Economics Working Paper 140

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

José Luis Pinto†
Universitat Pompeu Fabra

October 1995

Keywords: QALYs, Person Trade-Off, health status measurement.

Journal of Economic Literature classification: C93, H51, I18.

* I gratefully acknowledge financial support from Fondo de Investigaciones Sanitarias grant number 95/0767. I thank Han Bleichrodt, Erik Nord, Alan Williams and Xavier Badía for their helpful comments. The usual disclaimer applies.

† Department of Economics, Pompeu Fabra University, Balmes 132, 08008 Barcelona, Spain. E–mail: pinto@upf.es

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 <u>situations</u> equally desirable <u>for me</u>. 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 x 1 + (1-p) x 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*) x 1000 deaths in order to return to perfect health 1000 patients like **S**. This situation is shown in figure 3.

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 τ. 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 interpret 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 appropiate.

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 τ.

TABLE 6 ABOUT HERE

As we can see the value of τ 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 prioritization 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 justs 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

1. Eddy, D.M. Oregons's Methods: Did cost-effectiveness analysis fail?, *Journal of the American Medical Association* 1991; **266**: 2135-2141.

2. Nord, E. The trade-off between severity of illness and treatment effect in cost-value analysis of health care, *Health Policy* 1993; **24**: 227-238.

3. Nord, E., Richardson, J. & Macarounas, K. Social evaluation of health care versus personal evaluation of health states", *International Journal of Technology Assessment in Health Care* 1993; **9**(4): 463-478.

4. Richarson, J. Cost Utility Analysis: What should be measured?, *Social Science and Medicine* 1994; **39** (1): 7-21.

5. Nord, E. An alternative to QALYs: the saved young equivalent (SAVE), *British Medical Journal* 1992; **305**: 875-877.

6. Cohen, B. Utility measurement and the allocation of health care resources, *Medical Decision Making* 1995; **15**: 287-288.

7. Kahneman, D., Slovic, P. & Tversky, A. *Judgement under uncertainty: Heuristics and biases.*. Cambridge U.P, 1982.

8. McCord, M. and Neufville, R. Lottery equivalents: Reduction of the certainty effect problem in utility assessment", *Management Science* 1986; **32** (1): 56-60.

9. Hershey, J., Kunreuther, H., and Schoemaker, P. Sources of bias in assessment procedures for utility functions. In Bell, D., Raiffa, H. & Tversky, A. editors. *Decision Making.* Cambridge U.P, 1991: 422-442.

10. Fischhoff, B. Value elicitation: is there anything in there?, *American Psychologist* 1991, **46**: 835-847.

11. Payne, J., Bettman, J. & Johnson, E. *The adaptive decision maker.* Cambridge U.P, 1993.

12. Tversky,A. & Kahneman, D. Loss aversion in riskless choice: A reference dependent model, *Quarterly Journal of Economics* 1991; **106**:1039-1062.

13. Ubel, P., Scanlon, D., Loewenstein, G. and kamlet, M. Individual utilities and social priorities: a partial explanation of why Oregon´s cost-effectiveness list failed, *Medical Decision Making*, (in press).

14. Baron, J. Blind Justice: fairness to groups and the do-no harm principle", *Journal of Behavioral Decision Making* 1995; 8: 71-83.

15. Baron, J. and Ritov, I. Reference points and omission bias. *Organizational Behavior and Human Decision Processes* 1994, 59: 475-498.

16. Kahneman, D. & Tversky, A. Prospect theory: An analysis of decision making under uncertainty", *Econometrica* 1979, 47: 263-291.

17. Fischhoff, B., Quadrel, M., Kamlet, M., Loewenstein, G., Dawes, R., Fishbeck, P., Keppler, Leland, J. and Stroh, P. Embedding effects: Stimulus representation and response mode, *Journal of Risk and Uncertainty* 1993, 6: 211-234.

Figure 1. Standard Gamble-1

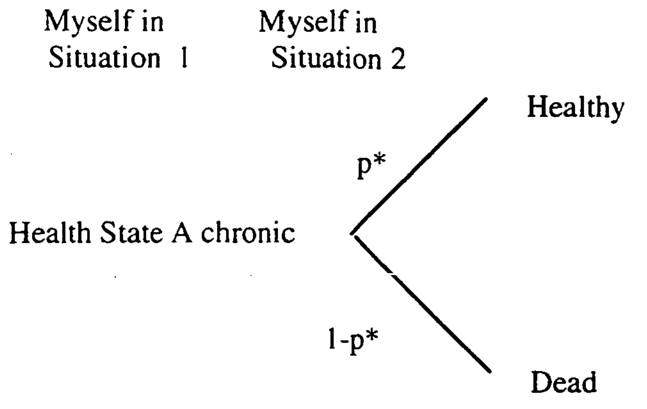

Figure 2. Standard Gamble-2

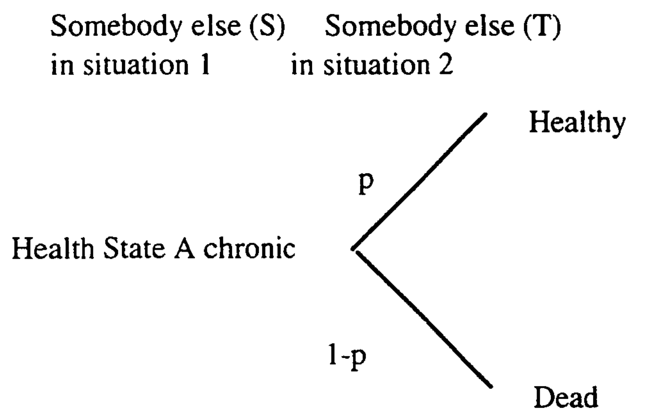

Figure 3. Standard Gamble-3

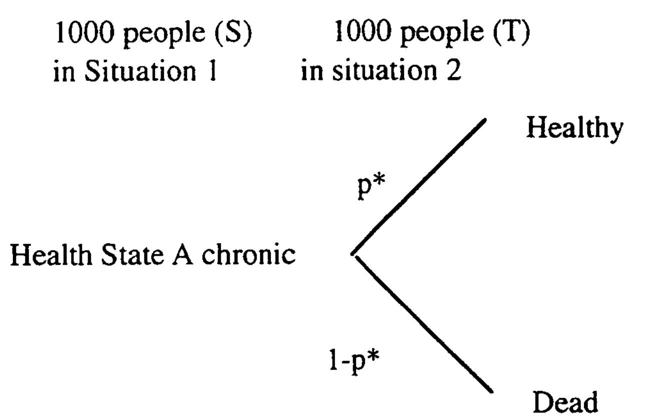

Figure 4. Different improvements compared

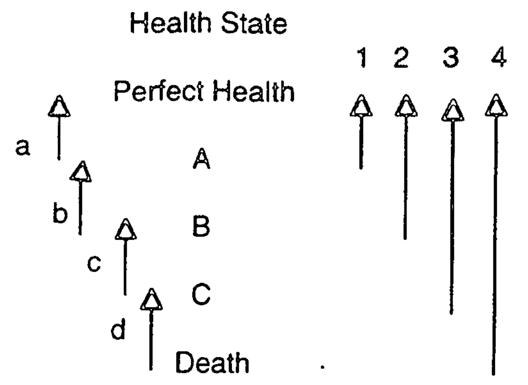

Table 1. Comparing the situation of S and T

Individual	Options	Consequence	Utility
S	Treatment	Perfect Health	1
	No treatment	A chronic	U(A)
T	Treatment	Perfect Health	1
	No treatment	Perfect Health with some probability p Death with complementary probability (1-p)	p x 1 + (1-p) x 0

Table 2. Examples of health improvements.

	Health State before treatment	Health State after treatment
Individual 1	About to die	D
Individual 2	D	C
Individual 3	C	B
Individual 4	B	A
Individual 5	A	Perfect Health

Table 3. Values of the health states using different preference elicitation methods.

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

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

	SG-1	SG-2	SG-3
	Mean (SD)	Mean (SD)	Mean (SD)
12121	95 (7)	98 (5)	99 (2)
21312	81 (16)	91 (12)	97 (4)
23232	71 (21)	80 (19)	91 (13)
32331	44 (28)	64 (27)	82 (24)

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).

EuroQol Health States	PTO-1	PTO-2	PTO-3
12121	98.63 (0.84)	99.20 (0.29)	99.14 (0.58)
21312	95.11 (1.32)	97.05 (0.69)	93.73 (2.43)
23232	84.19 (3.82)	90.78 (2.27)	81.26 (4.5)
32331	59.25 (6.44)	79.65 (6.44)	59.25 (6.44)

Note: there are no statistically significant differences (α= 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.

	VAS	SG	PTO-1	PTO-2	PTO-3
τ	-0,06 (0.072)	0,387 (0.067)	0,393 (0.053)	0,34 (0.07)	0,621 (0.077)

Note: the differences between VAS and the other methods are statistically significant (α= 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 (α=0.01)

Table 7. Sizes of the intervals

	VAS	SG-1	PTO-1	PTO-2	PTO-3
Death-32331	16	44	59	79	59
32331-23232	13	27	25	11	22
23232-21312	23	10	11	7	8
21312-12121	23	14	3.5	2	6
12121-Perfect Health	25	5	1.5	0.8	0.8

Note: calculated from tables 1 and 4

Table 8. Number of votes for each interval

	Death - 32331	32331 - 23232	23232 - 21312	21312 - 12121	12121- Perfect Health
Death-32331	-	18	18	20	24
32331-23232	10	-	16	22	25
23232-21312	10	12	-	18	27
21312-12121	8	8	10	-	25
12121-Perfect Health	4	3	1	3	-

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

WORKING PAPERS LIST

1. Albert Marcet and Ramon Marimon
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
Asymptotic Robust Inferences in the Analysis of Mean and Covariance Structures. (June 1991) [Published in *Sociological Methodology* (1992), pp. 249-278, P.V. Marsden Edt. Basil Blackwell: Oxford & Cambridge, MA]

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 Mato)*, Chapter 6, pp. 171-196, Alianza Economia]

5. Albert Marcet
Solving Non-Linear Stochastic Models by Parameterizing Expectations: An Application to Asset Pricing with Production. (July 1991)

6. Albert Marcet
Simulation Analysis of Dynamic Stochastic Models: Applications to Theory and Estimation. (November 1991), 2d. version (March 1993) [Published in *Advances in Econometrics* invited symposia of the Sixth World Congress of the Econometric Society (Eds. JJ. Laffont i C.A. Sims). Cambridge University Press (1994)]

7. Xavier Calsamiglia and Alan Kirman
A Unique Informationally Efficient and Decentralized Mechanism with Fair Outcomes. (November 1991) [Published in *Econometrica*, vol. 61, 5, pp. 1147-1172 (1993)]

8. Albert Satorra
The Variance Matrix of Sample Second-order Moments in Multivariate Linear Relations. (January 1992) [Published in *Statistics & Probability Letters* Vol. 15, no. 1, (1992), pp. 63-69]

9. Teresa Garcia-Milà and Therese J. McGuire
Industrial Mix as a Factor in the Growth and Variability of States'Economies. (January 1992) [Published in *Regional Science and Urban Economics*, vol. 23, (1993) pp. 229-241]

10. Walter Garcia-Fontes and Hugo Hopenhayn
Entry Restrictions and the Determination of Quality. (February 1992)

11. Guillem López and Adam Robert Wagstaff
Indicadores de Eficiencia en el Sector Hospitalario. (March 1992) [Published in *Moneda y Crédito* Vol. 196]

12. Daniel Serra and Charles ReVelle
The PQ-Median Problem: Location and Districting of Hierarchical Facilities. Part I (April 1992) [Published in *Location Science*, Vol. 1, no. 4 (1993)]

13. Daniel Serra and Charles ReVelle
The PQ-Median Problem: Location and Districting of Hierarchical Facilities. Part II: Heuristic Solution Methods. (April 1992) [Published in *Location Science*, Vol. 2, no. 2 (1994)]

14. Juan Pablo Nicolini
Ruling out Speculative Hyperinflations: a Game Theoretic Approach. (April 1992) [Forthcoming in *Journal of Economic Dynamics and Control*]

15. Albert Marcet and Thomas J. Sargent
Speed of Convergence of Recursive Least Squares Learning with ARMA Perceptions. (May 1992) [Forthcoming in *Learning and Rationality in Economics*]

16. Albert Satorra
Multi-Sample Analysis of Moment-Structures: Asymptotic Validity of Inferences Based on Second-Order Moments. (June 1992) [Published in *Statistical Modelling and Latent Variables* Elsevier, North Holland. K.Haagen, D.J.Bartholomew and M. Deistler (eds.), pp. 283-298.]

Special issue Vernon L. Smith
Experimental Methods in Economics. (June 1992)

17. Albert Marcet and David A. Marshall
Convergence of Approximate Model Solutions to Rational Expectation Equilibria Using the Method of Parameterized Expectations.

18. M. Antònia Monés, Rafael Salas and Eva Ventura
Consumption, Real after Tax Interest Rates and Income Innovations. A Panel Data Analysis. (December 1992)

19. Hugo A. Hopenhayn and Ingrid M. Werner
Information, Liquidity and Asset Trading in a Random Matching Game. (February 1993)

20. Daniel Serra
The Coherent Covering Location Problem. (February 1993) [Forthcoming in *Papers in Regional Science*]

21. Ramon Marimon, Stephen E. Spear and Shyam Sunder
Expectationally-driven Market Volatility: An Experimental Study. (March 1993) [Forthcoming in *Journal of Economic Theory*]

22. Giorgia Giovannetti, Albert Marcet and Ramon Marimon
Growth, Capital Flows and Enforcement Constaints: The Case of Africa. (March 1993) [Published in *European Economic Review* 37, pp. 418-425 (1993)]

23. Ramon Marimon
Adaptive Learning, Evolutionary Dynamics and Equilibrium Selection in Games. (March 1993) [Published in *European Economic Review* 37 (1993)]

24. Ramon Marimon and Ellen McGrattan
On Adaptive Learning in Strategic Games. (March 1993) [Forthcoming in *A. Kirman and M. Salmon eds.* "Learning and Rationality in Economics" Basil Blackwell]

25. Ramon Marimon and Shyam Sunder
Indeterminacy of Equilibria in a Hyperinflationary World: Experimental Evidence. (March 1993) [Forthcoming in *Econometrica*]

26. Jaume Garcia and José M. Labeaga
A Cross-Section Model with Zeros: an Application to the Demand for Tobacco. (March 1993)

27. Xavier Freixas
Short Term Credit Versus Account Receivable Financing. (March 1993)

28. Massimo Motta and George Norman
Does Economic Integration cause Foreign Direct Investment? (March 1993) [Published in *Working Paper University of Edinburgh* 1993:I]

29. Jeffrey Prisbrey
An Experimental Analysis of Two-Person Reciprocity Games. (February 1993) [Published in *Social Science Working Paper 787* (November 1992)]

30. Hugo A. Hopenhayn and Maria E. Muniagurria
Policy Variability and Economic Growth. (February 1993)

31. Eva Ventura Colera
A Note on Measurement Error and Euler Equations: an Alternative to Log-Linear Approximations. (March 1993) [Published in *Economics Letters*, 45, pp. 305-308 (1994)]

32. Rafael Crespí i Cladera
Protecciones Anti-Opa y Concentración de la Propiedad: el Poder de Voto. (March 1993)

33. Hugo A. Hopenhayn
The Shakeout. (April 1993)

34. Walter Garcia-Fontes
Price Competition in Segmented Industries. (April 1993)

35. Albert Satorra i Brucart
On the Asymptotic Optimality of Alternative Minimum-Distance Estimators in Linear Latent-Variable Models. (February 1993) [Published in *Econometric Theory*, 10, pp. 867-883]

36. Teresa Garcia-Milà, Therese J. McGuire and Robert H. Porter
The Effect of Public Capital in State-Level Production Functions Reconsidered. (February 1993) [Forthcoming in *The Review of Economics and Statistics*]

37. Ramon Marimon and Shyam Sunder
Expectations and Learning Under Alternative Monetary Regimes: an Experimental Approach. (May 1993)

38. José M. Labeaga and Angel López
Tax Simulations for Spain with a Flexible Demand System. (May 1993)

39. Daniel Serra and Charles ReVelle
Market Capture by Two Competitors: The Pre-Emptive Location Problem. (May 1993) [Published in *Journal of Regional Science*, Vol. 34, no.4 (1994)]

40. Xavier Cuadras-Morató
Commodity Money in the Presence of Goods of Heterogenous Quality. (July 1993) [Published in *Economic Theory* 4 (1994)]

41. M. Antònia Monés and Eva Ventura
Saving Decisions and Fiscal Incentives: A Spanish Panel Based Analysis. (July 1993)

42. Wouter J. den Haan and Albert Marcet
Accuracy in Simulations. (September 1993) [Published in *Review of Economic Studies*, (1994)]

43. Jordi Galí
Local Externalities, Convex Adjustment Costs and Sunspot Equilibria. (September 1993) [Forthcoming in *Journal of Economic Theory*]

44. Jordi Galí
Monopolistic Competition, Endogenous Markups, and Growth. (September 1993) [Forthcoming in *European Economic Review*]

45. Jordi Galí
Monopolistic Competition, Business Cycles, and the Composition of Aggregate Demand. (October 1993) [Forthcoming in *Journal of Economic Theory*]

46. Oriol Amat
The Relationship between Tax Regulations and Financial Accounting: a Comparison of Germany, Spain and the United Kingdom. (November 1993) [Forthcoming in *European Management Journal*]

47. Diego Rodríguez and Dimitri Vayanos
Decentralization and the Management of Competition. (November 1993)

48. Diego Rodríguez and Thomas M. Stoker
A Regression Test of Semiparametric Index Model Speciication. (November 1993)

49. Oriol Amat and John Blake
Control of the Costs of Quality Management: a Review or Current Practice in Spain. (November 1993)

50. Jeffrey E. Prisbrey
A Bounded Rationality, Evolutionary Model for Behavior in Two Person Reciprocity Games. (November 1993)

51. Lisa Beth Tilis
Economic Applications of Genetic Algorithms as a Markov Process. (November 1993)

52. Ángel López
The Comand for Private Transport in Spain: A Microeconometric Approach. (December 1993)

53. Ángel López
An Assessment of the Encuesta Continua de Presupuestos Familiares (1985-89) as a Source of Information for Applied Reseach. (December 1993)

54. Antonio Cabrales
Stochastic Replicator Dynamics. (December 1993)

55. Antonio Cabrales and Takeo Hoshi
Heterogeneous Beliefs, Wealth Accumulation, and Asset Price Dynamics. (February 1993, Revised: June 1993)

56. Juan Pablo Nicolini
More on the Time Inconsistency of Optimal Monetary Policy. (November 1993)

57. Lisa B. Tilis
Income Distribution and Growth: A Re-examination. (December 1993)

58. José María Marín Vigueras and Shinichi Suda
A Model of Financial Markets with Default and The Role of "Ex-ante" Redundant Assets. (January 1994)

59. Angel de la Fuente and José María Marín Vigueras
Innovation, "Bank" Monitoring and Endogenous Financial Development. (January 1994)

60. Jordi Galí
Expectations-Driven Spatial Fluctuations. (January 1994)

61. Josep M. Argilés
Survey on Commercial and Economic Collaboration Between Companies in the EEC and Former Eastern Bloc Countries. (February 1994) [Published in *Revista de Estudios Europeos* n° 8 (1994) pp. 21-36]

62. German Rojas
Optimal Taxation in a Stochastic Growth Model with Public Capital: Crowding-in Effects and Stabilization Policy. (September 1993)

63. Irasema Alonso
Patterns of Exchange, Fiat Money, and the Welfare Costs of Inflation. (November 1991, Revised: September 1993)

64. Rohit Rahi
Adverse Selection and Security Design. (July 1993, Revised: February 1994)

65. Jordi Galí and Fabrizio Zilibotti
Endogenous Growth and Poverty Traps in a Cournotian Model. (November 1993)

66. Jordi Galí and Richard Clarida
Sources of Real Exchage Rate Fluctuations: How Important are Nominal Shocks?. (October 1993, Revised: January 1994) [Forthcoming in *Carnegie-Rochester Conference in Public Policy*]

67. John Ireland
A DPP Evaluation of Efficiency Gains from Channel-Manufacturer Cooperation on Case Counts. (February 1994)

68. John Ireland
How Products' Case Volumes Influence Supermarket Shelf Space Allocations and Profits. (February 1994)

69. Fabrizio Zilibotti
Foreign Investments. Enforcement Constraints and Human Capital Accumulation. (February 1994)

70. Vladimir Marianov and Daniel Serra
Probabilistic Maximal Covering Location Models for Congested Systems. (March 1994)

71. Giorgia Giovannetti.
Import Pricing, Domestic Pricing and Market Structure. (August 1993, Revised: January 1994)

72. Raffaela Giordano.
A Model of Inflation and Reputation with Wage Bargaining. (November 1992, Revised March 1994)

73. Jaume Puig i Junoy.
Aspectos Macroeconómicos del Gasto Sanitario en el Proceso de Convergencia Europea. (Enero 1994)

74. Daniel Serra, Samuel Ratick and Charles ReVelle.
The Maximum Capture Problem with Uncertainty (March 1994) [Forthcoming in *Environment and Planning B*]

75. Oriol Amat, John Blake and Jack Dowds.
Issues in the Use of the Cash Flow Statement-Experience in some Other Countries (March 1994)

76. Albert Marcet and David A. Marshall.
Solving Nonlinear Rational Expectations Models by Parameterized Expectations: Convergence to Stationary Solutions (March 1994)

77. Xavier Sala-i-Martin.
Lecture Notes on Economic Growth (I): Introduction to the Literature and Neoclassical Models (May 1994)

78. Xavier Sala-i-Martin.
Lecture Notes on Economic Growth (II): Five Prototype Models of Endogenous Growth (May 1994)

79. Xavier Sala-i-Martin.
Cross-Sectional Regressions and the Empirics of Economic Growth (May 1994)

80. Xavier Cuadras-Morató.
Perishable Medium of Exchange (Can Ice Cream be Money?) (May 1994)

81. Esther Martínez García.
Progresividad y Gastos Fiscales en la Imposición Personal sobre la Renta (Mayo 1994)

82. Robert J. Barro, N. Gregory Mankiw and Xavier Sala-i-Martin.
Capital Mobility in Neoclassical Models of Growth (May 1994)

83. Sergi Jiménez-Martin.
The Wage Setting Process in Spain. Is it Really only about Wages? (April 1993, Revised: May 1994)

84. Robert J. Barro and Xavier Sala-i-Martin.
Quality Improvements in Models of Growth (June 1994)

85. Francesco Drudi and Raffaela Giordano.
Optimal Wage Indexation in a Reputational Model of Monetary Policy Credibility (February 1994)

86. Christian Helmenstein and Yury Yegorov.
The Dynamics of Migration in the Presence of Chains (June 1994)

87. Walter García-Fontes and Massimo Motta.
Quality of Professional Services under Price Floors. (June 1994) [Forthcoming in *Revista Española de Economía*]

88. Jose M. Bailen.
Basic Research, Product Innovation, and Growth. (September 1994)

89. Oriol Amat and John Blake and Julia Clarke.
Bank Financial Analyst's Response to Lease Capitalization in Spain (September 1994) [Forthcoming in *International Journal of Accounting*.]

90. John Blake and Oriol Amat and Julia Clarke.
Management's Response to Finance Lease Capitalization in Spain (September 1994)

91. Antoni Bosch and Shyam Sunder.
Tracking the Invisible Hand: Convergence of Double Auctions to Competitive Equilibrium. (Revised: July 1994)

92. Sergi Jiménez-Martin.
The Wage Effect of an Indexation Clause: Evidence from Spanish Manufacturing Firms. (August 1993, Revised: September 1994)

93. Albert Carreras and Xavier Tafunell.
National Enterprise. Spanish Big Manufacturing Firms (1917-1990), between State and Market (September 1994)

94. Ramon Faulí-Oller and Massimo Motta.
Why do Owners let their Managers Pay too much for their Acquisitions? (October 1994)

95. Marc Sáez Zafra and Jorge V. Pérez-Rodríguez.
Modelos Autorregresivos para la Varianza Condicionada Heteroscedástica (ARCH) (October 1994)

96. Daniel Serra and Charles ReVelle.
Competitive Location in Discrete Space (November 1994) [Forthcoming in Zvi Drezner (ed.): *Facility Location: a Survey of Applications and Methods*. Springer-Verlag New York.

97. Alfonso Gambardella and Walter García-Fontes.
Regional Linkages through European Research Funding (October 1994) [Forthcoming in *Economic of Innovation and New Technology*]

98. Daron Acemoglu and Fabrizio Zilibotti.
Was Prometheus Unbound by Chance? Risk, Diversification and Growth (November 1994)

99. Thierry Foucault.
Price Formation and Order Placement Strategies in a Dynamic Order Driven Market (Revised: June 1994)

100. Ramon Marimon and Fabrizio Zilibotti.
'Actual' versus 'Virtual' Employment in Europe: Why is there Less Employment in Spain? (December 1994)

101. María Sáez Martí.
Are Large Windows Efficient? Evolution of Learning Rules in a Bargaining Model (December 1994)

102. María Sáez Martí.
An Evolutionary Model of Development of a Credit Market (December 1994)

103. Walter García-Fontes and Ruben Tansini and Marcel Vaillant.
Cross-Industry Entry: the Case of a Small Developing Economy (December 1994)

104. Xavier Sala-i-Martin.
Regional Cohesion: Evidence and Theories of Regional Growth and Convergence (October 1994)

105. Antoni Bosch-Domènech and Joaquim Silvestre.
Credit Constraints in General Equilibrium: Experimental Results (December 1994)

106. Casey B. Mulligan and Xavier Sala-i-Martin.
A Labor-Income-Based Measure of the Value of Human Capital: an Application to the States of the United States. (March 1994, Revised: December 1994)

107. José M. Bailén and Luis A. Rivera-Bátiz.
Human Capital, Heterogeneous Agents and Technological Change (March 1995)

108. Xavier Sala-i-Martin.
A Positive Theory of Social Security (Revised: February 1995)

109. J. S. Marron and Frederic Udina.
Interactive Local Bandwidth Choice (February 1995)

110. Marc Sáez and Robert M. Kunst.
ARCH Patterns in Cointegrated Systems (March 1995)

111. Xavier Cuadras-Morató and Joan R. Rosés.
Bills of Exchange as Money: Sources of Monetary Supply during the Industrialization in Catalonia (1844-74) (April 1995)

112. Casey B. Mulligan and Xavier Sala-i-Martin.
Measuring Aggregate Human Capital (October 1994, Revised: January 1995)

113. Fabio Canova.
Does Detrending Matter for the Determination of the Reference Cycle and the Selection of Turning Points? (February 1994, Revised: March 1995)

114. Sergiu Hart and Andreu Mas-Colell.
Bargaining and Value (July 1994, Revised: February 1995) [Forthcoming in *Econometrica*]

115. Teresa Garcia-Milà, Albert Marcet and Eva Ventura.
Supply Side Interventions and Redistribution (June 1995)

116. Robert J. Barro and Xavier Sala-i-Martin.
Technological Diffusion, Convergence, and Growth (May 1995)

117. Xavier Sala-i-Martin.
The Classical Approach to Convergence Analysis (June 1995)

118. Serguei Maliar and Vitali Perepelitsa.
LCA Solvability of Chain Covering Problem (May 1995)

119. Serguei Maliar, Igor' Kozin and Vitali Perepelitsa.
Solving Capability of LCA (June 1995)

120. Antonio Ciccone and Robert E. Hall.
Productivity and the Density of Economic Activity (May 1995) [Forthcoming in *American Economic Review*]

121. Jan Werner.
Arbitrage, Bubbles, and Valuation (April 1995)

122. Andrew Scott.
Why is Consumption so Seasonal? (March 1995)

123. Oriol Amat and John Blake.
The Impact of Post Industrial Society on the Accounting Compromise-Experience in the UK and Spain (July 1995)

124. William H. Dow, Jessica Holmes, Tomas Philipson and Xavier Sala-i-Martin.
Death, Tetanus, and Aerobics: The Evaluation of Disease-Specific Health Interventions (July 1995)

125. Tito Cordella and Manjira Datta.
Intertemporal Cournot and Walras Equilibrium: an Illustration (July 1995)

126. Albert Satorra.
Asymptotic Robustness in Multi-Sample Analysis of Multivariate Linear Relations (August 1995)

127. Albert Satorra and Heinz Neudecker.
Compact Matrix Expressions for Generalized Wald Tests of Equality of Moment Vectors (August 1995)

128. Marta Gómez Puig and José G. Montalvo.
Bands Width, Credibility and Exchange Risk: Lessons from the EMS Experience (December 1994, Revised: June 1995) [Finance and Banking Discussion Papers Series (1)]

129. Marc Sáez.
Option Pricing under Stochastic Volatility and Stochastic Interest Rate in the Spanish Case (August 1995) [Finance and Banking Discussion Papers Series (3)]

130. Xavier Freixas and Jean-Charles Rochet.
Fair Pricing of Deposit Insurance. Is it Possible? Yes. Is it Desirable? No (January 1995, Revised: June 1995) [Finance and Banking Discussion Papers Series (4)]

131. Heinz Neudecker and Albert Satorra.
The Algebraic Equality of Two Asymptotic Tests for the Hypothesis that a Normal Distribution Has a Specified Correlation Matrix (April 1995)

132. Walter Garcia-Fontes and Aldo Geuna.
The Dynamics of Research Networks in Brite-Euram (January 1995, Revised: July 1995)

133. Jeffrey S. Simonoff and Frederic Udina.
Measuring the Stability of Histogram Appearance when the Anchor Position is Changed (July 1995) [Forthcoming in *Computational Statistics and Data Analysis*]

134. Casey B. Mulligan and Xavier Sala-i-Martin.
Adoption of Financial Technologies: Implications for Money Demand and Monetary Policy (August 1995) [Finance and Banking Discussion Papers Series (5)]

135. Fabio Canova and Morten O. Ravn.
International Consumption Risk Sharing (March 1993, Revised: June 1995) [Finance and Banking Discussion Papers Series (6)]

136. Fabio Canova and Gianni De Nicolo'.
The Equity Premium and the Risk Free Rate: A Cross Country, Cross Maturity Examination (April 1995) [Finance and Banking Discussion Papers Series (7)]

137. Fabio Canova and Albert Marcet.
The Poor Stay Poor: Non-Convergence across Countries and Regions (October 1995)

138. Etsuro Shioji.
Regional Growth in Japan (January 1992, Revised: October 1995)

139. Xavier Sala-i-Martin.
Transfers, Social Safety Nets, and Economic Growth (September 1995)

140. José Luis Pinto.
Is the Person Trade-Off a Valid Method for Allocating Health Care Resources? Some Caveats (October 1995)