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The measurement of preferences over the distribution of benefits: The importance of the reference point

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Abstract

This paper uses the Atkinson method, which was initially developed to measure the shape of the social welfare function (SWF) in the domain of income, to measure the shape of the SWF with respect to the distribution of health benefits. Two separate studies were conducted involving a total of 71 respondents. A comparison of the results across the two studies suggests that reference point effects play an important role in determining responses. Thus, more research is needed on the role that reference point effects ought to and do play in determining the nature and extent of the efficiency – equity trade-off before the results of studies of this kind can be interpreted as 'equity parameters' which may simply be 'plugged into' an appropriately specified SWF.

JEL classification: I1

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1. 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

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been considerable research effort devoted to developing technologies which 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. To measure this trade-off between efficiency and equity requires estimation of the appropriate social welfare function (SWF). The question is how? This paper looks at how one well-known way to estimate the shape of the SWF – the Atkinson index – can be used to measure the efficiency – equity trade-off in the domain of health benefits.

2. The Atkinson method

The method first described by Atkinson (1970) was initially designed to measure the shape of the SWF with respect to income distribution but in principle it can be used to measure the SWF with respect to the distribution of other commodities. Consider the case of health care. An important benefit here is the amount of health gain interventions confer on their recipients.[1] However, people may be willing to accept a lower total health gain for a more equitable distribution of this gain.[2]

When using the Atkinson method in the domain of health, it is necessary to make one important modification. In the original formulation, one unequally distributed income was compared with another equally distributed income but, whilst it is possible to transfer income between individuals, it is not possible to redistribute health in the same way. Therefore, Atkinson's method in this paper has been applied to *gains* in health, rather than to health *per se*.

The framework is illustrated in Fig. 1. The axes represent the value of different health states to X and Y.[3] Consider an initial situation, represented by point A, in which two individuals, X and Y, are in the same health state. Assume that under the current allocation of resources, it is possible to treat both individuals so that point B can be reached. According to the Atkinson method, there will be some level of health gain, ξ, that equally distributed between X and Y has the same social value as B. For example, an individual who is indifferent between points B and C (which is drawn at a perpendicular from B to the 45° line) would

[1] Whilst recognising that health care may confer benefits other than improved health status (Mooney, 1994), for the purposes of this paper benefits will be defined as health gain.

[2] There are clearly a number of other definitions of equity (Culyer, 1995), each with different implications for the allocation of resources, but in this paper equity is defined exclusively in terms of the distribution of health gain.

[3] It is assumed that an appropriate method of valuation exists which allows different states of health to be valued on a scale with interval properties.

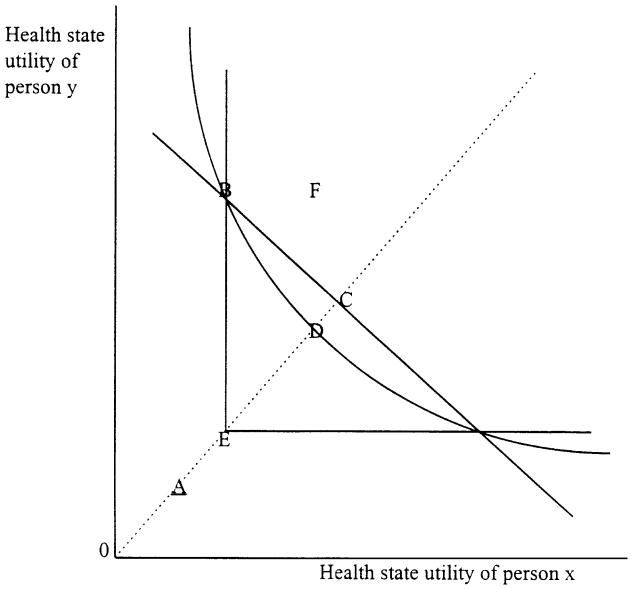

Fig. 1. The Atkinson social welfare function.

be inequality neutral since these two points yield the same total health gain. Such a preference implies a utilitarian SWF. For an individual who is inequality averse, the SWF would be convex to the origin and in the diagram cuts the 45° line at point D. Clearly, the more convex is this contour, the greater the inequality aversion. In the case of a Rawlsian SWF, the contour is parallel to the x- and y-axis such that point E yields the same social value as point B.

To quantify the extent to which the size of the total health gain is weighed against the distribution of that gain, an index, R, is calculated as $1 - \xi/M$, where M represents the mean gain across X and Y in the state of the world (such as that represented by point B in Fig. 1) where the gains are distributed unequally. An inequality neutral individual will set the equally distributed gain, ξ, equal to M, and hence $R = 0$. For an inequality averse individual, who is prepared to accept less total gain in order to achieve equality, $R > 0$, since $\xi < M$. For an individual with preferences akin to the Rawlsian SWF, R is at its upper boundary point.[4] And for an individual who is inequality prone $R < 0$, since

[4] The precise boundary points on the Atkinson index are defined by the initial distribution of health gain between the two individuals: when all the gain is initially going to one individual, a Rawlsian would forego the entire amount of health gain in order to achieve equity. In such circumstances, $R = 1$. The more equitable the intial distribution the smaller is the range of values that R may take. This highlights the descriptive element embodied in the Atkinson index (Sen, 1982).

$\xi > M$. The interpretation of the value of R is intuitively appealing: for example, a value of 0.10 indicates that, if health gain were distributed equally, 90% of the total gain available in the inequitable position would be required to achieve the same level of social welfare. The Atkinson method, then, appears to provide a relatively straightfoward method to examine respondents' attitudes towards equity. Study one was designed to do precisely that.

3. Study one

In order to introduce respondents to the notion that health states have a 'value', they were first asked to value five health states on a 100-point scale, with 'full health' and 'dead' as endpoints and then asked to imagine a health state classification system which was sufficiently sensitive to result in a continuum of values covering the entire space between full health and dead. Respondents were then asked to make choices concerning the health status of two individuals, X and Y, who were assumed to have preferences over health states identical to their own. They were asked to suppose that X and Y are currently in the same health state.

The specific instructions that followed were: '*Treatments are available which will be of benefit to both individuals. However, because of the way in which resources are currently allocated between the treatments of the two individuals, Y would benefit more than X. Alternatively, resources could be re-allocated between the treatment of the two individuals in such a way that X and Y would end up in the same health state. We would like you to think about the value that you attach to this common health state so that you are indifferent between this common outcome and the different outcomes brought about by the current allocation of resources*'.

The different prospective health outcomes currently faced by X and Y were shown on the left-hand side of the page. On the right-hand side of the page, respondents were presented with a range of possible values for a common outcome which could be brought about by a re-allocation of resources. They were asked to place a tick next to that value of the common health state which would make them indifferent between both individuals ending up in that state and X and Y ending up in different states.

Since we wished to test respondents' attitudes towards equity when the two individuals differ *only* with respect to the health gain they derive under the current allocation, respondents were asked to assume that X and Y are identical in every other respect and that both would live for another 50 years and then die. Respondents were asked a series of questions using the starting points, mean gains and distributions indicated in Table 1. The sample comprised of 37 students on Health Economics courses at the Universities of Newcastle and Leeds. The mean age of respondents was 25 and the sample was made up of 18 men and 19 women. There were no missing data.

Table 1
Question parameters for study one

Question	Current health state: X and Y	Mean gain (M)	Distribution of gains $X:Y$	Outcomes under current allocation $X:Y$
1	2	60	1:4	26:98
2	2	15	1:4	8:26
3	2	60	1:2	42:82
4	2	15	1:2	12:22
5	40	15	1:4	46:64
6	76	15	1:4	82:100

Table 2
Results of study one

Question	Mean gain (M)	Equally distributed gain (ξ)		Atkinson index (R)[a]	
		Mean	Median	Mean	Median
1	60	60.32	60	− 0.005	0
2	15	16.24	15	− 0.083	0
3	60	60.54	60	− 0.009	0
4	15	16.03	15	− 0.050	0
5	15	15.76	15	− 0.050	0
6	15	14.70	15	0.020	0

[a]For each individual, the index is calculated as $1 - \xi/M$.

Table 2 presents the results from the first questionnaire in terms of the equally distributed gain responses and the corresponding value of the Atkinson index. The results indicate that, at the aggregate level, there is no tendency to trade-off total health gain for the sake of the distribution of that gain. At the individual level, 15 respondents were either inequality neutral or inequality prone throughout, 10 were either inequality neutral or inequality averse, whilst 12 exhibited all three attitudes to inequality in their set of responses.

4. Explaining the results

The results from this questionnaire suggest that when two individuals differ only with respect to the benefit they derive from treatment, respondents are, on average, indifferent between an allocation of resources where health gain is

unequally distributed between the individuals and one in which that same health gain is distributed equally. This apparent inequality neutrality runs counter to the findings of other studies which have attempted to measure the efficiency-equity trade-off using very different techniques to the one employed here. When faced with treatment decisions involving patients with different illnesses, respondents have been found to favour treating the more severely ill even when doing so results in lower overall benefits (Nord, 1993a). And when faced with treatment decisions involving patients with similar illnesses, respondents often favour giving the same priority to all patients, irrespective of their capacity to benefit (Nord, 1993b).

In their work on preferences over the distribution of cadaver livers for transplantation, Ubel and Loewenstein (1996a, b) found that the public appear to place a high value on giving everyone a chance of a transplant, even when that means there is a significant reduction in the probability that the available organs will save lives. This apparent willingness to forego health gain for the sake of equity has also been found in studies eliciting preferences for the implementation of population screening programs. For example, Ubel et al. (1996) found that when respondents were asked to choose between two screening tests for colorectal cancer, the majority favoured offering a less effective test to everyone, even though 100 more lives would have been saved by offering a more expensive test to only a portion of the population.

Such differences could be explained by the composition of our sample in that health economics students may simply be more likely to focus on efficiency considerations than other respondents. Alternatively, framing effects, which are now widely recognised to have a significant effect on responses (for an overview, see Payne et al., 1992), may be responsible for the differences in results. In particular, *reference point effects* may have played a significant role in determining the value of the index derived here. When proposing their Prospect theory, Kahnemann and Tversky (1979), suggested a form of value function in which individuals evaluate outcomes as gains or losses relative to some perceived reference point. One important characteristic of this function is that it is steeper at each level of loss than at the corresponding level of gain, i.e. losses are weighted more heavily than gains.[5]

Although the situation depicted in Fig. 1 does not involve any actual losses, respondents may have adopted the *potential* gains available under the current allocation of resources (i.e. point B) as their reference point, in which case reallocation towards equality involves a 'loss' to individual Y. Whenever Y's potential losses are weighted more heavily than X's potential gains, an inequality neutral respondent will set ξ *above* the mean gain, rather than *equal to* it. To

[5] Another important feature of the value function is that it exhibits risk aversion in the domain of gains and risk proneness in the domain of losses. However, the model has also been used to explain choices made under certainty (Kahnemann and Tversky, 1984).

illustrate, consider how an inequality neutral respondent might answer Question 1 which sought to elicit a value for ξ which would set $U(\xi, \xi)$ equal to $U(24, 96)$, where 24 and 96 are the potential gains available to X and Y under the current allocation of resources. If she weights the loss to Y the same as the gain to X then $U(96 - \xi) = U(\xi - 24)$, and she would set ξ equal to 60. However, if she were to weight Y's losses as twice as heavily as X's gains,[6] i.e., $2U(96 - \xi) = U(\xi - 24)$, then ξ must now take on a value of 72.

More generally, when a point such as B is adopted as the reference point, loss aversion is exerting upward pressure on the value of ξ and, hence, is working in precisely the opposite direction to inequality aversion. The two effects may then cancel one another out and, thus, it is possible that a respondent who is averse to both inequality and to losses will also set ξ equal to M and point C will again be reached.

Now consider what happens when point C is adopted as the reference point and the question is asked in reverse (i.e. the level of ξ is fixed and the respondent is asked to set the level of M). Transitivity dictates a return to point B and indeed a loss neutral, inequality neutral individual would again be indifferent between points B and C. However, a respondent who is averse to both losses and inequality would require an allocation such as that implied by point F. This is due to the fact that the effects of loss aversion and inequality aversion work in the *same* direction from a starting point of the equitable position. Therefore, in such circumstances, the SWF would be more convex than the effect of inequality aversion alone would dictate.

Therefore, a second study was undertaken to test this hypothesis. If, from starting at point C, respondents were, on average, indifferent between this point and point B, we could conclude that inequality neutrality dominates and that reference point effects are insignificant. This would mean that transivity holds for this (utilitarian) SWF. If, on the other hand, the point of indifference with point C is one in which more total gain is required, then there would appear to be support for the hypothesis that loss aversion plays some part in determining the value of R. This would mean that the SWFs implied from responses to the two sets of questions would be intransitive.

5. Study two

Respondents in study two were initially asked to value the same five health states as in study one. They were also asked to suppose that X and Y are currently in the same health state. This time, however, their instructions were

[6] Kahnemann and Tversky (1979) suggest a loss-to-gains slope ratio of 2:1 whilst Fishburn and Kochenberger (1979) estimated the relationship empirically and found it to be closer to 5:1. Both studies deal with changes in wealth.

as follows: '*Treatments are available which will be of benefit to both individuals. The way in which resources are currently allocated means that the two individuals each receive the same amount of benefit. Alternatively, resources could be re-allocated between the treatment of the two individuals in such a way that Y would end up a better health state than X. Suppose that Y could end up in a health state valued at* $[\ldots h_y]$. *We would like you to think about the value of the health state* $[\ldots h_x]$ *that X would have to end up in so that you are indifferent between these different outcomes and the common outcome brought about by the current allocation of resources*'.

As far as possible the layout of the second questionnaire was identical to that of the first. This time the common health outcomes currently faced by X and Y were shown on the left-hand side of the page and the right-hand side of the page showed the predetermined outcome for Y brought about by a re-allocation of resources and a range of possible values for the outcome faced by X. Respondents were asked to place a tick next to that value of h_x which would make them indifferent between (i) X ending up in that state and Y ending up in h_y and (ii) both individuals ending up in the common health state.

Inequality aversion now dictates that more total gain is needed in the new (inequitable) situation compared to the current (equitable) allocation, tending to exert upward pressure on the indifference level of h_x (and hence, M). Loss aversion again dictates that Y must gain more units of health than X loses which, given that h_y is fixed, also has the effect of pushing up the indifference level of h_x. There is now no possibility of the two effects cancelling one another out since the index can only take on a value of zero when respondents are neutral with respect both to inequality and losses.

For comparability with study one, the six questions were the 'reverse' of those asked in the first study and are shown in Table 3. Comparing the values of R generated from these questions with those of the first study (using the Mann Whitney U test) tests the hypothesis that the Atkinson index is picking up aversion to losses as well as to inequality. If this hypothesis is correct then the value of R in each case will be greater than in the first study and greater than zero.

To allow for comparability between the two samples, the second questionnaire was administered on the next year's health economics students at the Universities of Newcastle and Leeds. There were 34 respondents in total. The mean age of respondents was 24 and the sample was made up of 18 men and 16 women. Again there were no missing data.

Table 4 gives the results from study two. The positive (mean and median) indices for all questions indicate that, on average, respondents require there to be more health gain if that gain is to be unequally rather than equally distributed. In other words, unlike their counterparts in study one, they would be prepared to accept less gain in the equitable position and thus would be classified as inequality averse using the Atkinson definition. At the individual

Table 3
Questions parameters for study two

Question	Current health state X and Y	Equally distributed gain	Outcomes for X and Y under current allocation	Outcome for Y under re-allocation
1	2	60	62	98
2	2	15	17	26
3	2	60	62	82
4	2	15	17	22
5	40	15	55	64
6	76	15	91	100

Table 4
Results of study two

Question	Equally distributed gain (ξ)	Mean gain (M)		Atkinson index (R)[a]	
		Mean	Median	Mean	Median
1	60	68.81	69.75	0.130	0.140
2	15	16.91	18	0.138	0.167
3	60	62.97	64	0.052	0.063
4	15	16.29	16	0.068	0.063
5	15	15.93	16.75	0.105	0.104
6	15	17.27	17	0.113	0.118

[a]For each individual, the index is calculated as $1 - \xi/M$.

level, two respondents appeared to be inequality neutral across all six questions but only seven of the remaining 192 responses suggested inequality neutrality or inequality proneness. It is not surprising, therefore, that the results of the Mann Whitney U test suggest that the responses to all six questions in the first and second studies are significantly different from one another ($p < 0.001$ in all cases).

6. Discussion

The purpose of this paper was to measure attitudes towards inequality with respect to the distribution of health gain using Atkinson's equally distributed income model. The results of study one indicated that respondents were, on

average, inequality neutral. But, in the presence of a reference point effect, in which loss aversion would have worked in the opposite direction to inequality aversion, we were reluctant to interpret the results in this way. And by 'reversing' the questions in study two, we were able to test for a reference point effect. The fact that significantly different results were generated when the questions were asked in reverse, suggests that reference point effects had indeed played a significant role in the results generated in study one. In particular, it appeared that the effects of loss aversion and inequality aversion had, on average, cancelled one another out.

The finding that reference points and loss aversion can affect stated preferences is not new. They have been used to explain the results from preference elicitation studies across a range of different contexts, including health care financing decisions (Schweitzer, 1995) and in contingent valuation studies to explain the large disparities found between willingness-to-pay and willingness-to-accept (McDaniels, 1992; Casey, 1995). In addition, a number of studies have found the effects of loss aversion to be greater whenever an action (or commission) is required to move away from the status quo (Ritov and Baron, 1992, 1995; Schweitzer, 1994). As respondents in both of our studies were required to consider an action, defined in terms of the re-distribution of health gain, the existence of such 'omission biases' would only serve to exacerbate the effects of the loss aversion uncovered here. Moreover, Baron (1995) has found that, when asked to choose between health care programs, respondents often adopt a principle of 'do no harm', the effects of which may be so profound that changes are rejected even when they would result in *all* patients receiving a greater chance of benefit.

Whilst the studies reported in this paper suggest that loss aversion and a status quo bias had a powerful effect on the results generated, there are other possible interpretations of the data. The anchoring and adjustment heuristic described by Tversky and Kahneman (1974) results in estimates being influenced by the provision of different anchors and is caused by respondents making insufficient adjustment away from the starting point. Such starting point biases have previously been found in respondents' assessments of probabilistic information (Kahneman, 1992) and in responses to contingent valuation questions (Boyle et al., 1997), and may also have influenced the results from the two studies reported here.

In the first study, the health gains to X and Y under the current allocation of resources provided respondents with both low and high starting points. Thus, no single anchor was provided away from which adjustment had to be made. In the second study, however, a single anchor was provided by the equally distributed gain, and respondents were required to adjust the amount of gain conferred upon X *downwards* from this point. Thus, insufficient adjustment away from the starting point would result in an over-estimation of the amount of gain required in the unequal state of the world. As with loss aversion, this exerts upward

pressure on the indifference level of M, producing a higher value for the Atkinson index than would result in the absence of such effects.

Whilst this raises the possibility that anchoring effects may have contributed to the observed differences between the two studies, it is impossible to determine the extent of these effects within the confines of the present study design. However, it is interesting to note that if, in study two, we had fixed the level of gain going to individual X in the unequal state of the world and asked respondents to adjust Y's gain *upwards* from the starting point, then anchoring effects would have worked in the opposite direction. This is something which could be tested in future experimental work.

A very different concern about whether the results from the two studies should be explained in terms of reference point effects is that a between-respondent test was used to compare the results. Therefore, it is unclear whether the same effects would have been observed had a within-respondent comparison been made. However, a between-respondent test of the reference point effect is arguably 'cleaner' than a within-respondent test because an individual's answer to one question frame may be contaminated by their initial response to the other question frame. By using two consecutive cohorts of students, the likelihood that the results could be explained by differences between the samples was reduced. And, whilst the precise trade-offs that people make may differ in other samples, the powerful effect of the reference point is likely to be robust.

7. Concluding remarks

Although efficiency and equity have been defined in this paper in terms of the amount of health gain conferred upon two (anonymous) individuals, the substantive findings are much more generalisable. The Atkinson method appears to offer a relatively simple means by which to measure attitudes towards inequality in *any* situation where there exists a meaningful trade-off between efficiency and equity. For example, it could be modified to assess whether society would be prepared to accept lower overall educational standards in order to bring about a more equitable distribution of academic achievement. Or it could be used to assess whether distributional considerations are important in the introduction of environmental or transport policies.

The results presented in this paper suggest that responses to any such questions might be contaminated by aversion to *potential* losses. And it seems plausible that this reference point effect would be even more marked in situations that involve *actual* losses. The question that arises, then, is whether or not it is appropriate to incorporate loss aversion into the SWF. It could be argued that it is, since any real re-allocation of resources in order to promote equity will of course deny some (actual or potential) benefit to the group or groups who stand to do better under the current allocation. There seems to be no obvious

reason why inequality aversion should be incorporated into a SWF but loss aversion should not. Moreover, models which ignore the status quo and loss aversion will predict more symmetry and reversibility than is observed in most real-world decision-making (Kahneman et al., 1991).

However, as shown above, having differential weights for gains and losses can result in intransitive SWFs. Moreover, any aversion to potential losses at the societal level will, at the margin, result in a pressure to maintain the status quo, presumably no matter how inequitable this status quo is. In this way, loss aversion is likely to perpetuate any current or past (mis)allocation of resources.

Much of the debate about whether or not loss aversion should be incorporated into the SWF turns on whether or not it is appropriate to take account of effects that are not directly related to the consequences of an action. According to consequentialism (which is central to the utilitarian philosophy), every choice is evaluated according to the consequent states of affairs (or final 'goodness' to use the language of Broome (1991)). Of course, much depends on precisely how consequences are defined but most consequentialists (including Broome) would probably define the consequences of the scenarios in the studies reported here in terms of the final health states that the two individuals end up in, particularly if the individuals have no knowledge of what might have happened had resources been allocated differently.

However, if X and Y are aware of what might have been, or if the welfare of others is affected by such knowledge, then the process by which a decision is made may have an effect independent of the outcome of that decision. For example, Hahn (1982) has argued that 'My utility may not only depend on what I get but on the manner in which I get it. That is, my utility may not only depend on the consequences of policy but on the policy itself'. Non-consequentialist philosophies, then, might suggest that loss aversion is an important process that should be accounted for in the overall welfare calculus.

A fuller discussion of these issues is beyond the scope of the present paper but the results presented here suggest that more theoretical and empirical research is needed on the role that reference point effects ought to and do play in determining the nature and the extent of the efficiency – equity trade-off across a wide range of public sector decisions.

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