PRINCIPLES OF BEHAVIORAL ECONOMICS

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Week 25

Lecture 25

Hello everyone, welcome back to the course on Principles of Behavioral Economics. This is lecture 25. In the previous lecture, we specifically talked about the editing phase of prospect theory. Basically, we have started the discussion on prospect theory. It has two phases: editing and evaluation.

So, in module 24, we discussed editing and the six operations under it. And now we are beginning with the next phase, which is evaluation. So, once the editing phase is complete, the decision maker must evaluate each of the edited prospects and is assumed to choose the prospect with the highest value. According to prospect theory, the overall value of an edited prospect is denoted by V. So, this is the value function. It is expressed in terms of two scales, v and pi—this is small v. So, this is the value scale, and this is the decision weighting scale; together they constitute the value function.

The first scale, v, assigns to each outcome x a number v(x), which reflects the subjective value of that outcome. The outcomes are defined relative to a reference point. Hence, v measures the value of deviations from that reference point—that is, gains and losses. So, we have already mentioned that prospect theory emphasizes the reference point. Gains and losses are not considered, or rather, we are not bothered about the final.

point of wealth, but rather the changes in wealth in terms of losses or gains. The second scale, pi, associates with each probability p, a decision weight pi(p) which reflects the impact of p on the overall value of the prospect. However, pi is not a probability measure. We will talk about pi later while discussing the weighting functions. For the time being, we will first broadly discuss the value function, followed by the value scale.

The theory presented here concerns simple prospects of the form (x, p; y, q), which have at most two non-zero outcomes. Just to recapitulate, remember that x and y are outcomes. and p and q are the associated probabilities with those outcomes. I am also going to give you some examples. In such a prospect, (x, p; y, q), one receives x with probability p, y with probability q,

and nothing with probability 1 - p - q. If p + q is less than 1, if p + q is equal to 1, then of course, the possibility of receiving nothing with probability 1 - p - q is actually 0. A prospect is strictly positive if its outcomes are all positive—that is, both x and y are greater than 0—and p plus q equals 1. It is strictly negative if its outcomes are all negative, so if both x and y are negative. And p plus q equals 1, then we call it a strictly negative prospect. A prospect is regular if it is neither strictly positive nor strictly negative.

In this sense, it has x, y, one of them. Greater than 0, one of them less than 0, and it is also possible that p plus q does not add up to 1. So, all those prospects will be considered as regular prospects. Now, let us take some examples. This is 500, 0.5 and 200, 0.5.

This is a strictly positive prospect because both X and Y are greater than 0, and p and q add up to 1. Minus 500, 0.3 and minus 300, 0.7 is a strictly negative prospect because both x and y are negative, and p plus q adds up to 1. Minus 500, 0.3 and minus 300, 0.3 is a regular prospect because though both of them are negative, but p and q do not add up to 1. p plus q is equal to 0.6, and that is less than 1.

400, 0.4, 200, 0.5 is again a regular prospect because both x and y are positive. but p plus q is equal to 0.9 here, and again this is less than 1. 500, 0.5 and minus 200, 0.5 is a regular prospect because x is greater than 0 and y is less than 0, though p plus q here actually equals 1. Minus 200, 0.1 and 200, 0.5 is also a regular prospect because x is negative, y is positive, and at the same time, p plus q is equal to 0.6, which is less than 1. Finally, 400, 0.5 and minus 100, 0.5 is also a regular prospect because x is positive and y is negative.

The basic equation of the theory, which is the prospect theory, describes the manner in which v and pi are combined to determine the overall value of regular prospects. So, we are going to mostly deal with regular prospects. Prospects having either x or y greater than 0 and less than 0, or vice versa, or p plus q is less than 1. If (x, p; y, q) is a regular prospect, then V(x, p; y, q) is equal to pi(p) multiplied by v(x) plus pi(q) multiplied by v(y), where v(0) equals 0 and pi(0) equals 0,

$$V(x, p; y, q) = \pi(p)\, v(x) + \pi(q)\, v(y)$$

Where $v(0) = 0$, $\pi(0) = 0$, $\pi(1) = 1$.

$$V(20,\ 0.5;\ -10,\ 0.5) = \pi(0.5)\ v(20)$$

which simply implies that if the probability is 0, that is either p or q equals 0, then the pi function also equals 0. Now, how pi is defined is something we are not going to discuss now. Similarly, if p or q or both are equal to 1, then pi(1) also equals 1. And if x or y takes a value equal to 0, then the value function also equals 0. These are some basic assumptions or properties of the value scale (small v) and the weighting scale pi.

V, or the value function (capital V), is defined on prospects, while small v is defined on outcomes. I have rewritten the value function here for easy reference. The two scales coincide for sure prospects, that is, V(x, 1.0) equals V(x), which equals v(x).

$$V(x,\ 1.0) = V(x) = v(x)$$

Of course, as you understand, if it is a sure prospect, which implies that I am going to have only one of them, say pi(P), multiplied by V(x).

Since it is a short prospect, there is no point in having two components. So, p can take any—sorry, p can—p is here; p takes the value of 1. And x can take any value, but this is a sure prospect, which means π(p) equals 1, and as a result, capital V(x, 1.0) equals small v(x) because π(p) equals 1. So, that is how for any sure prospect, the two scales coincide. This equation generalizes expected utility theory by relaxing the expectation principle.

As a simple example, take the situation of tossing a coin where the outcome of heads results in a gain of $20 and the outcome of tails results in a loss of $10. We can now express the utility of this regular prospect as V(20) with the probability of 0.5 and minus 10 because you are going to lose $10 here with the probability of 0.5. This is a regular prospect because x is greater than 0 and y is less than 0, but p and q add up to 1.

Now, π(0.5)v(20) plus π(0.5)v(-10)—this is how we are going to write the value functions.

The valuation of strictly positive and strictly negative prospects follows a different rule. In the editing phase, such prospects are segregated into two components. The riskless component is the minimum gain or loss, which is certain to be obtained or paid. And the risky component is the additional gain or loss, which is actually at stake. So, this is the segregation operation, which we discussed while discussing the editing phase.

The evaluation of such prospects is described as if p plus q equals 1. And either x and x greater than y greater than 0 or x less than y less than 0, we can also write it as y greater than x greater than 0. And Y less than X less than 0. Ideally, all we want to imply is that since these are either strictly positive or strictly negative prospects. Y, q equals to v(y), which is basically the sure component—either it is a sure gain or it is a sure loss—plus pi(p) into v(x) minus v(y). Now, concentrate here. Since we have written it like this—that is, x greater than y greater than 0—if it is a strictly positive prospect, then y is the smaller value which we are going to

receive for sure, and that is why V(y) is separated. Then we are having V(x) minus V(y), that is the difference between x and y multiplied by the probability associated with x. In a similar fashion, when we are considering x less than y less than 0, which means y is the smaller loss. So, again, we are separating v(y), the smaller loss, which is for sure there and then multiplying the difference between the larger loss and the smaller loss by the weighting decision or decision function associated with V(x).

That is, the value of a strictly positive or strictly negative prospect equals the value of the riskless component which is this one, plus the value difference between the outcomes multiplied by the weight associated with the more extreme outcome. For example, V(400, 0.25; 100, 0.75). You can see that this is a strictly positive prospect where both X and Y are greater than 0 and p and q add up to 1. Then we first separate out the sure gain, which is V(100), plus pi(0.25) because we are considering the weighting function of the probability associated with the possible larger gain.

And that is multiplied by v(400) minus v(100). The essential feature of the equation is that a decision weight is applied to the value difference v(x) minus v(y). Which represents the risky component of the prospect, but not to v(y), which represents the riskless component. Many elements of the evaluation model have appeared in previous attempts to modify expected utility theory. Markowitz was the first to propose that utility be defined on gains and losses rather than on final asset positions.

An assumption which has been implicitly accepted in most experimental measurements of utility. Markowitz also noted the presence of risk-seeking in preferences among positive as well as among negative prospects. And he proposed a utility function which has convex and concave regions in both the positive and the negative domains. So you can see that this is the positive or gain domain, and this is the negative or loss domain. So there are concave and convex portions in both losses and gains.

His treatment, however, retains the expectation principle; hence, it cannot account for the many violations of this principle. The replacement of probabilities by more general weights was proposed by Edwards and was investigated in several empirical studies. Similar models were developed by Fellner, who introduced the concept of decision weight to explain aversion for ambiguity, and by van Dam, who attempted to scale decision weights. The equations of prospect theory retain the general bilinear form that underlies expected utility theory. However, in order to accommodate the effects described with respect to the reference point,

It is assumed that values are attached to changes rather than to final states and that decision weights do not coincide with stated probabilities. These departures from expected utility theory must lead to normatively unacceptable consequences, such as inconsistencies in transitivities and violations of dominance. Such anomalies of preference are normally corrected by the decision maker when they realize that their preferences are inconsistent, intransitive, or inadmissible. In many situations, however, the decision maker does not have the opportunity to discover that their preferences could violate decision rules that they wish to obey. In these circumstances, the anomalies implied by prospect theory are expected to occur.

I conclude this module with this short discussion on prospects. In the next module, we will discuss at length the value scale. These are the references to be followed. Thank you.