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BEHAVIORAL AND EXPERIMENTAL ECONOMICS

WORKSHOP

for students of speciality 1-25 80 01 “Economics”

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The workshop includes a list of questions for discussion at seminars, test tasks and case studies.
The workshop is intended for students of the specialty 1-25 80 01 full-time and part-time forms
of education.

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INTRODUCTION

Behavioral and experimental economics as a discipline explains the economic behavior of a consumer using the achievements of psychology. Behavioral economics studies the psychological characteristics of human perception, the influence of emotional, cognitive and a number of other factors on economic decision-making by economic entities, whether it is an individual or a group; and the implications of this effect on market variables. The study of this discipline is based on theoretical knowledge gained in the development of such disciplines as "Economics", "Microeconomics".

The aim of studying the course “Behavioral and Experimental Economics” is to develop the economic kind of thinking of undergraduates, to form the foundation of economic knowledge that allows to understand how psychological factors, emotions and group dynamics influence decision-making of an economic entity.

The learning objectives of the course “Behavioral and Experimental Economics” are:

1. Developing interdisciplinary thinking. Behavioral Economics (broadly defined) combines knowledge from several disciplines, such as Economics, Psychology, Sociology and Neuroscience;
2. Understanding the increasing role of experiments in the modern economy;
3. The study of the psychological aspects of the economic behavior of economic entities;
4. The study of the impact on individuals of environmental factors in the decision-making process.

TOPIC 1. INTRODUCTION TO BEHAVIORAL ECONOMICS

Tests

1. Which of the following claims are descriptive and which are normative?
 - (a) On average, people save less than 10 percent of their income for retirement.
 - (b) People do not save as much for retirement as they should.
 - (c) Very often, people regret not saving more for retirement.
 - (d) Society faces a short-run trade-off between inflation and unemployment.
 - (e) A reduction in the rate of money growth will reduce the rate of inflation.
 - (f) The Federal Reserve should reduce the rate of money growth.
 - (g) Society ought to require welfare recipients to look for jobs.
 - (h) Lower tax rates encourage more work and more saving

2. Rationality is a methodological foundation of
 - a) Traditional economy
 - b) Behavioral economics
 - c) Neuroeconomics

3. Economics is the study of choice
 - a) Because resources are limited and wants are unlimited
 - b) Because resources are unlimited and wants are unlimited
 - c) Because resources and wants are limited

4. The rational choice of individuals means that
 - a) People minimize their individual satisfaction.
 - b) People maximize their individual satisfaction.
 - c) People maximize their individual cost.

5. A descriptive theory describes how people
 - a) should make decisions;
 - b) in fact make decisions;
 - c) fail to act in the proper way.

6. Behavioral economists reject the idea that
- a) people always behave in the manner that they should;
 - b) people fail to behave in the manner they should;
 - c) people make their decisions in conditions of scarcity.

7. Behavioral economics tries to increase
- a) the normative power of traditional economics;
 - b) the rational approach to the explanation of consumers behavior;
 - c) the predictive power of traditional economics.

8. The development of new descriptive theories of decision making is possible because the deviations from rational behavior are:
- a) large, systematic and predictable;
 - b) rare, and predictable;
 - c) rare and systematic.

9. The behavioral economics was born
- a) at the end of 1970's
 - b) at the beginning of twentieth century
 - c) at the 1756

Issues for discussion

1. Give the definition of Behavioral economics.
2. In few sentences explain, please, the differences between behavioral economics and traditional economy.
3. Why do people make decisions that are not in their self-interest? (answer in 2-5 sentences)

Task

In a recent study on financial decision-making, people's answers to three quick mathematics questions were strong predictors of their wealth: households where both spouses answered all three questions correctly were more than eight times as wealthy as households where neither spouse

answered any question correctly. So if you have ever struggled with math, be glad that you did. You can try answering the three questions for yourself:

(a) If the chance of getting a disease is 10 percent, how many people out of 1000 would be expected to get the disease?

(b) If five people all have the winning numbers in the lottery, and the prize is 2 million dollars, how much will each of them get?

(c) Let us say you have \$200 in a savings account. The account earns 10 percent interest per year. How much would you have in the account at the end of two years?

Case. Loss aversion in monkeys

Monkeys show the same “irrational” aversion to risks as humans.

Economists often speak of “Homo economicus” — rational economic man. In practice, human economic behavior is not quite as rational as the economists suggest it ought to be. When buying things in a straight exchange of money for goods, people often respond to changes in price in exactly the way that theoretical economics predicts. But when faced with an exchange whose outcome is predictable only on average, most people prefer to avoid the risk of making a loss than to take the chance of making a gain in circumstances when the average expected outcome of the two actions would be the same.

If it is possible to find similar behavior in another species of primate (none of which has yet invented a cash economy) this would suggest that loss-aversion evolved in a common ancestor.

First, the researchers had to introduce their monkeys to the idea of a cash economy. They did this by giving them small metal discs while showing them food. The monkeys quickly learned that humans valued these discs so much that they were willing to trade them for pieces of apple, grapes and jelly. Preliminary experiments established the amount of apple that was valued as much as either a grape or a cube of jelly, and set the price accordingly, at one disc per food item.

The monkeys were then given 12 discs and allowed to trade them one at a time for whichever foodstuff they preferred. Once the price had

been established, though, it was changed. The size of the apple portions was doubled, effectively halving the price of apple. At the same time, the number of discs a monkey was given to spend fell from 12 to 9. The result was that apple consumption went up in exactly the way that price theory (as applied to humans) would predict.

The experimenters then began to test their animals' risk-aversion. They did this by offering them three different trading regimes in succession. Each required choosing between the wares of two experimental "salesmen".

In the first regime one salesman offered one piece of apple for a disc, while the other offered two. However, half the time the second salesman only handed over one piece. Despite this deception, the monkeys quickly worked out that the second salesman offered the better overall deal, and came to prefer him.

In the second trading regime, the salesman offering one piece of apple would, half the time, add a free bonus piece once the disc had been handed over. The salesman offering two pieces would, as in the first regime, actually hand over only one of them half the time. In this case, the average outcome was identical, but the monkeys quickly reversed their behavior from the first regime and came to prefer trading with the first salesman.

In the third regime, the second salesman always took the second piece of apple away before handing over the goods, while the first never gave freebies. So, once again, the outcomes were identical. In this case, however, the monkeys preferred the first salesman even more strongly than in the second regime.

What the responses to the second and third regimes seem to have in common is a preference for avoiding apparent loss, even though that loss does not, in strictly economic terms, exist.

The fact that such behavior occurs in two primates suggests a common evolutionary origin. It must, therefore, have an adaptive explanation. What that explanation is has yet to be worked out. One possibility is that in nature, with a food supply that is often barely adequate, losses that lead to the hunger are felt more keenly than gains that

lead to the comfort of satiety. Agriculture has changed that calculus, but people still have the attitudes of the hunter-gatherer wired into them.

Discussion :

Explain the results of the experiment:

1. Methods:

- Describe the methods, that are used here (field experiments or laboratory experiments)
- How many trading regimes are used in order to compare responses and test the basic hypothesis of loss-aversion
- Did the modulator use the deception?

2 Evolutionary psychology

- Is it possible to say, that modulator worked in connection of behavioral economics and evolutionary psychology? Why?
- Does this experiment allow to test whether the widely-observed loss-aversion in humans is likely to have an evolutionary explanation.

3 Rationality

- How should a 'rational' subject behave himself according to the traditional economic model?

TOPIC 2. BELIEFS, HEURISTICS, BIASES

Tests

1. Why would anyone pay \$959,500 for a used guitar? Because it was owned by Eric Clapton is the simple answer. This refers to:

- a) endowment effect;
- b) positive contagion;
- c) disposition effect.

2. Biases are:

- a) systematic errors;
- b) methods for achieving a satisfactory result with modest amounts of computation;
- c) mental accountings.

3. A mistake that our brains make by assuming that the examples which come to mind easily are also the most important refers to:

- a) representativeness heuristic;
- b) endowment effect;
- c) availability heuristic.

4. In a case when a person overestimates the probability of dying in plane crashes, it is:

- a) availability heuristic;
- b) representativeness heuristic;
- c) disposition effect.

5. The availability heuristic refers to:

a) people overvalue and overestimate the impact of things that they can remember people undervalue and underestimate the prevalence of the events they hear nothing about;

b) people undervalue and underestimate the impact of things that they can remember and people overvalue and overestimate the prevalence of the events they hear nothing about;

c) both.

6. People have the tendency to evaluate the likelihood that a subject belongs to a certain category based on the degree to which the subject resembles a typical item in the category represents:

- a) representativeness heuristic;
- b) gambler's fallacy effect;
- c) availability heuristic.

7. When an individual believes that a certain random event is less likely or more likely to happen based on the outcome of a previous event or series of events it is:

- a) gambler's fallacy effect;
- b) representativeness heuristic;
- c) disposition effect.

8. The behavior of investors when they tend to hold onto stocks that have depreciated is an example of
- a) gambler's fallacy effect;
 - b) availability heuristic;
 - c) representativeness heuristic.

Issues for discussion

1. It has been proven that overconfidence negatively affects the ability to make the right decisions. Does this mean that a lack of confidence leads to the same detrimental outcome?
2. Based on what you now know about heuristics, which of them are inherent in your daily life? Give an example.
3. Do you think attention plays a role in cognitive illusions and decision making? Explain.
4. Impulsive behavior is usually associated with dysfunction of the frontal lobes. However, could impulsivity be the result of cognitive overload?
5. Explain what is meant by the representativeness heuristic. Give an example.
6. Explain the essence of the "law of small numbers."
7. Explain why people don't want to "tempt fate." Give an example from student life.
8. Give three reasons from behavioral economics why people prefer to travel by car rather than by plane.

Task. Player error effect

The coin is tossed 12 times; on the first three tosses, it lands heads up. (a) How would you rate the probability that a rational player will come up heads on the fourth toss? b) How will the player estimate the probability that the player will get heads on the fourth toss if he is subject to the player's fallacy?

Case. Trading on testosterone

Financial traders take a lot of risk, but often make high rewards. Until recently the role of the endocrine system in a trader's success or

failure had not been investigated. We now know that a high level of testosterone is a good predictor of daily trading profitability, while a high level of cortisol is associated with a high variance in a trader's profit and with market volatility. This was established by a study by Coates and Herbert in 2008, who examined 17 male traders in the City of London over a period of 8 days, recording testosterone and cortisol levels at 11am and 4pm, coinciding generally with the start and end of the main trading of the day. These findings are important in understanding not just the underlying psychology behind bubbles and crashes in financial markets, but also the physiology. A high level of testosterone tends to lead to high confidence and increased risk-taking. In a bull or rising market this will tend to lead to greater profits, which may engender more confidence and risk-taking in the future. Cortisol is a stress hormone. When markets are falling or when they are highly volatile this increases stress, which in turn tends to cause not only caution, but a reluctance to transact altogether. In this light it is easy to see how a crash or credit crunch can occur. The psychology of the market is driven by an underlying physiology.

Questions

- 1 Explain how overconfidence and underconfidence are related to neurotransmitters.
- 2 Explain one main implication of this study as far as trends in financial markets are concerned.
- 3 How is the above case related to the concept of reductionism described in the previous chapter?

TOPIC 3-4. CHOICE AND DECISION-MAKING UNDER RISK AND UNCERTAINTY

Tests

1. If your budget is \$100, the price of a cup of coffee is \$5, and the price of pizza is \$10, can you afford to buy 10 cups of coffee and 6 pizzas?
 - a) no;
 - b) yes.

2. The theories of consumers behavior try to explain how :

- a) the consumer should use his budget to maximize the utility he or she gains during consumption;
- b) the consumer should use his budget to get the utility during consumption;
- c) the consumer should use his budget to minimize the utility he or she gains during consumption.

3. The utility is:

- a) a characteristic of particular goods;
- b) a consumer's reactions to particular goods;
- c) a producer reactions to particular goods.

4. Marginal utility is:

- a) the amount by which total utility rises with consumption of one additional unit of a good;
- b) number of units of utility that a consumer gains from consuming all goods;
- c) the amount by which total utility rises with consumption of all units of good.

5. As consumer purchases more of goods marginal utility:

- a) doesn't change;
- b) increases;
- c) declines.

6. Total utility reaches its maximum when

- a) marginal utility is negative;
- b) marginal utility equals to zero ;
- c) marginal utility declines.

7. A consumer's choice is:

- a) limited by the available budget;
- b) unlimited by the available budget;
- c) limited by his needs.

8. Consider the function of total utility is $TU = 81 + 100Q - 10Q^2$.
The function of marginal utility will be:

- a) $MU = 81 + 100Q$;
- b) $MU = 100 - 10Q$;
- c) $MU = 100 - 20Q$.

9. The function of total utility is: $TU = 35 + 10Q^2$, the size of total utility(TU) if consumer purchases 3 units of the good will be

- a) 125;
- b) 45;
- c) 44.

10. Suppose after paying bills and setting aside some money for retirement, Joana has \$130 dollars left to spend on just two goods: concerts and books. For simplicity, we'll assume concert tickets cost \$55 and books cost \$10. Which of the following combination of goods could possibly be her utility-maximizing bundle?

- a) 3 concert tickets and 1 books;
- b) 2 concert tickets and 2 book;
- c) 1 concert ticket and 5 books.

11. Consider the function of total utility $TU = 9Q - Q^2$. The quantity of goods that bring maximum utility (TU) to the consumer will be:

- a) 4,5;
- b) 9;
- c) 2.

Issues for discussion

1. John McEnroe has been quoted as saying 'the older I get, the better I used to be'. Explain this in terms of prospect theory.

2. Show, using a numerical example, how the TAX model accounts for risk-aversion.

3. Explain the difference between a descriptive and a normative theory. How do traditional economy and prospect theory compare in these respects?

Tasks

1. According to prospect theory, which is preferred and why?

a) (0,80 \$50; \$0)

b) (0,40 \$100; \$0)

2. According to prospect theory, which is preferred and why?

a) (0,00002 \$500 000; \$0)

b) (0,00001 \$1000000; \$0)

3. Consider a person with following value function under prospect theory:

$$V(g) = g^{0.8} \text{ when } g \geq 0$$

$$V(g) = -2(-g)^{0.8} \text{ when } g < 0$$

Is this individual loss-averse? Explain why.

4. Assume now that this individual weights values by probabilities, instead of using prospect theory weighting function.

Prospect 1 (0.8, 1000; -800)

Prospect 2 (0.7, 1200; -600)

Prospect 3 (0.5, 2000; -1000)

Which of the following prospects will be preferred by the individual?

Case “The endowment effect”

According to the standard model, ownership or entitlement should not affect the value of goods. This assumption relates to the Coase theorem, which states that the allocation of resources will be independent of property rights. There are two main exceptions to this theorem:

(1) income effects may affect tastes;

(2) transactions costs may discourage trade.

In addition to these exceptions, there are certain other situations where economists have proposed that value may be affected by ownership:

(3) where ownership has conveyed experiential effects, causing people to value items they have owned for some time;

(4) where buyers and sellers need time to adjust to and learn market conditions, which may have recently changed.

Apart from the above exceptions, the standard model predicts that buyers and sellers should not on average demand different prices for the same good, i.e. the WTP of buyers should not differ significantly from the WTA of sellers. Stated in different terms, the standard model assumes that indifference curves are unaffected by ownership.

However, many anomalies have been observed over the years. For example, a number of hypothetical surveys have shown that in the case of hunting and fishing rights the WTA of sellers has been between 2.6 and 16.5 times as large as the WTP of buyers. In a real exchange experiment, it was found that the ratio for deer hunting rights was 6.9. Another such experiment found that the ratio for lottery tickets was 4.0. A particularly comprehensive and detailed study was performed by Kahneman, Knetsch and Thaler in 1990. One important objective of this study was to isolate any endowment effect from any of the other circumstances mentioned above that might cause discrepancies between WTP and WTA. For example, the researchers carried out a number of experiments with tokens first, to accustom the subjects to the situations. As expected, these induced-value experiments showed no difference between the WTP and WTA for tokens. However, when the experiments were repeated with consumer goods, using mugs and pens, significant differences appeared. Four trials were performed with the subjects, in order to eliminate any learning effect over time, but it was found that there was very little difference between the trials. There were 44 subjects involved, divided into two equal groups, one with the property right to the good which they could sell, and the other without the property right initially, but in a position to bid for it. It was also stressed to the subjects that it was in their interest to state their true willingness to pay and accept in the questionnaires, because after the four trials one trial would be taken at random, the market-clearing price (MCP) would be calculated from the responses, and the relevant transactions would then take place. Thus, if the subjects with the property right indicated a WTA at or below the MCP they would then sell at this price, while subjects without the property right who indicated a WTP at or above

the MCP would then buy at this price. The following results were recorded: Mugs – the median WTP soon settled to \$2.25 after the first trial, while the median WTA was a constant \$5.25 throughout all the trials. An average of 2.25 trades took place with each trial, compared with an expected 11 (50% of the 22 pairs of subjects would be expected to have the potential buyer value the good more than the seller). Pens – the median WTP was a constant \$1.25, while the median WTA varied between \$1.75 and \$2.50. An average of 4.5 trades took place per trial, compared with the expected 11.

The authors of the study came to the following conclusions:

1 There was evidence contradicting the standard model – people's preferences do depend on entitlements.

2 Indifference curves depend on the direction of trade – an indifference curve showing acceptable trades in one direction may cross another indifference curve showing acceptable exchanges in the opposite direction.

3 Endowment effects reduce the gains from trade – the volume of trade will be lower than predicted by the standard model. This is not because of inefficiencies like transaction costs, but because there are less mutually advantageous trades available.

4 Endowment effects will be different for different goods – they are unlikely to exist at all for money tokens, or for goods that are purchased explicitly for the purpose of resale, or for goods where perfect substitutes are available at a lower price. The effects are likely to be strongest 'when owners are faced with an opportunity to sell an item purchased for use that is not easily replaceable'. Examples given are tickets to a sold-out event, hunting licenses in limited supply, works of art, and a pleasant view.

5 Endowment effects can also apply to firms and other organizations – for example, firms may be reluctant to divest themselves of divisions, plants or products, and they may be saddled with higher wage levels than newer competitors.

There has been considerable laboratory evidence from numerous studies over many years that supports the existence of endowment effects in the traditional sense. These effects relate to the situation where an owner

of a good, or seller, places a higher value on it than a non-owner, or buyer. According to PT this phenomenon arises through a combination of reference points and loss-aversion. The owner or seller's reference point involves possessing the item, while the buyer's reference point does not involve possession; the seller's loss in a transaction is greater than the buyer's gain in the transaction. However, Plott and Zeiler point out that the term is now used to refer to two different phenomena, only one of which refers to endowment in the strict sense. There are two main kinds of criticism of the 'endowment effect':

(1) the effect does not really exist, when it is tested for under proper controlled conditions;

(2) the effect may exist, but it is caused by factors other than those proposed by prospect theory.

We will examine each criticism in turn. Many studies refer to differences between willingness to pay (WTP) and willingness to accept (WTA) as an endowment effect. This does not necessarily involve endowment, since sellers may not have been endowed with the good originally. Note that sellers may have come into possession of a good for many reasons, such as earning income to buy it, rather than it being gifted to them like 'manna from Heaven'. Thus there is not just a single phenomenon occurring. Evidence suggests that WTA by sellers may depend significantly on how they came into possession of the good. Further complications are raised by other possibilities. For example, the influence of the experimenter is an important factor. Subjects may interpret the choice of the good endowed by the experimenter as an indicator of relative quality. Furthermore, social preferences may be relevant if the endowed person regards the good as a gift from the experimenter, and therefore does not want to reject it for that reason. Another relevant factor concerns learning effects. If the seller has had time to thoroughly inspect the good to fully learn its value, this increases WTA. Some economists have expressed the belief that the endowment effect is merely the result of a mistake made by inexperienced consumers and through time these consumers will learn 'better' behavior that conforms to the neoclassical standard model. Some of these researchers have also reported empirical

findings that do not support the endowment effect hypothesis. Most recently List has conducted a large-scale study involving more than 375 subjects who actively participated in a well-functioning marketplace. The purpose of the study was to test the predictions of prospect theory in terms of the endowment effect against the predictions of the standard model. All subjects actively traded sportscards and memorabilia. In the experiment they were endowed with either a candy bar or a mug of similar market value, and asked whether they would like to trade. List found that both inexperienced and experienced consumers did not trade as much as predicted by the standard model, revealing an endowment effect as people tended to value the good they were endowed with more than the other product. However, for 'intense' consumers who traded in their usual market at least 12 times monthly, and for dealers, there was no reluctance to trade and therefore no evidence of an endowment effect. List's conclusion was that experience in the market did indeed tend to eliminate the endowment effect, and that furthermore there was a transference of this experience, meaning that experience in the subjects' normal market of sportscards and memorabilia transferred its effects to trading other goods. In a more recent study involving a field experiment that exogenously induces market experience, List finds confirming evidence that market experience alone can eliminate the endowment effect. Let us now consider the second criticism of the endowment effect, which is that it is caused by factors other than loss-aversion related to reference points. Birnbaum explains the endowment effect in terms of a configural weights model. It has been proposed that exchange asymmetries between WTA and WTP could be explained in terms of asymmetric costs to buyer and seller. A buyer makes a worse or more costly error by overestimating value than by underestimating value, whereas for a seller the more costly error is to underestimate value rather than overestimate it. The result is that, in a configural weights model, buyers assign greater weight to lower estimates of value and sellers assign greater weight to higher estimates of value. Birnbaum claims that various empirical studies involving judgments of buying and selling prices of either 'sure things' of uncertain value, like used cars and stocks, or standard risky gambles, support this explanation of

the endowment effect and are not consistent with the loss-aversion explanation. The conclusion, at least based on existing research, is that not only is the endowment effect an ambiguous term but also that both its causes and the circumstances of its effects remain controversial issues in behavioral economics.

Questions

1. Explain why the term 'endowment effect' is ambiguous.
2. Explain how prospect theory can explain endowment effects..
3. Explain, with the aid of a graph, how the endowment effect may cause indifference curves to cross, contrary to the standard model.
4. Wimbledon tickets are allocated by a lottery process. Given that there is a secondary market for such tickets, what implications does the endowment effect have in this situation?

TOPIC 5. THEORY OF MENTAL ACCOUNTING

Tests

1. Cognitive operations used by individuals and households to code, categorize and evaluate financial activities refers to:
 - a) mental accounting;
 - b) bias;
 - c) heuristics.
2. Using the "silver lining" principle give the example of pricing:
 - a) a new low price 15\$;
 - b) now only 15\$;
 - c) price 20\$ a discount – 5\$.
3. Which statement is true according to mental accounting of Behavioral economics
 - a) $v(x) + v(y) < v(x + y)$;
 - b) $v(x) + v(y) > v(x + y)$;
 - c) $v(x) + v(y) = v(x + y)$.

4. Transaction utility refers to:
- a) difference between the reference price and the price paid;
 - b) the value of the good obtained relative to its price;
 - c) economic surplus.
5. Using the consolidated price for a product bundle helps to:
- a) decrease the salience of the expense of individual items;
 - b) increase the salience of the expense of individual items;
 - c) disintegrate losses in terms of the costs.
6. Putting certain sums of money into different labeled envelopes on a regular basis is an example of:
- a) formalized budgeting;
 - b) non-formalized budgeting;
 - c) less frequent budgeting.
7. Unanticipated price increases
- a) reduce consumers' tendencies to buy discretionary goods;
 - b) increase consumers' tendencies to buy discretionary goods;
 - c) changes nothing.
8. If person exceeds his weekly budget of \$100 for eating out this will:
- a) decrease his reference point;
 - b) increase his reference point;
 - c) change nothing.
9. Is the following statement true or false "People try to smooth their consumption patterns over their lifetimes to maintain a consistent standard of living".
- a) true;
 - b) false.

10. Willingness to pay will be higher when:

- a) credit cards are required for payments;
- b) cash is required for payments;
- c) payment go before consumption.

Issues for discussion

1. Explain why people may drive for 20 minutes to save \$5 on a \$15 calculator but not for a \$125 dollar jacket. What principle of PT is relevant here?

2. Explain the mental accounting rule ‘segregate small gains from large losses’, and give an example relating to marketing.

3. Why are people more reluctant to replace a \$20 theatre ticket if they have lost it than if they have lost \$20 cash? What principle of the standard model does this violate?

4. Why would people prefer to pay by credit card and pay 12% interest when they have a savings account with sufficient funds paying them only 3%?

5. Explain what is meant by ‘emotional accounting’, giving an example.

6. Explain what is meant by disaggregated pricing; why would marketers use such a tactic?

7. Explain why default options are important, giving two examples.

8. Explain what is meant by a ‘target worker’, and why such workers behave in contrasting ways to the predictions of the standard model of labor supply.

Case Why you can’t find a cab on a rainy day

The theory of labour supply in the standard model predicts that the supply curve will be a normal upward-sloping one, where workers will work longer hours at higher wages. This theory is based on the concept of intertemporal substitution, meaning that when wages are high, workers will substitute work for leisure as the opportunity cost of leisure is higher at the higher wage. If people have diminishing marginal utility of leisure time, then they will be inclined to give up more leisure as the wage increases. In

practice however, the theory has been difficult to test empirically, since a number of conditions need to be satisfied. An ideal testing situation would involve the following factors:

- 1 The increase in wages should be temporary.
- 2 Wages are relatively constant within a day.
- 3 Wages vary from day to day, and are uncorrelated.

These conditions are satisfied well by one particular group of workers: cab drivers. On some days they are busy, and their hourly wage rate is higher, while other days are quieter, causing a lower rate. Drivers are in a position to determine the number of hours they work on a daily basis, depending on their average hourly wage for that day.

The objective of the study was to test two competing hypotheses:

- 1 standard model – upward-sloping supply curve, with positive wage elasticity.
- 2 behavioral model – downward-sloping supply curve, with negative wage elasticity.

The latter model involves the supposition that workers are target workers, meaning that they aim for a daily income target, and stop working when they reach that target. This implies a more specific hypothesis regarding wage elasticity. Wage elasticity measures the percentage change in hours worked in response to a 1% change in the wage rate. If workers aim for a daily income target then the wage elasticity should be -1 . The two estimates of wage elasticity are -0.926 and -0.975 , both very close to -1 . The study also investigated how elasticities varied with both experience and payment structure. Drivers were divided into two groups, according to whether they had more or less than three years of experience. The hypothesis relating to experience was that the more experienced drivers would learn that they could earn more by driving more on high-wage days and driving less on low-wage days. This would cause them to have a more positive elasticity. This hypothesis was indeed confirmed: there is a marked difference between the elasticities for experienced and inexperienced drivers. Indeed in two of the samples the elasticity is positive. It was also hypothesized that the way drivers pay for their cabs would affect elasticity. Drivers fall into three main categories here: those

who rent daily for a 12-hour shift; those who rent weekly or monthly; and those who own their own cabs. The first group has a relatively low negative elasticity (-0.197), while the elasticities for the other two groups are -0.978 and -0.867 , respectively, suggesting that they are target workers. The issue of optimality is also raised in the study. It is estimated that if drivers worked the same number of hours in total, but redistributed on the basis of working a constant number of hours per day, they could increase their earnings by an average of 5%. Furthermore, assuming that their utility function for leisure is concave, this fixed-hours rule would also improve total leisure utility. It was also estimated that, if drivers reallocated their total driving hours as if the wage elasticity were $+1$, they could increase earnings by 10% on average. The study concludes by considering different explanations for the results. Four possible explanations are rejected:

1 Drivers are ‘liquidity-constrained’. This means that they do not have enough cash to pay daily expenses and cannot borrow. If this is the case they could not afford to stop driving on low-wage days. However, cab owners are not liquidity constrained and yet their wage elasticities are still negative.

2 The calculation of the working hours and wage rate does not take into account actual hours worked. It may be that on quiet days drivers finish late, but take a lot of unrecorded breaks. This would cause total hours worked to be lower and the wage rate to be higher. However, in one of the samples the breaks were recorded and excluded; this made no difference to the results.

3 Drivers finish early because being busy and carrying a lot of passengers is tiring. However, a survey of the cab fleet managers revealed that most of them thought that fruitlessly searching for fares on a low-wage day was more tiring than carrying passengers.

4 The data are biased, since it only takes into account days worked, or ‘participation’, not the days when drivers chose not to work at all. It may be that there is a tendency to work unexpectedly on some days, this being correlated with working long hours. However, drivers usually

operate on a fixed shift schedule, with penalties for not showing up, making unexpected participation of little importance.

Having rejected the four explanations above, the authors conclude that daily income targeting is the best explanation for the results obtained. As with the previous case study relating to the equity risk premium, the essential behavioral factor here is myopic loss aversion. Drivers have a reference point in terms of a daily income target, and are averse to any shortfalls or losses compared to this target. Any gains have progressively less marginal utility because of the concavity of the utility function. The question then is: why do they have an evaluation period of such a short time as one day? This seems an extreme example of ‘narrow bracketing’. The authors of the study propose two explanations for this:

- 1 Daily income targets serve as a useful heuristic. It is easier to use this rule than to try to estimate the marginal utility of work time and compare it with the marginal utility of leisure time for each day.

- 2 Daily income targets serve as a useful self-control device. If longer evaluation periods are used, it becomes easy for drivers to slack off and finish early, with the intention of making up for lost time and income later in the week or month. The situation is similar to that of an author with a daily target of pages written, discussed earlier in the chapter. Furthermore, as the study notes: ‘a drive home through Manhattan with \$200–300 in cash from a good day is an obstacle course of temptations for many drivers, creating a self-control problem that is avoided by daily targeting’.

As a final point the authors of the study comment on the difference between experienced and inexperienced drivers. Experienced drivers are less likely to be target earners, and closer to being optimizers. The study suggests that there may be two reasons for this:

- 1 Drivers learn to optimize through experience.

- 2 Non-optimizing target-earners are weeded out by a selection process.

Questions:

- 1 Why can't you catch a cab on a rainy day?

- 2 Explain the differences between the predictions of the standard model and its behavioral alternative.

- 3 Explain why target earners have a wage elasticity of -1 .
- 4 Explain the meaning of the statement: 'furthermore, assuming that their utility function for leisure is concave, this fixed-hours rule would also improve total leisure utility'.
- 5 Explain why daily targeting is 'myopic'.

TOPIC 6. BEHAVIORAL GAME THEORY

Tests

1. A game when players can communicate with each other and collude refers to:
 - a) zero-sum and nonzero-sum games;
 - b) two-player and multi-player games;
 - c) cooperative and non-cooperative games.

2. A game when the gain of one player(s) is automatically the loss of another player(s) refers to:
 - a) zero-sum and nonzero-sum games;
 - b) static and dynamic games;
 - c) two-player and multi-player games.

3. An element of behavioral game theory which refers to how a game is perceived or mentally represented is called:
 - a) initial conditions;
 - b) representation;
 - c) social preferences.

4. Discrete strategies relate to:
 - a) situations where each action can be chosen from a limited number of alternatives;
 - b) situations where all the players knew for certain what all the payoffs were for each pair of strategies;
 - c) situations where there is a continuous interaction between competitors, who can change their decision variables at regular intervals.

5. A situation when neither player has a dominant strategy refers to:

- a) iterated dominant strategy equilibrium;
- b) Nash equilibrium;
- c) dominant strategy equilibrium.

6. Mixed strategy equilibrium means that:

- a) players randomize between different strategies in response to a given strategy of an opponent;
- b) that players do not choose the best response with certainty, as is the case with other equilibria, but 'better respond' instead.

7. Signaling may be used:

- a) in competitive situations;
- b) in cooperative situations;
- c) in both situations.

Issues for discussion

1. Explain what is meant by a dominant strategy equilibrium.
2. Compare the concept of dominant strategy equilibrium with Nash equilibrium.
3. Explain the structure of the prisoners' dilemma game, and show how its equilibrium is determined in traditional game theory
4. Explain what is meant by a mixed strategy equilibrium, and its implications for optimal strategy.
5. Explain why equilibrium in bargaining games are often different from those predicted by traditional game theory.
6. Explain the role of signaling in games.
7. Explain what is meant by a pooling equilibrium and the circumstances under which it may occur.

Case. Penalty kicking in professional soccer

Where should top soccer players aim their penalty kicks? One might think at first glance that this is a matter of knowing the kicker's strengths and the goalkeeper's weaknesses. Most right-footed kickers are better at

aiming to the left of the goal, or the goalkeeper's right. On the other hand, more goalkeepers are more proficient at diving to their right. However, as soon as the kicker predictably kicks in one direction the keeper can anticipate this and is more likely to make a save. Also, if the keeper becomes predictable in diving to one direction then the kicker can take advantage of this and aim elsewhere. The key to success then for both players is to be unpredictable and randomize their directions of shooting and diving. Welcome to mixed strategy equilibrium (MSE), as game theorists refer to it. As is often the case in game theory, the conclusions are often counterintuitive. In MSE each player will maximize their success when they are indifferent regarding the direction to aim or move, since if they have any preference the other player can take advantage of them, which means that they are not optimizing their chances of success. But does this prediction of game theorists actually predict behavior in terms of penalty kicking in the real world? After all, the calculations required to estimate the correct type of randomization to use involve long, complicated formulas. Maybe somewhat surprisingly, the theory predicts remarkably well, according to a study by Chiappori, Levitt and Groseclose (2002). Apparently most penalty kickers in the top French and Italian leagues are extremely good at mixing things up. This does not mean that these players are also extremely good mathematicians; they merely act 'as-if' they were good mathematicians. Learning and natural selection are responsible for the result. Let us consider the study in more detail. Five factors aided the development of an appropriate model:

- 1 Well-defined game structure The game involves two players, and is a zero-sum game. Each player must determine their move before they can observe the other player's move. This assumption can be tested empirically. A penalty kick can travel at up to 125mph, and reaches the goal in 0.2 seconds. Thus keepers must move before the kick is made. However, kickers must also determine direction before they observe the keeper move. This means that the game resembles a 'matching pennies' game.
- 2 Well-defined strategy space Both kickers and keepers can move right, left, or stay centre.
- 3 Well-defined outcomes Preferences are easy to determine: kickers want to score and keepers want to prevent a score. Furthermore, these results involve huge financial

incentives at the top level. 4 Available data There is plentiful video recorded data of top league games in France and Italy. These provided a sample of 459 penalty kick

5 Available history Players can and do examine histories of opposing teams. In particular keepers are trained to save penalties and know the past history of penalty kickers. There is an asymmetry here though that was observed empirically. While keepers treat kickers as individuals with different strategies based on their past history, kickers treat keepers as being homogeneous. Yet there is one final twist to the story of game theory and penalty taking. One empirical observation was not predicted by the theory. There is one kicking-direction strategy that produces notably more success than any other: kicking straight down the middle. This is what two of the best players of the last decade, Cristiano Ronaldo and Zinedine Zidane, did in the 2006 World Cup, both with success. Why is there this discrepancy with the theory? The anomaly is explained by a factor that the model in the study does not take into account: private costs and benefits to the kicker. If a kicker has a penalty saved when the ball is aimed to the left or right, the save can be put down to the keeper's skill. However, if the penalty is saved when the kicker aims down the middle he appears an incompetent fool. Thus in the conflict of interests between the individual player and the team, it may be better for the kicker to maximize his own private benefit rather than the benefit of the team, and aim to the left or right. Questions 1 What type of game does this resemble, in terms of the games described in the chapter? 2 Construct a table showing the normal form of the penalty game, assuming (1) players only take into account the team's benefits; (2) the penalty kicker is right footed and is equally able in kicking to the left or right; (3) the goalkeeper is equally proficient in diving to left or right. Determine the equilibrium of the game. 3 Construct a table showing the normal form of the penalty game, assuming (1) players only take into account the team's benefits; (2) the penalty kicker is right footed and is 20% stronger in kicking to their left side; (3) the goalkeeper is 20% stronger in diving to their right side. Determine the equilibrium of the game. 4 Construct a table showing the normal form of the penalty game, taking into account both the team's benefits and individual payoffs,

under the same assumptions as the previous question. Determine the equilibrium of the game. 5 Explain the implications of the differences between private and team benefits as far as goalkeepers are concerned. 6 Explain the implications of the differences between private and team benefits as far as team managers are concerned

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Questions

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