Lecture 7

Games with Private Information

Lecture Outline

- Two main types of private information: knowledge (information about type) and intent (information about action).
- We focus on the first
- When does private information matter?
- Screening versus signalling
- Separating versus pooling
- Semi-separating?

Two Main Types of Information

- In strategic situations, players may have two different sorts of information.
- In one case, a player may know something about the environment that the other player may care about but does not know
  - A health insurance client might know about a genetic risk factor
  - A seller of a car might know if it is a lemon
  - A potential draft candidate might know about the true severity of an injury
- These situations are often referred to as "adverse selection"

Two Main Types of Information

- In the other case, a player may take an action that the rival cares about but cannot observe
  - An employee might show up at work but spend most of the day surfing the web.
  - A financial consultant might pretend to give honest advice but really persuade a client to adopt behavior that generates high brokerage fees.
  - following a big contract, a promising young quarterback might carelessly ride a motorbike and break his jaw.
- These are often referred to as situations of moral hazard.
- We will postpone discussion of these situations to later.

Health Insurance

- Before the Affordable Care Act, approximately 41 million Americans have no health insurance. (it is now about 32 million, Henry Kaiser Foundation)

- Many of these were relatively young and therefore, generally healthy

- Despite this, if an uninsured 30 year-old attempted to buy health insurance in the private insurance market, he would likely pay far more than I (pushing ??) would have to pay
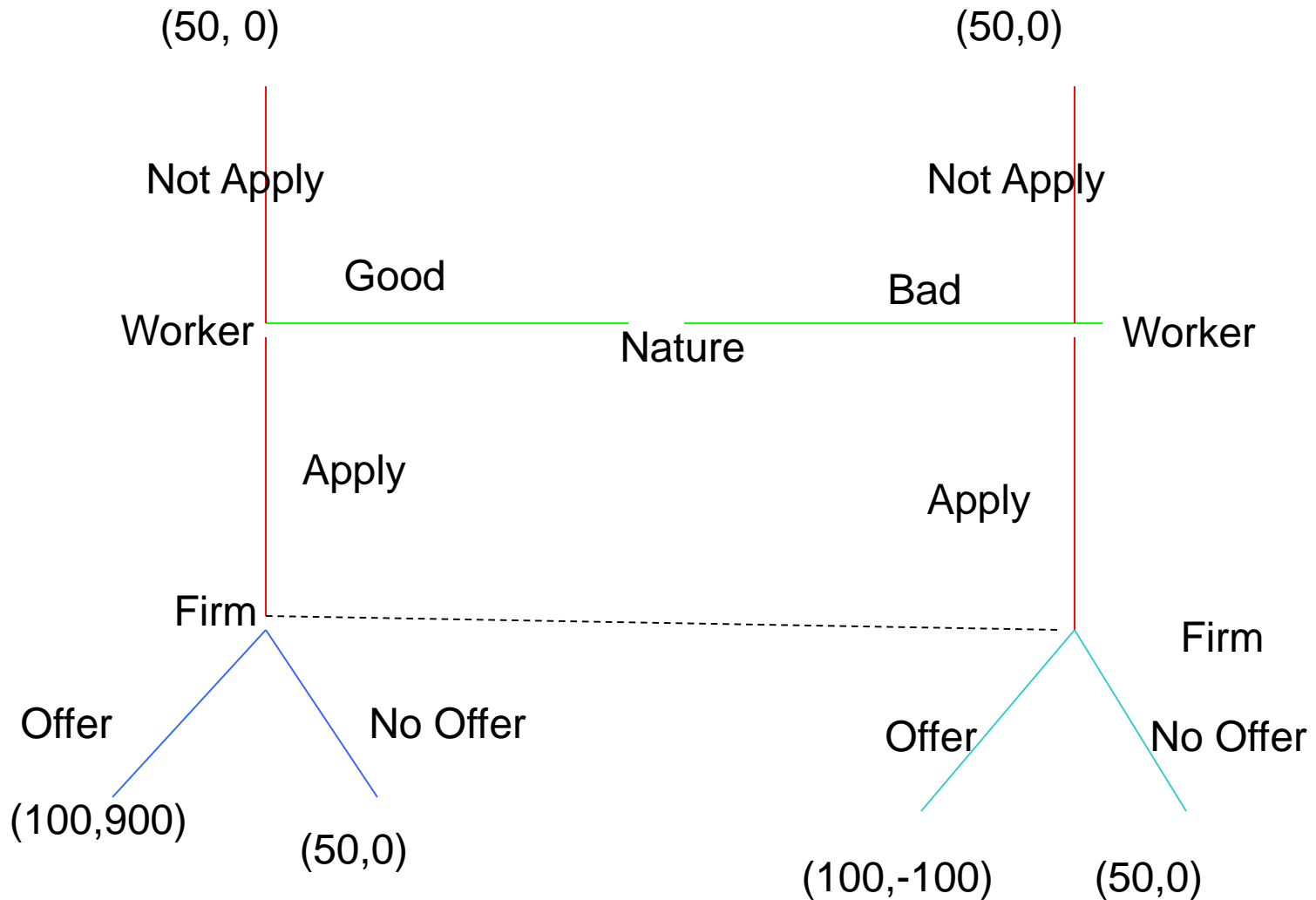
- Why?

Reasons/Issues

- Work insurance bundles pay and premia

- Tax breaks

- Pooling risk

- Adverse selection

- http://www.youtube.com/watch?v=cYcsFyim_Cs

- Swingers 2:39 3:51

Private Information Can Destroy a Market

- Suppose an owner of a firm would like to hire a manager who, if she is good, can make $1M for the firm.

- Unfortunately, there are good managers and bad managers in the world.

- Managers can always get a non-management job that pays $50,000.

- If the hire is a bad manager, the firm cannot make any money.

- The firm must pay $100,000 for a manager.

- But they look the same to the owner. What might happen?

A Picture

(50, 0)   (50,0)

Not Apply   Not Apply

                  Good   Bad
Worker ————————————   ———————————— Worker
                          Nature

Apply   Apply

Firm ┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄┄
                                                    Firm

Offer   No Offer   Offer   No Offer

(100,900)   (50,0)   (100,-100)   (50,0)

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How to Read the Diagram

- "Nature" moves first and with probability *p* she makes a good manager and with probability *1-p* she makes a bad manager.

- The worker knows if she is good or bad and chooses whether to apply for the manager job (down)

- The dashed line indicates that the firm does not know if the applicant is good or bad but must decide whether to offer the job or not.

What Should The Firm Do?

- We could try back to front reasoning but it is a bit hard to figure out what the firm should do.

- The firm's best choice depends on how likely it thinks it has a good applicant.

- Suppose a=Probability Applicant is Good.

- Then a=1, means only good applicants apply and the firm earns $900,000!

- But for other a, the firm gets a*900K-(1-a)*100K=a*1M-100k

- if a<.1 (10%), the firm loses money.

What Should the Worker Do?

- Notice that we can subdivide this question into "what should the Good Worker do?" And "What should the Bad Worker Do?"

- In each case, the worker has a dominant strategy: That is, Apply. Worse thing that can happen is you don't get the job.
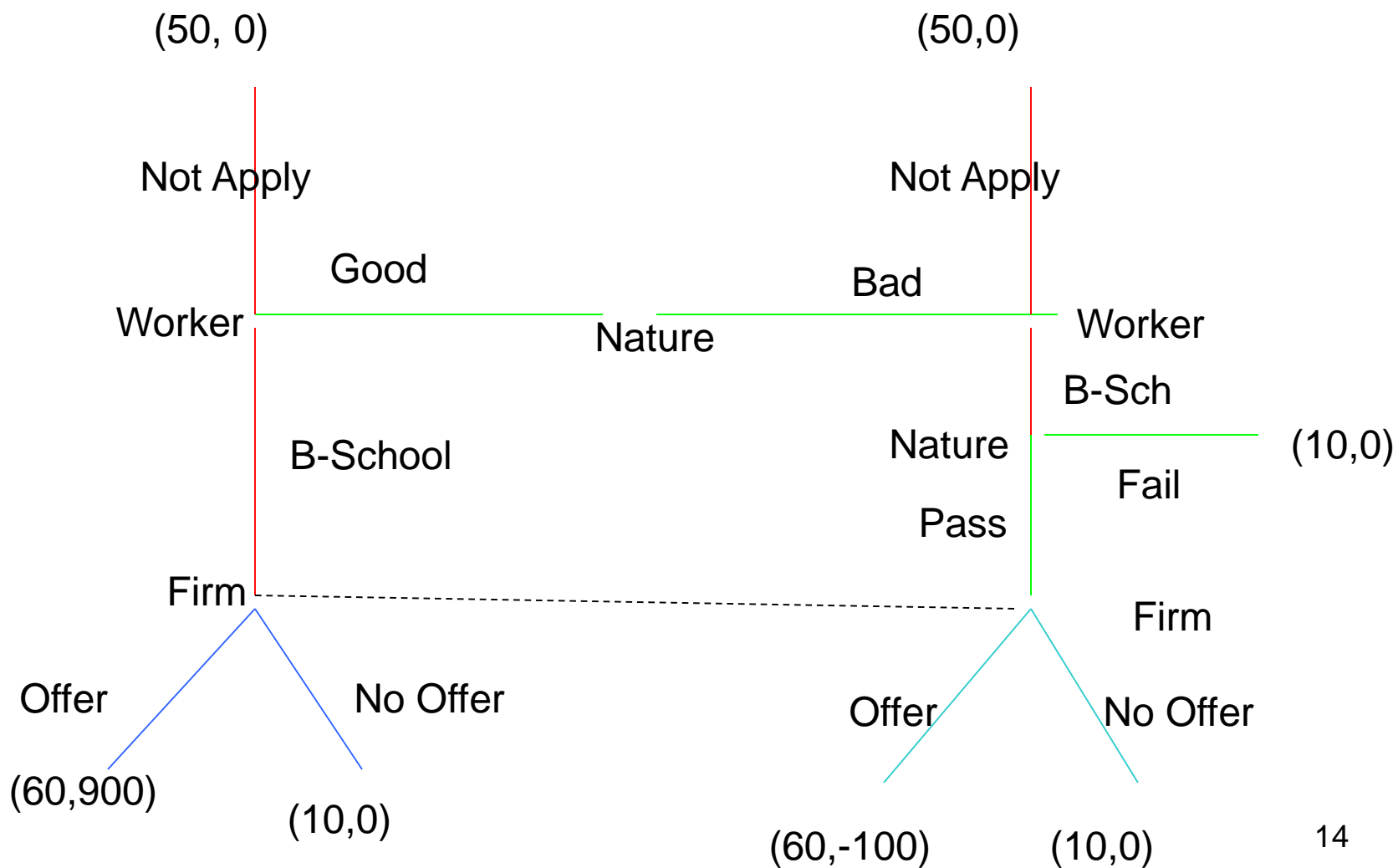
What Should the Firm Believe?

- If the firm was very optimistic, it would believe a=1 and then hire the applicant.

- But is this sensible since we argued that both bad and good workers will apply?

- Suppose Nature makes a good worker 5% of the time. Then the firm would lose money.

- Eventually, the firm should believe a=.05 and never hire an applicant.

- The firm never gets a good manager.

Screening and Signaling.

- Suppose that the worker before applying can choose to go to B-School (cost of $200K or $40K per year over five years)

- A good worker always passes. A bad worker fails B-School 50% of the time.

- Suppose the firm will never hire a manager without an MBA

- The game now changes:

A Picture

(50, 0)   (50,0)

Not Apply   Not Apply

Worker   Good   Bad   Worker
                              Nature
                                                 B-Sch

B-School   Nature   (10,0)
                                            Fail
                                   Pass

Firm -- Firm

Offer   No Offer   Offer   No Offer

(60,900)   (60,-100)   (10,0)
         (10,0)

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Worker Choices Now

- Consider first the choice of a worker who knows she is a bad manager.

- If she goes to B-School, even if the firm always hires someone with an MBA, she will only get a 50-50 chance at the high salary.

- So, B-School gives on average .5*(100-40)K+.5*(50-40)K=$35K

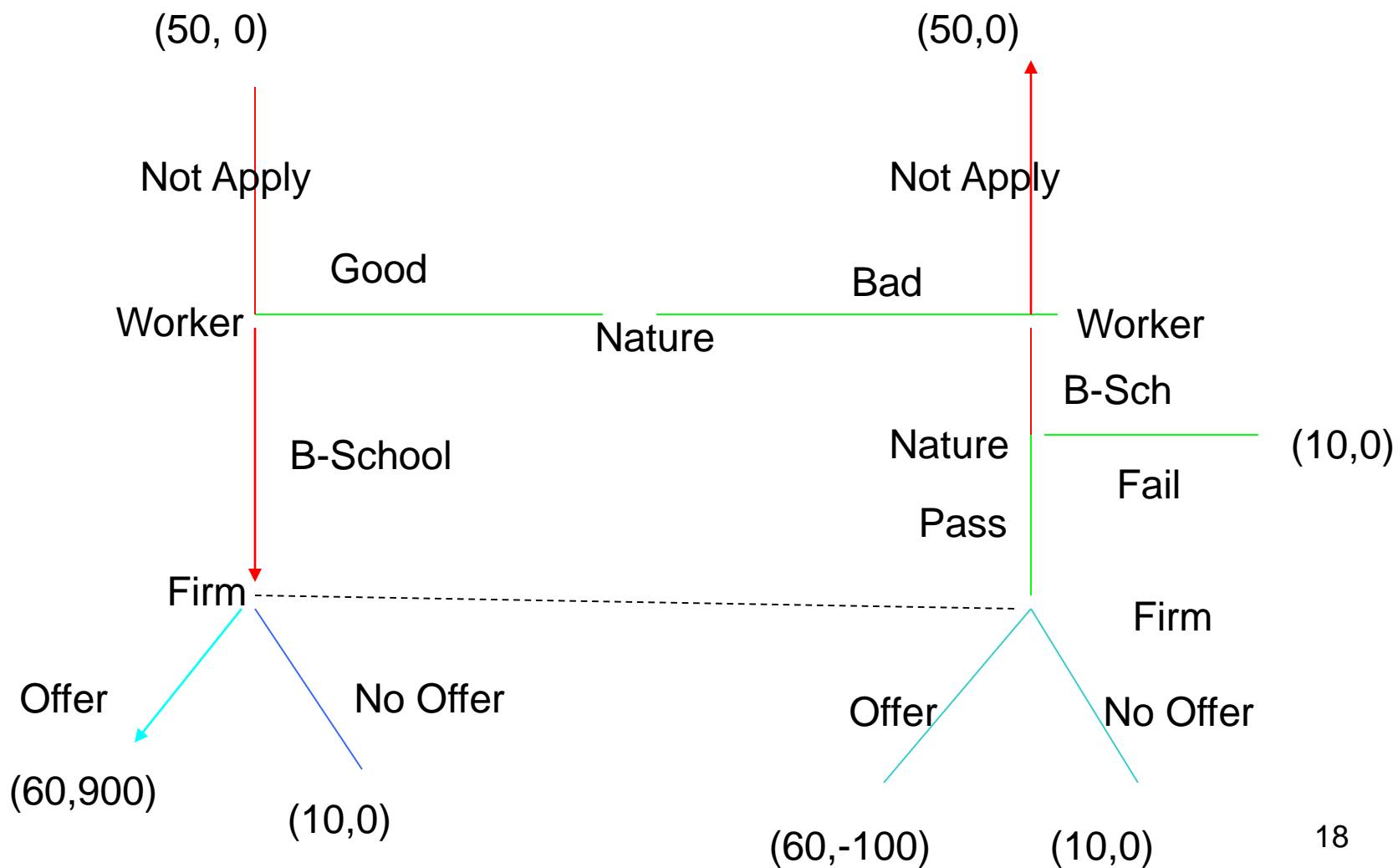- this is worse than $50K

Worker Choices Now

- Consider next the choice of a worker who knows she is a Good manager.

- If she goes to B-School, even if the firm always hires someone with an MBA, she will only get a 100% chance at the high salary.

- So, B-School gives on average (100-40)K=$60K

- this is better than $50K

Firm Beliefs and Behavior

- Now, does it make sense for the firm to believe that when a worker comes with an MBA, there is only a 5% chance she is a good manager?

- If Bad Workers never go to B-School, then everyone who applies with an MBA should be a Good worker. (that is, *a=1)*

- Now, it makes sense for the firm to hire.

A Picture

(50, 0)   (50,0)

Not Apply   Not Apply

Good   Bad

Worker   Nature   Worker

B-Sch

B-School   Nature   (10,0)

Fail

Pass

Firm   Firm

Offer   No Offer   Offer   No Offer

(60,900)   (60,-100)   (10,0)

      (10,0)

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Pooling

- https://www.youtube.com/watch?v=tu-QjTNtDz8&index=3&list=PLF27F8E1793C1BE7D

- 2:39 3:51

- (Swingers)

Discussion– Pooling and Separating

- Without the B-School option, workers "pool" their behavior. That is, both good and bad managers apply.
- Since they both apply, it makes sense for the firm to expect the same probability of a good worker as Nature selected (eg. 5%)
- But with the B-School Option, workers "separate" in terms of behavior.
  - Good workers *separate* by going to B-School
- Since only Good Workers go to B-School, it makes sense for the Firm to believe workers with MBAs are Good.

Screening and Signaling

- The MBA requirement is a "screen" that the firm can use to filter the Good from the Bad.

- Workers "signal" their type by going to B-School

- What would happen if both Good and Bad workers pass B-School for sure?

- To be an effective screen, it must be the case that it is valuable for one type to choose the behavior and not valuable for the other type.

Screening and Signaling Examples

- Low risk insurance clients "signal" their low risk by choosing policies with high deductibles (health insurance and car insurance for example)

- Athletes signal their high ability by accepting low base salary with high performance bonuses

- New firms signal their high quality by offering very generous warranties.

Damaged Goods

- Suppose IBM would like to sell a new 10 ppm laser printer

- There are two types of consumers, high value who would pay $400 and low value who would pay $200

- If IBM wanted to sell to both types, it would seem to have to offer the printer at a price of $200.

Damaged Goods

- Suppose High Value consumers are also impatient. They want their printer to print fast – they would pay $100 more for a 10 ppm printer than a 5 ppm printer.
- Low value consumers do not care very much. They would only pay $5 more.
- What if IBM offers two versions. One that prints at 10 ppm and the other which has a chip that slows down printing to 5 ppm.
- What prices can it get for the two versions of printers.