UNIVERSITY OF OREGON

Strategic Moves

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EC327 Game Theory

Outline

- So far, we have taken the **rules of a game** as fixed.
- But in many cases, the very structure of a game can be strategically manipulated by certain players.

- We have already talked about how different types of games favor some agents over others
  - I.e., first mover advantage,
  - second mover advantage,
  - asymmetric info
- So it would make sense that if players can *manipulate* the rules of a game in their favor, they will try to do so.

- We can think about adding a first-stage to our original game
  - **First Stage:** specify how you will act in second stage
  - **Second Stage:** the original game
    - but now players set their beliefs based on what happened in the first stage.

- Different first stage actions correspond to what we will call:
  - commitments,
  - threats,
  - or promises
- Whether any of these actions is **effective** depends on the beliefs of the other player(s).
  - The credibility of a strategic move *matters*.

Examples of Strategic Moves:

- Amazon publicly *commits* to going carbon neutral by 2040
- Parents *promise* "you will get a PS5 if you get all A's" to their children
- Nuclear powers *threaten* "Mutually Assured Destruction" to each other in brinksmanship games

Conditional Strategic Moves

- I might declare a **response rule** which is a move that depends on someone else's behavior
- I might try to take action to stop someone from doing something through a **deterrence** strategy
- Or I could try to get someone to do something through **compellence**
- **deterrence** or **compellence** could take the form of a threat or promise:
  - A threat: "Unless your action conforms to what I want, then I will *harm* you"
  - A promise: "If your action conforms to what I want, I will reward you"

What does it mean to move first?

- An action must be both **observable** and **irreversible**.
- If an action is *unobservable*, then other players can't react to it.
- If an action is *reversible*, then the 'first-mover' could change their action in reaction to another move.

Classification of Strategic Moves

Unconditional Strategic Moves

Commitment

- If a player makes an observable and irreversible move to **limit** their future actions.
- "In the game to follow, I will make a particular move, X"

Unconditional Strategic Moves

When does **Commitment** matter?

- When it changes the beliefs of other players
- This can rely on the credibility of certain commitments.

Unconditional Strategic Moves

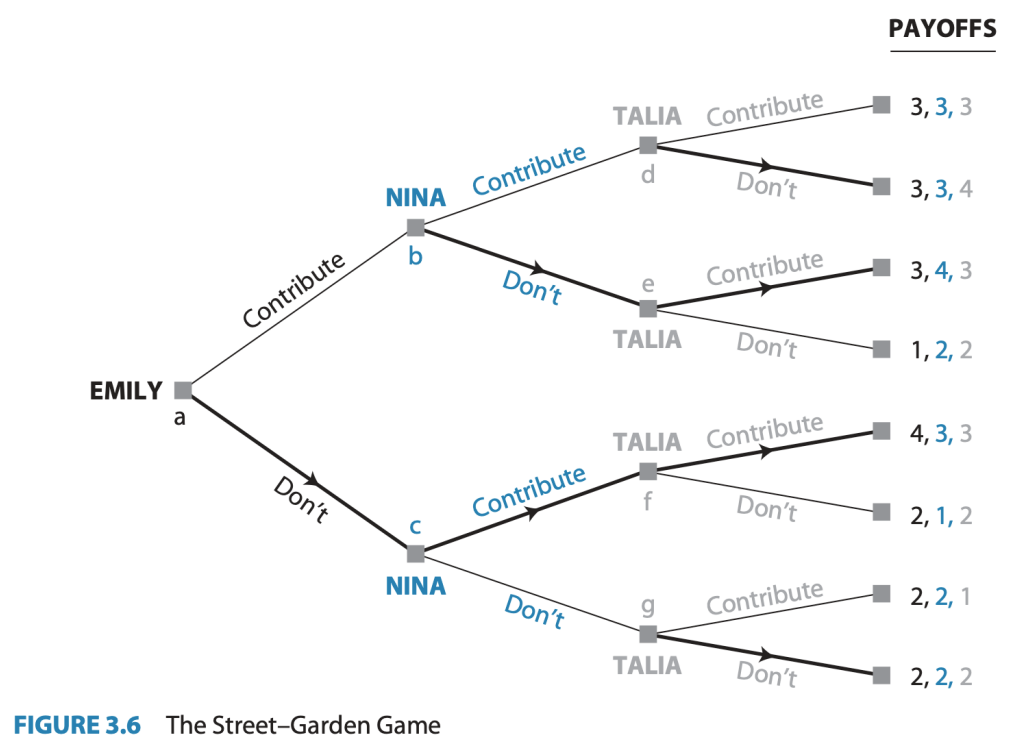


FIGURE 3.6 The Street–Garden Game

Recall that the Street-Garden Game ended with Emily *not contributing*, knowing that both Nina and Talia *would contribute*.

Unconditional Strategic Moves

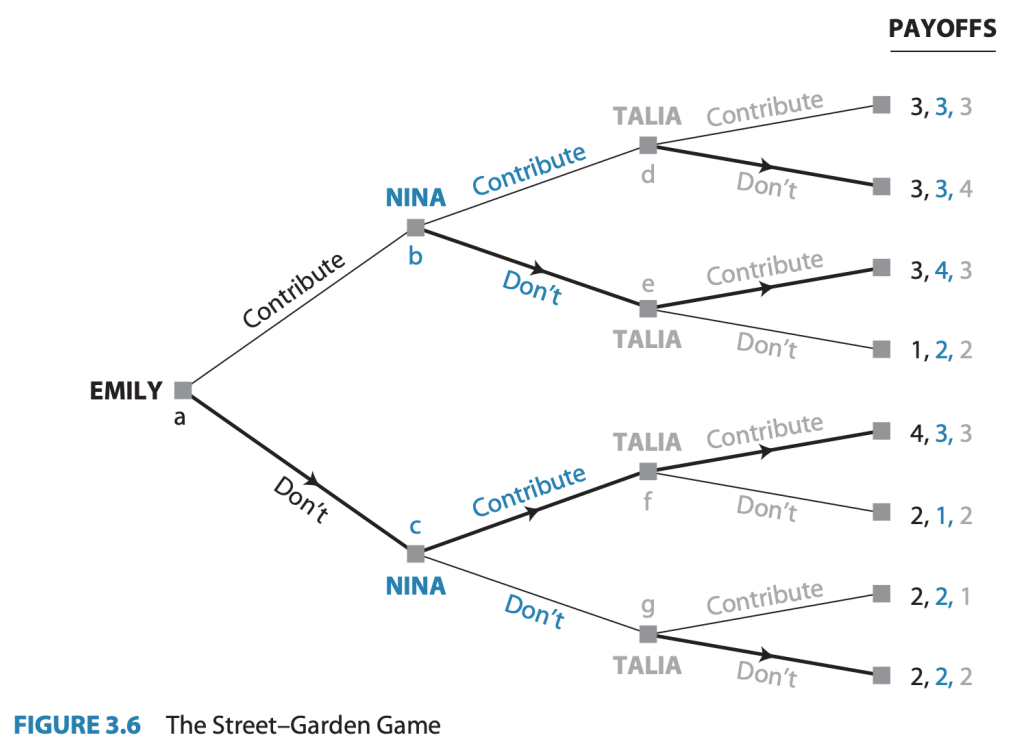


FIGURE 3.6 The Street–Garden Game

But what if either Nina or Talia can **commit** to *not contributing*? Maybe Talia could let everyone know that she has sunk all of her savings into an expensive home renovation.

Conditional Strategic Moves

Response Rules

- If a player makes an observable and irreversible plan that is **conditional** on another player's actions.
- "In the game to follow, I will respond to your choices in the following way. If you choose Y_1, I will do Z_1, if you do Y_2, I will do Z_2, ..."

Conditional Strategic Moves

Types of conditional strategic moves

- Deterrence: when the first player wants to *stop* another player from making some action
- Compellence: when the first player wants to *induce* another player to do something

Conditional Strategic Moves

Methods of achieving *deterrence* or *compellence*

- Threat:

  "Unless you do as I want, I will act to make you worse off"
- Promise:

  "If you do as I want, I will act to make you better off"

Credibility

What distinguishes an effective strategic move from **cheap talk**?

- Any player can promise or threaten anything they like, but whether it works to change other people's behavior depends on its credibility
- An effective *threat* will be **costly** to the person doing the threatening.

Split or Steal - Revisited

Recall the clip from Golden Balls we watched with Nick and Ibrahim

- How would you characterize Nick's strategic move here?
- Unconditional or Conditional?
- deterrence or compellence?
- What parts of Nick's story are credible?

Commitments

Game of Chicken

		Dean	
		Swerve	Straight
James	Swerve	0,0	-1,1
	Straight	1,-1	-2, -2

- How many Nash Equilibria are there?
- Which of the equilibria would **James** prefer?

Game of Chicken with Commitment

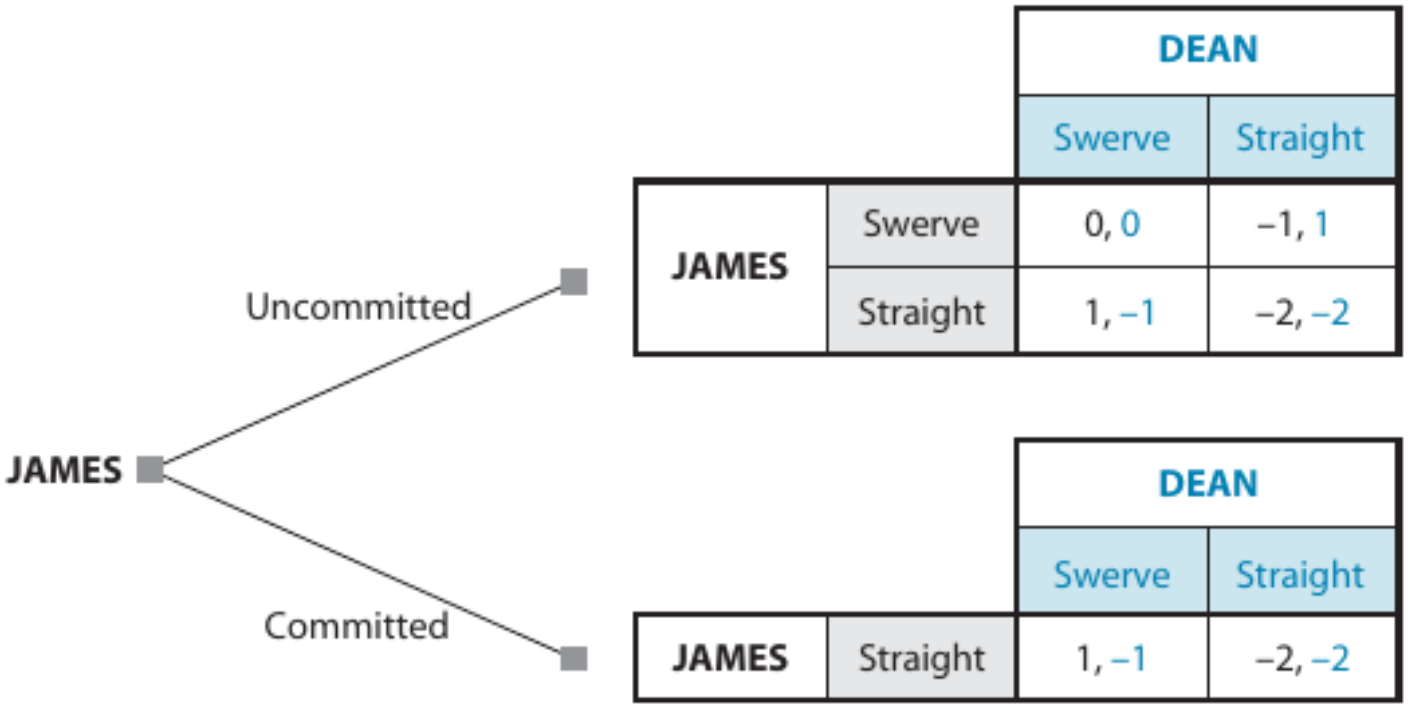


FIGURE 9.1 Chicken: Commitment by Restricting Freedom to Act

What would the outcome of this game be?

Game of Chicken with Commitment

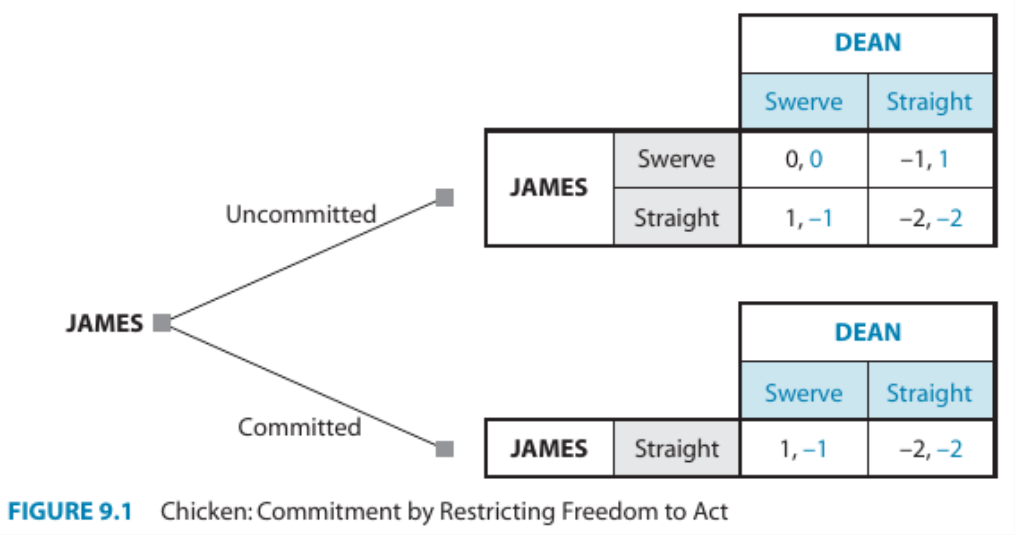


FIGURE 9.1 Chicken: Commitment by Restricting Freedom to Act

How can James make this commitment *credible*?

- Irreversible
- Visible to Dean

Game of Chicken with Commitment

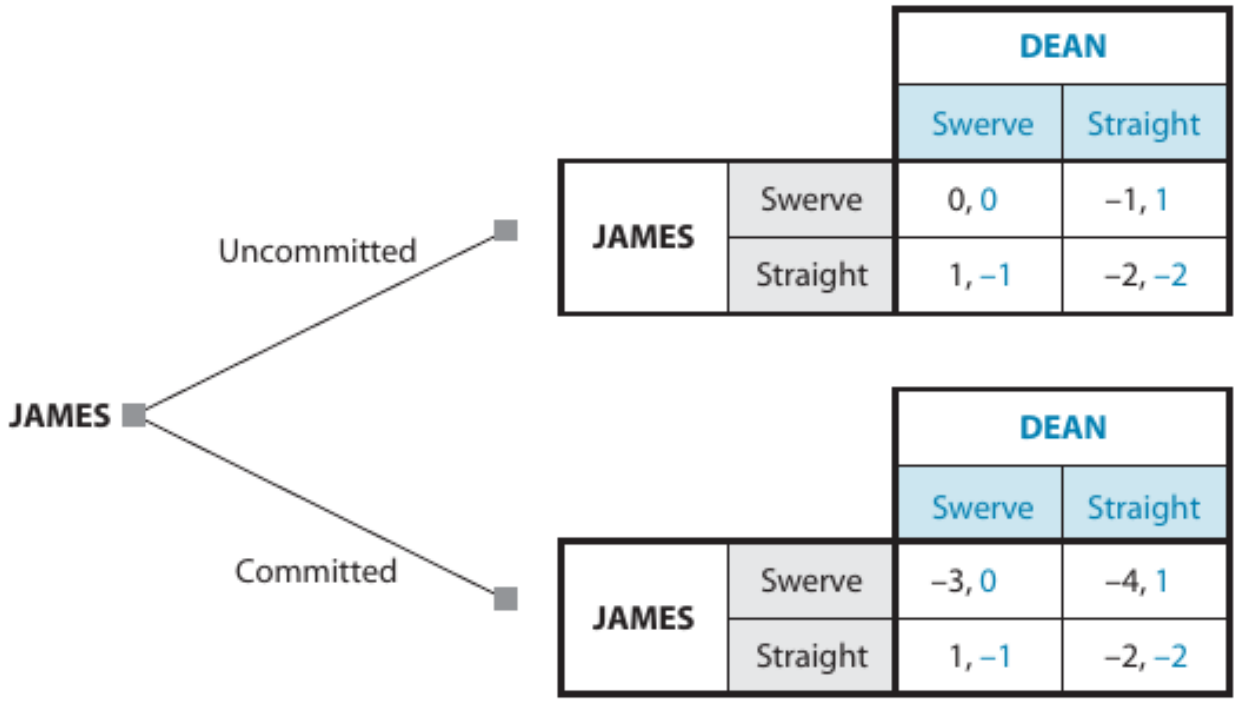


FIGURE 9.2 Chicken: Commitment by Changing Payoffs

James could also change his payoffs; maybe by gaining a *reputation* in repeated play of chicken so he would be humiliated if he ever swerves

Optimal Commitment in Larger Games

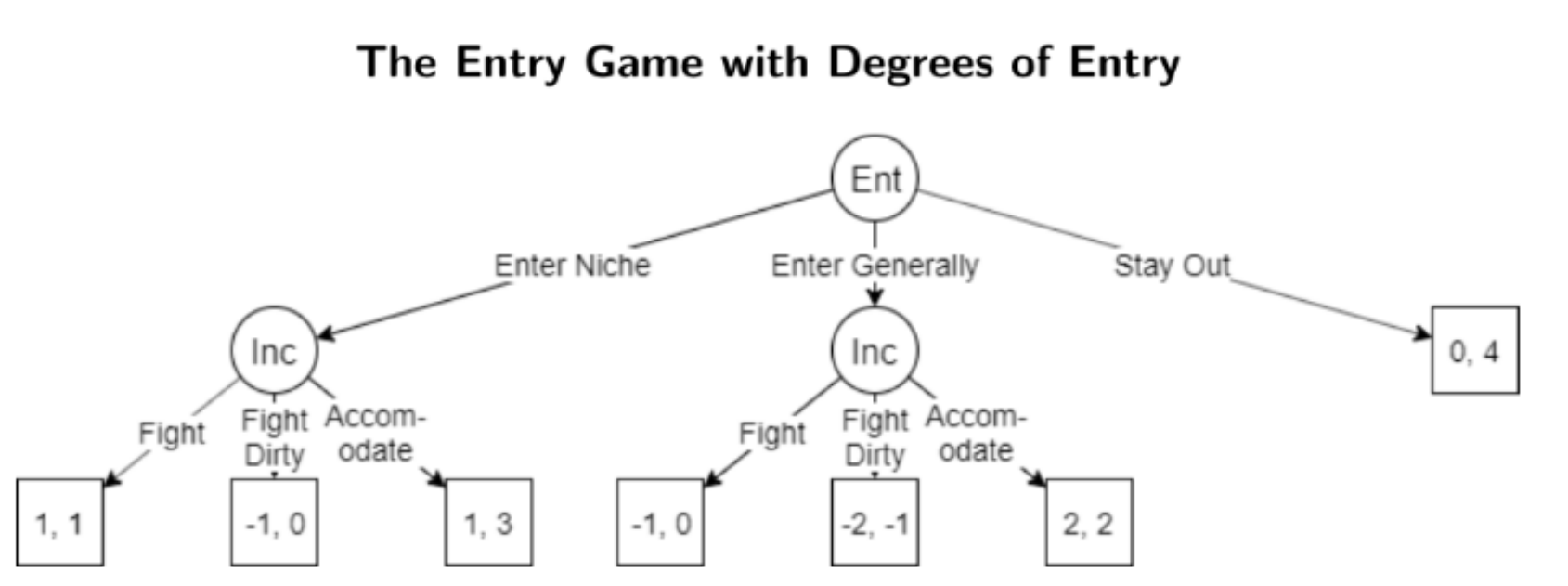
		P_2		
		X	Y	Z
P_1	A	4,4	1,5	0,0
	B	3,1	2, 2	5,1
	C	1,1	1,3	4,4

What is the (pure strategy) Nash Equilibrium?

Which strategy should P_1 commit to?

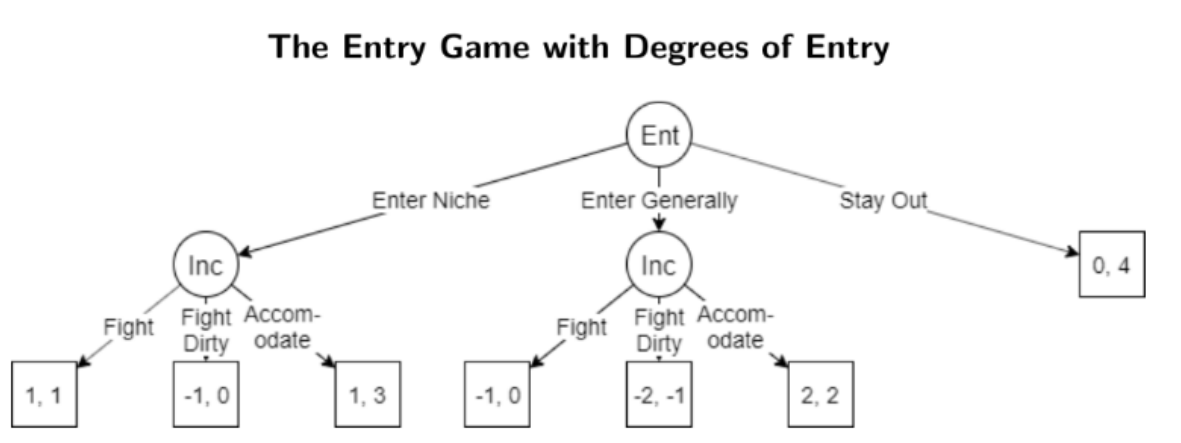
Threats and Promises

Examples of Threats and Promises



What is the **SPNE**?

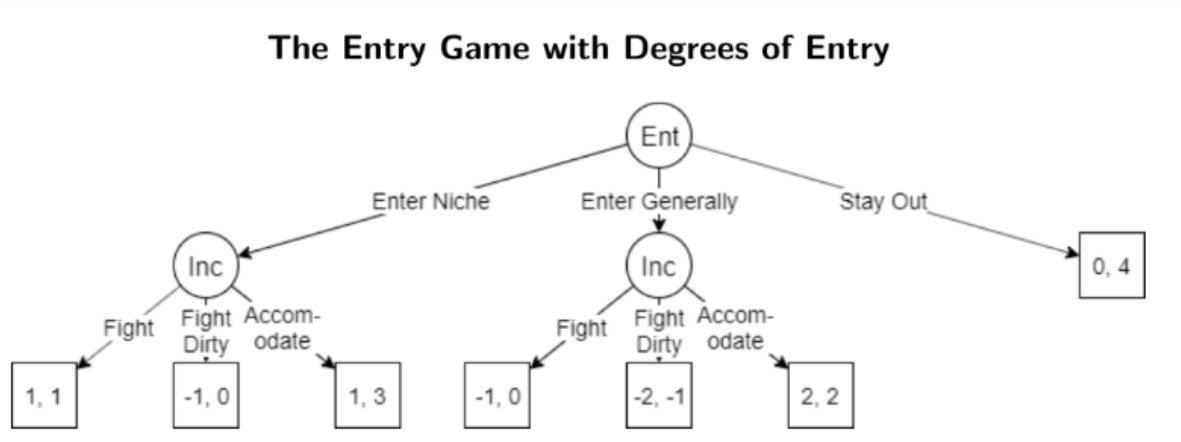
Examples of Threats and Promises



Examples of threats/promises that Incumbent could make:

- "If you enter niche, I will Fight; If you enter generally, I will Fight Dirty"
- "If you enter niche, I will Accommodate; If you enter generally, I will Fight"
- "If you enter niche *or* generally, I will Fight Dirty"

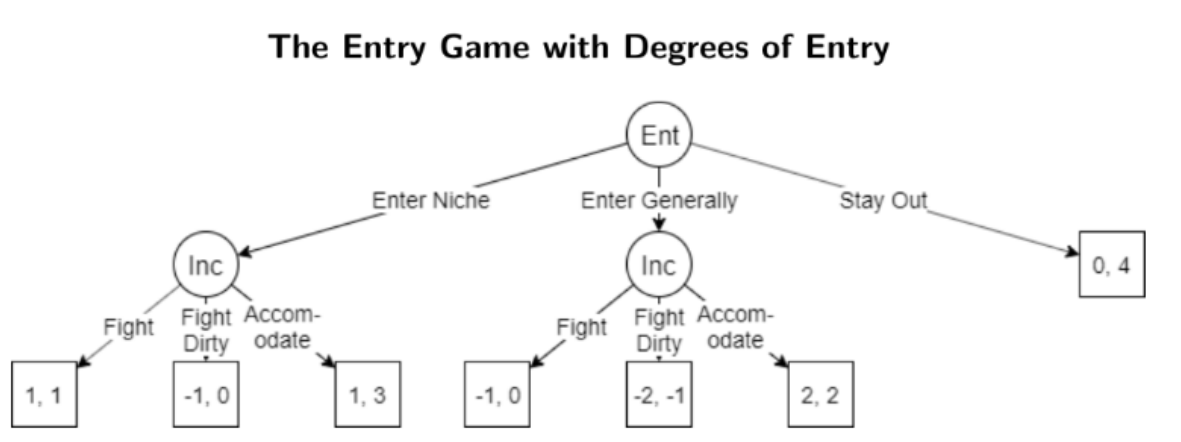
Examples of Threats and Promises



What is the **optimal commitment** for the Incumbent to make?

How can they be made credible?

Examples of Threats and Promises



Stay Out, (Fight Dirty, Fight) *is* a NE of this game, just not *subgame-perfect*

- An interpretation for those non-subgame-perfect NEs is that they exist as the result of such threats

Examples of Threats and Promises

		YVONNE'S BISTRO	
		20 (low)	26 (high)
XAVIER'S TAPAS	20 (low)	288, 288	360, 216
	26 (high)	216, 360	324, 324

FIGURE 9.6 Payoff Table for Restaurant Prisoners' Dilemma ($100s per month)

Consider the promise "I will charge a high price if you do"

Sounds good right?

Examples of Threats and Promises

		YVONNE'S BISTRO	
		20 (low)	26 (high)
XAVIER'S TAPAS	20 (low)	288, 288	360, 216
	26 (high)	216, 360	324, 324

FIGURE 9.6 Payoff Table for Restaurant Prisoners' Dilemma ($100s per month)

What if Xavier *promises* to set a high price?

- Should Yvonne believe him?
- How can Xavier *credibly commit* to not undercutting Yvonne when he sees she has set a high price?
  - Handing off the decision to a trusted 3rd party (commitment),
  - Develop a reputation of honesty (change his payoffs)

Deterrence of Entry (Harrington)

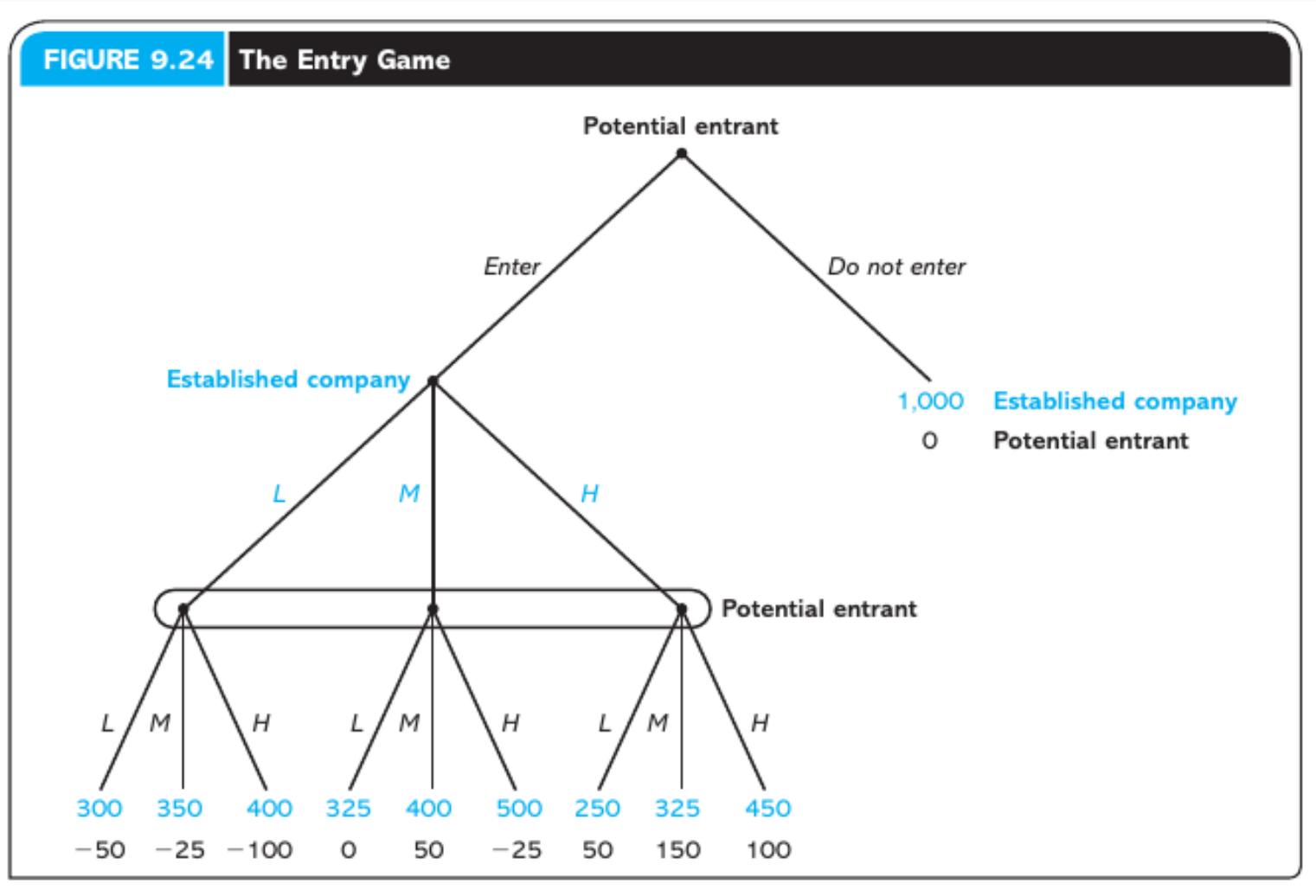
FIGURE 9.23 Post-Entry Game (Gross Profit)

Established company \ New company	*Low*	*Moderate*	*High*
Low	300,300	350,325	400,250
Moderate	325,350	400,400	500,325
High	250,400	325,500	450,450

Consider a market with an established and a potential new entrant:

- Established monopolist would usually earn 1,000 profit
- If competing, each company could set *low*, *moderate*, *high* price
- Start-up cost to entrant is 350.

Deterrence of Entry



What is the **SPNE**?

Deterrence of Entry

FIGURE 9.25 The Strategic Form of the Entry Game

Potential Entrant	Established Company: *Low*	*Moderate*	*High*
Enter/Low	−50,300	0,325	50,250
Enter/Moderate	−25,350	50,400	150,325
Enter/High	−100,400	−25,500	100,450
Do not enter/Low	0,1000	0,1000	0,1000
Do not enter/Moderate	0,1000	0,1000	0,1000
Do not enter/High	0,1000	0,1000	0,1000

Can you find NE which are *not subgame-perfect*?

Deterrence of Entry

Consider {Do not enter/Moderate, Low}:

- Given no entry, established company always gets 1,000
- So planning to set a low price in post-entry game is optimal for est. company
- Given that est. company prices low, new company has no regrets staying out
- If new company enters when est. company sets low price, the best they can do is *moderate* and earn -25

Deterrence of Entry

Consider {Do not enter/Moderate, Low}:

- Why is this *not* subgame-perfect?
- Consider what happens if the new company doesn't believe the threat, and actually *does* enter
- Then the established firm would actually be better off by setting a *moderate* price
- So we say that the threat of low price competition was not a **credible** threat

Deterrence of Entry

So what should the CEO of an established company do?

- How can they commit to an aggressive pricing strategy that they know they won't follow through on?
- What if there is a *costly* investment in a new technology which has an investment cost of 500, but lowers per-unit production costs

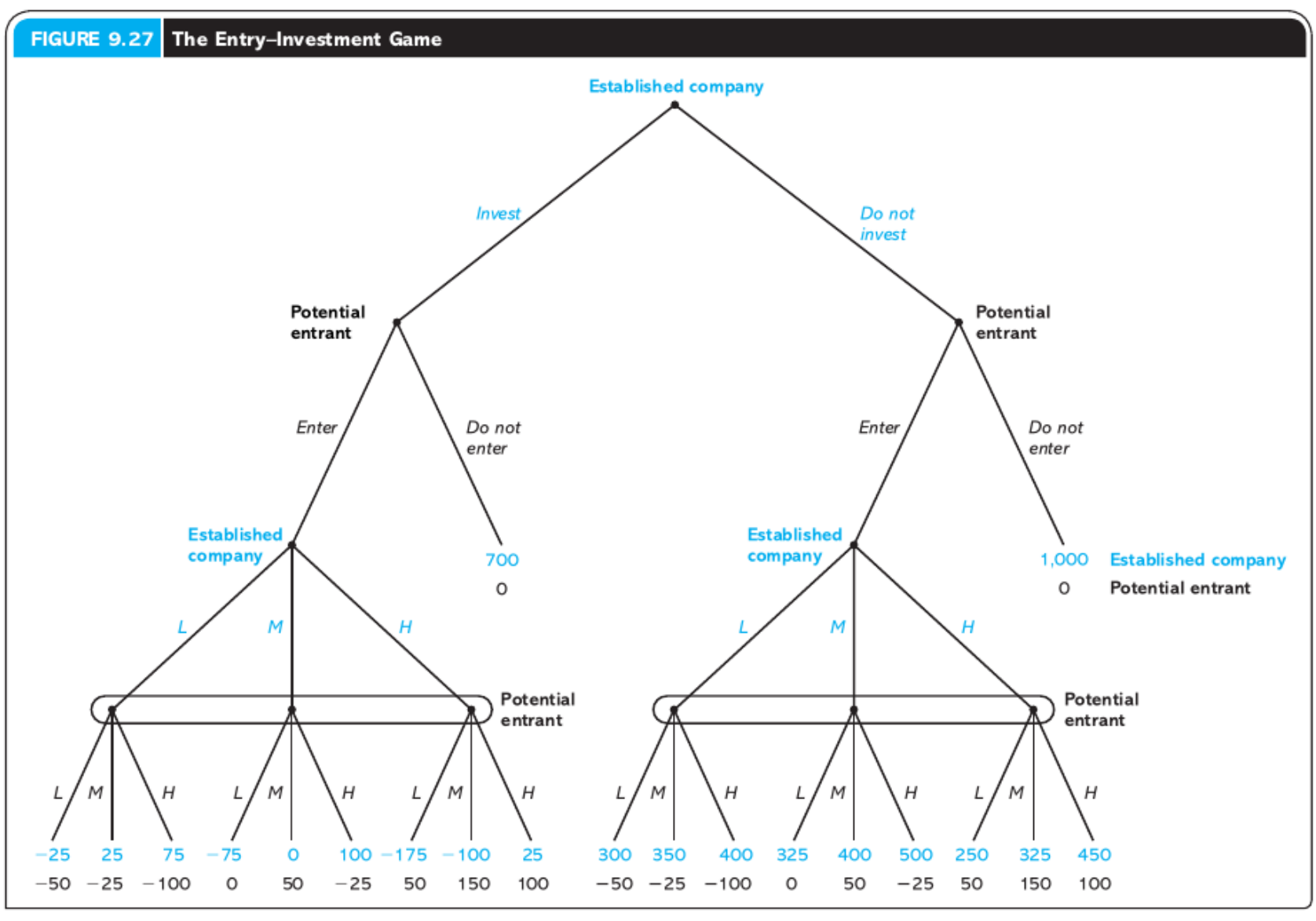
Deterrence of Entry

FIGURE 9.26 The Post-Entry Game After Investment (Gross Profit)

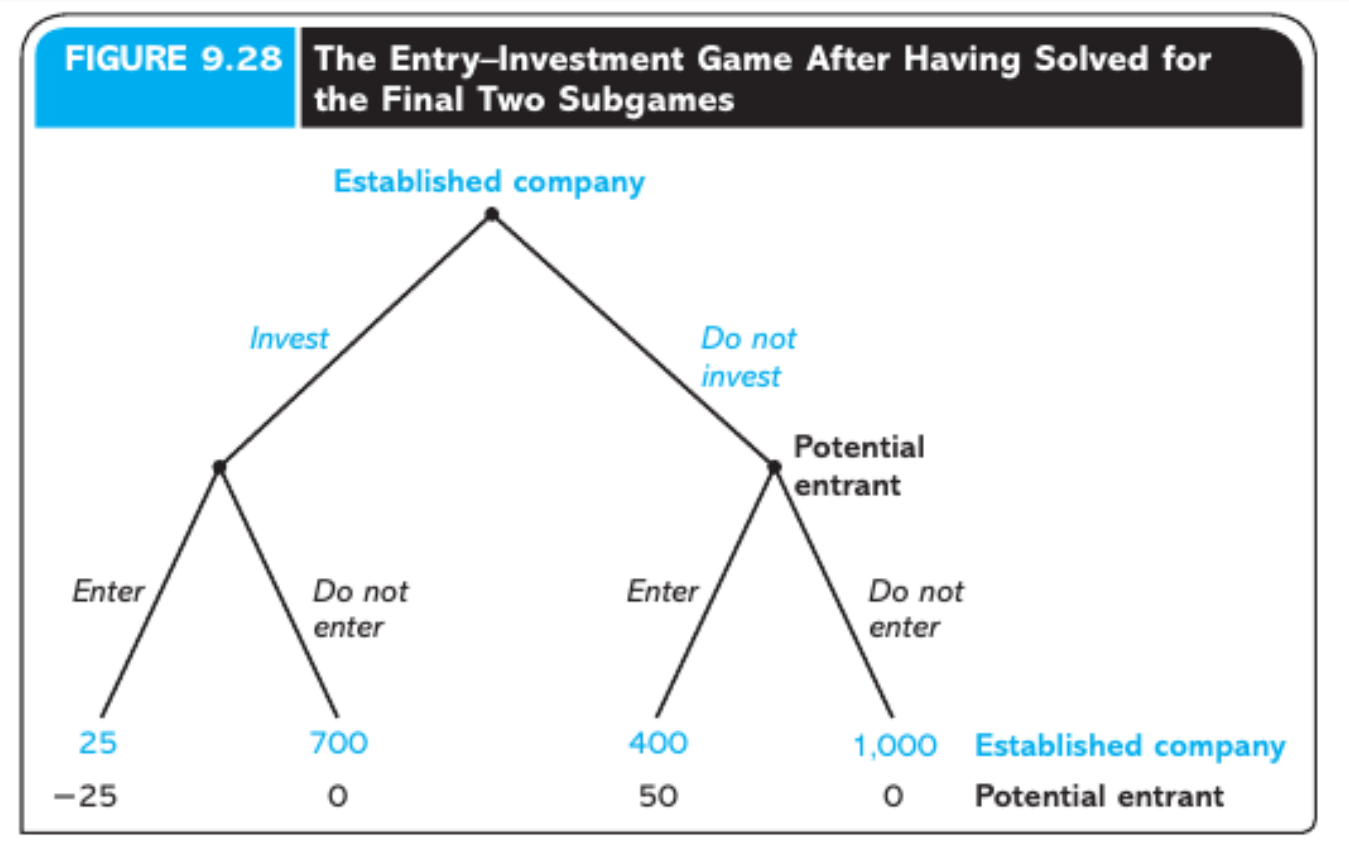
Established company \ New company	*Low*	*Moderate*	*High*
Low	475,300	525,325	575,250
Moderate	425,350	500,400	600,325
High	325,400	400,500	525,450

What is the NE of this new post-entry game?

Deterrence of Entry



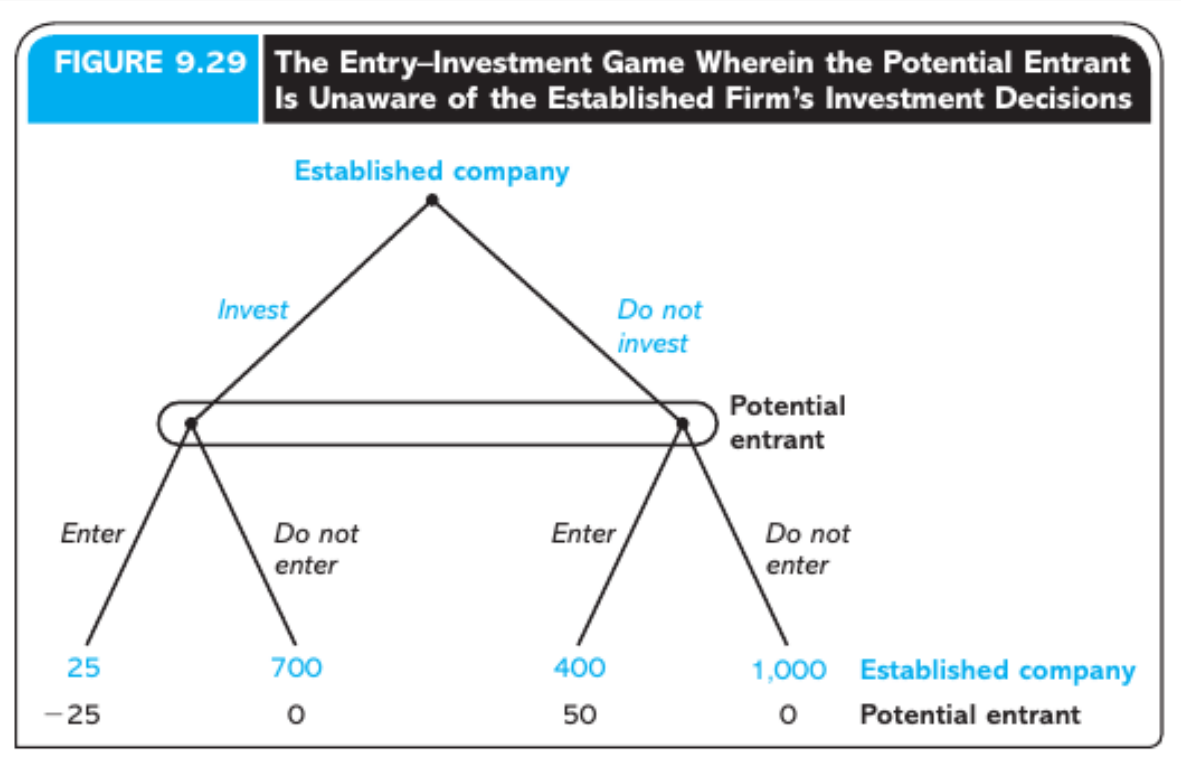
Deterrence of Entry



What is the **SPNE** now?

- Is the aggressive pricing strategy *credible* now?

Deterrence of Entry



Consider the importance of communicating the investment

- What is the SPNE when the potential entrant can't see whether the established company has invested?

A Doomsday Device

Spoilers for *Doctor Strangelove or: How I Learned to Stop Worrying and Love the Bomb* (1964)

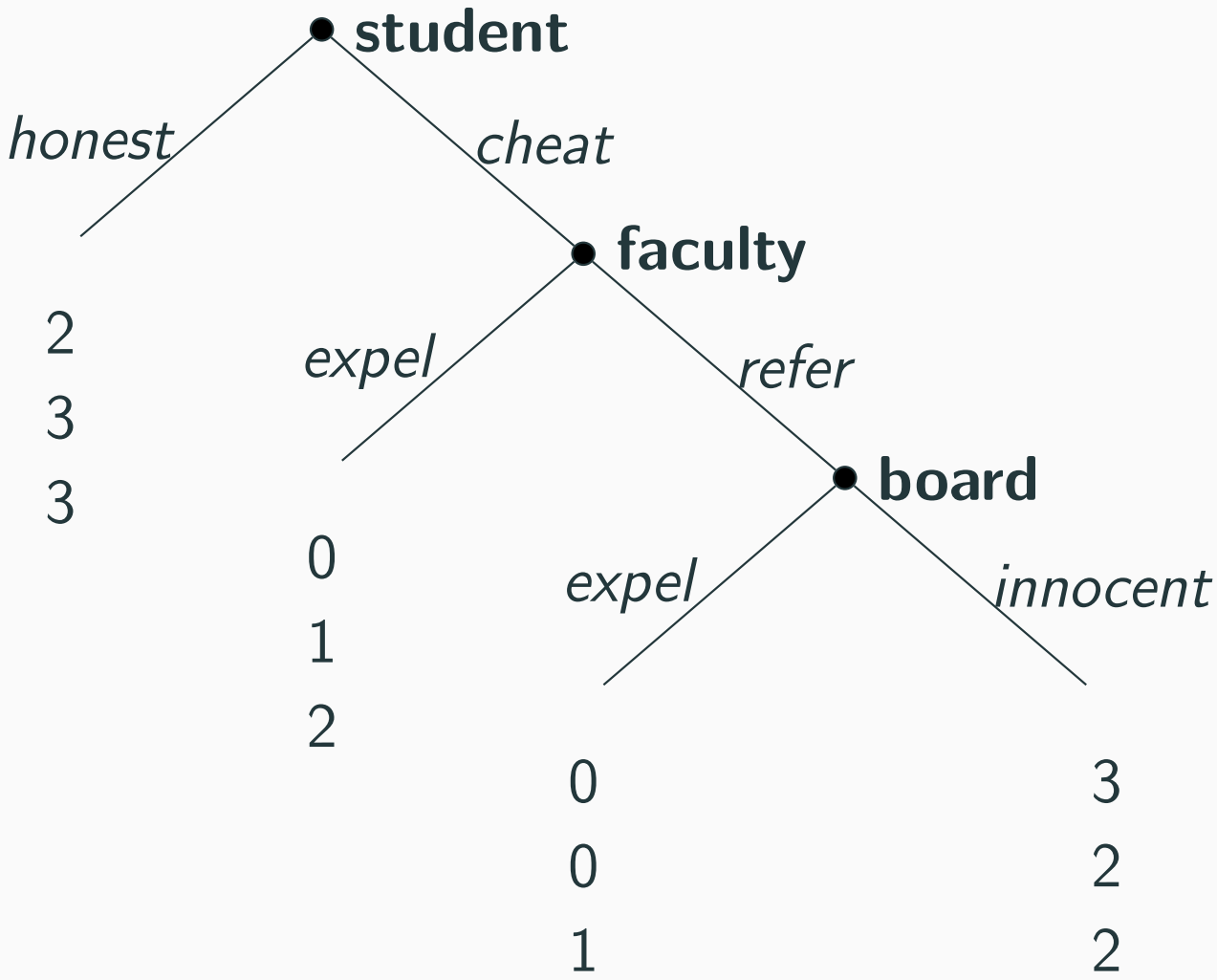
> **Dr. Strangelove:** *Mr. President, it is not only possible, it is essential. That is the whole idea of this machine, you know. Deterrence is the art of producing in the mind of the enemy . . . the fear to attack. And so, because of the automated and irrevocable decision making process which rules out human meddling, the doomsday machine is terrifying. It's simple to understand. And completely credible, and convincing. (Turning to DeSadeski.) But the whole point of the doomsday machine is lost if you keep it a secret! Why didn't you tell the world, eh?*
>
> **Soviet Ambassador DeSadeski:** *It was to be announced at the Party Congress on Monday. As you know, the Premier loves surprises.*

Brinksmanship

Brinksmanship

- In the last lecture, we learned about different roles uncertainty can play in games
- In this lecture we are talking about manipulating the rules of a game
- The idea of brinksmanship asks about when players might strategically implement uncertainty to their advantage

Assignment 2 - Question 4



Assignment 2 - Question 4

Recall that the **SPNE** in part (a) was { cheat, refer, innocent }

- But how can the board **commit** to expelling guilty students?
- Part (b) asked you to assume the board acts probabalistically

Assignment 2 - Question 4

We found that different SPNE could be achieved depending on the value of q:

- $\underline{SPNE_1}$: { cheat, refer, (q expel, $(1-q)innocent$) } when $q < 1/3$
- $\underline{SPNE_2}$: { honest, refer, (q expel, $(1-q)innocent$) } when $1/3 < q < 1/2$
- $\underline{SPNE_3}$: { honest, expel, (q expel, $(1-q)innocent$) } when $q > 1/2$

Assignment 2 - Question 4

What if we add a new 'first-stage' to this game where the board has to decide to enact this probabilistic play or not

- The board's utility from $\{$ cheat, refer, (q expel, $(1-q)innocent$) $\}$ is $2-q$
- and their utility is 3 from any equilibrium where students stay honest
- So the board *does* has a credible promise to make in this policy
- By *taking away* some of their own agency, they benefit the school