

# Natural disaster risk and egalitarian principles for relief programmes

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## ABSTRACT

Financial aid for the worst-off victims of earthquakes and other catastrophes seems to be a morally unquestioned principle for the allocation of public funds. This paper shows however, that this principle is ambiguous if the decision is viewed as a dynamic choice problem where such resources need to be allocated in two periods: before and after the event takes place (before and after uncertainty is resolved). The literature on social choice suggests that utilitarian principles fare better in such situations. After an exposition of the theoretical background of this claim, the context of natural disasters is examined more narrowly and questions arising for our moral intuition will be discussed.

**DRAFT. PLEASE DO NOT QUOTE.**

## 1. Introduction

It has often been stated that in the case of uncertainty, utilitarian policies do not have the same problems to be coherently implemented over time as egalitarian ones. One of the best known arguments in this direction is Harsanyi's 1955 aggregation theorem, that basically states the following: Given VNM individual utility functions and a VNM social welfare function and some Pareto condition, utilitarianism is implied. Whilst the formal argument can not be questioned, the ethical relevance of the result continues to be debated, for a concise discussion see Mongin and d'Aspremont (1999).

Myerson (1981) explicitly contrasts Utilitarianism and Egalitarianism and shows that the linearity condition, that is met only by a utilitarian social welfare function has a natural interpretation in terms of an equivalence of ex-ante and ex-post evaluation. Hammond (1981 and 1983) discusses the question in a richer temporal framework and concludes that ex-post welfare optimality should be the relevant criterion. Mongin (1995 and 1998) is the best reference for the even more complex problem of diverging subjective probabilities.

A comprehensive discussion would require a general framework that can accommodate all aspects of the four mentioned works, but that would be too ambitious for this presentation. Let us thus focus on the temporal or dynamic aspect of

the problem and move to a representation of the problem by the means of decision trees. Since the notational apparatus for decision trees is rather abundant, I will use a graphical representation for the ease of exposition and stick to a simple numerical example.

2. The example

Suppose a small society with only two individuals, named A and B, and let us have three periods. The society faces a significant risk of some natural disaster in period 2, where the probability of the disaster is denoted by  $d$ , whilst  $nd$  denotes the absence of the event, and  $d = 1 - nd$ . In general, the two individuals will have their subjective estimates about how probable the event is, but for the time being, we will use the social decision maker's probability evaluation as given, and say, for the sake of calculatory simplicity,  $d = 0,5$ . Whilst in period 2 nature has its move (represented in the decision tree in figure 1 by circle nodes) decisions need to be taken in period 1 and 3, represented by squares in the diagram. The decision to be taken in period one concerns building regulations  $x$  and  $y$  that both affect the individuals in a different way, and that have an impact on how well off the individuals are in case of the disaster, say an earthquake.

However, in period 3 the society needs to make a decision whether to adopt a policy  $x'$  that involves income equalising transfers. In case of the disaster these transfers can be interpreted as a relief-programme for that individual that is worse off. If the disaster did not take place, the transfers can be thought of as related to some even stronger building improvement program. The alternative  $y'$  involves no change in the individual's utilities.

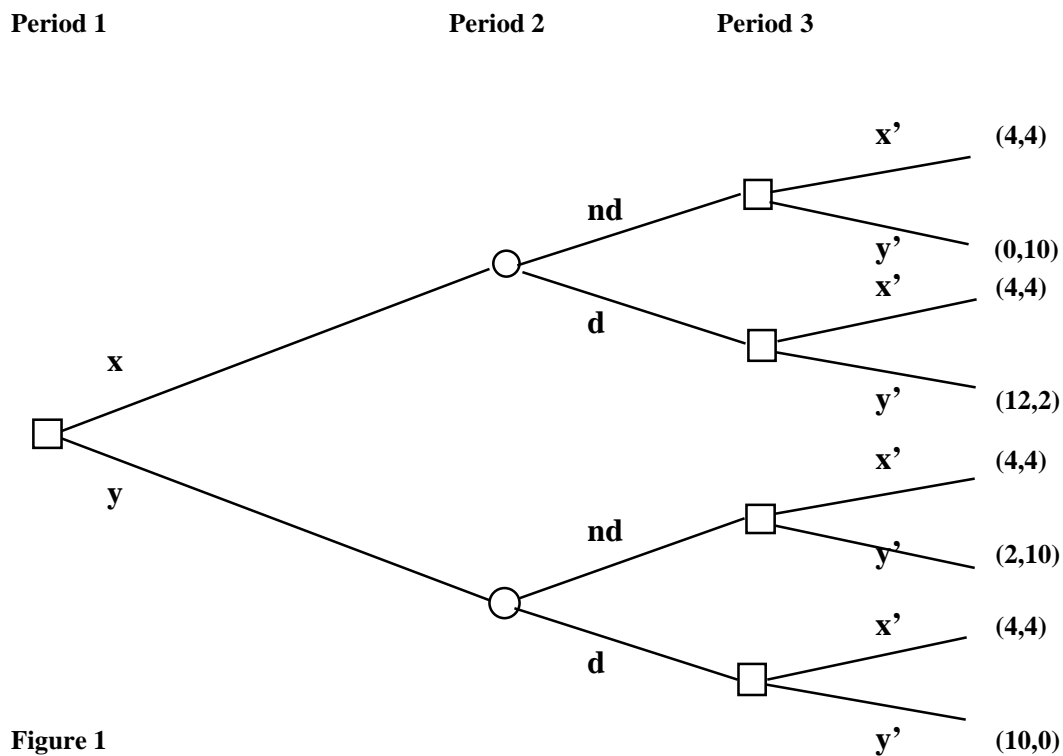


Figure 1

Let us now denote a policy plan by a triple (a;b,c), where  $a \in \{x,y\}$  and  $b,c \in \{x',y'\}$ , where a stands for the policy adopted in period 1, b for the policy that is adopted in period 3 if nd prevails and c stands for the policy adopted in period 3 if the disaster d takes place. This makes it easy to calculate the expected utilities of the two individuals in all the respective policy options:

Policy Plan	(EU <sub>A</sub> ,EU <sub>B</sub> )
(x;x',x')	(4,4)
(x;x',y')	(8,3)
(x;y',x')	(2,7)
(x;y',y')	(6,6)
(y;x',x')	(4,4)
(y;x',y')	(7,2)
(y;y',x')	(3,7)
(y;y',y')	(6,5)

Let us now consider the two social welfare functions that are of interest for us, the utilitarian one

$$W_u(U_A, U_B) = U_A + U_B$$

and the egalitarian one with

$$W_e(U_A, U_B) = \min \{ U_A, U_B \}.$$

If we now apply these two functions to the expected utilities given in the table, that is to say if we calculate  $W_u(EU_A, EU_B)$  and  $W_e(EU_A, EU_B)$  respectively, both take their maximal value with the plan (x;y',y'), which will thus be the chosen plan. But suppose now that we embark on this plan and choose indeed x in period 1 and reconsider the plan in period 3, after the uncertainty has been resolved. This time we apply the functions to the final utilities. Whilst  $W_u$  chooses y' in both states of the nature,  $W_e$  selects x' in both cases. This is in contradiction to our initial plan (x;y',y').

It seems thus that the utilitarian welfare function is somehow better adapted to dynamic situations than the egalitarian criterion. One might conclude that dynamic consistency and egalitarianism are incompatible. This judgement would be premature though. In fact, there are two problems being muddled here: Dynamic consistency is one thing that concerns us here, but we need also make the distinction between *ex ante* and *ex post* welfare optimality. The ex ante approach is, what we applied so far, that is to say, pick a decision node and apply the welfare function to the individual expected utilities at this node. The ex post approach on the other hand consists in first calculate the value of our welfare functions  $W_u$  and  $W_e$  respectively, and then calculate the expected value of each plan. If we apply this method to the given example we obtain:

Policy Plans	$EW_u$	$EW_e$
$(x;x',x')$	8	4
$(x;x',y')$	11	3
$(x;y',x')$	9	2
$(x;y',y')$	12	2
$(y;x',x')$	8	4
$(y;x',y')$	9	2
$(y;y',x')$	10	3
$(y;y',y')$	11	1

Following the utilitarian criterion, we will still choose the plan  $(x;y',y')$  and we know that this plan is temporally consistent. The egalitarian principle on the other hand will choose  $(x;x',x')$  or  $(y;x',x')$ , and it is easily checked that  $W_e$  would choose  $x'$  in period 3 in any case and any state of nature.

Hammond (1981,1983) generalises this result: an ex post analysis guarantees dynamic consistency.

### 3.Discussion

[to be completed]

### Literature:

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