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Is the Person Trade-Off a Valid Method for Allocating Health Care Resources? Some Caveats*

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Abstract

The Person Trade-Off (PTO) is a methodology aimed at measuring the social value of health states. The rest of methodologies would measure individual utility and would be less appropriate for taking resource allocation decisions. However few studies have been conducted to test the validity of the method. We present a pilot study with this objective. The study is based on the result of interviews to 30 undergraduate students in Economics. We judge the validity of PTO answers by their adequacy to three hypothesis of rationality. First, we show that, given certain rationality assumptions, PTO answers should be predicted from answers to Standard Gamble questions. This first hypothesis is not verified. The second hypothesis is that PTO answers should not vary with different frames of equivalent PTO questions. This second hypothesis is also not verified. Our third hypothesis is that PTO values should predict social preferences for allocating resources between patients. This hypothesis is verified. The evidence on the validity of the method is then conflicting.
1. Introduction

One of the most worrying events in the short history of Cost-Utility Analysis was its apparent failure the first time it was used for establishing priorities in the health sector in a large scale experiment: the Oregon experience. There have been several explanations for this failure. One of the reasons suggested was that the numbers used as values of the health states did not have the meaning that researchers thought they had. In the Quality of Well Being Scale (QWB) the numbers associated with each health state were used to compare the values of curing people with different health problems. On the basis of these numbers trade-offs between patients were done and, apparently, health states were assigned values that implied too low equivalence numbers for trivial treatments in comparison with treatments for severe conditions (1).

To solve the problem of the possible lack of meaning of the numbers, the Person Trade-Off method has been proposed as an alternative (2,3). Richardson (4) describes this technique as follows: "in this technique respondents are asked a question of the following kind: 'if there are x people in adverse health situation A and y people in adverse health situation B, and if you can only help (cure) one group, which group would you choose?'. One of the numbers x or y can be varied until the subject finds the two groups equivalent in terms of needing or deserving help. The undesirability (disutility) of situation B is x/y times as great as that of situation A". The main defence of the method is based on the distinction between the use of quality of life valuations for individual and for social decisions. Following this distinction, the methods most commonly used to obtain the value of a health state (the Visual Analogue Scale, the Standard Gamble and the Time Trade-Off) would give us the value that an improvement in his/her health would have for the individual whose preferences have been measured using any of these methods. However the social value of that improvement is a different question. To measure the social value of a health improvement, we need to also include equity considerations that are absent from the methodologies which obtain the individual utility.

It is argued that when somebody does a Person Trade-Off judgement, he/she considers efficiency and equity at the same time. An example used by Nord (5) will help to clarify this important issue: "consider three states A, B and C, that score 0.3, 0.5, and 0.9, respectively, on a health status index. In terms of QALYs an improvement from B to C would carry greater value than an improvement from A to B (0.4 vs. 0.2), but as noted above, on the ground that severity is an argument in
itself, people may very well consider it more important to help a person progress from state A to state B than help another person progress from state B to state C. It is argued that people prefer to give a certain amount of QALYs to somebody who is very ill than to somebody who is not so ill. In summary, society values both the increase in the health state (efficiency) and the severity of the initial state (equity) so "society may want to direct resources preferentially to those who are farthest from good health, even if larger aggregate benefits could be obtained under a different distribution" (6). Measures of individual utility would pick up only the first effect (efficiency); while the PTO would pick up both effects (efficiency and equity). The PTO would then have higher theoretical validity than the other methodologies, if the purpose of health status measurement is to allocate social resources.

PTO would also have the advantage of asking the right question, that is it would have higher face validity. If the values of the health states were used to make trade-offs between people, the best thing to do would be to ask that question directly. This is the so called "reflecting equilibrium" test: that is, it is explained to people how the numbers they have given are going to be used. They have to agree with researchers interpretation of those numbers and with the decisions that will be taken using those numbers.

The problem is: is it enough to ask the right question to obtain the right answer? There is a very good example that shows that asking the right question sometimes is not enough: the Willingness to Pay/Willingness to Accept disparity. Both have face validity, both ask theoretically equivalent questions; yet the obtained results differ significantly.

So asking the right question is not enough in all contexts. We have to be very cautious with PTO answers given the extensive literature showing that preference elicitation methods can be subject to important biases (7, 8, 9). These problems are particularly important when we try to elicit preferences for questions that are very unfamiliar to ordinary people (10). So before accepting the numbers coming from PTO questions, we should use some consistency checks to be sure that the numbers really reflect people's preferences. This is the objective of our study.

1. OBJECTIVE AND DESIGN OF THE STUDY

With the objective of trying to better understand and validate the PTO answers we interviewed 30 undergraduate economics students. Mean duration of the interview was an hour and a half. Questions were done using four EuroQol health
states (see appendix). The students were paid 2,000 pesetas ($16) for their collaboration. All of them had previously attended a lecture on health status valuation.

We tried to apply three consistency checks to PTO answers:

1. CONSISTENCY CHECK 1: RELATION BETWEEN INDIVIDUAL AND SOCIAL UTILITIES.

The social value of a health improvement has to be related to the private perception of the value of that improvement. PTO answers should then be related to individual preferences. If somebody thinks that illness A is worse than illness B, he/she should prefer to see a treatment for curing illness A prioritised over a treatment for curing illness B. There has to be a link between individual utilities (measured, for example, with SG) and social utilities (measured with PTO).

In order to study how individual (SG) utilities could be related to social (PTO) values we developed a three step procedure that linked both kind of questions. We show the questions that were asked in each of the three steps and the hypothesis underlying each one of them.

1. STANDARD GAMBLE-1. Imagine that you are going to be in health state A for the rest of your life. You can have an operation that may cure you completely but carries some risk of death. What is the minimum probability of success that would make you indifferent between the operation and the chronic state?

Sub-hypothesis-1: if the individual is a Expected Utility maximizer, the minimum probability of complete recovery is the EU of A. Let's call it p*.

P* is the probability that makes both situations equally desirable for me. Then we can say that U (A) = p*. This is shown in Figure 1.

FIGURE 1 ABOUT HERE

2. STANDARD GAMBLE-2. Imagine that you are a doctor and you have two patients S and T. You can treat only one of them.

S is in health state A. If you give him/her medication it is certain that he/she will recover. If you don't treat him/her he/she will be in that situation for the rest of his/her life.
T has an illness that you think he/she can overcome in a short amount of time without giving him/her medication. However, if you don’t give him/her medication there is a probability that he/she will die. If you give him/her medication it is certain that he/she will recover.

Imagine that you can treat only one (S or T). What is the probability for individual T of recovering without medication that would make you indifferent between treating S or T? This situation is shown in Figure 2.

FIGURE 2 ABOUT HERE

As table 1 shows the situation of S and T will be equivalent if \( U(A) = p \cdot 1 + (1-p) \cdot 0 = p \). We know from SG-1 that the individual considers \( U(A) = p^* \) and so he/she should reply \( p^* \) in this second question.

TABLE 1 ABOUT HERE

Sub-hypothesis-2: if an individual considers that \( U(A) = p^* \), he/she is indifferent between treating a patient like S or a patient like T when T faces a risk of death of \( (1-p^*) \).

3. STANDARD GAMBLE-3. Imagine that you are now a social planner and you have two different groups of patients. You have to decide which group will be treated.

You have 1000 S. They are in health state A. If you give them medication it is certain that they will recover. If you don’t treat them they will be in that situation for the rest of their lives (health state A for the rest of their lives).

You have also 1000 T. They have an illness that you think they can overcome in a short amount of time without giving them medication. However, if you don’t give them medication there is a probability that they will die. If you give them medication it is sure that they will recover.

What is the probability of T-type individuals of recovering without medication which would make you indifferent between treating 1000 S or 1000 T?.

Although the framing of the question is quite similar to SG-2, we made the interviewees consider that when dealing with groups probabilities will become certainties. That is, we told the subjects that if they had accepted an individual
risk of death for each patient of 1/1000 in SG-2 after taking the decision 1000 times they would have 1 patient dead at the end of the period. The SG-3 can then be interpreted as a PTO question framed in an alternative way. Usually the subjects are given a certain number of lives that are at risk and they have to give the number of people whose health state could be improved in order to make them indifferent between the two policies. In our SG-PTO question they were given a fixed number of people (1,000) whose health state could be improved with a given budget and they had to state the maximum number of fatalities that they would accept in order to improve the health state of those people.

Sub-hypothesis-3: If an individual is indifferent between treating a patient like $S$ or a patient like $T$ when $T$ faces a risk of death of $(1-p^*)$, he/she is indifferent between treating 1000 $S$ or 1000 $T$. He/she then accepts $(1-p^*) \times 1000$ deaths in order to return to perfect health 1000 patients like $S$. This situation is shown in figure 3.

![Figure 3](image)

**FIGURE 3 ABOUT HERE**

We will use a numerical example to illustrate our three sub-hypothesis. Using SG-1 we know that somebody is indifferent between facing a risk of death of 10% and living in health state $A$ for the rest of his/her life. Our sub-hypothesis-1 says that $U(A)=0.9$. If this is so, our sub-hypothesis-2 says the individual should be indifferent between returning to perfect health somebody who would be in $A$ for the rest of his/her life or returning to perfect health somebody who is facing a risk of death of 10%. Our individual should then answer 90% to our SG-2. The individual should then be indifferent between returning to perfect health 1000 people who will be in $A$ if they don't receive treatment or returning to perfect health 1000 people who are facing a risk of death of 10%. This means, and this is our sub-hypothesis-3, that the individual should accept the death of 100 people in order to return to perfect health 1,000 people who would be in $A$ for the rest of their lives if they were not treated. That is, the damage caused by the death of 1 person is just compensated by the benefit of returning to perfect health 10 people in $A$.

If we then link the three sub-hypotheses we can establish the next hypothesis:

**H1:** if somebody considers that $U(A)=p^*$ he/she is indifferent between returning to perfect health "$n$" people who are in a chronic health state $A$ or returning to perfect health somebody who is about to die. This "$n$" is calculated as $n= 1/(1-p^*)$. 
between curing 1A and curing 10B. We can then say that 1 life is equivalent to 100B. That would imply that \(U(A)=0.9\) and \(U(B)=0.99\)

H2: PTO answers are the same using PTO-1, PTO-2 and PTO-3.

3. CONSISTENCY CHECK 3: PREDICTIVE VALIDITY

PTO is a methodology addressed to measuring the values of health states. It will be used to prioritise treatments/patients. The values of the health states will have to reflect how society wants priorities to be established. In order to check this hypothesis we did the following exercise. We obtained the values of the health states using the PTO. We also asked subjects to order these four health states (say A, B, C and D) from the best to the worst (imagine A is the best and D is the worst). We then asked them the next question: imagine there are five people with health problems. One is about to die, another is in health state D, another in C, another in B and another in A. If you give treatment to one of them he/she will pass to the next best health state: the one who is about to die will be in D for the rest of his/her life, the one who is in D will be in C, the one who is in C will be in B, the one who is in B will be in A and the one who is in A will be in perfect health. If you could only treat one of them, who would be the first, the second, etc.? We can illustrate this question with table 2:

TABLE 2 ABOUT HERE

In figure 2 these improvements are represented by the arrows on the left (a, b, c and d).

What we did was to ask them to directly compare the value of the intervals. We then compared those answers with the priorities that would have been produced using the PTO (we also included VAS and SG in the comparisons).

The predictive validity will be tested at the individual and at the aggregate level. We will measure the degree of agreement between the expected ordering and the ordering directly obtained at the individual level. This degree of agreement is measured using Kendall's \(\tau\). This is a statistic that measures the degree of association between two orderings. It oscillates between 1 (maximum agreement) and -1 (maximum disorder) and it takes the 0 value when the two orderings are independent.

At the aggregate level we will compare the ranking of the intervals directly obtained and the ranking implicit in the valuations performed by our individuals. We
will interpret the ranking performed by the individuals as a voting exercise. Ranking one interval over another will be interpreted as a vote in favour of the former. We will then compare the "votes" obtained by the intervals with the final (aggregate level) sizes of the intervals (distances between the values of health states). We will use an example with the help of table 2. Suppose that, in table 2, somebody prioritizes individual 2 (improvement from D to C), then individual 3 (C to B) and then individual 4 (B to A). We will then assume that when having to choose (vote) between 2 and 3 he/she would choose (vote for) 2; between 3 and 4, he/she would vote for 3 and between 2 and 4 he/she would vote for 4. If individual 2 receives more votes than individual 3 the interval from D to C should be larger than the interval from C to B.

This methodology is far from perfect because majority voting does not take into account the intensity of preferences while preference elicitation methods do. For example, imagine that two people value D as 40, C as 70 and B as 90 and another person values D as 40, C as 45 and B as 95. Although the interval from D to C would receive two votes the aggregate values would show the interval between C and B as the largest. In spite of this hypothetical problem we think that this methodology can shed some light on the predictive validity of the different methodologies used.

H3: the order of preference between patients is predicted by the intervals obtained using the PTO.

2. RESULTS

We begin by showing in table 3 the values of the four health states evaluated in the study using VAS, SG-1 and PTO.

TABLE 3 ABOUT HERE

As we can see, the highest values are those obtained using the PTO and the lowest are those obtained using VAS. There is an upper-end compression when we move from VAS to SG and more upper-end compression when we move from SG to PTO.

From Table 3, it can be seen that curing somebody who is in health state 12121 has 150 times less value using PTO than using SG-1. The difference is not small. The question is, are these differences reasonable? We will look at our hypothesis of consistency.
In Table 4 we can see the values of the four health states using the four questions used in our consistency check 1.

**TABLE 4 ABOUT HERE**

As we can see, contrary to our sub-hypothesis 2 there is a clear difference between SG-1 and SG-2 results (there is an upper-end compression). It seems that the reason for the disparity between these values is that subjects applied different values when thinking of other people's welfare than when thinking of their own. By this we mean that, for example, they might prefer to face a risk of death of 10% rather than being in Health State A (HSA) for the rest of their life. We may think this is because they consider the Expected Utility of the operation greater than the Expected Utility of HSA for the rest of their life. Somebody facing a risk of death of 10% would be better off than somebody facing Health State A as a chronic condition. In theory when having to choose whom to treat, he/she who is in HSA should be prioritised. However, when having to choose between people it seems that our participants become more conservative. If for them facing a risk of death of 5% was equivalent to chronic HSA; when having to choose between two people facing those two situations they chose to avoid the risk of death.

There is also a difference between SG-2 and SG-3 results. In theory this shows a lack of consistency in the answers. If they accept a risk of death for others of 5% they should accept the death of 5 people for every 100 cases. But they don't. One may think that the discrepancy is due to the fact that the number of fatalities per 1000 is more concrete than individual probabilities and people understand much better what they are doing in SG-3. The conclusion could then be that their preferences are better reflected in SG-3 results. However, we will try to give an alternative explanation to this problem using the so-called "do-no-harm" heuristic (14). We will show that if the answers are governed by this heuristic we cannot accept SG-3 answers as the more appropriate.

Let's look at the results of our second consistency check. H2 is descriptive invariance. In order to check this hypothesis we will compare the results obtained using PTO-1, PTO-2 (SG-4) and PTO-3. These results are shown in Table 5.

**TABLE 5 ABOUT HERE**

It can be seen that results obtained using PTO-2 are different from the rest leading to higher values for health states. However, results of PTO-1 and PTO-3 are similar.
Our third consistency check was predictive validity: the order of preference between patients has to be predicted by the intervals obtained using the PTO (H3).

We show in Tables 6, 7 and 8 the results of our experiment. In Table 6 we measure the degree of agreement between the expected ordering and the ordering directly obtained at the individual level. That degree of agreement is measured using Kendall's $\tau$.

**TABLE 6 ABOUT HERE**

As we can see the value of $\tau$ for the VAS is close to 0 (independence of the two orderings), which seems to suggest that people used different criteria to answer both questions. If this were confirmed for larger samples, it would mean that VAS values cannot be interpreted as reflecting people's preferences for establishing priorities.

We can also see that SG, PTO-1 and PTO-2 are quite similar in predicting people's preferences. Using this finding the three methods would be equivalent. Of course, this is so at the ordinal level. What we cannot say using this methodology is what size of intervals better reflects people's preferences.

We can approach that question using Tables 7 and 8. In Table 7 we have the sizes of the intervals. In Table 8 we have the number of hypothetical votes that each interval received when compared with each of the rest. We can clearly see that the treatment that always received more votes was the one that allowed people to avoid death, even though the final health state was not good. The second interval that received more votes was the improvement from 32331 to 23232. That is, that interval received more votes than the rest when compared in pairs with the others, except when compared with the interval death-32331. The next most preferred interval was the improvement from 23232 to 21312. The next was the interval 21312-12121. The least preferred was the interval 12121-Perfect Health. It seems that the order of preference is inversely related to the severity of the initial health state.

**TABLE 7 ABOUT HERE**

**TABLE 8 ABOUT HERE**
The result of this hypothetical voting exercise would be perfectly explained by the three PTO methodologies. The sizes of the intervals have a perfect correspondence with the result of the voting. Using SG-1 creates a problem with intervals 23232-21312 and 21312-12121. The results of the SG-1 seem to suggest that people prefer the second over the former while the result of the votes is the opposite. Of course there could be a “logical” explanation of the result: maybe the people who voted in favour of the first interval considered it to be small while the people who voted in favour of the second saw it large. We then would have more people voting in favor of the first while the size of the second would be larger. Another explanation would be that, although they saw the first interval smaller than the second, they chose to improve the health of people who were in 23232 due to inequality aversion. That is, they preferred to have two people in 21312 than have one in 23232 and another in 12121, which would have increased inequality. The fact that the SG does not take into account inequality while -in principle- the PTO does, may explain why the SG has the above problem while the PTO doesn’t.

3. DISCUSSION

We said in the introduction that we were going to apply some consistency checks to PTO answers. Some apparently incoherent answers and the problems faced in eliciting preferences for non-familiar issues made us think that it is not enough to ask the right question to obtain the right answer.

In our first consistency check we observed two possible problems. The first (that leads to the discrepancy between SG-1 and SG-2) was that people applied different criteria when the consequences of the decision were going to fall only on themselves or when they were going to influence other’s welfare. It can be shown that using different criteria for measuring other people’s welfare and our own welfare can lead to a reduction in society’s welfare. For example, imagine that everybody in society prefers to face a risk of death of 10 % than be in health state A for the rest of their life. However as members of society they don’t accept more than a 2% risk for others. Imagine that society has to prioritise between two treatments: one cures the illness but has a mortality rate of 5% and the other avoids the patient being in A for the rest of his/her life. Although everybody considers A worse than the 5% illness, they would vote in favour of prioritising the other option. That would lead to a decrease in social welfare. A possible way out of this problem could be to choose for oneself behind the veil of ignorance.

The second problem -which leads to the discrepancy between SG-2 and SG-3 - is the refusal of people to accept a number of fatalities they had implicitly accepted in SG-2. People are not ready to accept more than a specific number of
fatalities for curing people in a severe condition. In our opinion, this shows that PTO questions can give rise to strong emotions (particularly with life saving programs) in the respondents, making the task of giving reasonable answers a very difficult one. People find it very difficult to accept that somebody has to die to improve the health of others. In our view, a problem of the PTO is that these trade-offs are made under conditions of certainty: people find it very difficult to accept that if they take a certain decision it is certain that somebody will die. In order to accept that somebody will die as a consequence of their decision, subjects will give large equivalent numbers.

The so called "do-no harm principle" (14) also explains this behavior. One moral principle is that it is wrong to harm some people in order to help others, even when the benefits outweigh the harm. However, as Baron (14) shows, "it leads to undesirable results when it is not pitted against an equivalent rule against causing harm through omission". Whereas in SG-2 they try to establish a reasonable rule to decide between two patients, in SG-3 they realize that the rule they have established may harm some people in order to help others and so they try to minimize the harm that they are "causing" with their rule. As the more prominent harm is the number of fatalities, they try to minimize that harm and so forget they are causing harm by omission because they are not treating the others who will remain in the chronic condition. In one case they are doing harm by an action and in the other by an omission and, as Baron and Ritov (15) show, there is an asymmetry between action and omission in the case of bad outcomes: people may prefer bad outcomes if they are caused by omission to less bad outcomes caused by positive actions.

In summary, as we have seen, in our example, the origin of the discrepancy between SG-1 and SG-3 results (producing the upper-end compression) may also be explained by other elements and the effect of equity is not the only explanation of the upper-end compression. We are not saying say that equity has no effect on any PTO exercise. We believe it has. What we say is that in our example we found other factors influencing those answers. In our case those elements were:

1. Using different criteria to evaluate own and others' welfare.
2. Unwillingness to make trade-offs in terms of number of fatalities.

The question is, what is the normative validity of these two elements? Is it reasonable to accept the values obtained using SG-3?

Let's look at our second consistency check. In Table 4 we can see that there is no apparent discrepancy between PTO-1 and PTO-3 and there is a clear
discrepancy between PTO-2 (SG-3) and the rest. It is quite clear that the framing of the question influences the results. To ask in terms of admissible fatalities for every 1,000 people cured leads to different PTO values from asking in terms of the number of people cured equivalent to saving 10 lives, although in both cases we are trading off lives against people cured. This finding is hardly a surprise because it is quite consistent with all the literature that has flourished after prospect theory: preferences change when questions are framed as gains or as losses (16, 12). In PTO-1 and PTO-3 the questions focus on gains (number of people cured) whereas in PTO-2 the focus is on losses (number of fatalities). What our results show is that the values we obtain using PTO may be manipulated when using a different framework.

It can be argued that to avoid manipulation we could standardise the methodology and accept only values obtained using one method. The question is, which method best reflects people's preferences? Our consistency check 3 allowed us to suggest an answer.

The results of our consistency check 3 showed that:

1. The values of the VAS keep little relation with the values used when doing the prioritisation exercise.
2. PTO-1, PTO-2 and SG-1 have the same predictive validity.
3. PTO-3 has the best predictive validity.

The method that apparently best reflects preferences for establishing priorities is PTO-3. What could be the reason for the superiority of PTO-3 over the rest? It seems that we have to attribute its -apparent- superiority to the only feature that clearly differentiates the method from the rest: it makes people directly compare the intervals. It seems reasonable to expect that the more distant the objects we have to compare the more difficult the matching exercise. We think that this result may be quite important for the PTO method for two reasons:

i) although we have shown that different framings may lead to different numbers, this test shows that PTO-3 is better than the others.

ii) People may find it easier to accept, from an ethical point of view, making these trade-offs between people when the health states they have to compare are not too different. In our subjects we perceived a better attitude towards PTO judgements with PTO-3 than with PTO-1 and PTO-2. This was particularly important for mild health states. For example, when they were asked how many people in health state 12121 had to be cured in order to produce the same benefit as saving 10 lives, 35% of the sample gave an answer like "I don't know, it had to
be a lot, say a million people". This answer just reflects the difficulty of making the judgement. With PTO-3 we just had this problem in a couple of subjects. However people seem to accept very well the trade-off between lives and the complete recovery of people who were in health state 32331. As health state 32331 is quite severe they were much less reluctant to accept that a trade-off had to be done. The reason is that they realized that the benefit gained by accepting the death of somebody would also be very important. So if we want to know how many headaches are equivalent to saving one life we better not ask that question directly because people will probably not be able to give reasonable answers.

One conclusion of all this is that in order to choose a method that reflects people's preferences, we would have to take into account how well the method adapts to subjects' possibilities of processing information and giving answers to our questions. "If subjects cannot use the response mode most convenient to investigators, then investigators must find a response mode that works for subjects" (17).

The difficulty that people have in expressing their preferences for very mild health states may also explain that the discrepancy between the intervals obtained using the SG and the PTO is larger for mild health states than for more severe health states. While in the PTO they are able to give quite high equivalence numbers for mild health states they cannot do the same with the SG. The reason is that ordinary people (like us) find it very difficult to distinguish between a risk of 1/1000 and a risk of 1/10000. At least in our study almost everybody was willing to accept a risk of 1/500 to avoid the less severe health state and the comment that most of the people made was "I would be really unlucky if this was me" or "1 in 500 is almost nothing", that is they tended to interpret 1 in 500 as almost 0. Maybe for them 1 in 500, 1 in 1,000 or 1 in 5,000 were all almost the same: all of them could be interpreted as "almost 0". As Kahneman and Tversky (16) say "the simplification of prospects in the editing phase can lead the individual to discard events of extremely low probability... Because people are limited in their ability to comprehend and evaluate extreme probabilities, highly unlikely events are either ignored or overweighted".

Maybe the difference between the intervals obtained using the PTO and the SG cannot be only attributed to "equity concerns" (not included in the SG) but also to psychological factors related to how people perceive probabilities.

From the results we have obtained we may draw some tentative conclusions:
1. There may be other factors, apart from equity, that explain why PTO values are different from VAS and SG values. We have mentioned:

   i) people use different criteria to evaluate own and others welfare. It seems that for others they are more conservative,
   ii) people are very reluctant to take a decision that may do some harm, especially if this harm is the death of somebody.

2. Changes in the framing of the questions can influence the values obtained.

3. Some ways of asking questions may be more feasible than others. We have shown that the more similar the two health states we have to compare, the more reasonable the PTO judgements seem to be. If we want to use the PTO we believe that PTO-3 is the best alternative, especially for mild health states.
REFERENCES


Figure 1. Standard Gamble-1

Myself in Situation 1

Myself in Situation 2

Healthy

p*

Health State A chronic

1-p*

Dead

Figure 2. Standard Gamble-2

Somebody else (S) in situation 1

Somebody else (T) in situation 2

Healthy

p

Health State A chronic

1-p

Dead

Figure 3. Standard Gamble-3

1000 people (S) in Situation 1

1000 people (T) in situation 2

Healthy

p*

Health State A chronic

1-p*

Dead
Figure 4. Different improvements compared

Health State

Perfect Health

1 2 3 4

a
b

A

A

B

B

C

C

Death

d

Table 1. Comparing the situation of S and T

<table>
<thead>
<tr>
<th>Individual</th>
<th>Options</th>
<th>Consequence</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Treatment</td>
<td>Perfect Health</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No treatment</td>
<td>A chronic</td>
<td>U(A)</td>
</tr>
<tr>
<td>T</td>
<td>Treatment</td>
<td>Perfect Health</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No treatment</td>
<td>Perfect Health with some probability p</td>
<td>p x 1 + (1-p) x 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Death with complementary probability (1-p)</td>
<td></td>
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Table 2. Examples of health improvements.

<table>
<thead>
<tr>
<th>Health State</th>
<th>Health State before treatment</th>
<th>Health State after treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual 1</td>
<td>About to die</td>
<td>D</td>
</tr>
<tr>
<td>Individual 2</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>Individual 3</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Individual 4</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Individual 5</td>
<td>A</td>
<td>Perfect Health</td>
</tr>
</tbody>
</table>
Table 3. Values of the health states using different preference elicitation methods.

<table>
<thead>
<tr>
<th></th>
<th>VAS Mean (SD)</th>
<th>Median (IQR)</th>
<th>SG-1 Mean (SD)</th>
<th>Median (IQR)</th>
<th>PTO Mean (SD)</th>
<th>Median (IQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12121</td>
<td>75 (13)</td>
<td>80 (65-85)</td>
<td>95 (7)</td>
<td>97 (92-99,5)</td>
<td>98,5 (4,5)</td>
<td>99,98 (99-99,999)</td>
</tr>
<tr>
<td>21312</td>
<td>52 (12)</td>
<td>50 (40-60)</td>
<td>81 (16)</td>
<td>86 (70-95)</td>
<td>95 (7,2)</td>
<td>98 (90-99,5)</td>
</tr>
<tr>
<td>23232</td>
<td>29 (11)</td>
<td>30 (20-36)</td>
<td>71 (21)</td>
<td>75 (50-90)</td>
<td>84 (21)</td>
<td>88,5 (80-95)</td>
</tr>
<tr>
<td>32331</td>
<td>16 (8,3)</td>
<td>17,5 (10-20)</td>
<td>44 (28)</td>
<td>40 (20-70)</td>
<td>59 (35)</td>
<td>70 (33-86)</td>
</tr>
</tbody>
</table>

Table 4. Value of the health states using the three step procedure.

<table>
<thead>
<tr>
<th></th>
<th>SG-1 Mean (SD)</th>
<th>SG-2 Mean (SD)</th>
<th>SG-3 Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12121</td>
<td>95 (7)</td>
<td>98 (5)</td>
<td>99 (2)</td>
</tr>
<tr>
<td>21312</td>
<td>81 (16)</td>
<td>91 (12)</td>
<td>97 (4)</td>
</tr>
<tr>
<td>23232</td>
<td>71 (21)</td>
<td>80 (19)</td>
<td>91 (13)</td>
</tr>
<tr>
<td>32331</td>
<td>44 (28)</td>
<td>64 (27)</td>
<td>82 (24)</td>
</tr>
</tbody>
</table>

Note: the differences between SG-1 and SG-2 results are not statistically significant (α=5%). The rest of the differences are all of them statistically significant (α=5%) except for the case of health state 12121.
Table 5. Comparison of PTO answers using different descriptions of the question. Numbers are means (standard errors in brackets).

<table>
<thead>
<tr>
<th>EuroQol Health States</th>
<th>PTO-1</th>
<th>PTO-2</th>
<th>PTO-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>12121</td>
<td>98.63 (0.84)</td>
<td>99.20 (0.29)</td>
<td>99.14 (0.58)</td>
</tr>
<tr>
<td>21312</td>
<td>95.11 (1.32)</td>
<td>97.05 (0.69)</td>
<td>93.73 (2.43)</td>
</tr>
<tr>
<td>23232</td>
<td>84.19 (3.82)</td>
<td>90.78 (2.27)</td>
<td>81.26 (4.5)</td>
</tr>
<tr>
<td>32331</td>
<td>59.25 (6.44)</td>
<td>79.65 (6.44)</td>
<td>59.25 (6.44)</td>
</tr>
</tbody>
</table>

Note: there are no statistically significant differences ($\alpha=5\%$) between PTO-1 and PTO-3 answers. Between PTO-1 and PTO-2 all differences are statistically significant except for health state 21313. Between PTO-2 and PTO-3 all differences are statistically significant except for the case of health state 12121.

Table 6. Predictive validity of different preference elicitation methods.

<table>
<thead>
<tr>
<th></th>
<th>VAS</th>
<th>SG</th>
<th>PTO-1</th>
<th>PTO-2</th>
<th>PTO-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau$</td>
<td>-0.06 (0.072)</td>
<td>0.387 (0.067)</td>
<td>0.393 (0.053)</td>
<td>0.34 (0.07)</td>
<td>0.621 (0.077)</td>
</tr>
</tbody>
</table>

Note: the differences between VAS and the other methods are statistically significant ($\alpha=0.001$). The differences between SG, PTO-1 and PTO-2 are not statistically significant. The differences between PTO-3 and the rest are statistically significant ($\alpha=0.01$).

Table 7. Sizes of the intervals

<table>
<thead>
<tr>
<th>States</th>
<th>VAS</th>
<th>SG-1</th>
<th>PTO-1</th>
<th>PTO-2</th>
<th>PTO-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death-32331</td>
<td>16</td>
<td>44</td>
<td>59</td>
<td>79</td>
<td>59</td>
</tr>
<tr>
<td>32331-23232</td>
<td>13</td>
<td>27</td>
<td>25</td>
<td>11</td>
<td>22</td>
</tr>
<tr>
<td>23232-21312</td>
<td>23</td>
<td>10</td>
<td>11</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>21312-12121</td>
<td>23</td>
<td>14</td>
<td>3.5</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>12121-Perfect Health</td>
<td>25</td>
<td>5</td>
<td>1.5</td>
<td>0.8</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Note: calculated from tables 1 and 4
Table 8. Number of votes for each interval

<table>
<thead>
<tr>
<th></th>
<th>Death-32331</th>
<th>32331-23232</th>
<th>23232-21312</th>
<th>21312-12121</th>
<th>12121-Perfect Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death-32331</td>
<td>-</td>
<td>18</td>
<td>18</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>32331-23232</td>
<td>10</td>
<td>-</td>
<td>16</td>
<td>22</td>
<td>25</td>
</tr>
<tr>
<td>23232-21312</td>
<td>10</td>
<td>12</td>
<td>-</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>21312-12121</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>12121-Perfect Health</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: the number of favourable votes that each interval received when compared with the interval in the column is shown in rows.
APPENDIX: EUROQOL HEALTH STATES USED IN THE STUDY

12121
No problems with walking about
Some problems washing or dressing self
No problems with performing usual activities (e.g. work, study, housework, family or leisure activities
Moderate pain or discomfort
Not anxious or depressed

21312
Some problems with walking about
No problems with self-care
Unable to perform usual activities
No pain or discomfort
Moderately anxious or depressed

23232
Some problems with walking about
Unable to wash or dress self
Some problems with performing usual activities
Extreme pain or discomfort
Moderately anxious or depressed

32331
Confined to bed
Some problems washing or dressing self
Unable to perform usual activities
Extreme pain or discomfort
Not anxious or depressed
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   Communication, Commitment and Growth. (June 1991) [Published in Journal of Economic Theory Vol. 58, no. 2, (December 1992)]

2. Antoni Bosch
   Economies of Scale, Location, Age and Sex Discrimination in Household Demand. (June 1991) [Published in European Economic Review 35, (1991) 1589-1595]

3. Albert Satorra

4. Javier Andrés and Jaume Garcia
   Wage Determination in the Spanish Industry. (June 1991) [Published as “Factores determinantes de los salarios: evidencia para la industria española” in J.J. Dolado et al. (eds.) La industria y el comportamiento de las empresas españolas (Ensayos en homenaje a Gonzalo Mateo), Chapter 6, pp. 171-196, Alianza Economia]

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6. Albert Marcet

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13. Daniel Serra and Charles ReVelle

14. Juan Pablo Nicolini

15. Albert Marcet and Thomas J. Sargent
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25. Ramon Marimon and Shyam Sunder  
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53. Ángel López  

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