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**Online Appendix to  
“Sequential Bargaining in the Field: Evidence from  
Millions of Online Bargaining Interactions”**

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# Appendix

## A Sample Construction

Starting with our original sample of approximately 92 million Best Offer listings, we imposed a handful of sample restrictions. Note that all sample restrictions are imposed at the listing level. That is, even if the sample restriction pertains to characteristics of an offer, we removed all listing that are associated with *any* offer that violates the restriction. In total, this leaves us with a sample of 88 million listings.

The sample restrictions are as follows:

### **Restrictions on Listing Attributes**

- (L1) *Listing price at or below \$1000.*
- (L2) *In the event of a sale, the sale price is at or below the listing price.*

### **Restrictions on Thread Attributes**

- (T1) *All offers are at or below the listing price.*
- (T2) *Neither the buyer nor the seller makes more than three offers.*
- (T3) *For all offers with a status of “countered,” a counter-offer exists in the dataset.*
- (T4) *For all offers accepted, there are no subsequent offers in the thread.*
- (T5) *There is not more than one offer arriving at the exact same time by the same buyer for the same item.*

The quantitative significance of these sample restrictions is described in Table A1. Restriction (L1), the largest, is an arbitrary restriction to simplify the analysis and the graphics and excludes approximately 10% of our sample. The second listing-level restriction, (L2), binds rarely, for only 42 thousand listings. It is possible that it happens because the sellers have agreed to bundle other products or services with the sale, however this is abnormal and inconsistent with eBay guidelines for communication in Best Offer bargaining.

**Table A1: Summary of Sample Restrictions**

	No. Violations	Fraction of Listings
L1	9547987	0.0971
L2	42524	0.000433
T1	386096	0.00393
T2 - buyer	3518	0.0000358
T2 - seller	0	0
T3	1451	0.0000148
T4	1109	0.0000113
T5	4273	0.0000435
No. Listings Before	98307281	
No. Listings After	88386471	

Notes: This table summarizes the incidence of violations of sample restrictions L1–L2, and T1–T5, to document the exclusion of approximately 10m listings from our main estimation sample.

Among the thread-level restrictions, (T1) is the most significant, affecting approximately 386 thousand listings. We suspect that it happens when an offer is made and the seller subsequently revises her price downward. In that case we only observe the final listing price, not the standing listing price that the buyer saw when making the offer. Indeed, we see from Table I that about 26% of listings have their prices adjusted at some point. Restrictions (T2) - (T5) are rarely binding, and we do not have an explanation for them besides data processing errors.

## B Reference Price Sample

Here we describe our reference price subsample—a portion of the data for which we observe item condition (used vs. new) and catalog product identifiers, where each product identifier represents a distinct product SKU that can be linked to third-party catalogs to which eBay subscribes. These products are narrowly defined, matching a product available at retail stores, such as: “Microsoft Xbox One, 500 GB Black Console,” “Chanel No.5 3.4oz, Women’s Eau de Parfum,” and “The Sopranos - The Complete Series (DVD, 2009).” We also construct a flag for the condition of the item as being new or used. For each product-by-condition cell, we compute a *reference price* (as in Coey, Larsen, and Platt 2019), which is the average price of sold fixed price listings of the same product

and condition over the time frame of our sample that did not have the Best Offer option enabled, limiting to product-by-condition cells with at least 20 such transactions (Einav et al. 2015 constructed similar reference prices based on listing titles rather than on product identities and item conditions). These reference prices are computed entirely outside of our main sample, as our sample consists only of Best-Offer-enabled listings. For each thread in our bargaining data, we then compute a normalized price by dividing the final sales price (when a sale occurred) by the reference price for that product.

Table B1 shows an analogue of the descriptive statistics from Table I using this subsample of listings for which we are able to construct reference prices. The advantage of this subsample is that we have some evidence on the expected outcome price, so we can think about whether the buyer got a “deal.” However, this comes at the cost of a somewhat opaque sample construction. By ruling out one-of-a-kind listings, for which no reference price will exist, it biases the sample towards the kinds of listings for which we expect relatively less bargaining. Consistent with this intuition, we see that these listings are substantially more likely to sell (47% as compared to 22% in the full sample), but that there is less “room to bargain,” as sale prices are substantially closer to list prices (91% as compared to 83%), and bargaining threads are substantially less likely to succeed (25% as compared to 45%). However, we still find that just under half (48%) of listings that sell in this sample are bargained (from Table B1, 0.224 sell through Best Offer and 0.467 sell overall, yielding  $0.224/0.467 = 0.480$  of sales coming through bargaining).

## C Heterogeneity: Players or Products?

Here we analyze the question of whether variance in bargaining outcomes is more a feature of *who* is bargaining or of *what* is being bargained over. The outcomes we examine are whether or not the bargaining pair comes to an agreement, how many periods the bargaining takes, and what price the players agree on when they do agree. The bargaining literature provides a number of possible explanations for why player heterogeneity may matter in explaining these outcomes: players may differ in their levels of patience, experience, or other measures of bargaining power/ability, or may differ in their valuations for the good. We also see the literature as establishing a role for

**Table B1: Descriptive Statistics for Reference Price Sample**

	Mean	Std. Dev.	Min	Median	Max
<b>Listing-Level Data</b>					
Listing Price	100	162	.99	27	1,000
Used	.719	.45	0	1	1
Revised	.233	.423	0	0	1
Sold	.468	.499	0	0	1
Sold by Best Offer	.224	.417	0	0	1
Received an Offer	.427	.495	0	0	1
No. Photos	2.09	2.71	0	1	12
Multiple shipping options	.171	.377	0	0	1
Slowest shipping	.0369	.188	0	0	1
Sale Price	111	158	.99	40	1,000
Sale Price / List Price	.91	.127	.00099	1	1
Bargained Price	122	161	.99	52	1,000
Bargained Price / List Price	.813	.124	.00099	.837	1
Sale Price / Reference	1.16	1.26	.000991	1	196
Bargained Price / Reference	1.1	1.38	.00159	.946	196
No. Listings	2,044,120				
<b>Seller-Level Data</b>					
Feedback Positive Percent	99.3	4.84	0	100	100
No. Listings	9.06	120	1	2	26,124
No. Sales	4.24	42.6	0	1	9,411
No. Sales by Best Offer	2.03	18	0	1	4,077
No. Sellers	225,610				
<b>Buyer-Level Data</b>					
No. Bargaining Threads	7.96	29.5	1	3	4,734
No. Offers	13.4	48	1	4	7,229
No. Purchases	1.49	4.09	1	1	1,059
No. Bargained Purchases	1.07	2.46	0	1	408
No. Buyers	427,649				
<b>Thread-Level Data</b>					
No. Offers	1.7	.959	1	1	6
No. Offers if Sold	1.62	1	1	1	6
Agreement Reached	.25	.433	0	0	1
Seller Experience	1,675	4,532	1	145	68,719
Buyer Experience	109	395	1	20	12,736
First Buyer Offer	152	166	0	95	1,000
First Buyer Offer / List Price	.681	.188	0	.714	1
First Buyer Offer / Reference	.869	.926	0	.797	196
No. Competing Buyers	.0979	.532	0	0	32
No. Competing Sellers	.0184	.364	0	0	100
No. Competing Listings	1.34	6.48	0	0	654
No. Threads	1,812,737				

Notes: This table presents summary statistics for the subsample of our data for which we have reference prices. Note that the feedback variable in the seller panel is missing for 7,159 sellers.

heterogeneity in the items being bargained over, as markets for different items may be characterized by varying degrees of asymmetric information, for example. We explore

**Table C1: Explaining Heterogeneity in Bargaining Outcomes**

	(1)	(2)	(3)	(4)	(5)	(6)
	Price	Sold	No. Offers	Price	Sold	No. Offers
Adjusted $R^2$ , Seller FE	.379	.176	.124	.36	.137	.118
Change in Adjusted $R^2$ from Adding Seller FE After...						
...Buyer FE	.303	.104	.12	.143	.077	.11
...Product FE	.259	.064	.097	.221	.057	.101
...Buyer and Product FE	.386	.075	.11	.102	.065	.103
Adjusted $R^2$ , Buyer FE	.29	.25	.112	.399	.217	.089
Change in Adjusted $R^2$ from Adding Buyer FE After...						
...Seller FE	.213	.178	.107	.182	.157	.081
...Product FE	-.058	.15	.101	.159	.137	.078
...Seller and Product FE	.069	.162	.114	.04	.145	.081
Adjusted $R^2$ , Product FE	.285	.131	.038	.309	.102	.024
Change in Adjusted $R^2$ from Adding Product FE After...						
...Seller FE	.165	.019	.01	.171	.023	.006
...Buyer FE	-.062	.032	.027	.069	.023	.012
...Seller and Buyer FE	.021	.003	.017	.029	.01	.006
No. Seller Fixed Effects	15,798	48,055	48,055	32,343	90,670	90,670
No. Buyer Fixed Effects	9,750	66,644	66,644	35,179	165,941	165,941
No. Product Fixed Effects	22,174	40,415	40,415	45,654	69,118	69,118
Condition	Used	Used	Used	New	New	New

Notes: This table presents the adjusted  $R^2$  coefficients from regressions of three dependent variables—normalized prices conditional on sale (see text for a discussion of the construction of reference prices), a dummy for whether the thread ends in a sale, and the number of offers—on buyer, seller, and product fixed effects. The table also shows the *change* in adjusted  $R^2$  when fixed effects are added in sequentially. The first three columns show results for used goods and the last three for new goods.

these issues by regressing outcomes on buyer fixed effects, seller fixed effects, product fixed effects, and combinations of these different fixed effects. We compare the adjusted R-squared from these regressions as we sequentially add in different fixed effects. For this exercise, we limit to our reference price sample, where we have a precise product identifier.

The results are displayed in Table C1, separately for used items (columns 1–3) and new items (columns 4–6). We analyze three outcome variables: normalized price, a dummy for whether the bargaining thread ended in agreement, and the number of offers. The top panel shows, in the first row, the adjusted  $R^2$  from a regression of seller fixed effects alone. The rows that follow display the *change* in adjusted  $R^2$  from adding

seller fixed effects after first including buyer effects, or after first including product fixed effects, or after first including both buyer and product fixed effects. The middle panel displays the same analysis for buyer FE and the bottom panel for product FE.

In column 1, for used goods, we find that more variation in the final price for is explained by seller fixed effects alone (an adjusted  $R^2$  of 0.379) than by buyer or product fixed effects (adjusted  $R^2$  values of 0.290 and 0.285). Column 1 also demonstrates that the incremental change in adjusted  $R^2$  is higher from adding seller fixed effect (an improvement of at least 0.259) than from adding buyer or product fixed effects (an improvement of at most 0.213). Variation in prices for new goods (column 4) display no such obvious pattern. In columns 2 and 5, for both used and new goods, variation in the probability of sale is explained more by buyer fixed effects—and the incremental change in adjusted  $R^2$  is higher when adding buyer fixed effects—than it is for seller or product fixed effects. In columns 3 and 6, we find that buyer and seller fixed effect explain more of the variation in the number of offers than do product fixed effects. Overall these results demonstrate that variation in bargaining outcomes is explained more by differences across *players* than by differences across *products*. This result is suggestive that characteristics of bargaining parties, such a bargaining strength (such as players' patience, experience, or outside options) may play a greater role in the outcome of the game than do characteristics of the good. This is broadly consistent with the substantial across-salesperson heterogeneity in negotiation outcomes found in Jindal and Newberry (2019), who study retail negotiations for new appliances.

## D Additional Concession Results

Table D2 displays results similar to those in Table VII from the body of the paper, but instead of regressing  $\gamma_t$  on  $\gamma_{t-1}$  we regress the percent change in a player's offer on the percent change in the opponent's offer. We define  $\Delta_t = \frac{P_t - P_{t-2}}{P_{t-2}}$  for odd  $t \geq 3$  and  $\Delta_t = \frac{P_{t-2} - P_t}{P_{t-2}}$  for even  $t \geq 2$ . We observe the same pattern of reciprocal gradualism as in Table VII.

In Table D1, we explore how concession weights relate to bargaining power as measured by buyer and seller experience. We run regressions of each stage's concession weight on buyer and seller experience (measured as in Table IV). The coefficients of

**Table D1: Concessions Regressed on Log Experience**

	(1)	(2)	(3)	(4)	(5)	(6)
	$\gamma_1$	$\gamma_2$	$\gamma_3$	$\gamma_4$	$\gamma_5$	$\gamma_6$
Log(Buyer Experience)	-0.00689*** (0.0000235)	-0.000811*** (0.0000479)	-0.0110*** (0.0000940)	0.000201 (0.000149)	-0.00342*** (0.000284)	0.00168*** (0.000409)
Log(Seller Experience)	0.00225*** (0.0000154)	-0.00382*** (0.0000308)	0.00267*** (0.0000627)	-0.00286*** (0.0000983)	0.00238*** (0.000193)	0.00130*** (0.000276)
Constant	0.617*** (0.000127)	0.451*** (0.000251)	0.414*** (0.000517)	0.253*** (0.000807)	0.322*** (0.00160)	0.180*** (0.00225)
Leaf FE	Yes	Yes	Yes	Yes	Yes	Yes
R <sup>2</sup>	0.0713	0.0462	0.0347	0.0376	0.0592	0.0945
N	25380258	7013471	1739294	774293	227804	109010

Notes: This table presents results from regressions where the dependent variable is  $\gamma_t$  (see text for a discussion of the construction of this variable) and the independent variables are measures of buyer and seller experience. Note that buyers make offers when  $t$  is odd, and sellers make offers when  $t$  is even. The number of observations changes across columns (becomes smaller) because fewer observations reached later periods of bargaining. All regressions include leaf category fixed effects. Robust standard errors are presented in parentheses. \*:  $\alpha = 0.10$ , \*\*:  $\alpha = 0.05$ , and \*\*\*:  $\alpha = 0.01$ .

the linear-log regressions can therefore be interpreted as the effect of experience on the concession weight ( $\gamma$ ). Recall that odd  $t$ 's represent buyer turns. In column 3, for example, the significant positive coefficient on seller experience indicates that a one log point increase in the seller experience measure is associated with a 0.0027 increase in the concession weight placed by the buyer on the seller's previous offer, and the significant negative coefficient on buyer experience in column 3 indicates that a one log point change in the buyer experience measure is associated with a 0.011 decrease in the buyer's concession weight. Thus, in their period 3 offers, buyers tend to concede more to more experienced sellers and concede less if they themselves are more experienced. This same pattern is observed at the buyer's period 1 and period 5 offers, shown in columns 1 and 5. Results for seller offers weights can be seen in even columns. In columns 2 and 4 we find that more experienced sellers tend to concede less, and column 6 suggests that sellers concede more to more experienced buyers. In general, however, the pattern we see for sellers' behavior is not as robust as for buyers'.



**Table D2: % Concession Regressed on Previous % Concession by One's Opponent**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\Delta_3$	$\Delta_3$	$\Delta_4$	$\Delta_4$	$\Delta_5$	$\Delta_5$	$\Delta_6$	$\Delta_6$
$\Delta_{t-1}$	0.143*** (0.0121)	0.0827*** (0.00974)	0.0106* (0.00419)	0.00520*** (0.00128)	0.145*** (0.0123)	0.125*** (0.00967)	0.0822*** (0.00634)	0.0799*** (0.00636)
Constant	0.187*** (0.00207)	0.193*** (0.00206)	0.0508*** (0.000904)	0.0506*** (0.000288)	0.0791*** (0.000830)	0.0829*** (0.000675)	0.0289*** (0.000620)	0.0280*** (0.000604)
Condition	USED	NEW	USED	NEW	USED	NEW	USED	NEW
$R^2$	0.0326	0.0200	0.153	0.145	0.201	0.161	0.262	0.248
No. Leaf FE	8833	12320	6524	9386	3794	5822	2442	4016
N	345964	529203	128599	210449	35447	60786	15953	29098

Notes: This table presents results similar to those in Table VII from the body of the paper, but instead regressing  $\Delta_t$  on  $\Delta_{t-1}$ , where  $\Delta_t = \frac{P_t - P_{t-2}}{P_{t-2}}$  for odd  $t \geq 3$  and  $\Delta_t = \frac{P_{t-2} - P_t}{P_{t-2}}$  for even  $t \geq 2$ . All regressions include leaf category fixed effects. Robust standard errors are presented in parentheses. \*:  $\alpha = 0.10$ , \*\*:  $\alpha = 0.05$ , and \*\*\*:  $\alpha = 0.01$ .

## Appendix References

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