Exploring a new method for deriving the Monetary Value of a QALY

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Abstract
Several studies have sought to determine the monetary value of health gains expressed as Quality Adjusted Life Years gained, predominantly using Willingness to Pay approaches. However, Willingness to Pay has a number of recognised problems, most notably its insensitivity to scope. This paper presents an alternative approach to estimate the monetary value of a QALY, which is based on the Time Trade-Off method. Moreover, it presents the results of an online study conducted in the Netherlands exploring the feasibility of this novel approach. The results seem promising, but also highlight a number of methodological problems with this approach, most notably non-trading and the elicitation of negative values. Additional research is necessary to try to overcome these problems and to determine the potential of this new approach.
Introduction

In light of increasing health care expenditure and the limited resources available, decision makers face the challenge to determine the appropriate allocation of these resources over health programs. To help determine an appropriate distribution, economic evaluations provide information on costs and effects of health technologies. Within economic evaluations, health effects are typically expressed in Quality Adjusted Life Years (QALYs). The QALY is an outcome measure of health benefit that combines length of life with quality of life. Quality of life is typically expressed on a scale from zero to one, where zero represents a health state equivalent to being dead and one represents perfect health [1]. By expressing health outcomes on a common unit of measurement, outcomes can be compared across different health programs, which is helpful for making reimbursement decisions. In several countries these economic evaluations are used to inform allocation decisions [2].

One intriguing question regarding the use of the outcomes of economic evaluations, typically taking the form of a ratio of incremental costs per QALY gained, is when to consider a technology to offer ‘value for money’ and hence to implement or fund it. That final judgment requires some threshold against which to evaluate the cost-per-QALY ratio. Different ideas regarding the nature and meaning of this threshold, and therefore the decision making context, exist [3-5]. It can either represent the amount a society is willing to pay for a QALY from private consumption, or in a fixed budget system the opportunity cost of a QALY from displaced health care activities [6]. This paper, however, is concerned with the former interpretation of it being a societal value of a QALY. For either interpretation only if the ratio of costs per QALY remains below the value of that QALY, introducing the technology can be deemed cost-effective, that is, welfare improving [3].

However, finding a societal value of the QALY is a delicate matter and by no means easy. Recently, two large studies have been conducted aimed at finding the monetary value of
the QALY (MVQ): the UK Social Value of a QALY (SVQ) project [7] and an international study involving nine European countries (EuroVaQ, [8, 9]). Both studies experienced important difficulties related to the methodological approaches chosen. Similarly to most other studies conducted to find the MVQ [10-18], these studies used a contingent valuation (CV) method to estimate the Willingness to Pay (WTP) for a health improvement (either life extension or quality of life improvement). However, CV has a number of recognised problems, most notably its insensitivity to scope [19], strategic behaviour [20], protest responses [21] and the restriction of personal income [22].

Insensitivity to scope (or scale) arises if respondents’ WTP does not change in response to the size of the outcome being valued. Evidence of insensitivity to scope concerns economists because it contradicts the fundamental principles of neo-classical theory: since ‘more is better’ consumers should be prepared to sacrifice more money to obtain more of some good (albeit at a diminishing rate). From a practical perspective, if WTP does not vary with size of the gain, any possible MVQ could be obtained by varying size of the gains. Although some studies found evidence against insensitivity to scope [23-25] quite a few other studies found evidence in support of scope insensitivity [19, 26-28].

Besides insensitivity to scope, a concern with WTP is the opportunity for strategic behaviour, depending on the payment vehicle (free-riding) [20, 29]. This may occur in two directions. Firstly, if respondents think they will actually have to pay the amount they reveal, they may underbid. Alternatively, if respondents do not believe they will actually have to pay their stated WTP amount, but they want to influence the provision of the good in question, they might overbid. There is limited available evidence regarding strategic behaviour in WTP studies in the health care field [20].

Another issue with WTP is the incidence of protest answers. For instance, people who indicate a WTP of zero may do so for several reasons, such as that they do not know
their true WTP, they actually have a zero value for the good (real zeros), or they protest against the exercise or payment for the good or outliers [18, 21, 29]. In a contingent valuation survey of Dalmau-Matarrodona (aimed at determining the value day case surgery as opposed to inpatient treatment) as much as 35% of the respondents stated a zero WTP [21]. One third of these were classified as protest zeros. An additional problem with WTP is the influence of ability to pay. This influence may be considered particularly problematic in the context of health care, where the emphasis is on accessibility and equity [30]. In WTP personal income acts as a budget constraint. The approach of WTP thus allows the wealthy to state higher values for the goods/treatments they prefer than the poor, which (depending on the use of the results) could bias health care decisions. This has led some to argue that WTP is only a valid method if we accept that the current distribution of income is appropriate [22], although Donaldson has argued that one can correct and adjust WTP towards any desired distribution [31].

In light of these issues with WTP, it seems useful to examine other ways than common WTP studies to obtain monetary valuations of health gains. In this paper, such an alternative approach is presented, which can be used to estimate the MVQ, which is based upon a Time Trade-Off (TTO) exercise of income with health held constant at perfect health. We present the methods and theory underlying this experimental approach and some results from an online feasibility study in the Netherlands.

**Methods**

TTO is a widely used choice-based method of health state preference elicitation. Buckingham and Devlin [32] have outlined how the TTO method can be interpreted in the theoretical context of Hicksian utility theory and hence comply with welfare economic principles in a similar fashion to WTP derived through CV. We designed a TTO exercise in which
respondents trade off length of life (in a certain health state) and income. People are thus asked to indicate their indifference between living longer (in health state X) with a lower income and living shorter (in health state X) but with a higher income. From these trade-offs, the implicit monetary value placed on a QALY can be derived. This is explained in more detail below.

Data and questionnaire

Data were gathered as part of a study seeking to determine whether respondents in TTO exercises consider the effects the states might have upon their income [33, 34]. Data were gathered through an online self-complete questionnaire administered in the Netherlands. Invitations were sent out to a subset of an existing panel of potential survey respondents in order to obtain a representative sample of 300 members of the Dutch general public. Only respondents between the ages of 18 and 65 were selected as questions about income were seen as being most relevant for people in this age bracket. The data collection was performed by an online market research company (Survey Sampling International; www.surveysampling.com). Following a number of background questions including age, sex, marital status and self-assessed health by means of a Visual Analogue Scale (VAS), respondents were presented with five different TTO exercises (see Tilling et al. [33] for more details). Two of these TTO exercises were relevant for this study, in which health is replaced by income so the trade-off becomes between longevity and income rather than longevity and health.

The wording of the first question looks as follows:

**TTO 1: Trading years to avoid an income loss in perfect health (Equivalent Variation of a Loss)**
“You can live for 10 years in perfect health with (100 - Y)% of your current annual income for each year and then die or you can live for a shorter period of time in perfect health with your current annual income for each year and then die.”

The indifference curves representing the trade-off are shown in Figure 1. The x axis represents length of life and the y axis represents income. Each indifference curve represents a level of utility that can be achieved by different combinations of longevity and income, where $U_2 > U_1 > U_0$. The first option asks the respondent to consider a move from point $b$ on indifference curve $U_1$ (10 years in perfect health with current income) to point $a$ on indifference curve $U_0$ (10 years in perfect health with less than current income). The second option involves a move from point $b$ to point $c$ (X years in perfect health with current income), which is again on $U_0$. The respondent must thus specify a decrease in longevity that is equivalent to a decrease in income, both of which causing a decrease in utility from $U_1$ to $U_0$.

Figure 1 Equivalent Income Loss and Compensating Income Gain (adapted from Buckingham and Devlin, 2006, p.1151).
The second question also asks respondents the decrease in longevity that would be required to compensate for an increase in income, but the reference point differs:

*TTO2: Trading years to achieve an **income gain** in perfect health (Compensating Variation of a Gain)*

“You can live for 10 years in perfect health with your current annual income for each year and then die or you can live for a shorter period of time in perfect health with \((100 + Y)\%\) of your current annual income for each year and then die.”

Referring again to Figure 1, the first option is to stay at point \(b\) on indifference curve \(U_1\) (10 years with current annual income). Note, in TTO2 the first option is on a higher indifference curve \(U_1\) than in TTO1 \((U_0)\), because income is set at current annual income. An increase in
income (to a value greater than current income) takes the individual on to a higher indifference curve $U_2$, at point $d$. The respondent must then specify a decrease in longevity that returns them to their original indifference curve at point $e$ on $U_1$.

In other words, respondents have to consider an equivalent variation for a loss in TTO1. *Equivalent variation* is ‘the amount of money a consumer would pay to avert a price increase’ [35]. In TTO1 the consumer is faced with a fall in income of $X\%$, which is essentially the same as an increase in prices. They are then asked how many years of life (rather than how much money) they would pay to avoid this ‘price increase’. Similarly, TTO2 can be viewed as asking a form of compensating variation. *Compensating variation* is ‘the amount of additional money a consumer requires to reach his initial level of utility after a change in prices’ [35]. For a drop in prices, the amount of additional money compensation will be negative. TTO2 essentially corresponds to a compensating variation that identifies the number of years payable that would let the individual maintain the initial level of utility after a drop in prices, or increase in income. Essentially both questions can be interpreted as WTP questions. However, while standard WTP questions ask people to trade money for an improvement in length of life or health, these questions asked people to trade length of life for an improvement in income. Respondents were thus paying in years of life.

Three income change levels ($Y$) were used: in version 1 of the questionnaire 20% was used, in version 2 40% and in version 3 60%. Respondents were randomised to one of the three income change levels which they then received in both TTO1 and TTO2. Since the survey was administered in an online self-complete fashion there was no iterative process. Respondents were simply asked to state how many years with higher income, was equivalent to 10 years with lower income. All respondents first received TTO1, followed by TTO2.
Analysis of responses

Our responses can only be interpreted and analysed after assuming the form of the utility function of respondents over health and income. In the current paper, given its explorative nature, we assume a simple additive function \( W(.,) \) over health \((H)\) and income \((Y)\):

\[
W(H, Y) = U(H) + Y
\]

That is, individuals derive utility \((U)\) from their health state \(H\) and have a linear utility function over income. This specification was used earlier by Eeckhoudt et al. [36]. The advantage of this function is that it becomes straightforward to elicit a monetary value of the utility of perfect health. Moreover, an additive way of thinking when answering this task is cognitively less demanding and appears more plausible than a multiplicative way of thinking.

To see how the results from these questions can be used to derive an MVQ imagine that a respondent facing TTO1 states that 9 years with normal annual income of €100,000 is equivalent to 10 years with 80\% of this income, so €80,000. Using prospective lifetime income values and assuming a zero discount rate, this point of indifference gives us the following information (with PH abbreviating Perfect Health):

\[
10U \left( PH \right) + 800,000 = 9U \left( PH \right) + 900,000 \quad (1)
\]

\[
10U \left( PH \right) - 9U \left( PH \right) = 900,000 - 800,000 \quad (2)
\]

\[
U \left( PH \right) = 100,000 \quad (3)
\]

In reality, it is likely that the utility from a year in perfect health will be higher when combined with a higher amount of income, whereas we assume a constant marginal rate of
substitution between health and income. Relaxing this assumption would require us to estimate an indifference curve across a range of values, which is beyond the scope of this first empirical exploration of the method.

The compensating gain data from TTO2 is analysed in a similar fashion to the equivalent loss data in TTO1. Consider a respondent who is indifferent between 10 years with their current income and 9 years with 120% of their current income. Their income is, once again, €100,000 per year:

\[
10U \text{(PH)} + 1,000,000 = 9U \text{(PH)} + 1,080,000
\]

(4)

\[
10U \text{(PH)} - 9U \text{(PH)} = 1,080,000 - 1,000,000
\]

(5)

\[
U \text{(PH)} = €80,000
\]

(6)

**Respondent Income**

In order to determine the level of “current annual income” for each respondent, respondents were asked to choose the income bracket within which their monthly income fell in the background characteristics questions. For our analysis these income brackets were converted into numerical values using the mid-point of each bracket [37]. For respondents in the lowest income bracket an income of two thirds of the upper limit of the bracket was used. For respondents in the highest income bracket an income of 1.5 of the lower income limit of the bracket was assumed [37].

**Non-Traders**

Some respondents did not trade any time in any of the TTO exercises. For these respondents, calculating an MVQ becomes problematic because the left hand side of equation (2) becomes 0, meaning that the equation would give an indeterminate value. If such responses occur and
are a protest against the exercise this poses questions about the feasibility of the exercise. If such responses are a meaningful statement of preference for a seemingly infinite preference for life over income then this does not mean the exercises are infeasible, but means the calculation method above is not capable of calculating a finite MVQ for such individuals based on these meaningful responses. These lexicographic responses can be displayed using indifference curve analysis as in figure 2.

**Figure 2 – Indifference curve showing infinite preference (lexicographic) for length of life over income**
Figure 2 shows vertical indifference curves representing an infinite preference for length of life over income. Since a given indifference curve shows the combinations of length of life and income that deliver a given level of utility, vertical curves show that a given length of life delivers a certain amount of utility regardless of income. Therefore, a respondent with lexicographic preferences of this nature would not give up any length of life to increase their income. In the context of the Equivalent Variation for a Loss questions, the decrease in income that the respondent is faced with (from current income to less than current income) does not decrease their utility; therefore they stay on their initial indifference curve, implying their equivalent loss in longevity is zero, because otherwise their utility would drop below this level.

It should be noted that non-trading in the Equivalent Variation for a Loss or Compensating Variation for a Gain questions does not necessarily mean that the indifference curve is perfectly vertical as in Figure 2 above, it just means that the curve is sufficiently steep that the utility gained from the increase in income is less than the amount of utility that would be lost through giving up the smallest amount of longevity possible (the smallest unit of trade was one month). Furthermore, non-trading for a given income change level does not mean that the entire indifference curve is vertical (or sufficiently steep) as in Figure 2, it only determines the slope of the indifference curve between the two income points on the y axis that the respondent is being questioned on.

Regardless of whether non-trades are protest responses or a true reflection of lexicographic preferences, if an individual calculation method (i.e. calculate an MVQ for each individual and then compute the mean) is to be used, then non-traders must be excluded, because their answers would imply an infinite MVQ [38]. Therefore, we excluded all ‘extreme non-traders’ (i.e. respondents who did not trade across all 14 TTO questions). An alternative is to use an aggregate approach (i.e. compute the mean income and the mean number of years traded and then divide these means on each other). Results are presented from both approaches.
Negative Values

One further problem of our approach is the potential generation of negative MVQ values. For TTO1, if the percentage of life years the respondent is prepared to give up is larger than the percentage income loss they are faced with, their MVQ will be negative. For example, if a respondent is faced with 20% income loss and is willing to trade more than 2 years of life to avert this, her MVQ value will be negative (while if she trades exactly 2 years, her MVQ value will be zero). In other words, for the 20% loss respondents, trading more than 2 years leads to a negative MVQ; for the 40% [60%] loss respondents, this holds for trades of more than 4 [6] years. For TTO2 the relationship is not linear. For a 20% [40%,60%] gain in income trades of more than 1.67 [2.86,3.75] years result in negative values. In the individual approach we truncated negative MVQ values at 0. In the aggregate approach we left the number of years traded unchanged.
Results

Data were available from 321 members of the Dutch general public. After exclusion of 80 ‘extreme non-traders’ the relevant sample size fell to 241. The sample consisted of slightly more males than females, and 41.5% of the sample was not employed. Just under half of the sample had children, and less than half of the sample was married. The mean VAS score for own health was 0.75. The results of $\chi^2$ tests showed that background characteristics did not differ significantly across the three versions of the questionnaire. Only employment was slightly different across the versions, with a smaller proportion of respondents in version 2 being in employment than in the other 2 versions.

Even after excluding the ‘extreme non-traders’, a substantial number of the respondents did not trade time in the compensating gain and/or equivalent loss questions. The proportion of non-traders in the equivalent loss questions decreased as the level of loss increased: 72% were non-traders for 20% loss, 54% for 40% loss and 45% for 60% loss. In the compensating gain questions the proportion of non-traders was fairly constant across the three income gain levels: 63%, 65% and 64% were non-traders for 20%, 40% and 60% gain respectively. Trading off life duration for income increases hence invokes a large degree of non-trading.

Table 1 shows the mean number of years respondents were willing to trade, in both the compensating gain and equivalent loss questions. Looking at the values including the non-traders, for two of the income change levels respondents were willing to trade more years to avoid an income loss than they were to achieve an income gain. However, these differences were only significant for the 60% income change level (at the 1% level). The median values were 0 in all but one case, which was a product of the large numbers of non-traders. Mann-Whitney rank-sum tests were performed to compare the values for the different
income levels, both for equivalent loss and compensating gain values. Number of years traded was significantly different between 20% and 40% equivalent loss (5% level) and between 20% and 60% equivalent loss (1% level). For the equivalent loss questions the standard deviations generally increased as the level of loss increased, while no clear relationship was observed for the gain questions.

Table 2 shows the MVQ estimates calculated according to the individual approach. As described, this approach excludes all non-traders, resulting in a much smaller sample for analysis. The mean MVQ values ranged from €17,439 to €65,957. A larger proportion of respondents gave negative MVQ values (which were truncated to zero for the analysis) for the compensating gain questions than for the equivalent loss questions. In general, the mean MVQ values increased as the level of income change increased, 60% income gain being the only exception. The monetary values for a QALY were higher for the gain questions than the loss questions, except in the case of the 60% income change level. The mean values were consistently higher than the median values, implying that the data were skewed. In half of the cases the median was 0, caused by the large number of respondents who traded enough years to generate a negative MVQ value, which was then truncated to zero.

Table 3 shows the MVQ values calculated using aggregate values. The estimates ranged from €2,805 to €49,437. Similar to the individual approach, the mean MVQ values increased as the level of income change increased. Except in the case of the 20% income change level, the MVQ was higher for the gain questions than for the loss questions.

As shown in table 4, we tested whether weighted mean monetary values for a QALY for both the individual and the aggregate approach differed between respondents in different income brackets. We found no clear relationship between respondents’ income and mean QALY values. For the individual approach values were broadly similar across income levels,
suggesting that the MVQ values generated by our method were not a function of respondent income.

**Discussion and Conclusion**

The aim of this study was not to present a definitive MVQ for the Netherlands, but to test the feasibility of an alternative method of eliciting an MVQ. The results from the small-scale online study suggest that the compensating gain and equivalent loss TTO exercises have potential, but a number of problems must be overcome before its use can be more widely advocated, other than for research purposes. Generally, respondents in our new method gave up more years when faced with a larger income change level rather than a smaller income change, suggesting some sensitivity to scope. However, these differences were not always significant and never significant without the ‘non-traders’, due to the small numbers in the sample. Surprisingly, we did not find a clear relation between respondents’ income and MVQ. Maybe this is related to the relative small sample size of our explorative study. Studies with larger sample sizes may be able to provide more insight into the relationship between income and MVQ values generated with this new approach. Moreover, it would allow further investigation of sensitivity to scope in the TTO method in this context.

Since respondents are forced to consider giving up years of life from a finite 10 year survival, one could claim that the introduced method here forces respondents to trade-off income and health in a very direct way. Furthermore, the method makes strategic behaviour difficult as it is not obvious to the respondent how the results from the exercise will be used, although the results from this feasibility study do not allow us to specifically test this.

Amongst the analysed sample (excluding 80 ‘extreme non-traders’), 60% of responses in the equivalent loss and compensating gain questions were non-trades. This is considerably higher than the 35% found in the study by Dalmau-Matarrodon [21] in the context of a WTP
exercise. We have no means of determining what proportion of these trades revealed true lexicographic preferences and what proportion were protest responses. The high proportion of non-trades may also be related to the use of an online survey. Van Nooten et al. [39] found that numerous respondents opted not to trade in conventional TTO exercises in their online questionnaire. It may well be that trading off life time for income is considered in some way ‘unethical’ by respondents or a trade-off they are even less willing to make than trading off length and quality of life. This requires further investigation.

A serious problem with the TTO based approach, and one not encountered when using WTP, is the elicitation of negative MVQ values. It is not easy for respondents to see that they are making choices that imply negative valuation of health, which they may not support if they were shown the implication. This is where the proportion of health traded off exceeds that of the income change. However, in reality it is plausible that individuals may wish to live for a shorter period of time with higher income than for a longer period of time with lower income, even though their total lifetime income may be lower. For instance, they may feel that the lower income is not enough to be able to sustain themselves and their significant others. This also relates to the shape of the utility function assumed here. The additive, linear utility function may not adequately describe peoples’ actual preferences. In addition, the zero discounting assumption we used here may not hold. If respondents instead discount future income very steeply, a short lifespan with high yearly income will give more discounted utility than a long lifespan with a lower yearly income. It is also likely that respondents may not have been able to calculate exactly at which point their lifetime income in one prospect became lower than that in the other prospect. In that sense, applying this method in an interview elicitation procedure, potentially using visual aids and providing feedback to respondents whose answers imply negative WTP, could support the decision
making process of respondents. This may reduce the number of respondents trading ‘too many years’, yielding negative valuations, but not being aware of this implication.

In this study respondents were told to imagine being in perfect health in both scenarios. In future work it may be preferable to tell respondents they would be in their own current state of health. Their current health could then be valued through either conventional TTO or VAS and the income changes obtained could be divided by the value of the respondents’ current health to give MVQ values. This may reduce the number of hypothetical aspects and hence make the task more manageable for respondents who are currently not in full health. However, this approach would entail further dependence upon the assumption of no interactions between health and income. This assumption, one of the impossibility theorem criteria set out by Dolan and Edlin [40], is not avoided in this study. The MVQ value elicited is essentially determined by the choice of income change level. A large scale study would make it possible to obtain values for enough income change levels to estimate an indifference curve between health and income. An average MVQ value across a range of income change levels could then be estimated. If it is found that the utility of health depends on income and vice versa, this would suggest that an additive utility function is not descriptively valid. In that case, a multiplicative utility function over health and income would be a logical alternative [41].

At this moment the aggregate approach seems to be preferred over the individual approach. Even though it may include some responses of individuals who strategically did not trade, the alternative (the individual approach) left a small number of ‘trading’ respondents after excluding non-traders and truncating negative values to zero. The aggregate approach represents a movement away from standard welfare economics (societal welfare as the sum of individual welfare), but it might be considered acceptable in an extra-welfarist framework, although further discussion remains warranted. Further research using face to
face interviews is needed to try to determine whether the non-trades are strategic or true indicators of preference, and hence whether the calculation method needs to be able to accommodate them.

In summary, the search for the monetary value of QALYs is ongoing, yet remains problematic. Here, we presented an alternative method for the elicitation of MVQ based on the TTO and a first empirical test found it to be feasible for respondents to answer. Still, the empirical exploration highlighted numerous important issues with the method, most notably the elicitation of ‘non-trades’ and negative values. Future research could address these issues, also looking at the shape of the utility function over income and health. An interview based study that requires respondents to engage in an iterative process, and that can be supplemented by a visual aid, is required to determine whether this approach is valid and should be taken forward, also as an alternative for WTP valuations.

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Table 1. Number of years traded

| Number of years traded to either avoid an income loss or achieve an income gain | Version 1: 20% (n=78) | Version 2: 40% (n=80) | Version 3: 60% (n=83) |
|---|---|---|---|
| | Loss | Gain | Loss | Gain | Loss | Gain |
| Mean | 0.99 | 1.47 | 1.81** | 1.33 | 2.45 | 1.51*** |
| SD | 2.23 | 2.96 | 2.74 | 2.63 | 3.28 | 2.89 |
| Median | 0 | 0 | 0 | 0 | 1 | 0 |

Stars represent significance as follows: **5% level ***1% level
Table 2. MVQ values calculated at the individual level (excluding non-traders)

|                                | Version 1: 20% | Version 2: 40% | Version 3: 60% |
|--------------------------------|----------------|----------------|----------------|
|                                | Loss           | Gain           | Loss           | Gain           | Loss           | Gain           |
| Number of respondents          | 22             | 29             | 37             | 28             | 46             | 30             |
| Mean number of years traded    | 3.5            | 3.95           | 3.91           | 3.81           | 4.43           | 4.17           |
| Mean Annual Income (Euros)     | 15,042         | 16,375         | 14,834         | 15,675         | 21,041         | 18,630         |
| Number of negative responses   | 11             | 17             | 16             | 14             | 13             | 14             |
|                                | Mean           |                |                |                |                |                |
| Value of a QALY (Euros)        | 17,439         | 42,212         | 43,564         | 65,957         | 56,827         | 48,846         |
|                                | SD             |                |                |                |                |                |
|                                | 44,561         | 166,650        | 13,8097        | 193,760        | 126,109        | 108,570        |
| Median                         | 0              | 0              | 0              | 1,020          | 8,673          | 10,994         |
Table 3. MVQ values calculated at the aggregate level

|                       | Version 1: 20% |          | Version 2: 40% |          | Version 3: 60% |          |
|-----------------------|----------------|----------|----------------|----------|----------------|----------|
|                       | Loss           | Gain     | Loss           | Gain     | Loss           | Gain     |
| Number of respondents | 78             | 78       | 80             | 80       | 83             | 83       |
| Mean number of years traded | 0.99      | 1.47     | 1.81           | 1.33     | 2.45           | 1.51     |
| Mean Annual Income (Euros) | 17,471 | 17,471   | 15,771         | 15,771   | 20,829         | 20,829   |
| Value of a QALY (Euros) | 17,824         | 2,805    | 19,082         | 25,353   | 30,181         | 49,437   |
Table 4. Weighted mean QALY values for different income brackets

| Respondent Income Level | Weighted Mean QALY value |
|-------------------------|--------------------------|
| **Individual Approach** |                          |
| Less than 12,000 euros  | 45,837                   |
| 12,000 to 17,999 euros  | 39,097                   |
| 18,000 to 23,999 euros  | 66,060                   |
| >24,000 euros           | 43,240                   |
| **Aggregate Approach**  |                          |
| Less than 12,000 euros  | 10,401                   |
| 12,000 to 17,999 euros  | 41,770                   |
| 18,000 to 23,999 euros  | 30,986                   |
| >24,000 euros           | 30,137                   |
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