UNIVERSITY OF BIRMINGHAM | BIRMINGHAM BUSINESS SCHOOL

Assessment and Feedback: Student Template

Student ID Number(s): 2244195

Programme: Economics suite of programmes

Module: LI Microeconomics

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Assignment Title: 28536

Date and Time of Submission: 05/11/2020

Actual Word Count: 998

Extension: N **Extension Due Date:**

I do wish my assignment to be considered for including as an exemplar in the **School Bank of Assessed Work. *** *delete as appropriate*

The purpose of this template is to ensure you receive targeted feedback that will support your learning. It is a requirement to complete to complete all 3 sections, and to include this completed template as the first page of every assignment that is submitted for marking (your School will advise on exceptions).
Section One: Reflecting on the feedback that I have received on previous assessments, the following issues/topics have been identified as areas for improvement: (add 3 bullet points). *NB – for first year students/PGTs in the first term, this refers to assessments in your previous institution* • Be careful about details • Add more appropriate argument • Be more academic in style
Section Two: In this assignment, I have attempted to act on previous feedback in the following ways (3 bullet points) • Consider like a first-time reader • Be more critical in mind • Learn more about academic writing

Section Three: Feedback on the following aspects of this assignment (i.e. content/style/approach) would be particularly helpful to me: (3 bullet points)

- clarity
- logical
- academic writing style

Please ensure that you complete and attach this template to the front of all work that is submitted.

By submitting your work online you are confirming that your work is your own and that you understand and have read the University's rules regarding plagiarism and the consequences that will arise should you submit plagiarised work.

Critical Illness Insurance

Why insurance is purchased?

Expenses of curing critical illnesses, like malignant tumor, can pose a heavy burden to ordinary people, sometimes even cost all of their life savings. Therefore, people would like to disperse such cost by purchasing critical illness insurance in advance, so that consumers can avoid paying them alone. Such insurance often covers a specific number of serious illnesses. If a consumer got one or more of them, he(she) can get an insurance indemnity which can greatly decrease the medical fee.

How to model the decision-making process?

To better model the decision-making process of purchasing critical illness insurance, some assumptions need to be made first:

1. For simplicity, it is assumed that the insurance covers 2 illnesses — benign tumor and malignant tumor. The probabilities of occurrence of the illnesses are $\pi_1 = 0.01, \pi_2 = 0.005$; the medical fees of the illnesses are $L_1 = £15{,}000, L_2 = £42{,}000$; the insurances for the illnesses are K_1, K_2. Each unit of wealth of critical illness insurance costs γ. And we assume the total insurance cost equals $\frac{\pi_1}{\pi_1+\pi_2}\gamma K_1 + \frac{\pi_2}{\pi_1+\pi_2}\gamma K_2$, i.e., weighted average of insurance costs for the two illnesses.
2. The happening of each illness is independent from each other, i.e., the probability of occurrence of one illness doesn't affect the probability of occurrence of the other illness. Because of this, the possibility of occurrence of no illness is $(1-\pi_1)(1-\pi_2)$. As π_1 and π_2 are fairly small, the occurrence is equivalent to $(1-\pi_1-\pi_2)$, which is denoted as π_{na}. As a result, occurrence of no illness, that of benign tumor and that of malignant tumor constitute unity while the simultaneous occurrence of benign and malignant tumor is dismissed.
3. The consumer owns $m = £50{,}000$ of wealth. C_{a1} is consumption value when there is benign tumor, C_{a2} is consumption value when there is malignant tumor, and C_{na} is consumption value when there is no illness.
4. For insurance firms, the market is perfectly competitive.
5. The consumer is risk-averse, meaning that marginal utility of wealth is monotonously decreasing as the wealth is increasing.

After all these prework, the decision-making process shall begin. When there's no illness, the consumer's consumption value is denoted by:

$$C_{na} = m - \frac{\pi_1}{\pi_1+\pi_2}\gamma K_1 - \frac{\pi_2}{\pi_1+\pi_2}\gamma K_2 \quad (1)$$

as what he or she spends is just the insurance expense. When there is benign or malignant tumor, the consumer's consumption value is

$$C_{a1} = m - L_1 + \left(1 - \frac{\pi_1}{\pi_1 + \pi_2}\gamma\right)K_1 - \frac{\pi_2}{\pi_1 + \pi_2}\gamma K_2 \tag{2}$$

$$C_{a2} = m - L_2 - \frac{\pi_1}{\pi_1 + \pi_2}\gamma K_1 + (1 - \frac{\pi_2}{\pi_1 + \pi_2}\gamma)K_2 \tag{3}$$

respectively, where he or she spends the medical and insurance expenses and gets the insurance indemnity. By subtracting (1) with (2) and (3) respectively, K_1 and K_2 can be represented by $(L_1 + C_{a1} - C_{na})$ and $(L_2 + C_{a2} - C_{na})$. By replacing K_1 and K_2 with them in (1) we get:

$$C_{na} = \frac{m}{1-\gamma} - \frac{(\pi_1 L_1 + \pi_2 L_2)\gamma}{(1-\gamma)(\pi_1 + \pi_2)} - \frac{\pi_1\gamma}{(1-\gamma)(\pi_1 + \pi_2)}C_{a1} - \frac{\pi_2\gamma}{(1-\gamma)(\pi_1 + \pi_2)}C_{a2} \tag{4}$$

which is the consumer's budget constraint. And according to the normal vector formula, its normal vector should be $((1-\gamma)(\pi_1 + \pi_2), \pi_1\gamma, \pi_2\gamma)$.

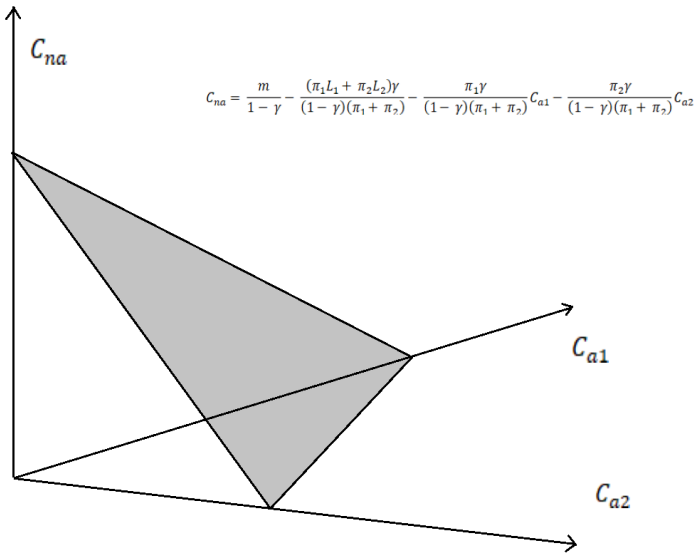

Figure 1 Budget constraint

As for consumer utility, it is assumed that expected utility is $EU = \pi_1 U(C_{a1}) + \pi_2 U(C_{a2}) + \pi_{na} U(C_{na})$, i.e., the weighted average of utility in different situations. By differentiating it we can get $dEU = \pi_1 MU(C_{a1})dC_{a1} + \pi_2 MU(C_{a2})dC_{a2} + \pi_{na} MU(C_{na})dC_{na}$. To stabilize expected utility, dEU should be zero, which indicate that $\pi_1 MU(C_{a1})dC_{a1} + \pi_2 MU(C_{a2})dC_{a2} + \pi_{na} MU(C_{na})dC_{na} = 0$. According to the normal vector formula, its normal vector should be $(\pi_{na} MU(C_{na}), \pi_1 MU(C_{a1}), \pi_2 MU(C_{a2}))$.

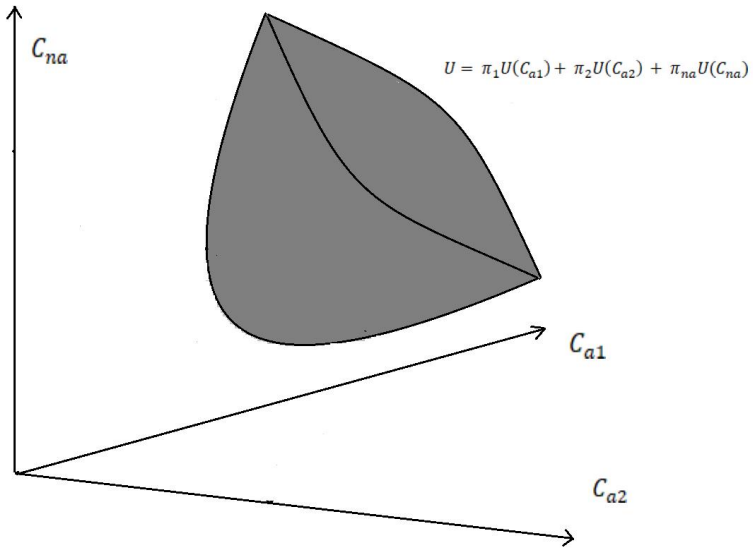

Figure 2 Expected utility

Putting the two graphs together, the optimal choice should be when the two normal vectors of the two faces point to the same direction:

$$\frac{(1-\gamma)(\pi_1+\pi_2)}{\pi_{na}MU(C_{na})} = \frac{\pi_1\gamma}{\pi_1 MU(C_{a1})} = \frac{\pi_2\gamma}{\pi_2 MU(C_{a2})} \tag{5}$$

i.e.,

$$\frac{(1-\gamma)(\pi_1+\pi_2)}{\pi_{na}MU(C_{na})} = \frac{\gamma}{MU(C_{a1})} = \frac{\gamma}{MU(C_{a2})}. \tag{6}$$

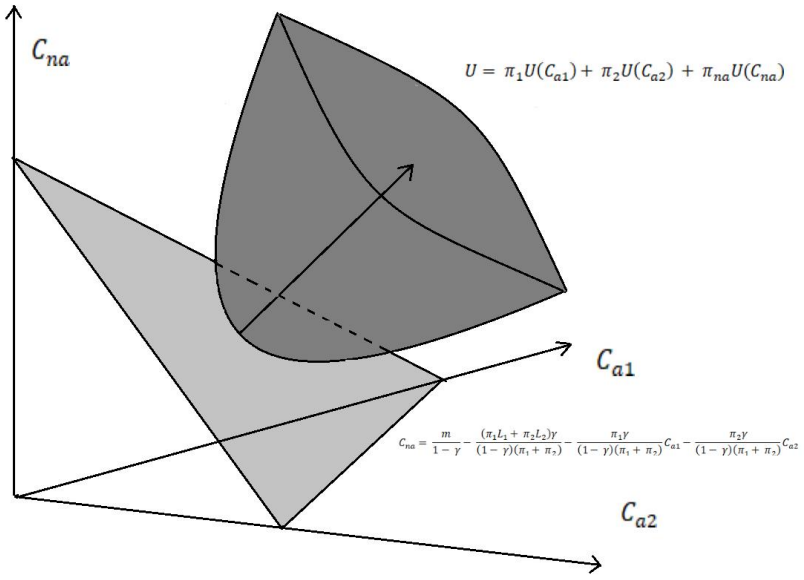

Figure 3 Budget constraint and expected utility

At this point, the consumer can maximize the expected utility within budget constraints.

For critical illness insurance firms, however, in a perfectly competitive market, their economic profit should be zero, i.e.,

$$profit = \frac{\pi_1}{\pi_1 + \pi_2}\gamma K_1 + \frac{\pi_2}{\pi_1 + \pi_2}\gamma K_2 - \pi_1 K_1 - \pi_2 K_2 - (1 - \pi_1 - \pi_2)0 = 0$$

from which we get:

$$\gamma = \pi_1 + \pi_2. \quad (7)$$

As a result, for insurance firms in perfectly competitive markets, the price of each unit of wealth shall be set to be equal to the probability of getting benign or malignant tumor.

Given the firms' decision, by putting (7) into (6) and as $\pi_{na} = 1 - \pi_1 - \pi_2$, we get $\frac{(1-\pi_1-\pi_2)(\pi_1+\pi_2)}{(1-\pi_1-\pi_2)MU(C_{na})} = \frac{\pi_1+\pi_2}{MU(C_{a1})} = \frac{\pi_1+\pi_2}{MU(C_{a2})}$ and by simplifying we get:

$$MU(C_{na}) = MU(C_{a1}) = MU(C_{a2}),$$

showing that the three consumption values should have equal marginal utility. As marginal utility of wealth is monotonously decreasing as the wealth is increasing for the risk-averse consumer, it must be that:

$$C_{na} = C_{a1} = C_{a2} \quad (8)$$

As a result, in a perfectly competitive market with "fair" price of critical illness insurance, the consumer shall buy full critical illness insurance to make sure that he or she is indifferent among the occurrence of benign tumor, malignant tumor and not.

According to the given value, $\gamma = \pi_1 + \pi_2 = 0.015$. Putting (1), (2), (3), (8) and given values in an equation set, we can get $K_1 = £15{,}000$, $K_2 = £42{,}000$, $C_{na} = C_{a1} = C_{a2} = £49{,}640$. As a result, as long as the consumer spends £360 for insurance, the insurance redemption will cover his or her full medical fees for benign or malignant tumor.

Why this example:

This example is chosen since critical illness insurance is gaining prevalence and accepted by more people recently while still lacks sound mechanism. Therefore, there is much commercial value in delving into it and room for improvement.

Limitations:

There exist some limitations in the previous model. There are some idealized assumptions for the model, which can hardly be the case in reality. For example, real-life critical illness insurances often contain dozens of illnesses, much more than two. Also, markets can never be perfectly competitive and people are not always risk-averse.

Link with material in Topic 2:

In topic 2, we only consider two complementary situations while this example considers three, increasing the model's adaptability to reality as the reality is always complex. While the basic idea is similar to that in topic 2, the model includes new dimension and this method can be used to go on to deal with n situations.

1. The detail and depth of explanations of the modelling of the decision-making process, as well as choice of elements to include in the explanations (part 1).

Overall, good discussion, the steps are clear and all key elements are included. Excellent work in taking the assignment further by including an additional state of the world. In order to improve your assignment, you could have provided more details about the intuitions behind the algebra and diagrams: what does the budget constraint represent? How does the addition of the consumer indifference curves contribute to the model?

2. Accuracy and appropriateness of use of diagrammatic representation and/or algebraic expressions (part 1).

Excellent use of diagrams and algebraic expressions! Everything is accurate, clearly labeled, and well discussed in the text.

3. How well and appropriately the example is used to answer the question (part 1) & Relevance of explanation of choice of example, including reflection and statement of limitations (part 2).

The example is appropriate and the choice of example is explained well. Limitations of the analysis were also discussed critically - well done!

4. Clarity & accuracy of explanations, originality of approach (parts 1 & 2) & Appropriate referencing and remaining within the parameters of the guidance given (parts 1&2); presentation.

Good presentation: clear, professional. Well done stating the word count and including the cover sheet appropriately.

Your approach is valid, but there are no references whatsoever. That is not acceptable. Check the UoB guidance on Harvard-style referencing (there was a link on the discussion board for week 5). While not mandatory a reference of a textbook (our key textbook or a suitable alternative) was rather expected for the theoretical background. You could then have included some references to illustrate why your example is interesting or relevant.

Explanations are clear and accurate, and your writing is of good academic standard.

3 Points Done Well

Please see comments on sections above. Very original approach, well done!

3 Points To Improve

Please see comments on sections above.