

Case 1.1 Loss aversion in monkeys

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

ECONOMISTS often like to speak of *Homo economicus* – rational economic man. In practice, human economic behaviour is not quite as rational as the relentless logic of theoretical economics suggests 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.

There has been a lot of discussion about this discrepancy in the economic literature – in particular, about whether it is the product of cultural experience or is a reflection of a deeper biological phenomenon. So Keith Chen, of the Yale School of Management, and his colleagues decided to investigate its evolutionary past. They reasoned that if they could find similar behaviour 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. They chose the capuchin monkey, *Cebus apella*, a South American species often used for behavioural experiments.

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 inedible discs so much that they were willing to trade them for scrumptious 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 nine. The result was that apple consumption went up in exactly the way that price theory (as applied to humans) would predict. Indeed, averaged over the course of ten sessions it was within 1% of the theory's prediction. One up to *Cebus economicus*.

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 behaviour 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. That such behaviour 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 pangs of 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. Economists take note.

Source: *The Economist*, June 23, 2005

Issues

This ingenious experimental study illustrates three particularly important aspects of behavioral economics:

1 Methods

The experimental approach, traditionally followed by psychologists, is used here, in order to achieve a degree of control that would be impossible to gain through mere observation. Three different trading regimes are used in order to compare responses and test the basic hypothesis of loss-aversion. Note the use of deception, although it is unlikely in this case to cause a general increase in cynicism among the population of capuchin monkeys available as subjects.

2 Evolutionary psychology

The purpose of the experiment is not just to test whether capuchin monkeys have loss-aversion, but more importantly to test whether the widely-observed loss-aversion in humans is likely to have an evolutionary explanation. The fact that loss-aversion has been observed in many different countries and societies constitutes evidence of an evolutionary origin, but the observation of the same characteristic in a fairly closely related species is even stronger evidence. This is a typical type of experiment carried out by evolutionary psychologists to test their hypotheses. It is also notable that the issue regarding why loss-aversion should be an evolved psychological mechanism or adaptation is also raised. This issue will be discussed in more detail in Chapter 5 on prospect theory.

3 Rationality

We have seen that the concept of rationality is a highly ambiguous term, which can be used in many different senses. However, in the current context, a 'rational' individual behaving according to the standard model should have no preference between the two 'salesmen' in the second and third trading regimes, since the outcomes from each are ultimately identical. The 'irrationality' observed in the monkeys is explained by the concept of loss-aversion, an important aspect of prospect theory. Thus behavioral economics is better able to explain the behavior observed in the experiment.

Case 1.2 Money illusion

The issue of money illusion is one that has been much discussed by economists since the days of Irving Fisher (1930). It has been defined in various ways, which has been the cause of some confusion, but a brief and useful interpretation has been given by Shafir, Diamond and Tversky (1997) in a classic article:

A bias in the assessment of the real value of transactions, induced by their nominal representation.

It should be noted that such an interpretation does not limit money illusion to the effects of inflation, as will be seen.

Economists have tended to take an attitude to the assumption of money illusion that Howitt describes in the *New Palgrave Dictionary of Economics* (1987) as 'equivocal'. At one extreme there is the damning quotation by Tobin (1972): 'An economic theorist can, of course, commit no greater crime than to assume money illusion.' The reason for this view is that money illusion is basically incompatible with the assumption of rationality in the standard model. Thus a rational individual should be indifferent between the following two options:

Option A Receiving a 2% yearly pay increase after a year when there has been inflation of 4%.

Option B Receiving a pay cut of 2% after a year when there has been zero inflation.

In each case the individual suffers a decrease in pay in real terms of 2%. However, some empirical studies indicate that people do not show preferences that are consistent with rationality in the traditional sense, and that money illusion is widespread.

Perhaps the best-known study of this type is the one quoted earlier by Shafir, Diamond and Tversky (1997; hereafter SDT). This used a questionnaire method, asking people about a number of issues related to earnings, transactions, contracts, investments, mental accounting, and fairness and morale. We will concern ourselves here with questions related to earnings and contracts, since these will illustrate the main findings.

An earnings-related situation was presented as follows:

Consider two individuals, Ann and Barbara, who graduated from the same college a year apart. Upon graduation, both took similar jobs with publishing firms. Ann started with a yearly salary of \$30,000. During her first year on the job there was no inflation, and in her second year Ann received a 2% (\$600) raise in salary. Barbara also started with a yearly salary of \$30,000. During her first year on the job there was 4% inflation, and in her second year Barbara received a 5% (\$1500) increase in salary.

The respondents were then asked three questions relating to economic terms, happiness and job attractiveness:

- As they entered the second year in the job, who was doing better in economic terms?

- As they entered the second year in the job, who do you think was happier?
- As they entered the second year in the job, each received a job offer from another firm. Who do you think was more likely to leave her present position for another job?

Of all the respondents 71% thought that Ann was better off, while 29% thought that Barbara was better off. However, only 36% thought Ann was happier, while 64% thought that Barbara was happier. In the same vein, 65% thought that Ann was more likely to leave her job, with only 35% thinking Barbara was more likely to leave.

A contracts-related question was designed to test people's preferences for indexing contracts for future payment to inflation. From a seller's viewpoint this would be preferred by decision-makers who were risk-averse in real terms, while those who were risk-averse in nominal terms would prefer to fix the price now. The situation featured computer systems currently priced at \$1000; sellers could either fix the price in two years at \$1200, or link the price to inflation, which was expected to amount to 20% over the two years. The options were framed first of all in real terms (based on 1991 as the current year) as follows:

Contract A You agree to sell the computer systems (in 1993) at \$1200 a piece, no matter what the price of computer systems is at that time. Thus, if inflation is below 20% you will be getting more than the 1993 price; whereas, if inflation exceeds 20% you will be getting less than the 1993 price. Because you have agreed on a fixed price your profit level will depend on the rate of inflation.

Contract B You agree to sell the computer systems at 1993's price. Thus if inflation exceeds 20% you will be paid more than \$1200, and if inflation is below 20%, you will be paid less than \$1200. Because both production costs and prices are tied to the rate of inflation, your 'real' profit will remain essentially the same regardless of the rate of inflation.

When the options of fixing the nominal price and index-linking were framed as above in real terms, a large majority of the respondents (81%) favored the option of index-linking, indicating risk-aversion in real terms. However, when the equivalent options were framed in nominal terms, as shown below, a different result was obtained:

Contract C You agree to sell the computer systems (in 1993) at \$1200 a piece, no matter what the price of computer systems is at the time.

Contract D You agree to sell the computer systems at 1993's price. Thus instead of selling at \$1200 for sure, you will be paid more if inflation exceeds 20%, and less if inflation is below 20%.

In this case a much smaller majority (51%) favored the index-linking option, which now seemed more risky.

When the contract situation was reversed, so that respondents were now in a buying situation, it was also found that the framing of the options affected the responses. Once again respondents were risk-averse in nominal terms when the options were framed in nominal terms and risk-averse in real terms when the options were framed in real terms.

Issues

The discussion of money illusion raises a number of important issues in behavioral economics. Some of these are similar to the previous case:

- *Methodology*

Economists have criticized the validity of the SDT results on two main grounds. First, they have doubts about the questionnaire methodology, suspecting that there may be considerable differences between what people say they might do in a hypothetical situation and what they would actually do in the real world when motivated by economic incentives. Second, they point out that it is not sufficient to show money illusion at the level of individual behavior; it must also be present at the aggregate level in order to have real economic significance. Individual differences may cancel each other out, thus resulting in no overall economic effect.

- *Rationality*

It is usually argued that money illusion is not rational at the level of the individual. However, it is notable from the SDT study that the majority of the respondents realized that Ann was better off in economic terms, even though a majority thought that Barbara was happier. This perceived decoupling of absolute economic welfare from happiness is not necessarily irrational, and will be discussed further in Chapter 3. Furthermore, it may well happen that a majority of individuals do not themselves suffer from money illusion at the individual level, but may believe that others do. Therefore, in order to understand the existence of money illusion at the aggregate level, it is necessary to examine the strategic interaction of individuals in the economy.

- *Mental accounting*

It is notable that the SDT study not only attempts to test for money illusion in a descriptive sense, it also goes some way towards trying to explain its existence in psychological terms. This involves general aspects of mental accounting, more specifically the theory of multiple representations. These aspects are discussed in detail in Chapter 6, but at this stage we can outline the theory by saying that it proposes that people tend to form not just a single mental or cognitive representation of information, but several simultaneously. Thus we may form both a nominal and a real mental representation of different options, but, depending on how they are framed, one or the other may be salient. Thus the concepts of framing effects and saliency are important. The SDT study maintains that normally the nominal representation tends to be salient, since it is cognitively easier to handle, demanding less information. This therefore tends to give rise to money illusion. Later on we will see that there are similarities here with types of optical illusion.

- **Strategic interaction**

As already stated, it is important to consider strategic interaction in order to understand money illusion at the aggregate level. If some economic agents act irrationally, for example by raising prices without any inflationary cause, then it may be optimal for other agents who are rational to react in the same way and 'follow the crowd'. This effect is of vital importance in stock markets, as noted by many researchers in behavioral finance, particularly in relation to the financial crisis that began in 2007. Strategic interaction also has to take into account the possible existence of 'super-rationality', as discussed by Fehr and Tyran (2003). These aspects are all examined in Chapter 9.

Case 1.3 Altruism

The joy of giving

Donating to charity rewards the brain

Providing for relatives comes more naturally than reaching out to strangers. Nevertheless, it may be worth being kind to people outside the family as the favour might be reciprocated in future. But when it comes to anonymous benevolence, directed to causes that, unlike people, can give nothing in return, what could motivate a donor? The answer, according to neuroscience, is that it feels good.

Researchers at the National Institute of Neurological Disorders and Stroke in Bethesda, Maryland, wanted to find the neural basis for unselfish acts. They decided to peek into the brains of 19 volunteers who were choosing whether to give money to charity, or keep it for themselves. To do so, they used a standard technique called functional magnetic resonance imaging, which can map the activity of the various parts of the brain. The results were reported in this week's *Proceedings of the National Academy of Sciences*.

The subjects of the study were each given \$128 and told that they could donate anonymously to any of a range of potentially controversial charities. These embraced a wide range of causes, including support for abortion, euthanasia and sex equality, and opposition to the death penalty, nuclear power and war. The experiment was set up so that the volunteers could choose to accept or reject choices such as: to give away money that cost them nothing; to give money that was subtracted from their pots; to oppose donation but not be penalised for it; or to oppose donation and have money taken from them. The instances where money was to be taken away were defined as "costly". Such occasions set up a conflict between each volunteer's motivation to reward themselves by keeping the money and the desire to donate to or oppose a cause they felt strongly about.

Faced with such dilemmas in the minds of their subjects, the researchers were able to examine what went on inside each person's head as they made decisions based

on moral beliefs. They found that the part of the brain that was active when a person donated happened to be the brain's reward centre – the mesolimbic pathway, to give it its proper name – responsible for doling out the dopamine-mediated euphoria associated with sex, money, food and drugs. Thus the warm glow that accompanies charitable giving has a physiological basis.

But it seems there is more to altruism. Donating also engaged the part of the brain that plays a role in the bonding behaviour between mother and child, and in romantic love. This involves oxytocin, a hormone that increases trust and co-operation. When subjects opposed a cause, the part of the brain right next to it was active. This area is thought to be responsible for decisions involving punishment. And a third part of the brain, an area called the anterior prefrontal cortex – which lies just behind the forehead, evolved relatively recently and is thought to be unique to humans – was involved in the complex, costly decisions when self-interest and moral beliefs were in conflict. Giving may make all sorts of animals feel good, but grappling with this particular sort of dilemma would appear to rely on a uniquely human part of the brain.

Source: The Economist, October 12, 2006

Issues

1 *The nature of economic behavior*

Economic behavior is not just about monetary transactions. 'Altruistic' acts and spiteful acts also are relevant. We need to understand the basis of such acts in order to explain and predict human behavior in a wide variety of different situations, such as donating to charity, labor strikes, lending the neighbor one's car and remonstrating with people who litter the streets.

2 *Fairness and social preferences*

This aspect is closely related to the first one. We need to understand the importance of inequality aversion, the perceived kindness of others, reciprocity and the intentions of others if we are to predict behavior in social situations when strategic interaction is important. This area is covered in Chapter 10.

3 *The role of neuroscience*

The study described above demonstrates clearly how useful neuroscience can be in explaining behavior that cannot easily be explained by the standard economic model. In particular it shows that 'self-interest' needs to be understood in a broad context. Charitable acts are thus self-interested acts because they make us feel good, contrary to the common narrow understanding of self-interested acts. It is important to realize that only by performing neuroscientific studies involving techniques like functional magnetic resonance imaging (fMRI) can we establish firm evidence regarding the real motivations behind 'altruistic' and spiteful acts, since people often deny these motivations, and even 'honest' introspection may not reveal them. This aspect is discussed in more detail in the next chapter and also in the concluding chapter.