Online Appendix to:
"Meet Me Halfway": The Costs and Benefits of Bargaining

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O1 Taobao Figures

Figure O1: Taobao Feedback Page

O2 Summary Statistics by Gender

Table O1: Transaction Summary Statistics by Gender

	Female (N = 7,357)		Male (N = 17,844)	
	Mean	Std. Dev.	Mean	Std. Dev.
Posted Price	1,339	1,190	1,361	1,179
Promotion Indicator	0.65	0.48	0.64	0.48
Bargaining Success Indicator	0.18	0.39	0.17	0.38
Bargaining Discount (yuan)	28.6	136	29.5	140
Buyer Shopping Experience	5.1	1.3	4.6	1.4

Figure O2: Taobao Reputation Rule

Table O2: Survey Summary Statistics by Gender

	Female (N=526 in Row 1,2; 376 in Row 3,4)		Male (N=492 in Row 1,2; 373 in Row 3,4)	
	Mean	Std. Dev.	Mean	Std. Dev.
I(Certainly Bargain)	0.50	0.50	0.58	0.49
I(May + Certainly Bargain)	0.71	0.45	0.76	0.43
Perceived Success Rate | Bargaining	0.46	0.25	0.51	0.25
E[Discounted Amount | Success] (yuan)	154	209	178	236

O3 Taobao Consumer Survey

In order to measure the bargaining-related costs among Taobao consumers, we supplement the transaction data with primary information collected via surveys. For robustness and identification purposes, we conducted three rounds of surveys. In 2015, we conducted the first (pilot) survey with 566 respondents. In 2016, we conducted the second survey on bargaining initiation costs with 1,009 respondents. In January 2020, we conducted the third round of survey with 1,417 respondents and added additional questions (Q5 & Q6) about loss-of-face cost after a failed bargain. All surveys were carried out in Chinese – the English translation of the 2020 survey is provided below.

The information from the first and second surveys, combined with the transaction data, allowed us to estimate the bargaining initiation costs. The correlation between the estimated bargaining initiation costs using the main survey data and using the combined main/pilot survey data is 0.95, suggesting the robustness on the bargaining initiation cost estimates. Using the third survey, we derive information on the loss-of-face cost distribution. One concern about the third survey is that consumers in 2020 may not match the consumers in 2015 or 2016. To test to what extent consumers have evolved over time on dimensions related to bargaining, we compared the answers to

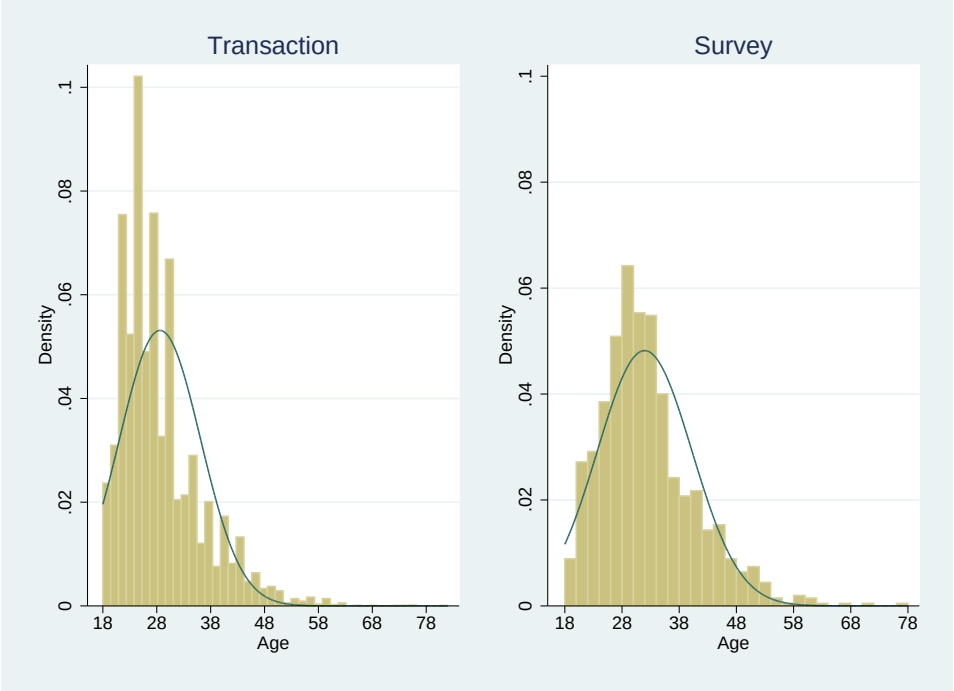
the bargaining intention and expectation questions, which were kept the same across all the surveys. We find that the overall numbers are similar (see Table O3 and Table 2 in the paper), though we do observe that the bargaining intention and the expected bargaining outcome become lower over time. This is expected and consistent with our finding that consumers are less likely to bargain when their opportunity costs become higher as their income increases over the years. Given the fact that the overall bargaining patterns between 2020's consumers and the 2016's consumers are similar, we believe consumers' loss-of-face costs should also be similar. Figure O3 plots a comparison of the age distribution in the transaction data and in the survey. The similarity also verifies that the the transaction sample and the survey are comparable.

Table O3: Summary Statistics: 2020 Taobao Consumer Survey

	N	mean	sd	min	max
I(Certainly Bargain)	1,417	0.524	0.499	0	1
I(May + Certainly Bargain)	1,417	0.689	0.462	0	1
Perceived Success Rate|Bargaining	977	0.463	0.240	0.1	1
E[Discount Amount|Success] (yuan)	977	152.4	143.6	1	1,000

Note: Only those respondents who answered "yes" or "maybe" to the bargaining intention question are required to provide information for the perceived success rate conditional on bargaining and the expected discount amount conditional on success. Thus, we see a decrease in the sample size in the last two rows. The questions related to the above information in the 2020 Taobao Consumer Survey are the same as the ones in the 2016 survey.

Figure O3: A Comparison of Age Distribution between the Transaction Sample and the Survey



Taobao Consumer Survey (translated-version)

The purpose of this survey is to understand Chinese consumers' online shopping behavior. We really appreciate your input.

1. Are you aware that one can bargain on Taobao?

   (a) Yes

   (b) No

2. Would you bargain with a seller if you are going to buy a cellphone priced at 1,500 yuan?

   (a) Yes

   (b) No

   (c) Maybe

3. How likely would you expect to succeed in bargaining?

   (a) About 100%

   (b) About 90%

   (c) About 80%

   (d) ...

   (e) Less than 10%

4. How much discount would you expect to get if bargaining succeeds?

   _____ yuan

5. Assume you plan to buy a cellphone and you are interested in a cellphone model sold by Seller A priced at 1,510 yuan. Though this price is below your willingness to pay, you still started to bargain with Seller A. After quite a while of bargaining, the seller did not give in. How would you describe your feelings at that moment?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I do not care.					
I feel embarrassed.					
I feel like a loser.					
I do not feel annoyed.					
I feel upset.					

6. Then, you see that Seller B is selling exactly the same cellphone priced at p_B yuan. Assume all the attributes (reputation, product description, service, logistics, etc.) of Seller A and Seller B are the same, from whom would you like to buy the cellphone, Seller A or Seller B? (Seller B's price p_B is randomly chosen from 1,511, 1,513, 1,516, 1,520, 1,530, 1,540, 1,550, 1,580, and 1,610 yuan.)

(a) Seller A

(b) Seller B

7. What is your age?

   _____ years old

8. What is your gender?

   (a) Female

   (b) Male

9. What is your education level?

   (a) Elementary School or below

   (b) Middle School

   (c) High School/Vocational School

   (d) College and above

10. What is your monthly income?

    (a) 2,000 - 3,999 yuan

    (b) 4,000 - 5,999 yuan

    (c) 6,000 - 7,999 yuan

    (d) ...

    (e) Above 20,000 yuan

O4 Robustness Checks

The goal of this paper is to accurately measure the value of bargaining for sellers, buyers, the e-commerce platform, and the social planner in terms of social welfare. It is important that our results and the policy simulation outcomes are robust to the model assumptions and can be generalized. In this section, therefore, we discuss the robustness of our results to several assumptions, particularly those that relate to buyers' bargaining decision and the bargaining realization process. We conclude with a replication of our analysis using data from another product category to judge its generalizability.

O4.1 Survey Response versus True Belief

In the baseline model, we assume that buyers' stated bargaining expectations in the survey are consistent with their formed bargaining expectations in reality. This subsection tests this assumption. In this exercise, we allow Taobao buyers to be either fully sophisticated, i.e., perceive the bargaining success rate to be the same as the realized success rate in reality, which means that they are overly optimistic in the survey, or fully naive, i.e., perceive the bargaining success rate as 100% in reality,

which means that they are overly pessimistic in the survey. The sophisticated assumption and the naive assumption provide a lower bound and an upper bound for the bargaining initiation costs, and further test whether our results comparing the fixed-price mechanism and the mixed-price mechanism are robust under the two extreme conditions.

For each assumption considered, we find that the changes in average transaction price and conversion rate are minimal compared with the baseline policy simulation in § 7.3. In contrast, changes in assumptions have a substantial effect on the saved bargaining initiation cost amount. Under the sophisticated and the naive assumptions, the saved bargaining initiation costs per day equal 1.9 and 6.7 million yuan, respectively. However, changes in bargaining assumptions yield qualitatively similar conclusions.

O4.2 Assumption with Respect to Non-purchasers

In order to distinguish between the three types of non-purchasers at the bottom of Figure 3, a necessary assumption we have to make is that bargaining outcomes conditional on success are not systematically different between purchasers (whose transactions are observed) and non-purchasers (whose transactions are unobserved). This assumption may be seen as strong in the sense that bargaining outcomes for purchasers on average should be better than that for non-purchasers. Unfortunately, without any data from non-purchasers, we are not able to test this assumption directly. However, we will provide three pieces of evidence that the impact of this assumption is not very strong.

The first piece of evidence is that the expected bargaining discount amount revealed in the survey is about the same as the realized bargaining discount amount observed in the transaction sample (170.3 yuan vs. 165.5 yuan). The similarity between the two suggests that buyers' expected bargaining outcomes are likely to be uncorrelated with the purchase decision (as the survey questions do not cover any aspect of the purchase decision).

The second piece of evidence is based on our finding that the correlation between a buyer's bargaining intention and her/his price elasticity is low at 0.17 (this is actually the main reason why sellers are not able to effectively price discriminate among buyers). As a result, using the purchasers' bargaining behavior to infer non-purchasers' bargaining behavior is unlikely to create bias.

The third piece of evidence is based on a robustness test of our results to this assumption directly through a simulation. Between purchasers and non-purchasers, the former is likely to have a higher bargaining success rate and a higher bargaining discount amount. Thus, if we infer these two bargaining outcomes for non-purchasers using the parameters estimated from purchasers, we are likely to overestimate them. In order to test the robustness of our results, we consider an extreme case of this overestimation. Specifically, we test how our results would change for a 100% overestimation. In other words, if the model predicts a potential buyer has 40% bargaining success rate and 20 yuan expected bargaining discount, then we will just use the "true" bargaining success rate of 20% and the "true" discount amount of 10 yuan for the subsequent estimation steps. Even in this extreme case, we find that our results on total revenue and conversion are robust. This is not surprising given that the baseline change in total revenue and conversion rate is small - less than 1%. While

the total savings in bargaining initiation costs become smaller, they are still not materially different and remain economically significant.

O4.3 Bargaining Realization Process

One of the critical assumptions underlying our two-part model for the bargaining realization process is the conditional independence of the error term, that is, the error term is uncorrelated with the explanatory variables, including the posted price. Although the included seller characteristics and the product fixed effects do a reasonable job controlling for the endogenous pricing decision, there could remain a bias caused by potential unobserved seller characteristics in the error term, e.g., sellers' bargaining skills and bargaining willingness. The best way to control for unobserved seller characteristics is to include seller fixed effects. However, to do so, we have to restrict the analysis to sellers with at least two transactions. Such a restriction introduces a sample selection. Given one of our goals is to estimate the value of bargaining for the platform, we want to keep the sample as representative as possible, and thus we did not include seller fixed effects in the baseline model. Besides the sample selection issue, given the large number of sellers in the sample and the product fixed effects, we found the baseline structural model with seller fixed effects to be computationally intractable.

As a compromise however, we carry out a reduced form analysis to investigate whether the conditional independence assumption could impact our results. Specifically, we use a probit model and a truncated regression model on a subsample (including sellers with at least 20 transactions) and include seller fixed effects in the bargaining realization process. Table O4 reports the estimated results. Columns (1) and (2) present probit regressions of the bargaining success on the explanatory variables without and with seller fixed effects. Columns (3) and (4) report truncated regressions of the realized bargaining discount amount without and with the seller fixed effects. The estimates are similar across columns, suggesting that our results are robust to the conditional independence assumption. Note that the key difference between the reduced form regression results (Table O4) and the structural model results (Table 5) is whether we account for a buyer's bargaining intention. In the structural model, we explicitly estimate the bargaining intention, while the reduced form regressions do not allow us to do so. Nevertheless, the comparison with the reduced-form results increases our confidence in the results.

O4.4 Loss-of-Face Cost Distribution

In order to test the robustness of our results to the loss-of-face cost distribution obtained via the survey (see Figure 2), we vary the parameters of this distribution. We use the four following distributions: (a) original shape parameter and 2 times the original scale parameter, (b) original shape parameter and 0.5 times the original scale parameter, (c) 2 times the original shape parameter and 0.5 times the original scale parameter (mean remains the same), and (d) 0.5 times the original shape parameter and 2 times the original scale parameter (mean remains the same). Our results remain materially unchanged across these four different distributions.

Table O4: Robustness of Bargaining Realization Process

	Bargaining Success Indicator		log(Bargaining Amount)	
log(price)	0.335***	0.424***	0.776***	0.937***
	(0.035)	(0.054)	(0.090)	(0.109)
I(Promotion)	-0.158***	-0.119**	-0.514***	-0.593***
	(0.037)	(0.045)	(0.081)	(0.075)
Seller Reputation Level	0.052***	-0.045	-0.243***	-0.247**
	(0.017)	(0.050)	(0.035)	(0.097)
Detailed Seller Rating	-0.387***	-0.017	0.634**	-1.033***
	(0.120)	(0.175)	(0.276)	(0.3257)
Store Age	-0.024*	-0.213**	0.067**	0.572***
	(0.011)	(0.074)	(0.027)	(0.141)
Buyer Shopping Experience	0.055***	0.052***	-0.069***	-0.043*
	(0.010)	(0.011)	(0.024)	(0.021)
Buyer log(income)	-0.164***	-0.262***	-0.033	-0.030
	(0.048)	(0.055)	(0.109)	(0.099)
I(Repeat Purchase)	0.425***	0.356***	0.134	0.026
	(0.041)	(0.045)	(0.085)	(0.073)
Product Age	0.016	0.022	0.122*	0.091*
	(0.020)	(0.026)	(0.050)	(0.052)
# of Sellers w/ Same Product	-0.057	-0.059	0.039	-0.137
	(0.041)	(0.046)	(0.097)	(0.087)
# of Sellers w/ Same Reputation	0.015	0.057**	-0.090**	-0.061
	(0.016)	(0.021)	(0.035)	(0.038)
Product FE	Yes	Yes	Yes	Yes
Seller FE	No	Yes	No	Yes
Log likelihood	-4,438	-4,025	-2,810	-2,388
Number of Observations	12,190	12,190	1,695	1,695

Note: Columns (1) and (2) are Probit regressions and columns (3) and (4) are truncated regressions. The sample is restricted to the sellers who have at least 20 observed transactions.

O5 Generalizability

Our analysis uses data from the cellphone category. However, given that the goal of the paper is to quantify the costs and benefits of bargaining for the platform, it is important to assess whether the findings from the cellphone category can be generalized to other categories. This section considers an additional product category and replicates the findings as a generalizability check.

In addition to cellphones, we were able to obtain data on the women's shoes category. Following the first two steps in §4, we find the the bargaining initiation cost is 8.6 yuan on average in this category[O1], which is very close to our estimate of 9.0 yuan for the cellphone category. Given that the unconditional success rate in women's shoes category is low, we expect similar findings in policy simulation where bargaining is not allowed. Specifically, we expect that major benefits would come from the saved bargaining initiation costs and loss-of-face costs. As women's shoes are smaller

[O1]Note that the estimation process did not include product fixed effects (due to the lack of standardized products in this category) and used the same survey data as in our main analysis to compute the average bargaining success rate conditional on bargaining.

ticket items than cellphones, the magnitude of the total benefit is likely to be smaller than that for cellphones but in the same direction. Overall, these analyses suggest that our results are not idiosyncratic to the cellphone category.

O6 External Validity with Real Chat Data

One of our data limitations is that we did not have any chatting history between buyers and sellers. This makes the negotiation process a "black box." Even though modeling the process is not the objective of our paper, we think that access to any such data can only increase the external validity of our analysis and results. We were able to obtain three months of chatting data (in text form) from a (small) seller on Taobao. This seller sells camera accessories. The data range from April 2013 to June 2013, spanning 306 chatting sessions. We want to state at the outset that we do not consider this seller to be a representative seller for the pool of sellers in our chosen product category of cellphones especially as the mean unit price in the cellphone category is about 1,500 yuan while it is about 250 yuan for this seller. Our objective is to provide some descriptive analysis based on these data to provide more context and hopefully external validity.

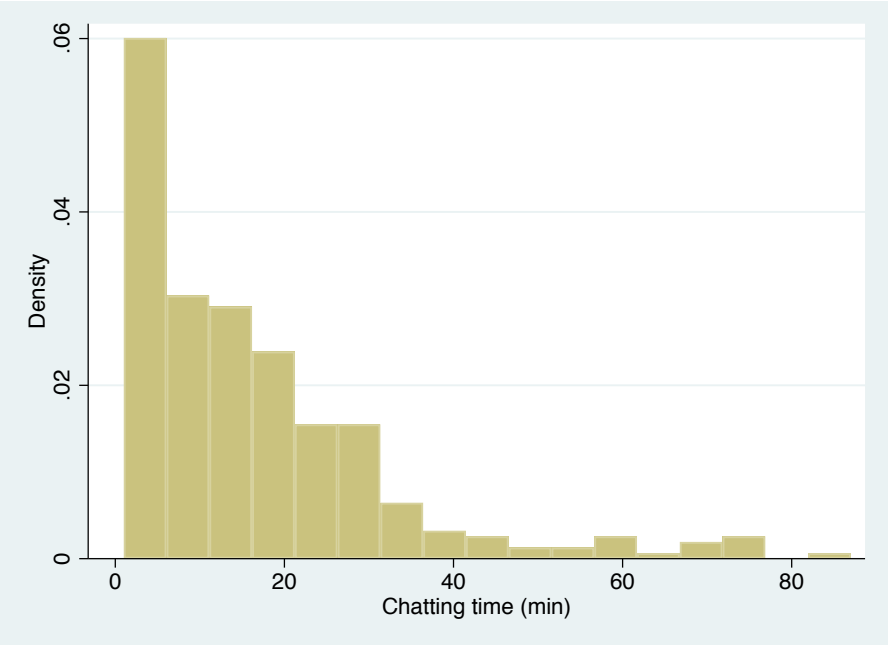
First, we use the chatting data to examine whether the bargaining initiation cost that we recover from our structural model is reasonable. We begin by looking at the time buyers spend chatting with the seller. The mean time spent on chatting is 17 minutes (Figure O4 shows the distribution). Unlike the cellphone category, where free shipping is standard, buyers bargain both on price and non-price attributes (e.g., shipping cost) in the camera accessories category. We split the chatting sessions based on whether the buyer bargained over the price, or bargained over non-price attributes, or did not bargain at all - see Table O5. Comparing rows 1 and 3, we see that a buyer spends on average about 10 more minutes chatting with the seller if s/he bargained over the price. Comparing rows 2 and 3, we see that if the subject of bargaining is other than price, then the chatting duration increases by a very modest amount (2 minutes). Using these data, we compute the average time cost of bargaining on average as follows. The median hourly wage in China in the 2012-13 period was reported 60 yuan (Fang and Lin, 2015). Thus the cost of 10 minutes spent on bargaining is 10 yuan. This estimate - 10 yuan - is very close to the average bargaining initiation cost that we backed out from our structural model at 9 yuan. The similarity in these numbers suggests that our estimates are likely to have external validity.

Table O5: Chatting Duration Summary Statistics by Bargaining

	Chatting Duration (min)		
	Number of Obs.	Mean	Std. Dev.
Bargain over price	98	23.6	18.1
Bargain over things other than price	47	15.5	17.8
No bargain at all	161	13.3	11.7
All	306	17.0	15.7

Next, we would like to see whether the bargaining intention revealed from the chatting data is comparable to that revealed from our survey. Among the 306 chatting sessions, we see that 145

Figure O4: Histogram of Chat Duration



buyers tried to bargain over both price and non-price attributes, implying a bargaining intention of 47%. This number is lower than what we got from the survey reports (54% - 74%). We think the main reason is the price difference. For the chatting data, the average price is only about 250 yuan while in the survey we asked buyers about their bargaining intention for a product of 1,500 yuan. As a result, it is not surprising to see that the bargaining intention in the chatting data is somewhat lower than that in the survey. In order to verify this intuition, we used our estimated model parameters and plugged in a price of 250 yuan to compute buyers' mean bargaining intention. We find that the predicted bargaining intention is 52%, which is quite close to 47% (in the chatting data). This suggests that the use of the survey data to model unobservables (e.g., bargaining intention) is a reasonable approach.

Further, we would like to see whether the bargaining success rate is reasonable based on our estimates compared with that obtained from the chatting data. Among 145 buyers who initiated bargaining, we see that the seller agreed to give 61 buyers a discount. Among these 61 successful bargaining cases, 31 resulted in a transaction. This observation is important as it directly supports our modelling framework in Figure 3, where the bargaining stage is distinct from the purchase stage i.e., a buyer can decide not to purchase even after being successful at bargaining. The above numbers suggest a conditional bargaining success rate of $61/145 = 42\%$. This lies in the interval between the conditional success rate obtained from the survey (49%) and in the transaction sample (20%). The closeness of the success rate between the chatting data and the survey (42% vs. 49%) suggests that our assumption of using the perceived success rate from the survey in the estimation is reasonable. At the same time, the distance of the success rate between the chatting data and the cellphone transaction data (42% vs. 20%) suggests that it is important to run robustness checks on the above

assumption (we do this in Online Appendix § O4.1). Another relevant piece of information from the chatting data is that out of 61 successful bargaining cases, the buyers buy about 50% of the time. This provides an additional piece of evidence that using purchasers' data to infer some of the non-purchasers' behaviour may not be that bad as we see the purchase decision and the bargaining success are not strongly correlated.

Finally, we also see support for our use of the repeat purchase indicator in our model (equations 9 and 15) and the resulting statistically significant coefficient. In 16 of the chatting sessions, buyers cited the fact that they were repeat customers to bargain for a price discount, which is consistent with the statistically significant positive coefficient of the repeat purchase indicator on bargaining outcomes.

In sum, we obtain four key findings from the chatting data analysis. First, the estimated time cost of the actual time that buyers spend bargaining with a seller is about 10 yuan, which is very similar to the average bargaining initiation costs estimated in the model at 9 yuan. Second, the bargaining intention revealed from the chatting data is comparable to that revealed from the survey, which suggests that our assumption that the bargaining intention in the survey represents the bargaining intention in the transaction sample is reasonable. Third, the bargaining success rate in the chatting data lies between that in the survey and in the transaction sample, implying the numbers that we used in the estimation are consistent with the reality. Lastly, we see support for our use of the repeat purchase indicator in our model. Overall, analysis of these data provides us correlationally consistent evidence on bargaining initiation cost, bargaining intention, bargaining success as well as support for our model structure and specification.

References

Fang, T. and C. Lin (2015). Minimum wages and employment in China. *IZA Journal of Labor Policy 4*(1).