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Prospect theory and utility theory: Temporary versus permanent attitude toward risk

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ABSTRACT

Prospect theory (PT), which relies on subjects' behavior as observed in laboratory experiments, contradicts the behavior predicted by the Expected Utility (EU) paradigm. Having wealth of $100,000 or having wealth of $90,000 and winning $10,000 in a lottery is the same by EU paradigm but not the same by Markowitz (1952) and by PT (1979) which emphasizes the importance of change of wealth rather than total wealth on welfare. In this study, we resolve this contradiction by introducing the concept of temporary attitude toward risk (TATR) and permanent attitude toward risk (PATR). Using these concepts, we build a model that merges both the PT and the EU paradigms. The TATR and PATR concepts explain recent experimental findings and the observed stock price overreaction. We show that a positive risk premium with decreasing absolute risk aversion (DARA) can be consistent with the S-shaped value function used in PT.

Theories of decision making under uncertainty and, in particular, portfolio selection, assume (explicitly or implicitly) expected utility (EU) maximization. Yet, EU is criticized on several grounds. Probably the most well known criticism was made by the French economist, Maurice Allais (1953, 1988, 1990), who showed that preferences are non-linear. According to Allais, an increase in the probability of receiving an amount w from .99 to 1.00 has more impact on individuals than an increase in the probability of receiving w from .10 to .11. This contradicts the expected utility theory that predicts an equal increase, of 0.01 $U(w)$ in both cases, U being the utility function.

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Markowitz (1952) also pointed out possible contradictions to the expected utility theory as early as 1952. Markowitz proposes a utility function that explains gambling and insurance which differs significantly from Friedman and Savage's (1948) utility function. To the best of our knowledge, Markowitz was the first one to raise a few important issues, later on confirmed by experimental studies. First, he claims that not only *total* wealth but also *change* of wealth may be a factor in the decision making process, and second, that "temporary" changes in the utility function might take place and therefore a distinction should be made between "customary" wealth and present wealth. Moreover, he also suggested that the inflection point temporarily "travels" along the utility function:

> "So far I have assumed that the second inflection corresponds to present wealth. There are reasons for believing that this is not always the case. For example, suppose that our hypothetical stranger, rather than offering to give you \$X or a chance of \$Y, had instead first given you the \$X and then had offered you a fair bet which if lost would cost you −\$X and if won would net you \$(Y − X). These two situations are essentially the same, and it is plausible to expect the chooser to act in the same manner in both situations. But this will not always be the implication of our hypotheses if we insist that the second inflection point always corresponds to present wealth. We can resolve this dilemma by assuming that in the case of recent windfall gains or losses, the second inflection point may temporarily deviate from present wealth. The level of wealth which corresponds to the second inflection point will be called "customary wealth." (See Markowitz (1952), p. 154–155 and also Mosteller and Nogee (1951)).

In a very well cited article Kahneman and Tversky (1979) suggested a new model which competes with the expected utility paradigm. They conducted a series of experiments confirming Markowitz's hypothesis by showing that subjects make decisions based on *change* in wealth rather than *total* wealth. They also show that subjects tend to subjectively overweight low probabilities. The combination of these two factors (together with a few more ingredients to be spelled out later in the paper) served to create a new explanatory framework of investor's behavior which was coined prospect theory (PT) by Kahneman and Tversky. PT competes with the von Neumann and Morgenstern (NM) expected utility theory. It is based on the experimental results that do not confirm with the expected utility theory. In a further development Tversky and Kahneman (1992) propose cumulative prospect theory (CPT) which preserves the main ingredients of PT without violating first degree stochastic dominance (FSD). The main difference between PT and CPT is that the subjective decision weights are assigned to the cumulative probabilities rather than to the probabilities themselves.[2]

Before we turn to the objectives of our paper let us summarize the main findings of PT:

(1) Most subjects violate expected utility exactly as shown by Allais.
(2) Subjects are commonly concerned with changes in wealth rather than total wealth, in contradiction to the expected utility paradigm.
(3) Subjects act to maximize the expected value function $V_w(x)$, which is S-shaped (concave for gains – risk aversion, and convex for losses – risk seeking). The value function is steeper for losses than it is for gains.
(4) Subjective decision weights are assigned to probability and are employed in calculating expectations (alternatively the cumulative probability is subjectively changed).

Our model is motivated by the hypothesis that it takes time to investors to adjust to changes, in particular in their wealth. This hypothesis is not new. For example, Rabin (1998) asserts:

> "Overwhelming evidence shows that humans are often more sensitive to how their current situation differs from some reference level than to the absolute characteristics of the situation (Harry Helson 1964). For instance, the same temperature that feels cold when we are adapted

[2] An attempt to combine Prospect Theory and market forces is made in Barberis, Huang, and Santos (2001). Various methods of distortion of probabilities are described in Edwards (1953, 1954) and Handa (1977). Distortion of cumulative probabilities is described in Quiggin (1982, 1987) and Yaari (1987). Levy and Wiener (1998) analyze the effect of various transformations on FSD as well as other stochastic dominance rules. For stochastic dominance rules see Levy (1992, 2006).