	27 (6.6)	35 (8.6)	409
SYMMETRY QUESTION (Q.2.3)	----	25 (6.1)	409
TOTAL	27 (6.6)	41 (10.0) *	409

(*) The totals are lower than the actual sum of the column where some respondents have been missing in more than one question.

3. Results

1. Inequality neutrality

Table 2 shows that only 6.7% of those who were given the first variant were indifferent between programmes A and B on the first page. The Table is made up of two parts. The top part relates to the 327 respondents that answered this question. On the first page of the questionnaire, where the relevant question was between points *a* versus *b* in Figure 2, with Programme A (78+2, 73+2) and Programme B (78+0, 73+4), 44 chose A, 261 chose B, and 22 were indifferent. The bottom part of the Table relates to the 22 respondents who were indifferent between the two Programmes on the first page. Each row presents the distribution of respondents when different combinations of Programmes A and B were presented. So, the potential presence of health maximisers does not rule out violation of strong monotonicity of the majority. In addition, in the follow-up, the proportion of those who prefer programme B is much larger when it is represented by point *c'* compared to points that are further way from the 45 degree line (*m* and *n* in Figure 2) suggesting that distribution neutrality may only be relevant when the programme does not increase the current inequality in health.

Table 2: Support of inequality neutral preferences and follow up (*)

Respondents answering the first variant (**N=327**)					
	Progrm A	Progrm B	Chose A	Chose B	Indifferent
a vs *b*	78+2, 73+2	78+0, 73+4	**44(13.5)**	**261 (79.8)**	**22 (6.7)**
Those respondents who chose indifferent on the first page (**N=22**)					
	Progrm A	Progrm B		Chose A	Chose B
a vs *c*'	78+2, 73+2	78+1, 73+3		**10 (45.5)**	**12 (54.5)**
a vs *m*	78+2, 73+2	78+3, 73+1		**18 (81.8)**	**4 (18.2)**
a vs *n*	78+2, 73+2	78+4, 73+0		**20 (90.9)**	**2 (9.1)**

(*) percentages sum to 100% along each row

2. Everybody should get something

The questionnaire accommodated those who are willing to target the worse-off but are also reluctant to give nothing to one party. Here, 13.5% of respondents preferred *a* over *b* of Figure 2 and go on to the corresponding follow-up page that explores this question. Of these, a majority remains preferring programme A (see Table 3). The result is that, therefore, rearranging the benefits so that no group gets no health gain is not enough to invite these respondents to target the worse-off.

Table 3: Testing if the absence of health benefits in programme B bias results (*)

Respondents answering the first variant (**N=327**)					
	Progrm A	Progrm B	Chose A	Chose B	Indiff.
a vs *b*	78+2, 73+2	78+0, 73+4	**44(13.5)**	**261 (79.8)**	**22 (6.7)**
Those respondents who chose Progrm A on the first page (**N=44**)					
	Progrm A	Progrm B	Chose A	Chose B	
a vs *c*'	78+2, 73+2	78+1, 73+3	**29 (65.9)**	**15 (34.1)**	
a vs *d*'	78+2, 73+2	78+1, 73+2.5	**34 (77.3)**	**10 (22.7)**	
a vs *e*'	78+2, 73+2	78+1, 73+2	**35 (79.5)**	**9 (20.5)**	
a vs *f*'	78+2, 73+2	78+1, 73+1.5	**37 (84.1)**	**7 (15.9)**	

(*) percentages sum to 100% along each row

3. Rawlsian or non-monotonic

Table 4 shows the results of the main question which aims to test whether those who violate strong monotonicity have Rawlsian or non-monotonic preferences.

Table 4: Results of the main question (titration version). Testing for non-monotonicity

Number of respondents answering the first variant (**N=327**)					
	Progrm A	Progrm B	Chose A	Chose B	Indiff.
a vs *b*	78+2, 73+2	78+0, 73+4	**44(13.5)**	**261 (79.8)**	**22 (6.7)**
Those respondents who chose Progrm B on the first page (**N=261**)					
	Progrm A	Progrm B	Chose A	Chose B	
a vs *c*	78+2, 73+2	78+0, 73+3	**56 (18.4)**	**249 (81.6)**	
a vs *d*	78+2, 73+2	78+0, 73+2.5	**72 (23.6)**	**233 (76.4)**	
a vs *e*	78+2, 73+2	78+0, 73+2	**105 (34.4)**	**200 (65.6)**	
a vs *f*	78+2, 73+2	78+0, 73+1.5	**140 (45.9)**	**165 (54.1)**	

Notes: percentages sum to 100% along each row

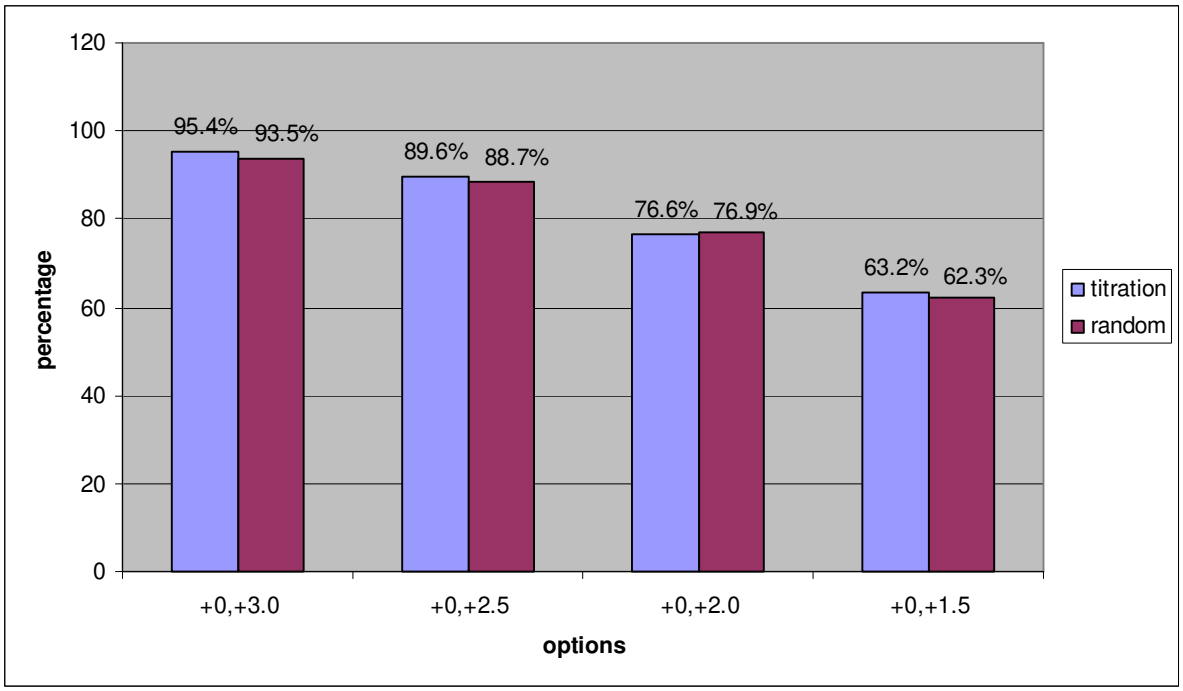
On the first page, 79.8% of respondents choose *b* (+0,+4) over *a* (+2,+2), whilst only 13.5% choose programme A. Looking at the 261 respondents who chose Programme B on the first page, as programme B becomes less efficient, more and more individuals shift to programme A showing a trade-off pattern. However, a clear majority (65.6% of this group of respondents) remains preferring *e* (+0, +2) over *a* (+2, +2), therefore violating the strong monotonicity principle. And more importantly, 54.1% of this group (50.5% of the overall sample for this question N=327) still

prefer *f* (+0,+1.5) over *a* (+2+2), that is, they have non-monotonic preferences, and therefore Rawlsian preferences are explicitly ruled out for the majority of the sample. A necessary (but not sufficient) condition for an individual respondent to hold Rawlsian preferences is to prefer *d* (+0, +2.5) over *a* (+2, +2), and to prefer *a* (+2+2) over *f* (+0,+1.5). Since there are 68 (21% of 327) such respondents, this is the upper limit of Rawlisan individuals in this sample under this question.

4. Titration and random ordering

As it can be seen in Figure 3, comparing the results from the *main titration* and the *main random* questions, there are no statistically significant differences ($p>0.01$) between the proportion of individuals choosing programme B at corresponding stages of the two versions of the questionnaire. So we reject the hypothesis that violation of strong monotonicity is caused by the titration sequence of the questionnaire.

Figure 3.Comparison of % individuals choosing programme B: titration vs random versions (*)

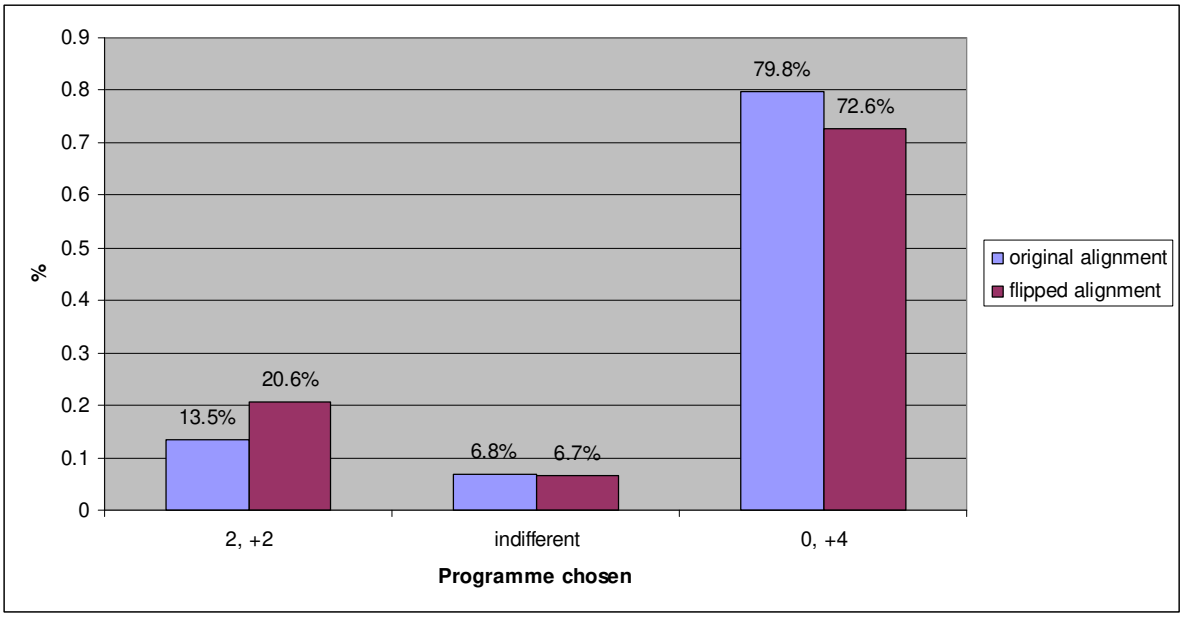


(*) Number of respondents answering the second variant = 345

5. Left-right alignment

Figure 4 presents the distribution of responses on the first page contrasting the original left-right alignment and the flipped alignment. In the original left-right alignment, 13.5% of respondents choose (+2,+2) whilst 79.8% choose (+0,+4) and 6.8% are indifferent between both options. With the flipped alignment, the proportions are 20.6%, 72.6% and 6.7%, respectively. In order to test the response order effect, a test for homogeneity has been undertaken (Rohatgi, 1976). With 95% confidence level, we can not reject the hypothesis of equality of proportions in relation with options A, B and indifferent (considered jointly).

Figure 4.Comparison of distribution of responses between original and flipped alignments(*)



(*) Number of respondents answering the second variant = 345

6. Alternative monotonicity test

Table 5 presents the results for the alternative monotonicity question: 49.4% of individuals were found to choose *a* (+2,+2) over the closest alternative in the north direction *g* (+2.5,+2), thereby violating monotonicity. Furthermore, 13.2% had preferences consistent with a Rawlsian HRSWF. As programme B moves towards point *k* those who choose *a* increases substantially reaching 62.7%.

Table 5: Alternative question to test for non-monotonicity (*)

	A	B	Number of respondents (%) (**)		
			Chose A	Chose B	Indiff
a vs *g*	78+2, 73+2	78+2.5, 73+2	**168 (49.4)**	**128 (37.5)**	**45 (13.2)**
a vs *h*	78+2, 73+2	78+3, 73+2	**209 (61.3)**	**132 (38.7)**	
a vs *j*	78+2, 73+2	78+3.5, 73+2	**212 (62.1)**	**129 (37.9)**	
a vs *k*	78+2, 73+2	78+4, 73+2	**213 (62.4)**	**128 (37.6)**	
a vs *l*	78+2, 73+2	78+4.5, 73+2	**214 (62.7)**	**127 (37.3)**	

(*) Number of respondents answering the third variant = 341
(**) percentages sum to 100% along each row

This alternative question adds robustness to the results related to the preferences of majority of respondents violating strong monotonicity.

7. Symmetry

Finally, Table 6 summarises the distribution of respondents across the nine possible combinations of preferences illustrated in Figure 2 (regarding the new reference point ***I'***). Symmetry requires respondents to be in one of the diagonal cells from the left hand side top to the right hand side bottom, and a total of 66.5% of those who were given these questions satisfy this. If we exclude those who prefer *y* (+2,+0) over *x* (+1,+1) and at the same time *z* (+0,+2) over *x* (+1,+1), i.e.

excluding those preferences with welfare contours around x that are concave to the origin, this will reduce the proportion of those who are in line with the necessary condition for symmetry to 54.5%. Of those who support asymmetry, it should be noted that the majority (31.1% of overall) are in the expected direction (i.e. in favour of the worse-off) and just 2.4% of the total would be in favour of the higher socioeconomic group.

Table 6: Testing for symmetry of preferences (*)

	$x \, f \, y$	$x \sim y$	y f x	Total
$x \, f \, z$	**172 (50.4)**	**6 (1.8)**	**2 (0.6)**	180 (52.8)
$x \sim z$	**2 (0.6)**	**14 (4.1)**	**0 (0.0)**	16 (4.7)
z f x	**98 (28.7)**	**6 (1.8)**	**41 (12.0)**	145 (42.5)
Total	272 (79.8)	26(7.6)	43 (12.6)	341(100.0)

(*) Number of respondents answering the third variant = 341

Similarly, 79.8% of individuals prefer x to y, whilst the proportion of those who prefer x to z are just 52.8%. That is, equal distributions are more preferred to unequal ones (by 26 percentage points) when the inequality favours the higher socioeconomic group.

4. Discussion

Monotonicity may be questionable as a welfare principle in the context of HRSWF. This conclusion remains when a revised version of the questionnaire reported in A&T is undertaken to explore a wider range of preferences and other hypotheses that might have affected the findings in A&T regarding preferences that violate strong monotonicity.

The A&T questionnaire was not able to accommodate the preferences of two types of individuals: those who are inequality neutral and those whose choice would be affected by the fact that some group gets no health gain, which is the case of programme B in the original question. With respect to the former, there is the possibility that the proportion of respondents violating strong monotonicity had been overestimated because those with inequality neutral preferences had been forced to choose programme B instead. However, this possibility is now ruled out, as only a small minority of individuals reported to be inequality neutral when the indifference option was offered in the first page of the main questionnaire; in other words, the potential presence of distribution-neutral health maximisers does not rule out the violation of strong monotonicity of the majority. It should be also acknowledged that it would have been desirable to offer an indifference option in subsequent questions of the follow-up page. However, the indifference option was omitted in the follow-up questions as we anticipated that for many respondents, this would make the questionnaire more complicated and could be an invitation for some respondents to choose the indifference option as an "easy" way out of the questionnaire. Indeed, the relatively higher rate of non-response or missing in the follow-up page to the *inequality neutral* question (see Table 1b above) may reflect the fact that this page did not include indifference options. The excess proportion of those who did not answer this particular follow-up page may be attributable to those whose view are distribution neutral along the $\Delta H_1 + \Delta H_2 =$ constant line, and therefore did not find either option on offer to be appropriate.

With regard to the second issue above, addressed by the *everybody gets something* question, the majority of those who preferred programme A in the very first page remain preferring this programme on the follow-up page despite programme B which now gives something to the better

off. This indicates that the "nobody should get nothing" argument is not a strong concern and, therefore, does not affect conclusions regarding violation of strong monotonicity.

One of the central aims of this paper was to check whether preferences that are found to violate the strong monotonicity principle are actually non-monotonic or Rawlsian. First of all, the results of the very last question of the *main titration* version in this study show that the majority of Spaniards still prefer health care programme B (+0,+1.5) that reduces health inequalities but gives the worse off less health gain than would be achieved through programme A (+2,+2) where health inequalities would remain constant. A Rawlsian respondent should, however, choose programme A (+2,+2) over programme B (+0,+1.5). Therefore our results confirm that the majority of Spaniards have non-monotonic preferences (i.e. violate the weak monotonicity principle as well), rather than Rawlsian preferences. In addition, this question suggests that the upper limit of the proportion of respondents with Rawlsian preferences is 21%.

Violation of strong monotonicity is not affected by the titration sequence of the questionnaire (*main titration*). Small incremental reductions in the health gain of the worse-off in programme B do not seem to postpone the shift to programme A as compared with the *main random* version where the respondents face bigger decrements. Regarding the *left-right effect* the results do not show evidence of a bias towards (+2,+2) insofar as it is the first option that the respondent can see (as it is located on the left hand side); rather, the original and the flipped alignments do not give significantly different results.

The *alternative monotonicity* question adds new evidence to the existence of non-monotonic preferences. Firstly, on the first page, just about half of individuals (49%) prefer programme A (+2,+2) to programme B (+2.5,+2) thus failing to maximise overall health, and having non-monotonic preferences. The indifference option consistent with Rawlsian preferences, which was offered to the respondents in this first question, was chosen by just 13% of individuals (which is consistent with the upper limit of 21% identified in the *main titration* version). The rest of respondents preferred programme B (i.e. have monotonic preferences). At this stage, the result is consistent with a Rawlsian preference for the median voter. However, when, in subsequent choices, programme B gives the better off more and more health gains (keeping constant the health of the worse-off), then an increasing proportion of respondents switches to programme A, exceeding the majority by a substantial margin (>60%). This result suggests that it is when health inequalities are regarded as being 'too large' that concern for equality overrides concern for efficiency, resulting in non-monotonic preferences. In other words, there is a point at which increasing overall health any further at the expense of health equality would begin to reduce overall health related social welfare. An interesting issue to explore would be to estimate where that tipping point might be located.

Another issue regarding the interpretation of results is the role of *symmetry*. The fact that those with better health are also those in a higher socio-economic position – with, say, greater ability to pay for private care – might have conditioned the responses of some individuals who may have used the health outcome to compensate the worse-off group (with lower socioeconomic level), thereby violating the symmetry property of SWFs. The results of the test for symmetry show that the majority of respondents have symmetric preferences across subgroups of rich and poor individuals. This question, however, allows to test for symmetry around point ***I'*** only, and not with respect to the current situation (point ***I***), thus being a necessary but not sufficient condition of symmetry. In other words, it only gives an upper bound of those who support symmetry, or a lower bound for those who support asymmetry. To test whether non-monotonicity of preferences would be symmetrically reproduced in the area to the right of the 45º line will face problems of

credibility, as it would require the assumption that the socio-economically better off (worse off) have worse (better) health; a situation which does not correspond to the current state of the world[2].

Finally, this study builds on earlier work by the authors, and explores further some of the shortcomings concerning the earlier work. However, if one regards the best evidence of peoples' preferences to be those *revealed* through *personal consumption* behaviour, then these studies are based on preferences that are fall short of this in two ways: they are *stated* and not revealed; and they are about *collective public* outcomes and not outcomes to private consumers. Thus, we would like to acknowledge that while we have made good progress on a number of key issues, we have not been able to solve all problems.

5. Conclusions

Standard social welfare functions require the satisfaction of monotonicity because one important assumption is invoked: that as a consequence of an increase in someone's health, ceteris paribus, the gain in efficiency should always overcome any loss due to possible increase in inequality. However, this assumption, particularly in the health context, is questionable as it has been shown in this research.

Alternative ways to elicit public preferences regarding the efficiency-equality trade-off in health confirm the evidence that motivated the A&T paper relating to the violation of monotonicity. The Spanish median voter has preferences that violate the strong monotonicity principle. This conclusion remains once we take into account the presence of inequality neutral preferences and other possible sources of bias of the questionnaire used in A&T. In addition, the majority of Spaniards have non-monotonic preferences rather than Rawlsian preferences. Finally, symmetry is satisfied by the majority of respondents, so there is no evidence that non-monotonicity would have an asymmetric pattern for the range tested. Thus, to conclude, more health is not always regarded as better for society, as it crucially depends on its distribution and on the extent of social aversion to health inequalities.

[2] All our examples are rank preserving in that the ranking of the two population groups relative to each other remain unaffected after either Programme. Perhaps a more interesting exercise might be to examine scenarios where health gains to the worse-off are big enough to catch up with or even to overtake the better-off.

6. References

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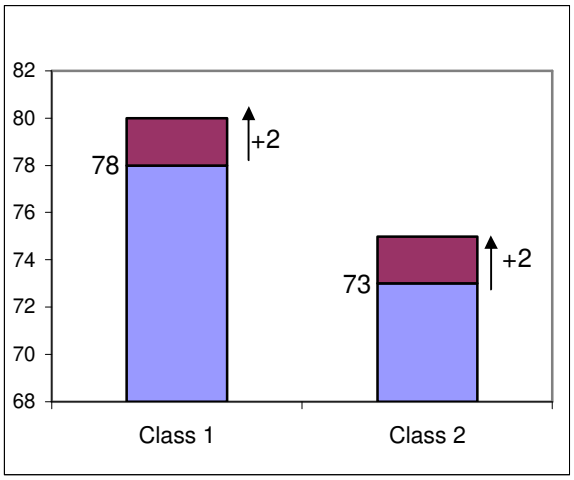
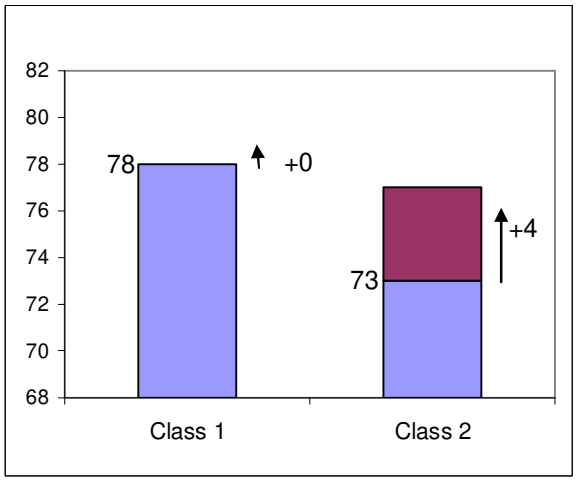
APPENDIX

Q.1.1 First page of the main questionnaire (original alignment).

PROGRAMME A



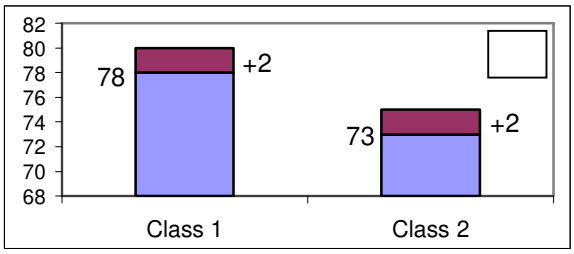
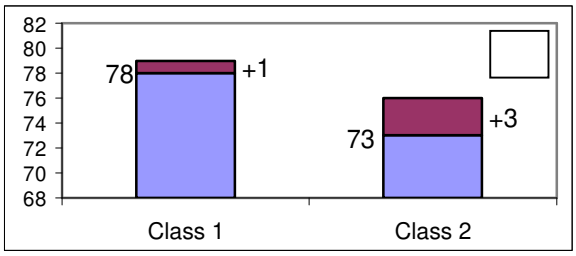
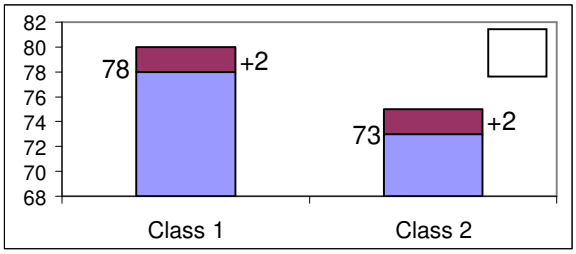
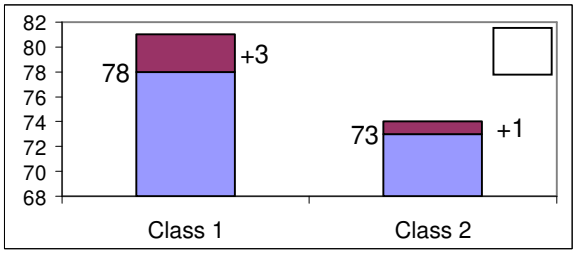
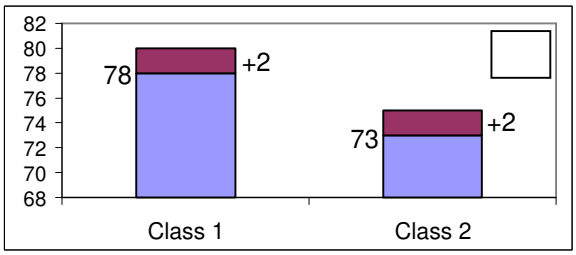
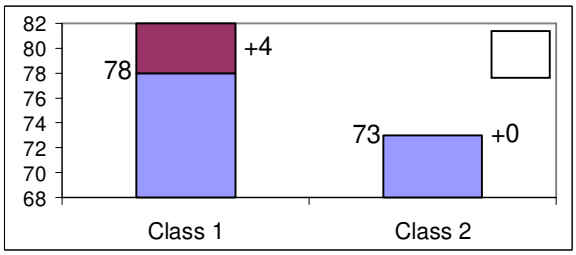
PROGRAMME B



I prefer A ☐ **A and B are equally good** ☐ **I prefer B** ☐

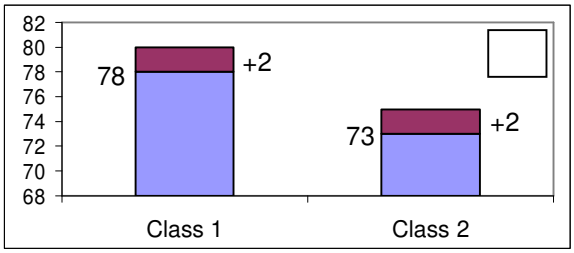
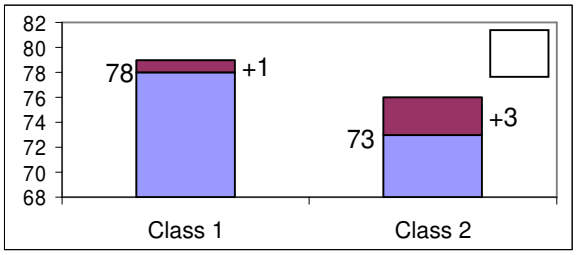
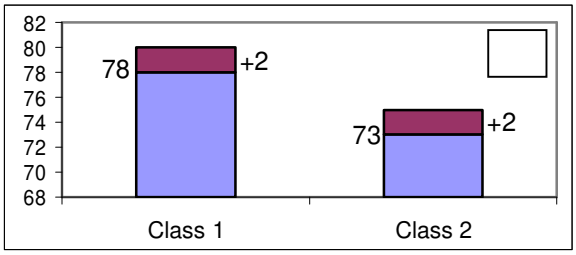
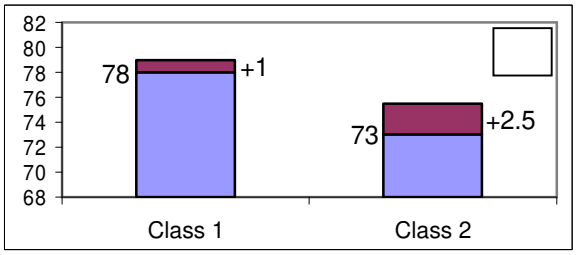
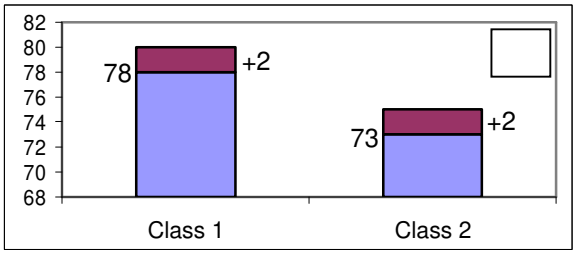
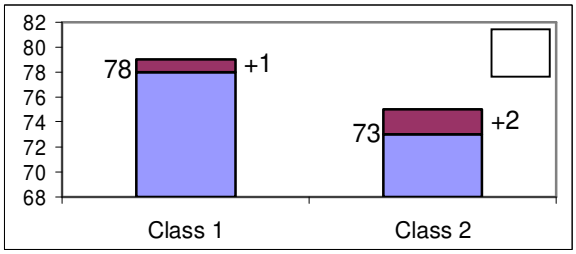
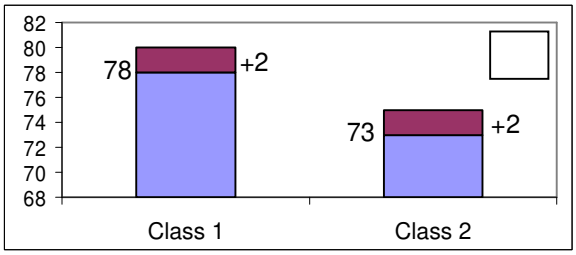
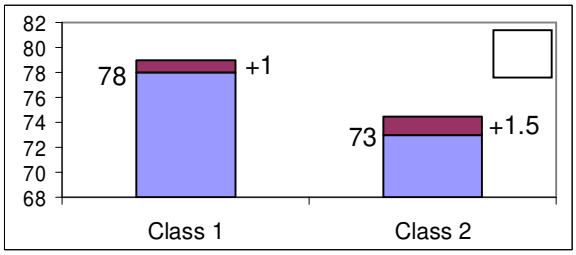
Q.2.1 Follow up of those who are indifferent in the first question of the main questionnaire (*inequality neutral*).

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

PROGRAMME A	**PROGRAMME B**
	
	
	

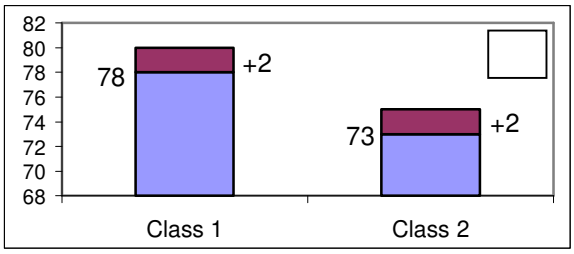
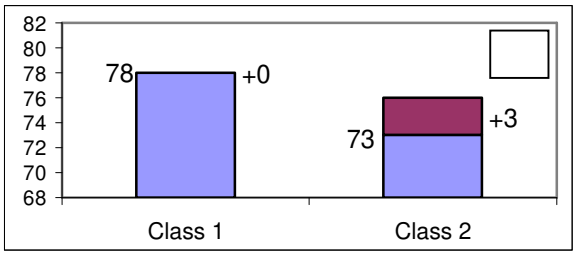
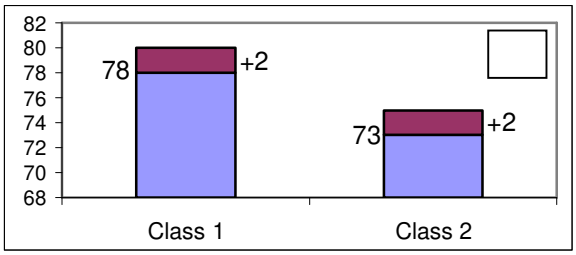
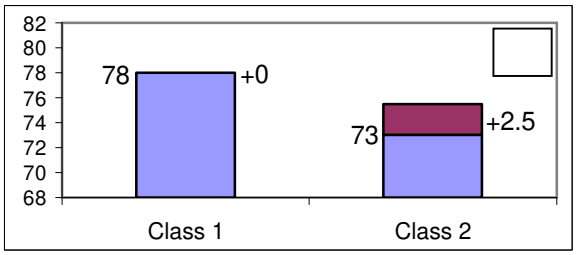
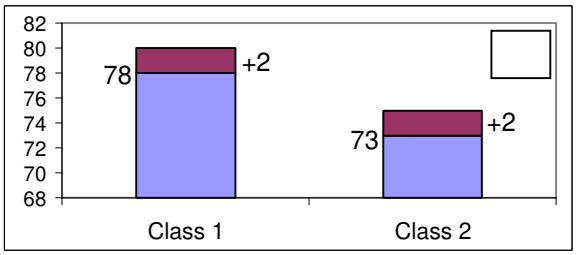
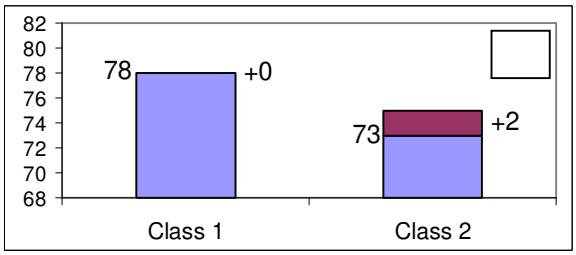
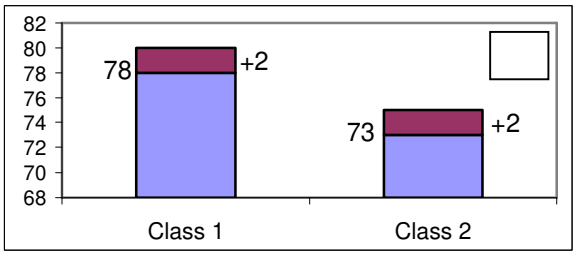
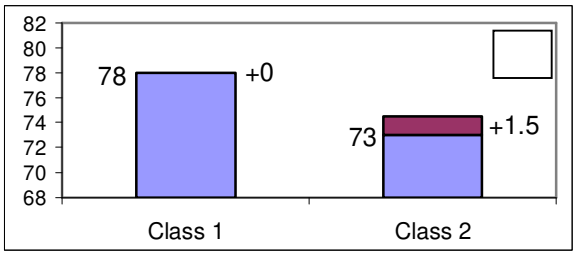
Q.3.1 Follow-up of those who choose A in the first question of the main questionnaire (*everybody gets something*).

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

PROGRAMME A	**PROGRAMME B**
	
	
	
	

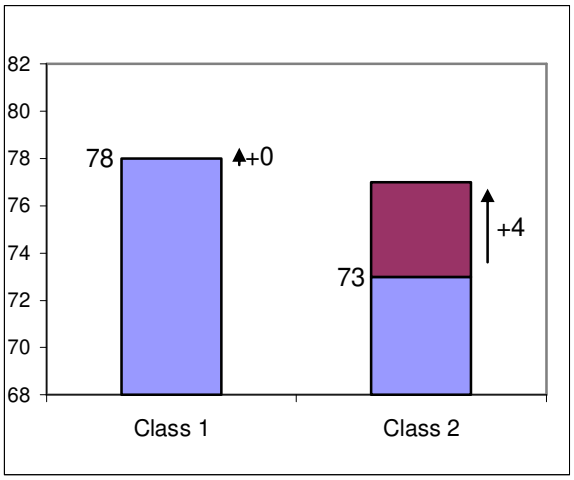
Q.4.1 Follow-up of those who choose B in the 1st question of main questionnaire (*main titration*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

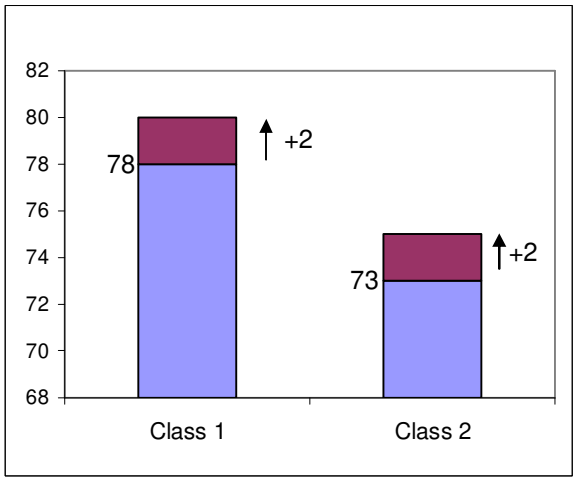
PROGRAMME A	**PROGRAMME B**
	
	
	
	

Q.5.1 First page of the main questionnaire (flipped alignment)

PROGRAMME A



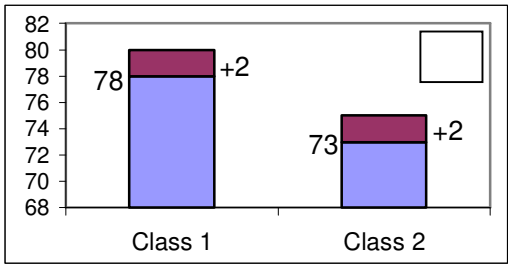
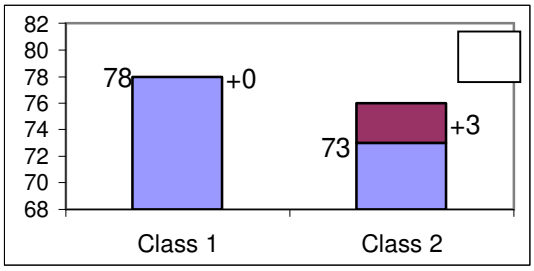
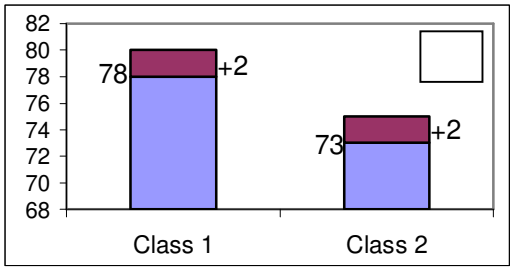
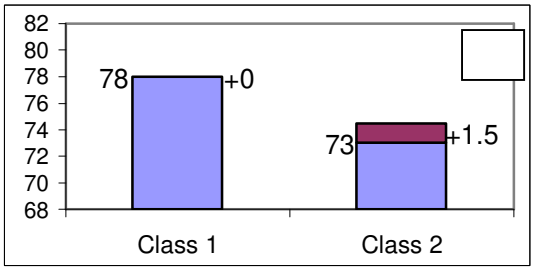
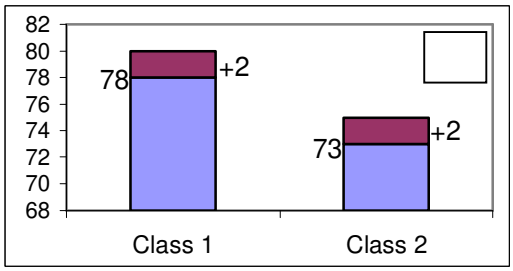
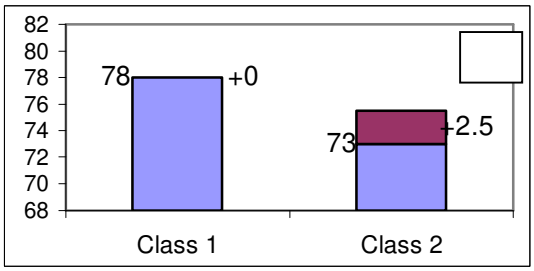
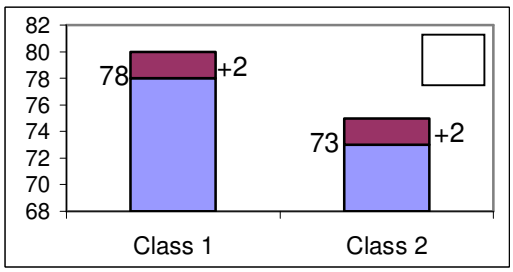
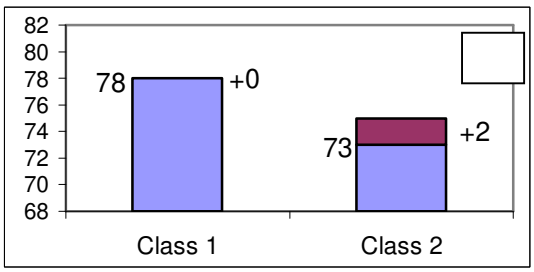
PROGRAMME B



I prefer A ☐ **A and B are equally good** ☐ **I prefer B** ☐

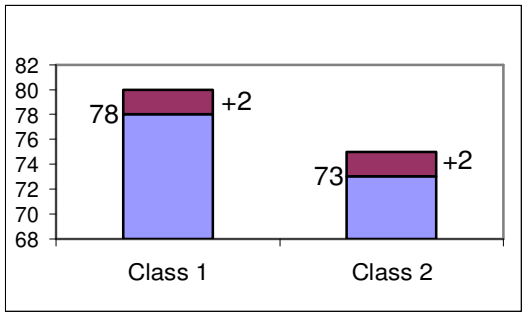
Q.1.2. Follow-up of those who choose B in the main questionnaire (*main random*)

Please tick in the corresponding box whether you prefer programme A or B in each of the following options:

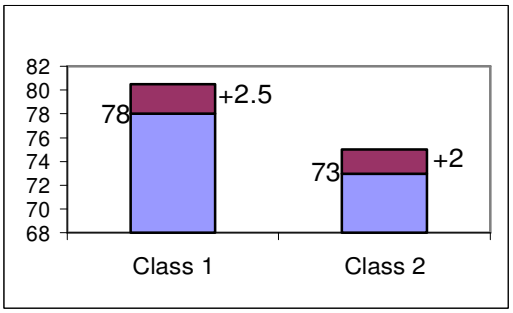
PROGRAMME A	PROGRAMME B
	
	
	
	

Q.1.3. Alternative question to test for monotonicity (*alternative monotonicity*)

PROGRAMME A



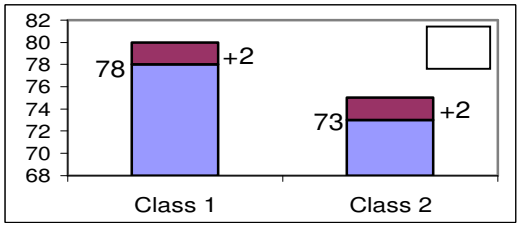
PROGRAMME B

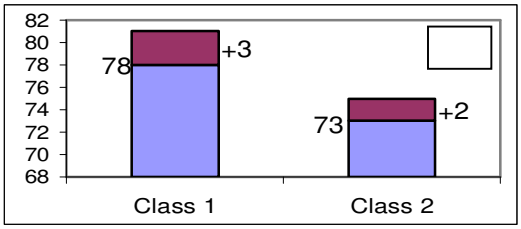


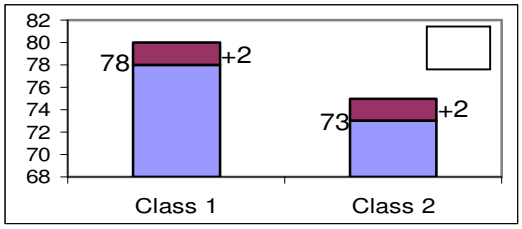
I prefer A ☐ **A and B are equally good** ☐ **I prefer B** ☐

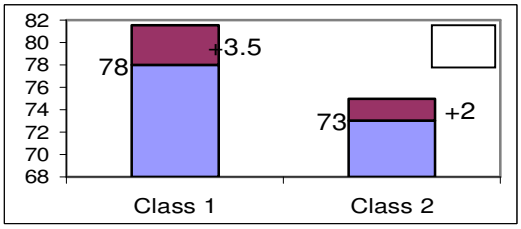
Now, please tick in the corresponding box whether you prefer programme A or B in each of the following options:

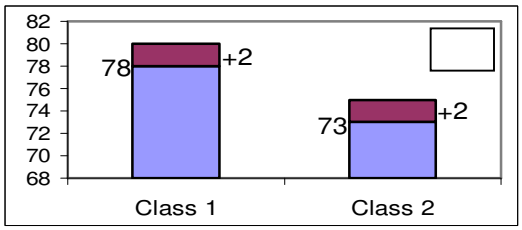
PROGRAMME A **PROGRAMME B**

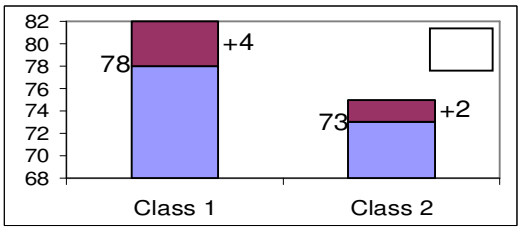


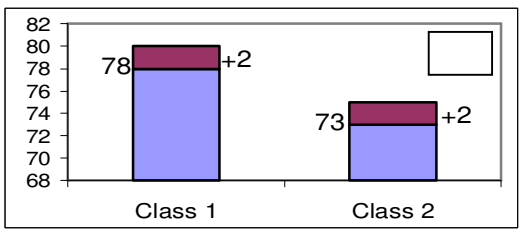


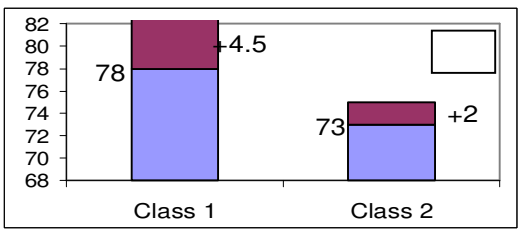






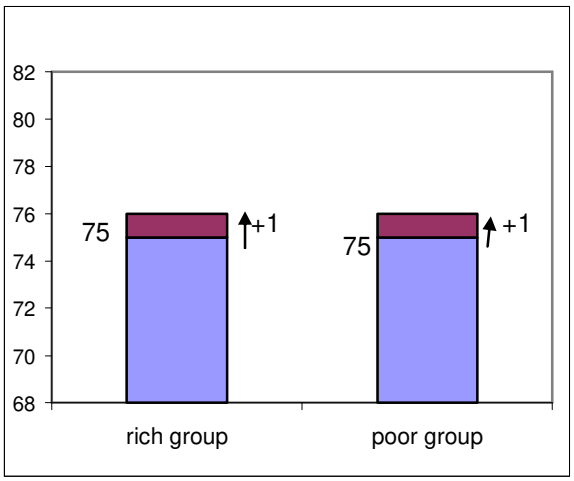




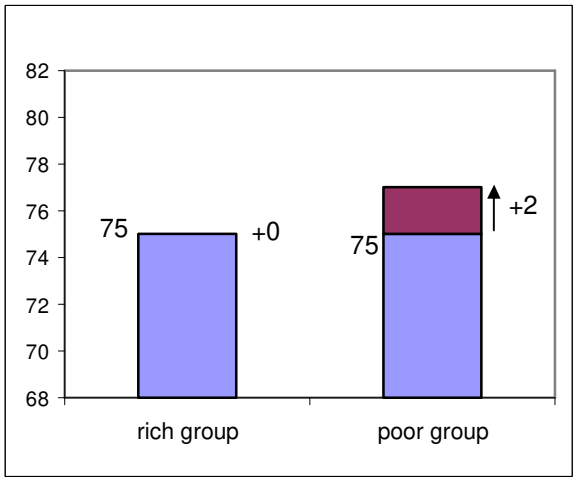


Q.2.3. Question to test for symmetry of preferences (*symmetry*).

PROGRAMME A

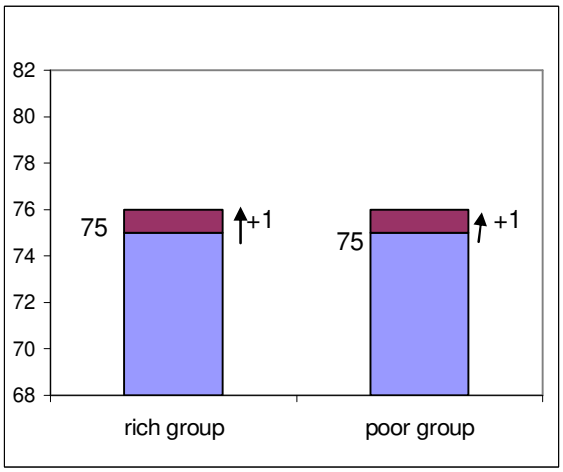


PROGRAMME B

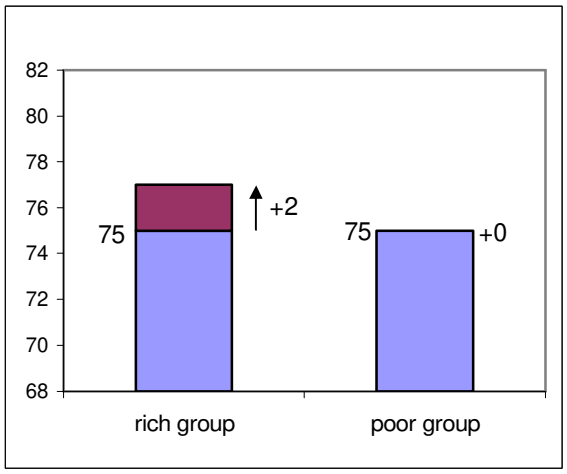


I prefer A ☐ **A and B are equally good** ☐ **I prefer B** ☐

PROGRAMME A



PROGRAMME B



I prefer A ☐ **A and B are equally good** ☐ **I prefer B** ☐