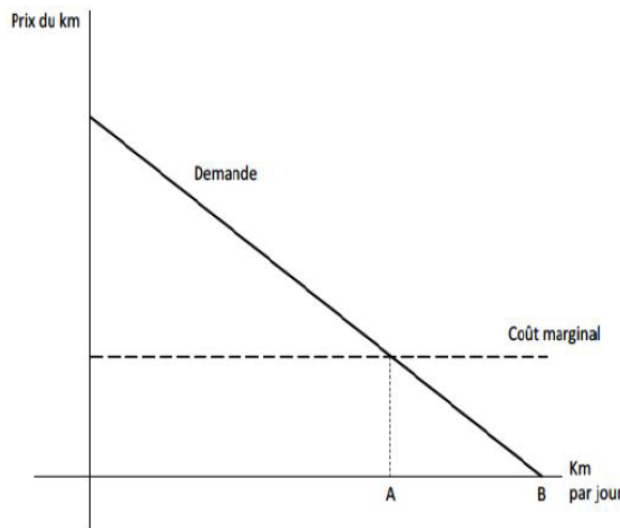


Problem Set 6: Asymmetric Information

Exercise 1: Car rental

Consumers who rent cars each have a km demand curve as shown below. The cost of using a car for a day is 30 euros, plus a marginal cost of 0.25 euros per km driven. The car rental market is assumed to be perfectly competitive.



1. In equilibrium, how much will rental contracts be when the number of km can be clearly observed (give the price per day and the price per km)?
2. A newspaper reveals that a car rental company has falsified its car mileage counter. The market regulator aiming at protecting the consumers imposes that the companies can only charge for the days the car is rented. Referring to the graph above, what is the equilibrium price for a daily rental car?
3. What is the expected social loss from not being able to charge for the km driven?

Exercise 2: Revelation through signaling

Two used car dealerships are competing with each other. The first one, Les Dupont Cars, always sells better quality cars than the second, Durant Cars. Consumers are willing to pay up to 10,000 for a high quality car and only 7,000 for a low quality car. Consumers don't know who sells what and are only willing to pay 8,500 for a car of unknown quality. Given the condition of the cars, a parts and labor warranty costs 1,000 per year at Dupont and 2,000 at Durant. The company that offers the longest warranty will be considered by consumers to have high quality cars.

1. Assume that Dupont has a one-year warranty.

- (a) How much can Durant win or lose by offering no warranty? and if he offers 1 year warranty? and 2 years?
- (b) How much will Dupont win or lose if Durant offers no warranty? and if he offers 1 year warranty? and 2 years?
- (c) What will Durant do?
- (d) Is it a good idea for Dupont to offer a one year guarantee?

Exercise 3: Signalling with graduation

Suppose that 40% of the population is already highly qualified, with a present value of their marginal productivity equal to 200,000 euros. These people can acquire a university degree at a reduced cost of 40,000 euros. The remaining 60% has a marginal productivity of 120,000 euros, and they can acquire a university degree at a cost of 90,000 euros. Potential employers are unable to identify who is highly qualified and who is not.

1. What wages will be offered to graduated and non-graduated workers? Who will choose to get a degree?
2. If the cost of training increases sharply to 100,000 euros for the qualified and to 140,000 euros for the unqualified, what is the expected value of the wages paid to the two types of workers?

Exercise 4: Old car market

Every year, 1000 citizens of a small town in Brittany sell their old cars and buy new ones. The owner of an old car does not have enough space to keep a second car and has to sell the old one, no matter what the market price is. The quality of used cars varies greatly from one car to another. The owner knows what is good and what is bad about his car, but the potential buyers cannot perceive the quality of the car just by looking at it. Unfortunately, car owners have no issue in lying about the quality of their cars. Every car has a value V . This value is what a buyer knowing all the characteristics of the car would be willing to pay for it. There are a lot of potential buyers, each is willing to pay V euros for a car worth V euros.

The distribution of the value of used cars on the market can be described quite simply. Each year, for each V between 0 and 2000 euros, there are $V/2$ cars on the market that have a value lower than V . Potential used car buyers are risk-neutral. This means that if they do not know the value of a car with certainty, they evaluate it at its expected value, given the information they have.

The garage Marcel tests all used cars and is able to determine their value V . Garage Marcel is known to be extremely accurate and honest. The only problem is that a thorough technical inspection of this garage costs 200 euros. The owners of bad cars are obviously not ready to pay 200 euros for the garage Marcel to claim that their car is in bad shape. But the

owners of good cars are willing to pay Marcel 200 euros so that he can tell everyone the true quality of the car so that they can sell it at its true value.

1. If no one has their car appraised, what will be the market price of used cars? What will be the total amount that used car owners will receive?
2. If all the cars worth more than X euros are appraised and all the cars worth less than X euros are sold without any appraisal, what will be the market price of the cars that have not been appraised by the garage Marcel?
3. If all the cars worth more than X euros are appraised and all the cars worth less than X euros are sold without any appraisal, then if your car is worth X euros, how much would you earn by having your car appraised and selling it at its true value? How much would you earn by selling it without being appraised?
4. In equilibrium, there will be a pivotal quality car so that cars of higher quality will be appraised and cars of lower quality will be sold without appraisal. The owner of this car will be indifferent between selling his car without an appraisal or to having it appraised and sold at its true value. What will be the value of this pivotal car?
5. At equilibrium, how many cars will be sold without appraisal and at what price will they be sold ?
6. At equilibrium, what will be the net total income of the owners of all the used cars after payment to garage Marcel for his expertise?

Exercise 5: Efficiency wages

Let's assume that all companies want to get rid of workers who are reluctant to work.

1. If only one firm increases its wages, does this have an effect on work effort?
2. If all firms raise their wages, does this have an impact on work effort?

Exercise 6: Individual and mandatory insurance

A collective health insurance for all the employees of a company is generally cheaper than an individual insurance. Collective car insurance policies are not much cheaper than individual insurance. The law requires that individuals must have automobile insurance.

1. Explain the price differences between collective and individual insurance.
2. Why are the same differences not observed in health insurance and automobile insurance?

Exercise 7: Optimal Contract for a CEO

The profit of a large company depends on the economic situation and the performance of its CEO, as presented in the following table (the profit is given in euros).

Table 2: Utility function of a given inhabitant

Economic conditions	Low	Medium	High
Weak effort	5 million	10 million	15 million
High effort	10 million	15 million	17 million

It is assumed that each of the conditions occurs with probability $1/3$. The CEO's utility function is $U(w, e) = \sqrt{w} - 100\delta_e$, where w is the CEO's salary and δ_e is 0 if he makes a low effort and 1 if he makes a high effort. The shareholders can see the level of profit but do not know the effort of the CEO. They look for the compensation contract that gives them the highest expectation of profit.

1. If the contract consists of a salary of 575,000 euros, what will be the CEO's effort and her expected utility? What is the expected benefit to the shareholders?
2. If the contract consists of a 6% share of the profits, what will be the CEO's effort and her expected utility? What is the expected shareholder benefit?
3. If the contract consists of a salary of 500,000 plus 50% of the profits above 15 million, what will be the CEO's effort and her expected utility? What is the expected shareholder benefit?
4. What is the CEO's preferred contract? What about the shareholders?

Exercise 8: Optimal Contract for a CEO 2

A company is created for a specific investment project. The net income of the initial investment is a random variable r that can take two values: 1 in case of failure and 15 in case of success. A manager is hired to manage the project. The chances of success depend on the effort e provided by the manager. This effort can take 2 values 0 or 1: if $e = 0$ (no effort) the probability of success is $1/3$; if $e = 1$ (some effort) the probability of success is $2/3$. The manager's utility depends on his monetary income t and his effort e through a utility function $U = \text{Log}(t) - e \times \text{Log}(2)$. The manager makes an effort if he can get a utility at least equal to the absence of effort, and he accepts the job if he can get a positive utility from it. The company's profit is equal to the net income minus the manager's remuneration: $\pi = r - t$. We assume that investors cannot control the level of the manager's effort.

1. Suppose that the manager is hired in exchange for a fixed wage w . What will be his level of effort?

2. Still assuming a fixed wage w , what is the minimum wage at which the manager will agree to work? What is the expected profit for the company?
3. A contingent contract is a contract that provides the manager a payment x in case of success and y in case of failure. Which contracts (x, y) will induce the manager to make an effort?
4. Among all possible contracts (x, y) , which one will induce the manager to accept the job?
5. Suppose $x = 8y$. What is the effort provided by the manager?