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Equity Analysis and Natural Hazards Policy

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Executive Summary

What is an "equitable" policy for mitigating the impacts of hurricanes, earthquakes, floods, and other natural hazards? Economists tend to see "equity" or "distribution" as irreducibly political and subjective. But, in truth, equity analysis and cost-benefit analysis are on a par. Both require a normative justification. Moreover, normative argument can help structure equity analysis, just as it can with cost-benefit analysis.

This paper argues that equity is a normative consideration distinct from efficiency or overall well-being. It then argues that equity is individualistic, not group-based; ex post, not ex ante; that the "currency" for equity consists in the multiple dimensions of well-being, not income or longevity; and that, at a minimum, equity analysis should be concerned to avoid serious deprivations with respect to any well-being dimension. The upshot is a set of concrete recommendations for how equity analysis of natural hazards policy should be structured.

Equity Analysis and Natural Hazards Policy

Matthew D. Adler

1. Introduction

A standard claim in the natural hazards literature is that natural hazards policy should be sensitive to equity concerns. (Mileti 1999, 6; Berke et al. 1993; Cochrane 1975; Heinz Center 2000, 51; Kunreuther and Rose 2004, xxiv). Is this true? Is equity really a normative consideration that is distinct from efficiency or overall well-being? Assuming it is, what does equity mean? Is equity group-based or individualistic? And, if the latter, what is equity's "currency"? Does equity concern the distribution of income, of fatality risk, of well-being generally, or perhaps of some other item? Further, is individualistic equity comparative or noncomparative? Is the idea to equalize the distribution of income/risk/well-being across the population, or rather to give priority to those who have lower levels of income/risk/well-being?

These are very general, abstract questions but are crucial to the design of natural hazards policy. For example, if equity is not a distinct consideration, then cost-benefit analysis should probably be the exclusive policymaking tool here. If it is, then cost-benefit analysis will need to be supplemented by an additional tool – an "equity analysis" – which will rank possible policies in terms of equity. And the appropriate structure of equity analysis will depend on deep and difficult questions about the nature of equity.[1]

This paper will consider those questions in a preliminary way, suggesting that equity *is* a distinct consideration additional to efficiency/overall well-being and that it is individualistic; that its focus is ex post not ex ante; that the "currency" for equity should be well-being; and that, at a minimum, equity analysis should focus on avoiding "poverty" (meaning a serious deprivation with respect to *any* component of well-being, not merely income poverty). Concretely, this means that equity analysis for natural hazards policy should be focused on reducing death,

[1] To be sure, choices by administrative agencies that address natural hazards, such as FEMA, are constrained by statutes and other legal mandates. The general normative framework elaborated here is relevant to agencies in exercising the discretion accorded them by their legal mandates, and to Congress in shaping those mandates. Moral rights are also plausibly part of the normative framework, along with overall well-being and equity, but presumably are less applicable to natural rather than human hazards policymaking. In any event, my claims about the content of equity are independent of whether the general framework for natural hazards policy is bipartite, including just overall well-being and equity, or tripartite, including both of those plus moral rights.

serious physical injury, psychological trauma, homelessness, hunger, social exclusion, and other grave harms to human welfare.

My account of equity may surprise natural hazards scholars – at least if they look to scholarship on "human hazards" (toxins, radiation, dangerous technology, and other hazards that result from human activities and do not involve extreme natural events). Human hazards scholarship often adopts a very different conceptualization of equity than that proposed here – using fatality risks rather than well-being generally as its currency, and adopting an ex ante rather than ex post view. The account I propose is much closer to the conception of distributive justice adopted by a body of scholarship that has recently emerged in development economics. This literature, inspired by the work of the revisionary economist Amartya Sen, attempts to measure poverty using a plurality of "functionings" – in effect, aspects of well-being or readily measurable proxies for these aspects.

In principle, equity analysis as I propose it should inform all aspects of natural hazards policy: not only mitigation policy but also choices about how to structure preparedness, response and recovery. Of course, decision-cost considerations may limit the scope for full-blown equity analysis (as they do for cost-benefit analysis itself). (Adler and Posner 1999) Still, it is important to get a sense of what a full-blown equity analysis for natural hazards policy would involve.

2. Efficiency/Overall Well-Being and Equity

Economists tend to think that governmental policy should be sensitive both to efficiency concerns and to equity concerns. By "efficiency" economists mean "Kaldor-Hicks efficiency." A policy is Kaldor-Hicks efficient if, in principle, those whom it benefits could fully compensate those whom it harms. The technique of cost-benefit analysis is seen, by economists, as a tool for identifying Kaldor-Hicks efficient policies. (Just et al. 2004, 1-13)

In my own work, I have taken issue with the economists' normative picture, arguing that the relevant standard is not Kaldor-Hicks efficiency but rather *overall well-being*. For practical purposes, however, the difference between Kaldor-Hicks efficiency and overall well-being is not huge. The two criteria significantly overlap, and *both* are best implemented through cost-benefit analysis. (Adler and Posner 2006; Adler and Posner 2001; Adler 2000; Adler and Posner 1999)

In other words, whether the underlying normative framework is efficiency plus equity (the framework of many economists) or overall well-being plus equity (the replacement framework I would defend), cost-benefit analysis should be *part* of the decisionmaking apparatus for administrative policymaking – including natural hazards policy. Cost-benefit analysis implements the *first* term in the framework – be it efficiency or overall well-being.

Cost-benefit analysis is now routinely used outside the area of natural hazards, for example by the Environmental Protection Agency in regulating pollutants. (Adler and Posner 1999, 169-76; Morgenstern 1997). And it has long been employed for certain aspects of natural hazards policy, for example by the Army Corps of Engineers in designing flood-control structures. FEMA, the chief federal natural hazards agency, has been relatively slow to adopt cost-benefit analysis -- perhaps because the Presidential cost-benefit orders, in place since the Reagan administration, have required an agency to prepare a full analysis only when it acts by regulation and issues a sufficiently major rule. (Exec. Order 12,866; Exec. Order 12,291). It seems that FEMA, unlike EPA, rarely (if ever) meets this standard.

To be sure, cost-benefit analysis of natural hazards policy raises many difficult problems. (Kunreuther and Rose 2004; Benson and Clay 2004; Committee on Assessing the Costs of Natural Disasters 1999; Ewing et al. 2005; Heinz Center 2000; Mechler 2003; Yezer 2002) How should nonmarket goods be valued? What about indirect rather than direct costs – for example, the ripple effects on the general economy that occur when a flood, hurricane, or earthquake hits one location? Should the cost-benefit analysis simply aggregate willingness-to-pay amounts: the traditional technique? Or should these be adjusted to reflect the variable marginal utility of money? Much more work on these matters needs to be undertaken. But there is no reason to think that they are insoluble, or even particularly murky. The questions are the same as, or at least similar to, those that arise in other policy areas – for example, environmental law -- where cost-benefit analysis has proceeded apace. Further, the overall structure of cost-benefit analysis is clear: summing (adjusted or unadjusted) willingness-to-pay amounts as a way to test whether policies are Kaldor-Hicks efficient or increase overall well-being.

By contrast, the second term in the efficiency/overall well-being plus equity framework remains *extremely* murky. There is zero consensus within economics about the meaning of equity. Often the concept is seen as being irreducibly subjective, by contrast with efficiency – a

matter for political choice rather than normative argument. (Just 2004, 10) The current Presidential cost-benefit order tells agencies to take account of "equity" and "distributive impacts" in choosing policies, rather than relying exclusively on cost-benefit analysis, but neither the order nor OMB's guidance documents takes a position about the meaning of equity. (Executive Order 12,866; Office of Management and Budget 2003)

There is no reason to think that equity is necessarily subjective and political. Just as normative argument might persuade us that efficiency/overall well-being has normative significance, so it might persuade us that equity also does, and that equity has a particular content. To be sure, in a democratic system, any policy choice or policy-analytic tool (such as cost-benefit analysis or equity analysis) is subject to being overridden by a legislative mandate – but normative analysis can help shape legislative mandates, and can help structure administrative policy in default of a legislative mandate.

3. Does Equity Matter

So we are led to the topic of this paper: which view of equity for natural hazards policy is most supportable, as a matter of normative argument? To begin, is the most attractive normative framework one that contains equity as a separate normative consideration, additional to efficiency/overall well-being?

To see the force of this question, consider the following point – a familiar point in the literature on tax policy. Maximizing overall *well-being* might require equalizing the distribution of *income*. Assume that money has declining marginal utility. The increment of well-being that a given individual reaps from his first dollar of income is larger than the increment he reaps from the second, which in turn is larger than the increment he reaps from the third, and so on. Further, assume that two individuals P and Q have the same utility function[2], and that P is richer than Q. Then (bracketing incentive effects) transferring income from P to Q increases well-being. In this sort of case we can justify income distribution without positing an equity factor in our normative framework additional to the factor of overall well-being.

[2] In this paper, I generally use the term "utility" to mean an interpersonally comparable measure of well-being. Well-being is interpersonally comparable and, if certain axioms are satisfied, is measurable. (Adler and Posner 2006) To be sure, policy analysts currently tend not to employ utility scales, preferring money or other scales which are easier to use.

A similar point is suggested by the literature on the special "vulnerability" of the poor and other groups to natural hazards. (Fothergill and Peek 2004; Fothergill et al. 1999; Heinz Center 2000, 114-19; Mileti 1999, 122-25; Morrow 1999; Peacock et al. 1997; Wisner et al. 2004). As one review article summarizes this literature with respect to socioeconomic status:

> [S]ocioeconomic status is a significant predictor in the pre- and post-disaster stages, as well as for the physical and psychological impacts [of disasters]. The poor are more likely to perceive hazards as risky; less likely to prepare for hazards or buy insurance; less likely to respond to warnings; more likely to die, suffer injuries, and have proportionately higher material losses; have more psychological trauma; and face more obstacles during the phases of response, recovery, and reconstruction. (Fothergill and Peek 2004).

These findings are extremely plausible. For example, because the poor tend to live in lower cost, less sturdy housing, poor individuals who fail to evacuate are likelier to incur fatal or nonfatal injuries in building collapses than wealthier individuals. Note, however, that this sort of asymmetry between the effects of disasters on the rich and the poor does not demonstrate that natural hazards policy needs to be sensitive to equity. Rather it suggests that, *even if* policymakers care only about maximizing welfare, some degree of special attention to the poor may well be justified. For example, if the policy choice presented is whether to spend limited mitigation funds in subsidizing building upgrades in poor or rich neighborhoods, the welfare-maximizing choice might well be the former. The risk of building collapse is larger in the former case and therefore the expected welfare benefit, in the form of avoided injuries and fatalities, that would result from upgrading buildings to the point where the risk of collapse is zero or de minimis, is also larger.

The point generalizes beyond poverty. Another recent review of the "vulnerability" literature points to a variety of groups that are particularly likely to be harmed by natural disasters. (Morrow 1999, 10)

Highly Vulnerable Groups

-- residents of group living facilities
-- elderly, particularly frail elderly
-- physically or mentally disabled
-- renters
-- poor households
-- women-headed households
-- ethnic minorities (by language)
-- recent residents/immigrants/migrants
-- large households
-- large concentrations of children/youth
-- the homeless
-- transients

The author suggests that disaster planners in each community should maintain a "community vulnerability inventory" showing where these vulnerable groups are concentrated, and that preparedness, response, recovery and/or mitigation activities should, to some extent, be targeted at them. If indeed members of some such group *are* particularly vulnerable to a given natural hazard – in other words, the expected welfare harm to them if that hazard occurs is especially high – then preparedness, response, recovery and/or mitigation dollars have a greater impact when expended to reduce their exposure to the hazard than when expended to achieve an equivalent reduction in the exposure of the average community member.

In other words, just as a welfare-maximization criterion plus the declining marginal utility of money can justify income redistribution to the poor, so a welfare-maximization criterion plus the heightened vulnerability of group G to natural hazards can justify "redistribution" of governmental efforts to protect citizens from natural hazards to the members of G. Equity isn't *necessary* to justify hazards policymakers in making special efforts to protect vulnerable groups; indeed, if our intuitions that the group members deserve extra concern can be borne out without invoking the fuzzy concept of equity, why invoke it?

Ironically, then, the "vulnerability" literature might move us away from an equity-inclusive framework for regulating hazards, and towards utilitarianism. But such a move should probably be resisted. It is fair to say that most modern scholarship in moral philosophy rejects utilitarianism – in other words, rejects the view that makes overall welfare the sole morally relevant consideration. (Kagan 1998) Why listen to the moral philosophers? Unlike many economists, philosophers have embraced the notion – the notion I want to entertain here – that problems of equity *are* problems for serious analysis and argument. (Rawls 1971; Dworkin

2000; Nagel 1991; Sen 1992; Temkin 1993; Arneson 2000; Clayton and Williams 2000; Pojman and Westmoreland 1997) And the upshot of modern philosophical work has generally been to recognize some role for equity.

Why? At the risk of wildly oversimplifying, let me suggest that two themes emerge in the philosophical literature. One is the theme of *fairness* – a central theme, for example, in John Rawls' work. Imagine that we work together in some common enterprise – a kitchen garden for the neighborhood, digging a common well, or, more grandly, sailing from the old world to the new and setting up a new society. Then if we make equal efforts we should share equally in the gains from the enterprise, or proportionately if our contributions are unequal. If you and I have made equal contributions then we're entitled to the same share of the social product even if our utility functions are shaped and positioned such that giving you more would increase overall well-being.

The second theme is one of *urgency* and need. Change the hypothetical and assume that neither you nor I have made any contributions to the project. Perhaps we've arrived too late on the scene. The garden has already been planted, the well already dug, the new world settled. But we could each benefit from the project, and the contributors are prepared to share some of it with us if they are morally obliged to do so. You're in a state of deprivation; I'm not. You're famished, or dehydrated, or about to be killed by pirates. I have my own supplies, or my own protection, although things would be easier for me if I could share in the common food, water, or protection. In this sort of case many have the intuition that the contributors have a distinctive moral obligation or reason to help you, not me. Note that overall welfare can't explain that intuition, since both of us would benefit from the common stuff. As a matter of overall welfare or efficiency, the distinction between us can only be quantitative, not qualitative.

So intuitions about fairness and urgency provide a strong tug towards equity. And normative analysis, in turn, is (in part) a matter of intuitions – of constructing a theory that is both reasonably coherent and systematic *and* fits reasonably well with our intuitions. (Daniels 1996) Utilitarianism is highly systematic but, for many, quite counterintuitive. A pluralistic view that incorporates both overall welfare and equity as separate factors is a bit messier than utilitarianism, but better coheres with intuitions that demand redistribution of resources to those who are entitled to them as a matter of fairness, or desperately need them, even in the teeth of welfare maximization. And a pluralist view of this sort need not be super messy. For example,

the view might be unified through the currency of well-being. Overall welfare demands the maximization of well-being. And equity could demand an appropriate distribution of well-being, or of the constituents or preconditions of well-being, such as food, shelter, health, and income.

This is no more than a sketch of an argument in favor of equity. The skeptical reader is advised to consult the scholarship that I have breezily summarized and to reach her own conclusions. But I hope she'll at least concede that an equity-regarding view is plausible and that it is worth some reflection to determine what the equity component of such a view would involve.

4. Is Equity Group-Based or Individualistic?

Equity might be group-based or individualistic. A individualistic view focuses on the distribution of some currency (income, other aspects of well-being, risks to well-being, etc.) among individuals; a group-based view focuses on the distribution of some currency among groups.

Group-based views, at first blush, may seem thoroughly wacky. Why even waste our time considering them? But in fact some of the views of equity proposed by the natural hazards literature, or the related body of scholarship that studies human hazards, turn out to be group-based views. One important example are views that seek *geographic equity*. Here, the idea is that different geographic areas should have equal impacts (in some sense) from human or natural hazards. Concretely, this might mean siting hazardous waste dumps so that each geographic jurisdiction has the same number of dumps, or the same total chemical exposure. (Been 1993) A parallel geographic-equity account for natural hazards policy can readily be constructed: for example, mitigating some category of hazard so that the number of hazard events, or total deaths, or total economic costs, or percentage of the population affected by hazards, for each geographic jurisdiction, is equalized. (Cross 2001; Cutter 2001)

A different kind of group-based view, pressed by the so-called "environmental justice" literature, focuses on the allocation of chemical and technological risks among *racial groups*.[3]

[3] The "environmental justice" literature also discusses socioeconomic (SES) skews in exposure to human hazards. Since an SES group-based equity view is clearly quite close to an individualistic equity view – since all equity theorists should agree that redistribution to those below income and other poverty lines increases equity, a point discussed below -- I will not discuss the SES variant of "environmental justice" here.

(Rechtschaffen and Gauna 2002) Siting decisions for hazardous waste sites and other polluting activities that have a disparate impact on racial minorities are seen to be especially problematic by this literature – a view that is endorsed by the President's Environmental Justice Order and by EPA's guidance statements regarding Title VI. (Executive Order 12,898; Mank 2000) Once more, one can readily imagine a race-based analogue for natural hazards policy. Natural hazards that disparately impact racial minorities (for example, hurricanes or earthquakes in cities with especially large minority populations) should receive higher priority; mitigation policies that fail to attend to such hazards, but instead disparately benefit whites (for example, tornado-mitigation policies or other policies that would benefit rural areas outside the South, which are disproportionately white) should be viewed more skeptically.

What to make of these or other group-based views? Consider first geographic views. Certain variants of geographic equity turn out to be equivalent to plausible individualistic views. In particular, if we normalize by each jurisdiction's population, then equalizing total fatalities per jurisdiction is effectively the same as equalizing individual fatality risks across the entire population. But other variants of geographic equity – for example, equalizing the total number of hazard events or total hazard damage per state (without normalization), or equalizing the percentage of each state's population affected by natural hazards -- are genuinely group-based. Why, as a normative matter, should equity in one of these senses be a concern? If the equitable distribution of natural hazard impacts across individuals is preserved, why should it matter that the impacts on certain states (or other geographic units) is much higher than the impacts on other states (or units)?

Political feasibility may require the policymaker to spread her mitigation resources equally across different geographic units – but that simply shows that politics may constrain the pursuit of normative goals like overall welfare or equity, not that equity means geographic equity. On a more normative note: jurisdictions with smaller populations may be less well positioned to prepare for/respond to/recover from/mitigate hazards than jurisdictions with larger populations. For example, it has been argued that:

> The immense power and resources of large settlements confer considerable resilience. Most major cities are able to harness massive financial resources and expertise … to combat disaster and to aid recovery – in many cases as part of the normal functioning of

> the city. To varying degrees, this counters the potential increased vulnerability of megacities to certain types of hazards. (Handmer 1995, 365, quoted in Cross 2001, 77)

Thus, expending governmental resources on small communities out of proportion to their populations may sometimes be cost-benefit justified. The private and public goods normally supplied in cities -- big hospitals, extensive fire and police departments – may in some cases mean that additional expenditures for hazard mitigation/preparedness/response/recovery are less cost-effective than in non-urban areas. But that effect should, in principle, be captured by a sophisticated cost-benefit analysis; there's no need for a separate geographic-equity analysis.

Ditto for the point that hazards which hit smaller communities are likelier to entirely disrupt community life – with special costs – than hazards which hit cities. If there are extra costs to the wholesale rather than partial disruption of a community, then cost-benefit analysis should capture those costs and – without more – would warrant special attention for smaller communities.

What about the equity accounts that focus on the distribution of natural hazards across racial groups? There are many subtle issues to be untangled here. To begin, a disparate impact test may be used to smoke out conscious or unconscious racial discrimination. The fact that a particular state government agency regularly pursues mitigation policies that disproportionately benefit whites should raise a red flag for federal overseers. Are the state decisionmakers consciously or unconsciously discounting the interests of nonwhites? Further, racial minorities may be especially vulnerable to natural hazards – either because minority groups are disproportionately poor, or independent of that. (For example, if "redlining" practices mean that racial minorities in certain communities tend to be underinsured, and therefore tend to take fewer individual mitigation measures, mitigation dollars spent in these communities would tend to have a greater benefit.) (Fothergill et al. 1999; Peacock et al. 1997, 171-90) Finally, the visible existence of policies that disparately affect minorities – for example, the clustering of hazardous waste dumps in inner-city neighborhoods, or a failure of rescuers to do much for hurricane refugees in such neighborhoods – may have substantial costs in terms of racial divisiveness, or in enhancing the "social exclusion" of certain minority-group members. (Sunstein 1994)

This analysis suggests that race-based equity should not be a concern for a genuinely impartial and sophisticated social planner. Divisiveness costs and social exclusion costs are effects on individuals, and will be incorporated in a sophisticated cost-benefit analysis or

sophisticated individualistic equity analysis, as will the enhanced vulnerability of members of certain racial groups. Race-based tests will also evidence the motivations of other actors; but the well-meaning social planner won't need to police her own motivations.

In our present circumstances, where techniques for quantifying costs such as racial division and social exclusion are still undeveloped, race-based tests plausibly function as practicable decision procedures that supplement cost-benefit analysis and individualistic equity analysis. The same may even be true of geographic equity tests. Still, it is hard to see why the normative criterion of equity should itself be group-based, any more than the criterion of overall welfare. Groups don't have interests apart from the interests of the individuals who comprise them. Avoiding disruption to groups, or disparate effects on groups, may be important in preventing harms to the groups' members – to the extent that members' goals and plans are bound up with the groups, or that others in society see them as group members. But the notion of protecting groups per se, let alone defining a basic moral construct such as equity in group-based rather than individualistic terms, is extremely puzzling.

5. Individualistic Equity: Ex Post or Ex Ante?

For the remainder of the paper I will focus on individualistic construals of equity: views that constrain the distribution of some item across individuals. Within this broad family of views, we might distinguish, first, between ex ante and ex post approaches to equity. The distinction is subtle but very important. Imagine that the item for distribution is income, and that the view is noncomparative. In particular, it seeks to ensure that everyone is above some threshold. The ex post variant of this approach would seek to ensure that everyone's actual income is above some threshold; the ex ante variant would instead define a threshold of expected income. (Morduch 1994)

The distinction persists if we shift to a comparative, income-based view. Comparativists want to equalize rather than raise everyone above a threshold. But what's being equalized: actual income or expected income?

Shift, now, to a different currency: life. Consider first the threshold view using this currency. The ex ante version of that view seeks to ensure that no one's risk of death is too high. Indeed, this view is reflected in much toxics regulation; agencies such as EPA, OSHA, or the

FDA often determine whether the exposure of the population to a given toxin is "safe" by asking whether maximally or highly exposed individuals would incur an incremental fatality risk above some numerical threshold (such as a 1 in 1 million, 1 in 100,000, 1 in 10,000, or 1 in 1000 incremental fatality risk). (Adler 2005) By contrast, the ex post version of the view that uses life as its currency, and that cares about thresholds, would try to avoid deaths that occur before a certain age – be it a fairly young age (18), or an intermediate age (40), or an substantial age (70), or a very advanced age (100).[4] The first choice would be the ex post analogue of an ex ante view that sets a fairly high fatality risk threshold; the last choice would be the analogue of setting a very low risk threshold (1 in 1 million) and would be virtually equivalent to a policy of minimizing all deaths.

Clearly, the ex ante approach of minimizing the number of individuals whose risk of death exceeds some threshold, and the ex post approach of minimizing the number of deaths, can diverge. This divergence, indeed, is a recurrent theme within the literature on equity in the regulation of human hazards, and connects to discussions of geographic equity. (Adler 2005; Adler 2003, 1423-36; Finkel 1996) A central question in this literature is whether policymakers should aim to reduce "individual risk" (an ex ante approach) or "population risk," i.e., the total number of deaths (an ex post approach). Imagine that EPA can choose to remedy a rural waste dump with a high concentration of dangerous chemicals, which exposes 10,000 individuals to a 1 in 10,000 incremental fatality risk; or instead to clean up an urban waste dump with a lower concentration of dangerous chemicals, which exposes 8 million individuals to a 1 in 2 million incremental fatality risk. The first policy mitigates many high risks but saves fewer lives; the second mitigates no risks above even a low threshold, but saves more lives.

If we kept the "currency" fixed, but focused on equalizing rather than raising above thresholds, a similar divergence would arise. The ex ante planner focuses on equalizing the distribution of fatality risks from some source; the ex post planner focuses on regulating the source so that the resultant distribution of longevity is more equal.

A final example of the divergence between ex ante and ex post approaches -- now using the currency of welfare itself, rather than income or life. A simple case will show how the two

[4] More precisely, these age thresholds would emerge from a combination of (1) using longevity as the currency for equity; (2) adopting an ex post rather than ex ante approach; and (3) using whole lifetimes rather than periods or moments as the temporal framework for measuring individual "holdings" of the currency. This last issue is discussed below, in the section on comparative and noncomparative views.

can diverge here. The policymaker for a society of N individuals is choosing between the status quo, where everyone's welfare is at utility level 100, and a policy which will moderately improve the welfare of 90% of the society (raising them to level 110) and dramatically decrease the welfare of 10% (lowering them to level 20). The identity of the 10% is unknown. The ex ante policy maker definitely approves this choice: Everyone's ex ante utility increases from 100 to 101 and equality of ex ante utilities is preserved. But the ex post policy maker may decline the policy, because in each state of the world it would produce a highly skewed outcome, with 10% of the society dramatically worse off than the remainder.

It might be thought equity analysis inevitably adopts an ex ante approach, given uncertainty on the part of the policymaker. This is incorrect. *Both approaches are consistent with policymaker uncertainty*. The difference concerns the stage at which uncertainty enters the equity analysis. The ex post approach views equity as a feature of the possible outcomes of policy choice. Assume that C_j (O_i) is individual j's holding of the relevant currency for equity in outcome O_i and that there are N individuals in the population. For a given policy, the ex post analyst: (1) identifies the possible outcomes $\{O_1 .. O_M\}$ of the policy; (2) performs an equity analysis for each outcome O_i, examining the distribution of the relevant currency (e.g., income, life, well-being) in that outcome; (3) ideally, summarizes the equity status of each outcome O_i with a number $E(O_i) = E(C_1(O_i), C_2(O_i), \ldots C_j(O_i), \ldots C_N(O_i))$, which represents how equitable the distribution of the currency in that outcome is; and (4) determines the expected equity of the policy as $\sum p_i E(O_i)$, where p_i is the probability of outcome O_i. By contrast, the ex ante analyst: (1) identifies the possible outcomes $\{O_1 \ldots O_M\}$ of the policy; (2) determines, for each individual j, her expected value of the relevant currency, that is, $\sum p_i C_j(O_i)$; and (3) performs an equity analysis on these N individual expected values. In short, the ex post approach to equity estimates the degree of inequity in each policy outcome, and then (discounting each outcome by its probability) estimates the expected degree of inequity; the ex ante approach determines each individual's expectation from the policy (expected income, expected utility, risk of death) and then determines the degree of inequity of these expectations.

Which approach to equity, ex ante or ex post, is more appealing? Interestingly, the question has been largely overlooked by philosophers of distributive justice; but it has been examined by a body of scholarly work in welfare economics, with no clear resolution. (Broome 1984; Diamond 1967; Hammond 1982; Mongin and d'Aspremont 1998, 437-44) The best

argument for the ex post approach, one that seems (to this author) pretty compelling, is that morality is ultimately a matter of producing good outcomes. Poverty means being poor – not having an expectation of a low income or utility. Psychological trauma means experiencing mental illness or suffering – not having the expectation of mental illness or suffering. Normative criteria, such as equity, are applicable to the consequences or outcomes of our choices – to what might actually occur as a result of the policies society chooses or refrains from choosing. In other words, the ex post approach to equity sits naturally with a "consequentialist" approach to policy choice. (Scheffler 1988) To put the point more technically: the so-called "sure thing" principle, an intuitively appealing principle of rationality, leads to the ex post approach.[5]

These are difficult matters, and the reader not already familiar with the social choice literature on ex ante versus ex post approaches to policy choice may be more puzzled than enlightened. Suffice it to say that the ex post approach views inequity as a property of the outcomes or consequences of policy choice, not of individual expectations; and that there are strong arguments in favor of this approach. More concretely: if equity cares about raising individuals above some threshold (as I will argue it minimally does), then the threshold should be defined in terms of individuals' actual holdings of some "currency," not individuals' risks or expectations. Consider the exemplary case where the policymaker has to choose between mitigating a high probability natural hazard that imposes a high risk of fatality, serious injury, psychological trauma, and other sorts of serious deprivation on each member of a small population; or a lower probability natural hazard that imposes a low risk of fatality, injury, trauma, and other such serious deprivation on each member of a large population, but with a higher expected number of fatalities, serious injuries, psychological trauma cases, and other instances of serious deprivation. Then the ex ante approach will argue for mitigating the first hazard, while the ex post approach will argue for mitigating the second.

[5] Think of policies as probabilistic packages, or lotteries, of outcomes – lotteries that produce different outcomes depending on which one of a plurality of possible conditions in the world or contingencies actually obtains. Then the sure thing principle says that the policymaker's ranking of two lotteries that produce the same or equally good outcomes on a given contingency should remain the same if we merely swap those outcomes for another pair of identical or equally good outcomes or change the probability of the contingency. In effect, indifferent outcomes or the probability of indifferent outcomes should make no difference to policy choice.

6. What is the Currency for Individualistic Equity?

I have argued that equity is "individualistic" and ex post in its structure. Equity analysis should determine the possible outcomes of a policy choice and, for each outcome O_i, should evaluate the distribution across individuals – not groups – of the relevant items. But which items are those? What is the "currency" of equity? (Arneson 2000)

One policy area where issues of equity and distributive justice have been salient concerns the alleviation of poverty. Economists have traditionally conceptualized poverty as a low level of income or expenditure. (Laderchi et al. 2003) The problem with these "currencies" is that they track well-being quite imperfectly. As Amartya Sen argues:

> Our physical and social characteristics make us immensely diverse creatures. We differ in age, sex, physical and mental health, bodily prowess, intellectual abilities, climactic circumstances, epidemiological vulnerability, social surroundings, and in many other respects. Such diversities ...can be hard to accommodate adequately in the usual . . . framework of inequality assessment. (Sen 1992, 28)

Consider the "currency" of expenditure. The fact that P's expenditure level is greater than Q's doesn't mean that P is better off than Q, all things considered. P may be physically disabled; he may need a high level of expenditure to facilitate activities that Q can perform effortlessly, such as locomotion. Or, P and Q may both be physically able but Q may benefit from various public goods (she lives in a cleaner or sunnier climate), or a sunnier disposition, or a bigger circle of friends, that compensate for her lower level of expenditure.

Similar points can be made about the inadequacy of income as a "currency" for measuring deprivation and, more generally, equity – at least if income is defined in a straightforward and readily measurable way as cash income (wage, investment, and transfer income).[6] Those with higher cash incomes tend to be better off than those with lower incomes, but the correlation is far from perfect. An individual's well-being is the upshot of her choices in expending her income on marketed goods *plus* her physical and mental state and her access to nonmarket goods.

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[6] Income might be declined more inclusively, to encompass the money value of services from durable goods, consumption paid for by the government, home production, time spent in leisure rather than work, and even the consumption of public goods. "Income" thus defined would correlate better with well-being than does cash income, although not perfectly given differences in individuals' physical and mental conditions. In any event, scholarship on "income" inequality typically does not use this sort of inclusive construct. (Bojer 2003, 65-77)

In the literature on environmental and technological risk, a different "currency" tends to be used for discussions of equity: the risk of death. (Adler 2005; Adler 2003, 1414-36) A policy that leaves some individuals with an above-threshold risk of dying as a result of some hazard (a 1 in 1 million, 1 in 100,000, 1 in 10,000, or 1 in 1000 risk, say), or that produces a skewed distribution in the risk of death from the hazard, is seen as inequitable. This approach is doubly problematic. First, as already discussed, it takes an ex ante approach to equity, focusing on each individual's expectation of premature death rather than on the actual occurrence of premature death. Second, and additionally, the "currency" of death or the risk of death is too narrow. Hazards – natural as well as human – produce a range of bad outcomes: not just death, but also non-fatal injury and disease, the loss of income and expenditure, unemployment, psychological trauma, and the disruption of family and community life. Policy analysis of preparedness/response/recovery/mitigation measures – both equity analysis and cost-benefit analysis -- should, in principle, capture all of these dimensions, not just the life/death dimension.

Clearly this is true for cost-benefit analysis (whether understood as a tool for implementing the criterion of Kaldor-Hicks efficiency, or a tool for implementing the criterion of overall welfare). Cost-benefit analysis aims to aggregate willingness-to-pay for all the welfare-relevant aspects of a policy, not just its effect on premature death. But it is no less true for equity analysis. Consider a natural hazards policy that focuses on warning and evacuation, with little effort given to strengthening structures or to recovery. This policy might be very effective in preventing fatalities, but would fail to prevent the host of serious non-fatality setbacks that occur when individual homes and a community's infrastructure are destroyed. In general, to its credit, the existing literature on natural hazards policy recognizes that good analysis should be inclusive in characterizing the impacts of hazards. (Cochrane 1975; Ewing et al. 2005; Heinz Center 2000; Mileti 1999)

So what *should* the "currency" for natural hazards equity analysis be? In principle, I suggest, the answer is well-being itself – not merely particular components of well-being, or particular preconditions for well-being, or particular resources that facilitate well-being, such as income or life. One objection to this approach is that well-being is subjective. Different individuals have different conceptions of well-being. Although this is surely true, well-being is objective to the extent that conceptions overlap. (Smith 1994, 173) If there were no overlap, how could there be *any* "currency" for equity analysis? But, in truth, virtually all of us have

conceptions of well-being that view life and income as intrinsically or instrumentally valuable. Similarly, virtually all of us have conceptions of well-being that view physical and psychological health, social interaction rather than isolation, meaningful employment, and other such items (not captured by the income and longevity "currencies") as intrinsically or instrumentally valuable.

A different critique of the welfare "currency," advanced by some philosophers, is that equity requires an equitable distribution of *opportunities* for well-being – not well-being itself. (Arneson 2000) After all, some individuals will end up with a low level of well-being because of their own choices; others, because of bad luck. Surely these two sorts of individuals should be treated differently by equity analysis. The answer to this point is twofold. First, equity analysis *should* in principle integrate considerations of choice and responsibility – but we don't yet have the practicable tools to do that. (Laderchi 2003, 255) Second, and more to the point, the choice/responsibility criticism hardly argues for a narrow rather than more inclusive currency. If we try to ensure that no one has a low income, or dies prematurely, then we will be aiding some individuals who are responsible for their deprivation (those who have squandered their resources, or knowingly engaged in risky activities), no less so than if we aim to ensure that no one is psychologically traumatized, socially isolated, or unemployed.

So what, then, is human welfare? What are the components of an individual's life that, most of us will agree, contribute to the well-being of that individual? This sort of question can be answered more or less systematically, through reflection, or discussion, or surveys. The World Health Organization has recently undertaken an impressively systematic effort to answer the question, organizing focus groups and surveys in many different countries to arrive at a list of the components of "quality of life" and a matching survey instrument that can be used to inform governmental policymaking, both in the health care field and perhaps in other fields too, as well as decisions by medical professionals and other private actors. (Szabo 1996; The WHOQOL Group 1998; Bonomi et al. 2000) The WHOQOL list consists of 24 "facets" or dimensions, organized into 6 domains.

WHOQOL Quality of Life Framework

Physical Domain	**Psychological Domain**	**Independence Domain**	**Social Domain**	**Environment Domain**	**Spiritual Domain**
Pain and Discomfort	Positive Feelings	Mobility	Personal Relationships	Physical Safety and Security	Spirituality
Energy and Fatigue	Thinking, Learning, Memory and Concentration	Activities of Daily Living	Social Support	Home Environment	
Sleep and Rest	Self-Esteem	Dependence on Medication or Treatments	Sexual Activity	Financial Resources	
	Body Image and Appearance	Working Capacity		Health and Social Care: Availability and Quality	
	Negative Feelings			Opportunities for Acquiring New Information and Skills	
				Participation in and New Opportunities for Recreation/Leisure	
				Physical Environment	
				Transport	

The philosopher Martha Nussbaum has for some time been intensively engaged in a broadly similar effort to define a list of the constituents of the quality of life that could guide governmental decisions – in particular, the definition of a "social minimum" that every citizen is entitled to.

Nussbaum's List of Central Human Capabilities

1. Life
2. Bodily health
3. Bodily integrity
4. Senses, imagination and thought
5. Emotions

6. Practical reason ("being able to form a conception of the good and to engage in critical reflection about the planning of one's life")
7. Affiliation (both "being able to live with and towards others" and "[h]aving the social bases of self-respect and non-humiliation")
8. Other species
9. Play
10. Control over one's environment (both "being able to participate effectively in political choices" and "being able to hold property")

(Nussbaum 2000, 78-80) Nussbaum's list and the WHOQOL list are presented here, not as the definitive lists of the constituents of well-being, but rather as particularly comprehensive and carefully constructed examples of this sort of list. Numerous other examples can be found in the philosophical and economic literatures. (Alkire 2002, 78-84) A meta-analysis of this literature would be one plausible way to generate a consensus list of the dimensions of well-being that a governmental agency could employ in policymaking, including equity analysis.

There are two apparent difficulties with the proposal that equity analysis should employ the currency of well-being, as identified by the sort of multi-dimensional list of the different constituents of welfare that the WHOQOL framework and Nussbaum's list exemplify. One difficulty is commensurability – integrating the different dimensions into a single measure of well-being. Let me bracket this problem for the moment, to return to it in the next section.

The other problem is the sheer multiplicity of the dimensions. Consider the WHOQOL list. None of the dimensions is inherently unmeasurable, but many are difficult to measure, and the decision costs of evaluating policies with respect to all 24 of the WHOQOL dimensions would be overwhelming.

The answer is that equity analysis should be sensitive to ease of measurement and to the related problem of decision costs. Equity analysts may need to make rough and ready, threshold assessments about which dimensions are worth quantifying – depending both on expected measurement costs, and the likelihood that measurement will provide choice-relevant information (that is, lead the policy maker to adopt a different policy than she would have absent the measurement). Relatedly, analysts will sometimes find it cost-effective to use proxy variables for certain dimensions or sets of dimensions: items that are not themselves an intrinsic

component of well-being but are readily measurable and correlate with certain aspects of well-being.

In many instances this sort of threshold assessment will suggest that a variety of dimensions should be quantified and, in particular, that focusing on the traditional equity currencies of income and risk/longevity is too limited. Consider, by way of analogy, cost-benefit analysis of environmental policies, where a variety of welfare effects are now routinely included in analyses, in particular, health, visibility, water quality, and recreational values, along with changes in consumption and fatality risks. (Cropper 2000)

An even closer analogy is the scholarly literature in development economics, inspired by Amartya Sen's work, which seeks to use a plurality of "functionings"[7] (in effect, particular aspects of well-being or proxy variables for such aspects) rather than income as the scales of poverty and development. (Alkire 2002; Balestrino 1996; Fukuda-Parr 2003; Kuklys 2005; Klasen 2000; Laderchi 2003; Qizilbash 2002) To give one illustrative example: Stephan Klasen measured the extent of poverty in a sample of South African households in two ways: first, by determining each household's expenditures; second, by measuring each household's achievement with respect to 14 different functionings: education, income, wealth, housing, water, sanitation, energy, employment, transport, access to financial services, nutrition, health care, safety, and perceived well-being. A household achievement with respect to each functioning was quantified using a measurable indicator. For example, the indicator for education was the average years of schooling of adult household members; the indicator for sanitation was the type of facility in the household, from no toilet at all to indoor flush toilet, ranked 1 to 5. An overall functioning for the household was determining by averaging the 14 components. A household was judged seriously impoverished with respect to expenditures if its expenditures were below the 20th percentile, and seriously impoverished with respect to functionings if its overall functioning was below the 20th percentile. Klasen found that the expenditure- and functioning-based analyses gave quite different pictures of the extent and distribution of poverty in South Africa.

[7] Sen argues that the currency for equality should be "capabilities," which are opportunities to achieve "functionings." (Sen 1992) In practice, much of the Sen-inspired work in development economics has used "functionings" not "capabilities," given the difficulty of measuring opportunities. (Laderchi 2003, 255) I therefore generally use the term "functioning" in discussing the Sen-inspired approach.

8. Individualistic Equity: Comparative or Noncomparative?

A very important distinction evident within the philosophical literature on equality is the distinction between comparative and noncomparative accounts. (Clayton and Williams 2000; Crisp 2003; Frankfurt 1987; Symposium 2003) Assume welfare is the "currency" for equity – as I've argued it should be. The comparativist, then, cares about the overall pattern of welfare levels. Her concern is how individual P fares, as compared to Q and R and S and so on. The noncomparativist does not have this concern: rather, her view is that improvements in someone's welfare become more important, morally speaking, the lower that person's overall level of welfare. In effect, the comparativist has a fairness-based view of equity, while the noncomparativist has an urgency-based view. More formally, the noncomparativist's ranking of outcomes is "separable" in individual welfares, while the comparativist's is not.[8]

Intuitions pull in both directions. Further, existing practices of measuring equity are sometimes comparativist, sometimes noncomparativist in spirit. For example, the popular "Gini coefficient," often used to evaluate the distribution of income, is a comparativist measure. By contrast, evaluating a income distribution by counting the number of individuals below a poverty line trades on the noncomparativist idea that it is particularly morally urgent to benefit individuals who are very badly off. (Bojer 2003, 92-106, 118-22)

Are we at an impasse? Maybe not. Some progress can be made by seeing that a transfer of a fixed amount of well-being from an individual who is well off to one who is below some threshold of well-being will be counted as an equity improvement both by comparativists and by noncomparativists.[9] To begin, comparativists should agree that such a "Robin Hood" transfer improves the equity pattern. (If it doesn't – if reverse-Robin Hood transfers are seen as possibly

[8] A ranking of outcomes is separable in individual welfares if the ranking of any two outcomes is independent of the welfare levels of "indifferent" individuals – those not affected by the choice. Imagine a population of 5 individuals. I will now construct an example in which the last 2 individuals are "indifferent." In outcome x, the welfare levels are (4, 10, 18, 20, 20); in y they are (6, 6, 20, 20, 20); in z they are (4, 10, 18, 6, 6); in w they are (6, 6, 20, 6, 6). Then "separability" means that x is ranked as more equitable than y if and only if z is ranked as more equitable than w.

[9] This is a weakened version of the "Pigou-Dalton" condition popular among economists who study inequality. The standard version of that condition, with well-being as the currency, says that the transfer of a fixed amount of well-being from someone who is better off to someone who is worse off increases equity. (Tungodden 2003, 19) On the standard view, any equity-regarding social welfare function *must* satisfy the Pigou-Dalton condition; further distinctions can then be delineated within the set of Pigou-Dalton respecting functions, for example between functions that are separable in individual welfares and those that are not. My weakening of the Pigou-Dalton condition allows for the plausible view that fixed transfers above a poverty line have no impact on equity.

improving the overall pattern – then the theorist can hardly be said to care about equity.) Further, noncomparativists may disagree about whether effects on well-being have variable weight above a threshold of poverty, but at a minimum they will surely agree that increments to the well-being of someone below such a threshold are more urgent than decrements to the well-being of someone above it.

In short, a noncomparative, threshold approach that quantifies the extent to which individuals lie below some "poverty line" of well-being should be the core of any equity analysis. Specific views of equity may require further analysis, but every equity theorist would presumably agree that, holding overall welfare constant, measures that benefit those below the poverty line are good policies.[10] To be clear, I use the term "poverty" as a term of art, to mean the deprivation of *well-being*. "Poverty" in the vernacular, meaning income poverty, is only one aspect of well-being poverty, for reasons already discussed. *Equity analysis should, at a minimum, quantify the effect of natural hazards policies on well-being poverty.* That is the essence of my recommendation.

Many complexities remain, to be resolved through further discussion, surveys, and technical work. One important question is whether to set a single all-dimensions-considered well-being poverty line, or rather poverty lines for each of the measured welfare dimensions. The first approach is more theoretically compelling, but more demanding in terms of measurement. The notion of an interpersonally comparable utility scale is, I believe, a coherent one, but we as yet lack a practicable set of tools for readily operationalizing this scale in policymaking.

Assuming the disaggregated approach is pursued, the problem of setting dimension-specific poverty lines arises. Since poverty lines, as described here, are meant to represent a kind of "overlapping consensus" across equity theories, the relevant line should be calibrated so as to capture the point of substantial deprivation – that point such that moving someone above the line, at the expense of someone who is well off, would be seen as an equity improvement by virtually all equity theorists. In principle, the poverty line should be absolute rather than relative – because it is meant to appeal to noncomparativists who are concerned with absolute deprivation, and not merely comparativists who focus on relative welfare. But some goods, most clearly

[10] By this I mean measures that, holding overall welfare constant, benefit some below the poverty line and harm none below it, imposing costs only on those above it. Measures that benefit some and harm others below the poverty line are a more controversial matter.

social status, are intrinsically relational. The income poverty line understood as a proxy variable for social status will be relative, not absolute; if your income is only a small fraction of your society's median income, you are likely to be ostracized and feel shame, even if that income is sufficient to nourish, clothe and shelter you. More generally, percentile, fraction-of-median, or other relative measures for many welfare dimensions will be a practicable way to set the poverty line in default of an implementable absolute threshold. (Qizilbash 2002, 758-59; Bojer 2003, 118-20)

A third and related problem is that of specifying the time period for measuring achievement with respect to a given dimension of well-being. (McKerlie 1989; Temkin 1993, 232-44) The literature on income distribution is relevant. Should we evaluate the distribution of lifetime income or of periodic (for example, annual) income? (Bojer 2003, 74-76, 90-91) Generally scholarship takes the latter approach, because lifetime values are hard to measure. The same would be true for measuring non-income welfare dimensions. For many dimensions, the simplest approach would be momentary rather than lifetime or periodic. Being in a state of seriously bad health at any time counts as a momentary deprivation of health; being homeless at any time counts as a momentary deprivation of shelter; being unemployed at any time counts as a momentary deprivation of meaningful work; being seriously psychologically traumatized at any time counts as a momentary deprivation of mental health; being hungry at any time counts as a momentary deprivation of nourishment; living without any social support at a time counts as a momentary deprivation of social support. Total bad health, homelessness, unemployment, etc., is then (most straightforwardly) a matter of the total time in which individuals are in the deprived state.[11] Life can be handled in a related manner: not being alive counts as a momentary deprivation of life, and the change in total longevity resulting from a policy is a measure of its equity effect on the life dimension.[12]

[11]To be sure, this kind of simple aggregate measure for dimension-specific poverty could be refined where there are equity-relevant differences among those below the line. This is not true for death: everyone not alive at a moment is equally dead then. But it is clearly true for bad health: among the universe of serious health conditions, some are worse than others and presumably generate stronger redistributive claims.

[12]Using lifetimes as the relevant time period for measuring well-being achievements with respect to the "life" dimension means measuring the equity impact of a policy as the change in the number of deaths that occur before some age threshold. By contrast, using moments as the equity period means measuring the change in longevity (the total years that individuals are alive.) On this approach, each increment to longevity relieves a momentary deprivation.

A fourth issue is how to handle uncertainty. For a simple illustration of the issues, assume that we have two welfare dimensions, f and g. We are choosing between a status quo S and a policy with two possible outcomes O and O*. f(_) is the extent of deprivation with respect to f in the given outcome; similarly for g(__). Probabilities p and (1-p) are the probabilities of O and O*, respectively, if the policy is chosen. The ex post approach to equity says that we should measure overall poverty in each outcome as a function of f-deprivation and g-deprivation, and then discount by outcome probabilities to determine expected equity. Formally, E(f(_), g(_)) measures overall poverty in the outcome. The status quo has equity measure E(f(S), g(S)); the policy has an equity measure equaling its expected equity pE(f(O), g(O)) + (1-p)E(f(O*), g(O*)).

If the function E is assumed to be roughly linear, then we can separate out the two dimensions. Imagine that $E(f(\_), g(\_\_)) = k_f f(\_\_) + k_g g(\_\_)$. Then the expected equity of the policy is $p [k_f f(O) + k_g g(O)] + (1-p) [k_f f(O^*) + k_g g(O^*)] = k_f [p f(O) + (1-p) f(O^*)] + k_g [p g(O) + (1-p) g (O^*)]$. In other words, the expected equity of the policy is the weighted sum of the expected measures with respect to the two welfare dimensions.[13] More generally, if overall poverty in an outcome is approximately a linear function of poverty with respect to the underlying dimensions, equity analysis of a given policy can proceed by determining the change in expected poverty produced by the policy for each dimension, and then aggregating these values using weighting factors to produce an overall equity score for the policy. Concretely: if the equity analysis measures deprivations with respect to the six dimensions of (say) longevity, hunger, homelessness, serious disease or injury, unemployment, and psychological trauma, then she will ideally establish weighting factors for these dimensions. Through reflection, discussion, or surveys, she will need to establish the equity importance of a day spent hungry, as compared to a day spent homeless, in a serious disease or injury state, unemployed, in a state of psychological trauma or (at the extreme) a day in which the subject is not alive at all. Equity analysis of a natural hazards policy will then consist in: (1) estimating the change in the expected amount of longevity, hunger, homelessness, serious disease or injury, unemployment, and psychological trauma, as produced by the policy relative to the status quo; and (2) applying the weighting factors to these quantities and aggregating.

[13] This should not be confused with the ex ante approach criticized earlier, which uses individuals' expectations as the basis for equity policy. Rather, the idea is that, under conditions of linearity, the expected overall ex post poverty arising from a policy is just the same as the weighted sum of the expected amount of poverty for each well-being dimension. The expectations being summed are not individual's expected utilities or expected holdings in some other currency, but the expected amount of poverty for each dimension.

9. Conclusion

Through normative argument, we can make progress in understanding what equity analysis for natural hazards policy should involve. There is no reason to think that equity analysis is wholly subjective or political, any more than cost-benefit analysis – although of course in both cases any governmental decision is ultimately subject to political control through the legislative process. The focus of equity analysis, I have argued, should be *well-being poverty*: serious deprivations with respect to any dimension of well-being. Well-being should be the basic "currency" for equity analysis – not fatality risk, income, or other such traditional currencies. Analysts should start with a basic list of well-being dimensions. The WHOQOL's list and Nussbaum's list are reasonable places to start, but there are other plausible lists in the literature as well, and one possibility is to meta-analyze this literature to produce a consensus list. Once a list of well-being dimensions is in place, a rough-and-ready "value of information" approach should be used to decide whether to include a given dimension in the analysis: the dimension should be included if doing so seems likely to make a difference to the analysis, and if the dimension can be measured (directly or with proxy variables) sufficiently easily given the stakes of the policy decision at hand. A "poverty line" needs to be set for each included dimension. This should in principle involve absolute, not relative poverty – for it is meant to represent the point of "overlapping consensus" among virtually all equity theorists, noncomparativist as well as comparativist – and, relatedly, should involve a serious deprivation (not just the absence of full flourishing). It should be the point at which individual claims become sufficiently urgent that overall-well-being-preserving transfers to individuals below the line, from those above, is – fairly uncontroversially -- good policy.

The equity analyst will also need to develop some sense of how the amounts of poverty along each well-being dimension, in a given outcome, interact to produce the overall degree of poverty in that outcome. Assuming the interaction is roughly linear, then equity analysis will have the following, simple structure: first assess the policy's expected impact with respect to each dimension, then weight and aggregate to determine an overall equity score for the policy. Concretely, this would mean predicting the extent to which the policy can be expected to increase longevity, reduce serious injury, stop serious psychological trauma, prevent hunger or

homelessness, lessen unemployment, prevent family breakdown, and reduce other such instances of serious well-being deprivation that typically accompany natural hazards – and then weighting and aggregating these poverty-reduction benefits. More generally, whatever specific dimensions are included, and whatever assumptions are made about the interaction of those dimensions, the basic thrust of equity analysis should be to quantify the change in expected well-being poverty produced by each policy under consideration.

Because this proposal departs from the accounts of equity common in the human hazards literature – in adopting an ex post rather than ex ante focus, and using well-being not fatalities as the currency – it may strike some readers as very odd. Suffice it to say that the proposal draws on a growing body of scholarship in development economics, inspired by Amartya Sen's scholarship, and that the implementation of equity analysis would also benefit from that scholarship – for example, in identifying dimensions and drawing poverty lines.

Clearly, even if this general approach is adopted, there is much room for debate and argument, in three areas: (1) further specifying the approach (identifying dimensions, poverty lines, methodologies for measuring dimension-specific poverties, and weights for the dimensions); (2) determining whether other sorts of equity analyses should also be performed (e.g., a Gini-type analysis, which comparativists might approve but noncomparativists will not); and (3) determining how to "balance" the results of cost-benefit analysis and equity analysis. But structured argument is different from an undisciplined "value choice." Whether because of global warming, meteorological or seismic cycles, or burgeoning populations in hurricane- and earthquake-prone areas, we seem to be entering a period when natural hazards will command national attention and resources as never before. It should be possible to bring some intellectual rigor and structure to the expenditure of those resources – not just at the stage of maximizing overall well-being/efficiency, but also at the stage of determining what an "equitable" expenditure would be.

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