

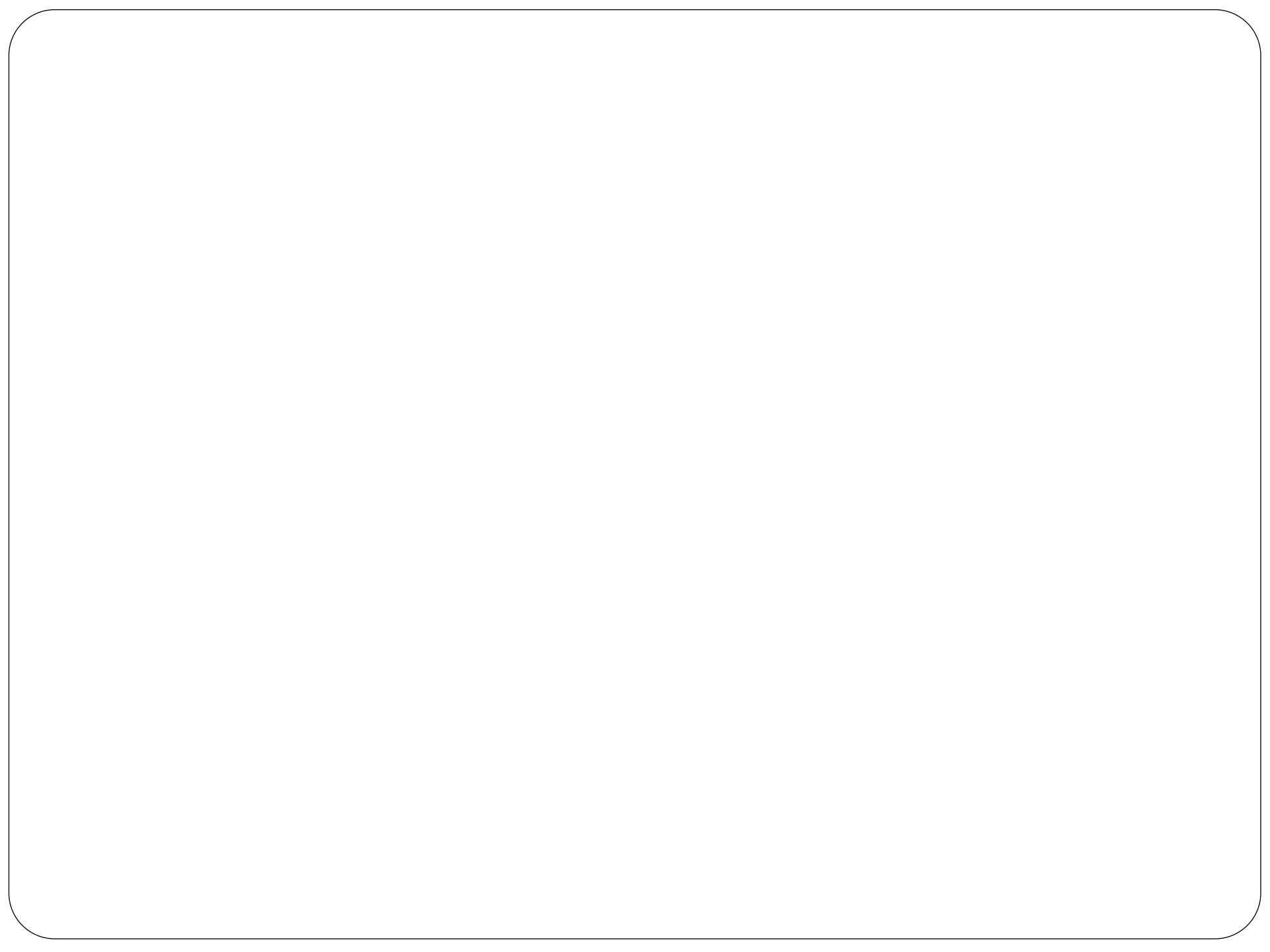
ASYMMETRIC INFORMATION

Overview

- In some markets, there is information asymmetry between buyers and sellers.
 - Information held by one party affects profitability of transaction
 - Cf. valuation of product
 - Examples include markets for insurance, second-hand goods, loans, etc.
 - Health insurance: underlying health condition
 - Auto insurance: driving skill
 - Used car: lemon or not
 - Loans: creditworthiness of the borrower

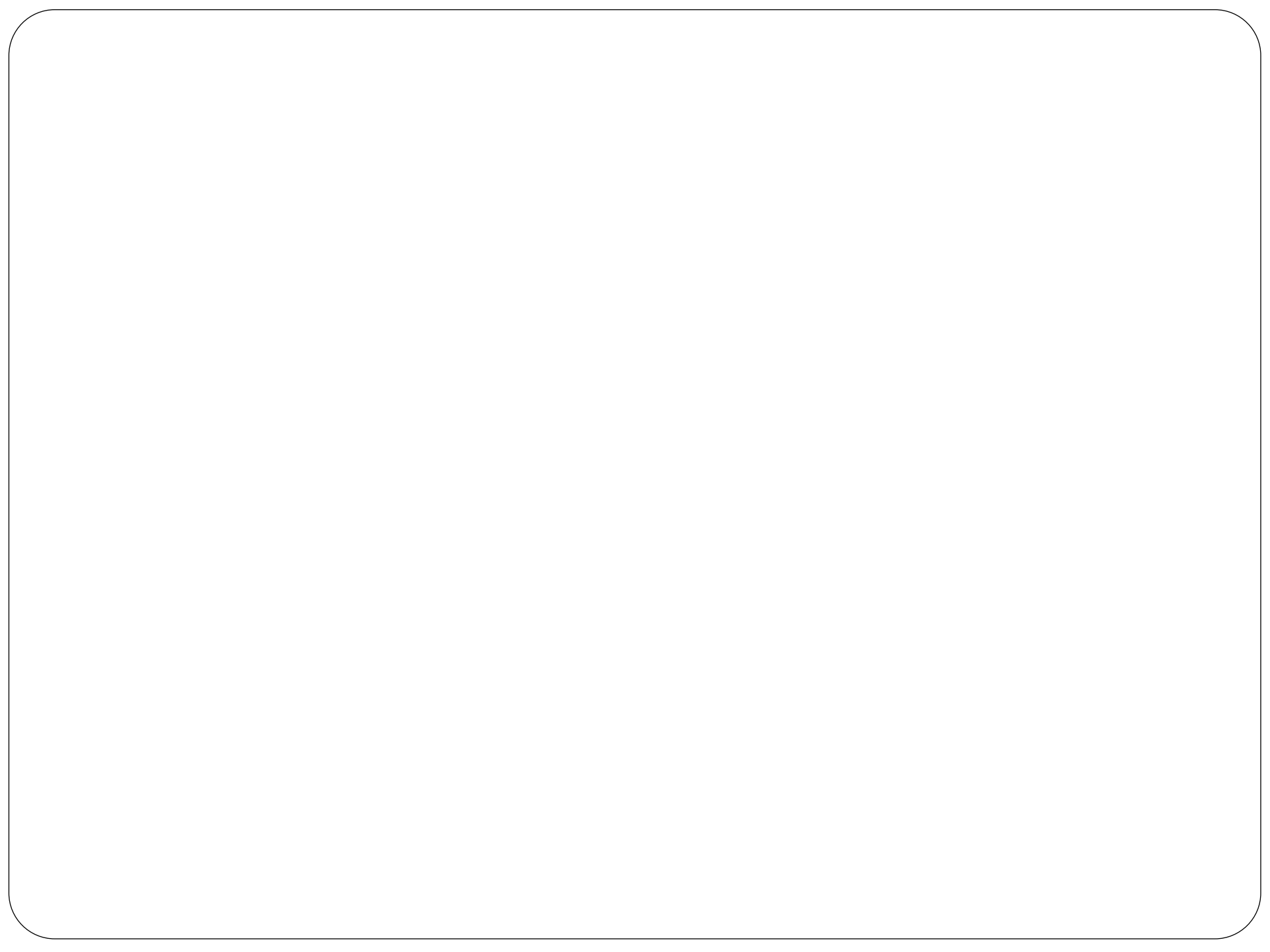
Example: Transaction of Used Cars

- As a buyer, you cannot tell a lemon (a car with many problems) from a non-lemon. Seller knows.
- Imagine you are thinking of buying a used-car from a neighbor.
 - You value a lemon at \$200 and a non-lemon at \$2,000
 - The seller values a lemon at \$100 and a non-lemon at \$1,200
 - Say, 50% of sellers have lemons. [You know this probability as well as the seller's valuation]
- You make an offer; the seller takes it or not. (No further negotiation.)
- What offer will you make?



Health Insurance

- You work for a Health Insurance Firm:
- Two types of people in the population (say 50% each)
 - Healthy person: Cost \$1000 on average, WTP \$2000.
 - Sick person: Cost \$5,000 on average, WTP \$7000.
- Insurance company cannot discriminate between healthy and sick (hence, hard to charge different prices).
- But firm knows distribution.
- What price should the firm charge?

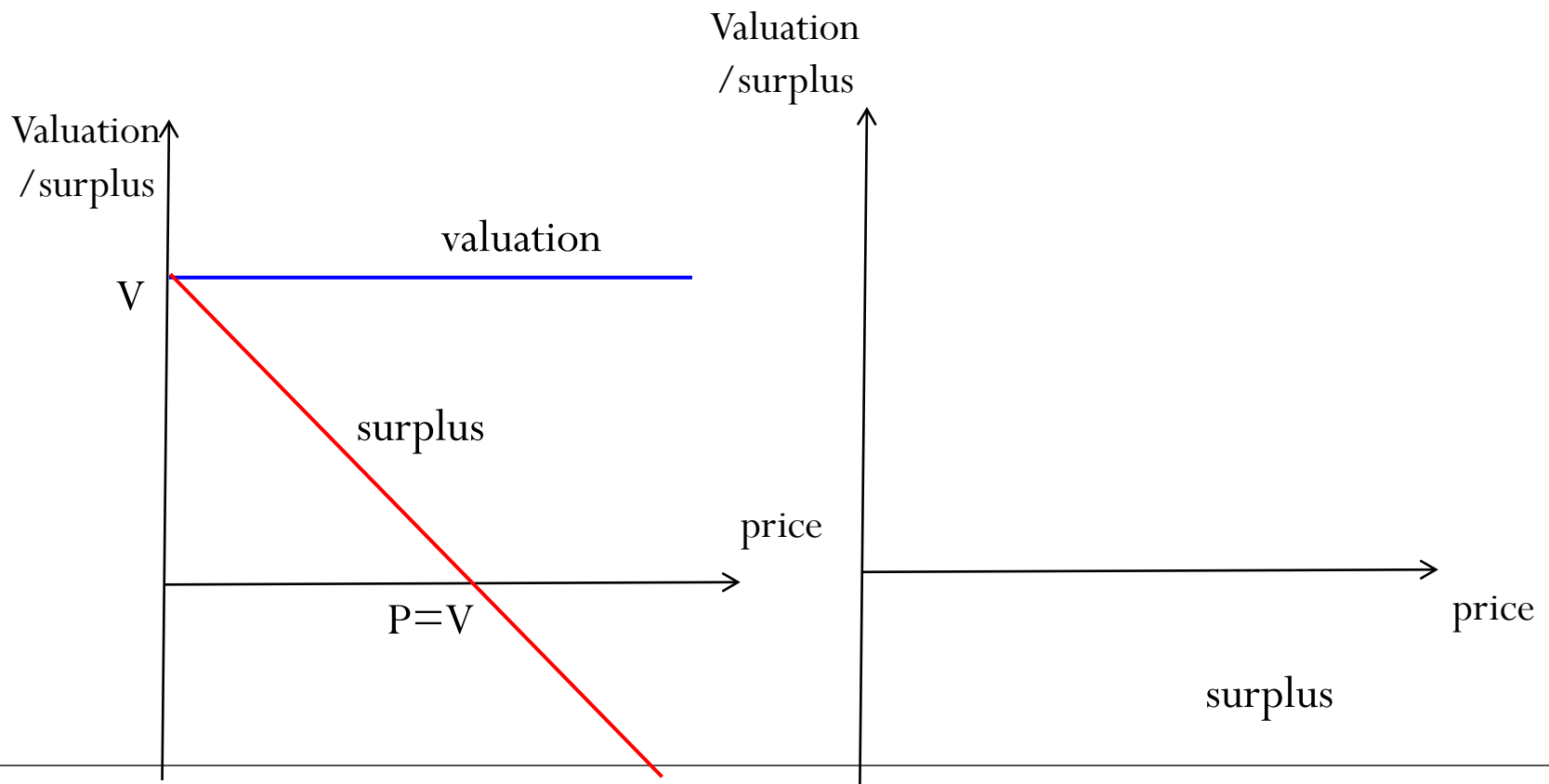


Comparison of markets with and w/o adverse selection

Relationship between valuation and price when buyer is making offer

No adverse selection

Adverse selection

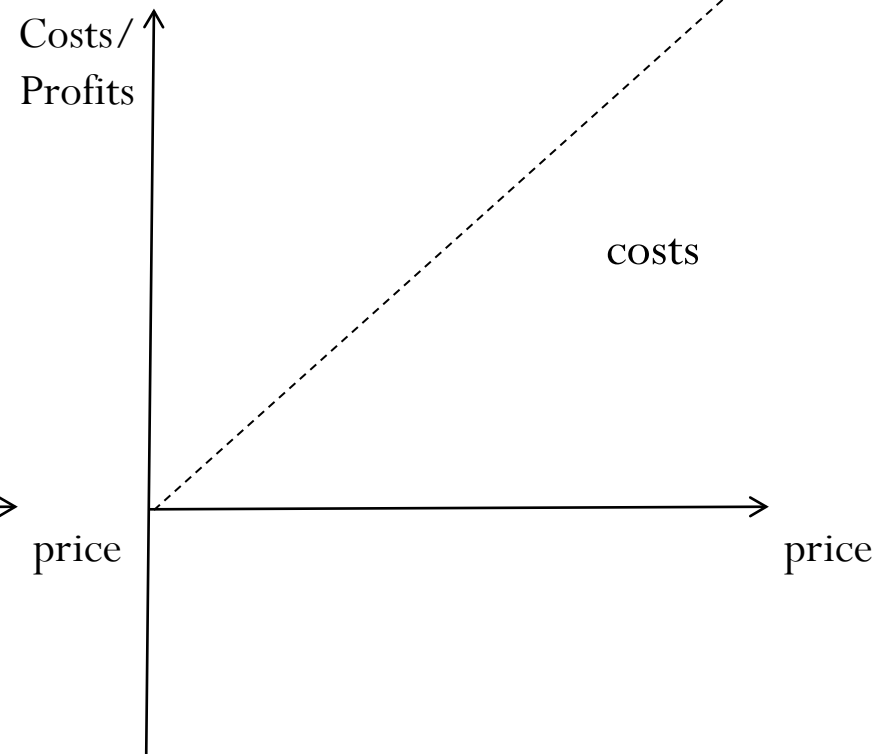
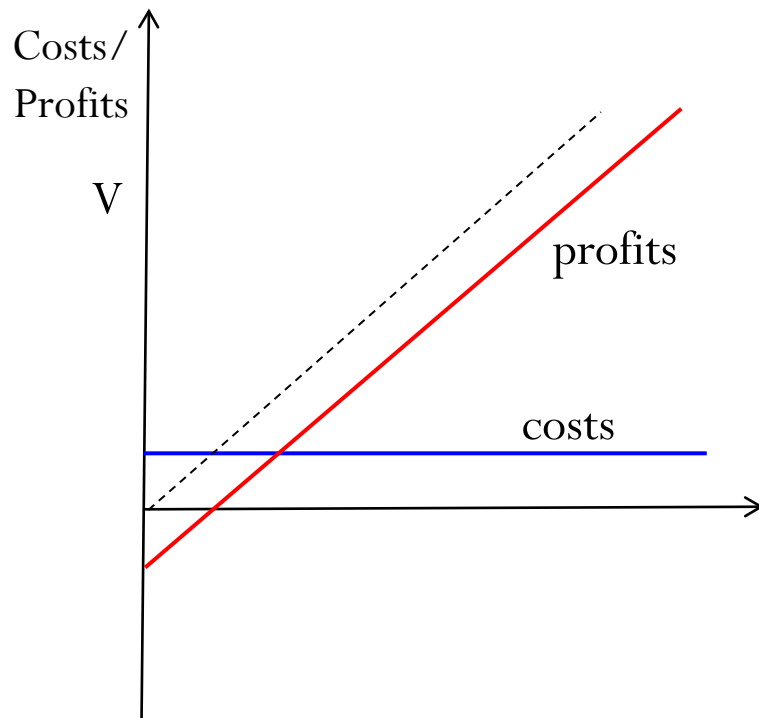


Comparison of markets with and w/o adverse selection

Relationship between costs and price when seller is making offer

No adverse selection

Adverse selection

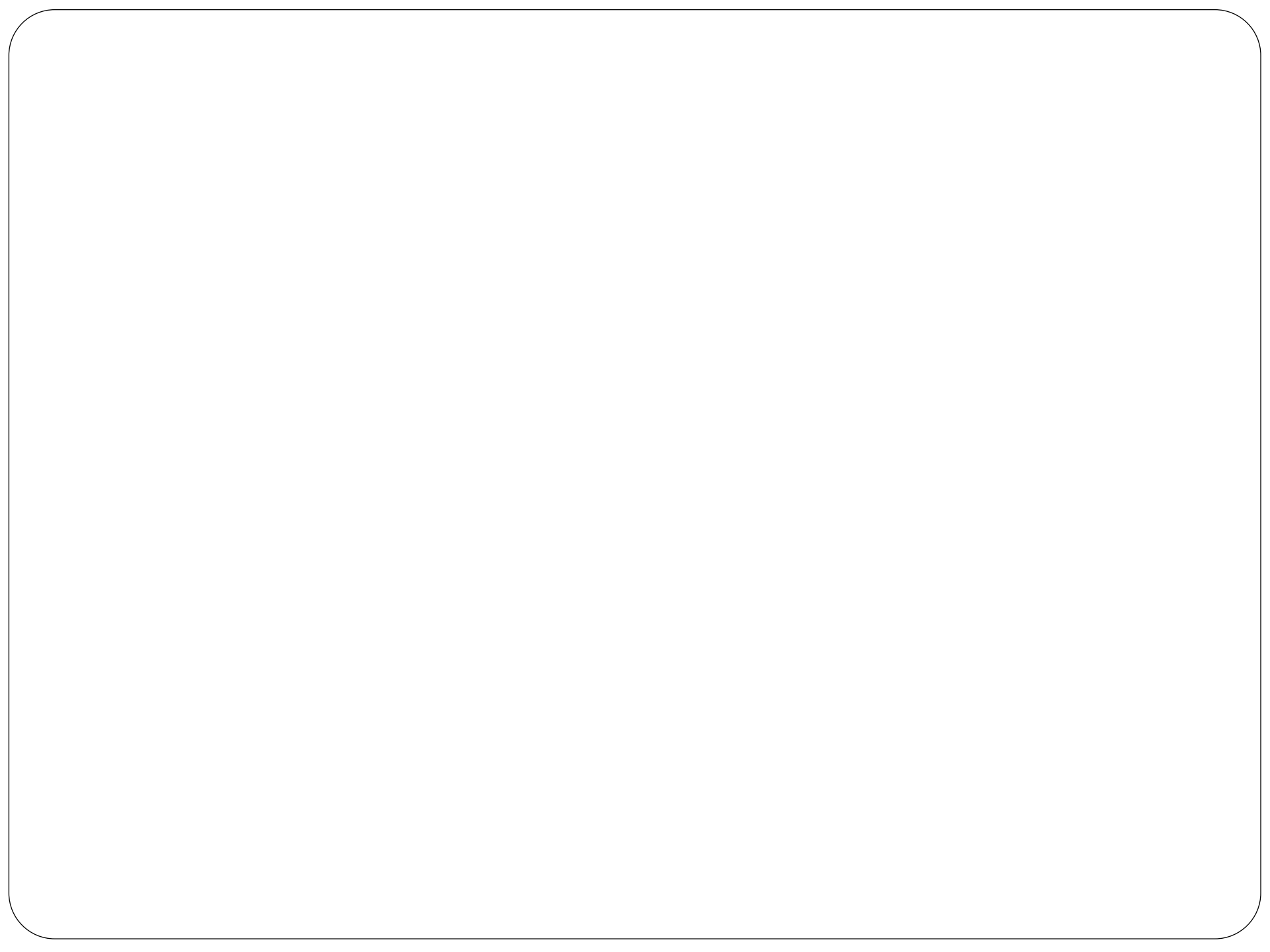


Other Examples of Adverse Selection

- Loans
 - Some borrowers are not creditworthy. With high interest rates, borrowers are more likely to be less creditworthy
- Labor market
 - Low-ability workers more likely to accept an offer
- General point: low-quality items tend to drive high-quality ones out of the market!

Loan Shark

- You are a loan officer at a payday loan.
 - Potential borrower is either high-risk or low-risk with 50% probability.
 - Low risk – repay for sure. Willing to borrow up to 10% interest.
 - High risk – repay with 70%. Willing to borrow up to 45%.
 - You don't know the type of the potential borrower.
 - What rate should you charge?

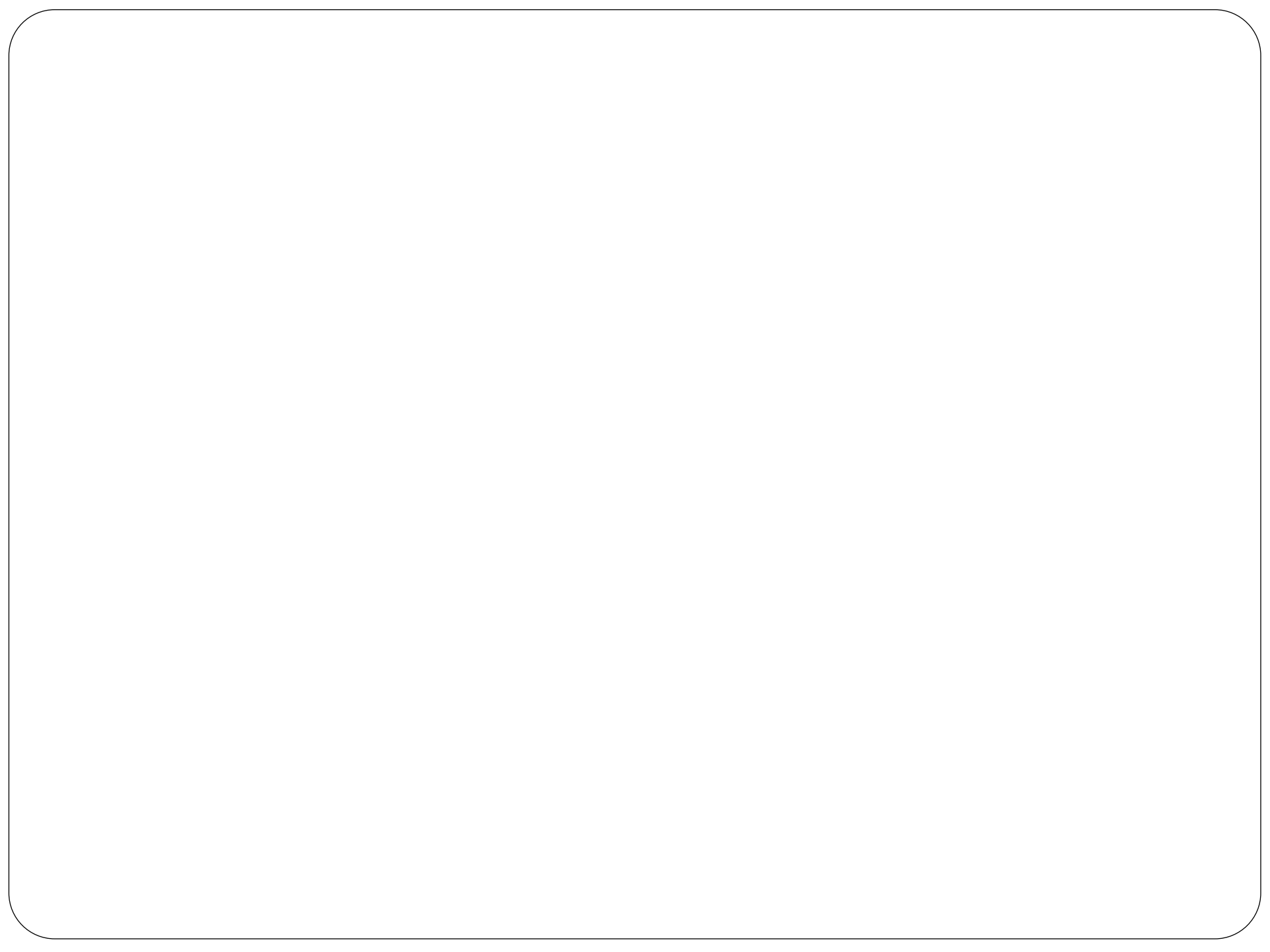


Loan Shark

- If you charge 10%...
 - With 50%, you lend to low risk, with **10% return**
 - With 50%, you lend to high risk, with **-23% return.**
[With 70% you make 10% return, with 30%, you make -100% return: $0.7 \times 10\% + 0.3 \times -100\% = -23\%$]
- On average, you lose money.
- If you charge 45%...
 - With 70%, you make 45% return, with 30%, you make -100% return: $0.7 \times 45\% + 0.3 \times -100\% = 1.5\%$
 - You make money.... But only serving the high risk.
[depending on the numbers, it may make sense to only serve everybody at 10%. Note that profits decrease a lot when going from 10% to 11% - credit rationing]

Hiring a worker

- You work at an HR department at a tech firm.
 - Worker is either high-skilled or low-skilled with 50% probability
 - High skilled – produces output worth \$1000/hour
 - Has good outside option. Willing to work at pay of \$600/hour or more.
 - Low skilled – produces output worth \$100/hour.
 - Has little outside option. Willing to work at pay of \$150/hour or more.
 - You don't know whether a potential worker is high or low skilled, but you know the market conditions.
 - What wage should you offer?



Hiring a worker

- Consider the profitability of wage = \$600
 - With 50% probability, we get a high-skilled worker, \$400 profitability/hour
 - With 50% probability, we get a low-skilled worker, -\$500 profitability/hour.
 - On net, negative profits.
 - Cannot hire any worker.

Some Solutions

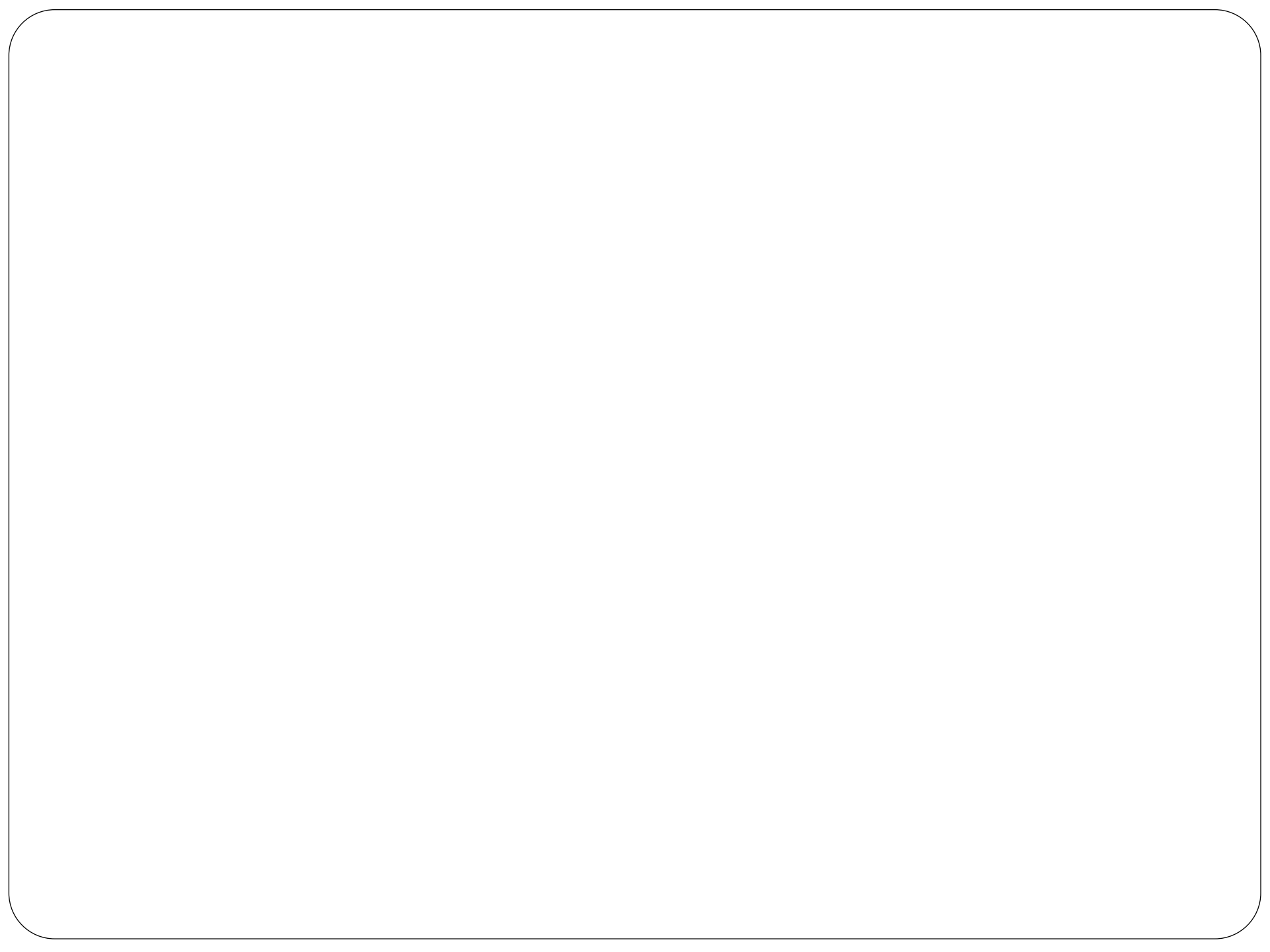
- Simple direct way:
 - Used car buyers ask that the car be checked by auto mechanic
 - Insurance companies ask for medical tests
- Indirect way: use menu of contracts to segment customers (*Screening*:)
 - E.g., in the health insurance case, low premium with low coverage, together with high premium with high coverage
 - Like “versioning” in advanced pricing

Recall: Health Insurance

- You work for a Health Insurance Firm:
- Two types of people in the population (say 50% each)
 - Healthy person: Cost \$1000 on average, WTP \$2000.
 - Sick person: Cost \$5,000 on average, WTP \$7000.
- Insurance company cannot discriminate between healthy and sick (hence, hard to charge different prices).
- But firm knows distribution.
- What price should the firm charge?
 - \$7,000.
 - Note that insurance company do not sell to healthy person although WTP (\$2000) > Cost (\$1000)
 - Profits: \$1000N (N is # of pop)

Recall: Health Insurance

- You work for a Health Insurance Firm:
- Two types of people in the population (say 50% each)
 - Healthy person: Cost \$1000 on average, WTP \$2000.
 - Sick person: Cost \$5,000 on average, WTP \$7000.
- Imagine introducing a more restricted plan (HMO, say)
 - Healthy person: Cost \$1000 on average, WTP \$2000.
 - Sick person: Cost \$5,000 on average, WTP \$2500.
- Find optimal prices for regular insurance and the restricted insurance such that healthy buys HMO and sick buys regular.



- Let p^R be the price for regular insurance, p^{HMO} be the price for HMO.
 - Sick buys regular means

$$WTP_S^R - p^R \geq 0$$
 (Willing to buy regular insurance) and

$$WTP_S^R - p^R \geq WTP_S^{HMO} - p^{HMO}$$
 (regular insurance is better than HMO)
 - This means,

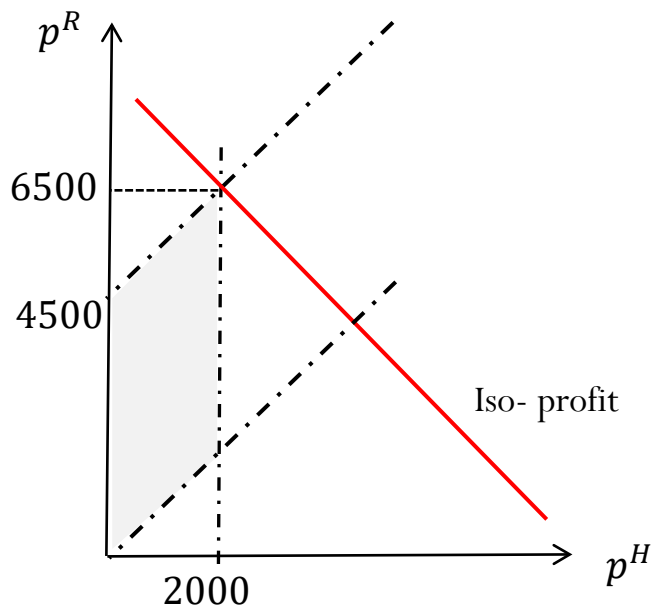
$$p^R \leq 7000$$
 and

$$7000 - p^R \geq 2500 - p^{HMO}, \text{ or } p^R \leq p^{HMO} + 4500$$
 - Healthy buys HMO means

$$WTP_H^{HMO} - p^{HMO} \geq 0, \text{ or } p^{HMO} \leq 2000$$
 and

$$WTP_H^{HMO} - p^{HMO} \geq WTP_H^R - p^R \text{ or } p^{HMO} \leq p^R$$

- Profit for the firm is $0.5N(p^R - 5000) + 0.5N(p^H - 1000)$
 $= 0.5N(p^R + p^H) - 3000N$



- Set $p^H = 2000, p^R = 6500$.
- Profit is $1250N (> 1000N)$

Modified: Hiring a worker

- You work at an HR department at a tech firm.
 - Worker is either high-skilled or low-skilled with 50% probability
 - High skilled – produces output worth \$1000/hour
 - Has good outside option Willing to work at pay of \$600/hour or more.
 - Low skilled – produces output worth \$200/hour.
 - Has little outside option. Willing to work at pay of \$150/hour or more.
- What is the optimal wage?
- Consider a menu that combines revenue sharing and wage:
 - Contract 1. Pays 60% of your output
 - Contract 2. flat wage of \$150

Some solutions (cont'd)

Signaling: the *informed* party takes actions to credibly reveal his private information

- Examples:
 - Warranty
 - Education
 - Advertising
- Conditions for effective signaling:
 - Signal is costly
 - *Signal is less costly (or more profitable) for a higher-quality seller*

Modified Example: Transaction of Used Cars

- As a buyer, you cannot tell a lemon (a car with many problems) from a non-lemon. Seller knows.
- Imagine you are thinking of buying a used-car from a used-car dealer.
 - You value a car at \$15,000 minus total maintenance costs.
 - The maintenance cost of a lemon is \$18,000 and a non-lemon is \$0.
 - You are better off not buying at all than getting a lemon.
 - Say, 50% of sellers have lemons. [You know this probability as well as the seller's valuation]
- The seller is willing to sell a non-lemon at \$12,000.
- The seller is willing to sell a lemon at \$500 (=scrap value).
- What offer will you make?

Modified Example: Transaction of Used Cars

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 - Say, 50% of sellers have lemons. [You know this probability as well as the seller's valuation]
- The seller is willing to sell a non-lemon at \$12,000.
- The seller is willing to sell a lemon at \$500 (=scrap value).
- If the seller has a non-lemon, can the seller give a warranty that would enable her to sell the car?

Discussion: Sales of Shearson

- In 1993, American Express sold Shearson to Primerica (now part of Citigroup)

“Among the sticking points in acquiring Shearson’s brokerage operations would be the firm’s litigation costs. More than most brokerage firms, Shearson has been socked with big legal claims by investors who say they were mistreated, . . . In 1992’s fourth quarter alone, Shearson took reserves of \$90 million before taxes for ‘additional legal provisions.’”
(Wall Street Journal: March 9, 1993)

- How would this affect negotiations? What resolutions come to mind?

Practice: Sale of Business

- Suppose seller's valuation is \$200m (net of legal costs).
- Suppose that buyer's valuation is \$210m (net of legal costs).
- Legal liability is either \$10m, \$20m, \$30m, ..., or \$100m, each with equal probability
- The seller knows the exact value, but the buyer only knows the distribution
- Buyer must make take-it-or-leave-it offer of some price p
- How much should the buyer offer?

Sale of Business ...

Offer	Probability of Acceptance	Expected value (to buyer) if accepted	Expected profit
100	10%	110	1.0
110	20%	115	1.0
120	30%	120	0
130	40%	125	-2.0
140	50%	130	-5.0
150	60%	135	-9.0
160	70%	140	-14.0
170	80%	140	-20.0
180	90%	150	-27.0
190	100%	155	-35.0

p=100: Seller accepts only if legal cost is 100m (=value of 100m)

p=110: Seller accepts only if legal cost is 100m or 90 (=value of 100 or 110)

....

Intuition=adverse selection: seller will only sell the unit if its value is lower than the offered price

Summary

- Asymmetric information prevails in the market
 - When people have superior information, expect them to use it to their advantage
 - Asymmetric information can lead to low market efficiency
- Moral hazard or agency problem: imperfectly monitored agents may take undesirable actions
- Possible remedies: better monitoring; incentive scheme; repeated interaction ...
- Adverse selection or lemon problem:
 - Low-quality products may flood the market, and beneficial transactions blocked
- Possible remedies: screening; signaling ...