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EVALUATING TIME STREAMS OF INCOME: DISCOUNTING WHAT?

ABSTRACT. For decisions whose consequences accrue over time, there are several possible techniques to compute total utility. One is to discount utilities of future consequences at some appropriate rate. The second is to discount per-period certainty equivalents. And the third is to compute net present values (NPVs) of various possible streams and to then apply the utility function to these net present values. We find that the best approach is to first compute NPVs of various possible income streams and then take the utility of such NPVs. We show the drawbacks of other alternative models of evaluating income streams. The article discusses the advantages of the power and logarithmic forms in the modeling of time preference. These are the only forms for which utility of income and utility of consumption are strategically equivalent. Further, these forms permit the flexibility in the choice of a time period (e.g., monthly or quarterly) without modifying the utility function, thus simplifying analysis.

KEY WORDS: discounted utility, indirect utility of income, net present value, time preference

1. INTRODUCTION

Consider the decision problem of an MBA student who is faced with the decision of selecting a job from a set of alternative job offers that he has received. The student evaluates these jobs on the criteria of first year salary and future salary (say 3 years from now), along with other criteria such as location of the job, functional area, travel requirements, etc. For simplicity, we assume that attributes other than the monetary attributes (first year salary and future salary) are fixed at a reference level and a pricing out procedure (Keeney and
Raiffa, 1976) is used to reduce all jobs in terms of equivalent first year salary, $x_1$, and future salary, $x_2$. Thus, all jobs have identical values on non-monetary attributes and differ with one another only on equivalent first year and future salaries. Further, suppose that $x_1$ and $x_2$ may be uncertain; for example, a part of the salary may be dependent on the performance of the company.

Keeney and Raiffa (1976) note that several techniques are suggested in practice to evaluate alternatives when consequences accrue over time. The first approach is to take expected utilities at each point in time and to discount these expected utilities. The second approach is to take certainty equivalents at each point in time and to discount these certainty equivalents. The third approach is to discount the various possible certain streams, assess a utility for such present values and then weight these utilities by the respective probabilities of the streams. We will define these approaches precisely in the ensuing sections. Our aim is to evaluate these three approaches from a prescriptive/normative standpoint.

For simplicity, we assume that there are only two time periods and that $(x_1, x_2)$ denotes the stream where a consequence $x_1$ occurs in period 1 (now) and $x_2$ occurs in period 2 (later). Consequences represent income streams (cash flows, earnings or lottery winnings). In general, consequences in a period may be uncertain.

To motivate the study, we begin in Section 2 with a simple example showing that different methods yield different valuations for the same project. In Section 3, we examine the normative appropriateness of the discounted utility model to evaluate income streams. We show that this model is normatively inappropriate. We also discuss Bell's (1974) model, which is a modification of discounted utility for income streams, which may have some normative appeal. Section 4 examines an alternative model that discounts the per-period certainty equivalents. We show the inappropriateness of this method unless used in the framework of the capital asset pricing model (CAPM). Essentially, these models result in a paradoxical preference for more money later to more money.