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Approach to Economics and Neuroeconomics through Your Choice: Guidelines for Problem Solving

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Introduction

There is a word to compare life to a journey. The Aoyama Standard Course "Problems in Modern Society" entitled Economics as one guideline; however, we consider the course of our own journey, which should not be said to be flat such as the contents of the lecture. How do you arrive at an answer when you encounter problems or when you are forced to choose? It could be said that this was a lecture in how to solve this problem. In particular, by considering the opportunity cost and sunk cost (sunk cost) of studying in university, each student was given the opportunity to give their answer to the question of what is the meaning of going to university. If the answer was temporarily for employment, I explained the concept of economics and what should be expected. In addition, it complemented the anomalies that cannot be explained by the interpretation of behavioral economics and neuroeconomics.

It may have been somewhat impossible to do such a lecture for a second-year student who is entering the university as a first-year student and thus has still not realized gainful employment. But it is well-known. Since I regret deeply that I did not have the opportunity to "know" all of it, I would like students who have entered Aoyama Gakuin University as their first choice, or students who do not like it at all, thinking it is good to have given my precious time of four years. In addition, I do not want juniors who are like younger siblings to me to have the same thought. Given such strong feelings, I intended to try to understand (avoid) only "opportunity loss." The target students were mainly in the 1st and 2nd grades, but the fact that the second graders who are thinking about 4th grade students in job hunting and college dropped out earnestly and listened to the lecture was a promising fact. Even so, many students like them are keen to choose their own choice and I strongly hope that they will have a meaningful life in the future.

"Choice" is the most important theme in economics. If analyzing human choice is the essence of economics, examining the value evaluation by choice can be said to be an important task. If you are completely a rationalist who is based on traditional economics, you can find options that make the utility the highest priority from a given set. However, real people tend to overestimate what has been chosen each time they choose, even if they are of the same value. In other words, the option that is finally left is relatively valuable. Therefore, by continuing to select what you choose, the final evaluation is maximized. Social psychology explains the psychology of human beings who overestimate their choices as cognitive dissonance, and underestimate what they did not choose (Festinger, 1957). In addition, this psychology has been confirmed in experiments by neuroeconomics (cranial nerve economics), which is a relatively new field of economics (Sharot et al., 2009).

In this paper, based on the subject dealt with within the lecture of the Aoyama Standard Course "Problems of Modern Society," from the viewpoint of neuroeconomics, we discuss the strengthening of our choice by the sunk cost effect.

The content of the lecture and the opinion of students regarding the choice of going to university. What is the meaning of going to university in contemporary society? If the answer is to get a job, what should you do during your university life of 4 years? If the lecture started with such a question, I explained the concept of economics in an easy-to-understand manner according to this theme, taking examples of job-related events close to the students as examples. In the first lecture, we calculated the opportunity cost and total cost of going to university. When graduating from high school, the wage that should have been obtained if you get a job is simply calculated as 6 million yen, and the expended expenses would be expected to be 6 million yen and 10 million yen, respectively. I clearly remember the stunned expression of the students when they saw this fact. Some of the students said that "I regret having chosen to go to university after listening to the lecture." Of course, it is not the purpose of the lecture to deny university admission. It was taken as an example as a means of finding a clear answer to the question as to why students decide to go to university. In the 2nd and 3rd lecture, in order to know the value of yourself, I explained the demand and supply of labor from the Hello Work job recruitment and job seeking situation. This lecture involved actually visiting Hello Work in order to realize the supply and demand balance and its difficulty through observing the actual situation. Even if you graduate from university, not everyone can automatically get a job. Students who were confronted with this reality were not calm.

In the 4th lecture, in order to compare their values, taking the division of labor between male students and girls students as an example, I explained the absolute advantage and comparative advantage. Whether or not knowledge of the comparative advantage will make a big difference in subsequent actions when working as a job hunting activity or a society person who waited until a few years later. We are saved by the wisdom of the division of labor and exchanges created by the great economists.

Some of the students thought that "college life is the last moratorium of my life," but I do not believe this is true. The university life of 4 years is long and short. In other words, it is a continuation of choice. For example, in the course registration for the first year, you must efficiently select items that conform to your interests from multiple subjects within a limited time of one week. In course decisions for the fourth year, within a limited period of several months, you have to choose from a wide range of options, such as finding employment or going on to higher education, in order to choose the path that matches your desires, and to decide on your own will. In my daily life, I judge myself how to live with something I want with a limited income. In this way, university life is never a moratorium, but full of responsibility and suffering of choice. It is an important growth process to overcome each one's choice and go to society. In such circumstances where choices are urged, is not the role of economics a help to make people's daily life better? The fact of the pain of choice comes to our shoulders every time we choose. Often it does not work even if you intend to make the best choice. It will regret at times, which will make inflict more suffering. If you make a mistake in choosing, how do you deal with it? In the 12th lecture, I explained my race and irrationality on my research topics from the example of a change in job title, years of employment, and years of qualification examinations. In recent years, a new field of economics called "Neuro Economy" has been developing. Neuro-economics aims to understand the information processing mechanism in the brain in order to construct an actual human behavioral model. In particular, it is thought that it becomes possible to infer these mechanisms by measuring the activity of the brain region related to decision making.

Some of the students regretted going to university, and there were a few things that I thought about, including dropping out or shifting. In addition to the initial lecture, individual consultations are often done after the lecture is over. In addition, although I checked all the comment papers distributed in the lecture each time, some things were remembered that hurt my heart. Decision making is a difficult problem so far. However, as a researcher's egg, we have to find a way to find a new weapon called neuroeconomics. It is a well-known fact that human beings do not possess perfect rationality, which is the premise of conventional economics, and exceptional (anomalous) behavior can be seen. Regarding such irrationality, what kind of answer does Neuro Economics put out? I explained the cost that it was impossible to get back to university by sunk cost, which is the concept of economics cost.

From the next section, based on these facts, we will report on the research and discuss sunk cost and its effects.

Objective of the Study and Research Questions

Choice and Sunk Cost Effect

In the main text of economics, sunk cost (sunk cost) is an unrecoverable cost and is explained as truncated. If it is a reasonable person, decision making will not be influenced by the sunk cost. However, real people are influenced by the sunk cost in every choice every day, and it cannot be truncated, because I do not want to waste sunk costs. Eventually, they showed obsession as if they were fascinated by the sunk cost. This phenomenon is called a sunk cost effect. The fact that sunk cost affects decision making is also evident in behavioral economics and social psychology studies represented by Kahneman and Tversky et al.'s research (Kahneman and Tversky 1984; Arkes and Blumer 1985; Gourville and Soman 1998; Prelec and Loewenstein 1998). So, why do you stick to regaining a wasted cost and make irrational choices?

There are two representative interpretations of the factors that cause the sunk cost effect and commitment/escalation. One is the interpretation by self-justification, and the other is interpretation by prospect theory. Interpretation by self-justification is likely to keep unreasonable behavior, as decision-makers have greater resistance to admitting losses. Therefore, the amount of psychological/physical investment is said to cause commitment/escalation (Staw and Ross, 1987a, Staw and Ross 1987b, Bobocel and Meyer 1994, Brockner 1992). On the other hand, the interpretation by the prospect theory is that, although the expected probability of gain is the same, it depends on the context of the decision making. Because humans try to avoid heavy reliable losses, they prefer decisions aimed at resuscitation, rather than accepting reliable losses from previous choices.

In early studies of behavioral economics regarding the sunk cost effect, it has been explained by Cost Benefit Analysis by MC and MB. In other words, it is obviously irrational to continue investment even if it becomes $MC > MB$, and it was the focus of a discussion on how to correct this (Kahneman and Lovallo, 1993). However, in Heath (1995), experimental results confirmed that marginal decision making on risk investment is influenced by sunk cost, which should be meaningless. In other words, escalation of commitment by sunk cost began to come into existence incidentally.

Recent studies of behavioral economics have stated that choice is not a simple reflection of outcome predictions in human decision making in real society (Ariely and Norton, 2008). Also, in "choice" in social psychology in related fields, it is stated that even though it is the same value option, the option chosen will be more highly appreciated, and alternatives that are not will be evaluated relatively low. This phenomenon is called cognitive dissonance (Festinger, 1957; Brehm, 1956; Egan, Santors and Bloom, 2007). In addition, it has been confirmed that neuroeconomics experiments

overestimate the choices you choose and underestimate what you did not choose in order to support this theory (Sharot et al., 2009).

From this fact, here, based on the interpretation that the sunk cost effect is justification of one's own choice, with cognitive dissonance as a keyword, cognitive dissonance such as a contradiction between the fact of loss in the past and his own belief and human's describe psychology. Can we think of the conventional sunk cost effect of unreasonable choice by self-justification as the strengthening of choice by using cognitive distortion and overestimation rather than capturing it as an anomaly? In other words, thinking that the sunk cost effect is an element for eliminating self-contradiction by choice and making the belief into one. In this paper, we consider such human irrationality as human wisdom and consider it by using a neuroeconomics method, which is a relatively new field of economics.

Experimental Method by fNIRS

In Heath (1995), it was confirmed by experimental results that the decision on investment under risk depends on the sunk cost. However, there is not much consideration by neuroeconomics. Therefore, the sunk cost effect under risk in the form of simulated investment experiment using fMRI was investigated. In recent years, the field of neuroeconomics, which seeks to integrate economics, psychology, and neuroscience has progressed, and functional nuclear magnetic resonance imaging (fMRI) and near infrared spectroscopy (functional Near-InfraRed Spectroscopy: fNIRS), Electroencephalograph (EEG), and, thus, human behavior can be inferred from brain activity. Among them, fMRI has attracted attention as a new brain function imaging device characterized by convenience in addition to non-invasiveness.

In this paper, in order to see the function of the orbital frontal cortex related to decision making, a fNIRS optical brain function imaging device (Spectratech OEG - 16 manufactured by Spectra Tech) specialized for frontal lobe measurement was attached, and oxygenated hemoglobin was measured as a change in concentration length. When the brain is activated, oxygenated hemoglobin concentrations increase. The subjects were one healthy male and one healthy female (25-year old female, right-handed). Measurement was over 4 hours after getting up, avoiding meals and caffeine ingestion for 2 hours before the experiment.

Experimental task.

Figure 1 Experiment Design

	Under Certainty	Under Uncertainty		Under Uncertainty + Sunk Cost	
		Risk < 50%	Risk > 50%	Risk < 50%	Risk > 50%
Investment or Not	○	○	×	×	○

12 choices under certainty and uncertainty were randomly displayed. Condition A: There is sunk cost. Condition B: There is no sunk cost. Expected values are the same for both.

Findings and Discussion

Experiment results and discussion

From the results of the experiments, there was a difference in the risk behavior of the subjects due to the difference in the probability under certainty and the probability under uncertainty (Table 1). In addition, even under experimental conditions with the same expected value, there were differences depending on the magnitude of the calculated risk. In addition, there was a significant difference in the oxygenated hemoglobin concentration change in blood ($p < 0.001$, FIG. 2) depending on the presence or absence of

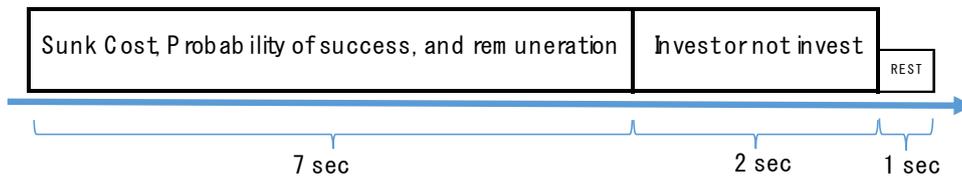
the sunk cost effect. From this view, the sunk cost effect was also confirmed from the neuroeconomic point of view.

In the case of sunk cost, we chose to show an excessive reaction to the loss and regain it. In other words, when overestimating the value of choosing an investment with sunk costs, a risk appetite trend was seen.

Festinger's cognitive dissonance includes significant implications for choice and effectiveness of the sunk cost. In his representative book, "Theory of Cognitive Dissonance," he states as follows: "Let's think about a person who has stimulated a very large amount of money to buy a new car of luxury type as an example. And after buying it, the car is somewhat weak and can also be repaired. If you notice that it costs a lot of money, you get higher than other cars when you ride that car, and not only that, he notices that your friends think that car is clunky ... he is horsepower. And I start to think that ride is more important than economic and appearance. They have made me run faster than ever, and I believe that being able to run at high speed is important to the car." (Festinger, 1965, pp.29)

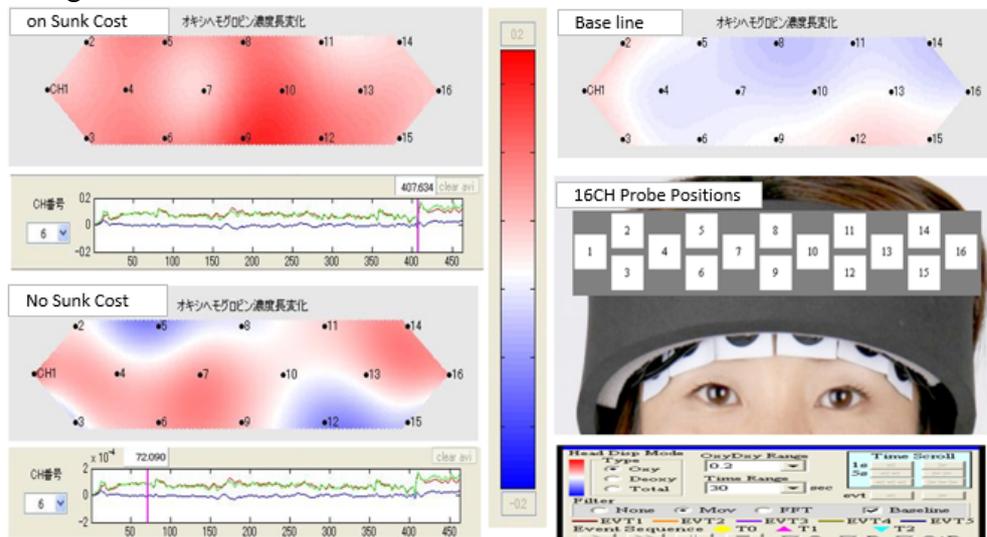
In this case, the sunk cost is not an unrecoverable past cost, but for us, a real society person, and is an important element in the choice. In other words, the existence of sunk costs can overestimate the value of choices made in the past. If human beings in real society are unreasonable, should not they be regarded as a material of overvaluation rather than thinking of sunk cost as a bias of choice by using its propensity?

Table 1
Mental Accounting under Risk and Sunk Cost Effect



With investment under uncertainty, a risk appetite trend is seen due to the sunk cost effect.

Fig. 2 The sunk cost effect and investment; oxygenated hemoglobin concentration; long change and waveform



Oxygenated hemoglobin concentration length change: red indicates oxygenated hemoglobin concentration is high, blue indicates oxygenated hemoglobin concentration is low

Waveform type: red is oxygenated hemoglobin, blue is deoxygenated hemoglobin, green is total.

Conclusion

Why do you stick to regaining a sunk cost and make irrational choices? In this paper, we investigate such human irrationality using the neuro - economic approach, which represents a new field of economics. Based on the experimental results, it is conceivable that the sunk cost effect is a strengthening of choice using cognitive distortion of overestimation. Therefore, rather than seeing the sunk cost effect as an irrational choice and an anomaly, it is possible to conclude that it is an element to eliminate self-contradiction by choice and to make a new belief together.

At the same time, the collaborative research of neuroeconomics, which is a progressing field, considers the cognitive ability of a human being who has a conscious mind and acts by reading context (Nakagome et al., 2011a, 2011b). Thus, we are aiming for a new development of economics from human wisdom far beyond that which is not the reversal of the resulting preferences or irrational behavior. I believe this can be the basis for a new cognitive science in economics.

Choice is an important theme in economics. What is the meaning of going on to university in contemporary society? With regard to this, I started with considering the opportunity cost of going to college by using the concept of conventional economics, supplementing explanations from the viewpoint of behavioral economics and neuroeconomics, which themselves cannot explain the sunk cost effect. In this lecture, we aimed to cultivate the ability to set and solve problems themselves among various problems of real society through learning. By the end of 15 lectures, each student completed their own guidelines and intends to work together to form a natural and judgmental force. I think that it is meaningful to learn economics as a guideline during troubled student days.

What is important to notice again after finishing the lectures is the ability to learn at the same time as teaching. I have learned a lot from the students. I was able to find a light of hope of honor under the responsibility to stand as the teacher, the severity of the world of the game, the settlement to my own conflict, and the day of distress. It would be greatly appreciated if we could contribute even a little to future classroom management by reporting on the educational practices from both the viewpoint of students and faculty members. At the Faculty of Economics, the system where one can be enrolled in a doctoral course and serve as a part-time lecturer is new. It is too short for attractive classes of experienced teachers. I borrowed the job title of a part-time lecturer and I am aware that it is impossible even to write such a report in this way. However, as stated in the proverb of parents' feelings, it can be noticed for the hardships and deep love of teachers so far by standing by the instructor.

It is also a great opportunity to decide the readiness to always face the front as the students are growing day by day, and to cultivate their spiritual power. I strongly wish the students to cultivate the spirit of flight to the future as a member of society in university life, and to encourage the ability to survive the weight of choice and responsibility that will be imposed. How can you find an answer when you hit a problem in the journey of life? Is not the answer always within yourself? I would be pleased if they could notice their way of solving through the problem of choice. The choice is heavy, and it is more beautiful than anything else.

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