# Risk Aversion is Grounds for Rejecting the Ex Ante Pareto Principle

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## Abstract

This paper argues against applying the ex ante Pareto principle universally as a decisive criterion for policy decisions under risk. The ex ante Pareto principle relies on the measure of expected utility in order to assess people's prospects under each policy. Expected utility theory, however, does not sufficiently account for people's risk attitudes as distinct psychological attitudes. Therefore, policies might expose people to risks which they would rationally not want to take. It concludes that the ex ante Pareto principle cannot be justified from a contractualist standpoint and loses its appeal.

**Keywords:** Allais Paradox; Expected Utility Theory; Risk Aversion; ex ante Pareto Principle

In this paper, I argue against the universal applicability of the ex ante Pareto principle (hereafter EAP) as a decisive criterion in cases of policy decision making under risk. I argue that the necessary measure of well-being standardly employed by the EAP, expected utility (EU), does not adequately capture the risk preferences of individuals. Consequently, certain policies may subject individuals to risks they would not willingly take, leaving the EAP unjustifiable from a contractualist standpoint in some cases. First, I outline the EAP and explain its appeal for decision makers. I then motivate my critique by using a stylized case of a policy decision. In order to assess the validity of EU as a criterion for decision making, I delineate what it in fact captures, arguing that the independence axiom in expected utility theory (EUT) is inadequate for measuring attitudes to risk. This point is illustrated using the Allais paradox, which systematically violates the independence axiom in individual decision making. Concrete cases are taken from experiments in health outcomes in similar contexts to exemplify the argument's direct relevance for policy. I conclude that decision makers must take this shortcoming of the EAP into account when making policy decisions concerning risk.

Policy decisions often have to be made regarding uncertain states of the world. The EAP is a principle that is often invoked to make such policy decisions involving risk. The principle "holds that if an alternative has higher expected utility for every person than every other alternative, then this alternative should be chosen" (Fleurbaey and Voorhoeve 2013: 114). This principle is very appealing to decision makers as it is often claimed, it can be justified

from a contractualist standpoint of moral rightness, meaning that "an action is right if and only if it is justifiable to each person" (Frick 2013: 132). As far as EU forms basis of decision making, it follows that it is justifiable to choose a policy through which EU is higher for every person than in any other alternative policy. EU maximising individuals are not reasonably expected to reject an alternative that gives them the highest EU. The decision maker would in this manner determine what is in people's best interest, given the available information.

To illustrate the principle through a stylized case: A policymaker might be faced with a decision about compulsory cancer screening. There are minor side effects to being screened, which means that for many individuals the outcome utility if screened is slightly lower than if the test is not conducted. If a person is not screened, they have a 1% chance of dying from cancer, but are otherwise slightly better off. The EUs are expressed in Table 1.

| Probability of state of the world | Individuals' utility of outcome for policy *X* (no screening) | Individuals' utility of outcome for policy *Y* (screening) |
|---|---|---|
| No cancer (*P=0.99*) | 0.86 | 0.85 |
| Cancer (*P=0.01*) | 0 | 0.85 |
| **Expected Utility** | **0.8514** | **0.85** |

**Table 1.** Expected utilities of cancer screening policies.

To calculate EU in the bottom row, we multiply the probability of a world state with an individual's utility of outcome for that world state. As we see above, every individual's EU is higher without a vaccination under policy X. The EAP therefore dictates that we should choose policy X, since the EU is higher for every person. Importantly, this measure of utility is assumed to be derived from the three rationality axioms of the von Neumann-Morgenstern utility theorem (Fleurbaey and Voorhoeve 2013: 115). The theorem is the basis of EUT and prevails in orthodox decision theory and economics (Stefansson and Bradley 2017: 2). It allows us to measure and calculate EU as above.

Should this measure of EU, which is central to the EAP, really be a decisive criterion in decisions concerning risk? Both policies yield relatively desirable outcomes. The EAP dictates that we choose X, precisely because it yields a higher EU. But would I forego an outcome of 0.85 and risk losing everything for a marginal gain in EU (to 0.8514)? Intuitively, I do not think I would. I would feel disinclined to take this, admittedly small, risk. However, as a utility maximising agent, rationality dictates that I choose policy X. So, what accounts for the EAP's misalignment with the intuition that I should choose Y?

The problem lies with EUT, which is used to determine the ex ante superior alternative. It does not independently take into account the attitude I hold towards risk taking. In EUT, my risk attitude is derived from the choices I make in certain gambles, not the other way around. I am said to be risk averse with respect to a certain good if I prefer to take the certain outcome of quantity q over a gamble which may yield the expected outcome of q (Stefansson & Bradley 2017: 1). This is only the case if I get diminishing marginal utility from the good. In EUT, risk aversion is a property of an agent's utility curve of a good and arises as a consequence of diminishing marginal returns to the good in question – no independent attitudes towards risk taking are taken into account. The guaranteed advantage of this approach is that we can easily and elegantly calculate the EU with only two inputs, as we did in Table 1. However, it does not capture our attitudes towards risk in a manner that is useful for decision making purposes. Hansson (1988) expresses this problem as one of conjoint measurement. Our measurement of utility conjointly measures risk attitudes as well as the desirability of a certain outcome. This is where the above dissonance between intuition and

rationality arises. Of course, under certainty, I prefer an outcome of 0.8514 over an outcome of 0.85. But at the same time I may not be willing to risk a certain outcome of 0.85 for a slightly higher expected utility carrying with it a small chance of losing everything. Desirability of an outcome is one thing – my attitude towards risk taking is another. This distinction is not accounted for in EUT.

One of the most significant examples of the shortcomings of this measure of utility and risk is the Allais (1953) paradox. In this paradox we compare the choices of individuals in two experiments, which in turn consist of two gambles with monetary payoffs (see Table 2). The expected payoffs of these gambles can be seen in the last row of the table. When presented with the choices between gambles 1A or 1B and gambles 2A or 2B, EU maximising agents are supposed to choose either 1B over 1A and 2B over 2A, or 1A over 1B and 2A over 2B, depending on their utility curves. Either of the two choice patterns would be valid under EUT. Agents choosing the latter are simply less risk averse with respect to losing money than agents choosing the former . Very often, however, agents choose 1A over 1B but choose 2B over 2A (Allais 1953). This choice pattern is not compatible with EUT. If agents are more risk averse and choose 1A over 1B, they must also choose 2A over 2B, since the chance of winning is higher in both gambles, and vice versa. This result is significant in the sense that the choice pattern indicates a systematic violation of EU maximization.

| Experiment 1 | | | | Experiment 2 | | | |
|---|---|---|---|---|---|---|---|
| Gamble 1A | | Gamble 1B | | Gamble 2A | | Gamble 2B | |
| Winnings | Chance | Winnings | Chance | Winnings | Chance | Winnings | Chance |
| $1 million | 89% | $1 million | 89% | Nothing | 89% | Nothing | 89% |
| $1 million | 11% | Nothing | 1% | $1 million | 11% | Nothing | 1% |
| | | $5 million | 10% | | | $5 million | 10% |
| **$1 million** | | **$1.39 million** | | **$110k** | | **$500k** | |

**Table 2.** The two gambles of the Allais paradox.

When agents demonstrate this choice pattern, they effectively violate the independence axiom of EUT, which is one of the three fundamental rationality axioms we need to measure and calculate EU. This axiom states that if two gambles are mixed with an irrelevant third one, then agents should still make the same choice as before. Formally put, for all gambles R, P and Q, if R ≥ P, then RxQ ≥ PxQ, where RxQ means gamble R is mixed with gamble Q. In Table 2 above, a violation of this axiom can clearly be seen. Comparing experiments 1 and 2, we observe that 89% of the gambles gave the same outcome respectively (row shaded in grey), making these parts of the gambles irrelevant. If we disregard the row shaded in grey, however, all the gambles are identical, which should give us a consistent outcome in both experiments. But, as we know, once we mix in the irrelevant part, the choice pattern is often inconsistent, which violates the independence axiom.

It is essential to my argument to explain why this violation matters. The violation of the independence axiom highlights risk attitude as a distinct factor in decision making. The choice pattern is only inconsistent due to a significant change in risk, not due to a significant change in the expected outcome. The significant difference between Experiments 1 and 2 are not the outcomes, B is dominating in both. The significant change lies in the probabilities. Consequently, it seems that having risk preferences as distinct psychological attitude should not be seen as irrational or wrong. If this is true, then the EAP as defined by Fleurbaey and Voorhoeve (2013) and defended by Frick (2013) is in trouble. The reason we employ the EAP is because it can be justified from a contractualist standpoint. Policy decisions under the EAP are seen as correct because they are supposedly justifiable to each person. And yet – they might not be. Decisions made under the EAP are not

necessarily justifiable to each person because people may hold psychologically distinct risk attitudes which are not represented by the EU. Individuals might, therefore, reasonably reject policy X in Table 1, despite it yielding a higher EU.

Though the issue may seem technical, it is important for policymakers not to ignore it. The Allais experiment has been replicated many times, including, relatively recently, using health outcomes. Adam Oliver (2003) found a pattern violating the independence axiom for 14 out of 38 participants of his study. The experiment used "living x years in full health" rather than money as payoffs, but maintained the same chance profile (Oliver 2003: 43). Oliver explains that the pattern is the result of different cognitive processes and argues that "we cannot conclude that these cognitive processes are inconsistent, irrational or wrong. They are merely different" (Oliver 2003: 45). If this is true, using EU as a basis for decision making may not be justifiable to each person. Plausibly, a significant part of the group affected by the policy would be subjected to risks they do not want to take. The example in Table 1 is one instance where this might be the case.

I have argued that the EAP should be used with caution as a decisive criterion for decisions involving risk. The ex ante measurement that is employed, EU, does not capture all the relevant factors of individual decision making – particularly attitudes to risk. Experiments in Allais-type contexts show this to be the case. If it is true that there are distinct psychological attitudes towards risk, decision makers need to take them into account, potentially through theories such as Risk-Weighted Expected Utility Theory (Buchak 201). Otherwise, policy decisions may not be justifiable to each person, as individuals could be subjected to risks they would not take. If policies are not justifiable to each person, then the EAP cannot be justified from a contractualist standpoint of moral rightness, which is a principal basis of its appeal in the first place.

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