Electronic Supplementary Material

Article title:
Revisiting gender differences in ultimatum bargaining: Experimental evidence from the US and China

Journal name: Journal of the Economic Science Association
Author names: Shuwen Li, Xiangdong Qin and Daniel Houser
Corresponding author: Shuwen Li, Department of Economics, University of North Carolina at Charlotte, Charlotte, NC, USA. Email address: lshuwen@uncc.edu.

Contents

ESM1. Recombinant Estimation

We apply Mullin and Reiley (2006)'s technique to calculate the group outcomes including rejection rates, proposer and responder earnings. Means and standard errors are reported in Table E2b, E3b, E4b and E5 in the next section. See Fig. E2 and Fig. E3 for three comparisons reported in the main text.

Note that the observed group outcomes are determined by the realized random pairing of the subjects in the lab, but because there is no interaction between the proposer and the responder in a pair, the hypothetical group outcomes under other ways of pairing are as valid as those observed. To extract the maximum information out of the data, we use simulations to compute the expected rejection rates, proposer and responder earnings based on all possible realizations of pairing that could have occurred.

For example, suppose there are n M-F pairs in the Name treatment in the actual experiment, where male proposer M_1 is matched with female responder F_1, male proposer M_2 is matched with female responder $F_2, \ldots$, and male proposer M_n is matched with female responder F_n. To estimate expected proposer earnings, the baseline estimator computes the simple average of proposer earnings from these realized n pairs. Under recombinant estimation, however, male proposer M_1 is hypothetically paired with every female responder $F_1, F_2, \ldots, F_n$, male proposer M_2 is hypothetically paired with every female responder $F_1, F_2, \ldots, F_n$ and so on. The recombinant estimator computes the average of proposer earnings from all these possible n^2 pairs. Note that pairs in the recombinant sample are not independent because each pair shares one player with some other pairs. As a result, standard errors need to be adjusted accordingly.

Suppose there exist a total of J possible pairs ($J = n^2$ in the above example). Let $y_j =$ proposer earnings under pair j, where $j = 1,2, \ldots, J$. Note that random variables y_j, $j = 1,2, \ldots, J$ constitute a sample of size J of the population $y \sim (\mu, \sigma^2)$, so all y_js are identically distributed $y_j \sim (\mu, \sigma^2)$.

The estimated mean proposer earnings are

$$\hat{\mu} = \frac{\sum_{j=1}^{J} y_j}{J}$$

However, y_j, $j = 1,2, \ldots, J$ is not a random sample because some pairs share (exactly one) common player. As a result, we cannot apply the standard way to calculate standard

error of the mean. Let $\phi = \mathrm{cov}(y_s, y_t) \neq 0$ be the common covariance between proposer earnings of two pairs that share exactly one common player, $\forall s, t$. For example, pair $M_1 - F_3$ and pair $M_1 - F_5$ share common player M_1. Because each player's strategy is independent of all other players' strategies, when there is no overlap between two pairs of players, the covariance is 0.

Variance of the mean is

$$var(\hat{\mu}) = \frac{J\sigma^2 + 2m\phi}{J^2}$$

where m = number of combinations of two pairs that share exactly one common player

Standard error of the mean is

$$se(\hat{\mu}) = \sqrt{\frac{J\sigma^2 + 2m\phi}{J^2}}$$

Note that σ^2 can be estimated by the sample variance of the realized outcomes $\{y_1, y_2, \ldots, y_J\}$:

$$\widehat{\sigma^2} = \frac{\sum_{j=1}^{J}(y_j - \hat{\mu})^2}{J - 1}$$

and ϕ can be estimated by the sample covariance between those pairs which share one common player:

$$\hat{\phi} = \frac{\sum_{i=1}^{J-1} \sum_{k=i+1}^{J} 1(p_i \cap p_k \neq \emptyset)[(y_i - \hat{\mu})(y_k - \hat{\mu})]}{\sum_{i=1}^{J-1} \sum_{k=i+1}^{J} 1(p_i \cap p_k \neq \emptyset)}$$

where $1(p_i \cap p_k \neq \emptyset)$ is equal to 1 if pair i and pair k share a common player, and 0 otherwise. Note further that $m = \sum_{i=1}^{J-1} \sum_{k=i+1}^{J} 1(p_i \cap p_k \neq \emptyset)$.

Reference

Mullin, C. H., & Reiley, D. H. (2006). Recombinant estimation for normal-form games, with applications to auctions and bargaining. *Games and Economic Behavior*, *54*(1), 159-182.

ESM2. Tables

Table E1 Percentages of Even or Greater Offers by Type of Pair in Each Country

		Responder (R)							
		Male		Female		Gender unknown to P		Total	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	83%	83%	100%	86%	93%	60%	92%	77%
		(38/46)	(40/48)	(43/43)	(31/36)	(38/41)	(21/35)	(119/130)	(92/119)
	Female	92%	73%	85%	73%	80%	81%	86%	75%
		(34/37)	(33/45)	(40/47)	(35/48)	(24/30)	(30/37)	(98/114)	(98/130)
	Total	87%	78%	92%	79%	87%	71%	89%	76%
		(72/83)	(73/93)	(83/90)	(66/84)	(62/71)	(51/72)	(217/244)	(190/249)

Note: Number of observations in parentheses.

Table E2 Rejection Rates by Type of Pair in Each Country

		Responder (R)							
		Male		Female		Gender unknown to P		Total	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	13.0%	10.4%	2.3%	11.1%	7.3%	28.6%	7.7%	16.0%
		(6/46)	(5/48)	(1/43)	(4/36)	(3/41)	(10/35)	(10/130)	(19/119)
	Female	10.8%	13.3%	10.6%	14.6%	10.0%	16.2%	10.5%	14.6%
		(4/37)	(6/45)	(5/47)	(7/48)	(3/30)	(6/37)	(12/114)	(19/130)
	Gender unknown to R	6.7%	18.9%	9.8%	25.7%	-	-	8.5%	22.2%
		(2/30)	(7/37)	(4/41)	(9/35)	-	-	(6/71)	(16/72)
	Total	10.6%	13.8%	7.6%	16.8%	8.5%	22.2%	9.0%	15.3%
		(12/113)	(18/130)	(10/131)	(20/119)	(6/71)	(16/72)	(22/244)	(38/249)

Note: Number of observations in parentheses.

Table E2b Expected Rejection Rates by Type of Pair in Each Country
(Under Recombinant Estimation)

		Responder (R)							
		Male		Female		Gender unknown to P		Total	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	13.3%	8.8%	2.3%	9.8%	7.4%	21.9%	7.9%	14.4%
		(281/2116)	(202/2304)	(43/1849)	(127/1296)	(216/2911)	(551/2520)	(540/6876)	(880/6120)
	Female	13.2%	13.7%	10.1%	14.0%	12.8%	11.4%	11.9%	12.9%
		(181/1369)	(277/2025)	(223/2209)	(322/2304)	(273/2130)	(305/2664)	(677/5708)	(904/6993)
	Gender unknown to R	7.7%	15.2%	11.2%	17.9%	-	-	9.7%	16.5%
		(163/2130)	(404/2664)	(326/2911)	(452/2520)	-	-	(489/5041)	(856/5184)
	Total	11.1%	12.6%	8.5%	14.7%	9.7%	16.5%	9.7%	13.6%
		(625/5615)	(883/6993)	(592/6969)	(901/6120)	(489/5041)	(856/5184)	(1217/12584)	(1784/13113)

Note: Number of observations in parentheses.

Table E3 Actual Proposer Earnings by Type of Pair Average and Standard Error in Each Country

		Responder (R)							
		Male		Female		Gender unknown to P		Average	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	4.09	4.53	4.73	4.33	4.39	3.50	4.40	4.17
		(0.27)	(0.23)	(0.12)	(0.28)	(0.24)	(0.39)	(0.13)	(0.17)
	Female	4.19	4.41	4.31	4.21	4.38	4.11	4.29	4.25
		(0.30)	(0.28)	(0.24)	(0.29)	(0.32)	(0.32)	(0.16)	(0.17)
	Average	4.13	4.47	4.51	4.26	4.39	3.82	4.35	4.21
		(0.20)	(0.18)	(0.14)	(0.20)	(0.19)	(0.25)	(0.10)	(0.12)

Table E3b Expected Proposer Earnings by Type of Pair Average and Standard Error in Each Country (Under Recombinant Estimation)
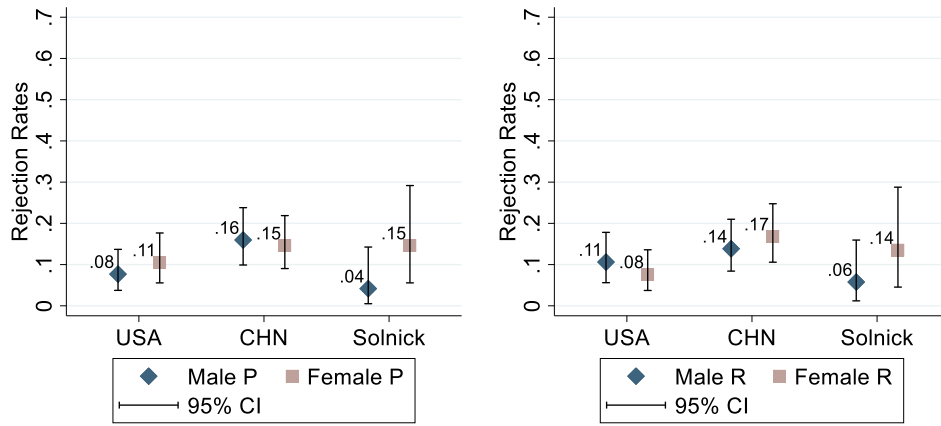
		Responder (R)							
		Male		Female		Gender unknown to P		Average	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	4.10	4.67	4.74	4.43	4.40	3.92	4.40	4.31
		(0.21)	(0.12)	(0.12)	(0.21)	(0.19)	(0.23)	(0.11)	(0.12)
	Female	4.07	4.44	4.36	4.26	4.21	4.40	4.23	4.37
		(0.28)	(0.17)	(0.18)	(0.17)	(0.22)	(0.20)	(0.13)	(0.11)
	Average	4.08	4.56	4.53	4.32	4.32	4.17	4.32	4.34
		(0.17)	(0.10)	(0.11)	(0.13)	(0.16)	(0.16)	(0.09)	(0.08)

Table E4 Actual Responder Earnings by Type of Pair Average and Standard Error in Each Country

		Responder (R)					
		Male		Female		Average	
		USA	CHN	USA	CHN	USA	CHN
Proposer	Male	4.61	4.43	5.03	4.56	4.81	4.48
(P)		(0.30)	(0.22)	(0.13)	(0.30)	(0.17)	(0.18)
	Female	4.73	4.26	4.63	4.33	4.67	4.30
		(0.33)	(0.27)	(0.26)	(0.29)	(0.20)	(0.20)
	Gender	4.88	4.19	4.68	3.72	4.77	3.96
	unknown to R	(0.30)	(0.36)	(0.27)	(0.38)	(0.20)	(0.26)
	Average	4.72	4.30	4.78	4.22	4.75	4.26
		(0.18)	(0.16)	(0.13)	(0.19)	(0.11)	(0.12)

Table E4b Expected Responder Earnings by Type of Pair Average and Standard Error in Each Country (Under Recombinant Estimation)

		Responder (R)					
		Male		Female		Average	
		USA	CHN	USA	CHN	USA	CHN
Proposer	Male	4.58	4.45	5.03	4.59	4.79	4.50
(P)		(0.28)	(0.19)	(0.13)	(0.25)	(0.16)	(0.15)
	Female	4.61	4.19	4.63	4.34	4.62	4.27
		(0.32)	(0.24)	(0.23)	(0.26)	(0.19)	(0.18)
	Gender	4.86	4.32	4.61	4.03	4.71	4.18
	unknown to R	(0.27)	(0.29)	(0.25)	(0.28)	(0.19)	(0.21)
	Average	4.69	4.33	4.73	4.27	4.71	4.30
		(0.17)	(0.14)	(0.13)	(0.16)	(0.11)	(0.11)

Table E5 Number of Pairs by Type of Pair in Each Country

(Under Recombinant Estimation)

		Responder (R)							
		Male		Female		Gender unknown to P		Total	
		USA	CHN	USA	CHN	USA	CHN	USA	CHN
Proposer (P)	Male	2116	2304	1849	1296	2911	2520	6876	6120
	Female	1369	2025	2209	2304	2130	2664	5708	6993
	Gender unknown to R	2130	2664	2911	2520	-	-	-	-
	Total	5615	6993	6969	6120	-	-	12584	13113

ESM3. Figures

(a) Rejection rates by proposer gender   (b) Rejection rates by responder gender

Fig. E1 Rejection rates in the US (USA), Chinese (CHN) and Solnick's sample
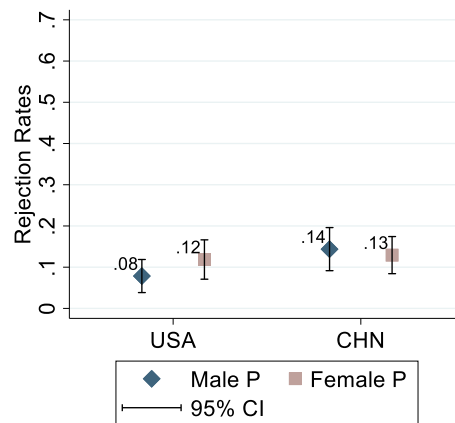
Fig. E2 Rejection rates by proposer gender in the US (USA) and Chinese (CHN) sample under recombinant estimation
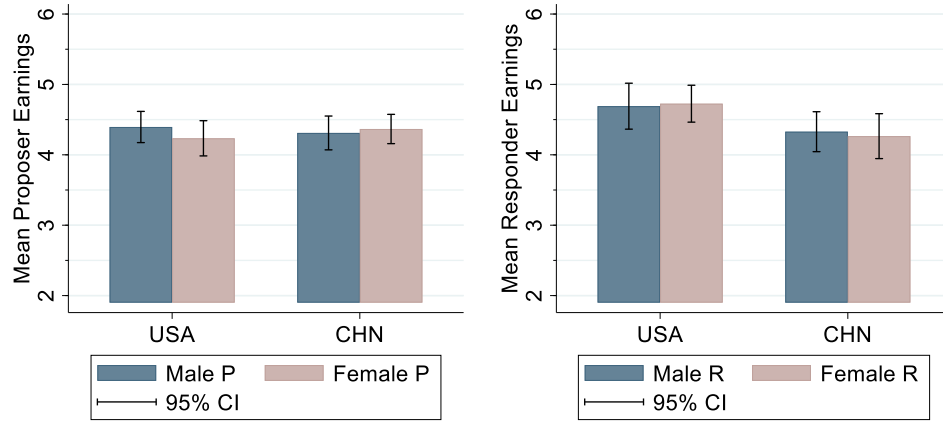
(a) Mean proposer earnings by proposer gender   (b) Mean responder earnings by responder gender

Fig. E3 Mean player earnings in the US (USA) and Chinese (CHN) sample under recombinant estimation

ESM4. Instructions

Instructions (Name Treatment)[1]

Thank you for coming to this experiment.

Please turn off all electronic devices and place them in your bags. Please keep quiet and remain seated during the experiment. If you have any questions, raise your hand and we will come to personally assist you.

All participants will receive a payment of $5 for showing up on time. In addition, if you follow the instructions carefully, you can earn more money based on your decision and the decision of other participants. At the end of the experiment, you will be paid privately in cash.

Upon arrival, every one of you has been randomly assigned an experimental ID which will be shown to you on the screen soon. This ID identifies your decision today, and no one including the experimenters will be able to link your decision to your name. Please keep it private to yourself. **Note that this ID is an artificial first name that is assigned according to your gender.**[2]

The decision task is a two-person money-splitting game between **Proposer and Responder**. You have been randomly paired with another participant in this room, who becomes your counterpart. One of you is randomly chosen to be Proposer and the other Responder. You will see your role and your counterpart's ID on the screen before making any decision.

The Proposer and Responder in a pair have $20 to split. **On the decision screen, the Proposer makes an offer specifying how much of the $20 the Responder will get. At the same time, the Responder inputs the minimum amount of money out of $20 that he/she is willing to accept (the minimum acceptable offer).** The offer and the minimum acceptable offer must be integers between 0 and 20 (inclusive). Neither of them will see each other's input until the end of the experiment. **If the offer from the Proposer is greater than or equal to the Responder's minimum acceptable offer, this offer is accepted; the Responder gets the offer, and the Proposer gets the rest (=20-offer). Otherwise, the offer is rejected, and both players get $0.**

A questionnaire follows the decision task.

---

[1] Instructions in Chinese are available upon request.
[2] For Number Treatment, this sentence is replaced by "**Note that this ID is a three-digit number**."

After the questionnaire, you will see on the screen results of the decision task and your profits.

Let us know if you have any questions. To make sure you understand these instructions, we will distribute a quiz now.

ESM5. Screenshots[3]

Fig. E4 Decision Task Interface for the Proposer (Name Treatment)

Fig. E5 Decision Task Interface for the Responder (Name Treatment)

---

[3] Screenshots in Chinese are available upon request.

Fig. E6 Questionnaire (Name Treatment)

Fig. E7 Decision Task Interface for the Proposer (Number Treatment)