Investigating Social Proof Theory as a Decision-making Mechanism in Online Negotiations on eBay

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Abstract:

According to social proof theory, individuals in unfamiliar situations are more likely to mimic the behaviour of others when they believe that their entourage possesses more contextual knowledge than them (Cialdini 1985). Moreover, this theory posits that actors would be more likely to replicate the behaviour of people who are more similar to themselves. Crucially, we want to determine whether social proof theory is present in the context of negotiating item prices on eBay. Ergo, we develop a multiple linear regression model to examine the effect of external social influences—the price of a previously sold similar item and the seller's starting price—on a consumer's behavioural output—the buyer's initial offering price. If social proof theory is present in item price negotiations on eBay, then the similar item price and starting price regressors should exhibit statistical significance; however, the former should also harbour economic significance. In addition, if this similarity bias in behavioural replication exists, the similar item price regressor should significantly differ from the starting price regressor in terms of magnitude, strengthening the presence of social proof theory. We predict that social proof theory is present in this context; we hypothesize that current consumers' initial offer would mimic similar item prices more than starting prices due to the former being more driven by past buyers, a group similar to current buyers. At last, we evaluate if a seller's affiliation with a trusted eBay store significantly increases the magnitude of the starting price's regressor, remedying similarity bias. Data-wise, we estimate our model using listings from eBay's bargaining platform, called *Best Offer*, between 2012 and 2013. Outcomes-wise, we obtained statistically significant regressors for the starting price and similar item price; however, the latter was also economically significant, implying that consumers are guided by social proof theory. Our similar-item-price regressor significantly deviated from its similar-price counterpart, reflecting a selective similarity bias between past buyers' and sellers' prices, amplifying social proof theory's presence. Finally, being part of an eBay store did not significantly alter the starting price regressor, suggesting that buyer-seller similarity issues cannot be remediated using credibility cues. We encourage investigating social proof theory across recent listings on trading platforms that are less personal and lack negotiability, as well as accounting for cultural and personality confounders. In conclusion, social proof theory is present in "eBay trading."

- https://github.com/UofT-Econ-DataAnalytics/eco375-project-phase-2-yuvraj-y

Literature Review:

As a social species, humans often resort to efficient social learning mechanisms to solve problems. In particular, observational learning, the process of acquiring new knowledge by watching others, is quintessential to human learning (Bandura 1975). An interesting subset of observational learning, social proof theory, posits that individuals in unfamiliar situations are more likely to mimic the behaviour of others when they perceive their entourage possesses more contextual knowledge than them (Cialdini 1984). Social psychologists have argued that social proof theory permeates decision-making across many social contexts, such as buying meat products at a store (Venema et al. 2020). However, past research has not explored whether this theory applies to the online negotiation of item prices on eBay. Acquiring this knowledge would seal this gap in the literature and further solidify decision-making frameworks in behavioural economics, such as Tversky and Kahneman's (1974) anchoring and adjustment heuristic.

Primordially, social proof theory operates through two mechanisms: increased reliance on others' behavior during uncertainty about the correct decision and a stronger influence when individuals perceive greater similarity with the surrounding group. The former is demonstrated in a study where product assessors were more inclined to rely on others' opinions via social proof when their personal experience with the product was unclear (Wooten and Reed II 1998). The latter is exemplified in an experiment where researchers conducting in a door-to-door charity campaign observed that a longer list of previous donors increased the likelihood of the following individual contributing. This effect was even stronger when the donor list included individuals familiar to the prospective donor, such as friends or neighbours (Cialdini 2001).

Application-wise, we examine social proof theory's existence under eBay's *Best Offer* program. To begin, the seller lists items with regular prices and enables the *Best Offer* feature. Then, the buyer makes an offer. The seller reviews the offer and decides to accept, make a counteroffer, or decline the consumer's offer. Finally, this process continues until the buyer and seller agree on a price or the listing expires. In terms of input, we assume that when eBay buyers—our unit of observation—attempt to purchase an item, they are exposed to the item's reference price, i.e. the price at which a similar item was previously sold, and the seller's starting price. Crucially, we believe consumers use these prices as probes for their entourage's behaviour. Also, we assume that current clients view the reference price as a better reflection of past buyers' behavior than the seller's starting price. This attention bias stems from the reference price

representing a mutually agreed-upon value, signaling fairness and reciprocity, whereas the starting price is set unilaterally by the seller. In terms of output, the initial offering price by the current consumer serves as our behavioral outcome. Thus, we define the reference price and starting price as our treatment variables and the final price as our outcome variable. Moreover, our treatment variables have high levels of variation due to eBay having a rich diversity of items in terms of price. To answer our research question, we run a multiple linear regression analysis to study how the initial offer changes with reference price and starting price. Critically, if the buyer perceives that former purchasers are more similar to them than the current sellers, and that the reference price is more reflective of the past buyers' behaviour than the starting price, then the reference price and starting price regressors should exhibit statistical significance; however, the former should also display economic significance. Explanation-wise, having statistical significance in each regressor would symbolize that the buyer assessed both data points when conjuring their initial offer. Similarly, having economic significance in the reference price regressor would mean that the buyer seriously considered the reference price, due to group similarity bias, when deciding their initial offer. Finally, these results would signify the presence of social proof theory.

Regarding the mechanisms in social proof theory, our data does not capture the degree of the buyer's uncertainty about the item's "true" price, blurring the impact of uncertainty on the desire to mimic another group's behavior. Concerning the similarity mechanism, we assume that the sellers and the buyers have an orthogonal set of goals, such that buyers want to buy low and sellers want to sell high. Given this set of differing goals, the buyers may not fully trust the sellers' starting price. In addition, consumers may harbour a favourable perception of the reference price as it was heavily influenced by past buyers with a similar set of goals. Therefore, we hypothesize that the reference price regressor significantly differs from the starting price regressor in terms of magnitude. To evaluate this similarity bias, we run a hypothesis test to determine if the effects of the reference price and starting price regressors are the same.

Additionally, we explored whether credibility cues would help mitigate this similarity bias. Notably, eBay buyers can assess the legitimacy of a listing by checking whether it is affiliated with an eBay store. To examine this trust factor, we rerun the previous regression, isolating cases where the seller was part of an eBay store versus cases where they were not, subsequently analyzing its impact on the starting price regressor.

The Context and Data

Our cross-sectional data is directly sourced from Backus et al. 2020, an article observing sequential bargaining on eBay. Our population of interest is encompassed in a two-part dataset containing global listings from eBay's *Best Offer* program, spanning May 2012 to June 2013. The first dataset contains many important properties of all eBay listings, including anonymized buyer and seller IDs, final sell price, reference price, buyer and seller ratings, product condition, etc. If the item was sold through the *Best Offer* program, its negotiation data, consisting of initial offers and counteroffers, would be in the second dataset. The article focuses on observing the probability of a sale based on seller and buyer experience, convergence of buyer and seller offer prices over time, and bargaining behaviours. However, this article has no linear regressions, rendering our linear analysis expansive. Our investigation uses a multiple linear regression to determine if social proof theory can be observed in the online negotiation of items on eBay. We construct our dataset by merging the two aforementioned datasets via the anonymized listing identification number. Consequently, the listing's bidding behaviour, i.e. initial offer, is associated with the item's important properties, such as reference price and starting price. Furthermore, we drop any unmatched observations, unwanted variables, and any observations without a reference price, a starting price, and/or an initial offer. Afterward, we filter for observations with initial offers placed by the buyer, removing any counter-offers. In addition, due to our dataset being very large (roughly 20 million observations after data cleaning and merging, check Table 1), we randomly select 2 million observations of our sample to expedite our computations on STATA. This process is accomplished using a set seed, to ensure replicability of results. Finally, we remove outlier observations, later described in this paper. Simply put, our dataset primarily consists of observations from the second dataset that have a reference price and a starting price.

Regarding the summary statistics of our variables, the buyer's offer price, our outcome variable, has a mean of $109.326 and a standard deviation of $211.58. The first regressor of reference price has a mean of $133.632 and a standard deviation of $254.676, whilst the second regressor of starting price has a mean of $168.349 and a standard deviation of $324.178. Finally, our seller's eBay store affiliation variable has a mean of 0.482 and a standard deviation of 0.5 (Table 1).

Regression Results

The primary regression model is given by:

$$Y_i = \alpha + \beta_1 ReferencePrice_i + \beta_2 StartingPrice_i + \beta_3 (ReferencePrice_i \times StartingPrice_i) + \epsilon_i$$

Where;

- Y_i represents the initial offering price of eBay listing i by the buyer
- $ReferencePrice_i$ represents average price for sold fixed price listings with the same listing title as item i, sold during the time frame of the data.
- $StartingPrice_i$ represents the starting price set by the seller for listing i.
- ϵ_i is the error term

To begin, we analyze if our dataset satisfies the least square assumptions in chronological order. For the first least square assumption, when the model's residuals are plotted against the independent variables, we see that the points cluster around the zero line, suggesting no relationship between them; therefore, the conditional mean of ϵ is roughly zero (Figures 2 & 3). Secondly, all data points in the dataset are independently and identically distributed as eBay listings are independent of each other; multiple listings can't sell the same instance of an item. This notion extends to the variables in each observation and the random sample drawn from the cleaned dataset. Thirdly, by the central limit theorem, the large size of our dataset (n = 1,677,273) implies a normal distribution in our variables (Table 1). Ergo, to study the general trend without being muddied by outliers, we include all results that are within 4 standard deviations of the mean, roughly encompassing 99.99% of observations. Thus, large outliers in Y and X are rare. Finally, we do not observe perfect multicollinearity as the scatter plot of the reference price and starting price do not have a perfect linear relationship (Figure 1). Therefore, all least-square assumptions are satisfied.

Concerning regression results, the coefficient of the reference price regressor is 0.758, its starting price counterpart is 0.058, and the interaction coefficient is negligible (Table 2). Interpretation-wise, on average, a 1$ increase in reference price leads to a 0.758$ increase in the initial offer whilst, in general, a 1$ increase in the starting price induces a 0.058$ increase in the initial offer. Ergo, the former has economic significance, unlike the latter. In addition, both regressors were statistically significant ($p < 0.000$ for both regressors) (Table 2). Altogether,

these results signify the presence of social proof theory in the online negotiation of items on eBay.

Moreover, the reference price regressor significantly differs from the starting price regressor in magnitude, suggesting a similarity bias between the buyers and the sellers. In addition, our hypothesis test comparing the reference price and starting price regressors indicates a statistically significant difference ($p < 0.000$) (Table 2). This notion strengthens the presence of social proof theory in online negotiations on eBay. Finally, we rerun the aforementioned regression, but we isolate cases where the seller is affiliated with an eBay store and vice-versa, assessing the impact of being part of a reputable organization on the starting price's coefficient. We observe that the starting price coefficient is 0.065 when the seller is part of an eBay store and 0.052 otherwise (Table 2). Ergo, the difference between these two regressors is negligible, suggesting that buyers do not seriously consolidate with the store's reputation when determining an appropriate initial offer.

Regarding estimation concerns, we use robust standard error to account for heteroscedasticity. Unfortunately, we were not able to address the normality of residual assumption as any transformations to variables would compromise the interpretability of results. Concerning omitted variable bias, a weak negative trend can be observed in the residual versus independent variables plots (Figures 2 & 3) and the residual versus fitted values of initial offer plot (Figure 4). This trend means that there are omitted variables preventing the residuals from trending across the zero line. Pertaining to functional form misspecification, we ran a Ramsey RESET test; it checks for potential misspecification in your model by testing if the powers of the fitted values significantly explain the dependent variable, indicating potential omitted variables or issues with functional form. Crucially, we obtained a statistically significant result, indicating potential functional form misspecification. This misspecification may stem from the absence of reference price variables with varying exponents. According to Martinčić et al. (2022), consumers' marginal willingness to pay decreases as prices increase marginally; hence, including such terms would account for the observed reduction in initial offers when reference prices exceed a certain threshold.

Limitations

Regarding general limitations, our model does not utilize other available measures of seller trustworthiness, i.e. the seller's feedback rating. If they were incorporated into our analysis, the results might have indicated that credibility cues help remediate similarity bias. Secondly, the model assumes that all buyers accurately determine the reference price of the item before making an offer. However, this assumption is unrealistic as most buyers are not privy to this information due to a lack of personal research. In addition, our dataset is confined to items that were offered through eBay's Best Offer program, leading to a selection bias in our buyer sample. These items would attract people who are willing to bargain for items at a lower price, leading to a low 0.758 regression coefficient (Table 2). Unfortunately, we do not have any variables that determine how uncertain the person was about the item's "true" price, omitting an important mechanism of social proof theory. Also, our model is functionally misspecified, leading to erroneous interpretations of the coefficients; however, we do not believe that this would affect the economic and statistical significance of our regressors. Finally, the model does not include control variables because the datasets do not have any variables that would impact the initial offer price whilst being apart from the entourage's observable behaviour.

With regards to threats to internal validity, omitted variable bias present in our residual plots (Figures 2 & 3). As the omitted variable(s) are not measured, the usage of instrumental variables regression would be a potential solution. Additionally, our analysis revealed potential functional form misspecifications; thus, we believe an additional review of existing literature is required to identify sensible nonlinear specifications for the dependent variables. Interestingly, the model developed relies on an accurate reference price for an item. However, there is ambiguity in what qualifies other listings to be "similar" to the original item, creating a source of errors-in-variables bias. On a positive note, missing data entries are relatively rare and random in our dataset due to its sheer size. Also, we can safely assume that simultaneous causality bias is not present; the initial offer price cannot impact the reference price: the reference price is measured before the initial offer price. Additionally, the starting price of an item is set by the seller before any buyers make offers.

Moving on to external validity, our results are only applicable to other online impersonal platforms like eBay due to our model not considering the added complexities of in-person negotiations. Any alternative platform would have to make similar information available to the

buyer as eBay, including browsing tools to gather a reference price, a starting price, seller verification status, etc. Therefore, our findings are externally valid but only in environments not dissimilar to eBay.

Conclusion

In conclusion, we obtained statistically significant regressors for the starting price and similar item price; however, the latter was also economically significant, implying that consumers are guided by social proof theory. In addition, our similar-item-price regressor significantly deviated from its similar-price counterpart, reflecting a selective similarity bias between past buyers' and sellers' prices. This notion amplifies the social proof theory's presence. Finally, eBay store-affiliated sellers had an economically similar regressor for starting price relative to non-eBay store-affiliated sellers, suggesting that buyer-seller similarity issues cannot be remediated using credibility cues. All in all, social proof theory seems to be a decision-making mechanism in online negotiations on eBay.

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Appendix

Table 1. Summary Statistics of the Sample

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99
Initial Offer Price (2012-2013 USD)	1677273	109.326	211.58	.99	2080	1.5	1150
Reference Price (2012-2013 USD)	1677273	133.632	254.676	.99	2349.5	1.99	1425
Starting Price (2012-2013 USD)	1677273	168.349	324.178	.99	12000	2.99	1775
Affiliation with trusted eBay store	1677273	.482	.5	0	1	0	1

Table 2. Regression Results

	Initial Offer Price (2012-2013 USD)		Initial Offer Price (2012-2013 USD) Not affiliated with eBay store		Initial Offer Price (2012-2013 USD) Affiliated with eBay store	
Reference Price (2012-2013 USD)	0.758	**	0.755	**	0.755	**
	(0.004)		(0.006)		(0.006)	
Starting Price (2012-2013 USD)	0.058	**	0.065	**	0.052	**
	(0.003)		(0.005)		(0.005)	
Reference Price * Starting Price	-0.000	**	-0.000	**	-0.000	**
	(0.000)		(0.000)		(0.000)	
Intercept	0.662	**	0.411	**	1.012	**
	(0.098)		(0.149)		(0.133)	
Number of Observations	1677273		868823		808450	

** p<.01, * p<.05

Figure 1. Reference price versus Starting Price

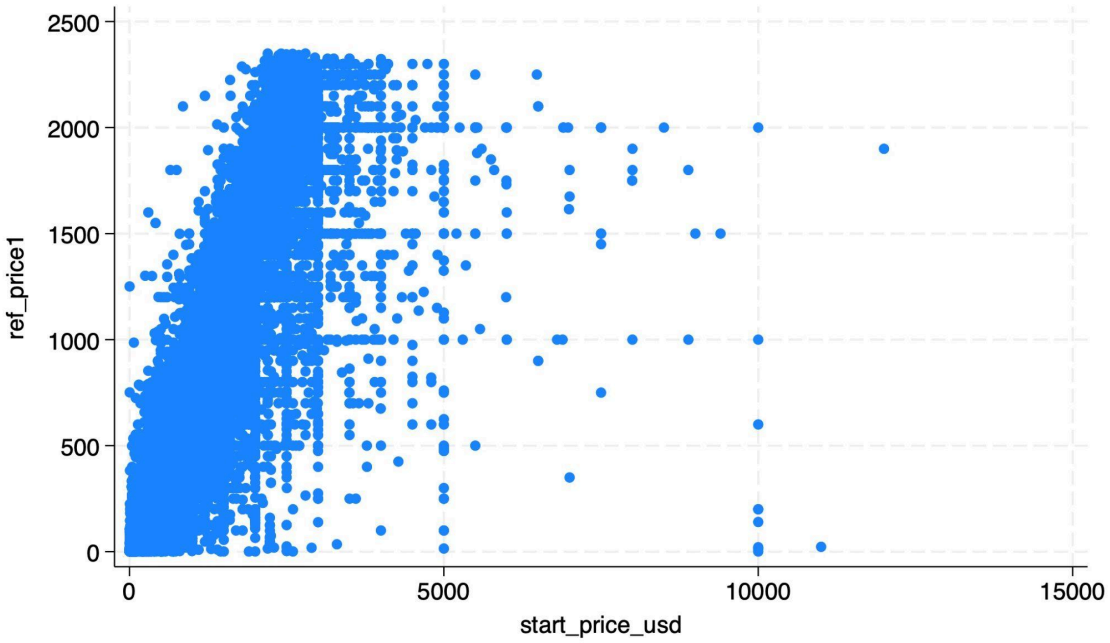

Figure 2. Residuals from Regression 1 (first column) versus Reference price

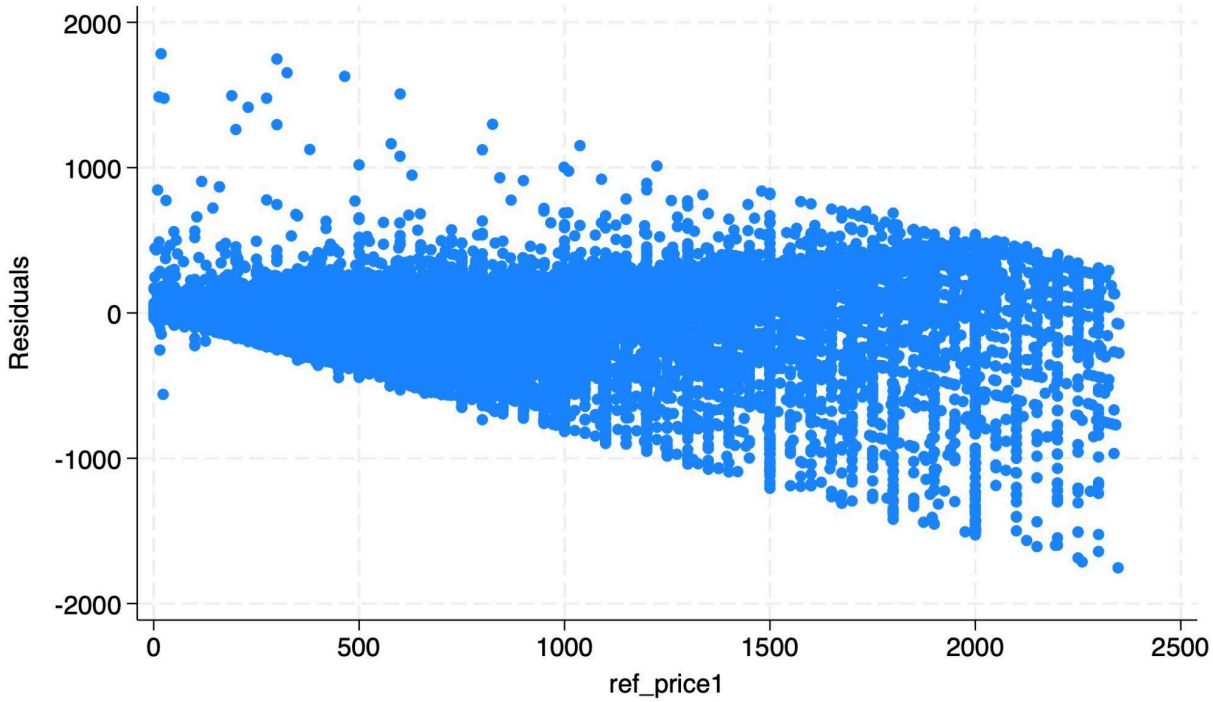

Figure 3. Residuals from Regression 1 (first column) versus Starting price

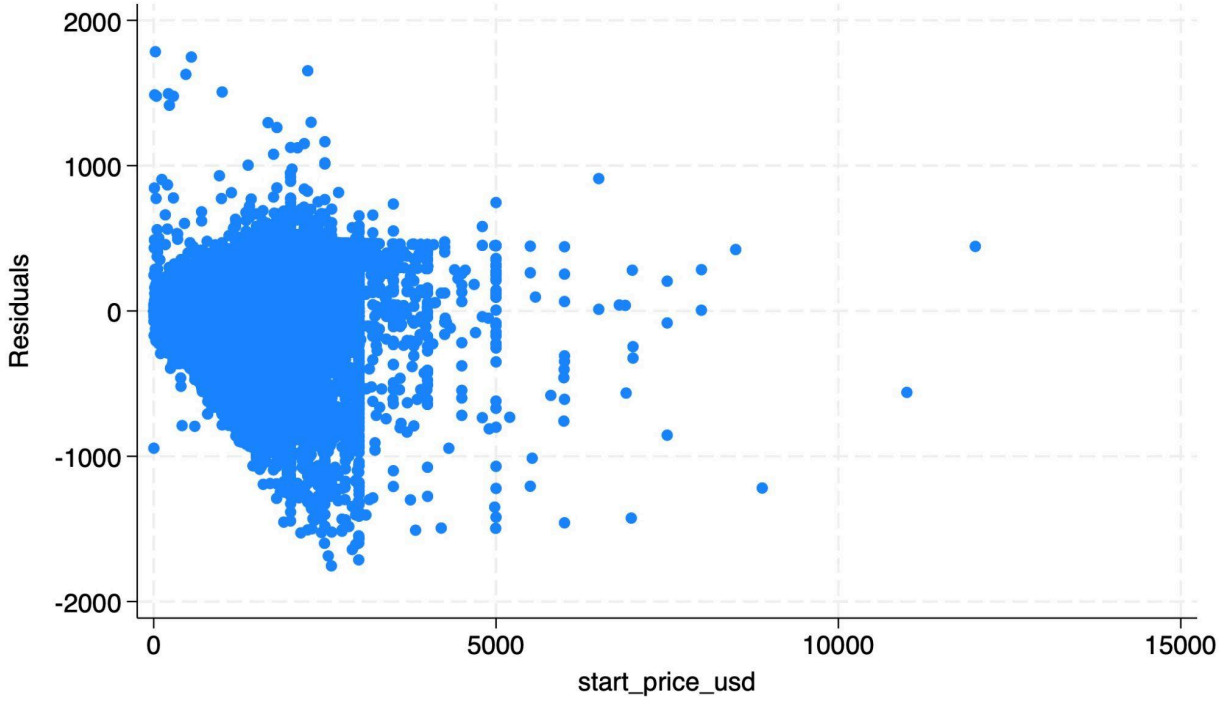

Figure 4. Residuals from Regression 1 (first column) versus Fitted Values of Initial Offer