Bargaining (議價談判)

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Lecture 5, EE-BGT

Bargaining (議價談判)

- Bargaining (就是「討價還價」！)
  - Process by which economic agents agree on the terms of a deal (個體間討論條件、達成交易的過程)
- Common even in competitive markets
  - The pit market in NYSE/market experiments
    - (即使在完全競爭市場也很常見，例如紐約股市的交易坑市場)
  - Edgeworth Box (原本是用來研究談判！) was created to show range of possible bargaining outcomes
- Have you ever bargained with someone?
  - 你有跟別人談判過嗎？

Bargaining (議價談判)

- Nash (1950, 1951):
  - (Cooperative) Nash Bargaining Solution (奈許談判解)
  - (Non-cooperative) Nash Equilibrium (奈許均衡)
- Nash could have won two Nobels...
- Nash Program: Is NBS the NE/SPE of a particular game? (奈許問：NBS是否為某賽局的NE/SPE?)
  - Yes: Binmore, Rubinstein and Wolinsky (1986)
- References (參考章節):
  - BGT, Ch. 4, HEE, Ch. 4, MGS, Ch. 23

2 Bargaining Experiments (兩種談判實驗)

- Cooperative NBS vs. Non-cooperative NE
  - 對應合作賽局NBS和非合作賽局NE，也有兩種談判實驗：

1. Unstructured Bargaining Experiments
   - Free form procedure determined by players
   - Closer to naturally occurring bargaining
     - 自由談判實驗：雙方自行決定談判形式過程，較接近實務上談判
2. Structured Bargaining Experiments
   - Procedure specified by experimenter
   - Game theory makes specific predictions
     - 制式談判實驗：形式過程由實驗者決定，賽局論能做出明確預測

Negotiation Research in Applied Psychology

3. Negotiation Research: Bazerman et al. (2000)

- Bazerman, Magliozzi and Neale (1985)
  - Negotiate over several issues (ex: price/quantity)
  - Free form communication with fixed deadline
  - Private point schedule (dep. on each issue)
    - 應用心理學研究：雙方各自知道自己的報酬計分方式，在一定時限自由溝通討論，最後須在價格數量等多層面(連續或類別)上達成協議
- Results: Deals not Pareto-efficient
  - Affected by systematic heuristics and other cognitive variables (unrelated to game)
    - 結果：達成的協議不都有效率且受到無關的經驗法則與認知因素影響

Negotiation Research (協商談判研究)

- Why not much overlap? (為何沒有交集？)
  - Game theory assumes too much rationality
  - Solvable games are too simplified
  - Hard to apply to Negotiation games
    - 賽局論假設完全理性，解得出來賽局又太簡單，很難用在協商研究
- Like 2 traditions of experimental economics
  - Game experiments are too simplified
  - Hard to apply to market experiments
    - 正如賽局論實驗太過簡單，很難用賽局論來預測市場實驗的結果
- But research questions are the same! (研究問題一樣)

Unstructured Bargaining (自由談判)

- Test: Nash Bargaining Solution (NBS)
  - The point maximizing the product of utility gains (beyond the disagreement point)
    - 奈許談判解(NBS):與談判破裂相較讓雙方效用增加量的乘積最大的解
- Only point satisfying 4 axioms:
  1. Pareto Optimality (效率性、不受額外無關選項影響)
  2. Symmetry (對稱、不受效用平移伸縮影響)
  3. Independence of Irrelevant Alternatives (IIA)
  4. Independence from affine utility transformation

Nash Bargaining Solution (NBS)

$$S^* = \arg\max_{(x_1,x_2)\in S}(x_1-d_1)(x_2-d_2)$$
$$= \arg\max_{(x_1,x_2)\in S}[u_1(x_1)-u_1(d_1)][u_2(x_2)-u_2(d_2)]$$

Satisfies:

1. Pareto Optimality (效率性): $\forall x \in S^*, \nexists y \in S, \underline{y > x}$
   $\underline{\Leftrightarrow y_i \geq x_i \forall i, y_j > x_j}$
2. Symmetry (對稱):
   $$d_1 = d_2, (x_1, x_2) \in S^* \Rightarrow (x_2, x_1) \in S^*$$
3. IIA (Independence of Irrelevant Alternatives; 不受額外無關選項影響)
   S^* solves (T, d) if S^* solves (S, d) and $S^* \subset T \subset S$
4. IAT (Independence from affine utility transformation, 不受效用平移伸縮影響): $u_1(x) = Ax + B, u_2(x) = Cx + D$

Unstructured Bargaining (自由談判)

- Roth and Malouf (Psych Rev 1979)
- Player bargain over 100 lottery tickets
  - Risk neutral if can reduce compound lottery
  - 雙方談判如何分配100張彩券(每張 = 1%機率贏得獎金)。用彩券可讓人風險中立地決策(假設人們會把複合機率簡化成單一機率)
- 1 ticket = 1% chance winning a big prize
- Equal ($1) vs. Unequal Prize ($1.25/$3.75)
- Full vs. Partial (know own prize) Info.
- NBS: 50-50 split (NBS預測：50-50 對分)
  - 2x2實驗設計:獎金相同/不同，資訊透明/不透明

Unstructured Bargaining (自由談判)

Information	Money Prize	# of Tickets for Player 2							% of Disagreement
		20	25	30	35	40	45	50	
Full Info.	1/1	0	0	1	0	1	0	20	0%
	1.25/3.75	1	6	3	2	2	1	4	14%
Part. Info.	1/1	0	0	0	0	0	1	14	6%
	1.25/3.75	0	0	0	0	0	3	13	0%

Unstructured Bargaining (自由談判)

- Results: Agreements cluster at 50-50
  - Rare Disagreement (很少未達成協議，大部分 50-50 對分)
- 14% Disagree when both know inequality
  - Divide tickets or $$$ payoffs equally
  - Sensitive to $$$ payoffs
  - Violate IAT (indep. of affine transformation)
    - 雙方清楚知道獎金不平等時，有14%未達成協議(彩券 vs. 金錢平分)
    - 結果受金錢多寡影響，違反「不受效用平移伸縮影響」公設
- Rawlsian Bargaining Solution explains this
  - Followup: Roth & Murnighan (ECMA 1982)

Rawlsian Bargaining Solution (羅斯談判解)

$$S^* = \arg\max_{(x_1,x_2)\in S}(x_1-d_1)(x_2-d_2)$$
$$= \arg\max_{(x_1,x_2)\in S}[u_1(x_1)-u_1(d_1)][u_2(x_2)-u_2(d_2)]$$

Satisfies:

1. Pareto Optimality (效率性): $\forall x \in S^*, \nexists y \in S, \underline{y > x}$
2. Symmetry ($d_1 = d_2, (x_1, x_2) \in S^* \Rightarrow (x_2, x_1) \in S^*$
3. IIA (S^* solves (T, d) if S^* solves (S, d) and $S \subset T$)
4. Independence of utility transformation preserving preference order & which player has larger gain

$$\underline{x_1 - d_1 \geq x_2 - d_2 \Leftrightarrow u_i(x_1 - d_1) \geq u_i(x_2 - d_2)}$$

$$\underline{x_i \geq y_i \Leftrightarrow u_i(x_i) \geq u_i(y_i)}$$

Unstructured Bargaining (自由談判)

- Review earlier studies to find: (回顧先前實驗發現)
  - Murnighan, Roth & Schoumaker (JRU 1988)
- Pairs settle @ final minutes (of 9-12 min)
  - Convey private info (Stubbornness/Delay Cost)?
    - 最後幾分鐘才達成協議 (用以表示自己很堅持/可以負擔延遲成本?)
- Follow-up: Roth & Schoumaker (AER 1983)
  - First play against computer that gives you a lot
- Expect & get this from later human players
  - Strong Reputation (如果有人先跟軟弱的電腦談判、被訓練覺得自己該拿比較多，接下來面對真人態度也會較強硬、並且真的拿比較多)

Unstructured Bargaining (自由談判)

- Mehta, Starmer and Sugden (bk chp. 1992)
- Nash Demand Game (奈許需求實驗): 2 Players
  - Each state demand (兩人分別列出自己的需求金額)
  - Get their demand If sum <= £10, 0 otherwise.
    - 如果總和 <= 10英鎊就會得到所求，不然都得0
- Focal point: Players split 4 Aces + 4 deuces
  - Before bargain, players were told: "4 aces worth £10 together, so to earn $$ you have to pool your aces and agree on how to divide the £10."
    - (兩人抽八張牌，其中四張A、四張2)

Unstructured Bargaining (自由談判)

- Results: 被告知四張A合起來值十英鎊，因此要賺錢就得把四張A合起來並同意如何平分十英鎊。實驗結果居然受此敘述(與報酬無關)影響!!
- Aces split 2-2:
  - Agree 50-50 Split (各兩張A就對分)
- Aces 1-3: (一張/三張)
  - Half 50-50, (一半對分)
  - Half 25-75;
  - 22% disagree

  (另一半要求25-75, 22%爆掉)

Demand	1A	2A	3A
£2.50	11	0	0
£3.00-4.50	5	1	1
£5.00	16	40	17
£5.50-7.00	0	1	11
£7.50	0	0	4
N	32	42	33

Can BGT Explain This? (行為賽局論解釋?)

- Roth (1985) explains as Coordination Game
- Two sides simultaneously propose to split tickets either 50-50 or h-(100-h)
  - 可用協調賽局解釋: 雙方同時提議分配為 50-50 或 h -(100 – h)
- MSE:

$$p_1 = \frac{h-50}{150-h} \quad p_2 = \frac{h-50}{h+50}$$

- Disagreement rates $= \dfrac{(h-50)^2}{(150-h)(50+h)}$

Can BGT Explain This? (行為賽局論解釋?)

- Roth (bk chp 1985)
- Disagreement rates $= \dfrac{(h-50)^2}{(150-h)(50+h)}$
- Predicted to be 0% → 7% → 10%
  - For $h = 50, 75, 80$ in pervious experiments
- Data: 7% → 18% → 25% (Direction is right!)
- Murnighan et al. (JRU 1988)
  - $h = 60, 70, 80, 90$ predict 1%, 4%, 10%, 19%
- Actual data not as good: Constant across h

Can BGT Explain This? (行為賽局論解釋?)

- Cause of Disagreement: Self-Serving Bias (自利偏誤)
  - "What is better for me" = "Fair" (對我有利才叫公平)
- Add this to the above coordination game
  - Can explain higher disagreement rate in data
- Same in Kagel, Kim and Moser (GEB 1996):
  - Ultimatum over 100 tickets (P/R value differently)
- Not know P value H/L → Propose 45%/30%
  - Know P value higher, R rejects 40%, wants >50%

(最後通牒談判分配100張(價值不同的)彩券，對方不知道價值時提議者提議55-45(價值高)/70-30(價值低)。知道對方價值較高時回應者會要求比50-50更好，拒絕40%的提議)

Babcock et al.(AER 1995, Law&Social Inquiry 1997)

  - Self-serving bias Exp: Loewenstein et al. (JLS 93')
- Read 27-page actual legal case (讀27頁卷宗/談判和解)
  - Motorcyclist sues driver: $100,000 injury damage
- Bargain for 30 min. to settle it for ?? dollars
  - $5000 legal fees for every 5-min delay
  - Retired judge imposes award if no agreement
- First Guess what judge would award
  - US$1 (or 1 Grade Point) for every $10,000
  - 30分鐘談判和解(訴訟金額$100,000)，每延遲5分鐘須付$5000律師費
  - 事先預測和解不成法官會如何判 (實驗中$10,000 = 一美金或 1 GPA)

Gap of E(judgment) Predicts Disagreement

- Baseline: 70% cases settled at period 3-4 (out of 6)
- E(judgment) differ by $20,000 (20% of $100,000)
  - 控制組結果: 70%的組在第3-4回合達成和解(總共6回合)
  - 雙方預期判決結果的落差在$20,000左右(訴訟金額的20%)

Information	Settlement Stat.				E(judgmt) Gap	
	N	%	periods	(s. e.)	mean	(s. e.)
Control: Babcock 95'	47	72	3.75	(0.28)	$18,555	(3,787)
Control: Babcock 97'	26	65	4.08	(0.46)	$21,783	(3,956)

More Pairs Settled (and More Rapidly) if...

- Don't know role @ reading: 94% (in 2.51 pds)
  - Or, before bargaining, 1st tell about bias and
- List Weakness of own case: 96% (in 2.39 pds)

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Control: Babcock 95'	47	72	3.75	(0.28)	\$18,555	(3,787)
Didn't know roles $p<0.01$	47	94	2.51	(0.21)	-\$6,275 $\doteq 0$	(4,179)
Control: Babcock 97'	26	65	4.08	(0.46)	\$21,783	(3,956)
1st List Weakness $p=0.01$	23	96	2.39	(0.34)	\$4,676 $p=0.02$ $\doteq 0$	(6,091)

Summary for Unstructured Bargaining

- Focal points affect bargaining outcome
- Chip value affect bargaining outcome
  - Violate IAT Axiom of NBS
- BGT Explanation: Bargainers try to coordinate under multiple focal points
- Self-serving bias predict costly delay/settle
  - "Outcome favoring me is more likely/fair"
  - Caused by knowing my role when reading case

Structured Bargaining (制式談判)

- Finite Alternating-Offer Game (有限回交互提案)
- Binmore, Shaked & Sutton (1985): 2 period
- 1 offers a division of 100p to 2
- If 2 rejects, makes counteroffer dividing 25p
  - 成員甲提議如何分配100p，成員乙回應。若拒絕則由他提議分配25p
- SPE: Offer 25-75 (子賽局完全均衡：成員甲提議25-75)
- Experimental Results: mode at 50-50, some 25-75 and others in between
  - 實驗結果：提議分配的衆數在50-50，有些在25-75，其他在兩者之間

Structured Bargaining (制式談判)

- Neelin, Sonnenschein and Spiegel (1988)
  - Economics undergrads yield different results
- Are they taught backward induction? Also,
  - 經濟系大學部學生實驗結果不同，因為學過倒推法？還是實驗說明？
- Binmore: "YOU WOULD BE DOING US A FAVOR IF YOU SIMPLY SET OUT TO MAXIMIZE YOUR WINNINGS."
  - Neelin: "You would be discussing the theory this experiment is designed to test in class."

Structured Bargaining (制式談判)

- Social Preference or Limited Strategic Thinking? (是因為人們有社會偏好，還是理性思考有限制？)
- Johnson, Camerer, Sen & Rymon (2002), "Detecting Failures of Backward Induction: Monitoring Information Search in Sequential Bargaining," *Journal of Economic Theory*, 104 (1), 16-47.
- Some do not even look at the last stage payoffs in 3-stage bargaining games!
  - 三回合談判，有人「不看」最後一回合

Structured Bargaining (制式談判)

- Random Termination vs. Discounting
- Zwick, Rapoport and Howard (ToD 1992)
- Divide $30 with random termination
- Continuation probabilities 0.90, 0.67, 0.17
- SPE: 14.21, 12, 4.29
  - Accepted final offers: 14.97, 14.76, 13.92
- Close to discounting results (50-50 & SPE)
  - 14.90, 14.64, 13.57

Structured Bargaining (制式談判)

- Fixed Delay Cost in Bargaining
  - Lost wages, profits, etc.
- SPE: Strong side (lower delay cost) gets all
- Rapoport, Weg and Felsenthal (ToD 1990)
  - Divide 30 shekels (pseudo-infinite horizon)
  - Fixed Cost: 0.10 vs. 2.50 or 0.20 vs. 3.00
- Strong support for SPE: In the 1st round,
  - Strong P offer 4.4-7.9, weak R accept 60-80%
  - Weak P offer low, strong R accept 30%, but later quickly settle in 2nd (35%) or 3rd-4th (22%)

Outside Option and Threat Points

- Binmore, Shaked and Sutton (QJE 1989)
  - Two players bargain over £7, discount
  - Player 2 has outside option of £0, £2, or £4
- Split-the-difference (NBS): 47%, 64%, 76%
  - Divide surplus beyond the threat points
- Deal-me-out (SPE): 47%, 47%, 57%(=4/7)$_{\delta}$
  - Options matter only if is credible; ignore if $< \frac{\delta}{1-\delta}$
- BGT, Figure 4.4: Deal-me-out wins
  - £0, £2: spike around 50% / £4: cluster @ 57%

Incomplete Information (資訊不透明)

- Add Asymmetric Information to bargaining
- More realistic, but
  - Hard to bargain for a bigger share AND convey information at the same time
- Might need to turn down an offer to signal patience or a better outside option

Seller Make Offer to Informed Buyer

- Rapoport, Erve, and Zwick (MS 1995)
- Seller: Own item (worthless to herself)
- Buyer: Private reservation price is unif.[0,1]
- Seller makes an offer each period
- Common discount factor δ

Seller Make Offer to Informed Buyer

- Unique Sequential Equilibrium:
- Seller Offer:

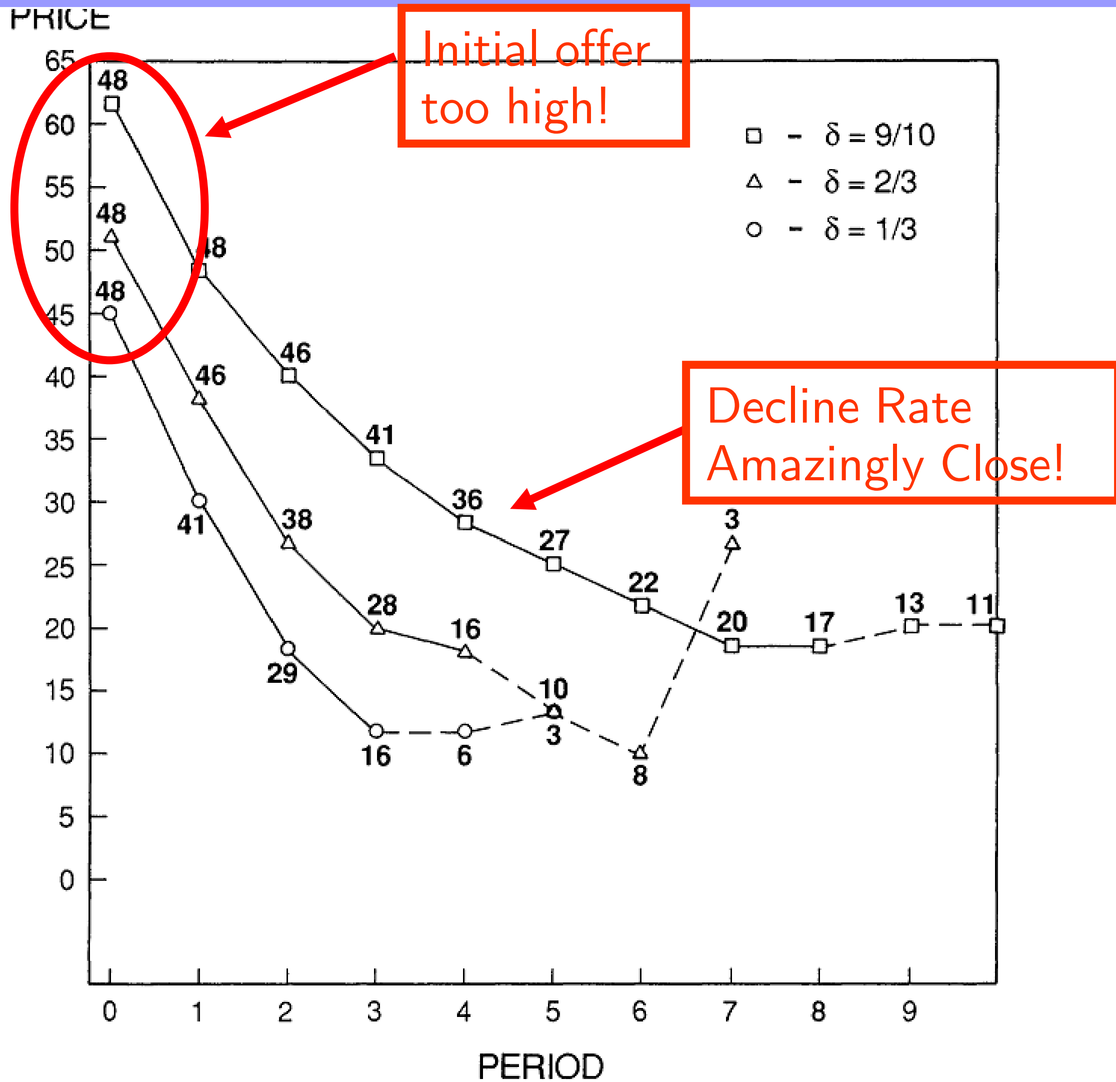
$$p_0 = \gamma \cdot \frac{1-\delta}{1-\gamma\cdot\delta}, \quad \gamma = \frac{1-\sqrt{1-\delta}}{\delta}$$

- Subsequently: $p_t = p_0 \cdot \gamma^t$
- Buyer Accepts if $p_t \leq v \cdot \dfrac{1-\delta}{1-\gamma\cdot\delta}$

Seller Make Offer to Informed Buyer

- Complicate Strategy: Depend on δ
  - Price discriminate high/low-value buyers
  - Price declines slow enough so high-value buyers will not want to wait
- Can subjects get these in experiments?
  - Different δ : H (0.90), M (0.67), L (0.33)
  - Opening p_0 : H (0.24), M (0.36), L (0.45)
  - Discount γ : H (0.76), M (0.68), L (0.55)

Seller Make Offer to Informed Buyer



Seller Make Offer to Informed Buyer

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  - Opening p_0 : H (0.24), M (0.36), L (0.45)
  - Discount γ : H (0.76), M (0.68), L (0.55)
- Buyers accept the 1st or 2nd offer below v
  - Accept offers too soon
- Sellers ask for higher prices (than equil.)
  - But discount γ : H (0.81), M (0.68), L (0.55)

Strikes and 1-Sided Information

- Forsythe, Kennan and Sopher (AER 1991)
- Only Informed bargainer I sees pie size
  - Either large (π_g) or small (π_b)
- Free-form bargaining
- Uninformed U can strike to shrink pie by γ
- Can we predict what happens?

Strikes and 1-Sided Information

- Forsythe, Kennan and Sopher (AER 1991)
  - Only Informed bargainer I sees pie size π_g or π_b
- Uninformed U can strike to shrink pie by γ
- Can we predict what happens?
  - Free-form bargaining
- Myerson (1979): Revelation Principle
  - I announces true state
  - U strikes to shrink pie by γ_g or γ_b
  - I gives U (based on true state) x_g or x_b

Strikes and 1-Sided Information

- IC requires:

$$(\gamma_g - \gamma_b)\pi_b \leq x_g - x_b \leq (\gamma_g - \gamma_b)\pi_g$$

- Interim Incentive Efficiency requires:

$$\gamma_g = 1, x_g - x_b = (1 - \gamma_b)\pi_g$$

- Strike ($\gamma_b < 1$) if and only if $p\pi_g > \pi_b$

- Deriving this is complicated…
- Could ANY subject get close to this?

Strikes and 1-Sided Information

- Random Dictator (RD) Axiom:
  - Agree fair mix between each being dictator to propose mechanism
- Then:

$$\gamma_g = 1, x_g = \frac{\pi_g}{2}, \gamma_b = \frac{1}{2}, x_b = 0 \text{ if } p\pi_g > \pi_b$$

$$\gamma_g = 1, x_g = \frac{\pi_b}{2}, \gamma_b = 1, x_b = \frac{\pi_b}{2} \text{ if } p\pi_g < \pi_b$$

Strikes and 1-Sided Information

- This is a win-win experiment:
  - Success if theory predictions are close
  - If not, will point to which assumption fails
- Forsythe et al. (AER 1995):
  - 10 minute sessions; written messages
- Is Myerson (1979) confirmed?
  - Surprisingly yes, though not perfect...

Strike Condition Off $p\pi_g < \pi_b$

Game	p	State	π	π_U	π_I	Total	% Strike
III	0.5	b	2.80				
		g	4.20				
		aver.	3.50	1.50	1.80	3.29	6.0%
		pred.		1.40	2.10	3.50	0.0%
IV	0.25	b	2.40				
		g	6.80				
		aver.	3.50	1.21	2.04	3.24	7.4%
		pred.		1.20	2.30	3.50	0.0%

Strike Condition On $p\pi_g > \pi_b$

Game	p	State	π	π_U	π_I	Total	% Strike
I	0.5	b	1.00				
		g	6.00				
		aver.	3.50	1.05	2.00	3.05	13.0%
		pred.		1.50	1.75	3.25	7.1%
II	0.75	b	2.30				
		g	3.90				
		aver.	3.50	1.41	1.76	3.18	9.3%
		pred.		1.46	1.75	3.21	8.3%

Sealed-Bid in Bilateral Bargaining

- Both buyers and sellers have private information
- Sealed-Bid Mechanism
  - Both write down a price
  - Trade at the average if $p_b > p_s$
  - Call Market: Many buyers vs. many sellers
- Two-Person Sealed-Bid Mechanism
  - One form of bilateral bargaining

Sealed-Bid in Bilateral Bargaining

- Two-Person Sealed-Bid Mechanism
- Buyer V: unif.[0,100]; Seller C: unif.[0,100]
- Piecewise-linear equilibrium: (not unique)
  - Chatterjee and Samuelson (1983)
  - Max. ex ante gains (Myerson & Satterthwaite 83)

$$p_b = \begin{cases} V & \text{if } V < 25 \\ \frac{25}{3} + \frac{2}{3}V & \text{if } V \geq 25 \end{cases}$$

$$p_s = \begin{cases} 25 + \frac{2}{3}C & \text{if } C < 75 \\ C & \text{if } C \geq 75 \end{cases}$$

Sealed-Bid in Bilateral Bargaining

- Radner and Schotter (JET 1989): 8 sessions
- 1, 2, 8: Baseline as above
- 3: Trade at price $(\mathrm{v} + \mathrm{c} + 50)\ /\ 3$ if $\mathrm{v}{>}\mathrm{c}{+}25$
  - Should bid their values $\mathrm{v} = V$, $\mathrm{c} = C$
- 4: Price = v, (Buyers should bid $\mathrm{v} = \mathrm{V}/2$)
- 5,6: Alternative distribution for more learning
  - Distribution w/ more trade (for learning): $\mathrm{m}{=}0.438$
- 7: Face-to-face bargaining

Estimated Buyer Bid Function Slope

Session	Below Cutoff β	$\hat{\beta}$	t-stat	Above Cutoff β	$\hat{\beta}$	t-stat
1	1	1.00	(0.01)	0.67	0.85*	(4.14)
2	1	0.91	(-0.52)	0.67	1.06	(1.28)
8	1	0.91	(-0.14)	0.67	0.80*	(2.32)
3	1	0.92	(-0.88)	1	0.73*	(-2.64)
4	0.5	0.55	(0.66)	0.5	0.58*	(2.32)
5	1	0.80*	(-4.17)	0.438	0.50	(1.12)
6 (-20)	1	0.85	(-1.40)	0.438	0.40	(0.56)
6 (21-)	1	1.11	(0.70)	0.438	0.32	(-1.55)

Estimated Seller Bid Function Slope

	Below Cutoff			Above Cutoff		
Session	β	β	t-stat	β	β	t-stat
1	0.67	0.58	(-1.38)	1	0.97	(-0.32)
2	0.67	0.74	(1.28)	1	1.07	(0.14)
8	0.67	0.75	(1.65)	1	1.07	(0.17)
3	1	1.06	(1.04)	1	0.67	(-0.58)
5	0.438	0.48	(0.87)	1	1.00	(0.60)
6 (-20)	0.438	0.57*	(2.16)	1	0.97	(-0.79)
6 (21-)	0.438	0.52	(1.20)	1	0.95	(-0.69)

Sealed-Bid in Bilateral Bargaining

- Face-to-face yields efficiency 110%
  - Some truthfully reveal; others do not
- Radner and Schotter (1989, p.210):
  - The success of the face-to-face mechanism, if replicated, might lead to a halt in the search for better ways to structure bargaining in situations of incomplete information.
  - It would create, however, a need for a theory of such structured bargaining in order to enable us to understand why the mechanism is so successful.

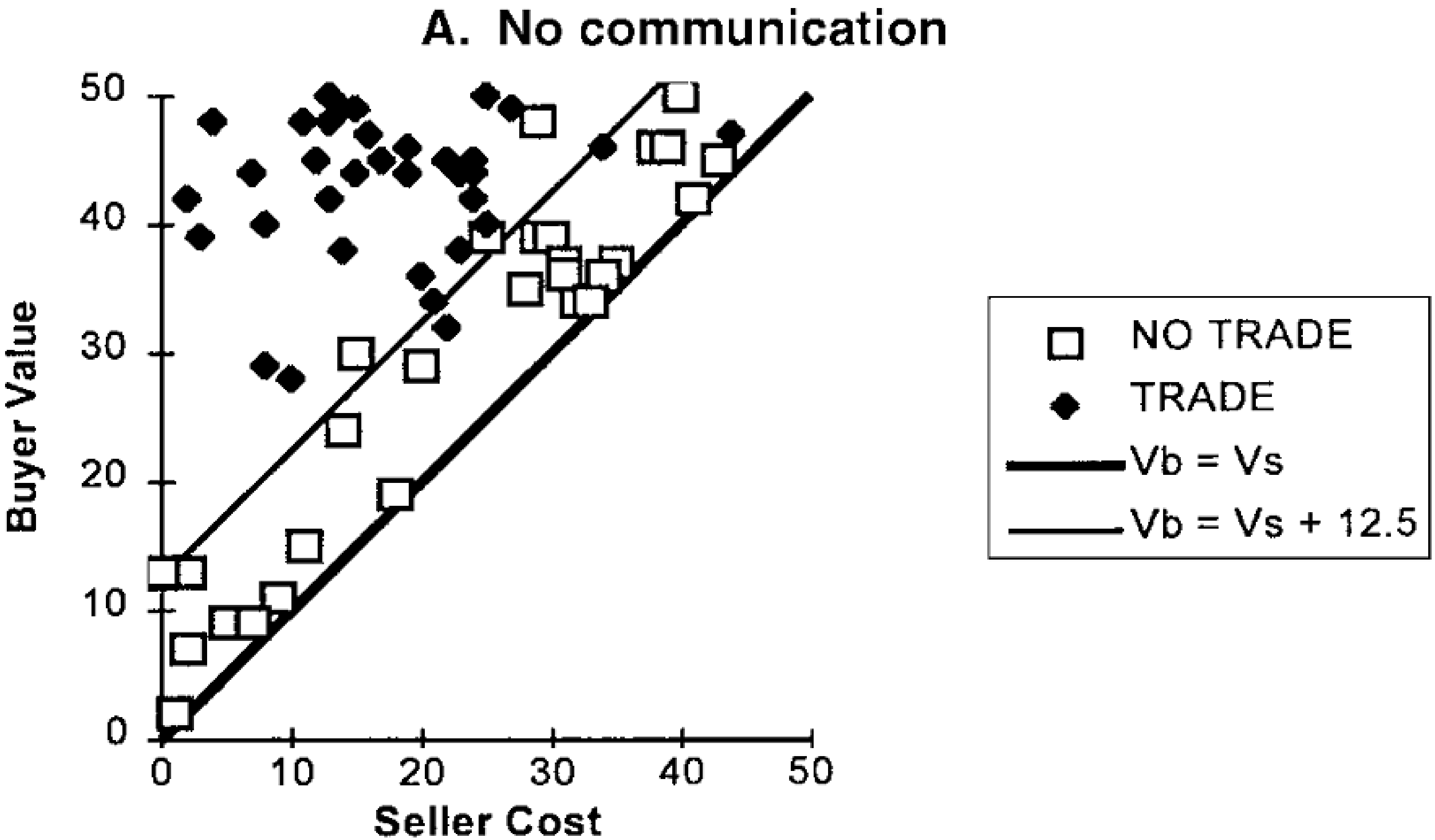
Sealed-Bid in Bilateral Bargaining

- Follow-up Studies:
- Schotter, Snyder and Zheng (GEB 2000)
  - Add agents
- Rapoport and Fuller (1995)
  - Strategy method; asymmetric value dist.
- Daniel, Seale and Rapoport (1998)
  - Asymmetric value distribution (20 vs. 200)
- Rapoport, Daniel and Seale (1998)
  - Flip buyer-seller asymmetry; fixed pairing

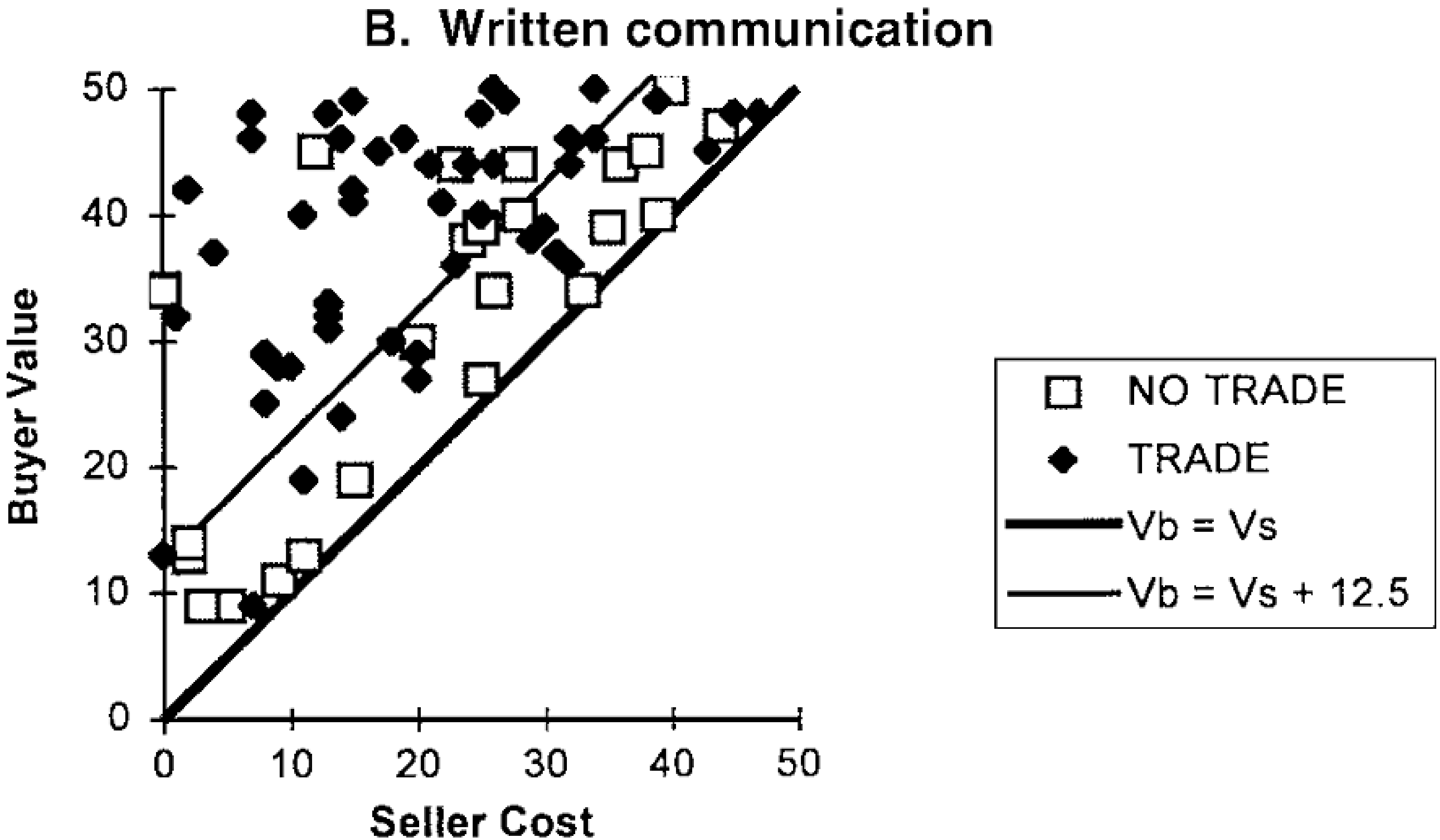
Communication vs. Sealed-Bid

- Valley et al. (GEB 2002): Communication
- Buyer/Seller Values/Costs: uniform[0, $50]
  - Bargain by stating bids; 7 periods; no rematch
  - Half had no feedback
- No communication: Sealed-bid in 2 minutes
- Written communication: Exchange messages for 13 minutes before final bid
- Face-to-face: Pre-game communication

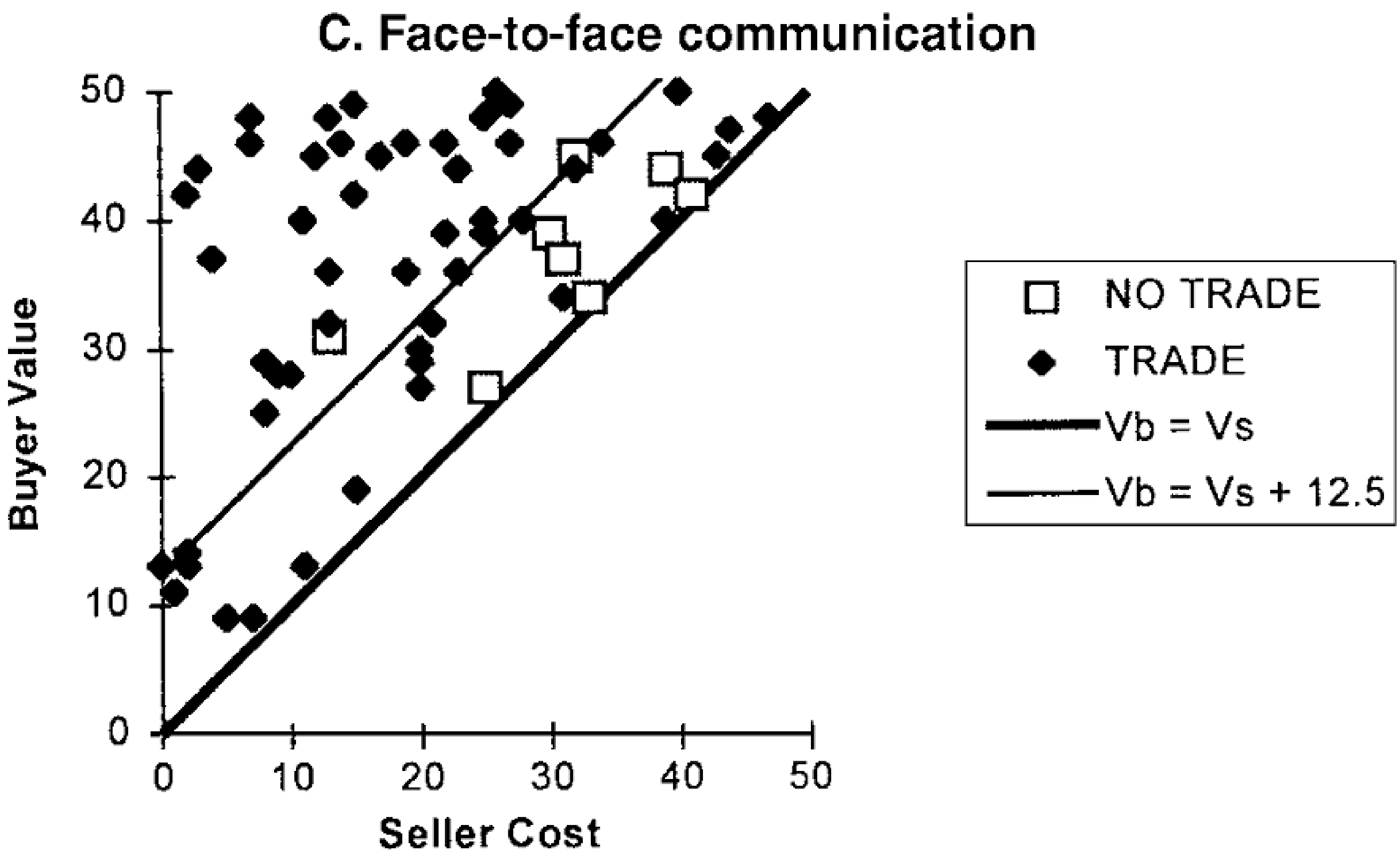
Communication vs. Sealed-Bid



Communication vs. Sealed-Bid



Communication vs. Sealed-Bid



Communication vs. Sealed-Bid

- Empirical bid function slope = 0.7 (~0.67)
- Why are there "gains of communication"?
- Slope of buyer bids against seller bids=0.6
- Buyers bid higher when seller bids higher
  - Mutual bidding of values (common in students)
  - Mutual revelation of values (com. in students)
  - Coordinating on a price (40% written; 70% face)

Communication vs. Sealed-Bid

- Coordinating on a price
  - Happens 40% in written, 70% in face-to-face
- Not truth-telling (only 1/3)
  - TT not coordinated (4% written, 8% face)
- Feel each other out; give enough surplus
  - Modal – equal split of surplus
- Variance of surplus doubles (by mismatch)

Conclusion

- Unstructured Bargaining
  - Focal divisions; competing focal points
  - Self-serving bias (erased by veil of ignorance or stating weakness of own case)
- Structured Bargaining
  - Deviate toward equal splits
  - Social preference models could explain this
  - But Johnson et al. (JET 2002) suggest limited look-ahead as reason for such deviations

Conclusion

- Outside options affect bargaining divisions only if threats are credible
  - Lower fixed cost player gets everything
- Information Asymmetry: One-Sided
  - Revelation Principle + Random Dictator: Good
  - Bazaar mechanism:
  - Offers decline as theory predicts, but start too high and respond to δ wrongly
  - Buyers accept too early

Conclusion

- Bilateral Bargaining: Two-Sided
  - Sealed-bid mechanism: between truthful revelation and piecewise-linear equilibrium
- Players over-reveal values in face-to-face
  - Too honest, but "more efficient"
- Communication → agree on a single price
- Why theory does better in sealed-bid than alternative-offer bargaining?
  - Is sealed-bid cognitively more transparent?

致謝

感謝 Management Science還有以下三位教授讓我們在第47張投影片使用下述論文的圖片:

- Amnon Rapoport, Ido Erev, and Rami Zwick (1995), "An Experimental Study of Buyer-Seller Negotiation with One-Sided Incomplete Information and Time Discounting," *Management Science*, 41(3), 377-394.

感謝Games and Economic Behavior 還有以下四位教授讓我們在77, 78, 79 這三張投影片中使用以下文章的一張圖表:

- Kathleen Valley, Leigh Thompson, Robert Gibbons, Max H. Bazerman (2002), "How Communication Improves Efficiency in Bargaining Games," *Games and Economic Behavior*, 38(1), 127–155.