Economic Analysis of Law

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Lecture 3: Game Theory and Applications to Law

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- One-Shot.
- Examples:

(1) Prisoner's Dilemma

	C	D
C	-10, -10	-30, 0
D	0, -30	-20, -20

(2) Battle of the Sexes

	A	B
A	4, 2	0, 0
B	0, 0	2, 4

(3) Matching Pennies

	H	T
H	1, -1	-1, 1
T	-1, 1	1, -1

(4) Chicken

	C	D
C	3, 3	1, 4
D	4, 1	0, 0

Dominant Strategy

- Dominant strategy: The best strategy to play regardless of others' strategies. (e.g., PD)
- If a game has a dominant strategy for every player, then outcome is easy to predict.

Equilibrium (Nash)

- No player can unilaterally changes his strategy and gain.
- Example: Battle of the Sexes, Chicken.
- Mixed strategy: randomization over available strategies (e.g., in matching pennies).

Applications: liability rules

- Benchmark case:

  A motorist (M) and a pedestrian (P). M can potentially hit P and cause an accident. They can exercise care to reduce occurrence of accident.

  Cost of accident: -100.

  Cost of Care: -10.

  Prob. accident: $1/10$ if both exercise due care; otherwise 1.

$$\text{Social optimum calculation:} \begin{cases} (N, N) : -100 \\ (N, C) : -110 \\ (C, N) : -110 \\ (C, C) : -100 * 1/10 - 10 - 10 = -30 \end{cases}$$

Social Optimum: $(C,\ C)$.

Applications: liability rules

No liability

	N	C
N	-100, 0	-100, -10
C	-110, 0	-20, -10

Strict liability

	N	C
N	0, -100	0, -110
C	-10, -100	-10, -20

Negligence

	N	C
N	0, -100	-100, -10
C	-10, -100	-20, -10

Contributory negligence

	N	C
N	-100, 0	-100, -10
C	-10, -100	-10, -20

Negligence and Contributory Negligence are efficient

Applications: liability rules

- When care costs differ: $C^P = 10,\ C^M = 85$
- Social optimum: $(N,\ N)$.

	N	C
N	-100, 0	-100, -85
C	-110, 0	-20, -85

	N	C
N	0, -100	0, -185
C	-10, -100	-10, -95

	N	C
N	0, -100	-100, -85
C	-10, -100	-20, -85

	N	C
N	-100, 0	-100, -85
C	-10, -100	-10, -95

No Liability and Strict Liability are efficient.

- When M's care does not affect prob. of accident, suppose probability of accident is 1/10 if P has due care, and 1 if not.
- Social optimum: (C, N).

	N	C
N	-100, 0	-100, -10
C	-20, 0	-20, -10

	N	C
N	0, -100	0, -110
C	-10, -10	-10, -20

	N	C
N	0, -100	-100, -10
C	-10, -10	-20, -10

	N	C
N	-100, 0	-100, -10
C	-10, -10	-20, -10

No Liability and Contributory Liability are efficient

Applications: liability rules

- When P's care does not affect prob. of accident, suppose probability of accident is $1/10$ if M has due care, and 1 if not.
- Social optimum: (N, C).

	N	C
N	-100, 0	-10, -10
C	-110, 0	-20, -10

	N	C
N	0, -100	0, -20
C	-10, -100	-10, -20

	N	C
N	0, -100	-10, -10
C	-10, -100	-20, -10

	N	C
N	-100, 0	-10, -10
C	-10, -100	-10, -20

Strict Liability and Negligence are efficient

Applications: liability rules

- General case:
  - Let p_{ij} be the probability of accident when the care taken by P and M are i and j, respectively. $(i, j = C, N)$
  - C_i^P and C_j^M are cost of taking care i and j, respectively.
  - Total social loss: $\Sigma_{i,j} 100 p_{ij} + C_i^P + C_j^M$.
  - What is the social optimum depends on the values of p_{ij} and C_i^P, C_j^M.

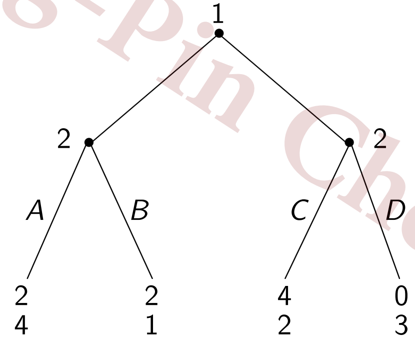
- Also can draw the game matrix for each liability regime. For examples, strict liability:

	N	C
N	$-C_N^P, -C_N^M - 100P_{NN}$	$-C_N^P, -C_C^M - 100P_{NC}$
C	$-C_C^P, -C_N^M - 100P_{CN}$	$-C_C^P, -C_C^M - 100P_{CC}$

- General Lesson:
  Depending on environments (viz, values of p_{ij} and C^M, C^P), different legal rules are needed in order to attain social optimum.

- Dynamic in nature.
- Information matters.
- Examples:

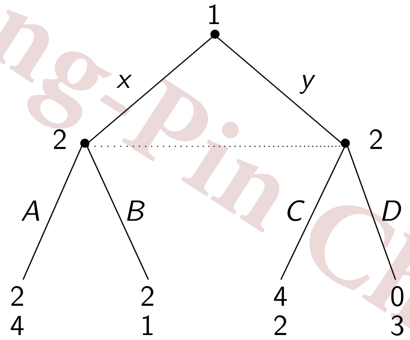
(1) Perfect information



(3)

Extensive Form Games

(2) Imperfect information



(3)

Equilibrium: Subgame perfect equilibrium (SPE)

- Key: Backward induction.
- Example I: SPE$\left(x, (A, D)\right)$.
- Example II: SPE$\left((\frac{1}{4}x, \frac{3}{4}y), (\frac{1}{2}A, \frac{1}{2}B)\right)$.

Application: Litigation

- Two types of litigation model: expectation model and private information model.
- Expectation model: The reason why parties do not settle out-of-court is because they have different perceptions of winning chance.
- Private information model: Because they have different information.

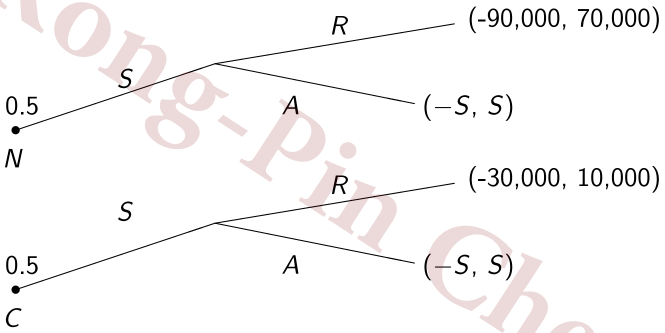
Application: Litigation

- Example: An accident occurs which costs the victim (V) 100,000. Litigation cost for both victim and injurer (I) are 10,000.
- Suppose prob that injurer will be found liable is p.
- If litigated, V expects to receive $100,000p - 10,000$, while I expects to lose $100,000p + 10,000$. For any p, there is a range for settlement. But why sometimes not in reality?
- Expectation model explanation: $p_V > p_I$.
- If $100,000p_V - 10,000 > 100,000p_I + 10,000$ (i.e., $p_V - p_I > 1/5$), then there will be no settlement range.

- Private information model: I knows more than V about the value of p.
- Suppose I is of two types: negligent or careful. The former is expected to prevail with prob 0.2, and the latter 0.8.
- Only I knows his own type.
- V believes that I is equally likely to be either.

Application: Litigation

- Game form I: Suppose I makes a take-it-or-leave-it offer:



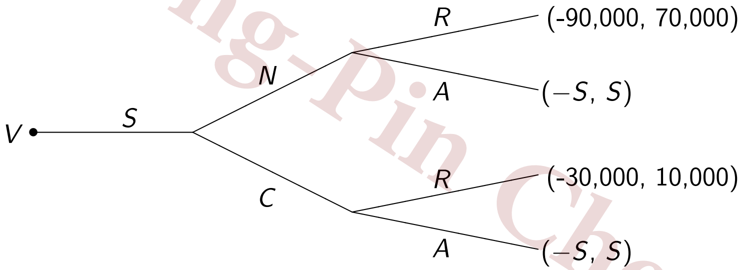
V thus expects to receive 70,000*0.5+10,000*0.5=40,000 in litigation.

Application: Litigation

- Separating equilibrium
  - N-type offers 70,000.
  - C-type offers 0.
  - V accepts iff $S \geq 70,000$
- Pooling equilibrium:
  V's expects payoff is 40,000, and will accept S if and only if $S \geq 40,000$. But C-type is only willing to offer 30,000. There is thus no offer that is accepted for sure.

Application: Litigation

- Game form II: V makes take-it-or-leave-it offer.



Application: Litigation

- SPE:
  - N-type: accept S iff $S \leq 90,000$.
  - C-type: accept S iff $S \leq 30,000$.
  - $S^* = 90,000$.
- Expected payoff:
  - N-type: -90,000.
  - C-type: -30,000.
  - $V = 90,000$.
- In both models, N-type settles and C-type litigates.
- Both have positive chance to go to court.

Application: Litigation

- What if British rule is used?
- I's payoff is -120,000 if wins, and 0 if lose.
- V's payoff is 100,000 if wins, and -20,000 if lose.
- What if V or I are risk-averse? More favorable to proposer.