Guideline for Midterm answer

BACHELOR OF ECONOMICS
THAMMASAT UNIVERSITY

(Take home exam) Midterm Examination: EE 434 SEM 1/2021

Subject: **Behavioral Finance**

Instructor: Dr. Sunsiree Kosindesha

Date and Time: Thursday, 30 September, 2021; 09.00 – 11.00 AM

Instructions:

1. This is a TAKE-HOME exam. Books, class materials, notes, and google search are allowed.
2. There are 4 questions and 100 points in total. This is equal to 25 percent of semester's total scores.
3. Students must hand in the answer to all of the questions **in your own handwriting**. You can write on A4 paper or on iPad/Tablet. **Put page number, ID number, Question number on every page.**
4. **Do not consult with other students.** It is with your honor that you will not give or receive any unauthorized assistance on this examination. Importantly, this exam is designed to fit the time provided, so your best strategy is to work on your own and try your best.
5. If you are caught consulting with other students, you will automatically receive an "F" for this course and be suspended for one academic year.
6. Before submitting the exam, don't forget to indicate **your id number and how many pages** your answer is on the front page of your answer.

1. [25 points] Mr.Spock & Captain Kirk

[1.1] Mr.Spock is with the utility function over wealth: $u(w) = \ln(w)$, w = wealth in thousands of dollars. Suppose that he has US$ 500k in wealth.

Claim: If Mr.Spock's decision-making under risk **can be explained by expected utility theory**, **then** he will be indifferent between accepting and rejecting a coin toss which pays him US$ 1k if he wins or he pays US$ 1k if he loses. That is, he will be risk-neutral when considering accepting or rejecting the prospect $(1k, 0.5;\ -1k, 0.5)$.

Is the claim true or false? Please explain why it is true or why it isn't.

Note: k means "in thousand".

[1.2] Captain Kirk is considering two scenarios, each scenario has two options:

Scenario 1: Choose between

Prospect A:	\$4,000 with probability 0.10,
	\$2,500 with probability 0.88,
	Zero with probability .02.
And Prospect B:	\$2,500 with certainty.

Scenario 2: Choose between

Prospect C:	\$4,000 with probability 0.10,
	Zero with probability 0.90.
And Prospect D:	\$2,500 with probability 0.12,
	Zero with probability 0.88.

[1.2.1] How does scenario 2 relate to scenario 1? Please explain.

[1.2.2] If Captain Kirk is an expected-utility maximizer and is risk-loving, which prospect will he choose in each scenario? And, why?

[1.2.3] Now assume instead that Captain Kirk behaves in accordance with Allais paradox, what will be the choice pattern we expect to see from each scenario? Explain why his choices will violate expected utility theory.

[1.2.4] Is it possible that Captain Kirk is risk-loving and also exhibit Allais' paradox choice pattern?

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1.1 Yes, it should be true according to Rabin's Calibration

EU of taking $(1k, 0.5; -1k, 0.5)$

$= 0.5 \ln(501) + 0.5 \ln(499) = 0.5 \times 6.217 + 0.5 \times 6.213$

$= 3.11 + 3.11$

$= 6.22$

$\approx \ln(500) = U(EW)$

$\therefore$ risk neutral

1.2

1.2.1 Scenario 2 is Scenario 1 when \$2500 wp 0.88 is \$0 wp 0.88 instead.

1.2.2 Scenario 1 $\rightarrow$ A $\succ$ B

Scenario 2 $\rightarrow$ C $\succ$ D

because A is riskier than B

C " ——————— " D

1.2.3 Scenario 1 $\rightarrow$ B $\succ$ A (because 2% of \$0 makes A unattractive)

Scenario 2 $\rightarrow$ C $\succ$ D

Scenario 1 $\rightarrow$ B $\succ$ A

$U(\$2500) > 0.1U(\$4000) + 0.88U(\$2500)$; assume $U(\$0) = 0$

$0.12U(\$2500) > 0.1U(\$4000)$ (1.)

Scenario 2 $\rightarrow$ C $\succ$ D

$0.1U(\$4000) > 0.12U(\$2,500)$ (2.)

(1.) & (2.) cannot be true at the same time $\therefore$ violate EUT

1.2.4 ~~No, Allais paradox implicitly assume risk aversive utility function.~~ To accept B, choosing B over A, 2,500 wp 1 needs to be more than EV_A which is not the case here. Hence, it is not possible for Captain Kirk to be risk loving & shows Allais Paradox

2.[25 points] An angel investor

Assume that an angel investor has the following value function under Prospect theory:

$$v(x) = \begin{cases} x^{0.5} & ,x \geq 0 \\ -\lambda(-x)^{0.5} & ,x < 0 \end{cases}$$

Also assume that the probability weighting function is $\pi(p) = p$, that is the investor has the weighting of probability equal to the objective probability.

Consider three startups: SamSan Tech (SST), Syng, and Cazoo. Suppose that the profit levels and their relates probabilities for each startup are as follow:

$$SST = (2089, 0.80; 1625, 0.20),$$

$$Syng = (2225, 0.70; 1625, 0.30),$$

$$Cazoo = (3116, 0.70; 996, 0.30)$$

[2.1] Suppose that you are a consultant to this angel investor and you are trying to understand his risk preferences. A series of questions was earlier answered by this angel investor with his responses shown below. If the angel investor says he has the targeted profit of US$1,000 as his reference point, rank the startups from the most to the least preferred from this angel's perspective based on Prospect theory. Explain and show your calculation in detail.

Would you accept the following bet? A coin toss where:	The recorded answers:
If tails, lose $100, heads win $150?	No
If tails, lose $100, heads win $160?	No
If tails, lose $100, heads win $170?	No
If tails, lose $100, heads win $180?	No
If tails, lose $100, heads win $190?	No
If tails, lose $100, heads win $200?	Yes
If tails, lose $100, heads win $210?	Yes
If tails, lose $100, heads win $220?	Yes
If tails, lose $100, heads win $230?	Yes
If tails, lose $100, heads win $240?	Yes
If tails, lose $100, heads win $250?	Yes
If tails, lose $100, heads win $260?	Yes

[2.2] If the angel investor follows your advice **not to** be loss-averse, will the ordering change? If so, how ? and why ? If not, why not?

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[2.1] From the table : $\lambda = \frac{\$200}{\$100} = 2$

$r = \$1000$

With the reference point, the three prospects can be coded to be:

SST = (1089, 0.8 ; 625, 0.2)

Syng = (1225, 0.7 ; 625, 0.3)

Cazoo = (2116, 0.7 ; -4, 0.3)

$V(SST) = 0.8\,(1089)^{1/2} + 0.2\,(625)^{1/2}$

$= 0.8 \times 33^{26.4} + 0.2 \times 25^{5} = 31.4$

$V(Syng) = 0.7\,(1225)^{1/2} + 0.3\,(625)^{1/2}$

$= 0.7 \times 35^{24.5} + 0.3 \times 25^{7.5} = 32$

$V(Cazoo) = 0.7(2116)^{1/2} - 2(0.3)(4)^{1/2}$

$= 0.7 \times 46^{32.2} - 1.2 = 31$

$\therefore$ Syng $\succ$ SST $\succ$ Cazoo

[2.2] If $\lambda = 1 \Rightarrow V(Cazoo) = 0.7(2116)^{1/2} - (0.3)(4)^{1/2}$

$= 32.2 - 0.6 = 31.6$

$\therefore$ Syng $\succ$ Cazoo $\succ$ SST

because now 1 unit of loss is equally weighted as 1 unit of gain.

3.[25 points] Reflection Effect

Reflection effect is coined by Kahneman and Tversky(1979) to address the observation that the preference between negative prospects is the mirror image of the preference between positive prospects.

An analyst observes the following pattern of preferences over prospect (x, p), in which the gain or loss x happening with probability p and payoff 0 happening with the probability $1 - p$. Note that $A \succ B$ means prospect A is strictly preferred to B. He intends to produce a high quality piece of analysis to explain this pattern:

$$(6{,}000, 0.45) \prec (3{,}000, 0.90)$$
$$(-6{,}000, 0.45) \succ (-3{,}000, 0.90)$$
$$(4{,}000, 0.80) \prec (3{,}000, 1)$$
$$(-4{,}000, 0.80) \succ (-3{,}000, 1)$$

[3.1] The analyst plans to use expected utility theory to help explain the pattern of preference. Additionally, he is also considering using the following Prospect Theory's value function to explain such pattern of preference:

$$v(x) = \begin{cases} x & if\ x > 0 \\ \lambda x. & if\ x < 0 \end{cases} \quad \text{,where } \lambda \geq 1.$$

As a mentor to the analyst, how will you guide him so that his intention is fulfilled? Please explain in detail.

[3.2] How would you recommend the analyst to enhance his piece of analysis about the observed *reflection effect* with the insight you have on *disposition effect*?

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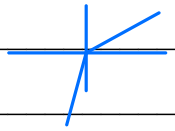
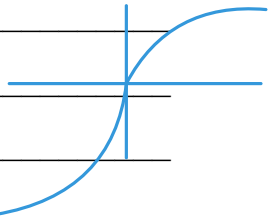
[3.1] reflection effect → risk aversion in gain domain
risk seeking in loss domain

The reflection effect cannot be explained by
both EUT
and prospect theory with $v(x) = \begin{cases} x, & x>0 \\ \lambda x, & x<0 \end{cases}$

not by EUT ∵ if an individual is risk-averse at an initial wealth
he cannot be risk-loving nor risk neutral.
except he has a kink utility fn at his
initial wealth

not by Prospect theory with value fn that is not concave over gain

& not convex over loss
which exhibits no diminishing sensitivity

The reflection effect needs concavity over gain
convexity over loss


That is, it needs for example:

$$v(x) = \begin{cases} x^{\alpha}, & x>0 \\ \lambda(-x)^{\beta}, & x<0 \end{cases}, \quad \alpha<1, \beta<1$$

[3.2] Disposition effect : sell winners too soon
hold losers too long

This can be explained by
risk-seeking over loss + integration of price loss
risk-aversion over gain + segregation of gain
↳ which is captured by reflection effect

4.[25 points] Bear and Bull

[4.1] In a bear market, a market in decline, Tom is now experiencing loss. His outstanding **loss** amounts to US$ 1000. He is currently thinking about what to do next and is looking at three stocks, BLD, DVN, and SNAP that he has not invested in earlier. The gain or loss and their relates probabilities of each stock are as the followings. You can view these payoffs as the estimated future gain or estimated future loss if Tom decides to invest in the stocks today.

$$BLD = (500, 0.50; -500, 0.50),$$

$$DVN = (995, 0.50; -995, 0.50),$$

$$SNAP = (1225, 0.50; -1225, 0.50),$$

Based on Prospect theory and Hedonic editing, an idea proposed by Thaler&Johnson(1990), discuss and explain what Tom's preference ranking of these three stocks and how his investing behavior will be.

[4.2] In a bull market, a market on the rise, Jerry is now experiencing gain. His outstanding **gain** amounts to US$ 1000. He is currently thinking about what to do next and is looking at two stocks, DVN and SNAP, that he has not invested in earlier. The gain or loss and their relates probabilities of each stock are as the followings.

$$DVN = (995, 0.50; -995, 0.50),$$

$$SNAP = (1225, 0.50; -1225, 0.50),$$

Based on Prospect theory and Hedonic editing, an idea proposed by Thaler&Johnson(1990), discuss and explain how Jerry's investing behavior will be.

[THE END]

[4.1] bear

There can be two scenarios when prior loss is integrated

Break-even effect → invest in SNAP

because it offers chance to breakeven

→ risk-seeking behavior ($1225 > $1000)

snake bit effect → no more investment

because all three prospects

will yield negative prospect theory value

since $\lambda >> 1$

→ risk-averse behavior

[4.2] Bull

With the integration of prior gain

→ become more risk seeking

→ house-money effect

→ But it is possible that DVN > SNAP

because the potential loss from SNAP

is bigger than prior gain

that is the coded gambles are

DVN = (1995, 0.5; 5, 0.5)

SNAP = (2225, 0.5; −225, 0.5)