Economics 101A
(Lecture 26)

Stefano DellaVigna

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Outline

1. Hidden Action (Moral Hazard) II
2. Hidden Type (Adverse Selection)
3. Empirical Economics: Intro
4. Empirical Economics: Retirement Savings
5. Some Advice
6. Course Evaluation

1 Hidden Action (Moral Hazard) II

- Back to Principal-Agent problem

- Solve problem in three Steps, starting from last stage (backward induction)
  - **Step 1** *(Effort Decision)*. Given contract $w(y)$, what effort e^* is agent going to put in?
  - **Step 2.** *(Individual Rationality)* Given contract $w(y)$ and anticipating to put in effort e^*, does agent accept the contract?
  - **Step 3.** *(Profit Maximization)* Anticipating that the effort of the agent e^* (and the acceptance of the contract) will depend on the contract, what contract $w(y)$ does principal choose to maximize profits?

- **Step 1.** Solve effort maximization of agent:

$$Max_e a + be - \frac{\gamma}{2} b^2 \sigma^2 - c(e)$$

- Solution:

$$c'(e) = b$$

- If assume $c(e) = ce^2/2$ –> $e^* = b/c$

- Check comparative statics

  - With respect to b –> What happens with more pay-for-performance?

  - With respect to c –> What happens with higher cost of effort?

- **Step 2.** Agent needs to be willing to work for principal

- *Individual rationality* condition:

$$EU\left(w\left(e^{*}\right)\right)-c\left(e^{*}\right)\geq 0$$

- Substitute in the solution for e^{*} and obtain

$$a+be^{*}-\frac{\gamma}{2}b^{2}\sigma^{2}-c\left(e^{*}\right)\geq 0$$

- Will be satisfied with equality: $a^{*}=-be^{*}+\frac{\gamma}{2}b^{2}\sigma^{2}+c\left(e^{*}\right)$

- **Step 3**: Owner maximizes expected profits

$$\max_{a,b} E[\pi] = e - E[w(y)] = e - a - be$$

- Substitute in the two constraints: $c'(e) = b$ (Step 1) and $a^* = -be^* + \frac{\gamma}{2}b^2\sigma^2 + c(e^*)$ (Step 2)

- Obtain

$$\begin{aligned} E[\pi] &= e - \left(-be + \frac{\gamma}{2}b^2\sigma^2 + c(e)\right) - c'(e)\,e \\ &= e + be - \frac{\gamma}{2}b^2\sigma^2 - c(e^*) - c'(e)\,e \\ &= e + c'(e)\,e - \frac{\gamma}{2}\left(c'(e)\right)^2\sigma^2 - c(e^*) - c'(e)\,e \\ &= e - \frac{\gamma}{2}\left(c'(e)\right)^2\sigma^2 - c(e^*) \end{aligned}$$

- Profit maximization yields f.o.c.

$$1 - \gamma c'(e)\,\sigma^2 c''(e) - c'(e) = 0$$

and hence

$$c'(e^*) = \frac{1}{1 + \gamma\sigma^2 c''(e^*)}$$

- Notice: This implies $c'(e^*) < 1$

- Substitute $c(e) = ce^2/2$ to get

$$e^* = \frac{1}{c}\frac{1}{1 + \gamma\sigma^2 c}$$

- Comparative Statics:
  - Higher risk aversion γ –>...
  - Higher variance of output σ –>...
  - Higher effort cost c –>...

- Also, remember $b^* = c'(e^*) = ce^*$ and hence

$$b^* = ce^* = c\frac{1}{c}\frac{1}{1+\gamma\sigma^2 c} = \frac{1}{1+\gamma\sigma^2 c}$$

- Notice $0 < b^* < 1$:
  - Agent gets paid increasing function of output to incentivize
  - Does not get paid one-on-one ($b = 1$) because that would pass on too much risk to agent
  - (Remember $w^* = a^* + b^* y = a^* + b^* e + b^* \varepsilon$)
  - Comparative Statics: what happens to b^* if $\gamma = 0$ or $\sigma = 0$? Interpret

- Consider solution when effort is observable

- This is so-called **first best** since it eliminates the uncertainty involved in connecting pay to performance (as opposed to effort)

  - Principal offers a flat wage $w = a$ as long as agent works e^*

  - Agent accepts job if

$$a - c(e^*) \geq 0$$

  - Principal wants to pay minimal necessary and hence sets $a^* = c(e^*)$

  - Substitute into profit of principal

$$\max_{a,b} E[\pi] = e - E[w(y)] = e - a^* = e - c(e)$$

  - Solution for e^*: $c'(e^*) = 1$ or

$$e^*_{FB} = 1/c$$

- Compare e^* above and e^*_{FB} in first best

- –> With observable effort (first best) agent works harder

- Summary of hidden-action solution with risk-averse agent:

- **Risk-incentive trade-off:**
  - Agent needs to be incentivized ($b^* > 0$) or will not put in effort e
  - Cannot give too much incentive (b^* too high) because of risk-aversion
  - Trade-off solved if
    * Action e observable OR
    * No risk aversion ($\gamma = 0$) OR
    * No noise in outcome ($\sigma^2 = 0$)
  - Otherwise, effort e^* in equilibrium is sub-optimal

- Same trade-off applies to other cases

- Example 2: *Insurance* (Not fully solved)
  - Two states of the world: Loss and No Loss
  - Probability of Loss is $\pi(e)$, with $\pi'(e) < 0$
    - Example: Careful driving (Car Insurance)
    - Example: Maintaining your house better (House insurance)
    - Agent chooses quantity of insurance α purchased
  - Agent risk averse: $U(c)$ with $U' > 0$ and $U'' < 0$

- Qualitative solution:
  - No hidden action –> Full insurance: $\alpha^* = L$
  - Hidden action –>
    - Trade-off risk-incentives –> Only Partial insurance $0 < \alpha^* < L$
    - Need to make agent partially responsible for accident to incentivize
    - Do not want to make too responsible because of risk-aversion

2 Hidden Type (Adverse Selection)

- Nicholson, Ch. 18, pp. 671-672

- First type of asymmetric information problems: Hidden Action (Moral Hazard)
  - Manager can shirk when she is supposed to work hard.

- Second type of asymmetric information problems: Hidden Type (Adverse Selection)
  - Informational problem: one party knows more than the other party.
  - Example: finding a good mechanic. (Most people don't have any idea if they are being told the truth. People can shop around, but this has considerable cost. Because of this, mechanics can sometimes inflate prices)

- **Lemons Problem**

- Classic asymmetric information situation is called "Lemons Problem"
  - (Akerlof, 1970) on used car market
  - Idea: "If you're so anxious so sell to me do I really want to buy this?"

- Simple model:
  - The market for cars has two types, regular cars (probability q) and lemons (probability $1 - q$).
    - To seller, regular cars are worth \$1000, lemons are worth \$500.
    - To potential buyer, regular cars are worth \$1500 and lemons worth \$750.

- Which cars should be sold (from efficiency perspective)?
  - All cars should be sold since more valuable to buyer.
  - BUT: buyers **do not know** type of car, sellers **do know**
- Solve in two stages (backward induction):
  - Stage 2: Determine buyers willingness to pay
  - Stage 1: Determine selling strategy of sellers
- Stage 2. What are buyers' WTP?
  - Expected car value $= \mu 1500 + (1 - \mu)750 = 750 + \mu 750$
  - Notice: μ is expected probability that car sold is regular (can differ from p)

- Buyer willing to pay up to $p = 750 + \mu 750$

- Stage 1. Seller has to decide which car to sell
  - Sell lemon if $500 \leq p = 750 + \mu 750$ YES for all μ
  - Sell regular car if $1000 \leq p = 750 + \mu 750 \Leftrightarrow \mu \geq 1/3$

- Two equilibria
  1. If $q \geq 1/3$: *Sell both types of cars* –> $\mu = q \geq 1/3$ –> $p^* = 750 + \mu 750$
  2. If $q < 1/3$: *Sell only lemons* –> $\mu = 0$ –> $p^* = 750$

- Market for cars can degenerate: Only lemons sold

- *Conclusion*: the existence of undetectable lemons may collapse the market for good used cars

- *Basic message*: If sellers know more than buyers, buyers must account for what a seller's willingness to trade at a price tells them about hidden information

- Same issues apply to:
  - *Car Insurance.* If offer full insurance, only bad drivers take it
  - *Salary.* If offer no salary incentives, only low-quality workers apply

3 Empirical Economics: Intro

- So far we have focused on economic models

- For each of the models, there are important empirical questions

- **Consumers**:
  - Savings decisions: Do Americans under-save?
  - Attitudes toward risk: Should you purchase earthquake insurance?
  - Self-control problems: How to incentive exercise to address obesity 'epidemics'?
  - Preferences: Does exposure to violent media change preferences for violent behavior?

- **Producers:**
  - When do market resemble perfect competition versus monopoly/oligopoly?
  - Also, what if market pricing is more complicated than just choice of price and quantity p?

- But this is only half of economics!

- The other half is empirical economics

- Creative and careful use of data

- Get empirical answers to questions above (and other questions)

4 Empirical Economics: Retirement Savings

- Retirement Savings – In the US, most savings for retirement are voluntary (401(k))

- Actively choosing to save is... hard

- Self-control problems: Would like to save more... Just not today!

- Saving 10% today means lower net earnings today

- Brilliant idea: SMRT Plan (Benartzi and Thaler, 2005) Offer people to save... tomorrow.

- Three components of plan:

  1. Retirement contribution to 401(k) increases by 3% at every future wage increase

  2. This is just default – can change at any time

  3. Contribution to 401(k) goes up only when wage is increased

- This works around your biases to make you better off:

  1. **Self-control problem.** Would like to save more, not today

  2. **Inertia.** People do not change the default

  3. **Aversion to nominal (not real) losses.**

- The results...

- Setting:
  - Midsize manufacturing company
  - 1998 onward

TABLE 1
PARTICIPATION DATA FOR THE FIRST IMPLEMENTATION OF SMART

Number of plan participants prior to the adoption of the SMarT plan	315
Number of plan participants who elected to receive a recommendation from the consultant	286
Number of plan participants who implemented the consultant's recommended saving rate	79
Number of plan participants who were offered the SMarT plan as an alternative	207
Number of plan participants who accepted the SMarT plan	162
Number of plan participants who opted out of the SMarT plan between the first and second pay raises	3
Number of plan participants who opted out of the SMarT plan between the second and third pay raises	23
Number of plan participants who opted out of the SMarT plan between the third and fourth pay raises	6
Overall participation rate prior to the advice	64%
Overall participation rate shortly after the advice	81%

- Result 1: High demand for commitment device

- Result 2: Phenomenal effects on savings rates

TABLE 2
AVERAGE SAVING RATES (%) FOR THE FIRST IMPLEMENTATION OF SMART

	Participants Who Did Not Contact the Financial Consultant	Participants Who Accepted the Consultant's Recommended Saving Rate	Participants Who Joined the SMarT Plan	Participants Who Declined the SMarT Plan	All
Participants initially choosing each option*	29	79	162	45	315
Pre-advice	6.6	4.4	3.5	6.1	4.4
First pay raise	6.5	9.1	6.5	6.3	7.1
Second pay raise	6.8	8.9	9.4	6.2	8.6
Third pay raise	6.6	8.7	11.6	6.1	9.8
Fourth pay raise	6.2	8.8	13.6	5.9	10.6

* There is attrition from each group over time. The number of employees who remain by the time of the fourth pay raise is 229.

- Plan triples savings in 4 years

- Currently offered to more than tens of millions of workers

- Law passed in Congress that gives incentives to firms to offer this plan: *Automatic Savings and Pension Protection Act*

- Psychology & Economics & Public Policy:
  - Leverage biases to help biased agents
  - Do not hurt unbiased agents (cautious paternalism)

- For example: Can we use psychology to reduce energy use?

- Summary on Empirical Economics

- Economics offers careful models to think about human decisions

- Economics also offers good methods to measure human decisions

- Starts with Econometrics (140/141)

- Then go on with applied econometrics (142)

- Empirical economics these days is precisely-measured social science

5 Advice

1. Listen to your heart

2. Trust yourself

3. Take ‘good’ risks:

   (a) hard courses

   (b) internship opportunities

   (c) (graduate classes?)

4. Learn to be curious, critical, and frank

5. Be nice to others! (nothing in economics tells you otherwise)