

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? (奈許大哉問: 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, MGSB, 2nd ed., Ch. 14

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): $\forall x \in S^*, \nexists y \in S, \underline{y} > x$
 $\Leftrightarrow \underline{y_i} \geq x_i \forall i, y_j > x_j$
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 Dis-agreement
		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 $(S, d), S^* \subset T \subset S$)
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 $\text{sum} \leq \text{£}10$, 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 $\text{£}10$ together, so to earn \$\$ you have to pool your aces and agree on how to divide the $\text{£}10$."
 - ▶ (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	<u>16</u>	40	<u>17</u>
£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** over allocation focal points 50-50 vs. $h-(100-h)$
 - ▶ Each favoring one ($50 > h$ whenever $50 < 100-h$)
 - ▶ 可用協調賽局解釋: 考慮兩個分配上的協調焦點 50-50 或 $h-(100-h)$
- ▶ Both simultaneously choose to **demand** their favorite or **acquiesce** to the less favorable
 - ▶ If both demand favorite: Both earn 0
 - ▶ If only one demands favorite: Play focal point
 - ▶ 兩邊同時選擇「要求有利自己的分配」或「願接受另一個分配」。
 - ▶ 若都「要求」, 兩邊報酬皆為0; 只有一方「要求」, 則按「要求」分配

Can BGT Explain This? (行為賽局論解釋?)

- ▶ If both acquiesce: Earn average of the two focal points $x_1 = (50+h)/2$, $x_2 = (150-h)/2$
- ▶ 若都「接受另一個」則獲得兩分配平均 $x_1 = (50+h)/2$, $x_2 = (150-h)/2$
- ▶ MSE:

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

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

Can BGT Explain This? (行為賽局論解釋?)

- ▶ Roth (bk chp 1985)
- ▶ Disagreement rates =
$$\frac{(h - 50)^2}{(150 - h)(50 + h)}$$
- ▶ 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)
- ▶ If R unaware of H/L, P_H/P_L propose 55-45/70-30
 - ▶ If aware of P_H , R will reject 60-40, wants $>50\%$

最後通牒談判分配100張彩券(價值不同), 對方不知道價值時價值高/低的提議者提議55-45/70-30。知道價值高時回應者會拒絕60-40、要求比50%更好

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 $E(\text{judgment})$ Predicts Disagreement

- ▶ Baseline: 70% cases settled at period 3-4 (out of 6)
- ▶ $E(\text{judgment})$ 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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	N	%	periods	(s. e.)	mean	(s. e.)
Control: Babcock 95'	47	72	3.75	(0.28)	\$18,555	(3,787)
Didn't know roles <small>p<0.01</small>	47	94	2.51	(0.21)	-\$6,275	(4,179)
Control: Babcock 97'	26	65	4.08	(0.46)	\$21,783	(3,956)
1 st List Weakness <small>p=0.01</small>	23	96	2.39	(0.34)	-\$4,676	(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：提議分配的眾數在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 (T&D 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 (T&D 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)**
 - ▶ 2 players bargain over £7, discount factor $\delta = 0.9$
 - ▶ Rubinstein-Stahl solution is $\left(\frac{1}{1+\delta}, \frac{\delta}{1+\delta}\right)$
 - ▶ 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)**
 - ▶ Ignore non-credible options or $\left(\frac{\delta}{1-\delta}\right)$
- ▶ **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:

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

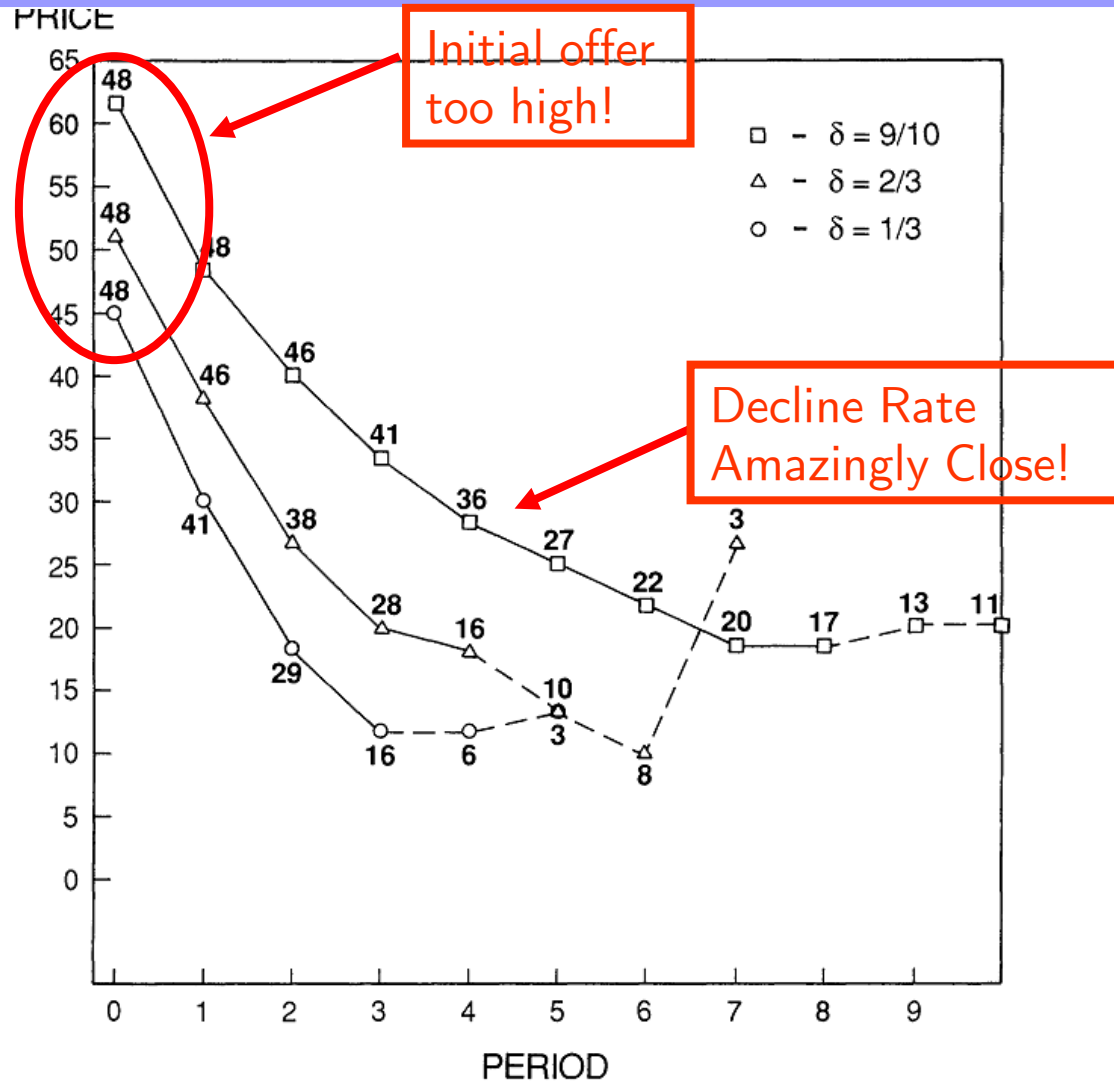
▶ Subsequently: $p_t = p_0 \cdot \gamma^t$

▶ Buyer Accepts if $p_t \leq v \cdot \frac{1 - \delta}{1 - \gamma \cdot \delta}$

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

- ▶ 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)
- ▶ 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 $(v + c + 50) / 3$ if $v > c + 25$
 - ▶ Should bid their values $v = V, c = C$
- ▶ 4: Price = v , (Buyers should bid $v = V/2$)
- ▶ 5,6: Alternative distribution for more learning
 - ▶ Distribution w/ more trade (for learning): $m=0.438$
- ▶ 7: Face-to-face bargaining

Estimated Buyer Bid Function Slope

Below Cutoff

Above Cutoff

Session	β	$\hat{\beta}$	t-stat	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	$\hat{\beta}$	t-stat	β	$\hat{\beta}$	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

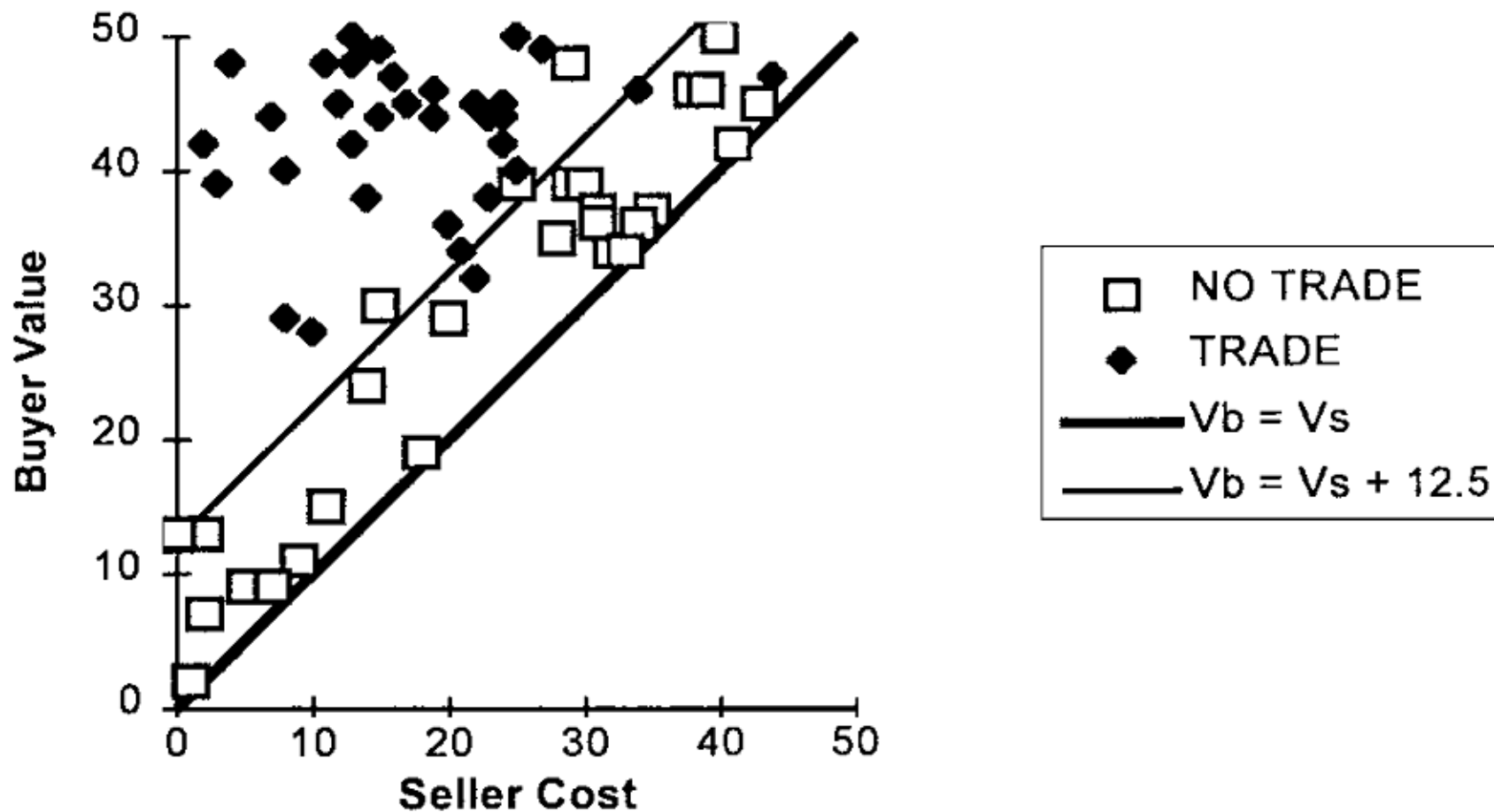
- ▶ Follow-up Studies:
- ▶ Schotter, Snyder and Zheng (GEB 2000)
 - ▶ Add agents
- ▶ Rapoport and Fuller (1995)
 - ▶ Strategy method; asymmetric value dist.
- ▶ Daniel, Seale and Rapoport (1998)
 - ▶ Asymmetric value distribution (20 vs. 200)
- ▶ Rapoport, Daniel and Seale (1998)
 - ▶ Flip buyer-seller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

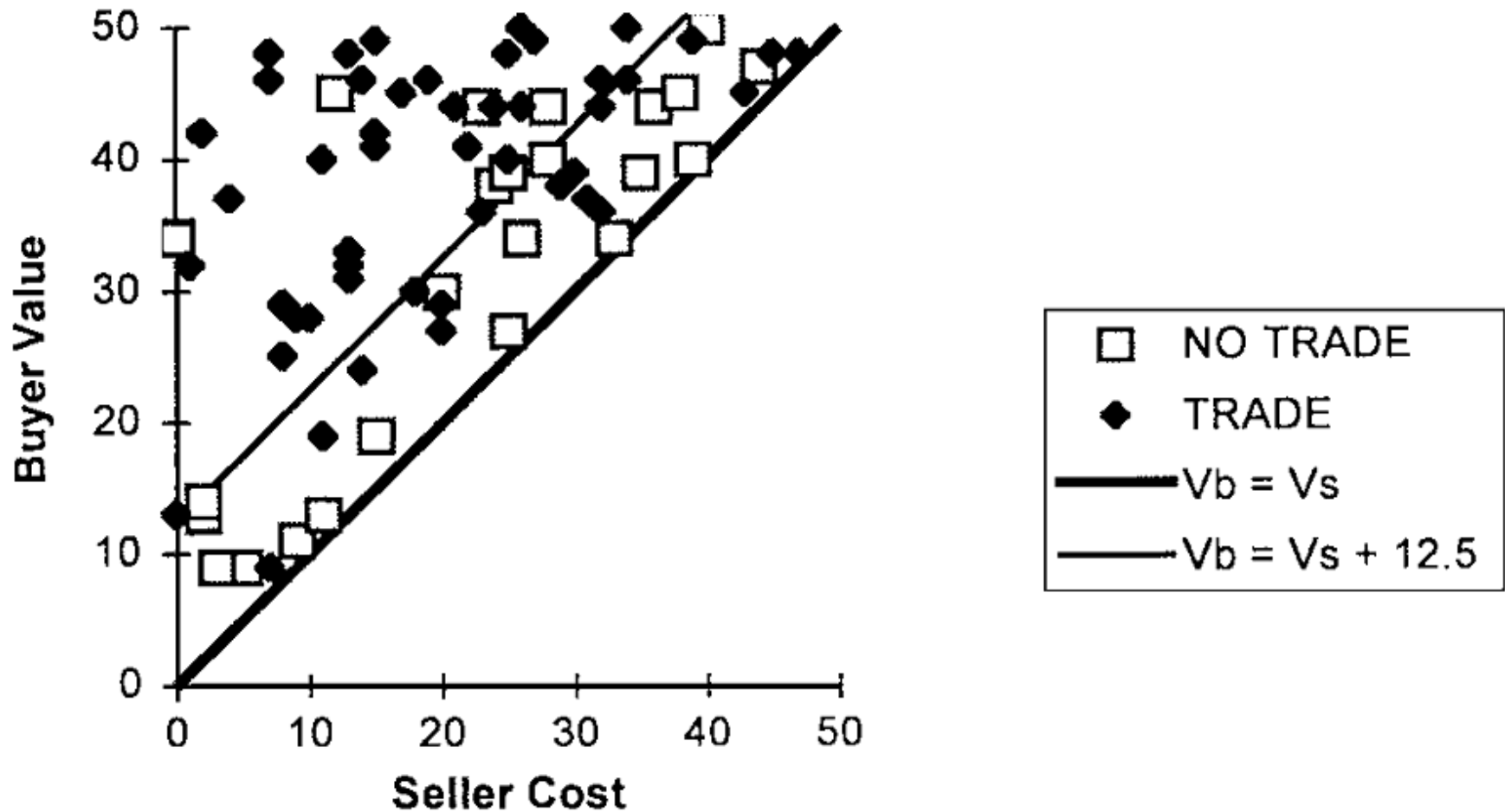
Communication vs. Sealed-Bid

A. No communication



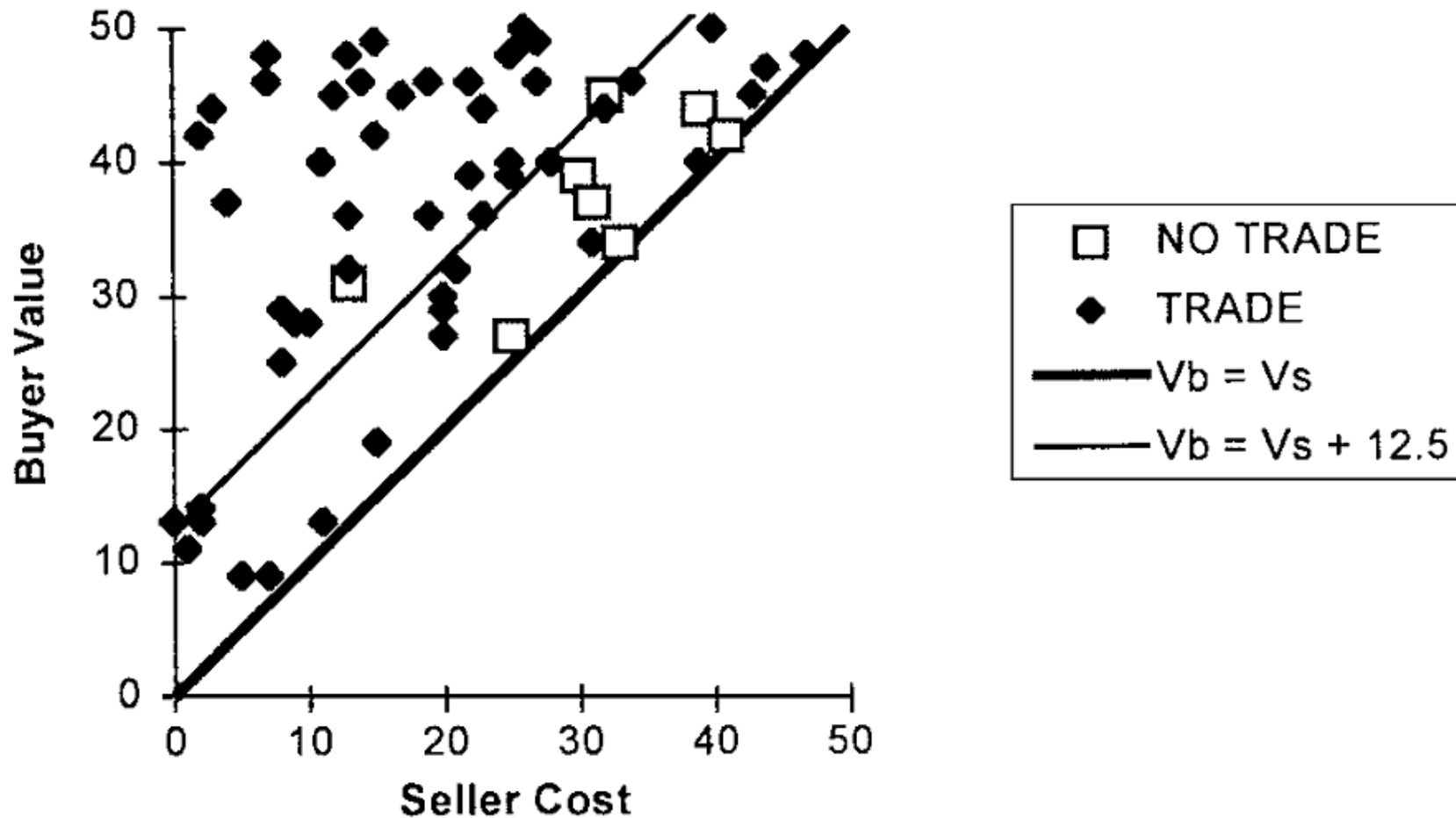
Communication vs. Sealed-Bid

B. Written communication



Communication vs. Sealed-Bid

C. Face-to-face communication



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?