to support the liberal faith that democracy satisfies the political preferences of citizens better than any other form of government.

APPENDIX: THREE TYPES OF UTILITY FUNCTIONS

This appendix briefly explains the differences among ordinal utility, von-Neumann-Morgenstern cardinal utility, and interpersonal cardinal utility.

A pollster can ask a voter to rank three alternatives by using the letters A, B, and C. The ranking provides no information about how much more the voter likes one alternative than another. Since the distance between rankings has no meaning, the operation “B-C” is meaningless.

The pollster could obtain the same information by asking the voter to assign the numbers 3, 2, and 1 to the three alternatives, with a higher number indicating a higher preference. As before, the ranking provides no information about how much more the voter likes one alternative than another. Since the distance between rankings has no meaning, the operation “2-1” is meaningless, even though using numbers rather than letters suggests that subtraction is meaningful.

Now assume the pollster wants more information. The pollster could ask the voter to assign a number between 0 and 5 to each candidate, with a higher number indicating a higher preference, and the gap between rankings indicating the extent of the difference. (Most voters would have difficulty responding, so an indirect method would get the same information more reliably, but my concern here is theoretical, not practical.) A voter who performs this task provides information about how much more he likes one alternative than another. Assume the voter assigns “1” to the worst alternative, “2” to the middle alternative, and “4” to the best alternative. Since the distance between rankings has meaning, the operation “2-1” also has meaning. Specifically, the fall in the voter’s satisfaction when changing from 4 to 2 exceeds the fall when changing from 2 to 1, as indicated by “4-2 > 2-1.”

In the preceding example, the first voter gave the numbers (4, 2, 1) to the three alternatives. Now assume the pollster asks the same question of a second voter, who gives the numbers (5, 3, 0). The poll has not provided any information about how to compare the satisfaction of two different voters. Perhaps the first voter counts satisfaction in large units analogous to meters, whereas the second voter counts satisfaction in small units analogous to centimeters. We have no way to

38 The particular numbers chosen do not matter so long as “larger” corresponds to “preferred.” To illustrate, instead of the numbers 1, 2, and 3, the pollster could use the numbers -4, 8, and 10. Although the numbers differ, they convey the same information so long as higher numbers get assigned to more preferred alternatives.

39 Distance between rankings can be measured by choices among gambles. To illustrate, the pollster might ask, “Assume that you face a gamble in which your third choice will win with probability .6 and your first choice will win with probability .4. Would you rather face this gamble or another gamble in which your third choice will win with probability .5 and your second choice will win with probability .5?” For a discussion of how to make public policy by using the preferences of people toward gambles, see Raiffa 1968.
compare the distance between the best and worst alternatives for the two voters. Perhaps 4-2 in units of satisfaction for the first voter exceeds 5-0 in units of satisfaction for the second voter, just as 2 meters exceeds 5 centimeters.

Scholars have long debated whether a method exists for making public policy by combining the satisfaction of different people. Economists sometimes assume that such a method exists and then consider its consequences in formal models. If such a method existed, then units of satisfaction could be standardized across people. If the answers of the two voters were given in standardized units, then an increase in satisfaction of 4-2 units for the first voter is less than an increase in satisfaction of 5-0 in units for the second voter, just as 2 meters is less than 5 meters.

Over a long history, economics has distinguished several types of utility functions. The first type of utility function, in which utility differences have no meaning, is called ordinal. Pareto efficiency uses ordinal utility functions. The second type of utility function, in which utility differences have meaning for a single person, is called cardinal utility, or, more precisely, von-Neumann-Morgenstern cardinal utility. This type of utility is used to model individual choices under uncertainty. The third type of utility, which standardizes units for counting satisfaction of different people, is called interpersonal cardinal utility. This type of utility is used for welfare maximization.

Pareto efficiency clearly requires ordinal utility, and welfare maximization clearly requires interpersonal cardinal utility. What about cost-benefit efficiency? Cost-benefit efficiency can be regarded as welfare maximization under a special assumption about interpersonal cardinal utility. The special assumption is that utility increases by the same amount when an extra dollar is given to someone, regardless of who receives it. Under this assumption, the rich and the poor gain equal amounts of utility from an additional dollar. That is the method of cost-benefit analysis.

Alternatively, cost-benefit efficiency can be defended without reference to maximizing cardinal utility. To illustrate, if rational people were to bargain over the terms for organizing a state, they might agree to organize its politics to maximize the nation’s wealth. This argument is a contractarian defense of cost-benefit analysis.

40 The method most discussed in economics is found in Harsanyi 1953 and Harsanyi 1955.
41 The most famous example is the optimum income tax problem, as formulated in Mirrlees 1971.
42 Besides an ordinal utility function, the other two primary types are von Neumann-Morgenstern utility, which applies to choice under uncertainty (von Neumann and Morgenstern 1944), and interpersonally comparable utilities, which apply to redistributive policies (Sen 1970a).
43 For an exchange on this point, see Posner 1981 and Coleman 1980.