

08375

Economics of Uncertainty and Information

Topic 3: Information

Plan:

- ▶ Topic 1: Introduction and Recap
- ▶ Topic 2: Uncertainty
- ▶ Topic 3: Information
- ▶ Topic 4: Current Research Areas



Information



Introduction

Lying and cheating

- ▶ In daily life, lying and cheating are ubiquitous
- ▶ Humans are fascinated with the moral foundations and social consequences
 - ▶ Novels, films, music, theatre all thrive on the intrigue and disruption
- ▶ We tend to consider lying and cheating to be morally repugnant
 - ▶ Cheating on a spouse, or in an exam, or on your tax return
 - ▶ Lying about your actions or your intentions
- ▶ Nonetheless, we distinguish between lies of different types
 - ▶ “White lies” protect someone from information they don’t need
 - ▶ “Black lies” protect ourselves from others’ judgement or retribution
 - ▶ Omitting part of the truth may not be considered as bad as a lie
 - ▶ Exploiting loopholes / cheating those with more power than ourselves

Lying and cheating

- ▶ In economics, we assume **people are greedy** and they **do whatever it takes to maximise their own payoff**.
- ▶ In this sub-topic, we assume they will **be willing to lie and cheat** if this is in their own material best interests
- ▶ A large and fascinating literature challenges this assumption by looking at inherent lying costs and altruistic concern for others
- ▶ For our purposes, let's take the economists' stance and assume **lying and cheating** are morally neutral, just like any other action.

Lying and cheating

- ▶ We will consider cases where **not all information is known to all agents**, and so some people will have insider information.
- ▶ We will seek **equilibrium** solutions whereby agents on both sides **optimise based on their constraints**.
 - ▶ Now these constraints will include a lack of information.
- ▶ You have done this before in various places:
 - ▶ People did not know other people's reservation prices and so could engage in **free riding in public goods games**
 - ▶ Firms did not know their consumers' demand type (H or L) in **price discrimination** situations and so could not extract all of the surplus for themselves
 - ▶ Firms did not know whether other firms cheat or collude in a **cartel** situation
- ▶ Now we bring together these insights under the umbrella of “information”.

Building blocks (1)

- ▶ **Private information**
 - ▶ “hidden information”. Known only to a given agent. “Unobservable” to others.
- ▶ **Public information**
 - ▶ “publicly observable”. “Common knowledge” if everyone knows that everyone knows.
- ▶ **Hidden action**
 - ▶ Action (not information) known only to a given agent, unobservable to (or unverifiable by) others.
- ▶ **Information asymmetry**
 - ▶ Arises when there is hidden information or hidden action.

Building blocks (2)

- ▶ **Pre-contractual opportunism:**
 - ▶ Using information asymmetry to one's advantage before entering into a contract
- ▶ **Post-contractual opportunism:**
 - ▶ Using information asymmetry to one's advantage after entering into a contract
- ▶ (to reiterate) We assume that people are willing to lie and cheat if this is in their own material interest, and don't incur any lying costs.

Preview

▶ Adverse selection:

- ▶ The market for lemons illustrates how under information asymmetries, the market can unravel since the risk of a bad purchase (lemon) undermines the price and so good quality items are not traded.

▶ Signalling and Screening:

- ▶ People can engage in costly signals so that they can reliably and credibly signal their type to the other side of the market.
- ▶ Firms can offer contracts to encourage types to self-select and reveal their types.

▶ Moral Hazard

- ▶ When a principal engages an agent to perform a task, but cannot observe their subsequent actions, then the agent has an incentive to shirk and the principal must preempt this through their contract design

Preview

- ▶ For each topic we will discuss
 1. The model (with a fairly general application)
 2. Other applications
 3. Experimental evidence



Information



Adverse Selection

Plan:

▶ Topic 3: Information

▶ 3.1 Adverse Selection

- ▶ The market for lemons
- ▶ Other applications
- ▶ Experimental evidence

▶ 3.2 Signalling and Screening

- ▶ Signalling in the job market
- ▶ Screening in the job market
- ▶ Other applications
- ▶ Experimental evidence

▶ 3.3 Moral Hazard

- ▶ Moral hazard in the insurance market
- ▶ Other applications
- ▶ Experimental evidence

Topic Outline

- ▶ By the end of this sub-topic, you should be able to analyse the following:
 - ▶ Adverse selection in the labour market
 - ▶ Adverse selection in the goods market
 - ▶ Other applications of adverse selection
 - ▶ Experimental evidence about adverse selection
 - ▶ Empirical evidence about adverse selection

What's it all about?

- ▶ A classic observation:
- ▶ When you buy a brand new car and drive it off the forecourt, it dramatically reduces in value
- ▶ Why?
 - ▶ It's the same car, of the same quality, as it was before you bought it.
 - ▶ So if it isn't about the car itself, why does the price fall so much?
- ▶ The answer may lie in the idea of **adverse selection**

What's it all about?

- ▶ Imagine you wish to buy a second hand car. You can't tell from looking whether any given car is a “lemon” or a “peach”
- ▶ So you make an assumption about the likely quality of the car.
 - ▶ You aren't willing to pay the value of a peach (it might be a lemon)
 - ▶ You're willing to pay more than the value of a lemon (it might be a peach)
 - ▶ The price you are willing to pay for a car will be between these values
- ▶ **BUT** sellers **KNOW** the quality of their own car
 - ▶ If have a peach, they won't accept the in-between price
 - ▶ The only cars in the market are worth less than the in-between price
- ▶ Buyers know this and so adjust quality estimate, and price, downwards
- ▶ But then some of the previously willing sellers have cars worth more than the new market price, so these drop out too.... Etc.

What's it all about?

- ▶ The sellers of low quality cars have an incentive to pretend to be selling high quality cars
- ▶ The sellers of high quality cars cannot reliably signal the quality of their car. They can only engage in “cheap talk”
- ▶ The buyers have no way to ascertain the quality of the cars in the market
- ▶ As a result, **Pareto-improving trades will not be made**
- ▶ In general, information asymmetries lead to lower societal welfare than full information.

What's it all about?

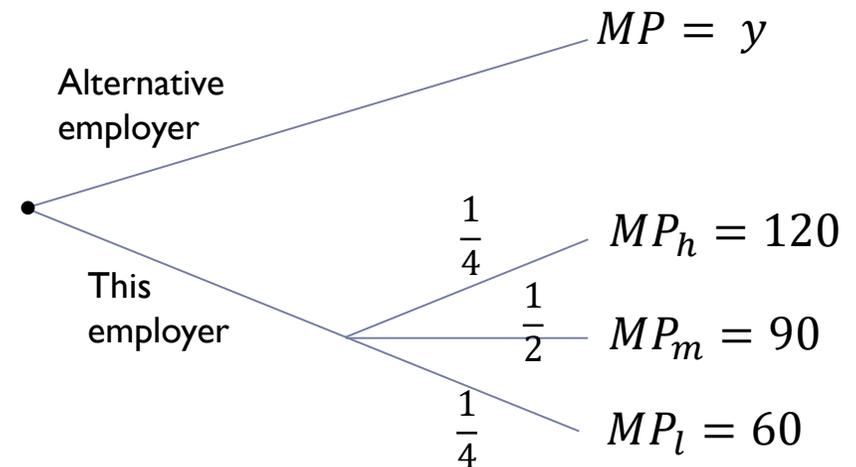
- ▶ You met (and analysed) this story last year in Microeconomics
- ▶ We called it “Akerlof’s Lemons”
 - ▶ referring to Akerlof, George (1970) “The market for lemons: quality uncertainty and the market mechanism” *Quarterly Journal of Economics* 84, pp. 488-500
- ▶ In this sub-topic we will consider Akerlof’s ideas in a new setting (labour market), return to the second hand car setting more formally, and consider some extensions and other applications.

Adverse selection in the labour market

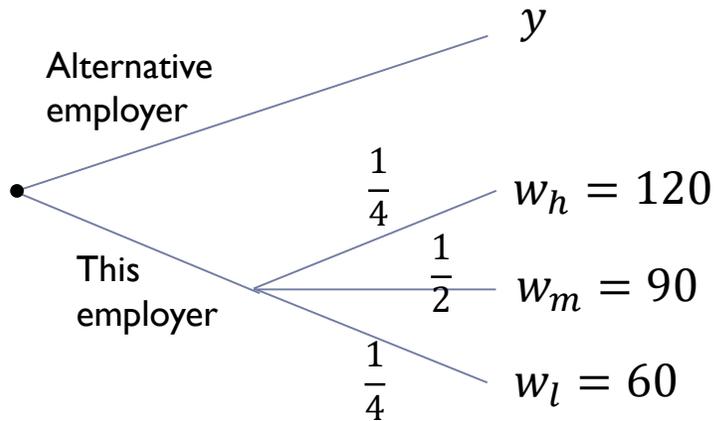
- ▶ A firm wishes to hire workers for a job.
- ▶ Workers can be of three types: high (h), medium (m) or low (l) quality
 - ▶ Quality refers to their productivity, such that $MP_h > MP_m > MP_l$, *ceteris paribus*
- ▶ The firm would like to pay a wage to each worker according to his or her quality: $w_h = MP_h$, $w_m = MP_m$ and $w_l = MP_l$.
- ▶ Workers would be happy to work for the wages that the firm is willing to pay for their type. But they would always prefer higher wages to lower wages.
- ▶ However, the firm **cannot tell which worker is of which type**
 - ▶ For now, assume workers have no means of signalling
- ▶ Therefore, low and medium quality workers have an incentive to claim they are high quality workers, and attain wage w_h .

Adverse selection in the labour market

- ▶ Assume there is an alternative wage level y available from a different employment. There, worker type is irrelevant (all workers are equally productive).
- ▶ For clarity, let's add some numbers:
 - ▶ $MP_h = 120$, $MP_m = 90$, $MP_l = 60$
 - ▶ Proportions: $p_h = \frac{1}{4}$, $p_m = \frac{1}{2}$, $p_l = \frac{1}{4}$
 - ▶ We will vary y in the analysis.



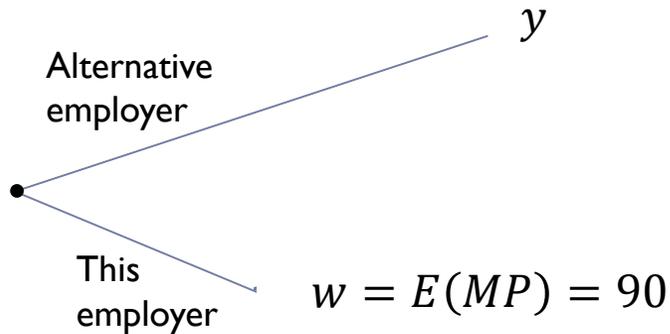
Adverse selection in the labour market



This is efficient: all workers are employed where they should be employed, based on marginal productivity in each firm.

- ▶ In perfect information, firms can tell the worker type and pay wage = productivity.
- ▶ If outside option has $MP = y > 120$:
 - ▶ All workers will choose the alternative employer and receive wage $y > 120$
- ▶ If $y = 95$
 - ▶ High quality workers still choose this employer and medium and low quality choose the alternative
- ▶ If $y = 65$
 - ▶ High and medium quality workers choose this employer and low quality choose the alternative
- ▶ If $y < 60$
 - ▶ All workers should choose this employer and none the alternative.

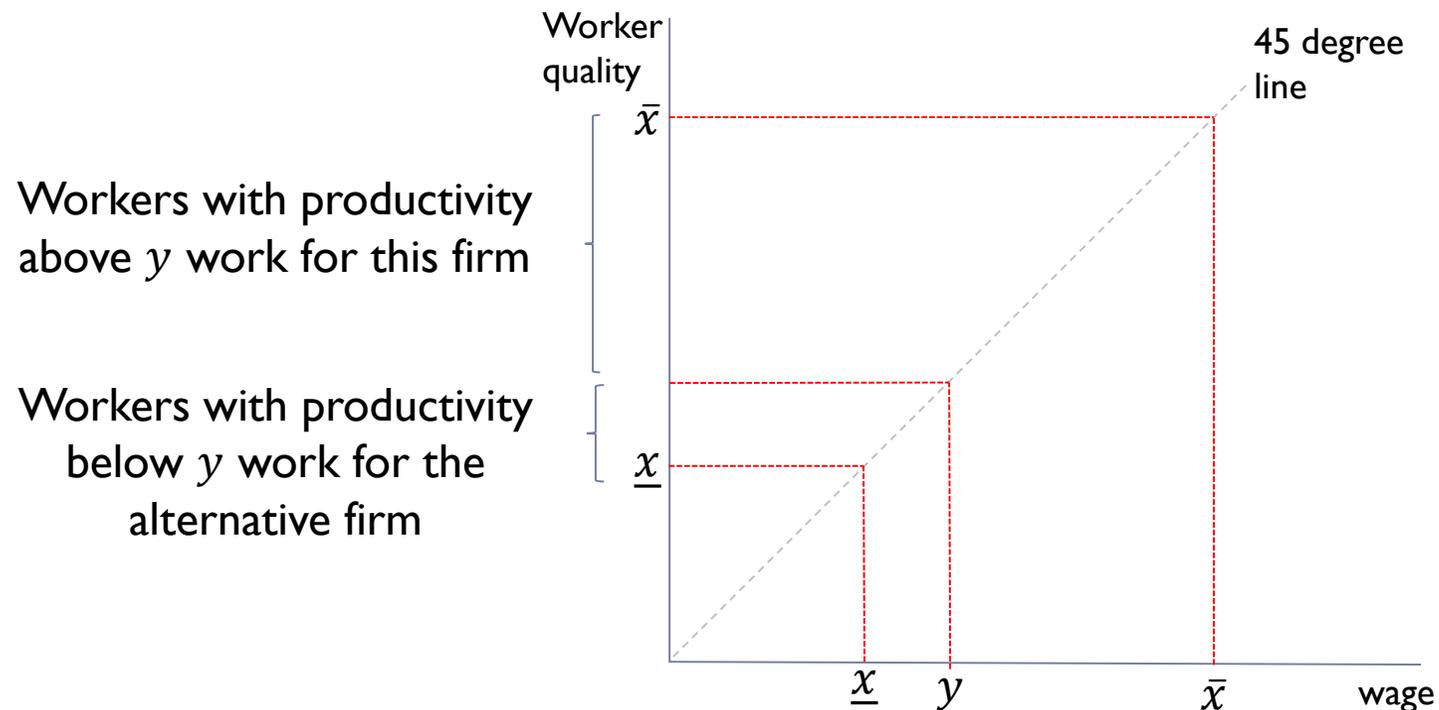
Adverse selection in the labour market



- ▶ In imperfect information, the firm **cannot** tell the worker type and pays wage = expected productivity $\frac{1}{4}120 + \frac{1}{2}90 + \frac{1}{4}60 = 90$
- ▶ If outside option has $MP = y > 120$
 - ▶ As before: all choose alternative. Still efficient.
- ▶ If $y = 95$
 - ▶ All choose alternative because $95 > 90$. **UNDEREMPLOYMENT** at this employer. Firm **should** attract H types but they work for the alternative instead.
- ▶ If $y = 65$
 - ▶ All choose this employer because $65 < 90$. **OVEREMPLOYMENT** at this employer. Firm **should not** retain L types but they work for it anyway.
- ▶ If $y < 60$
 - ▶ As before: all choose this employer. Still efficient.

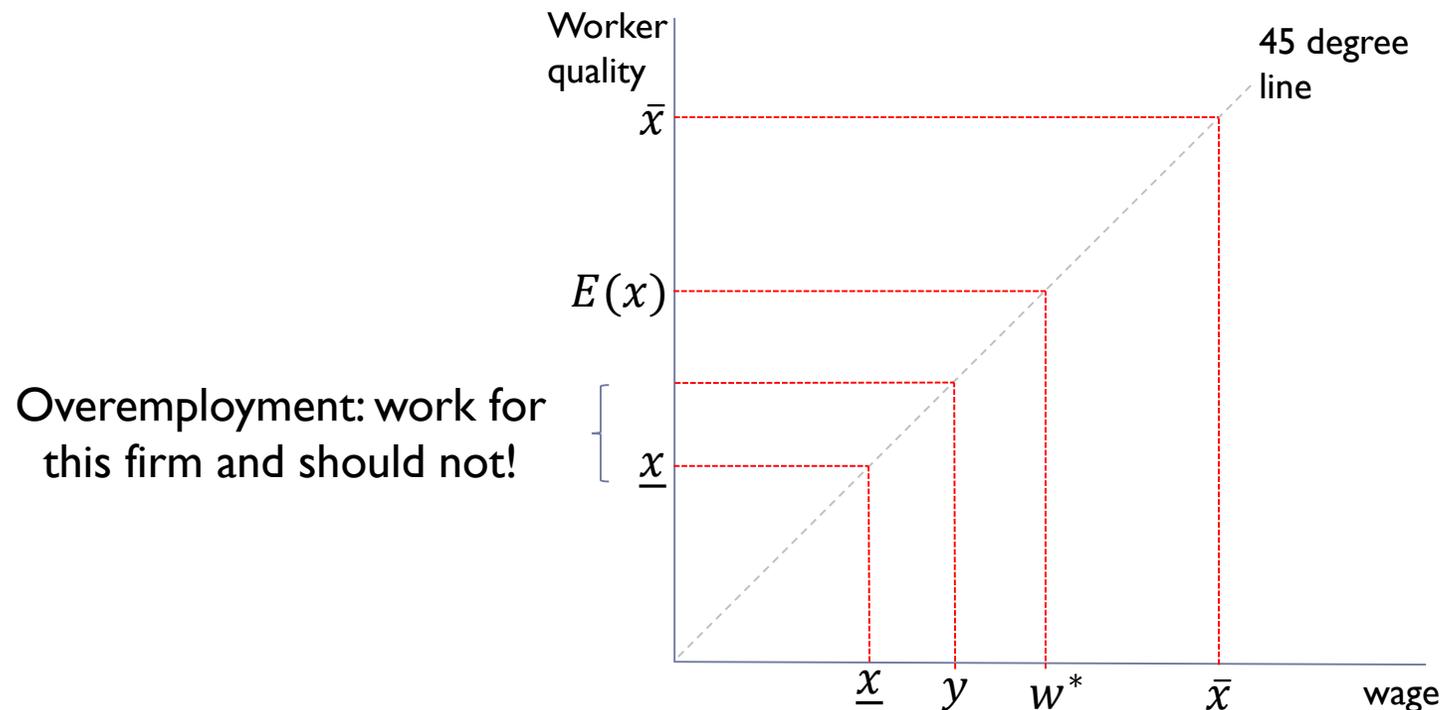
Adverse selection in the labour market

- ▶ With a continuum of worker types:
 - ▶ Continuum of productivity types of workers in terms of this employment: $[\underline{x}, \bar{x}]$
 - ▶ Alternative wage is y as before: all workers are equally productive in the alternative employment.
- ▶ With full information:



Adverse selection in the labour market

- ▶ With a continuum of worker types:
 - ▶ Continuum of productivity types of workers in terms of this employment: $[\underline{x}, \bar{x}]$
 - ▶ Alternative wage is y as before: all workers are equally productive in the alternative employment.
- ▶ With imperfect information:

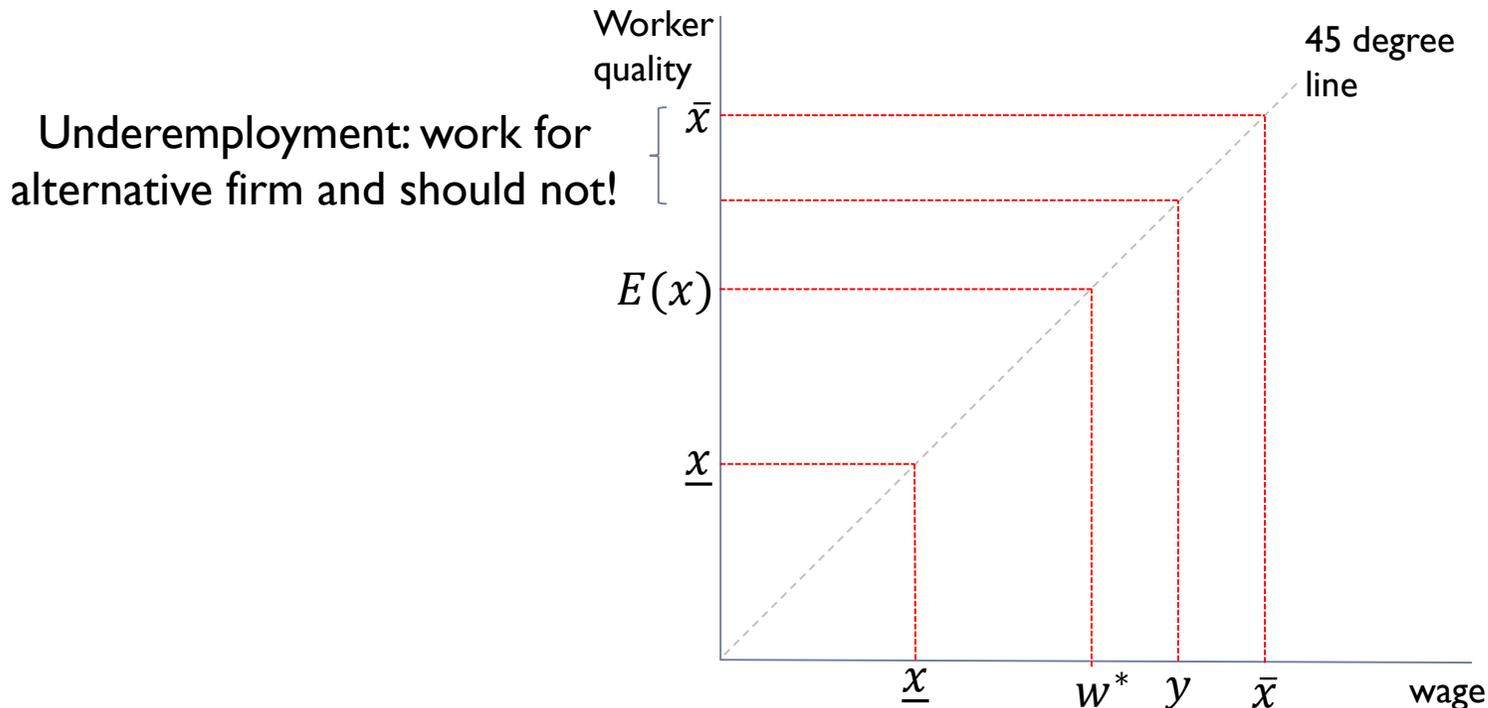


Case I:

- $w^* = E(x) > y$
- All workers work for this firm.
- **Overemployment** because workers with productivity $x < y$ should be working for the alternative firm instead.

Adverse selection in the labour market

- ▶ With a continuum of worker types:
 - ▶ Continuum of productivity types of workers in terms of this employment: $[\underline{x}, \bar{x}]$
 - ▶ Alternative wage is y as before: all workers are equally productive in the alternative employment.
- ▶ With imperfect information:

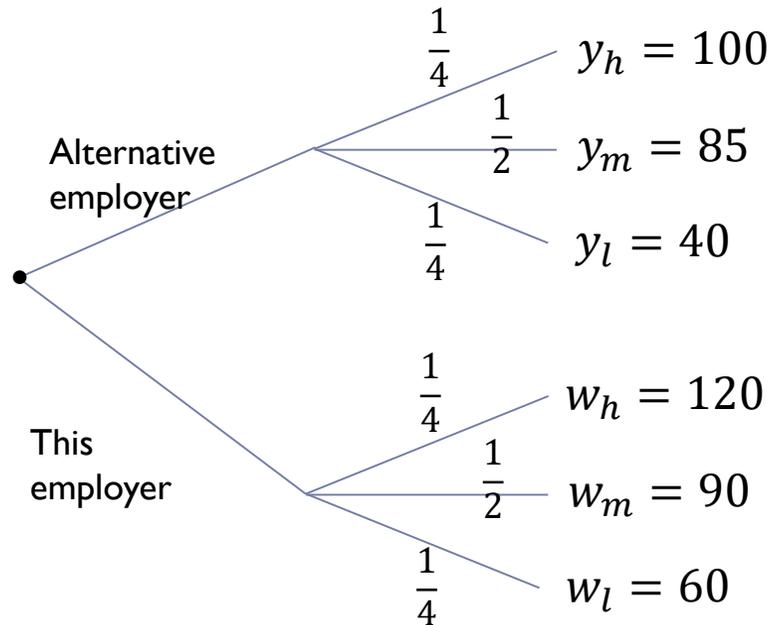


Case 2:

- $w^* = E(x) < y$
- All workers work for the alternative firm.
- **Underemployment** because workers with productivity $x > y$ should be working for this firm instead.

Adverse selection in the labour market

- ▶ What if the outside offer depends on the worker's type?
- ▶ Return to our three-type world. Let the alternative employer KNOW worker type and pay wages as follows: $y_h = 100$; $y_m = 85$; $y_l = 40$



- ▶ First, this employer offers $w^* = 90$ as before, based on average productivity.
- ▶ But this is **not an equilibrium**: type H workers move to the alternative firm to earn $y_h = 100 > 90$
- ▶ This firm knows this, and adjusts the wage: $\frac{2}{3}90 + \frac{1}{3}60 = 80$
- ▶ But this is **not an equilibrium**: type M workers move to the alternative firm to earn $y_m = 85 > 80$
- ▶ This firm knows this, and adjusts the wage to 60
- ▶ **This is an equilibrium** because the low quality workers all apply and no one has an incentive to deviate.
- ▶ **But clearly it is not optimal compared to full information**

Adverse selection in the goods market

- ▶ Let's write the formal model of Adverse Selection in the context of used cars.
- ▶ Two groups
 - ▶ Members of Group 1 own a used car and may sell it or keep it
 - ▶ Members of Group 2 do not own a used car and may buy one or not.
- ▶ For any level of quality, members of group 1 place a higher value on the used car than members of group 2 do.
 - ▶ This ensures there are potential gains from trade
- ▶ Sellers **KNOW** the quality of their used car
- ▶ Buyers must decide whether or not to buy based on the **EXPECTED** quality
 - ▶ Hence: information asymmetry

Adverse selection in the goods market

First, focus on Group 2 (potential buyers)

- ▶ **Utility function:** $U_2 = M + \left(\frac{3}{2}\right) q \cdot n$
 - ▶ M is consumption of other goods and services
 - ▶ q is the quality of the used car
 - ▶ n takes the value 1 if they buy and 0 if they do not.
- ▶ **Budget constraint:** $y_2 = M + p \cdot n$ or $M = y_2 - p \cdot n$
 - ▶ y_2 is the income of the group 2 trader
 - ▶ p is the price of the used car
 - ▶ Implicitly assume the numeraire price of other consumption = 1

Adverse selection in the goods market

- ▶ Given the uncertainty on quality, buyers decide based on expected utility:
- ▶ $E(U_2) = M + \frac{3}{2}E(q) \cdot n = M + \frac{3}{2}\mu \cdot n$
 - ▶ $\mu = E(q)$ is the average (expected) quality of used cars on the market
- ▶ Sub in the budget constraint for M:
 - ▶ $E(U_2) = y_2 - p \cdot n + \frac{3}{2}\mu \cdot n$
 - ▶ $\rightarrow E(U_2) = y_2 + \left[\frac{3}{2}\mu - p\right]n$
- ▶ Members of group 2 will buy iff $\left[\frac{3}{2}\mu - p\right]$ is positive, i.e. $p \leq \frac{3}{2}\mu$
 - ▶ Intuition: quality must be high enough to justify the price

Adverse selection in the goods market

Second, focus on Group I (potential sellers)

▶ Utility function: $U_2 = M + q \cdot n$

- ▶ M is consumption of other goods and services
- ▶ q is the quality of the used car
- ▶ n takes the value 1 if they buy and 0 if they do not.

Sellers value ANY GIVEN
CAR car less than buyers do,
since $\frac{3}{2} > 1$

So there are **potential gains
from trade**

▶ Budget constraint: $y_1 = M + p \cdot n$ or $M = y_1 - p \cdot n$

- ▶ y_1 is the income of the group I trader
- ▶ p is the price of the used car (to be gained if sell)
 - ▶ Intuition: some of wealth is locked up in the car's value – selling releases it for spending
- ▶ Implicitly assume the numeraire price of other consumption = 1

Adverse selection in the goods market

- ▶ No uncertainty on quality for sellers: they decide based on utility:
- ▶ $U_1 = M + q \cdot n$
 - ▶ q is the known quality of the seller's own used car
- ▶ Sub in the budget constraint for M:
 - ▶ $U_1 = y_1 - p \cdot n + q \cdot n$
 - ▶ $\rightarrow U_1 = y_1 + [q - p] \cdot n$
- ▶ Members of group I will sell iff $[q - p]$ is negative, i.e. $p \geq q$
- ▶ Intuition: price must be high enough to justify giving up ownership.

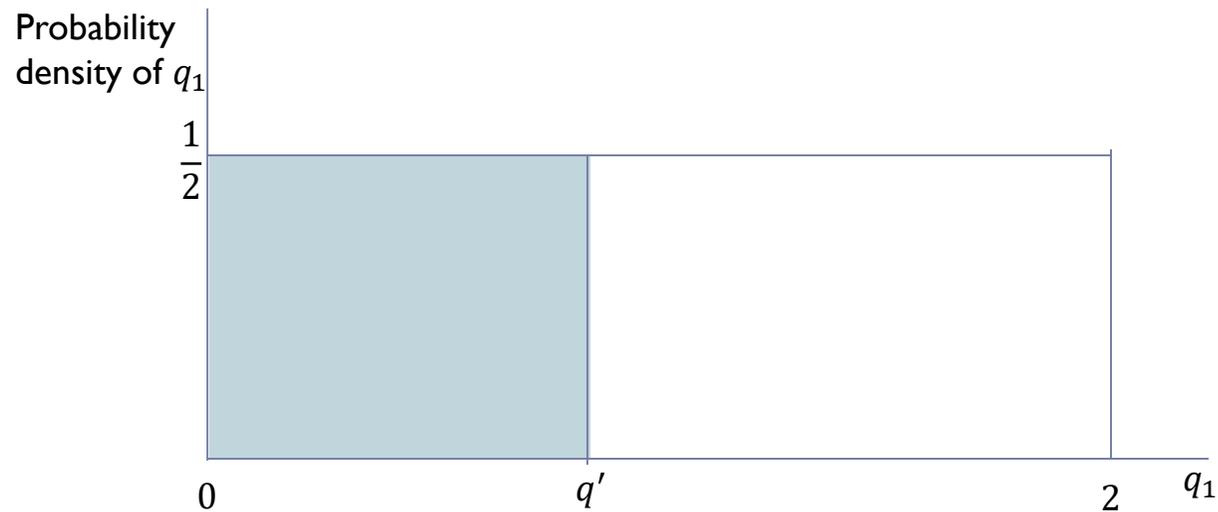
Adverse selection in the goods market

- ▶ We next wish to bring both sides together.
- ▶ We know buyers will buy iff $p \leq \frac{3}{2}\mu$
- ▶ We know sellers will sell iff $p \geq q$

- ▶ To proceed, we need to know more about the distribution of quality in the market.

Adverse selection in the goods market

- ▶ Assume there is a uniform quality distribution as follows

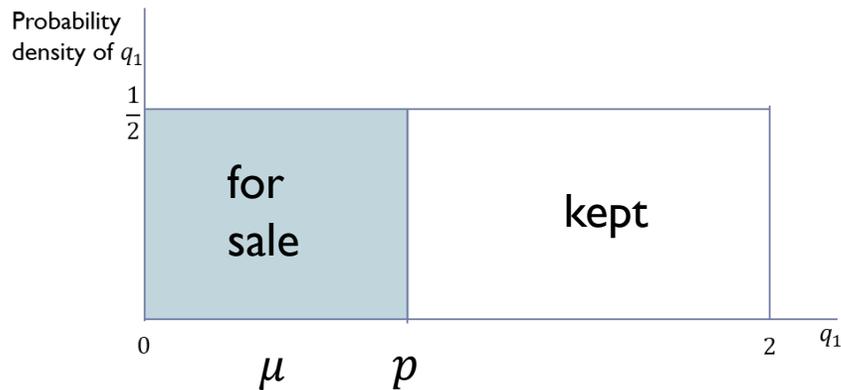


The probability of drawing a car with quality equal to or less than some level q' is equal to the area to the left of q' on the graph.

- ▶ Best possible quality = 2
- ▶ Worst possible quality = 0
- ▶ A car randomly selected is equally likely to have any given quality level between 0 and 2
 - ▶ Potential sellers' car will be a random draw from this distribution

Adverse selection in the goods market

- ▶ Seller will only sell if $p \geq q$
- ▶ If market price = p then only cars with quality $\leq p$ would be up for sale
- ▶ So the shaded area shows cars for sale at any given p

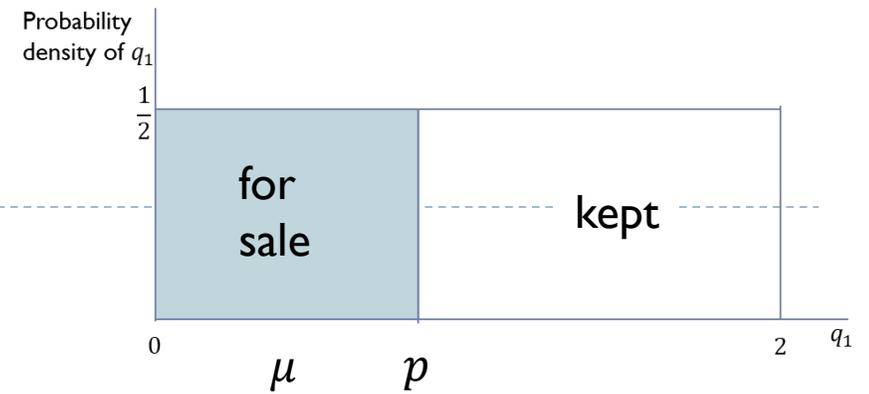


What is the average quality of cars for sale at any given p ?

1. Probability that a randomly chosen car is put up for sale: vertical axis height multiplied by distance along x axis = $\frac{1}{2} * p$
2. Total stock of used cars for sale = probability $\left(\frac{1}{2}p\right)$ multiplied by total cars (assume N traders have 1 car each) = $N \rightarrow S = \frac{1}{2}pN$
3. Average quality of the cars for sale is given by the diagram. At price p , the cars put up for sale are of quality $q \in [0, p]$, and average quality is $\mu = \left(\frac{1}{2}\right)p$ (half of the cars have quality above μ and half below μ)

Adverse selection in the goods market

- ▶ What is the equilibrium?
- ▶ We know buyers will only buy if $\frac{3}{2}\mu \geq p$
- ▶ We just showed that sellers' behaviour results in $\mu = \frac{1}{2}p$
- ▶ These **CANNOT** hold simultaneously: **NO** equilibrium with positive prices.
 - ▶ To see why:
 - ▶ $\mu = \frac{1}{2}p$
 - ▶ $\frac{3}{2}\mu \geq p \rightarrow \mu \geq \frac{2}{3}p$
 - ▶ $\frac{1}{2}p \geq \frac{2}{3}p$
 - ▶ Not possible with $p > 0$! Implies $\frac{1}{2} \geq \frac{2}{3}$



Adverse selection in the goods market

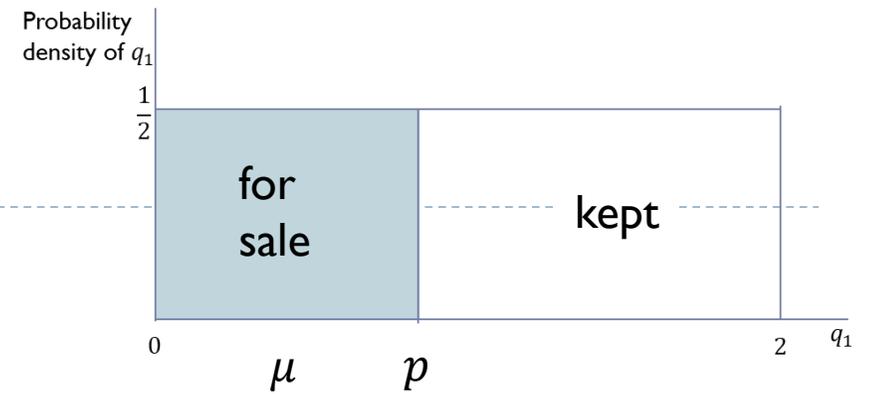
- ▶ The only equilibrium that exists is with $p = 0$

- ▶ $\frac{1}{2}p \geq \frac{2}{3}p$ holds with equality when $p = 0$

- ▶ Sellers whose cars have the lowest quality possible are indifferent between selling or not when $p = 0$ and buyers are indifferent between buying or not.

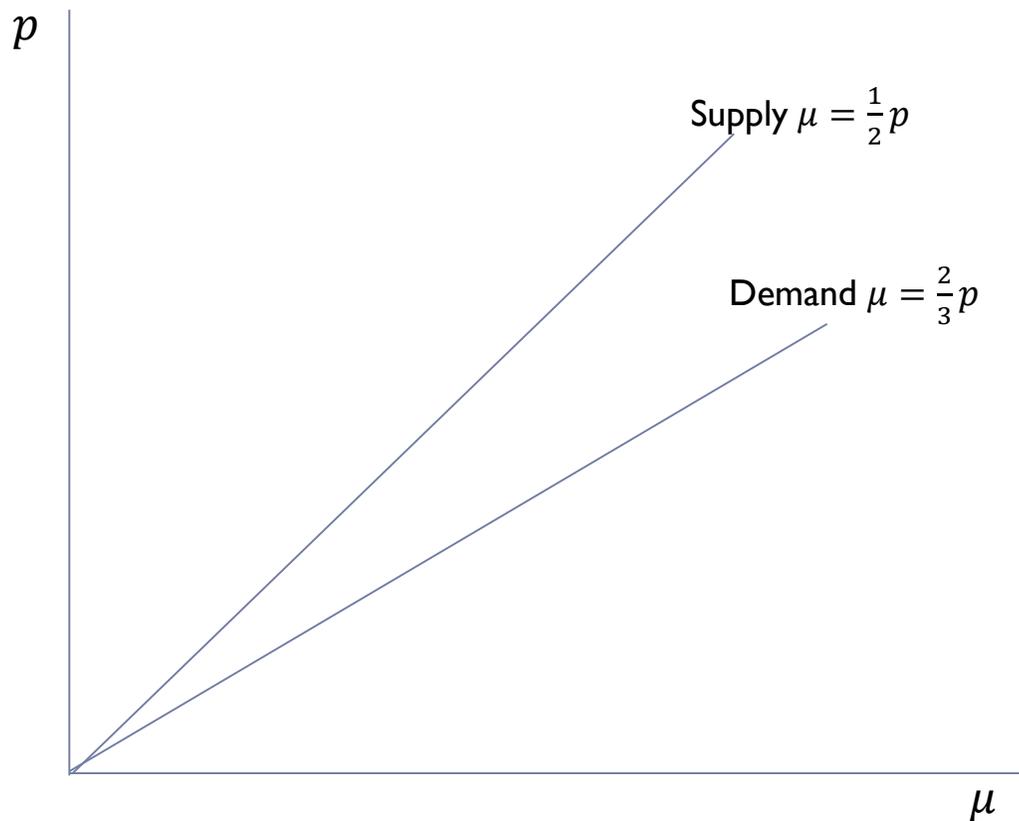
- ▶ At equilibrium, $p = 0$ and $q = \mu = 0$.

- ▶ But $\text{pr}(q = 0)$ is negligible, so essentially no trade occurs. Market breakdown!



Adverse selection in the goods market

▶ In a diagram:



- ▶ Supply: average quality of cars on the market for any given p , $\mu = \frac{1}{2}p$
- ▶ Demand: positive at any point to the right of the $\mu = \frac{2}{3}p$ line
- ▶ Zero trade because no supply in the area where demand is positive

Intuition

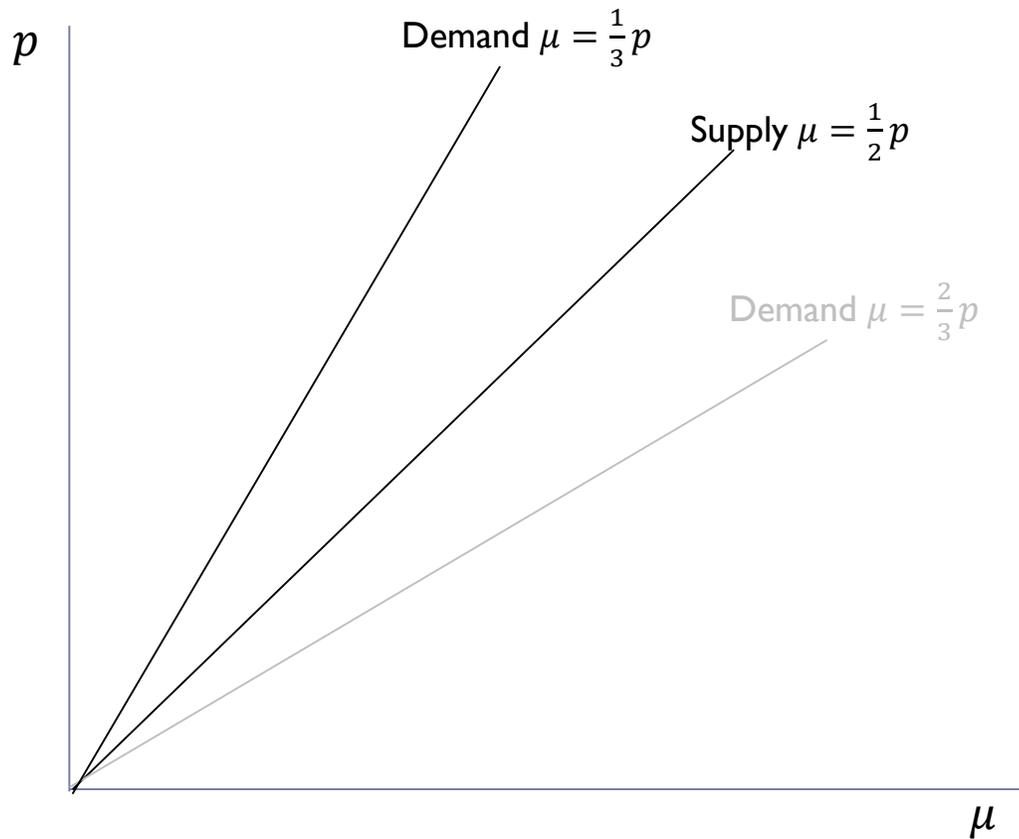
- ▶ Sellers want systematically to sell lower quality cars for any given price
- ▶ Buyer reasons that if the car is on sale it can't be very good so they don't buy it

Adverse selection in the goods market

- ▶ Slightly change the utility function for buyers to find a case where there is trade at positive prices:
 - ▶ Utility function: $U_2 = M + 3q \cdot n$
 - ▶ Budget constraint: $M = y_2 - p \cdot n$
 - ▶ Given the uncertainty: $E(U_2) = M + 3E(q) \cdot n = M + 3\mu \cdot n$
 - ▶ Sub in the BC for M: $E(U_2) = y_2 - p \cdot n + 3\mu \cdot n$
 - ▶ Simplify: $E(U_2) = y_2 + [3\mu - p] \cdot n$
- ▶ Buyers will buy if $p \leq 3\mu$ (Demand line becomes $\mu = \frac{1}{3} p$)
- ▶ Sellers will still sell if $p \geq q$
- ▶ Sellers' decisions still lead to the result that average quality supplied is $\mu = \frac{1}{2} p$
- ▶ These hold simultaneously for all p

Adverse selection in the goods market

▶ An example with positive trade:



- ▶ Supply: average quality of cars on the market for any given p , $\mu = \frac{1}{2}p$
- ▶ Demand: positive at any point to the right of the $\mu = \frac{1}{3}p$ line
- ▶ All units are traded because supply lies completely in the area where demand is positive

Intuition

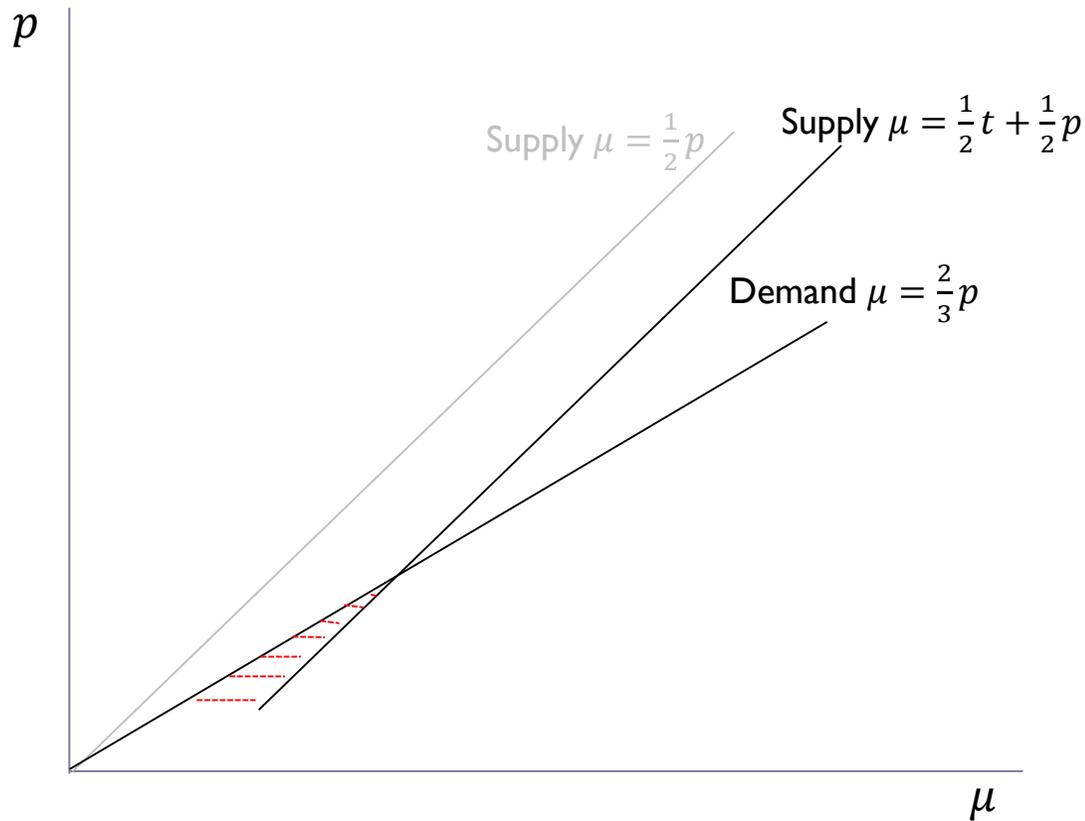
- ▶ Because buyers value cars so much more than sellers do, even though buyers assume the car is only of average quality, sellers are nonetheless willing to sell at this price.

Adverse selection in the goods market

- ▶ Slightly change the assumptions of the market to find a case where there is trade at positive prices:
 - ▶ Quality is uniformly distributed between $t > 0$ and 2.
- ▶ Other features stay the same
 - ▶ Buyers utility function is back to the original one
 - ▶ Demand curve is also back to the original one: $\frac{3}{2}\mu \geq p$
 - ▶ Sellers' preferences: sell iff $p \geq q$
- ▶ Average quality of a car for sale as a function of price is now $\mu = \frac{t+p}{2}$
 - ▶ Since sellers sell if $p \geq q$, supply curve becomes $\mu = \frac{t+p}{2}$
- ▶ We can show that $\mu = \frac{t+p}{2}$ and $\frac{3}{2}\mu \geq p$ both hold where $p < 3t$, and by assumption $p > t$. Equilibrium: $t < p < 3t$

Adverse selection in the goods market

▶ An example with positive trade:



- ▶ Supply: average quality of cars on the market for any given p , $\mu = \frac{1}{2}t + \frac{1}{2}p$
- ▶ Demand: positive at any point to the right of the $\mu = \frac{2}{3}p$ line
- ▶ Shaded units are traded because here, $D > S$

Intuition

- ▶ As long as there is a minimum quality of cars on the market, we can find prices such that there is some trade.
- ▶ The “worst case scenario” car is better than 0, so the average quality is high enough to ensure some trade will happen.
- ▶ But trade will only be in lower quality goods

Some implications of the adverse selection model (1)

- ▶ Adverse selection results from asymmetric information (hidden information) between buyers and sellers, or workers and firms.
- ▶ Adverse selection generally means that, because quality cannot be verified, the presence of low quality reduces the market value of the average product, but that the owners of higher value products then drop out of the market.
- ▶ Essentially, the presence of possible bad outcomes drives out the good, and makes the bad more likely.
- ▶ This can lead to market breakdown and lower overall welfare.

Some implications of the adverse selection model (2)

- ▶ Total market failure can occur under adverse selection even though both parties are price takers, and there are potential gains from trade:
 - ▶ Sellers valued a given quality car less than buyers did but in some cases there was no trade at all.
 - ▶ Firm wanted to hire workers and the workers wanted to work there but in some cases all workers went to the alternative firm
- ▶ The root of the market failure is the dual role that the price plays in the model:
 - ▶ The price determines the average quality of cars on the market
 - ▶ The price equilibrates the market
 - ▶ The equilibrating non-zero price for a given average quality will tend to reduce the average quality, requiring a new (lower) equilibrating price, etc etc.

Some implications of the adverse selection model (3)

- ▶ **The other root of the failure is the lack of credible signals**
 - ▶ If a great car is brought to the market, the seller can say it's great. But equally, the seller of a low quality car can claim their car is great too
 - ▶ Unless the quality claim can be verified, the sellers cannot prove the quality of their cars.
 - ▶ Hence the need for legally enforceable warranties (and contracts more generally)
- ▶ **The adverse selection problem can be considered as an externality problem:**
 - ▶ Full information: if a seller brings a high quality car to the market they gain the full benefit in terms of a high price
 - ▶ Imperfect information: if a seller brings a high quality car to the market, the market price for ALL cars goes up **marginally**, with only a **marginal increase** being enjoyed by the seller of that car

More applications (theoretical work)

Credit Rationing (I)

- ▶ E.g. Stiglitz and Weiss (1981)
- ▶ Observation: Excess demand in the credit market.
- ▶ This is surprising: why don't the banks raise interest rates so the market clears?
- ▶ Two types of borrower: low risk and high risk
 - ▶ Low risk: wish to borrow at low rates. Very low chance of default.
 - ▶ High risk: wish to borrow even at high rates. Higher chance of default.
- ▶ Will the bank raise interest rates?

More applications (theoretical work)

Credit Rationing (2)

- ▶ If the bank raises interest rates:
 - ▶ Low risk borrowers may drop out (returns are not worth the interest rates)
 - ▶ High risk borrowers may still borrow
 - ▶ If project succeeds, the very high returns are worth the higher interest rates.
 - ▶ If project fails, they **default** and the bank covers the loss. So not put off by higher interest rates in this case either.
- ▶ From the bank's point of view, raising the interest rates will lower the quality of the portfolio
- ▶ Good risks drop out, bad risks remain
- ▶ Therefore, they prefer to keep interest rates low, below the market clearing rate, and for some potential borrowers to miss out on credit.

More applications

Reputation effects (I)

- ▶ E.g. Heal (1976)
- ▶ Lemons problem as a prisoner's dilemma.
- ▶ Two players (A and B) both wish to sell goods to one another.
- ▶ Can sell high or low quality.
- ▶ Nash: both trade low quality despite wishing to trade high.
- ▶ However, in infinitely repeated game, they can maintain high quality trade outcomes due to their reputation for high quality.

		Person A	
		High quality	Low quality
Person B	High quality	π_2, π_2	π_4, π_1
	Low quality	π_1, π_4	π_3, π_3

More applications

Reputation effects (2)

▶ High: $\pi_2 + \frac{\pi_2}{(1+r)^t}$

▶ Low: $\pi_4 + \frac{\pi_3}{(1+r)^t}$

▶ **Defect if:**

• $\pi_2 + \left(\frac{\pi_2}{(1+r)^t}\right) < \pi_4 + \left(\frac{\pi_3}{(1+r)^t}\right)$

• $\left(\frac{\pi_3 - \pi_2}{(1+r)^t}\right) < \pi_2 - \pi_4$ i.e. $\left(\frac{1}{(1+r)^t}\right) < \frac{\pi_2 - \pi_4}{\pi_3 - \pi_2}$

- Need to care sufficiently little about future, have high cheat payoffs and low punishment.
- Reputation can build perceived probability of not defecting.

		Person A	
		High quality	Low quality
Person B	High quality	π_2, π_2	π_4, π_1
	Low quality	π_1, π_4	π_3, π_3

More applications

Price signals of product quality (I)

- ▶ E.g. Wolinsky (1983)
- ▶ Consumers shop around by visiting firms. Each visit incurs a search cost. They acquire imperfect information on the quality of the firm's product.
- ▶ Step 1: consumers decide their WTP for the product. They want the best quality at that price.
- ▶ Step 2: consumers sample firms offering the product for that price. They form an expectation of quality that depends on the price charged.
- ▶ Step 3: consumers select a firm to buy the product from

More applications

Price signals of product quality (2)

- ▶ The firms can:
 - ▶ Reduce the quality. This lowers costs. But they may be “found out” during search
 - ▶ Not reduce the quality. This doesn't lower costs but may increase chance of a sale
- ▶ In equilibrium, the quality available at a given price depends on how good the information is that is received through search.
- ▶ As information becomes near perfect, the mark-up over MC becomes near zero. (The market tends towards the perfectly competitive equilibrium).
- ▶ When information is very bad, the mark-up over MC is high. Eventually the market tends towards the Akerlof equilibrium with no trade at all.

Experimental evidence

- ▶ The theories are nice, but is there empirical support?
- ▶ The clearest way to study the adverse selection problem is using experiments
 - ▶ Non-experimental empirical approaches are subject to possible confounds and selection biases that are not the ones we try to model
 - ▶ Experiments give us full control over who knows what, and can hold everything else equal across subjects
- ▶ **We will focus on the version by Lynch, Miller, Plott and Porter (1986)**
 - ▶ Lynch, M., Miller, R. M., Plott, C. R., & Porter, R. (1986). Product Quality, Consumer Information, and 'Lemons' in Experimental Markets. *Empirical Approaches to Consumer Protection Economics*. Washington, DC: Federal Trade Commission, Bureau of Economics, 251-306.
 - ▶ Hereafter LMPP
- ▶ The paper has multiple aims. Here we focus on baseline adverse selection

Experimental evidence

▶ Traders:

- ▶ Buyers: if they purchase a good, they redeem it for a “redemption value”, RV. This RV, less cost of purchase, gives an experimental Consumer Surplus.
- ▶ Sellers: if they sell a good, they get the price they sold it for. This price, less the cost of production (specified by experimenters), gives an experimental Producer Surplus.

▶ Goods

- ▶ Two types of good: Regular and Super
- ▶ Redemption value of regulars is less than redemption value of supers
- ▶ Costs of producing regulars is less than cost of producing supers

▶ Information

- ▶ In adverse selection treatments, buyers do not know the quality of their purchase in advance

Experimental evidence

▶ Market features

- ▶ 8 buyers and 6 sellers per group
- ▶ Cost of production = ECU20 for regulars and ECU120 for supers
- ▶ Sellers can produce up to 2 products per period, both R, both S or a mix
- ▶ Buyers' RV declines with quantity as follows:

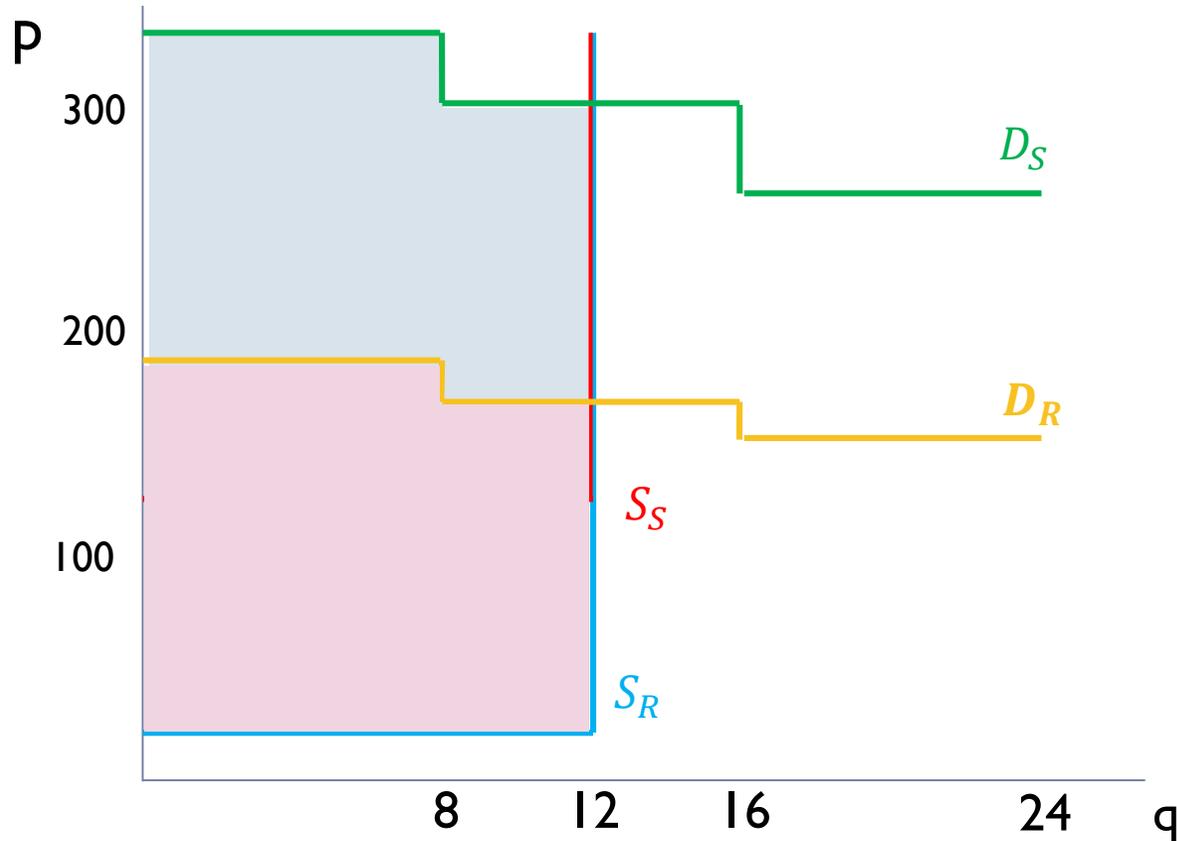
	RV Super	RV Regular
1 st unit	330	180
2 nd unit	300	165
3 rd unit	270	150

Experimental evidence

- Cost of production
- ECU20 for regulars
 - ECU120 for supers

	RV Super	RV Regular
1 st unit	330	180
2 nd unit	300	165
3 rd unit	270	150

► Demand and supply

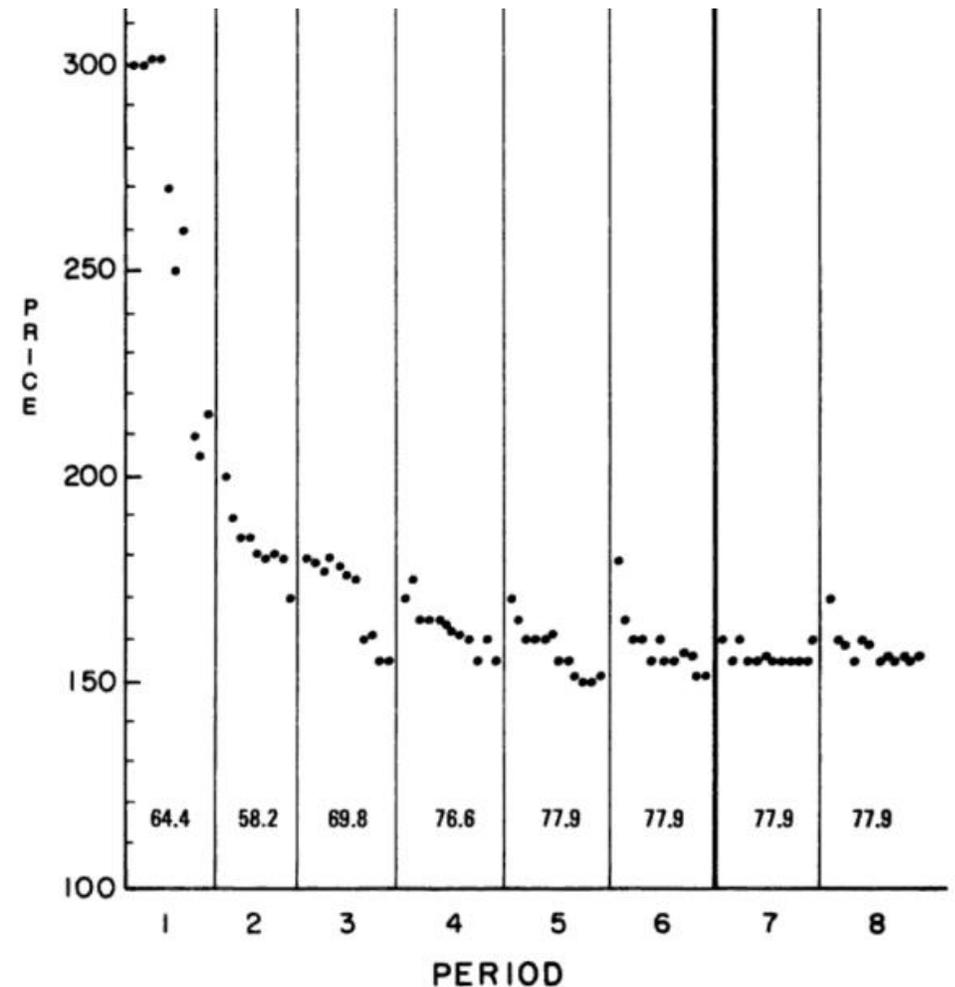


- Pale blue area: total surplus if only Supers are traded ($p=300$) (surplus = 2400)
- Pale pink area: total surplus if only Regulars are traded ($p=165$) (surplus = 1860)
- So in perfect info only Supers should be traded
- But our theory tells us that with adverse selection only Regulars will be traded

Experimental evidence

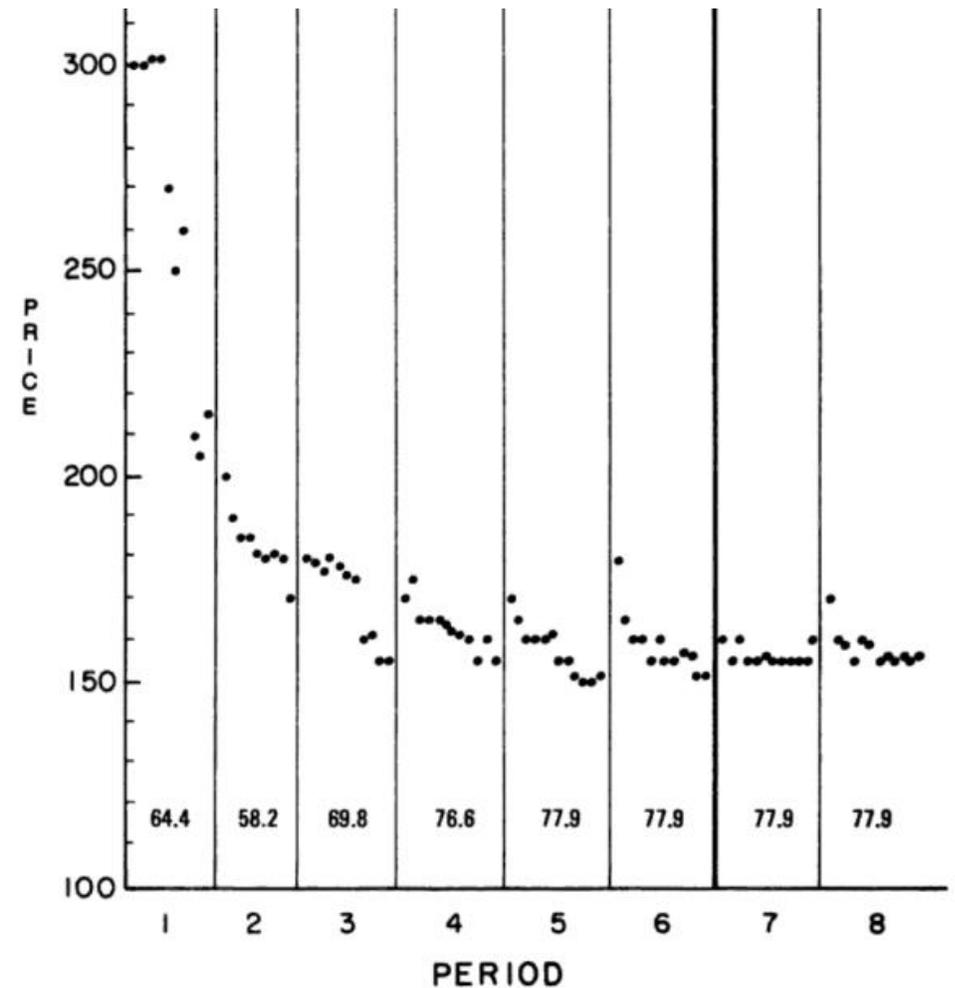
▶ Results

- ▶ Efficiency index: how much surplus did the market generate, compared to total possible surplus?
- ▶ In early periods, they find that some trades happen around the market price of Supers (300), but as the game progressed, clear convergence around the Regulars equilibrium
- ▶ Overall,
 - ▶ Market efficiency = 78% as predicted by lemons model
 - ▶ Market price = roughly 165 which is the Regulars trading price



Experimental evidence

- ▶ **Conclusion**
 - ▶ The results of the LMPP experiment provide strong support for the Akerlof model of adverse selection



Experimental evidence

Holt and Sherman (1990)

- ▶ Instead of LMPP's "double auction" design, H and S use a "posted offer" market
 - ▶ Sellers post a price tag and buyers shop around
- ▶ More possible qualities could be tested, with redemption values and production costs also varying.
- ▶ Results:
 - ▶ 84% of maximum trading surpluses was made under full information
 - ▶ 46% of maximum trading surplus was made under asymmetric information (buyers unable to observe quality).

Empirical evidence

Gensove 1993

- ▶ Wholesale used car market
- ▶ Car dealers buy and sell cars on this market very quickly, so lots of imperfect information.
- ▶ Used Car Dealers only deal in used cars. New Car Dealers deal in both new and used
- ▶ Adverse selection is likely to affect Used Car Dealers more than New Car Dealers because some of the NCD cars will be new and hence high quality
- ▶ They find empirical support for this hypotheses: price paid by buyers to NCDs exceeds the price paid to UCDs.

Empirical evidence

Gibbons and Katz (1991)

- ▶ Empirical support for labour market argument
- ▶ People laid off from their job because of plant closure cannot be assumed to be low quality
- ▶ People laid off from their job in other circumstances might be assumed to be low quality (hence not chosen to be retained)
- ▶ Empirically, found that laid-off workers that were not due to factory closures were subsequently unemployed for longer, all else held equal.
- ▶ Also, those that were re-employed were paid a lower wage.
- ▶ This fits the broad adverse selection story.

Empirical evidence

Saeedi (2019)

- ▶ Ebay, reputation and adverse selection in iphone sales
- ▶ Sellers' quality is unobservable to buyers.
- ▶ Adverse selection predicts that low quality sellers remain in the market (low quality and low prices).
- ▶ They show that allowing sellers to build reputations for high quality helps to keep them in the market
- ▶ Removing this mechanism:
 - ▶ Increases low quality sellers' market share
 - ▶ Reduces prices
 - ▶ Reduces sellers' profit by 66% and lowers consumer surplus by 35%

To sum up:

- ▶ Adverse selection results from asymmetric information (hidden information) between buyers and sellers, or workers and firms.
- ▶ Adverse selection generally means that, because quality cannot be verified, the presence of low quality reduces the market value of the average product, but that the owners of higher value products then drop out of the market.
- ▶ This can lead to market breakdown and lower overall welfare.
- ▶ We studied this theoretically through labour and goods markets.
- ▶ We learned about experimental tests of adverse selection.
- ▶ We touched on some of the wider empirical literature.

References and readings:

- ▶ Akerlof, George (1970) “The market for lemons: quality uncertainty and the market mechanism” *Quarterly Journal of Economics* 84, pp. 488-500
- ▶ Lynch, M., Miller, R. M., Plott, C. R., & Porter, R. (1986). Product Quality, Consumer Information and “Lemons” in Experimental Markets. In *Empirical Approaches to Consumer Protection Economics: Proceedings of a Conference Sponsored by the Bureau of Economics, Federal Trade Commission, April 26-27, 1984* (p. 251). USFTC.

Extras

- ▶ Genesove, D. (1993). Adverse selection in the wholesale used car market. *Journal of Political Economy*, 101(4), 644-665.
- ▶ Gibbons, R., & Katz, L. F. (1991). Layoffs and lemons. *Journal of Labor Economics*, 9(4), 351-380.
- ▶ Heal, G. (1976) “Do bad products drive out good?” *Quarterly Journal of Economics*, 90 (3), pp. 499-502
- ▶ Holt, C., & Sherman, R. (1990). Advertising and Product Quality in Posted-Offer Experiments. *Economic Inquiry*, 28(1), 39-56.
- ▶ Saeedi, M. (2014). Reputation and adverse selection, theory and evidence from eBay. *Theory and Evidence from eBay*.
- ▶ Stiglitz, J. E., & Weiss, A. (1981). “Credit rationing in markets with imperfect information.” *The American economic review*, 71(3), 393-410.
- ▶ Wolinsky, A. (1983). Prices as signals of product quality. *The review of economic studies*, 50(4), 647-658.