Adverse Selection

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Content

> **Adverse Selection**

Adverse Selection

- What happens when we allow uncertainty on actor risk to exist in insurance models?
- Why do many states mandate all drivers purchase automobile insurance?
- What would happen if we took a mandated market and removed the mandate?

Adverse Selection

- Adverse selection refers to an asymmetry in information between buyers and sellers which is exploited.
- If I know more about my risks than an insurer does, then I may know if I am Agent A or Agent B
- If an insurer prices for a market of Agent A and B, but only As participate what would happen to the insurer?

Adverse Selection

- We expect that in cases of adverse selection, in insurance models, that only those with higher expected costs participate, and those with lower expected costs to leave the market

Adverse Selection

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- If we had an insurance market of 50 Agent As and 50 Agent Bs:

Full Market: $\frac{50}{100} * \left(\frac{1}{9}\right) + \frac{50}{100} * \left(\frac{5}{9}\right) = \frac{3}{9} = \frac{1}{3} = 33\%$

Agent A (50 members)
5/9 chance

Agent B (50 members)
1/9 chance

Adverse Selection

- We expect that in cases of adverse selection, in insurance models, that only those with higher expected costs participate, and those with lower expected costs to leave the market
- We know Agent As want to stay, but Agent Bs want to leave, so maybe 20 Agent Bs leave:

Full Market: $\frac{30}{80} * \left(\frac{1}{9}\right) + \frac{50}{80} * \left(\frac{5}{9}\right) = \frac{7}{18} = 38\%$

Agent A (50 members)
5/9 chance

Agent B (30 members)
1/9 chance

Adverse Selection

- We expect that in cases of adverse selection, in insurance models, that only those with higher expected costs participate, and those with lower expected costs to leave the market
- Another 20 leave:

Full Market: $\frac{10}{60} * \left(\frac{1}{9}\right) + \frac{50}{60} * \left(\frac{5}{9}\right) = \frac{13}{27} = 48\%$

Agent A (50 members)
5/9 chance

Agent B (10 members)
1/9 chance

Adverse Selection

- We expect that in cases of adverse selection, in insurance models, that only those with higher expected costs participate, and those with lower expected costs to leave the market
- The last 10 leave:

Full Market: $\frac{0}{50} * \left(\frac{1}{9}\right) + \frac{50}{50} * \left(\frac{5}{9}\right) = \frac{5}{9} = 55\%$

Agent A (50 members)
5/9 chance

Agent B (0 members)
1/9 chance

Adverse Selection

- Insurance inherently has an adverse selection problem because you likely know more then some business about your health risks
- Practice Problem

Adverse Selection

- When considering the effects of adverse selection, we are really thinking about any market where information is hidden about the actual characteristics of goods, services, and actors
- With insurance we were concerned about uncertainty over the cost of medical expenditures as well as the chance of getting sick/injured

Adverse Selection

- Three types of people:
  - Type 1: 80% of the population, 15% chance of getting sick, $1,000
  - Type 2: 15% of the population, 10% chance of getting sick, $10,000
  - Type 3: 5% of the population, 20% chance of getting sick, $15,000

- What would be the bundled actuarially fair price of insurance? (Insurers cannot determine type of person)

Adverse Selection

- **Three types of people:**
  - **Type 1:** $80\% * 15\% * \$1,000 = 120$
  - **Type 2:** $15\% * 10\% * \$10,000 = 150$
  - **Type 3:** $5\% * 20\% * \$15,000 = 150$

  - $\$120 + \$150 + \$150 = \$420$

Adverse Selection

- Three types of people:
  - Type 1: $80\% * 15\% * \$1,000 = 120$
  - Type 2: $15\% * 10\% * \$10,000 = 150$
  - Type 3: $5\% * 20\% * \$15,000 = 150$
  - $\$120 + \$150 + \$150 = \$420$
  - Would Type 1, Type 2, and Type 3 people want this insurance, assuming they are risk neutral?

Adverse Selection

- Three types of people:
  - Type 1: $15\% * \$1,000 = \$1.5$
  - Type 2: $10\% * \$10,000 = \$1,000$
  - Type 3: $20\% * \$15,000 = \$3,000$

  - $Cost\ of\ Insurance = \$420$

  - Type 1 – No, $1.5 < $420
  - Type 2 – Yes, $1,000 > $420
  - Type 3 – Yes, $3,000 > $420

Adverse Selection

- Two types of people: Since Type 1 people have all left the market, we now have:
  - Type 1: $0\% * 15\% * \$1,000 = 0$
  - Type 2: $75\% * 10\% * \$10,000 = 750$
  - Type 3: $25\% * 20\% * \$15,000 = 750$
  - $\$750 + \$750 = \$1500$
  - We know Type 1 people are out, but would Type 2 and Type 3 people want this insurance, assuming they are risk neutral?

Adverse Selection

- **Two types of people: Since Type 1 people have all left the market, we now have:**
  - **Type 2:** $10\% * \$10,000 = \$1,000$
  - **Type 3:** $20\% * \$15,000 = \$3,000$
  - $\$750 + \$750 = \$1500$
  - **Type 1 – No**
  - **Type 2 – No, $1,000 < $1,500**
  - **Type 3 – Yes, $3,000 > $1,500**

Adverse Selection

- With the exit of Type 1 & 2 people, only Type 3 are left. This is the insurance death spiral
- This same process can occur in other markets of asymmetric information
- Take the market for used cars:
  - Commonly this problem is described as the “market for lemons”

Adverse Selection

- A good car and a bad car may be indistinguishable until after you have driven it for several miles and spent time using it
  - Assume neither a buyer or seller know which cars are good and which cars are bad
  - Value of a good car to a buyer: $V_B^G = \$5,000$
  - Value of a good car to a seller: $V_S^G = \$4,000$
  - Value of a bad car to a buyer: $V_S^B = \$2,000$
  - Value of a bad car to a seller: $V_S^B = \$1,500$
  - 2/3 of the cars are bad, 1/3 are good

Adverse Selection

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- Value of a bad car to a buyer: $V_B^B = \$2,000$
- Value of a bad car to a seller: $V_S^B = \$1,500$
- 2/3 of the cars are bad, 1/3 are good

- $Value\ to\ Sellers = \frac{2}{3} * V_S^B + \frac{1}{3} * V_S^G$
- $Value\ to\ Buyers = \frac{2}{3} * V_B^B + \frac{1}{3} * V_B^G$

Adverse Selection

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- Value of a bad car to a buyer: $V_B^B = \$2,000$
- Value of a bad car to a seller: $V_S^B = \$1,500$
- 2/3 of the cars are bad, 1/3 are good

- $Value\ to\ Sellers = \frac{2}{3} * 1,500 + \frac{1}{3} * 4,000 = \$2,333$
- $Value\ to\ Buyers = \frac{2}{3} * 2,000 + \frac{1}{3} * 5,000 = \$2,999$
- So the market clears!

Adverse Selection

- What if sellers know if the car is good or bad?
  - Value of a good car to a buyer: $V_B^G = \$5,000$
  - Value of a good car to a seller: $V_S^G = \$4,000$
  - Value of a bad car to a buyer: $V_S^B = \$2,000$
  - Value of a bad car to a seller: $V_S^B = \$1,500$

Adverse Selection

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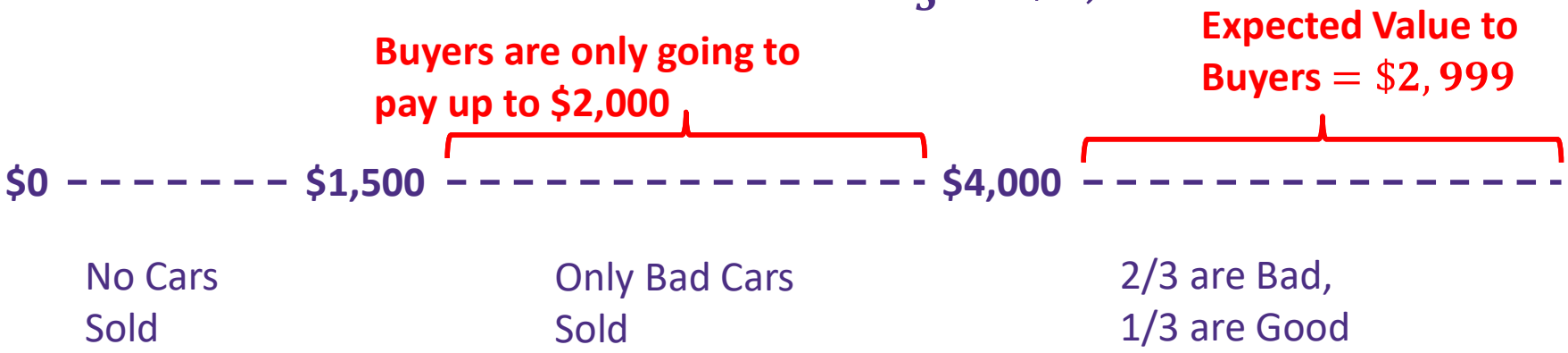

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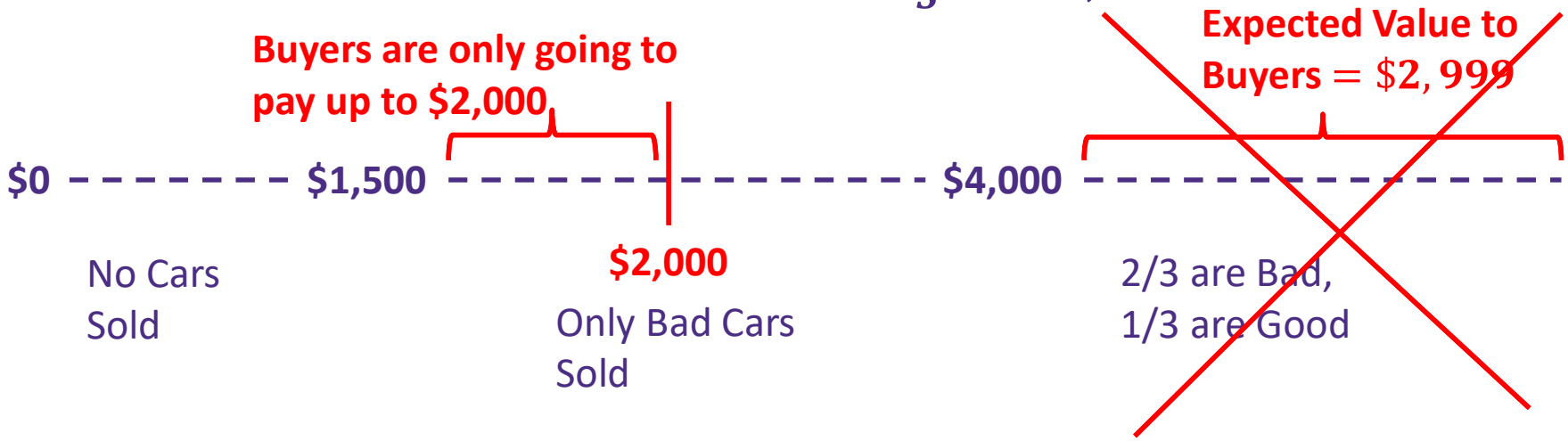

Adverse Selection

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- Value of a bad car to a buyer: $V_B^B = \$2,000$
- Value of a bad car to a seller: $V_S^B = \$1,500$
- 1/3 of the cars are bad, 2/3 are good
- Sellers know if they have a good or bad car
- Does this change anything?

Adverse Selection

- Value of a good car to a buyer: $V_B^G = \$5,000$
- Value of a good car to a seller: $V_S^G = \$4,000$
- Value of a bad car to a buyer: $V_B^B = \$2,000$
- Value of a bad car to a seller: $V_S^B = \$1,500$
- 1/3 of the cars are bad, 2/3 are good
- Sellers know if they have a good or bad car
- $Value\ to\ Sellers = \frac{1}{3} * 1,500 + \frac{2}{3} * 4,000 = \$3,166$
- $Value\ to\ Buyers = \frac{1}{3} * 2,000 + \frac{2}{3} * 5,000 = \$4,000$

Adverse Selection

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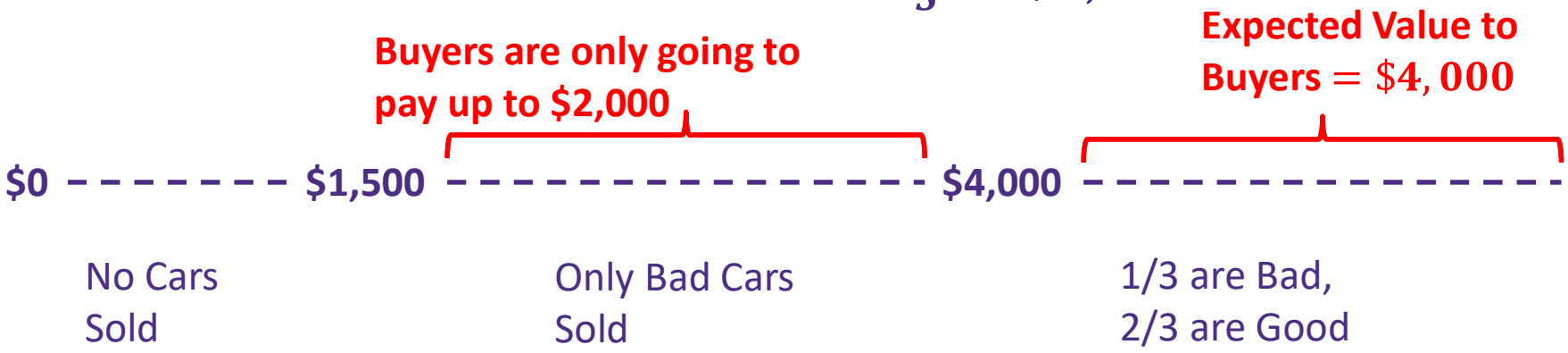

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  - Value of a bad car to a seller: $V_S^B = \$1,500$

In this case the market will clear

Adverse Selection

- What this tells us is that markets with a substantial amount of uncertainty on the quality/value of goods may fail to clear entirely
- While the bad cars manage to always get sold, none of the good used cars did when the market was saturated with low-quality used cars
- "The cost of dishonesty, therefore, lies not only in the amount by which the purchaser is cheated; the cost also must include the loss incurred from driving legitimate business out of existence" - Akerlof

Adverse Selection

- Requirements for a market of Lemons
  - Asymmetry of information, in which no buyers can accurately assess the value of a product, but sellers can
  - An incentive exists for the seller to pass off a low-quality product as a higher-quality one
  - Sellers have no credible way to prove they have a high-quality product
  - Buyers are sufficiently pessimistic about the seller's quality
  - No significant quality assurances broadly
- Practice Problem

Adverse Selection

- In small groups:
  - Pick an example and define buyer/seller valuations
    - Value of a good one to a buyer: V_B^G
    - Value of a good one to a seller: V_S^G
    - Value of a bad one to a buyer: V_B^B
    - Value of a bad one to a seller: V_S^B
  - Define the share of the market which is good/bad
  - Solve for the equilibrium when neither knows which is which
  - Solve for the market when sellers know, and buyers don't