Using behavioral science to inform the design of sugary drink portion limit policies

Supplement

Methods and Results of Pre-registered Study Reported in Main Text

Preregistration: https://aspredicted.org/x6ju5.pdf
Stimuli: https://osf.io/73puw/?view_only=28eaedb13ba6495da15a671120d87031

Method and stimuli:

Participants (N = 610; M_{age} = 36.94, SD = 11.69; 43.9% female; 80.9% White) were first told: "Imagine that you are at a fast food restaurant right now and are about to purchase a meal for only yourself for dinner" and were then asked to select which drink option they would be most likely to purchase. The options were: a small (16-oz.), medium (24-oz.), or large (32-oz.) drink, or no drink. Using a between-subjects design, participants were randomized to either non-linear drink pricing ($1.59, $1.79, $1.99; c.f. Wilson et al., 2013) or linear drink pricing ($1.19, $1.79, $2.39) and either drink bundling or no bundling (based on Wilson et al., (2013)). Specifically, in the bundled condition, the medium was depicted as 2x12-oz. cups, and the large as 2x16-oz. cups. We pre-registered two primary outcomes, both of which lead to the same conclusion. Due to space constraints, we only report the oz. ordered outcome in the main text. Participants also answered a manipulation check question asking if they selected their drink option for themselves only to ensure they did not make a selection assuming they could share the drink. This question was, "When making your selection on the previous page, I responded thinking that I… (a) could share my soda order with someone, (b) was buying the soda for only myself (i.e., that I could not share it with anyone), (c) none of the above."

Analyses and Results

We ran a logistic regression testing the effect of bundling, pricing, and their interaction on whether people ordered a medium or large drink (the sizes on which the bundling was implemented). There was a significant main effect of bundling. Overall, participants were more likely to order no drink or a small drink relative to those in the typical portion size conditions ((OR) = 0.16, 95% CI = [0.11, 0.23], p = .001). There was no effect of pricing ((OR) = 1.13, 95% CI = [0.78, 1.64], p = .53), and no interaction between these two factors ((OR) = 0.98, 95% CI = [0.46, 2.07], p = .96). See Figure S1. When we excluded participants who failed the manipulation check (N = 78), the effect for bundling remained significant, ((OR) = 0.10, 95% CI = [.06, .15], p = .001), and the effect of pricing remained non-significant, ((OR) = 1.39, 95% CI = [0.89, 2.15], p = .15), and there was still no interaction between these two factors ((OR) = 1.16, 95% CI = [0.48, 2.80], p = .74).

We also ran a 2x2 analysis of variance (ANOVA) using drink oz. ordered as the outcome. The results were consistent with those of the binary choice outcome (Figure 1). There was a significant effect of bundling (F(1, 609) = 25.27, p < .001), such that participants ordered fewer oz. in the bundled conditions relative to the typical portion conditions, ($M_{bundled}$ = 15.16, SD = 9.04; $M_{typical\text{-}portion}$ = 19.24, SD = 10.91; t(608) = -5.03, p < .001, d = .41), but there was no effect for pricing nor was there an interaction (ps > .62). These results did not significantly differ when we excluded participants who did not correctly answer our manipulation check question.

In summary, in this new online study with hypothetical sugary drink size choices we do not find evidence to support Wilson and Stolarz-Fantino's hypothesis that the different results between our original paper and theirs are due to pricing structure. Instead, consistent with Study 1 from our original article, we find that regardless of pricing, and even in this hypothetical context in which social stigma and inconvenience are less salient, people are less likely to order the medium and large sizes when they are bundled (i.e., apportioned across two cups), relative to when they are served in one cup.

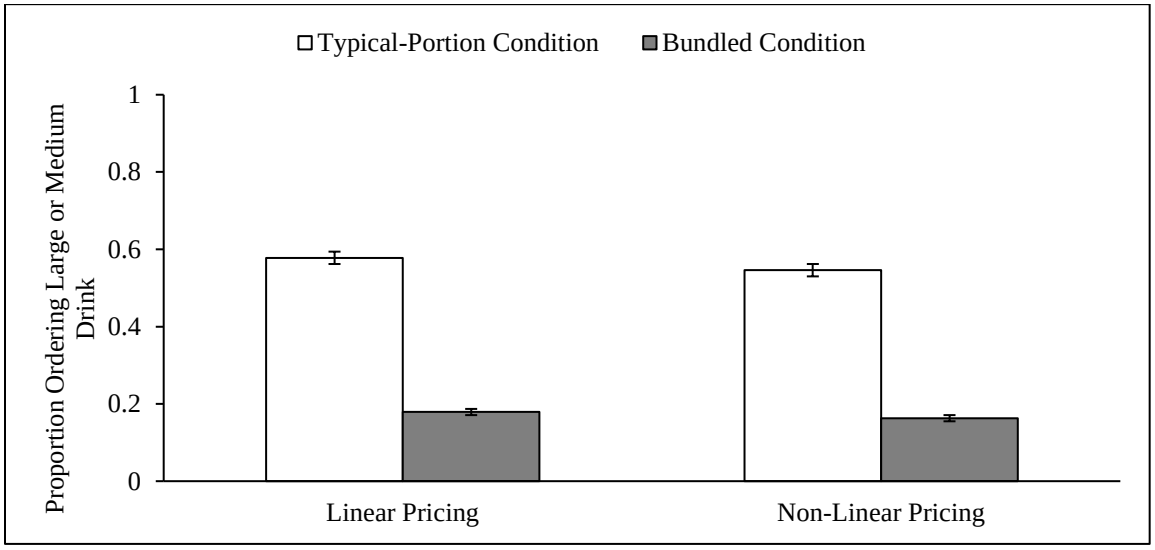

Fig. S1. The proportion of participants who bought a medium or large drink as a function of pricing, separately for the typical-portion and bundled conditions. Error bars indicate +/- 1 *SEM*.

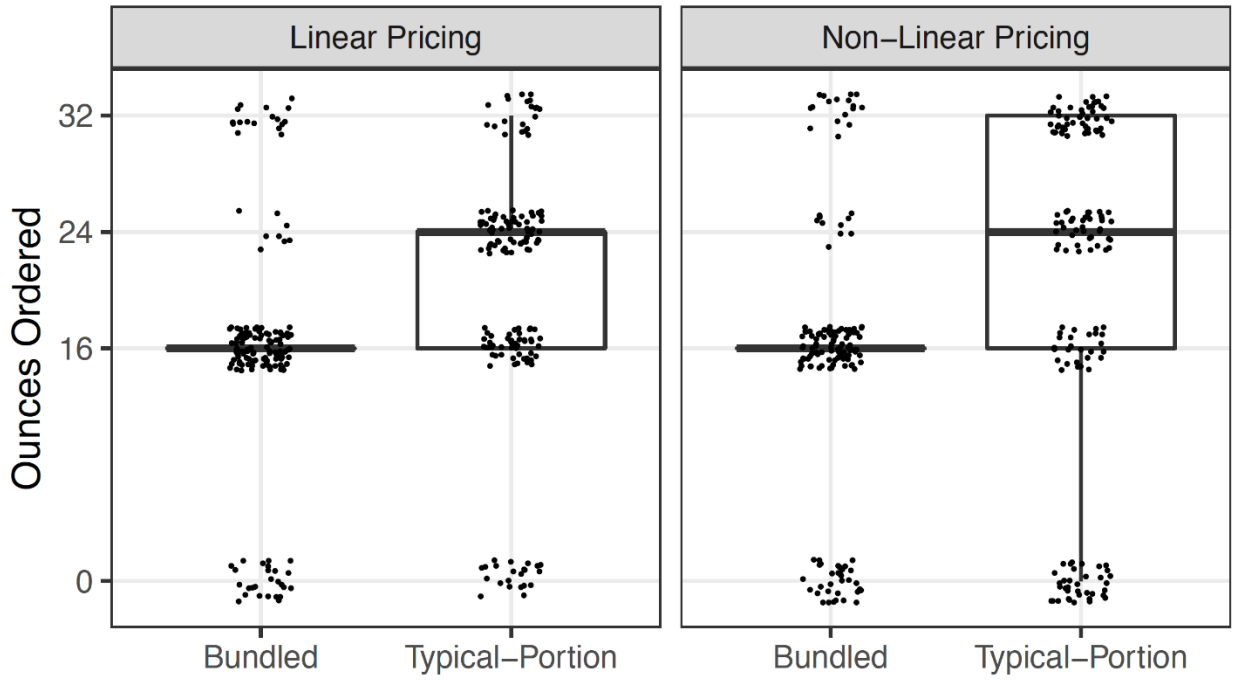

Fig. S2. Box plots of ounces ordered as a function of pricing, separately for the typical-portion and bundled condition. Error bars indicate +/- 1 *SEM*.

Exploratory (non-preregistered) Analysis #1: Drink choice treating medium and large drink choices separately

We pre-registered the drink choice outcome variable as a categorical outcome indicating whether or not participants ordered a medium or large drink (coded as a 1) or a small or no drink (coded as a zero). We did this because the bundling manipulation was applied to any drink larger than 16 oz., and therefore applied to both the medium and large drink sizes, but not the small drink size, which was less than 16 oz. The results, however, are consistent with those of the pre-registered outcomes when we treat drink choice as a 3-level categorical outcome measure (i.e., small or no drink = 0, medium = 1, large = 2).

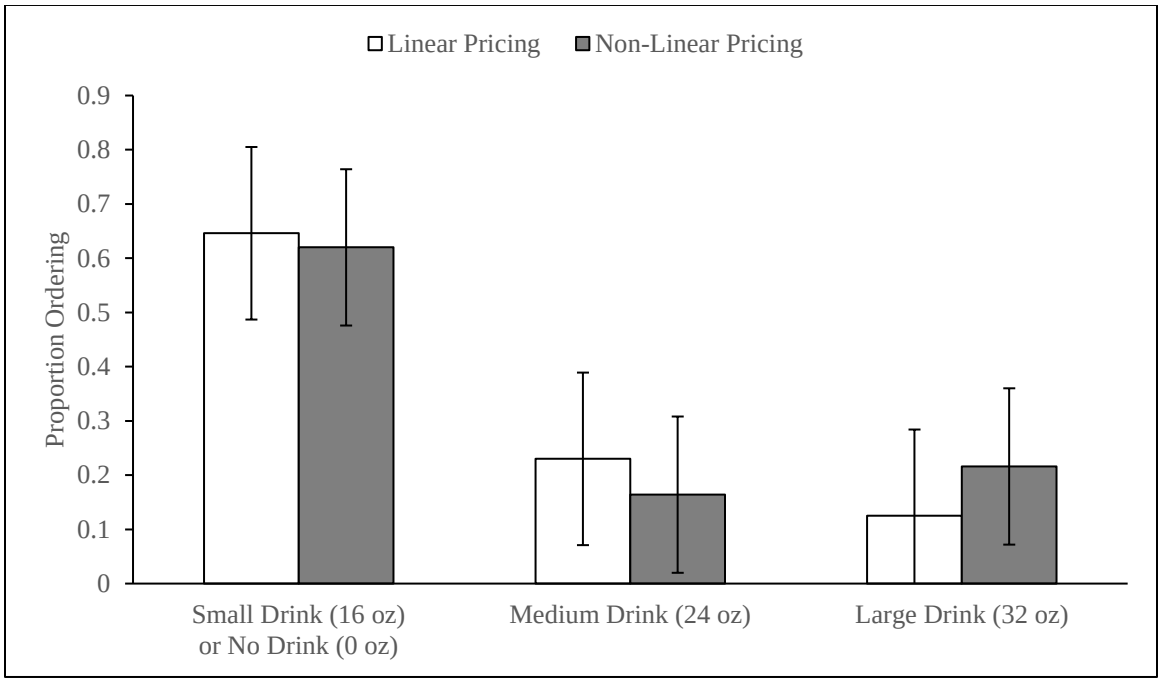

Fig S3. Proportion of participants purchasing drink sizes as a function of pricing. The error bars indicate +/- 1 *SEM*.

Exploratory (non-pre-registered) Analysis #2: Purchasing by Pricing

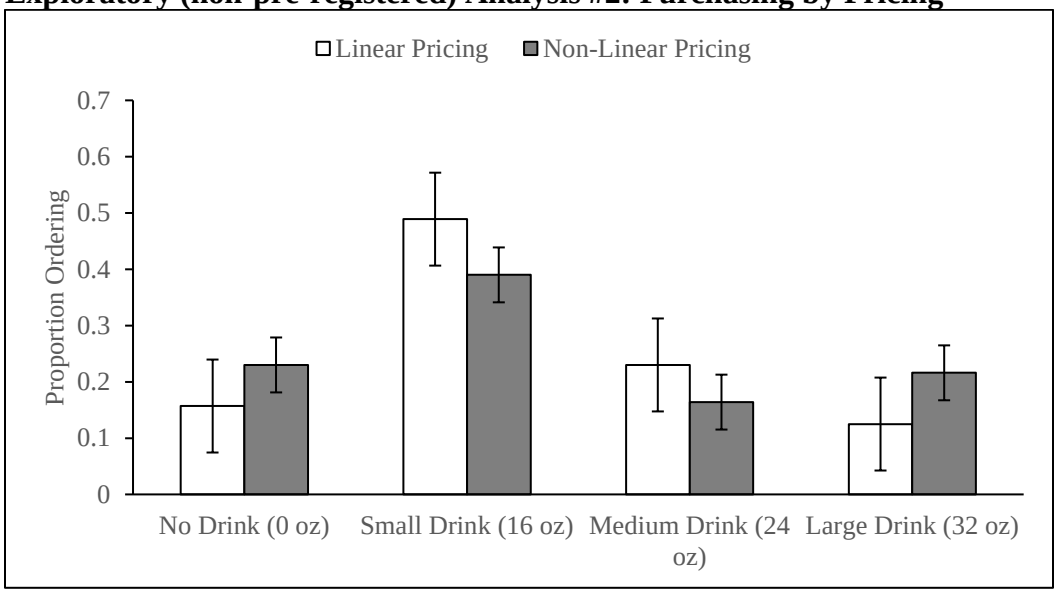

Fig S4. Proportion of participants purchasing drink sizes as a function of pricing. The error bars indicate +/- 1 *SEM*.

No Drink:
A chi square test comparing linear versus non-linear pricing, collapsed across portion style (bundled vs typical) predicting the tendency to not order a drink was significant (percent choosing no drink: 23.0% in non-linear vs 15.7% in linear ($\chi^2(1) = 5.09$, $p = .02$). Participants were significantly less likely to order a drink under non-linear pricing.

Small Drink:
A chi square test comparing linear versus non-linear pricing, collapsed across portion style (bundled vs typical) predicting the tendency to order a small sized drink was significant (percent choosing a small drink: 39.0% in non-linear vs 48.9% in linear ($\chi^2(1) = 5.99$, $p = .01$). Participants were significantly more likely to order a small drink under linear pricing.

Medium Drink:
A chi square test comparing linear versus non-linear pricing, collapsed across portion style (bundled vs typical) predicting the tendency to order a medium drink was significant (percent choosing a medium drink: 16.4% in non-linear vs 23.0% in linear ($\chi^2(1) = 4.15$, $p = .04$). Participants were significantly more likely to order a medium drink under linear pricing.

Large Drink:
A chi square test comparing linear versus non-linear pricing, collapsed across portion style (bundled vs typical) predicting the tendency to order a large drink was significant (percent choosing a large drink: 21.6% in non-linear vs 12.5% in linear ($\chi^2(1) = 9.09$, $p = .003$). Participants were significantly more likely to order a large drink under non-linear pricing.

Conclusion: Although participants are less likely to purchase a drink under non-linear pricing compared to linear pricing, when they order one, it is more likely to be a large drink.

Additional Study Referenced in Main Text

The above pre-registered study was a direct replication of an earlier study we ran, the methods and stimuli for which are posted here:
https://osf.io/6n9x7/?view_only=b5591dc37c1c4f5bbcb0efb9545d28d6

In a 2x2 between-subjects design, participants (N = 407 MTurkers; M_{age} = 37.82 (*SD* = 13.05); 39.1% female; 83.5% white) made a hypothetical drink choice from either a bundled or a regular menu, and we manipulated whether the pricing was linear or non-linear.

The likelihood of ordering a large or medium drink was examined in a logistic regression with three independent variables: portion limit (typical portion vs. bundled), pricing (linear vs. non-linear), and their interaction. There was a significant main effect of portion limit, odds ratio (OR) = -0.93, 95% CI = [0.22, 0.69], p = .001. Bundling made large sizes less appealing than a typical portion. There was a marginally significant main effect of pricing, OR = -0.51, 95% CI = [0.34, 1.04], p = .07. Participants purchased marginally more oz. under non-linear pricing than linear pricing. As shown in Fig S4, there was no significant interaction between portion limit and pricing, (OR) = 0.24, 95% CI = [0.56, 2.89], p = .56.

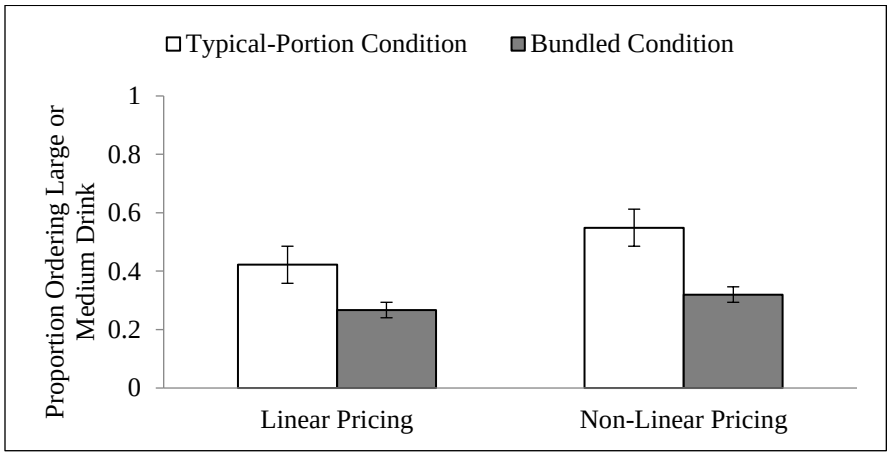

Fig. S5. The proportion of participants who bought a medium or large drink as a function of pricing, separately for the typical-portion and bundled conditions. Error bars indicate +/- 1 *SEM*.

We conducted a 2 x 2 ANOVA with between-subject factors of portion limit (typical portion vs. bundled) and pricing (linear vs. non-linear) to investigate the influence on number of drink oz. ordered. Consistent with our analysis for drink choice, there was a non-significant interaction between portion limit and pricing on oz. ordered, $F(1,403) = .04$, p = .84; η^2=.00, Bayes Factor = .13 (see Figure S5). There were also non-significant main effects for pricing, $F(1,403) = 1.44$, p = .23; η^2=.00. Bayes Factor = .22 (linear: M = 16.67, SD = 9.90; non-linear: M = 17.89, SD = 10.71), and a non-significant main effect for portion limit, $F(1,403) = 1.83$, p = .18; η^2=.00, Bayes Factor = .26 (typical: M = 17.97, SD = 10.93; bundled: M = 16.59, SD = 9.65).

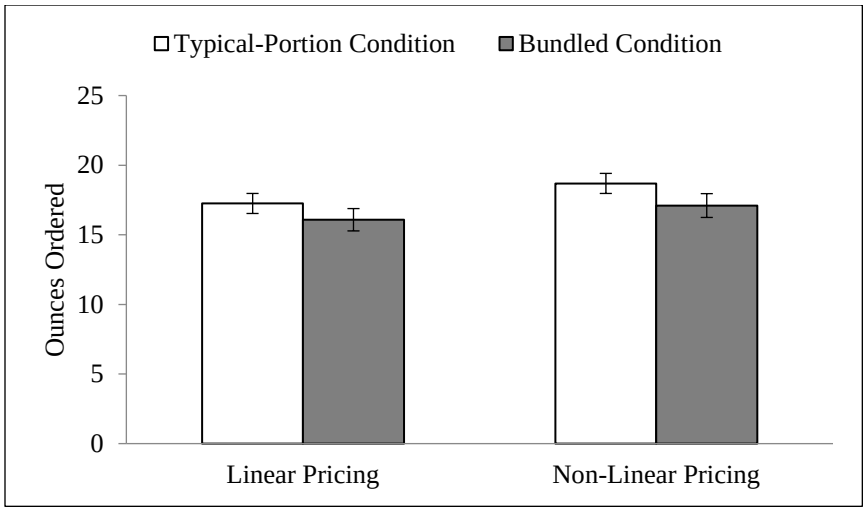

Fig. S6. Oz. ordered as a function of pricing, separately for the typical-portion and bundled conditions. Error bars indicate +/- 1 *SEM*.

Supplementary Analysis for Additional Study

In the additional non-pre-registered study we presented, there was only a marginally significant main effect of the pricing manipulation, and it did not interact with the bundling manipulation. It is possible that these weak effects of the pricing manipulation arose out of respondent confusion over linear vs non-linear pricing. We were interested in how many people noticed linear vs. non-linear pricing and so after the primary outcomes were measured, we asked participants to answer the following true/false question: "As the size increased, the price per oz. of soda decreased." We re-ran our analyses excluding participants who did not answer this question correctly (N = 168), leaving a total sample of 239 participants. As reported below, the results of our primary analysis hold.

The likelihood of ordering a large or medium drink was examined in a logistic regression with three independent variables: portion limit (typical portion vs. bundled), pricing (linear vs. non-linear), and their interaction. Consistent with our findings from using the full sample, there was a significant main effect of portion limit, odds ratio (OR) = -0.74, 95% CI = [0.25, 0.91], p = .03 (see Figure S6). Bundling made large sizes less appealing than a typical portion. There was a non-significant main effect of pricing, OR = 0.02, 95% CI = [0.49, 2.13], p = .96. There was a non-significant interaction between portion limit and pricing, (OR) = 0.04, 95% CI = [0.32, 2.92], p = .94.

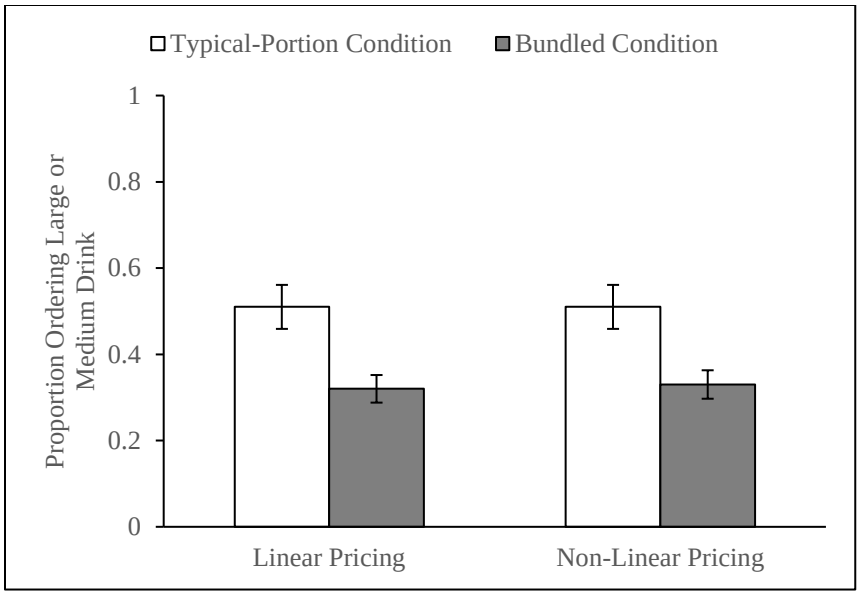

Fig. S7. The proportion of participants who bought a medium or large drink as a function of pricing, separately for the typical-portion and bundled conditions, and restricting the sample to those who passed the pricing comprehension check. Error bars indicate +/- 1 *SEM*.

We conducted a 2 x 2 ANOVA with between subject factors of portion limit (typical portion vs. bundled) and pricing (linear vs. non-linear) to analyze number of oz. ordered. Consistent with our analysis for drink choice, there was a non-significant interaction between portion limit and pricing on drink oz. ordered, $F(1,235) = .65$, $p = .42$; $\eta^2=.00$, Bayes Factor = .26 (and see Figure S7). There was also a non-significant main effect for pricing, $F(1,235) = .83$, $p = .36$; $\eta^2=.00$, Bayes Factor = .24 (linear: $M = 19.02$, $SD = 8.95$; non-linear: $M = 17.59$, $SD = 11.02$), and a non-significant main effect for portion limit, $F(1,235) = 1.29$, $p = .26$; $\eta^2=.00$, Bayes Factor = .23 (typical: $M = 18.75$, $SD = 10.77$; bundled: $M = 17.41$, $SD = 9.92$).

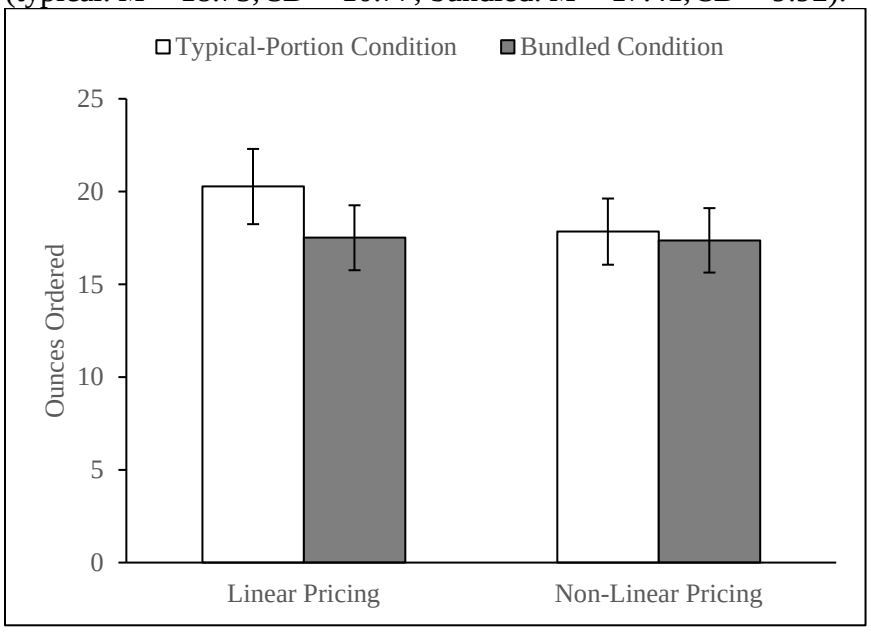

Fig. S8. Oz. ordered as a function of pricing, separately for the typical-portion and bundled conditions, and restricting the sample to those who correctly identified non-linear and linear pricing. Error bars indicate +/- 1 *SEM*.