Akerlof Lemon Market: Used Cars Example

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3 Car Sellers $(j=1,2,3)$

- define car quality (q) as the value of a car to owners
- $q_j \in \{\$0, \$5K, \$10K\}$
- sell when price $p \geq q_j$

Many Car Buyers (seekers)

- Values car 50% more than owners (WTP for a car with $q = \$10K$ is $\$15K$)
- buy when price $WTP \geq p$

Setting

- **Quality Uncertainty and Information Asymmetry**
  sellers know q_j, buyers only know $\bar{q}$: the $avg(q_j)$
  → all cars are sold at the same p
- **Gains from Trade** trade is socially optimal: buyers value cars more

Market Simulation: Preparation

United States Department of Transportation

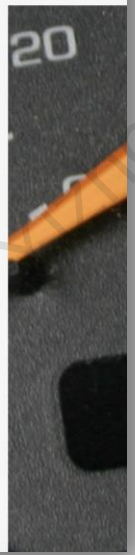
NHTSA

Ratings

Odometer Fraud

Overview

Odometer fraud is the disconnection, resetting or alteration of a vehicle's odometer with the intent to change the number of miles indicated. NHTSA estimates that more than 450,000 vehicles are sold each year with false odometer readings. This crime costs American car buyers more than $1 billion annually. We want consumers to know how to spot odometer fraud, how to protect against it, and who to contact if you think you're a victim of this illegal behavior.



Market Simulation: Preparation

50K miles

~~50K miles~~
100K miles

~~50K miles~~
150K miles

- Quality = sellers' value of car ∝ - mileage
  - Assume q_j = \$(150K – mileage$_j$) /10 = {\$10K, \$5K, \$0}

Quality Uncertainty & Information Asymmetry

- Owners/sellers know quality of each car

- Buyers do not know the quality of each car…
  - they only know the distribution of true mileage in the market so they can infer q *given* p

Gains from Trade

- Buyers value cars 50% more than owners/sellers: {$10K, $5K, $0} * 1.5x = {$15K, $7.5K, $0}

- If all three cars are traded, what's the total gains from trade?

Let’s Try some Scenario Simulations!

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Market Simulation #1

What's the highest possible p that any seller can potentially charge and still get a buyer?

$15K

(the best car in the market is only worth $15K to seekers)

Market Simulation #1

Which sellers would agree to sell their car at this price?

All 3

(p = \$15K > all sellers' valuation of their cars)

Market Simulation #1

- What is the average mileage and the $\bar{q}$ of cars in the market?
- What is buyers' valuation?

100K mileage $\rightarrow \bar{q}$ = \$5K

\$(150K – 100K)/10

\$7.5K

$\bar{q}$ * 1.5x

Maybe the price is too high, let's redo

Will buyers buy any cars?

No

($7.5K < $p = \$15K$)

Maybe the price is too high, let's redo

In the last simulation, seeker valuation was $7.5K…

Let's set our new $p = \$7.5K$!

Market Simulation #2

Which owners would agree to sell their car at this price?

Only 2 and 3

(owner of first car value her car at \$10K > p = \$7.5K)

Market Simulation #2

- What is the average mileage and the $\bar{q}$ of cars in the market?
- What is buyers' valuation?

125K mileage $\rightarrow \bar{q}$ = \$2.5K

\$(150K – 125K)/10

\$3.75K

$\bar{q}$ * 1.5x

Maybe the price is too high, let's redo

Will buyers buy any cars?

No

($3.75K < $p = \$7.5K$)

Maybe the price is too high, let's redo

What happened?!

The owner of the highest-quality car dropped out!

When quality is unobserved, the average quality ($\bar{q}$) of products in the market becomes "endogenous" to prices (in addition to quantity)

Still unconvinced?

Maybe the price is just not low enough!

Let's set our new $p = \$3.75K$!

Market Simulation #2

Which owners would agree to sell their car at this price?

Only 3

(owner of second car value her car at \$5K > p = \$3.75K)

Market Simulation #2

- What is the average mileage and the $\bar{q}$ of cars in the market?
- What is buyers' valuation?

150K mileage $\rightarrow \bar{q}$ = \$0K

\$(150K – 150K)/10

\$0

$\bar{q}$ * 1.5x

Maybe the price is too high, let's redo

Will buyers buy any cars?

No

(0 < p = \$3.75K)

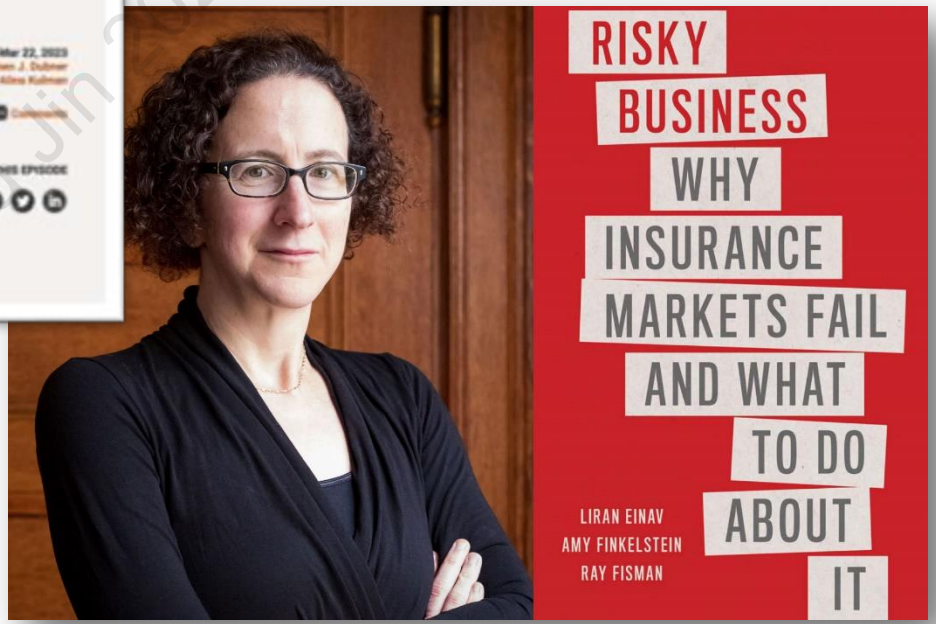
Lemon Market

The only way the market equilibrates is at the lowest quality product!

No more information asymmetry because quality is known to be 0!

The Insurance Example

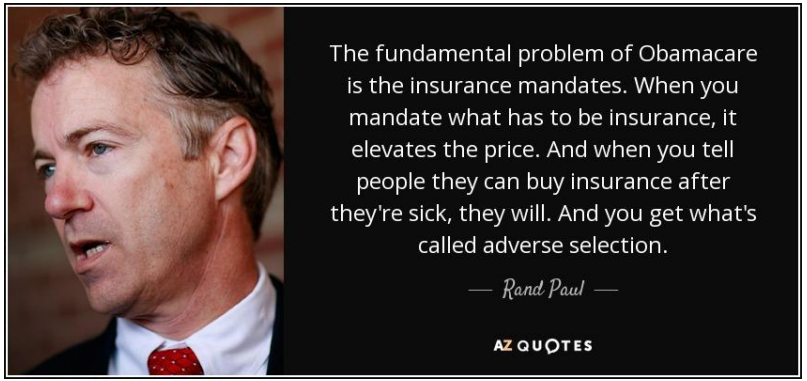
freakonomics.com/podcast/insurance-is-sexy-discuss/



Solution 1: Mandates

- Auto/health/unemployment insurance is mandated
  - We have complementary private auto/health insurance
  - We do not have private unemployment insurance (why?)

- Problem:
  - not always politically possible
  - almost always difficult to enforce!
  - goes against free market principals and introduces other inefficiencies (e.g. moral hazard as in next class: more health insurance = more spending)



Solution 2: Signaling

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SPENCE'S JOB MARKET SIGNALING MODEL

Michael Spence (1973). "Job Market Signaling".
Quarterly Journal of Economics, **87** (3): 355–374.

Spence found that even if education adds nothing to employee productivity, it can still be of value to both the employer and the employee due to its ability to address information asymmetry.

*If an appropriate **cost-benefit structure** exists (or is established), employees will continue to educate themselves to signal their higher productivity.*

Solution 2: Signaling

Two groups of workers:

What is the information asymmetry here? What is quality?

workers of type **H**igh productivity

workers of type **L**ow productivity

Suppose the firm wants to use education to separate out H vs. L workers
"cost-benefit structure" of education

Cost of education years (y)

- **H** workers: $C_H(y)=y/2$
- **L** workers: $C_L(y)=y$

Benefit of education years

- *wage* $w=\begin{cases} 2 \text{ if } y \geq y^* \\ 1 \text{ if } y < y^* \end{cases}$

Solution 2: Signaling

"cost-benefit structure" of the signal: education

Suppose the firm wants to use education to separate out H vs. L workers

Cost of education years (y)

- **H** workers: $C_H(y)=y/2$
- **L** workers: $C_L(y)=y$

e.g. the cost of 2 years of education is 1 for **H** workers, but 2 (more costly) for **L** workers

Benefit of education years

- *wage* $w=\begin{cases} 2 \text{ if } y \geq y^* \\ 1 \text{ if } y < y^* \end{cases}$

Recall that the firm does not know if a worker is **H** or **L**, but observes her education y. The firm gives high wage if a worker has more than y^* years of education.

Solution 2: Signaling

The level y^* is a signaling (or screening) equilibrium* if:

*the most productive workers (**H**) spontaneously decide to acquire it, and the less productive (**L**) decide not to acquire it.*

What conditions must be satisfied in order for the company's choice of y^* to lead to a signaling equilibrium?

**Another term for signaling equilibrium is "screening equilibrium" where a firm "screens" applicants.*

Solution 2: Signaling

In this model, there is no incentive for any worker to get more than y^* years of education. So the decision for workers is whether to get y^* or no education at all.

For L workers

- does not acquire y^* iff $C_L(y^*) > w(y^*) - w(0)$
- $y^* > 1$

For H workers

- acquires y^* iff $C_H(y^*) < w(y^*) - w(0)$
- $y^* < 2$

If the firm sets a threshold value:

$1 < y^* < 2$

a **screening equilibrium** exists

only for the more productive agents it is convenient to acquire the signal

Taking Stock

Setting

- Education is useless in increasing productivity
- Without information asymmetry, education is socially wasteful
  - Both H and L workers would prefer to not spend costs on education
  - H workers acquire the signal/get educated *only* to differentiate from L workers

asymmetric information, and the need to solve it, imposes social costs

Other examples in strategy?

- advertising on digital platforms
- long(er) waiting-times in public housing
- [related but not the same] Insurance competition (Rothchild and Stiglitz,1976)