Behavioural Economics and Asymmetric Information

Simon Naitram[1]

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[1]University of the West Indies, simon.naitram@cavehill.uwi.edu

Tonight's Lecture

- Observational equivalence
- Asymmetric information
- Behavioural Economics

Reading

- Hal Varian, Intermediate Microeconomics Chapter 37 (Asymmetric Information)
- Hal Varian, Microeconomic Analysis Chapter 25 (Information)
- Hal Varian, Intermediate Microeconomics Chapter 30 (Behavioural Economics)

Observational Equivalence

- We often observe behaviour that does not fit with the idea of rationality.
- The simplest response is to assume that individuals are irrational.
- However, economics has two much more nuanced responses: behavioural biases, and imperfect information.
- Today we examine the foundational tools for these two deviations from standard modelling approaches.

Section 1

Asymmetric Information

Asymmetric Information

- We have thus far assumed that buyers and sellers have the same information.
- In many markets it may be easy to verify information about the quality of what is being sold.
- In financial markets, however, it is costly to verify information about assets and some participants may simply have different information.
- Asymmetric information is at the core of finance, and is a central tool in the financial economist's toolbox.

Types of Asymmetric Information

- There are two main forms of asymmetric information: **adverse selection**, and **moral hazard**.
- Adverse selection is a **hidden information** problem: when one side is unable to observe the type or quality of the goods on the other side of the market.
- Moral hazard is a **hidden action** problem: when one side of the market is unable to observe the actions of the other.

The Market for Lemons

- George Akerlof's famed 13-page work on the used car market identifies how symmetric information can damage a market.
- Suppose buyers cannot distinguish between good cars and bad cars (lemons).
- Assume we can index the quality of a used car by some number q, which is uniformly distributed over the interval $[0, 1]$, implying the average quality in the market is $1/2$.
- There are buyers willing to purchase used cars of quality q at a price $\frac{3}{2}q$.
- There are a large number of sellers willing to sell a car of quality q at price q.

The Market for Lemons

- If everyone knew exactly what q was for every car, each car of quality q would get sold at some price in the interval $[q, \frac{3}{2}q]$.
- Now suppose quality is not observable by the buyers.
- Instead buyers might try to estimate the quality of a car by considering the average quality of he cars offered in the market.
- This means the willingness to pay for a used car will be $\frac{3}{2}\bar{q}$.
- What is the equilibrium price in this market?

The Market for Lemons

- Assume we begin from an equilibrium price of $p > 0$.
- Now all used car sellers with a car of quality $q > p$ will not want to sell their car, while all sellers with a car of quality $q < p$ will want to sell their car.
- The quality of car offered will be uniformly distributed over the interval $[0, p]$ with average quality $\bar{q} = p/2$.
- Substituting this into the buyer's reservation price, a buyer is willing to pay

$$\frac{3}{2}\bar{q} = \frac{3}{2}\frac{p}{2} = \frac{3}{4}p$$

which is *less than* p, so that no cars will be sold at the equilibrium price p.

- This holds for any price $p > 0$, so that no cars will be sold at any positive price.
- This implies that the equilibrium price in this market is $p = 0$.
- Therefore, asymmetric information between buyers and sellers has destroyed the market for used cars.
- An price that is attractive to the owners of good cars is even more attractive to owners of lemons.
- We end up with a biased sample of lemons being offered.

Adverse Selection in Finance

- There are two types of productive projects: A and B, each requiring an initial investment I.
- They pay cash flows of X_A and X_B with probabilities p_A and p_B if they succeed and 0 if they fail.
- The initial investment is totally financed with a loan, and we assume risk neutral entrepreneurs.
- Suppose that both projects have the same expected value:

$$V_A = p_A X_A = p_B X_B = V_B$$

but the cash flow from project B is higher than the cash flow from project A, so that $X_B > X_A$ and $p_A > p_B$.

Pricing without Asymmetric Information

- Without asymmetric information, the bank's optimal choice of interest rate on a loan L must be equal to its opportunity cost r:

$$(1+r)L = p(1+r)L + (1-p)0$$

- Rearranging, the bank therefore charges a different optimal interest rate for each project type:

$$(1+r_A) = \frac{1+r}{p_A}, \qquad (1+r_B) = \frac{1+r}{p_B}$$

which depends on the probability of success (i.e. risk of failure).

- The expected profit on both these projects work out to be the same, since:

$$\mathcal{E}\pi_A = V_A - p_A(1+r_A)L = V_A - (1+r)L$$

$$\mathcal{E}\pi_A = V_A - p_A(1+r_A)L = V_B - (1+r)L$$

Pricing with Asymmetric Information

- Now suppose that type B entrepreneurs can camouflage themselves to look like type A entrepreneurs to get the lower interest rate.
- The lender does not know which type they are potentially lending to.
- They know, however, the existing proportion of types in the economy: $s_A + s_B = 1$, implying we can use these as the probability that a potential borrower before the lender is of a specific type.
- Assume all entrepreneurs claim to be of type A, then the lender will use these probabilities to establish a single interest rate:

$$(1 + r) = s_A p_A (1 + r_L) + s_B p_B (1 + r_L)$$

which gives an equilibrium interest rate of:

$$(1 + r_L) = \frac{1 + r}{(s_A p_A + s_B p_B)}$$

where the denominator is the weighted probability of success the lender anticipates.

Pricing with Asymmetric Information

- We find that in equilibrium $r_B > r_L > r_A$ under asymmetric information since

$$p_A > s_A p_A + s_B p_B > p_B$$

.

- This implies that type B entrepreneurs have a partially successful strategy, since they see a reduction in their financing cost.
- Type A borrowers suffer as they see an increase in their interest rate.
- This contract is now more favourable for riskier entrepreneurs, and in fact they end up making a larger return than less risky entrepreneurs.

Principal-Agent Problem

- The principal-agent problem with hidden action is one key form of **moral hazard**.
- One person, the principal, wants to induce another person, the agent, to take some action which is costly to the agent.
- The principal may be unable to directly observe the action of the agent, but instead observes of output x, determined at least in part by the actions of the agent.
- The principal's problem is therefore to design some incentive payment $s(x)$ to induce the agent to take the best action from the principal's perspective.
- The most common forms of the principal agent problem are the shareholder and manager, and the manager and worker.

Moral Hazard in Insurance

- Let's return to the insurance problem from our lecture on uncertainty.
- Suppose there are many identical consumers contemplating buying insurance against auto theft.
- If a consumer's car is stolen, they bear a cost L.
- State 1 is the state of nature where the car is stolen, while state 2 is the state of nature where it is not.
- The probability of the car being stolen depends on the consumer's actions: for example, locking the car.
- Let π_{1b} be the probability of the car being stolen if the consumer remembers to lock the car, and π_{1a} be the probability of it being stolen if it isn't locked.
- Let c be the cost of remembering to lock the car.
- Let s_i be the net payment from the consumer to the insurance company in state $i = 1, 2$.

Moral Hazard in Insurance

- If there is no incentive problem so that the consumer's actions don't affect the probability of theft, then the optimal solution is that the insurance company will fully insure the consumer, so that $s_2 = s_1 + L$, implying that the consumer has the same wealth whether or not the theft occurs.
- If the consumer's actions affect the probability of theft, then assuming the insurance company wants the consumer to lock the car, the incentive problem is:

$$\begin{aligned} \max_{s_1, s_2} \quad & \pi_{1b} s_1 + \pi_{2b} s_2 \\ \text{such that} \quad & \pi_{1b} u(w - s_1 - L) + \pi_{2b} u(w - s_2) - c \geq \bar{u} \\ & \pi_{1b} u(w - s_1 - L) + \pi_{2b} u(w - s_2) - c \geq \\ & \pi_{1a} u(w - s_1 - L) + \pi_{2a} u(w - s_2) \end{aligned}$$

Moral Hazard in Insurance

- The principal wants to make the agent's consumption depend on his choices so as to give the agent an incentive to take proper care.
- To do this, the principal rations the consumer's insurance.
- While the consumer would like to buy more insurance at actuarily fair rates, the industry will not offer such contracts since it would incentivize the consumer not to take proper care.
- Equilibrium is determined by the zero-profit condition: $\pi_{1b}s_1 + \pi_{2b}s_2 = 0$ and the incentive compatibility constraint.

Moral Hazard in Finance

- Consider again entrepreneurs who can invest in two projects, H and L, where the expected value of project H is higher than the expected value of project L, $\mathcal{E}V_H > \mathcal{E}V_L$.
- Underlying this assumption is a higher cash flow $X_H > X_L$ and a higher probability of success $p_H > p_L$.
- Suppose that the actions of the entrepreneurs are hidden.
- Each entrepreneur, regardless of the final use of funds, will announce that they will be undertaking a project of type H.
- This way, they can obtain financing at $r_H < r_L$.

Pricing with Moral Hazard

- If a borrower, pretending to be type H, undertakes a project of type L, then the lender will get a lower expected return than the required rate of return.
- The lender therefore needs to make sure that project H is more attractive than project L in the borrower's eyes.
- That is, the lender needs to set r ensure that $\mathcal{E}\pi_H > \mathcal{E}\pi_L$, which is the **incentive compatibility constraint**:

$$\mathcal{E}\pi_H = p_H[X_H - (1+r)L] > \mathcal{E}\pi_L = p_L[X_L - (1+r)L]$$

Pricing with Moral Hazard

- The maximum interest rate consistent with this incentive compatibility constraint is:

$$(1 + r) < \frac{p_H X_H - p_L X_L}{(p_H - p_L)L}.$$

- The gross interest rate needs to be lower than the ratio of the difference in expected value to the difference in expected loan recovery.
- Interest rates higher than this will attract all borrowers to type L projects under the false pretence of choosing type H projects.
- Why? For the same interest rate under H and L projects, there is a higher probability of success and therefore a higher probability of repayment, increasing the borrower's responsibility.
- That is, for a type H borrower it is more difficult to elude financial obligations, and when financial obligations are too high (r too high), then borrowers will offset this by switching to L to lower their financial obligations.

Asymmetric Information: Further Reading

- Milgrom, P. and Stokey, N., 1982. Information, trade and common knowledge. Journal of economic theory, 26(1), pp.17-27.
- Akerlof, G.A., 1978. The market for "lemons": Quality uncertainty and the market mechanism. In Uncertainty in economics (pp. 235-251). Academic Press.
- Grossman, S.J. and Stiglitz, J.E., 1980. On the impossibility of informationally efficient markets. The American economic review, 70(3), pp.393-408.

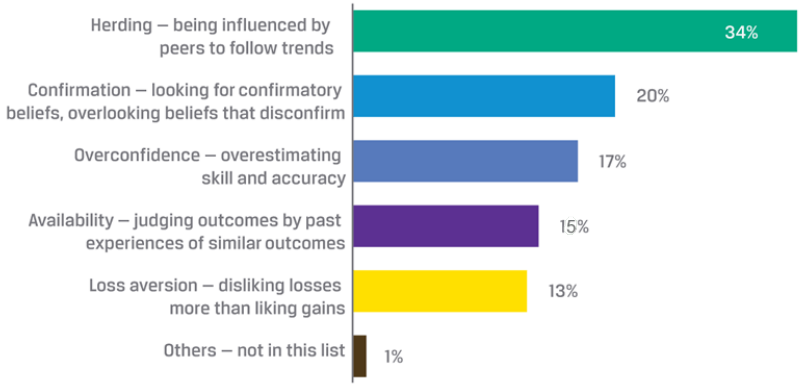
Section 2

Behavioural Economics

Behavioural Economics

- The field of behavioural economics uses some insights from psychology to develop better predictions about choice people will make.
- Many of these models of how consumers *actually* make choices are at odds with conventional economic models of "rational consumers.
- Unlike conventional models, there are potentially many different theories in behavioural finance that explain many different deviations from "rationality".
- Behavioural economics & finance is a entire course in itself, so that this is simply an introduction to the topic.
- Often behavioural economics consists of examples and illustrations, rather than general theories.

Which behavioral biases affects investment decision making the most?



Herd Behaviour

- This is actually called an **information cascade**: people make decisions sequentially, with later people watching actions of earlier people and inferring what earlier people know.
- Information cascade is one potential explanation for why herding behaviour exists.
- **Rational herding** is the idea that paying attention to people's decisions is rational because their decisions may reflect information that they have and we do not (see Banerjee, QJE 1992)
- Rational herding in financial markets can take place because some investors believe others to be better informed than themselves, and follow them, disregarding their own information or market fundamentals.

There are a couple other explanations for why herding may exist in financial markets (Bikhchandani and Sharma, 2000):

- **Reputation-based herding**: Investor care about their reputation as being high ability. Managers will be more favourably evaluated if they take the same decision of the others: Share the blame (Scharfstein and Stein, AER 1990)
- **Compensation-based herding**: If an investor's compensation depends on how their performance stacks up to other investors, then this distorts the agent's incentives and might lead to an inefficient portfolio.

Heuristics

- Judgement heuristics are informal algorithms that generate an approximate answer to a problem.
- Rules of thumb are effectively special cases of heuristics.
- Heuristics speed up cognition, but often produce incorrect answers.
- The errors are known as “bias”, and are unintended effects.
- Kahnemann and Tversky are two leaders in the field of cognitive psychology, identifying three important heuristics in the early 1970’s:
  - representativeness
  - availability
  - anchoring

Heuristics: Representativeness

- Decision makers use similarity or representiveness as a proxy for probabilistic thinking.
- Similarity is sometimes a poor predictor of true probability, and can lead to a wide range of biases:
  - insensitivity to prior probabilities of outcomes
  - insensitivity to sample size
  - misconceptions of chance
  - insensitivity to predictability
  - the illusion of validity
  - misconceptions of regression

Heuristics: Availability

- People assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind.
- In finance, the availability heuristic means that people are likely to overweight current information as opposed to processing all relevant information.
- For example, Kliger and Andrey Kudryavtsev (2010) find that positive stock price reactions to recommendation upgrades are stronger when accompanied by positive stock market index returns, and negative stock price reactions to recommendation downgrades are stronger when accompanied by negative stock market index returns.

Heuristics: Anchoring

- Anchor points seem to matter—for example, the starting point, frames, defaults, etc.
- There are three types of explanation for this behaviour:
  - People make estimates by beginning from the anchor and making adjustments
  - People take the question as a hint from the experimenter
  - People subconsciously recruit memories consistent with the anchor

Behavioural Biases: Framing Effects

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Behavioural Biases: Framing Effects

Framing Effects in Stock Market Forecasts

- Surveys that ask for future stock price levels are more likely to produce mean reverting expectations than surveys that directly ask for future returns.
- Subjects were asked to state mean forecasts for seven time series.
- One half of the subjects was asked to state future price levels, the other group was directly asked for returns.
- For upward sloping time series, the return forecasts stated by investors in the return forecast mode are significantly higher than those derived for investors in the price forecast mode.
- For downward sloping time series, the return forecasts given by investors in the return forecast mode are significantly lower than those derived for investors in the price forecast mode.

Time: Hyperbolic Discounting

- We commonly use **exponential discounting** so that the utility of consumption t years in the future is given by:

$$\delta^t u(c), \quad \delta < 1.$$

- Some research finds that people value payoffs in the future less than exponential discounting theory would predict based on their time preferences.
- One alternative hypothesis is **hyperbolic discounting**:

$$\frac{1}{1+kt} u(c).$$

Time: Hyperbolic Discounting

- One central concern is that hyperbolic discounting is **time inconsistent**. Consider Strotz's example.

Thaler (1981)

- Students were told that they had won some money in a lottery held by their bank. They could take the money now or wait until later.
- Each subject received a 3×3 table to fill in with amounts varied in one dimension and length of time to wait in the other.
- He finds that the implicit discount rates are very large, and that they drop sharply as the size of the prize or the length of time increases.
- He finds that people would be indifferent between receiving \$15 immediately or \$30 after 3 months, \$60 after 1 year, or \$100 after 3 years.
- These indifferences reflect annual discount rates that declined from 277% to 139% to 63% as delays got longer.

Behavioural Economics

- While decision-makers need cognitive shortcuts, researchers haven't been able to build models that generally predict the decisions we make.
- Only domain-specific models have been successful.
- It turns out that the "rational actor" is the best model proposed to date:
  - Precise theory (i.e., it makes quantitative predictions)
  - Applicable to all problems that can be expressed with explicit payoff functions
  - Comparative statics are usually right
- In contrast, no single framework exists in cognitive science and there are many complementary and overlapping frameworks.

Bounded Rationality

- Herbert Simon uses the concept of 'bounded rationality' to designate rational choice that takes into account the cognitive limitations of the decision-maker—limitations of both knowledge and computational capacity.
- That is, people intend to be rational, but they cannot make rational decisions.
- The hope is that this will generate a unified framework for behavioural economics, but there haven't been many great advances.

Bounded Rationality

- Bounded rationality as noise: Consumer sees a noisy signal $\tilde{q} = q + \sigma\varepsilon$ of the quantity or quality q.
- Bounded rationality as imperfect monitoring of the state of the world: people only look up variable k at some specific times $t_1, \ldots, t_n$.
- Bounded rationality as adjustment cost: I am currently doing a_0 where κ is the cost of changing. I will only change my decision from a_0 to a^* (which is the best choice of a) if $u(a^*) - u(a_0) > \kappa$.

Behavioural Economics: Further Reading

- Kliger, D. and Kudryavtsev, A., 2010. The availability heuristic and investors' reaction to company-specific events. The journal of behavioral finance, 11(1), pp.50-65.
- Anderson, L.R. and Holt, C.A., 1997. Information cascades in the laboratory. The American economic review, pp.847-862.
- Thaler, R., 1981. Some empirical evidence on dynamic inconsistency. Economics letters, 8(3), pp.201-207.
- `https://blogs.cfainstitute.org/investor/2015/08/06/the-herding-mentality-behavioral-finance-and-investor-biases/`
- Barberis, N. and Thaler, R., 2003. A survey of behavioral finance. Handbook of the Economics of Finance, 1, pp.1053-1128.

The End.