
Article:
Dolan, P. and Tsuchiya, A. orcid.org/0000-0003-4245-5399 (2010) Determining the parameters in a social welfare function using stated preference data: an application to health. Applied Economics, 43 (18). pp. 2241-2250. ISSN 0003-6846

https://doi.org/10.1080/00036840903166244

Resubmitted to *Applied Economics* Feb 09

Determining the parameters in a social welfare function using stated preference data: an application to health

Paul Dolan

Professor of Economics, Imperial College Business School.

Aki Tsuchiya*

Reader in Economics and Health Economics, Department of Economics and the School of Health and Related Research, University of Sheffield.

* Corresponding author: A.Tsuchiya@sheffield.ac.uk. Department of Economics, University of Sheffield, S1 4DT, UK

ABSTRACT

One way in which economists might determine how best to balance the competing objectives of efficiency and equality is to specify a social welfare function (SWF). This paper looks at how the stated preferences of a sample of the general public can be used to estimate the shape of the SWF in the domain of health benefits. The results suggest that people are willing to make trade-offs between efficiency and equality and that these trade-offs are sensitive to what inequalities exist and to the groups across which those inequalities exist. (90 words)

JEL Classification: I10

Key words: social welfare function, preference elicitation, equality -efficiency trade-off

Running title:

Social welfare function and stated preference data on health

(60 characters with space)

Determining the parameters in social welfare functions using expressed preference data: an application to health

I. INTRODUCTION

An important consideration when establishing priorities in the public sector is the amount of benefit generated by alternative allocations. As a result, there has been considerable research effort devoted to developing technologies that allow the benefits from a range of public services to be measured and subsequently valued. If benefits were the only consideration, then the objectives of public policy could be defined in terms of the maximisation of these benefits. However, policy-makers, as well as the general public, are also likely to be concerned with how benefits are distributed.

Although standard economic models assume that people do not care about inequalities, there is increasing interest in the economics literature in people's preferences regarding fairness (Rabin 1993; Fehr and Schmidt, 1999). These models focus on self-centred inequality aversion in the sense that people care only about their own outcomes relative to those of other people, but they do not care about inequality amongst other people *per se*. This has important implications for how social welfare functions (SWFs) are constructed and how preferences are aggregated (for example, see Quesada, 2003). In this paper, we are concerned with an individual's distributional preferences as they relate to the treatment of other people. Specifically, our inquiry is into whether a SWF can be constructed from people's other-regarding, or social, preferences (Menzel, 1999).

The SWF is, in principle, a powerful device for determining how best to balance these competing objectives of efficiency and equality. However, in practice, there has hitherto been only limited success in developing a SWF that is operationally useful. There have been some attempts to estimate the parameters of SWFs from the stated preferences of individuals. For example, Amiel and Cowell (1999) have asked respondents to choose between different distributions of income across population groups.

Similar attempts have been made to estimate the SWF for health, using relatively small samples of students (Dolan and Robinson, 2001). In this context, a policy that maximises population health might be of relatively less benefit to less healthy groups, or a policy that reduces inequalities might forego the opportunity to improve the health of the relatively healthy. This paper demonstrates how the stated preferences of a sample of the general public can be used to estimate the parameters of a SWF in the domain of health. The issues addressed in this paper are of real policy concern in many countries, such as the United Kingdom, Australia and New Zealand, that have put into place policies that seek to improve overall population health *and* reduce health inequalities (Department of Health, 1999; Rice and Smith, 2001).

In order for the SWF approach to be operationally useful, two main questions need to be answered: 1) what type of SWF is to be employed; and 2) how is the shape of the SWF to be determined? Sections 2 and 3 deal with each of these questions in turn and Section 4 presents the design of an empirical study that elicited the public's preferences over two health programmes, one that maximises health and one that reduces inequalities in health between particular population subgroups. Section 5 shows how these data can be used to derive a set of relative weights to be given to a unit health gain to people from different population subgroups and hence to estimate the shape of the SWF. Section 6 discusses the implications of the results.

II. DEFINING THE SWF

The SWF in economics textbooks are welfarist in the sense that they rely on an individual's subjective assessment of her own well-being and, as such, they are concerned with the distribution of *individual utility*. In the few empirical studies that have sought to empirically estimate the parameters in a SWF, economists have used more readily quantifiable proxies for utility, such as in income (Amiel and Cowell, 1999). Health economics have a tradition of expressing utility in health-related terms e.g. in terms of quality-adjusted life years (QALYs), where the quality adjustment weight – the 'Q' in the QALY – is typically defined in terms of dimensions of a health state classification system (see for example Drummond *et al*, 2005). Whilst health (and income for that matter) represents only a sub-set of the determinants of utility, it more readily allows for interpersonal comparisons and may suffer from fewer of the ethical

problems with comparisons of utility identified by Sen (1992). From a public policy perspective, citizens and policy-makers may well prefer to focus on the distribution of health across society rather than on the distribution of utility (see for example, Dolan and Olsen, 2002; Tsuchiya and Miyamoto, 2009).

In short, there are good normative and practical reasons for defining a *health-related* SWF in terms of the different levels of health experienced by different groups (Dolan 1998). In this paper, differences in health are represented as differences in average life. When the analytical objective is that of searching for a more equal distribution of health (rather than utility or health-related utility), a SWF in terms of health is potentially more useful in a policy context since life is more readily interpersonally comparable than utilities (see Olsen 1997).

In this study, we assume that health–related social welfare is a function of: a) the average levels of health of different groups within a given population; and b) the inequalities in health that exist between those groups. Of course, differences in health exist *within* any population sub-group, as well as *between* groups. In principle, the SWF could be estimated across groups of any size, including across individuals, but in practice it would be impossible to get reliable health data at such a micro level.

There are a number of functional forms that this SWF can take. In order to deal with varying degrees of inequality, an additive SWF with convexity to the origin to allow for inequality aversion has been widely used in the literature (Atkinson, 1970; Little and Mirrlees, 1974; Layard and Walters, 1994). Let us start with a SWF with a constant elasticity of substitution (CES):

$$W_{[1]} = \left[\alpha H_a^{-r} + \beta H_b^{-r}\right]^{-\frac{1}{r}}, \qquad H_a, H_b > 0, \quad \alpha + \beta = 1, \quad r \geq -1, \quad r \neq 0, \qquad [1]$$

where W is the health-related social welfare and H_a and H_b are the average levels of health of groups of equal size. (The function is, of course, generalisable to more than two groups, and to groups of different sizes.) The nature of the SWF, and the resulting iso-welfare curves, is determined by r and α.

The parameter r measures the degree of aversion to inequality, as represented by the convexity of the iso-welfare curves. If $r = -1$, social welfare is equal to the sum of individual health and there is no aversion to inequality. This utilitarian-type SWF results in iso-welfare contours that are straight lines with a gradient of -1. If $r > -1$, there is aversion to inequality, or diminishing marginal rate of social substitution (MRSS) between the health of the two groups: along a given iso-welfare curve, the greater the inequalities in health between the two groups, the greater is the weight given to the worse-off group relative to the better-off group. In the extreme, r approaches ∞ and all that matters is the health of the worse-off group. This results in a Rawlsian-type SWF with right-angled iso-welfare curves.

The parameters α and β determine the rate at which the welfare of subgroups a and b enter the social welfare calculus. It might be argued, for example, that relatively less weight should be given to those who considered more responsible for their poor health (Le Grand, 1991; Schokkaeart and Devooght, 2003). In the literature on SWFs, however, it is common to assume 'anonymity', which implies that both individuals and groups are equally deserving of any given gain in well-being (Musgrave, 1959; Harsanyi, 1982; Boadway and Bruce, 1984). In this paper, we will also make this anonymity assumption i.e. that $\alpha = \beta = 0.5$.

The objective of this study is to derive the implied weights to be given to a unit health gain to one group relative to another. This is represented as the MRSS along the relevant iso-welfare curve. As such, reference is made only to *contours* of the SWF, and not to the *level* of social welfare implied by these contours. In this respect, the CES SWF is equivalent to the Atkinson SWF (Atkinson, 1970) that was first proposed to address income distributions and has been applied to the health context (Wagstaff, 1994). The CES specification is chosen as the baseline specification because it is individualistic, additive, non-decreasing (or monotonic), strictly concave, exhibits constant relative inequality aversion (or scale independence or homotheticity) and, with $\alpha = \beta$, it also satisfies anonymity, and thus, satisfies all the conventional requirements of a SWF.

We will also look at two alternative SWF specifications by way of sensitivity analysis. These are derived from the generic form:

$$W_{[2]} = (H_a + H_b)^{\kappa} - c\left|H_a - H_b\right|^{\lambda}, \quad \text{where } \kappa > 0,\ \frac{\lambda}{\kappa} \geq 1,\ c \geq 0, \qquad [2]$$

which provides a family of SWFs that are increasing in total health and decreasing in inequality in health (Abásolo and Tsuchiya, 2004).

When $\varkappa = \lambda = 2$, the contours become hyperbolic and when $\varkappa = 1$ and $\lambda = 2$, they become parabolic. The parabolic and hyperbolic specifications are individualistic, additive, inequality averse and symmetric. The parabolic specification satisfies constant relative inequality aversion, while the hyperbolic specification satisfies constant absolute inequality aversion instead. The main characteristic of these two specifications is that beyond a given level of inequality, social welfare ceases to be non-decreasing in composite health.

III. ESTIMATING THE MRSS GIVEN A SWF SPECIFICATION

The question now is how do we identify the MRS, given a SWF specification? One way is to elicit the preferences of the general public over stylised questions specifically designed to allow us to identify points on the same social welfare contour. Williams (1997) suggests that respondents could be presented with the current unequal distribution of health and then asked to think about an equal distribution of health that makes them indifferent between the two distributions, which corresponds to the concept of equally distributed equivalent income by Atkinson (1970). In this way, the general format of the questions would be similar to those used in empirical studies that have attempted to measure the degree of inequality aversion in relation to income distributions (Amiel and Cowell, 1999; Amiel *et al*, 1999). However, whilst it is possible to take income from one person and transfer it to another, it is not possible to redistribute health in the same way. Therefore, it seems more appropriate to design the empirical study in terms of the distribution of *gains* in health from an initial position.

Figure 1 shows the basis of the questions. The initial situation (I) is presented to respondents together with a programme (A) that will benefit both groups by the same amount. They are then presented with an alternative programme (B) that targets the benefit on the worse-off group. The aim then is to determine, in an iterative way, how much Programme B would have to benefit the worse-off group

in order to be considered equally as valuable as Programme A. Once indifference between Programmes A and B has been established, the MRSS of the SWF can be calculated.

For the baseline CES specification, the value of r can be obtained by using standard spreadsheet procedures (e.g. the "goal seek" tool in MS Excel), by looking for the value of r that makes $W_{[1]}$ identical at two points, X and Y. Alternatively, for a mathematical solution, see Abásolo and Tsuchiya (2004). The weight implied to the less advantaged group a relative to group b is calculated from the MRSS:

$$-\frac{dH_b}{dH_a} = \left[\frac{H_b}{H_a}\right]^{(1+r)}.$$

Provided $r > -1$, MRSS increases exponentially with the extent of the equality - efficiency trade-off (since the iso-welfare contour in Figure 1 is convex), and so the mean of any group of values would give greater relative weight to the preferences of those most concerned about equality. This makes it difficult to account for the strength of each individual's preferences in the overall preferences of a group. For this reason, we will concentrate our analysis and interpretation on the median. Use of the median is also consistent with the median voter rule, which has been used to model public policy choices (Mueller 1979). Furthermore, the relationship between the number of years traded off and the level of inequality aversion implies that the mean of the former will not correspond to the mean of the latter, thus making the median a more attractive summary measure to use.

For the hyperbolic and the parabolic specifications, suppose $H_a(X)$, $H_b(X)$ and $H_a(Y)$, $H_b(Y)$ represent two points on the same indifference curve. By solving $W_{[2]}(X)=W_{[2]}(Y)$ for C:

$$C = \frac{\left[H_a(X)+H_b(X)\right]^{\alpha} - \left[H_a(Y)+H_b(Y)\right]^{\alpha}}{\left[H_a(X)-H_b(X)\right]^{\beta} - \left[H_a(Y)-H_b(Y)\right]^{\beta}},$$

the relative weight for the less advantaged group at point (H_a,H_b) will be given by:

$$-\frac{dH_b}{dH_a} = \frac{\alpha\left[H_a+H_b\right]^{(\alpha-1)} - C\beta\left[H_a-H_b\right]^{(\beta-1)}}{\alpha\left[H_a+H_b\right]^{(\alpha-1)} + C\beta\left[H_a-H_b\right]^{(\beta-1)}}.$$

Any one respondent could be asked to adopt a number of different *perspectives* when answering questions of the kind used in this study (see Dolan *et al*, 2003). In this study, we asked respondents to adopt a citizen-type perspective, where they are not explicitly asked to think about being in either group. This is the perspective adopted by Amiel and Cowell (1999) in their empirical studies on income inequalities. To us, and as famously emphasised by Rousseau (1762), there is a legitimate distinction between a person's self-regarding preferences based on her own self-interest and her society-regarding preferences which reflect her views about what society should look like. The distinction has more recently received attention – and support – from a number of economists and political scientists, including Harsanyi (1955) and Etzioni (1986). We therefore collected information on a range of background characteristics in order to examine the extent to which self-interest might be playing a part in responses.

IV. THE QUESTIONNAIRE DESIGN

Differences in health in this study, as noted in Section 2, have been defined in terms of average life expectancy. The most obvious differences in mortality in the UK exist between the social classes (Acheson 1998). Of the six social classes often used in British surveys, we employ data concerning the top and the bottom classes, which highlights the extent of the prevailing inequalities and has the advantage that the fraction of the population in each of these classes is roughly the same (about 7% in each case). On average, people in the highest social class (such as doctors and other professionals) live five years longer than those in the lowest social class (unskilled manual workers such as cleaners.

Scenarios with population subgroups other than social class are also used. Differences of the same magnitude (five years) in average life expectancy exist between women and men. This means that by presenting separate respondents with identical questions regarding life expectancy, but relating them to differences by sex instead of by social class, it is possible to test whether the degree of inequality aversion is a function of the groups across which the inequalities exist. To further test the sensitivity of inequality aversion, other respondents were presented with the same life expectancy differences across groups that were simply defined as the 'healthiest 20%' and the 'unhealthiest 20%' of the population.

The questionnaire was administered during a face-to-face interview, which gave the interviewer the opportunity to assess the respondent's understanding of the task and provided the respondent with the opportunity to ask any clarificatory questions. The interview began with a brief description of the task and an explanation of the population sub-group used. The questionnaire was developed through in-depth interviews and extensive piloting, during which time it emerged that the clearest way in which to represent the health of the two groups was in the form of graphical representations, as shown in the Appendix. Respondents were first asked to make a discrete choice between Programme A (that benefits both groups by the same amount) and Programme B (that targets the same amount of overall benefit on the worse-off group). They were told that the two groups were of approximately equal size and that the two Programmes would cost the same.

For those respondents who chose Programme A, it was assumed that, since they were unwilling to target the worse off group when overall benefits were the same, they would also be unwilling to target the worse off group when overall benefits were reduced, and so no further sub-questions were asked. Those respondents who chose Programme B were presented with a series of pairwise choices in which the benefits from choosing B were gradually reduced. This order was chosen to make the trade-off between efficiency and equality as transparent as possible and because it was felt that it would be cognitively less demanding for respondents than a random order that would have required them to 'jump around' between different trade-offs. Note that respondents were not provided with the opportunity to state that they were indifferent between the two Programmes. This option was in the pilot interviews but was never chosen and in fact caused confusion.

The interviews were carried out in two rounds using different respondents. In the first round around half the respondents were given the social class scenario and the other half were given the sex scenario. In the second round around half the respondents were given the social class scenario and the other half were given the quintiles scenario. The response categories presented in the two rounds (independently of scenario) are shown in Table 1. Respondents in the first round who initially chose Programme B were presented with six additional pairwise

choices. The response categories in the second round of interviews were revised in the light of the distribution of responses from the first round, resulting in only four additional pairwise choices in the second round. In addition to some of the response categories in the first round being largely redundant, this allowed us to test whether respondents were following a particular pattern of responses e.g. choosing the middle option.

For those respondents who initially chose to target on Programme B but then switched at some point to Programme A, their point of indifference has been taken to be half-way between the last point at which they chose B and the first point at which they chose A. The first columns of Table 2 present the implied points of indifference, their associated inequality aversion parameters depending on SWF specification, and their corresponding implied relative weights to the worst off group at the initial point, given the options in Table 1. The precise trade-offs made by those who choose not to target and by those who always choose to target are indeterminate, and so, strictly speaking, inequality aversion can only be calculated for those respondents who switch from Programme B to Programme A at some point. Having said this, for those who chose A in the initial pairwise comparison, we have assumed that they are inequality neutral (although we cannot rule out the possibility that some respondents may have favoured increased inequality). For those who always chose B, we have assumed that they are indifferent at the implied point presented on the last row, but again we cannot be sure.

As can be seen, the choice functional form for the SWF does not have much effect on the relative weight given to the two groups except in the highly inequality averse region. And even in this range, it is more important to identify the preferences accurately than it is to identify the correct functional form to represent those preferences. Under extreme inequality aversion, where a reduction in inequality is preferred even when it entails loss in the health of the better off so that the monotonicity principle is violated, the CES specification can no longer accommodate such preferences. However, the hyperbolic and the parabolic specifications can, and the relative weights across these two functional forms are similar to each other.

V. THE EMPIRICAL STUDY

In order to interview a broadly representative sample of the general population, every 8th person on the electoral register in three wards in York, UK, was contacted and invited to participate, for which they would receive £15. Out of a total of 1,500 letters of invitation, 467 people (31%) agreed to take part. To ensure representativeness, 140 respondents were selected for interview based on information on a broad range of characteristics obtained from their reply slips. In total, 130 individuals were interviewed. The interviews took place at the University of York and lasted for about an hour. The achieved sample was broadly representative of the population of the Yorkshire and Humberside region: 48% were male (compared to 47% for the region as a whole); 50% were aged under 45 (compared to 50%); 67% had children (compared to 66%); 54% were employed (compared to 56%); and 60% had the minimum level of education (compared to 61%). This paper is based on the life expectancy question, which appeared at the beginning of the interview and was answered by all 130 respondents.

The results are summarised in Table 2 where the last five columns present the distribution of responses. The numbers of respondents were 29 and 37 for the social class scenario across the two rounds, 31 for the sex scenario (in round one) and 33 for the quintiles scenario (in round two). Since the implied trade-offs that respondents made between the social classes did not differ across the rounds (Mann Whitney U Test, $p>0.05$), pooled responses are also reported. Using these pooled results, the median respondent is indifferent between people in the highest and lowest social classes living on average to be 80 and 75, respectively (i.e. the outcome for choosing Programme A), and these groups living to be 78 and 75.5, respectively (i.e. the outcome for Programme B from the median respondent). Depending on the SWF specification, this implies that a marginal health gain to the lowest social class is valued 6.8 to 9.9 times more than a marginal health gain to the highest social class. This is also the median response when the sub-groups are defined in terms of the healthiest and unhealthiest quintiles of the population. However, when identical data are presented but the sub-groups are defined by sex, the median preference is to favour no targeting of men at all, thus implying that a marginal health gain to men and to women are equally valued. The responses were not related to any of the personal characteristics (using the χ^2 test, $p>0.05$).

VI. DISCUSSION

This study has sought to determine the shape of a health-related SWF from people's stated preferences over various equality -efficiency trade-offs. While a CES was used as the baseline specification, similar results are derived from the hyperbolic and the parabolic specifications.

Overall, the results seem plausible, suggesting that there is aversion to inequalities in life expectancy, but its extent is sensitive to the groups across which the inequalities exist. However, the study also raises a number of methodological issues that warrant further discussion. In the first part of each question, the information regarding the size of the health gains of the two Programmes was easy to understand and, in the second part of each question, the implications of choices were made clear through changes in the size of the bars on the graph. Nevertheless, to facilitate this visual representation, the scales on the graphs did not start at zero (see the Appendix), and this could have led some respondents to perceive that the relative difference between the two groups was larger than it really was.

In general, it has been shown that very subtle changes in the framing of a question can sometimes have a dramatic effect on responses (for an excellent review, see Rabin 1998). This study was designed to minimise the effects of certain framing effects but it is impossible to remove every potential bias. For example, we were aware of the evidence from other studies that suggests that respondents might be reluctant to give all the benefit to one individual or group (see, for example, Cuadras-Morato *et al* 2001). We went further, though, and asked respondents who chose not to target if they would have targeted if there had instead been a one-year benefit to the better-off group (and hence a three-year benefit to the worse-off group). None of these respondents chose to revise their answers.

It is now well established that respondents may give greater weight to the losses of one group as compared to an equivalent gain to the other group (Schweitzer 1995). Therefore, the questions were designed so that neither Programme in the two questions involved any losses, and so that neither Programme was presented as representing the status quo. However, it is possible that loss aversion may also be

present when considering *potential* as well as actual losses from a particular reference point (Dolan and Robinson 2001). Therefore, if some respondents adopted the potential gains available to both groups in Programme A as their reference point, then Programme B would involve a 'loss' to the better-off group. It would be interesting, and policy relevant, to test with further research how sensitive the degree of inequality aversion is to variation in the initial situation.

There is a status quo bias of a different kind that might have made respondents more inclined to stick with Programme B if they chose it initially. This relates to the fact that respondents were always presented with response categories in the same order; that is, Programmes A and B start out being equally effective and then B becomes incrementally less effective. This ordering was chosen to make the equality -efficiency trade-off as transparent as possible and was informed by the results from the pilot interviews which suggested that the trade-off questions would have been cognitively too difficult if the ordering of the response categories was randomised. However, there is the possibility of a status quo bias whereby some respondents get 'locked into' choosing B throughout (see Samuelsen and Zeckhauser 1988). On the other hand, there is some limited evidence that shows there may be a 'left hand side' bias: when respondents are asked to choose between two options laid out next to each other, the default choice is the option on the left hand side, and the right hand side option will be chosen only when it is significantly more preferable than the default option on the left hand side (see, for example, McIntosh and Ryan, 2003). Thus, there are two potential biases working in opposite directions.

Despite these concerns about the data, we believe that this study represents an advance in terms of both the methodology used and the implications for future research that seeks to enhance the policy usefulness of stated preference data. It suggests that people are willing to forego overall health in order to reduce differences in average life expectancy between the social classes. On the other hand, differences in the average life expectancies of men and women did not seem to matter much at all, with the median respondent unwilling to sacrifice any overall gains in life expectancy in order to target men. Tsuchiya and Williams (2005) tries

to get behind some of the reasons for the very different attitudes towards health inequalities by sex as compared to those by social class.

In conclusion, this study has demonstrated that, using carefully designed questionnaire instruments, the SWF can develop from being a theoretical construct to becoming a potentially powerful practical policy tool. A survey instrument can be designed that elicits meaningful trade-off responses from the general population that can then be used to determine the shape of the SWF. We therefore believe that the study indicates a promising new avenue of economic enquiry that is relevant to important policy questions in health care and other areas of public policy.

ACKNOWLEDGEMENTS

We are indebted to Rebecca Shaw who conducted the interviews. The Economic and Social Research Council (Award No: L128251050) supported Rebecca Shaw and the fieldwork. We would like to thank John Cairns, Angus Deaton, Atsushi Higuchi, Daniel Kahneman, Peter Lambert, Chris McCabe, Jan Abel Olsen, and the anonymous referee for *Applied Economics* for their helpful comments. The paper has also benefited from the comments made by participants at a range of seminars, including those held at Princeton, Toronto, East Anglia and Oslo. We are grateful to all the respondents who agreed to take part. Last but not least, special thanks are due to Peter Smith and Alan Williams. The usual disclaimers apply.

REFERENCES

Abásolo, I, and A. Tsuchiya, (2004), Exploring social welfare functions and violation of monotonicity: an example fro inequalities in health. *Journal of Health Economics*, **23**(2), 313-329

Amiel, Y. and F.A. Cowell, (1999). *Thinking about Inequality*. Cambridge: Cambridge University Press.

Amiel, Y., Y.J. Creedy and S. Hurn, (1999), Measuring attitudes towards inequality. *Scandinavian Journal of Economics*, **101**(1), 83-96.

Atkinson, A.B., (1970), On the measurement of inequality. *Journal of Economic Theory*, **2**, 244-263.

Barry, B.M., (1989), *A treatise on social justice*, vol I: Theories of justice. University of California Press.

Boadway, R. and Bruce, N., 1984, *Welfare Economics*. Basil Blackwell.

Cuadras-Morato, X., Pinto-Prades, J.L. and Abellan-Perpinan, J.M., (2001), Equity considerations in health care: the relevance of claims, *Health Economics*, **10**(3),187-205.

Department of Health, (1999), *Saving lives: Our healthier nation*, CM4386, July 1999.

Dolan, P., (1998), The measurement of individual utility and social welfare. *Journal of Health Economics*, **17**, 39-52.

Dolan, P. and Robinson, A. (2001), The measurement of preferences over the distribution of benefits: the importance of reference points. *European Economic Review*, **45**(9), 1697-1709.

Dolan, P., Olsen, J.A., (2002) *Distributing Health Care: Economics and Ethical Issues*, Oxford University Press

Dolan, P., Olsen, J.A., Menzel, P. and Richardson J., (2003) An inquiry into the different perspectives that can be used to elicit preferences to inform priority-setting, *Health Economics*, **12**, 7, 545-551.

Drummond, M.F., Sculpher, M.J., Torrance, G.W., O'Brien, B.J., Stoddart, G.L., (2005), *Methods for the Economic Evaluation of Health Care Programmes*, 3rd ed, Oxford University Press

Etzioni, A., (1986), The case for a multiple utility conception, *Economics and Philosophy*, **2**, 159-183.

Fehr, E. and Schmidt, KM., (1999), A theory of fairness, competition and cooperation, *Quarterly Journal of Economics*, **114**(3) 817-868.

Harsanyi, J.C., (1955), Cardinal welfare, individualistic ethics and interpersonal comparisons of utility, *Journal of Political Economy*, **63**, 309-321.

Harsanyi, J.C., (1982), Morality and the theory of rational behaviour. In A. Sen and B. Williams eds. *Utilitarianism and Beyond*, Cambridge University Press.

Independent Inquiry into Inequalities in Health, (1998*), Independent Inquiry into Inequalities in Health Report (The Acheson Report)*. London: The Stationary Office.

Layard, R. and A.A. Walters, (1994), Allowing for income distribution. In R. Layard and S. Glasiter eds. *Cost-Benefit Analysis*, 2nd ed. Cambridge University Press (reprinted from R. Layard and A.A. Walters, 1978, *Microeconomic Theory*, McGraw-Hill)

Le Grand, J., (1991), *Equity and choice*, Harper Collins, London.

Little, I.M.D. and J.A. Mirrlees, (1974), *Project appraisal and planning for developing countries*: Heinemann Educational Books.

Menzel, P., (1999), How should what economists call 'social values' be measured?, *The Journal of Ethics*, **3**, 249-273.

McIntosh, E. and Ryan, M. (2003) *Eliciting preferences for hernia repair: A comparison of strength of preference modelling and discrete choice experiments*. In Health Economists' Study Group Brunel.

Mueller, D., (1979), *Public Choice*, Cambridge University Press.

Musgrave, R.A., (1959), *The Theory of Public Finance*, McGraw Hill.

Olsen, J.A., (1997), Theories of justice and their implications for priority setting in health care. *Journal of Health Economics*, **16**, 625-639.

Quesada, A. (2003), Positional independence in preference aggregation, *Social Choice and Welfare*, **20**, 3, 363-370.

Rabin, M, (1993). Incorporating fairness into game theory and economics. *American Economic Review*, **83**, 1281-1302.

Rabin, M, (1998), Psychology and economics. *Journal of Economic Literature*, **36**, 11-46.

Rice, N. and P. Smith, (2001), *Capitation and Risk Adjustment in Health Care Financing: An International Progress* Report, Millbank Quarterly, **79**, 1.

Rousseau, J.J., (1762), *The Social Contract*, (1998 translation) London:Wordsworth

Samuelson, W. and R. Zeckhauser, (1988), Status quo bias in decision-making, *Journal of Risk and Uncertainty*, **1**: 7-59

Sen, A., (1992), *Inequality reexamined*. Oxford University Press.

Schweitzer, M, (1995), Multiple reference points, framing, and the status-quo bias in health-care financing decisions, *Organizational Behavior and Human Decision Processes*, **63**, 69-72.

Schokkaert,E., Devooght, K. (2003), Responsibility-Sensitive Fair Compensation in Different Cultures, *Social Choice and Welfare* **21**, 2, 207-242.

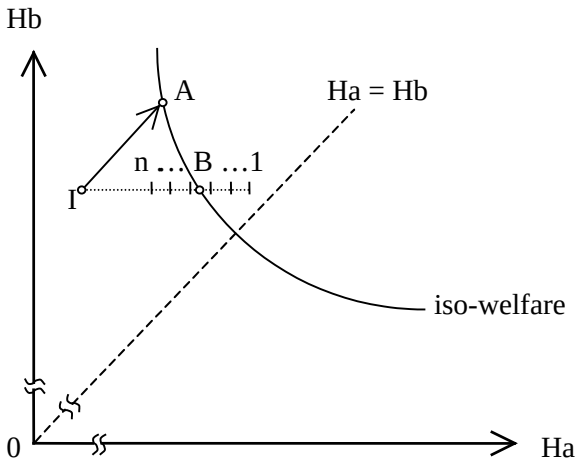
Tsuchiya, A., Miyamoto, J. (2009), Chapter 20 Social choice in health and health care, in Anand, P., Puppe, C., Pattanaik, P. eds, *Handbook of Rational and Social Choice*, Oxford University Press

Tsuchiya, A., Williams, A. (2005), A "Fair Innings" Between the Sexes: Are Men Being Treated Inequitably?, *Social Science & Medicine*, 60: 277-286

Wagstaff, A, (1994), QALYs and the equity-efficiency tradeoff, In *Cost-Benefit Analysis*, Layard, A. and Glaister, S. eds, Cambridge University Press (reprinted from *Journal of Health Economics*, 10:21-41, 1991 with corrections).

Williams, A, 1997, Intergenerational equity: an exploration of the 'fair innings' argument. *Health Economics*, **6**, 117-132.

Figure 1: The SWF and the life expectancy questions



H_a: health of the less advantaged group

H_b: health of the more advantaged group

I: initial point

It is assumed that $\alpha = \beta$

A: outcome offered by Programme A

the horizontal broken line: the set of options (1 to *n*) offered by the alternative Programme B

B: the point at which the median respondent is indifferent between the two Programmes, and thus the point through which the iso-welfare curve crosses the broken line

Table 1: The response options

The initial situation is one in which group a (the worst-off group) live to be 73 and group b (the best-off group) live to be 78. The numbers in the Table show average increases in life expectancy per group depending on the Programmes chosen for each of the pairwise choices.

1st round of interviews				2nd round of interviews			
Programme A		Programme B		Programme A		Programme B	
Group a	Group b	Group a	Group b	Group a	Group b	Group a	Group b
+2	+2	+4	+0	+2	+2	+4	+0
+2	+2	+3.5	+0	-	-	-	-
+2	+2	+3	+0	+2	+2	+3	+0
+2	+2	+2.5	+0	-	-	-	-
+2	+2	+2	+0	+2	+2	+2	+0
+2	+2	+1.5	+0	+2	+2	+1.5	+0
+2	+2	+1	+0	+2	+2	+1	+0

"-" indicates where a response category was not offered to respondents

Table 2: The three SWF specifications and the results

Indifference points as inferred from response options	CES		hyperbolic		parabolic		Social class[3]			Sex [3] (n=31)	Quintiles[3] (n=33)
	inequality aversion parameter[1]	relative weight at initial point[2]	inequality aversion parameter[1]	relative weight at initial point[2]	inequality aversion parameter[1]	relative weight at initial point[2]	Round 1 (n= 29)	Round 2 (n=37)	Pooled (n=66)		
(75,80) ~ (77,78)	-1.0	1.00	0.00	1.00	0.00	1.00	9	15	24	**20**	12
(75,80) ~ (76.75,78)	2.3	1.25	3.30	1.25	0.01	1.24	0	-	0	1	-
(75,80) ~ (76.5,78)	5.9	1.58	6.80	1.58	0.02	1.56	-	5	5	-	2
(75,80) ~ (76.25,78)	9.8	2.05	10.57	2.08	0.03	2.04	0	-	0	0	-
(75,80) ~ (75.75,78)	20.1	4.04	19.36	4.57	0.06	4.36	2	-	2	1	-
(75,80) ~ (75.50,78)	27.9	6.80	24.68	9.94	0.08	9.00	-	11	**11**	-	**14**
(75,80) ~ (75.25,78)	41.2	16.38	30.94	-83.12	0.10	-559.00	11	-	11	5	-
(75,80) ~ (74.75,78)	unspecified	unspecified	47.96	-4.40	0.16	-4.58	4	5	9	3	3
(75,80) ~ (74.25,78)	unspecified	unspecified	77.25	-2.28	0.25	-2.32	0	0	0	-	1
(75,80) ~ (73.5,78)	unspecified	unspecified	225.84	-1.31	0.74	-1.31	3	1	4	1	1

Notes

1. Inequality aversion parameter is *r* for the CES, *C* for the hyperbolic and the parabolic

2. Relative weight at initial point is the implied equality weight given to group b relative to group *a* at the initial point where life expectancy for groups a and *b* are 73 and 78 respectively.

3. Median respondent in bold; "-" indicates where a response category was not offered to respondents

Appendix: Example of the questions across social class

As you might know, average life expectancy differs by social class.

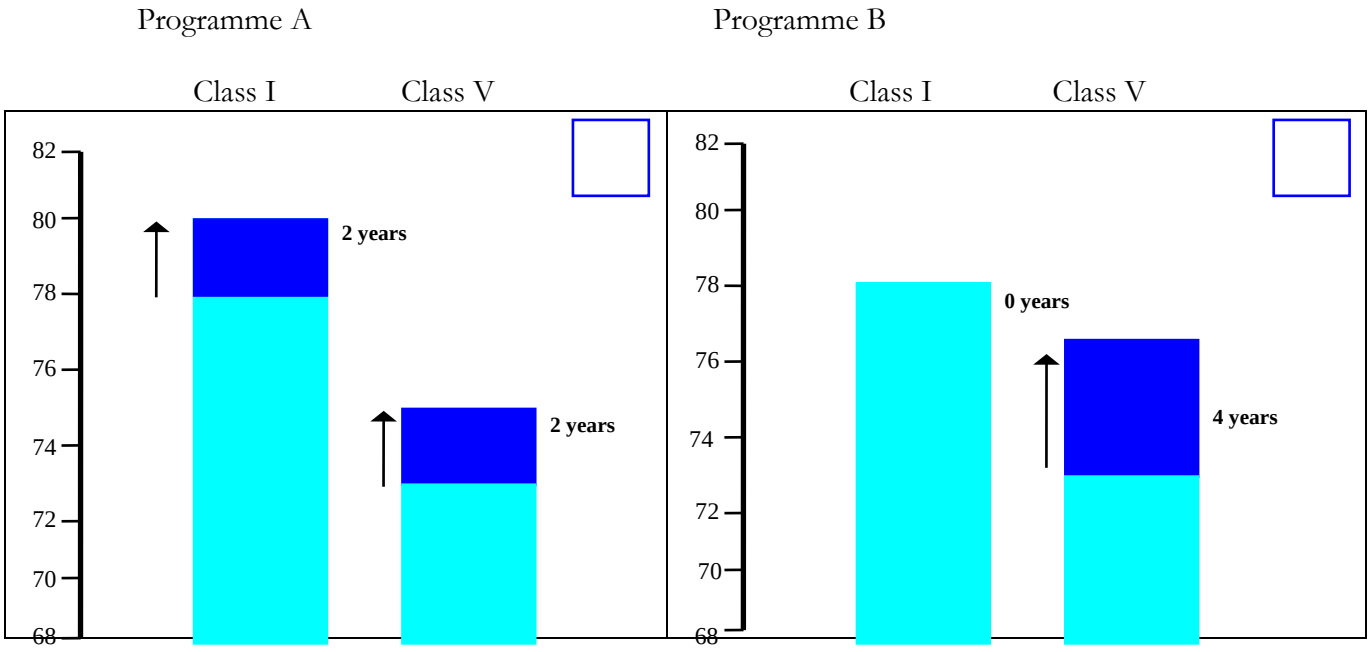
Whilst actual life expectancy varies between individuals, on average, people in social class 1 live to be 78 and in social class 5 they live to be 73.

Imagine that you are asked to choose between two programmes which will increase average life expectancy. Both programmes cost the same.

In the two graphs below the light grey part shows average life expectancy, and the dark grey part shows the increase in life expectancy. There is a separate graph for each of the programmes.

As you can see, Programme A is aimed at both social classes equally and Programme B is aimed more at social class 5.

Please indicate whether you would choose A or B by ticking one box.



If the respondent chose A, that was the end of the question. If the respondent chose B, she was told:

"Choosing Programme B might mean that the increase in life expectancy is less overall. For each of the six [or four, depending on the round] choices below, please tick one box to indicate whether you would still choose B, or whether you would now choose A."

The presentation of the choices was of the same kind as that illustrated above