# Are People Really Risk Seeking for Losses?

Kontek, Krzysztof

Artal Investments

14 December 2009

# Are People Really Risk Seeking for Losses?

Krzysztof Kontek
Artal Investments
ul. Chrościckiego 93/105
02-414 Warsaw, Poland
e-mail: kontek@artal.com.pl
kkontek2000@yahoo.com
tel.:+48 504 16 17 50

**Abstract**

This short paper demonstrates that the claim of Cumulative Prospect Theory (CPT) that people are risk seeking for loss prospects, which confirmed a hypothetical assumption of the earlier Prospect Theory (PT), appears to be merely a result of using a specific form of the probability weighting function to estimate the power factor of the value function. Using experimental data and the form of the probability weighting function presented by CPT gives a power factor for losses of less than 1. This would mean that people are risk seeking for loss prospects. However, once more flexible, two-parameter forms are used, the power factor takes on values between 1.04 and 1.10. This, however, makes the value function convex, which indicates risk aversion. It follows that people are generally risk averse both for gains and for losses. This contradicts one of the main theses of Prospect Theory.

**JEL classification**: C91, D03, D81, D87

**Keywords:** Prospect Theory, Value Function, Probability Weighting Function, Risk Attitude

## 1. Power Factor in Cumulative Prospect Theory

**1.1.** One of the main theses of Prospect Theory (1979) is that people are risk averse with respect to gains and risk seeking with respect to losses. The hypothetical value function proposed by Prospect Theory (PT) is therefore convex for gains and concave for losses. However, PT did not propose any functional form of the value function. This was left to Cumulative Prospect Theory (1992), which proposed the power function for this purpose:

$$v = x^{\alpha} \tag{1}$$

where $\alpha$ is the power factor. CPT estimated $\alpha$ to be 0.88, for both gains and losses, on the basis of experimental results. The paper presenting CPT, however, does not give a lot of information about the method of estimation. It merely states that: "*In order to obtain a parsimonious description of the present data, we used a nonlinear regression procedure to estimate the parameters of the value and probability weighting functions, separately for each subject*". The median values of individual estimations were then determined. The paper further states that: "*The parameters estimated from median data were essentially the same*".

**1.2.** Gonzales and Wu (1999) noted that CPT represents the certainty equivalent (*CE*) as

$$v(CE) = w(p)v(X) + [1 - w(p)]v(Y) \tag{2}$$

where $X$ and $Y$ are outcomes such that $X > Y \geq 0$, $v$ denotes the value function, $w$ denotes the probability weighting function, and $p$ denotes probability. By assuming a functional form of $v$ and $w$, the estimation procedure is as follows:

$$CE = v^{-1}\{w(p)v(X) + [1 - w(p)]v(Y)\} \tag{3}$$

where $v^{-1}$ denotes the inverse function of $v$. They also stated that examples of this approach appear in several works, including that of Tversky and Kahneman (1992).

**1.3.** Procedure (3) is therefore used to check the estimation results for losses. In order to do this, the functional form of the probability weighting function has first to be defined. CPT uses the following function:

$$w(p) = \frac{p^{\delta}}{\left[p^{\delta} + (1-p)^{\delta}\right]^{1/\delta}} \tag{4}$$

where $\delta$ denotes the shape parameter. Furthermore, the median data presented by the CPT paper (1992) are used, as this paper does not provide individual data for each subject. This should not, however, make a significant difference, according to Tversky and Kahneman. The results obtained using the estimation procedure are $\alpha = 0.906$ and $\delta = 0.704$. These values are similar to those presented by CPT ($\alpha = 0.88$ and $\delta = 0.69$).

## 2. Power Factor Estimation Using Other PWF Forms.

**2.1.** The drawback of the form proposed by CPT is that it only has a single parameter to model the shape of the probability weighting function ("curvature" and "elevation" to use Gonzales and Wu's nomenclature, 1999). More flexible, two–parameter functions are used to check whether the functional form of the probability weighting function has an impact on the result of the power factor estimation ($\gamma$ and $\delta$ denote parameters):

a). The form used by Gonzales and Wu (1999)

$$GW = \frac{\delta p^{\gamma}}{\delta p^{\gamma} + (1-p)^{\gamma}} \tag{5}$$

b). The form proposed by Prelec (1998),

$$PR = e^{-\delta(-\ln p)^{\gamma}} \tag{6}$$

c). Cumulative Beta Distribution

$$BT = I_p(\gamma, \delta) \tag{7}$$

where $I$ denotes the beta regularized function.

d). Cumulative Kumaraswamy Distribution

$$KM = 1 - \left(1 - p^{\delta}\right)^{\gamma} \tag{8}$$

**2.2.** These power factor estimations for losses are presented in Table 1.

| | ***α*** | ***CE* st. err.** |
|---|---|---|
| ***KT*** | 0.91 | 3.43 |
| ***GW*** | 1.06 | 2.69 |
| ***PR*** | 1.04 | 3.00 |
| ***BT*** | 1.10 | 2.73 |
| ***KM*** | 1.09 | 2.69 |

Table 1. Estimation of $\alpha$ for loss prospects using different forms of the probability weighting function with the corresponding standard errors of *CE* estimation.

As presented, the power factor is only ever less than 1 when the form of the probability weighting function proposed by CPT is used. In every other case, it is greater than 1. This makes the value function for losses convex, which indicates that people are generally risk averse. This contradicts one of the main claims of Prospect Theory.

As is shown, the standard error of *CE* estimation is greatest in the case of the function proposed by CPT. Using other forms results in much lower errors, indicating that these models better fit the experimental data and that their estimations of $\alpha$ are more reliable.

## 3. Conclusions

The paper shows that the form of the probability weighting function has a big impact on the estimation of the power factor of the value function. When the form proposed by Cumulative Prospect Theory (1992) is used, the $\alpha$ parameter for losses is less than 1, confirming the Prospect Theory thesis that people are generally risk seeking with respect to loss prospects. However, $\alpha$ has a value of between 1.04 and 1.10 when more flexible, two-parametric forms of the probability weighting function are used. This makes the value function for losses convex. It follows that people are risk averse rather than risk seeking for losses which contradicts one of the main theses of Prospect Theory. The claimed risk seeking attitude for losses appears to be merely a result of using a specific form of the probability weighting function during estimation of the power factor. It follows that people are generally risk averse both for gains and for losses and the “reflection effect” as presented by Prospect Theory is not confirmed by the CPT's experimental data.

## References

Gonzales, R., Wu, G., (1999). *On the Shape of the Probability Weighting Function.* Cognitive Psychology, 38, pp 129-166.

Kahneman, D., Tversky, A., (1979). *Prospect theory: An analysis of decisions under risk.* Econometrica, 47, pp 313-327.

Prelec, D., (1998). *The probability weighting function.* Econometrica, 60, pp 497-529.

Tversky A., Kahneman D., (1992). *Advances in Prospect Theory: Cumulative Representation of Uncertainty.* Journal of Risk and Uncertainty, vol. 5(4), October, pp 297-323.