The Market for Lemons

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Outline

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   - Game Theory
   - Nash Equilibrium
2. The Market for Lemons
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   - Insurance Industry
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What is Game Theory

The branch of mathematics concerned with the analysis of strategies for dealing with competitive situations where the outcome of a participant's choice of action depends critically on the actions of other participants

What is Nash Equilibrium

- A Nash Equilibrium in game theory is when the optimal outcome of a game is where there is no incentive to deviate from the initial strategy, i.e. all players in the game are in a state of non-change, as all players have reached individual points of maximum benefit.

A simple example: The Prisoner's dilemma

- Two accomplices are caught for a crime. The police know (but can't prove) that the pair committed murder.
- They have two options: confess or remain silent

The payoff matrix is as follows:

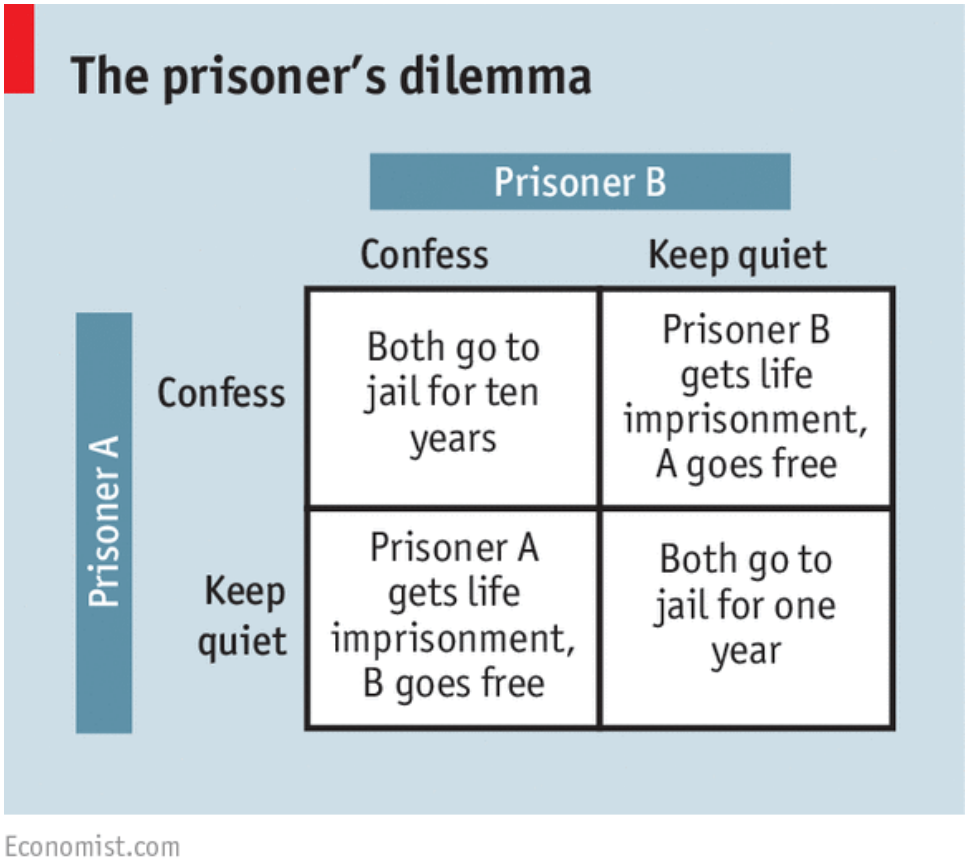

Figure: Payoff matrix

The Prisoner's dilemma

The dilemma here is which is the best strategy for the accomplices to choose without communicating with each other.
Following this, the Nash equilibrium is at the point where neither will benefit from changing strategy.
If they stay silent, they remain in the dilemma, as there is benefit to be had by confessing.
But if both confess, then there's no benefit in changing strategy, so the equilibrium point for the Prisoner's Dilemma is that both prisoners confess.
Here, this problem has a **single Nash equilibrium**.
NOTE: A game may have single Nash equilibrium, multiple Nash equilibria or none at all.

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Introduction

Economist George Akerlof won the Nobel Prize for analyzing how a used car market can break down in the presence of asymmetric information.

Definitions

- Lemons: American slang for a car that is found to be defective after it has been bought
- Asymmetric information: study of decisions in transactions where one party has more or better information than the other

Basic setup of a very simplified version of this model:
Suppose that there are cars of only two types: good cars (G) and lemons (L). A good car is worth \$9,000 to all sellers and \$12,000 to all buyers, while a lemon is worth only \$4,000 to sellers and \$6,000 to buyers.

The Market

Table: Basic Setup

	Seller Worth	Buyer Worth
Good Car (G)	\$9,000	\$12,000
Bad Car (B)	\$4,000	\$6,000

A seller knows what kind of car he is selling. But, a buyer does not know what kind of car he bought: lemons and good cars are indistinguishable at first, and a buyer only discovers what kind of car he bought after a few weeks, when the lemons break down.
Here, an incentive exists for the seller to pass off a low-quality product as a higher-quality one.
If the buyer had complete information, he could break even by splitting the differences with the seller and gain \$1,500 for a good car and \$1,000 for a lemon.

Market Breakdown

Now, buyers know that a fraction p of cars on the market are lemons. So a rational buyer will pay a maximum of :

$$f(p) = 6000p + 12000(1 - p)$$

As he is willing to spend as much as the average quality of goods on the market.

Note: if $p > \frac{1}{2}$

$$\begin{aligned} f(p) &= 6000p + 12000 - 12000p \\ &= 12000 - 6000p \\ &< 12000 - 3000 \\ &= 9000 \end{aligned} \tag{1}$$

Market Breakdown contd...

So, $f(p) < \$9000$ and so the sellers with good cars won't sell. This will cause p to increase and $f(p)$ to further decrease, and soon there will only be lemons left on the market.

From this simplified model, we can see that, asymmetric information hurts sellers with good cars, as well as buyers.

Since only the average quality of the goods will be considered, the side effect noticed is that goods that are above average in terms of quality will be driven out of the market. This mechanism is repeated until a no-trade equilibrium is reached.

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The Lemon Problem in Life:

Fruit market

Insurance industry

Fruit Market

Sweet, delicious apples VS. Lemon

Figure: Fruit Market

Adverse Selection

Since the buyers and sellers have unequal information, particularly concerning the risk factors of the transaction, one group has a distinct advantage over the other. One side can thus exploit the other for their own gain.

How does Lemon Problem influence the insurance industry?

Question: Does insurance company know if a person is a lemon?

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So how do we solve the Lemon Problem?

i.e., How do we avoid adverse selection?

Key point: Reduce the information asymmetry for the customers

1) Hiring an expert
2) Reading reviews
3) Dealers certify good products -> customers buy it

References

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