The Role of Visual Attention in Opportunity Cost Neglect and Consideration Supplemental Materials

Appendix A: Online Post-Test

Online Behavioral Order/Position Effect Study

One interesting outcome from the two eye-tracking studies is the difference between the two different order conditions. Participants who saw the implicit-explicit ordering (rather than explicit-implicit ordering) had a significantly larger effect (i.e., a greater difference in choice proportions between implicit and explicit conditions). The first study, however, cannot distinguish between a carryover effect and a position effect. In other words, is the difference in effect due to the carryover from the first frame to the second frame or due to the location of the explicit framing in the study (i.e., 1^{st} vs. 2^{nd})? We conducted the following experiment to address this question.

Methods

Participants

Four hundred and ninety-nine Amazon Mechanical Turk workers participated in this preregistered study.[1] This study was approved by the relevant Internal Review Board. Participants were paid $2.00 for their participation.

Procedure

First, participants used the mouse to indicate how much they would be willing to pay for each of 50 food items on a continuous scale from $0.00 to $4.00. If they did not like the food at all, they were told to rate the food at $0.00. Unbeknownst to participants, rating a food at $0.00 ensured that the disliked food would not appear in the subsequent choice task.

[1] The preregistration may be found at: https://aspredicted.org/blind.php?x=kj5wc6.

Next, participants made 100 hypothetical purchase choices (separated in two blocks of 50 trials each) about these food items. Specifically, on each trial, participants saw a picture of one food item and two options on the same screen: a buy option and a do-not-buy option. Crucially, we manipulated the framing of the do-not-buy option. The options were either labeled “Buy Food for $X” and “Do Not Buy Food for $X” (the *implicit* opportunity cost condition) or they were labeled “Buy Food for $X” and “Keep $X” (the *explicit* opportunity cost condition).

Participants completed two blocks of trials, and the type of framing in each block was randomly determined. Thus, there were four groups of participants: *implicit-explicit*, *explicit-implicit*, *implicit-implicit*, and *explicit-explicit*. Moreover, the positioning (left vs. right) of the options was randomly assigned on each trial. Each price was randomized to take on a value between $0.50 below a participant’s WTP for that item and $0.50 above a participant’s WTP for that item. The price was uniformly sampled from this range, with a minimum price of $0.01 and a maximum price of $4.00. This participant-level personalization ensured that each participant’s trials comprised a comparable range of difficulties.

Data Exclusions

As stated in our preregistration, we excluded 123 participants who chose against their stated WTPs.

Results

First, we sought to replicate our previous findings, so we compared purchase rates in the first block completed by participants. Specifically, we regressed purchase rate on the framing condition (explicit = +1, implicit = –1). We find a significant effect of frame ($b_1 = -0.056$, SE = 0.01, $t = –5.68$, $p < 0.001$) such that participants who saw the explicit framing were significantly less likely to purchase than participants who saw the implicit framing.

Next, we tested for the presence of carryover effects, i.e., whether there were differential carryover effects depending on the first block framing. We examined average purchase rate in the second block as a function of first block frame, second block frame, and their interaction. Differential carryover would be supported by a significant interaction, such that the effect of second block frame is greater when first block is implicit than when first block is explicit. Indeed, that is what we find, $b_4 = 0.026$, SE = 0.01, $t = 2.20$, $p = 0.03$. This implies that the effect of the second block frame being explicit (vs. implicit) is smaller when the first block was explicit (vs. implicit). Therefore, the difference in effect between the (frame-order) conditions we observed in Study 1 is likely due to an order effect, rather than a position effect.

Finally, to test whether the WTPs were well-calibrated, we used first-block choices to regress Choice on intercept, first-block frame (-1, 1) surplus (WTP - price), and their interaction, with participant-level random intercept and slope on surplus. We do not find well-calibrated WTPs in either condition (fig. S1), which suggests that hypothetical purchase studies are not ideal for comparing/calibrating WTPs (see Hascher, Desai, and Krajbich, 2021 for further discussion).

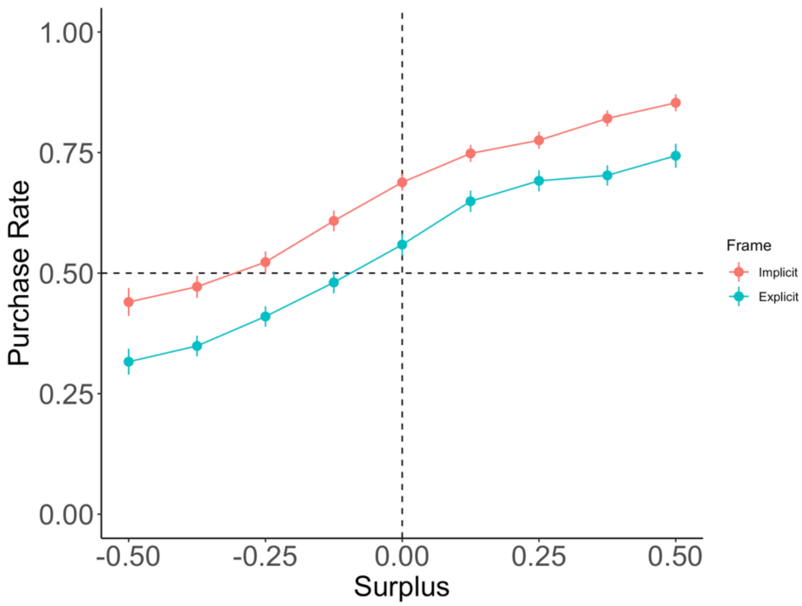

Figure S1. Purchase rate by surplus and frame.

Appendix B: Robustness Check (Including Pre-registered Excluded Data)

Table S1. Main results with excluded data.

Analysis	Result (collapsed across studies)	Result (with excluded data)
Eq. 1: Purchase Rate Difference ~ b0 + b1*Order	b0 = 0.074 (0.009)***	b0 = 0.074 (0.009)***
Eq. 2: Buy ~ b0 + b1*Position + b2*OppCost + b3*Surplus	b2 = –0.21 (0.03)***	b2 = –0.21 (0.02)***
Eq. 3a: Buy Dwell Advantage Difference ~ b0 + b1*Order	b0 = –0.038 (0.01)**	b0 = –0.044 (0.01)**
Eq. 3b: Buy Dwell Proportion Difference ~ b0 + b1*Order	b0 = –0.027 (0.005)***	b0 = –0.026 (0.005)***
Eq. 4a: Buy Dwell Advantage ~ b0 + b1*OppCost + b2*Position + b3*Surplus	b1 = –0.014 (0.006)*	b1 = –0.010 (0.007)
Eq. 4b: Buy Dwell Proportion ~ b0 + b1*OppCost + b2*Position + b3*Surplus	b1 = –0.011 (0.003)***	b1 = –0.010 (0.003)***
Eq. 5a: Purchase Rate Difference ~ b0 + b1*Order + b2*BuyDwellAdvantageDifference + b3*MCBuyDwellAdvantageSum	b2 = 0.36 (0.05)***	b2 = 0.24 (0.05)***
Eq. 5b: Purchase Rate Difference ~ b0 + b1*Order + b2*BuyDwellProportionDifference + b3*MCBuyDwellProportionSum	b2 = 1.06 (0.11)***	b2 = 1.05 (0.11)***
Eq. 6a: Buy ~ b0 + b1*OppCost + b2*Position + b3*Surplus + b4*BuyDwellAdvantage + b5*MCTotalDwell	b4 = 2.16 (0.09)***	b4 = 1.84 (0.09)***
Eq. 6b: Buy ~ b0 + b1*OppCost + b2*Position + b3*Surplus + b4*BuyDwellProportion	b4 = 5.94 (0.22)***	b4 = 5.85 (0.21)***
Eq. 7a: Buy ~ b0 + b1*OppCost + b2*Position + b3*Surplus + b4*BuyDwellAdvantage + b5*MCTotalDwell + b6*OppCost*BuyDwellAdvantage + b7*OppCost*TotalDwell	b6 = 0.13 (0.05)**	b6 = 0.09 (0.04)*
Eq. 7b: Buy ~ b0 + b1*OppCost + b2*Position + b3*Surplus + b4*BuyDwellProportion + b5*OppCost*BuyDwellProportion	b5 = 0.31 (0.12)*	b5 = 0.34 (0.12)**
Eq. 8: Buy ~ b0 + b1*OppCost + b2*Position + b3*Surplus + b4*BuyDwell + b5*NonBuyDwell + b6*OppCost*BuyDwell + b7*OppCost*NonBuyDwell	b6 = 0.062 (0.05) b7 = –0.20 (0.05)***	b6 = 0.028 (0.044) b7 = –0.17 (0.05)**

Appendix C: Model Derivation

The drift rates during dwells to the buy and non-buy options are specified in equations 9 and 10. Consequently, the total net evidence gained for the buy option within a trial is:

(11) $$A_B(d_B X_B - \theta_N d_N X_N) + A_N(\theta_B d_B X_B - d_N X_N) + \varepsilon$$

Here, A_B and A_N are the proportion of trial dwell time spent on the buy and non-buy options, respectively, and ε is an error term to represent the noise in the accumulation process. After rearranging terms, we obtain the following:

$$d_B A_B X_B - d_N \theta_N A_B X_N + d_B \theta_B A_N X_B - d_N A_N X_N + \varepsilon$$

$$\downarrow$$

(12) $$d_B Z_1 + d_N Z_2 + d_B \theta_B Z_3 + d_N \theta_N Z_4 + \varepsilon$$

$$\downarrow$$

$$\beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 + \varepsilon$$

Where

$$Z_1 = A_B X_B$$

$$Z_2 = -A_N X_N$$

$$Z_3 = A_N X_B$$

$$Z_4 = -A_B X_N$$

And

$$\frac{\beta_3}{\beta_1} = \frac{d_B \theta_B}{d_B} = \theta_B$$

$$\frac{\beta_4}{\beta_2} = \frac{d_N \theta_N}{d_N} = \theta_N$$

Thus, since the Z_i comprise measured variables in our study (i.e., the values of the options, X_i, and the proportion of attention devoted to each option, A_i), we can estimate the β_i (and ultimately, the θ_i) in a mixed-effects logistic regression (with choice as a binary variable, where choosing to buy = 1, and random slopes and intercepts at the participant level).

Appendix D: RUM Recovery Exercise

Separate θ_i Recovery Exercise

We first simulated 100 datasets with parameters from the following ranges: $d \in [0.00015, 0.00025], \sigma \in [0.015, 0.025], \theta_B \in [0, 1], \theta_N \in [0, 1], ndt \in [300, 500]$. We then estimated θ_B and θ_N using the RUM approach detailed in the main text. Scatterplots of the true and fitted θ_i parameters can be found below (Fig. S2).

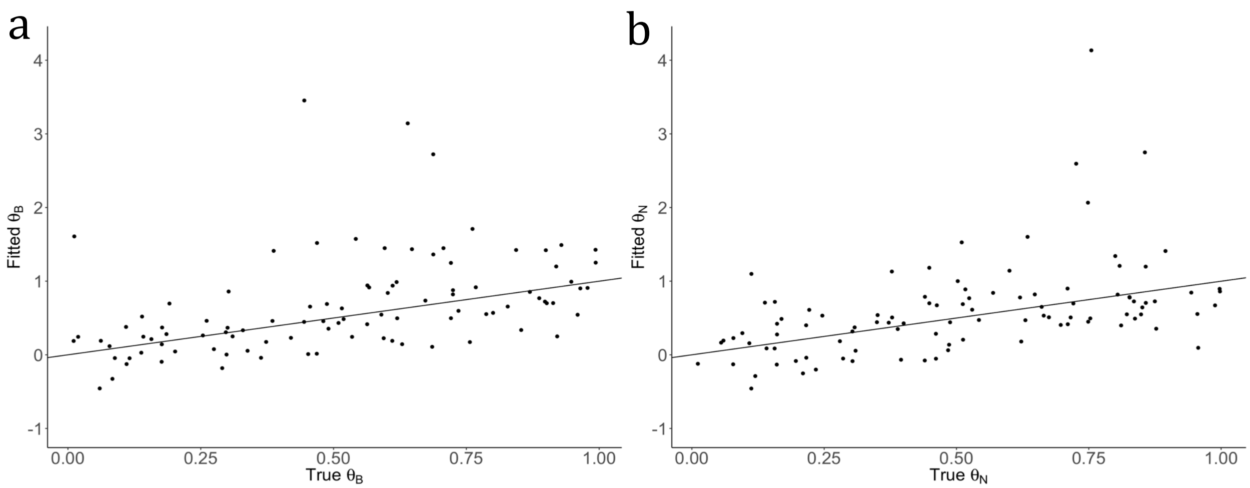

Figure S2. Scatterplots of true and fitted θ_i. Attentional discounting on the (a) buy and (b) non-buy options is recoverable using the RUM method. The Spearman correlations for this exercise are *rs*(98) = 0.56 and *rs*(98) = 0.57, respectively, *p*s < 0.001. Two points (fitted θ_B = -158 and 6) from panel (a) are excluded from the graph for presentation purposes.

Appendix E: Computing Confidence Intervals

Testing Differences Between Conditions in θ_B and θ_N

Clearly, the numbers in Table 1 are only point estimates. Unfortunately, estimating confidence intervals/statistical significance is non-trivial because of the multi-level nature of the data and the regression. Therefore, we chose to estimate all of the data in one regression, with strategically placed interaction/dummy terms so as to isolate the magnitude of the difference in θ between the two conditions:

$$A_B\big((d_B + \delta_B I_E)X_B - (d_N + \delta_N I_E)(\theta_N + \alpha_N I_E)X_N\big) + \\ A_N((d_B + \delta_B I_E)(\theta_B + \alpha_B I_E)X_B - (d_N + \delta_N I_E)X_N) \tag{13}$$

Here, I_E is an indicator variable (equal to 0 for the implicit condition and 1 for the explicit condition), δ_i is the difference in d_i between the conditions, and α_i is the difference in θ_i between the conditions. Thus, we are most interested in the magnitude/direction of α_i. In order to estimate α_i, we need to transform this into a functional regression equation. Working through the algebra, we obtain the following:

$$d_B Z_1 + d_N Z_2 + \delta_B I_E Z_1 + \delta_N I_E Z_2 + \\ d_B \theta_B Z_3 + (d_B \alpha_B + \delta_B \theta_B + \delta_B \alpha_B) I_E Z_3 + \\ d_N \theta_N Z_4 + (d_N \alpha_N + \delta_N \theta_N + \delta_N \alpha_N) I_E Z_4 \tag{14}$$

Which allows us to regress (in addition to an intercept and simple effect of I_E:

$$\beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3 + \beta_4 Z_4 +$$

$$\beta_5 I_E Z_1 + \beta_6 I_E Z_2 + \beta_7 I_E Z_3 + \beta_8 I_E Z_4 \quad (15)$$

Then, we can calculate:

$$d_B = \beta_1, d_N = \beta_2$$

$$\delta_B = \beta_5, \delta_N = \beta_6$$

$$\theta_B = \frac{\beta_3}{\beta_1}, \theta_N = \frac{\beta_4}{\beta_2}$$

$$\alpha_B = \frac{\beta_7 - \beta_5\left(\frac{\beta_3}{\beta_1}\right)}{\beta_1 + \beta_5}, \alpha_N = \frac{\beta_8 - \beta_6\left(\frac{\beta_4}{\beta_2}\right)}{\beta_2 + \beta_6}$$

This is the most flexible version of the model. We tested more constrained versions of the model (with $d_B = d_N$ and $\delta_i = 0$, or the simpler constraint of $d_B = d_N$), but these models fit significantly worse than the full model (likelihood-ratio tests; χ^2(14,20) = 49.57 and χ^2(18,20) = 24.76, *p*s < .001).

With the full model (equation 15), we find point estimates of α_B= –0.14 and α_N= 0.06. These are similar to our estimates of these metrics separately for each condition (Table 1). To get a sense for the distribution of the α_i (and ultimately, θ_i), we use the fixed effect coefficients (β_i) and the calculated covariances ($\sigma_{i,j}$) among these coefficients. We pulled 10,000 draws from a multivariate normal distribution (using $\mu_i = \beta_i$ and the covariance matrix comprising $\sigma_{i,j}$). Evidence that we appropriately recovered the point estimates and correlations among the coefficients is in Fig. S3. The 10,000 draws yield approximated distributions of all of the coefficients in regression equation 15, above, which provides a more complete sense for the values of α_i (i.e. $\theta_i^E - \theta_i^I$) and θ_i (Fig. 4).

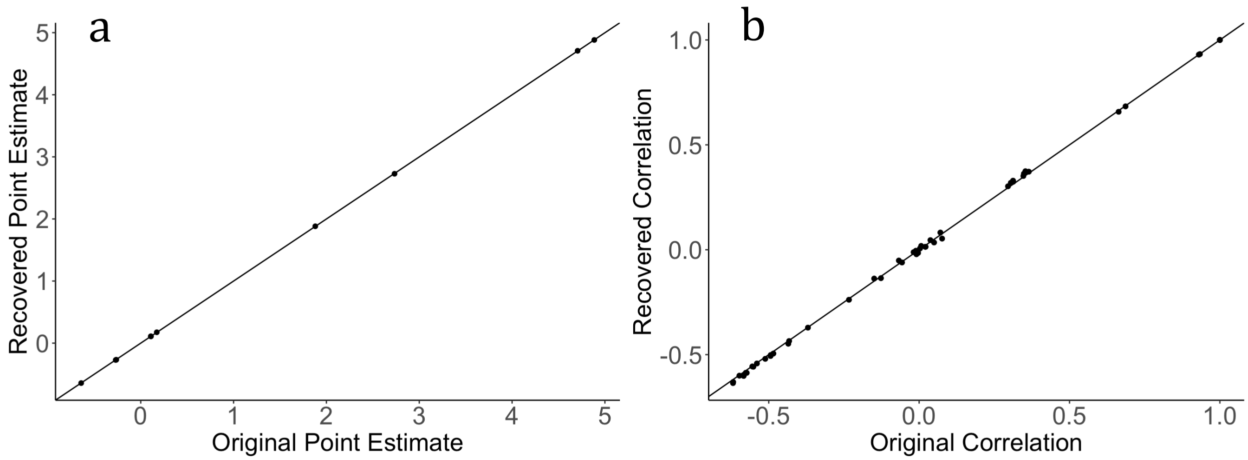

Figure S3. Recovery evidence from a multivariate normal sample (N = 10,000). Based on the (a) point estimates for fixed effects and (b) correlations between fixed effects, we can conclude that our recovery was effective.

Another approach for estimating confidence intervals on the attentional discounting parameters is a bootstrapping procedure. However, because a mixed effects regression has to be estimated on each sample, this is relatively computationally intense. With the help of a server, we ran 5000 samples. Each sample was generated by randomly sampling participants (with replacement) and then, for each selected participant, randomly sampling from their trials (with replacement). For each of these samples, we ran the mixed effects regression (equation 15) and calculated each α and θ. The results of this analysis are in Fig. S4. We find results that are very similar to the approximation exercise in the main text. The discount on the "buy" option (when it is not looked at) is greater in the explicit (vs. implicit) condition, and the discount on the "non-buy" option (when it is not looked at) is greater in the implicit (vs. explicit) condition.

Table S2. Confidence intervals (approximate distributions of parameters)

Data	$\boldsymbol{\theta_B}$**: explicit**	$\boldsymbol{\theta_B}$**: implicit**	$\boldsymbol{\alpha_B}$	$\boldsymbol{\theta_N}$**: explicit**	$\boldsymbol{\theta_N}$**: implicit**	$\boldsymbol{\alpha_N}$
All Data	[0.14, 0.36]	[0.28, 0.51]	[-0.29, 0.004]	[0.49, 0.82]	[0.46, 0.73]	[-0.12, 0.25]
S1	[-0.06, 0.26]	[0.15, 0.55]	[-0.48, -0.02]	[0.54, 1.30]	[0.39, 0.85]	[-0.10, 0.71]
Keep/Do Not Buy (both studies)	[0.04, 0.30]	[0.21, 0.48]	[-0.34,-0.005]	[0.49, 0.92]	[0.45, 0.79]	[-0.16, 0.34]
Study 2	[0.21, 0.51]	[0.28, 0.58]	[-0.26, 0.12]	[0.39, 0.75]	[0.42, 0.77]	[-0.24, 0.20]
Study 2: Keep/Do Not Buy	[0.08, 0.49]	[0.15, 0.55]	[-0.33, 0.19]	[0.32, 0.85]	[0.40, 0.92]	[-0.41, 0.27]
Study 2: Skip/Save	[0.22, 0.66]	[0.30, 0.76]	[-0.39, 0.20]	[0.36, 0.89]	[0.34, 0.82]	[-0.26, 0.36]

Table S3. Confidence intervals (bootstrapping)

Data	$\boldsymbol{\theta_B}$**: explicit**	$\boldsymbol{\theta_B}$**: implicit**	$\boldsymbol{\alpha_B}$	$\boldsymbol{\theta_N}$**: explicit**	$\boldsymbol{\theta_N}$**: implicit**	$\boldsymbol{\alpha_N}$
All Data	[0.08, 0.38]	[0.44, 0.85]	[-0.36, 0.06]	[0.22, 0.54]	[0.41, 0.77]	[-0.23, 0.32]
S1	[-0.15, 0.29]	[0.46, 1.37]	[-0.59, 0.04]	[0.09, 0.61]	[0.36, 0.90]	[-0.24, 0.79]
Keep/Do Not Buy (both studies)	[-0.03, 0.33]	[0.41, 0.97]	[-0.43, 0.06]	[0.21, 0.48]	[0.40, 0.83]	[-0.30, 0.43]
Study 2	[0.14, 0.55]	[0.34, 0.80]	[-0.36, 0.22]	[0.20, 0.63]	[0.37, 0.86]	[-0.38, 0.28]
Study 2: Keep/Do Not Buy	[-0.02, 0.60]	[0.22, 0.95]	[-0.48, 0.37]	[0.06, 0.65]	[0.32, 1.10]	[-0.69, 0.42]
Study 2: Skip/Save	[0.16, 0.70]	[0.32, 0.95]	[-0.51, 0.29]	[0.21, 0.87]	[0.28, 0.93]	[-0.39, 0.44]

Appendix F: Bootstrapping Distributions of α_i and θ_i

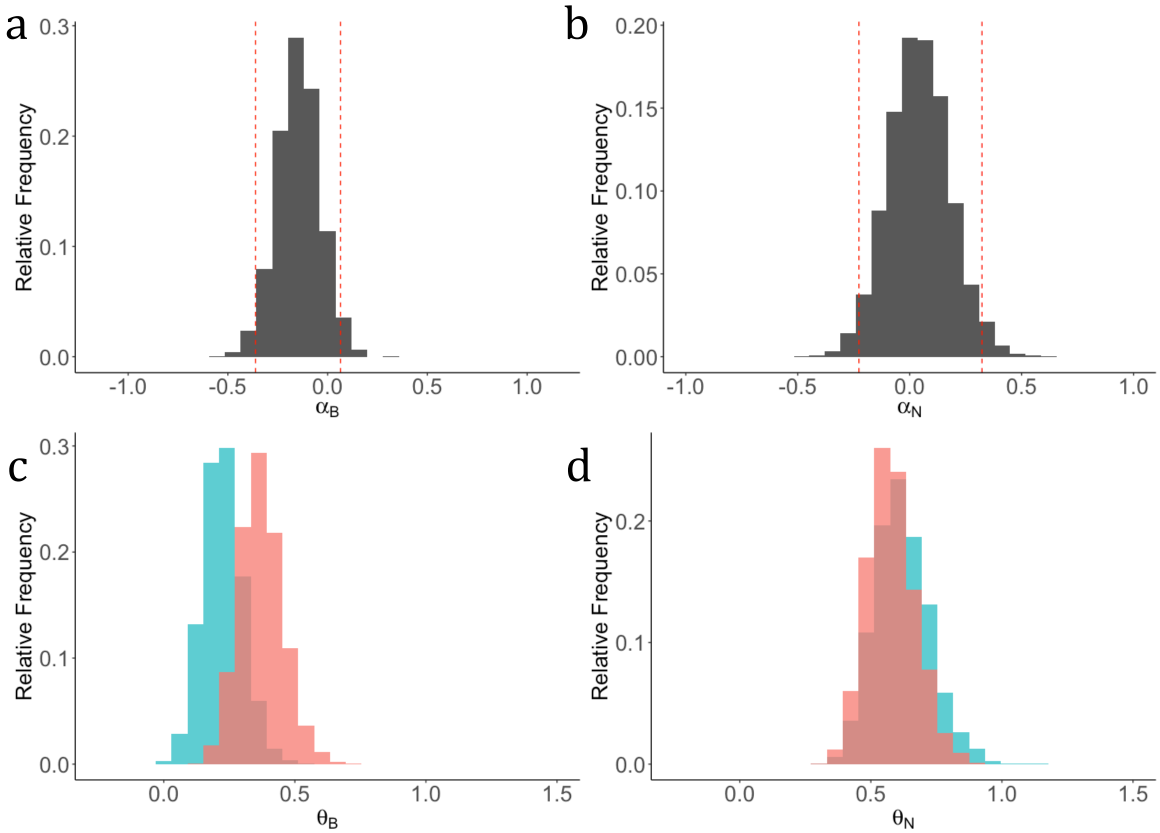

Figure S4. Bootstrapping results for α_i and θ_i from all data (collapsed over studies and wording). The discount on the “buy” option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.36, 0.06]. The 95% confidence intervals for θ_B (c) are: explicit = [0.08, 0.38]; implicit = [0.22, 0.54]. The discount on the “non-buy” option is slightly stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.23, 0.32]. The 95% confidence intervals for θ_N (d) are: explicit = [0.44, 0.85]; implicit = [0.41, 0.77].

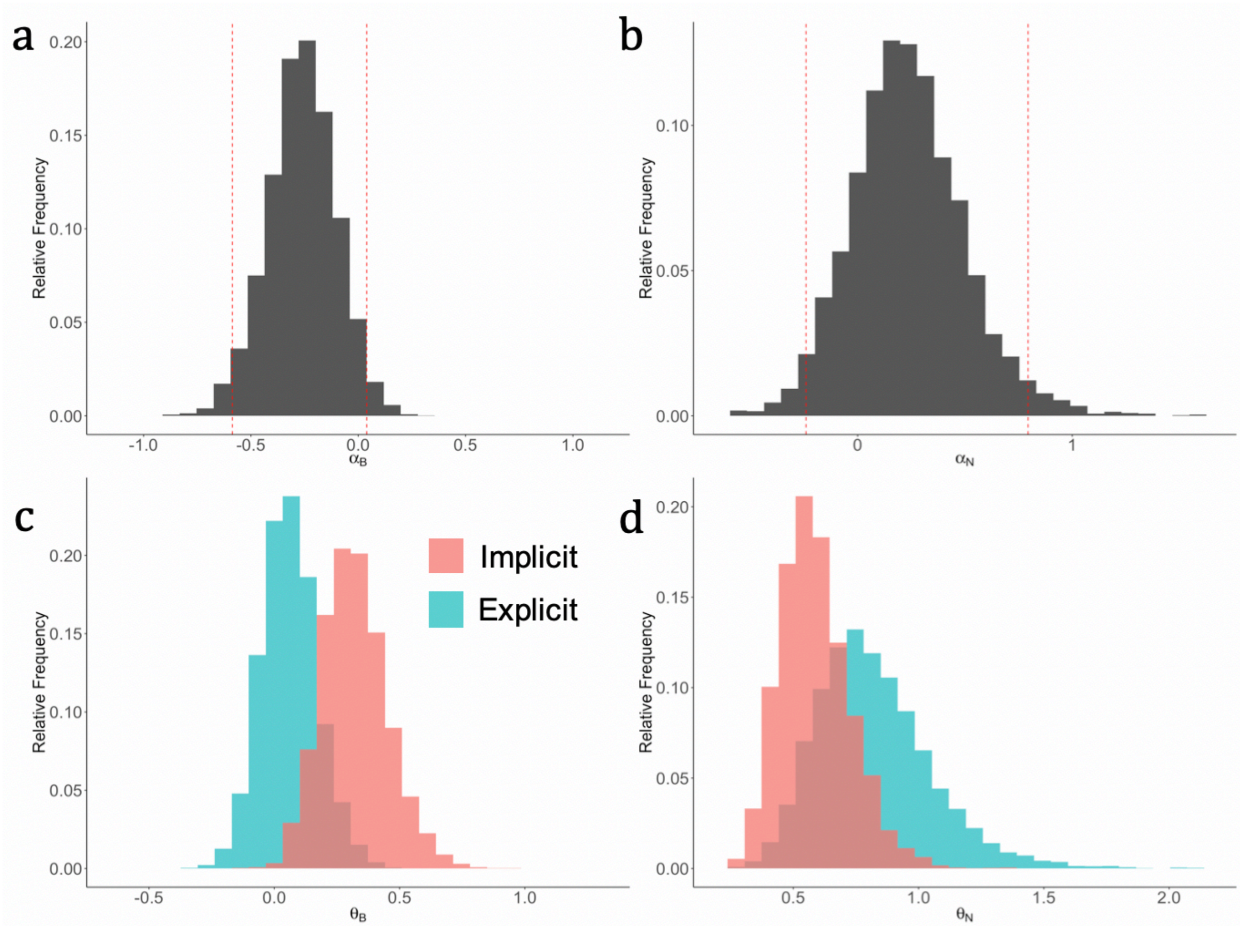

Figure S5. Bootstrapping results for α_i and θ_i from Study 1. The discount on the "buy" option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.59, 0.04]. The 95% confidence intervals for θ_B (c) are: explicit = [–0.15, 0.29]; implicit = [0.09, 0.61]. The discount on the "non-buy" option is slightly stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.24, 0.79]. The 95% confidence intervals for θ_N (d) are: explicit = [0.46, 1.37]; implicit = [0.36, 0.90].

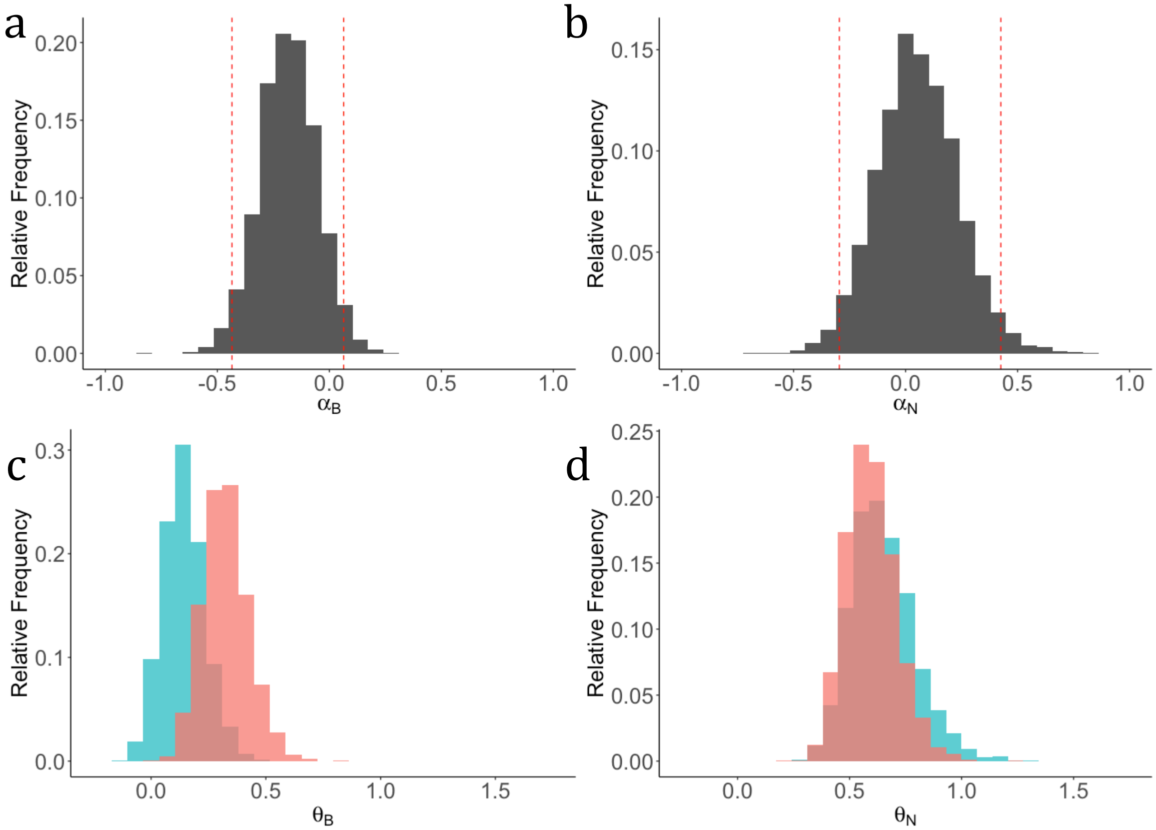

Figure S6. Bootstrapping results for α_i and θ_i using the “Keep” / “Do Not Buy” wording (collapsed across both studies). The discount on the “buy” option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.43, 0.06]. The 95% confidence intervals for θ_B (c) are: explicit = [–0.03, 0.33]; implicit = [0.15, 0.53]. The discount on the “non-buy” option is slightly stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.30, 0.43]. The 95% confidence intervals for θ_N (d) are: explicit = [0.41, 0.97]; implicit = [0.40, 0.83].

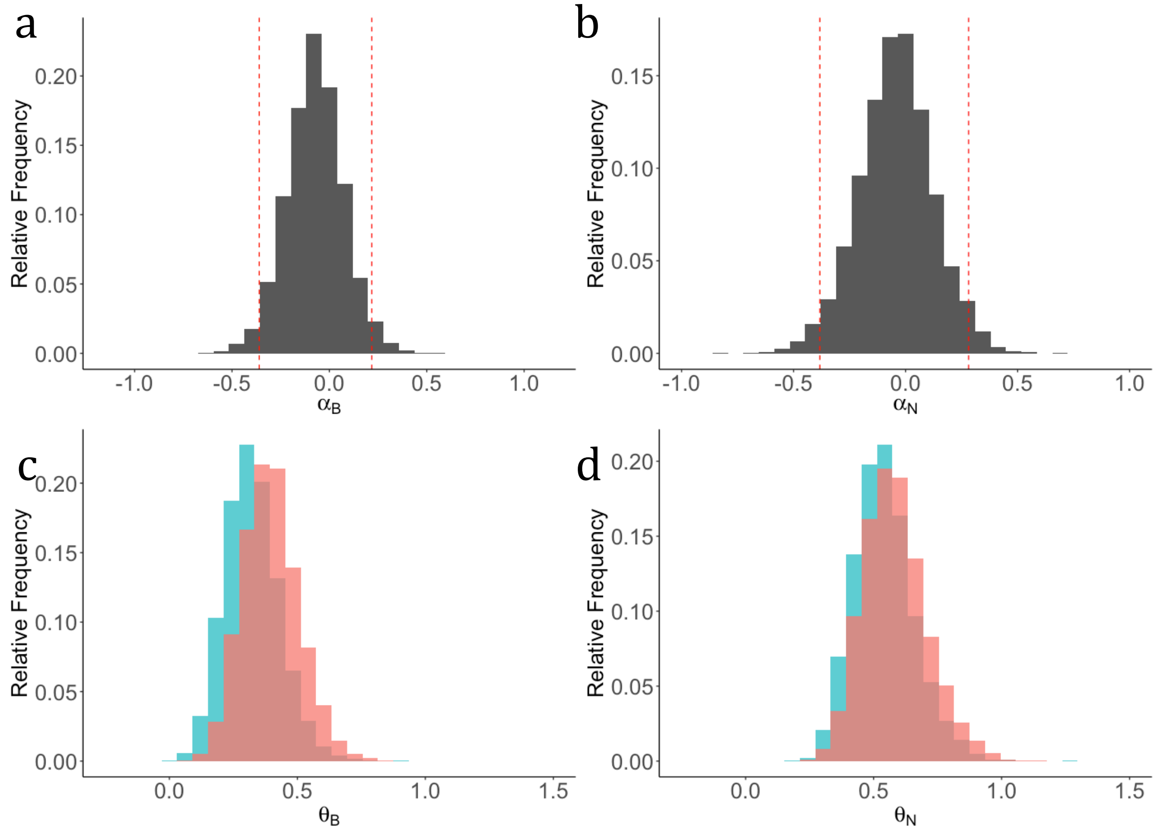

Figure S7. Bootstrapping results for α_i and θ_i from Study 2 (collapsed across both wordings). The discount on the "buy" option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.36, 0.22]. The 95% confidence intervals for θ_B (c) are: explicit = [0.14, 0.55]; implicit = [0.20, 0.63]. The discount on the "non-buy" option is slightly stronger in the explicit (vs. implicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.38, 0.28]. The 95% confidence intervals for θ_N (d) are: explicit = [0.34, 0.80]; implicit = [0.37, 0.86].

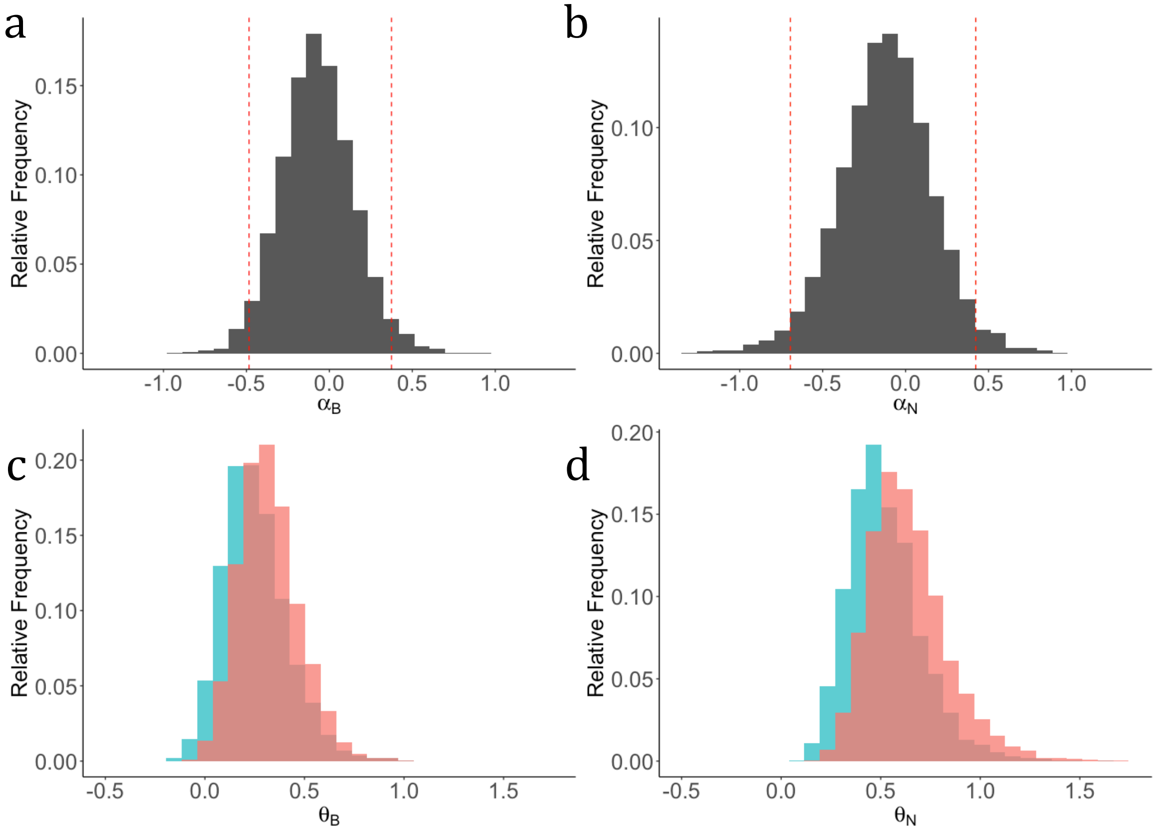

Figure S8. Bootstrapping results for α_i and θ_i from Study 2 (“Keep” / “Do Not Buy” wording only). The discount on the “buy” option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.48, 0.37]. The 95% confidence intervals for θ_B (c) are: explicit = [–0.02, 0.60]; implicit = [0.06, 0.65]. The discount on the “non-buy” option is slightly stronger in the explicit (vs. implicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.69, 0.42]. The 95% confidence intervals for θ_N (d) are: explicit = [0.22, 0.95]; implicit = [0.32, 1.10].

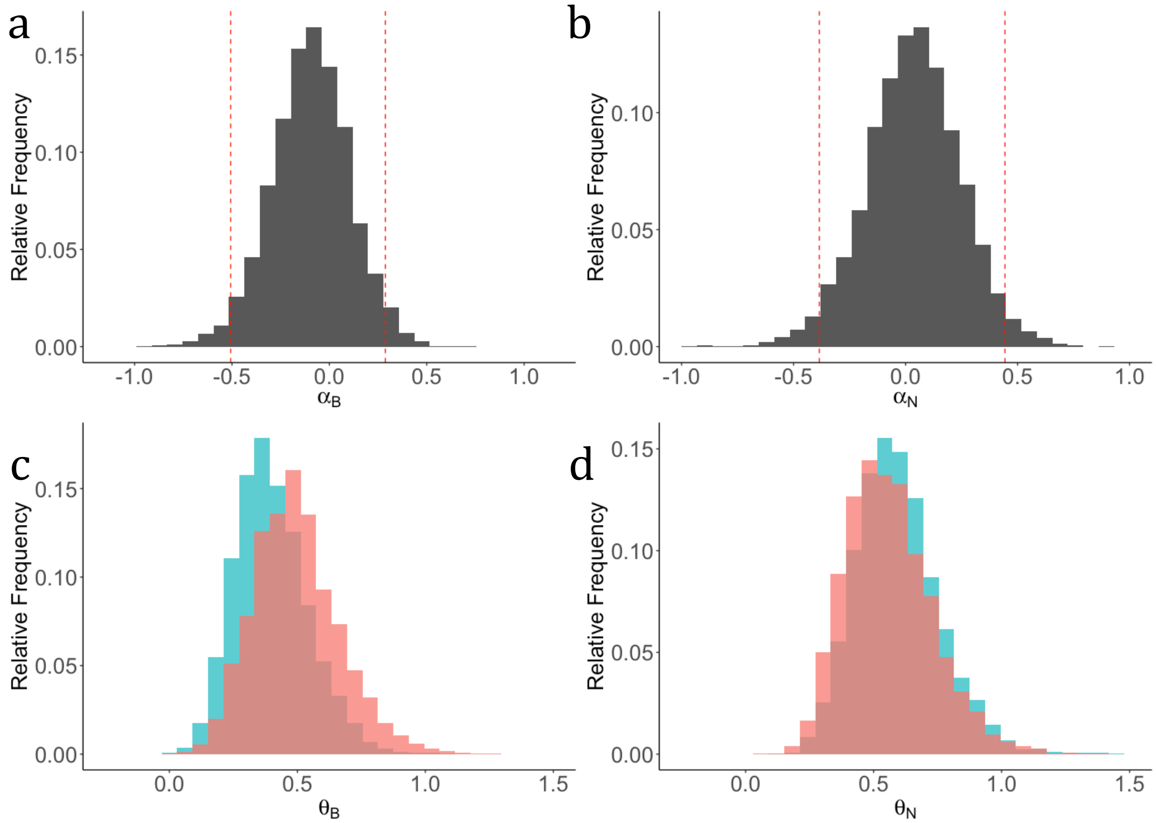

Figure S9. Bootstrapping results for α_i and θ_i from Study 2 ("Skip" / "Save" wording only). The discount on the "buy" option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.51, 0.29]. The 95% confidence intervals for θ_B (c) are: explicit = [0.16, 0.70]; implicit = [0.21, 0.87]. The discount on the "non-buy" option is slightly stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.39, 0.44]. The 95% confidence intervals for θ_N (d) are: explicit = [0.32, 0.95]; implicit = [0.28, 0.93].

Appendix G: Approximate Distributions of $\boldsymbol{\alpha_i}$ and $\boldsymbol{\theta_i}$

Table SX. Confidence Intervals (95%) on α_i and θ_i

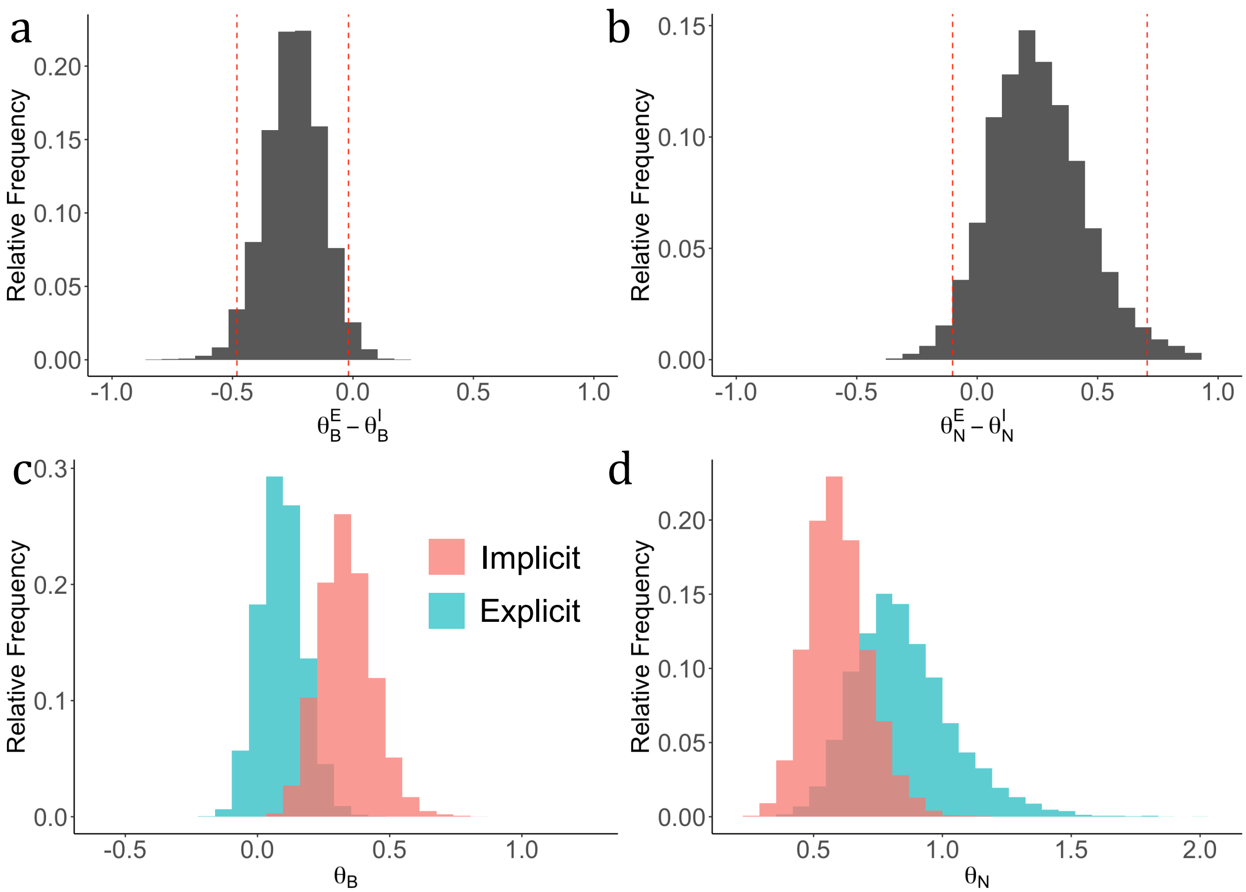

Figure S10. Approximate distributions of α_i and θ_i in Study 1. The discount on the buy option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on the difference in θ_B between the conditions (a) is [–0.48, –0.02]. The 95% confidence intervals for θ_B (c) are: explicit = [–0.06, 0.26]; implicit = [0.15, 0.55]. The discount on the do-not-buy option is stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on the difference in θ_N between the conditions (b) is [–0.10, 0.71]. The 95% confidence intervals for θ_N (d) are: explicit = [0.54, 1.30]; implicit = [0.39, 0.85].

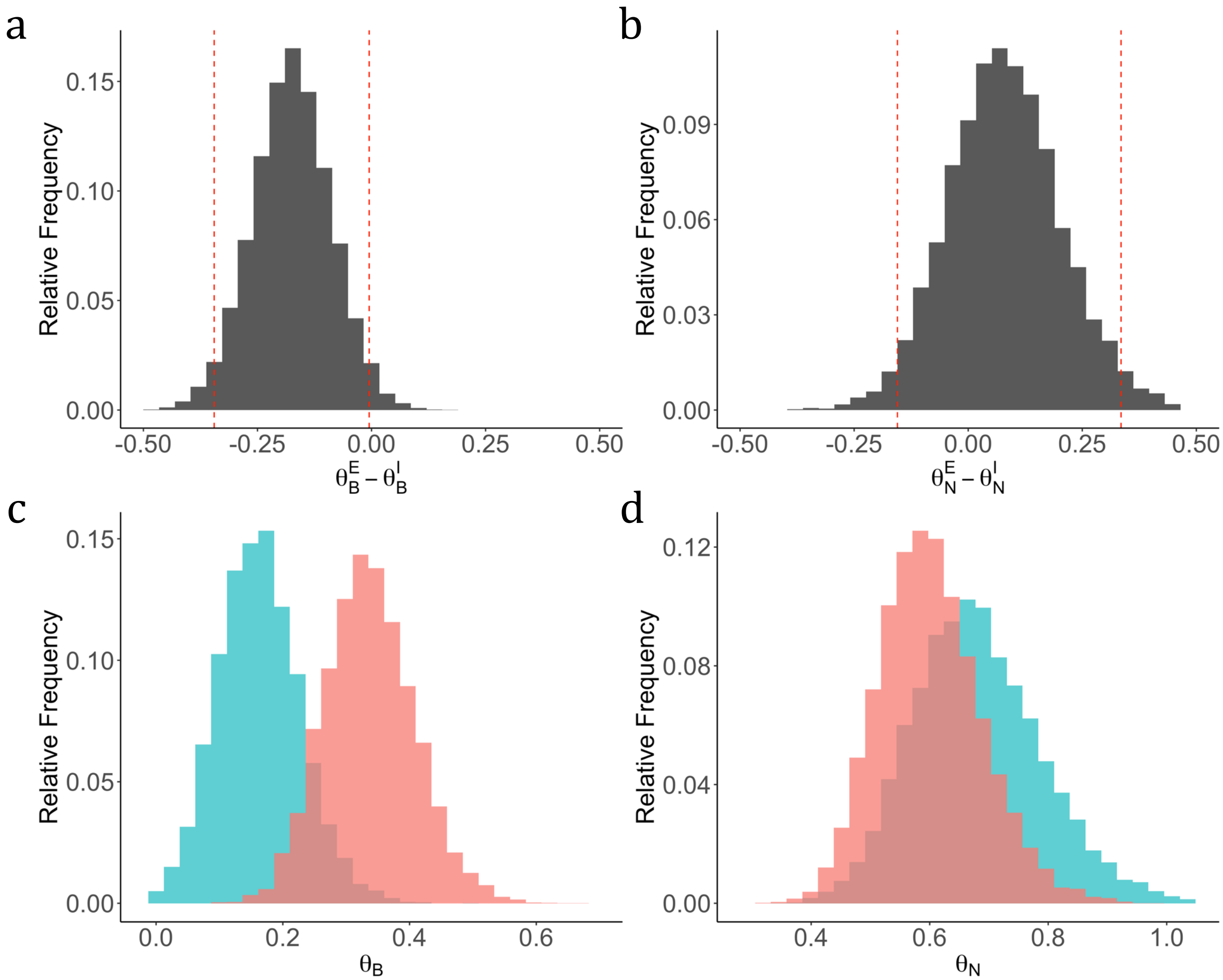

Figure S11. Approximate distributions of α_i and θ_i using the "Keep" and "Do Not Buy" wording (collapsing across Study 1 and Study 2). The discount on the buy option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on the difference in θ_B between the conditions (a) is [–0.34, –0.005]. The 95% confidence intervals for θ_B (c) are: explicit = [0.04, 0.30]; implicit = [0.21, 0.48]. The discount on the do-not-buy option is stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on the difference in θ_N between the conditions (b) is [–0.16, 0.34]. The 95% confidence intervals for θ_N (d) are: explicit = [0.49, 0.92]; implicit = [0.45, 0.79].

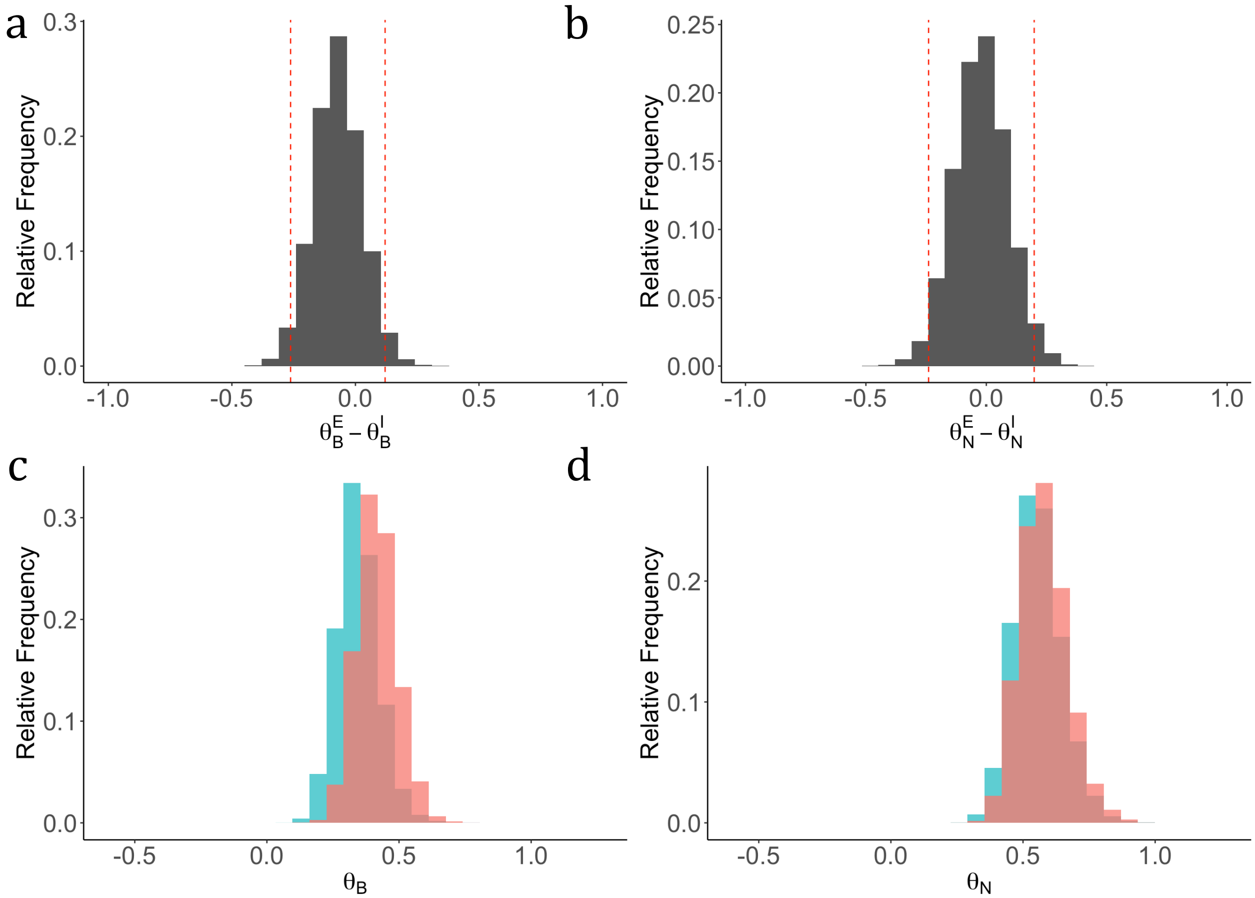

Figure S12. Approximate distributions of α_i and θ_i in Study 2 (collapsed across wordings). The discount on the "buy" option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.26, 0.12]. The 95% confidence intervals for θ_B (c) are: explicit = [0.21, 0.51]; implicit = [0.28, 0.58]. The discount on the "non-buy" option is slightly stronger in the explicit (vs. implicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.24, 0.20]. The 95% confidence intervals for θ_N (d) are: explicit = [0.39, 0.75]; implicit = [0.42, 0.77].

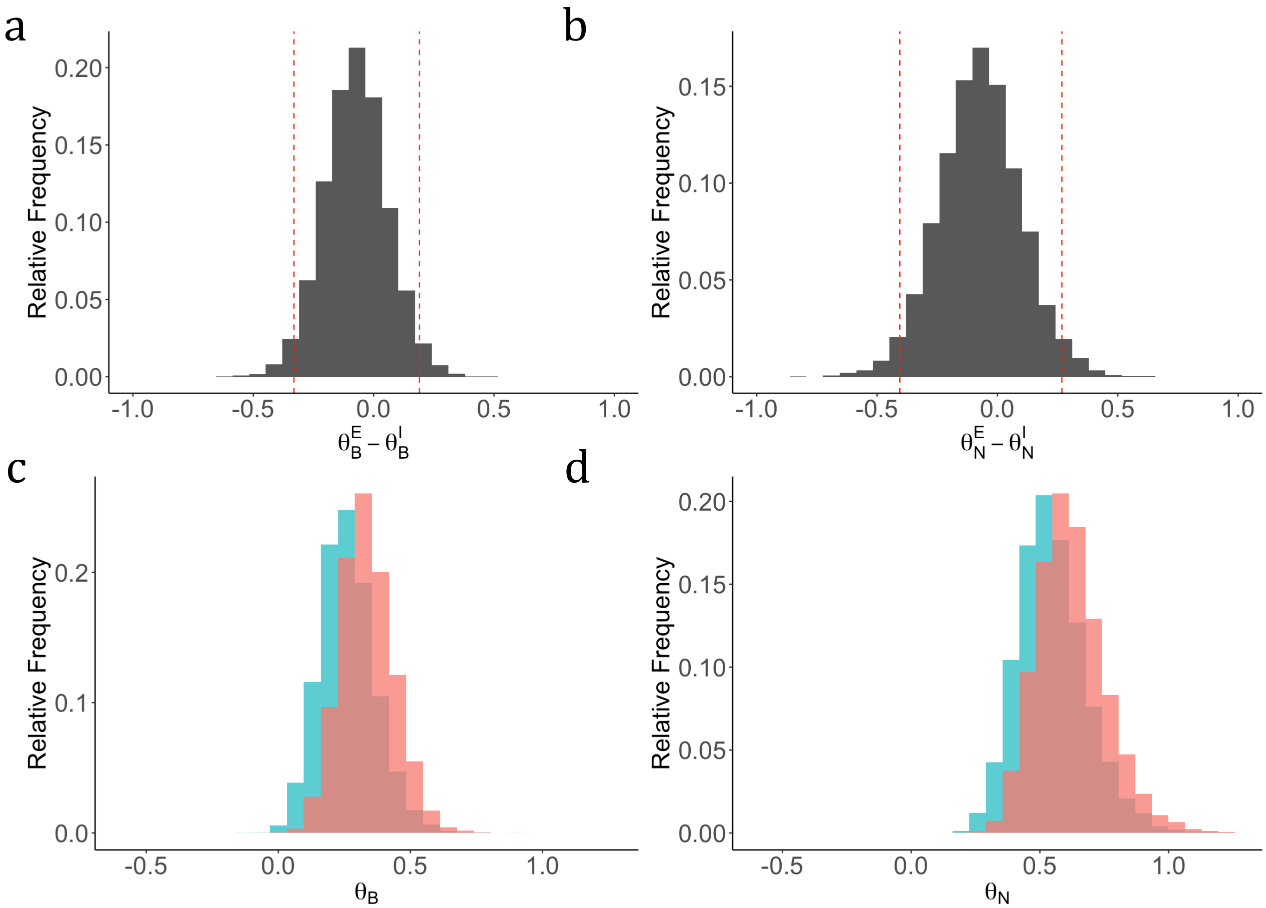

Figure S13. Approximate distributions of α_i and θ_i in Study 2 ("Keep" and "Do Not Buy" wording only). The discount on the "buy" option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.33, 0.19]. The 95% confidence intervals for θ_B (c) are: explicit = [0.08, 0.49]; implicit = [0.15, 0.55]. The discount on the "non-buy" option is slightly stronger in the explicit (vs. implicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.41, 0.27]. The 95% confidence intervals for θ_N (d) are: explicit = [0.32, 0.85]; implicit = [0.40, 0.92].

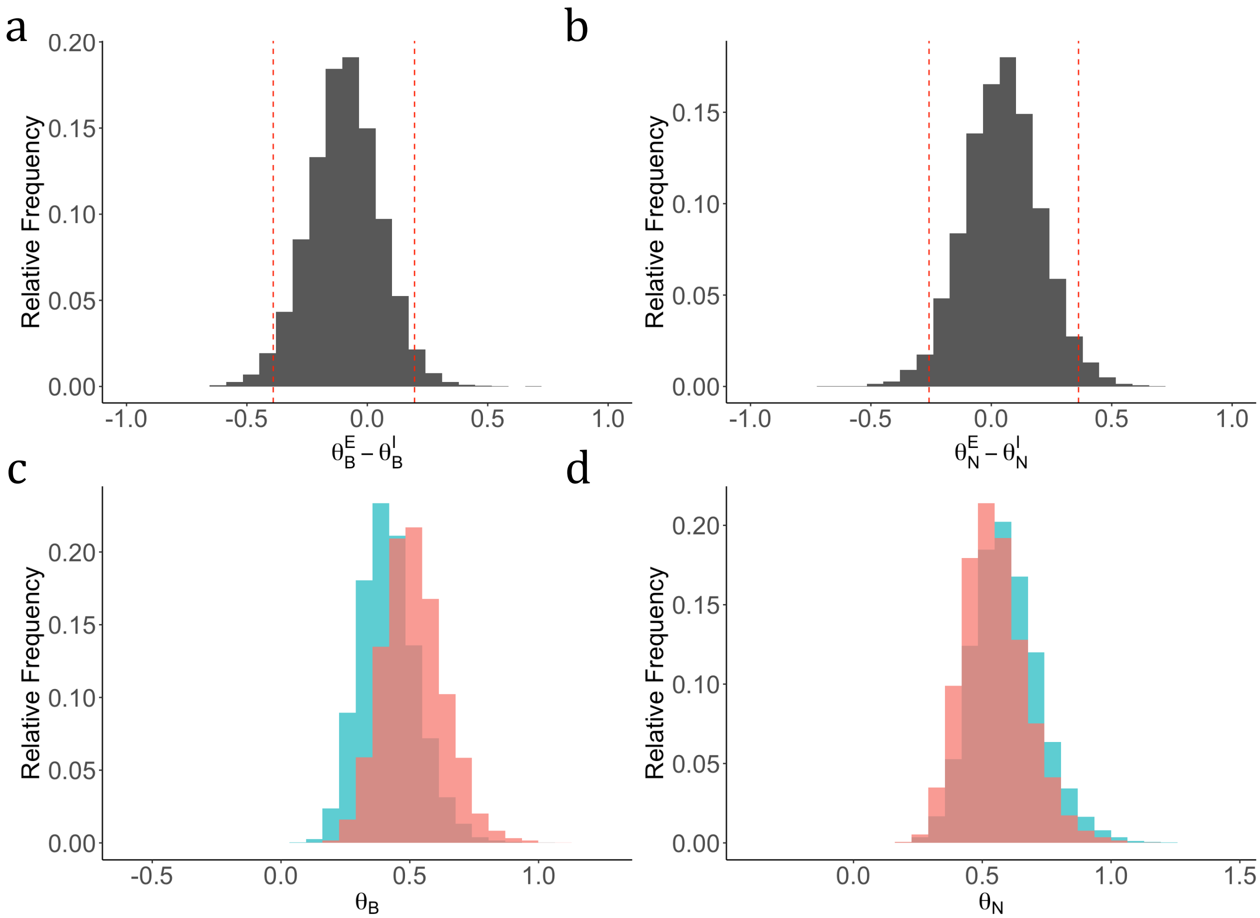

Figure S14. Approximate distributions of α_i and θ_i in Study 2 ("Skip" and "Save" wording only). The discount on the "buy" option is slightly stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on α_B (a) is [–0.39, 0.20]. The 95% confidence intervals for θ_B (c) are: explicit = [0.22, 0.66]; implicit = [0.30, 0.76]. The discount on the "non-buy" option is slightly stronger in the implicit (vs. explicit) condition (b, d). The 95% confidence interval (red dashed lines) on α_N (b) is [–0.26, 0.36]. The 95% confidence intervals for θ_N (d) are: explicit = [0.36, 0.89]; implicit = [0.34, 0.82].

Appendix H: HSSM Model Fits

We fit a version of the aDDM using the HSSM package (Fengler et al., in preparation), which provides hierarchical Bayesian estimation of DDM parameters. In this model, we allowed boundary separation and starting point to vary by condition, using the following specifications:

$$a \sim 1 + C(condition) + (1|Subject)$$

$$z \sim 1 + C(condition) + (1|Subject)$$

We also allowed drift rate to be a function of attention, values, and condition (Cavanagh et al. 2014; Smith & Krajbich 2019; Smith, Webb, & Krajbich 2019):

$$v \sim 1 + (Z_1 + Z_2 + Z_3 + Z_4) * C(condition) + (1|Subject)$$

Where the Z_i are defined as in Appendix C. We used N = 5000 draws and set the tuning to N = 200. The model fits are in Table S4 and the estimates of θ are in Table S5, below.

We do not find evidence for a difference in starting point (z) between conditions (95% HDIs for the difference include 0 in both studies). We also do not find evidence for a difference in boundary separation (a) between conditions in Study 1, but we do find a small positive effect in Study 2, which suggests that the boundary separation is slightly wider in the explicit (vs. implicit) condition.

With respect to θ_i, we see (as expected) a smaller θ_B in the explicit vs. implicit condition (means = 0.17 vs. 0.25 in Study 1; 0.33 vs. 0.40 in Study 2), which is indicative of greater discounting of the buy option when paired with “Keep” (or “Save”) compared to “Do not buy” (or “Skip"). The estimates for θ_N are slightly less consistent. We see a minimal difference between conditions in Study 2 (means = 1.00 vs. 0.98), but surprisingly, we see a smaller θ_N in the explicit (vs. implicit) condition in Study 1 (means = 0.79 vs. 0.93). This implies greater discounting of “Keep” than “Do Not Buy.” However, when we look at the distributions of these parameters, we see a much wider distribution for the condition-level difference between θ_N than for θ_B (i.e., panel b in figures S15 and S16 show a wider distribution than panel a). As in the main text, this is consistent with the idea that attention to the non-buy option is more reliably condition-dependent (lower θ_B in explicit vs. implicit) than attention to the buy option.

Table S4. HSSM Fits

	Study 1		Study 2	
Parameter	**Mean**	**95% HDI**	**Mean**	**95% HDI**
a intercept	1.21	[1.14, 1.27]	1.31	[1.25, 1.36]
a coefficient	0.003	[-0.02, 0.03]	0.03	[0.01, 0.04]
z intercept	0.49	[0.48, 0.51]	0.50	[0.49, 0.52]
z coefficient	-0.01	[-0.02, 0.01]	0.002	[-0.01, 0.01]
β_1 (implicit)	1.74	[1.56, 1.90]	1.82	[1.69, 1.96]
β_1 (explicit)	1.57	[1.39, 1.76]	1.65	[1.52, 1.79]
β_2 (implicit)	1.12	[0.95, 1.29]	1.25	[1.12, 1.39]
β_2 (explicit)	1.11	[0.93, 1.28]	1.19	[1.05, 1.33]
β_3 (implicit)	0.44	[0.27, 0.62]	0.74	[0.60, 0.88]
β_3 (explicit)	0.26	[0.08, 0.45]	0.54	[0.39, 0.67]
β_4 (implicit)	1.05	[0.88, 1.20]	1.25	[1.12, 1.39]
β_4 (explicit)	0.87	[0.69, 1.05]	1.16	[1.02, 1.29]

Note. The intercept terms for a and z are the estimates for the implicit condition; the coefficient terms for a and z represent the difference between the implicit and explicit conditions. The β_i are the estimated coefficients for each respective Z_i in each condition.

Table S5. Theta 95% Highest Density Intervals

Study	Variable	Explicit	Implicit	Difference (Explicit-Implicit)
Study 1	θ_B	[0.04, 0.31]	[0.14, 0.38]	[-0.26, 0.09]
	θ_N	[0.57, 1.08]	[0.71, 1.22]	[-0.50, 0.22]
Study 2	θ_B	[0.22, 0.44]	[0.31, 0.51]	[-0.23, 0.07]
	θ_N	[0.79, 1.22]	[0.82, 1.22]	[-0.32, 0.28]

Note. These CIs are calculated by taking the ratios of the traces of the coefficients in Table S4; the difference is computed by taking the difference in the ratios of the traces of the coefficients in Table S4.

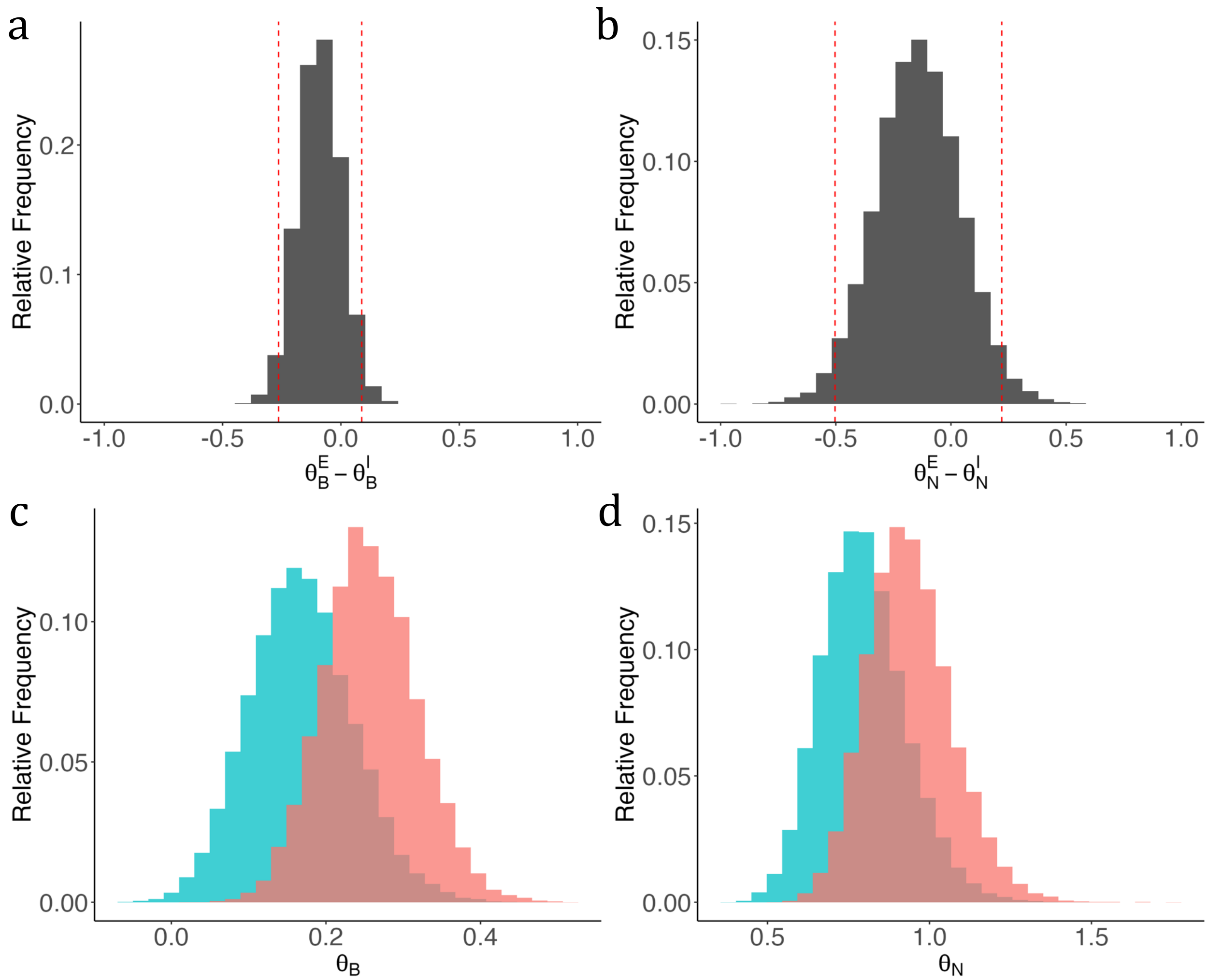

Figure S15. Distributions of HSSM parameters in Study 1. The discount on the buy option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on the difference in θ_B between the conditions (a) is [–0.26, 0.09]. The 95% confidence intervals for θ_B (c) are: explicit = [0.04, 0.31]; implicit = [0.14, 0.38]. The discount on the do-not-buy option is stronger in the explicit (vs. implicit) condition (b, d). The 95% confidence interval (red dashed lines) on the difference in θ_N between the conditions (b) is [–0.50, 0.22]. The 95% confidence intervals for θ_N (d) are: explicit = [0.57, 1.08]; implicit = [0.71, 1.22].

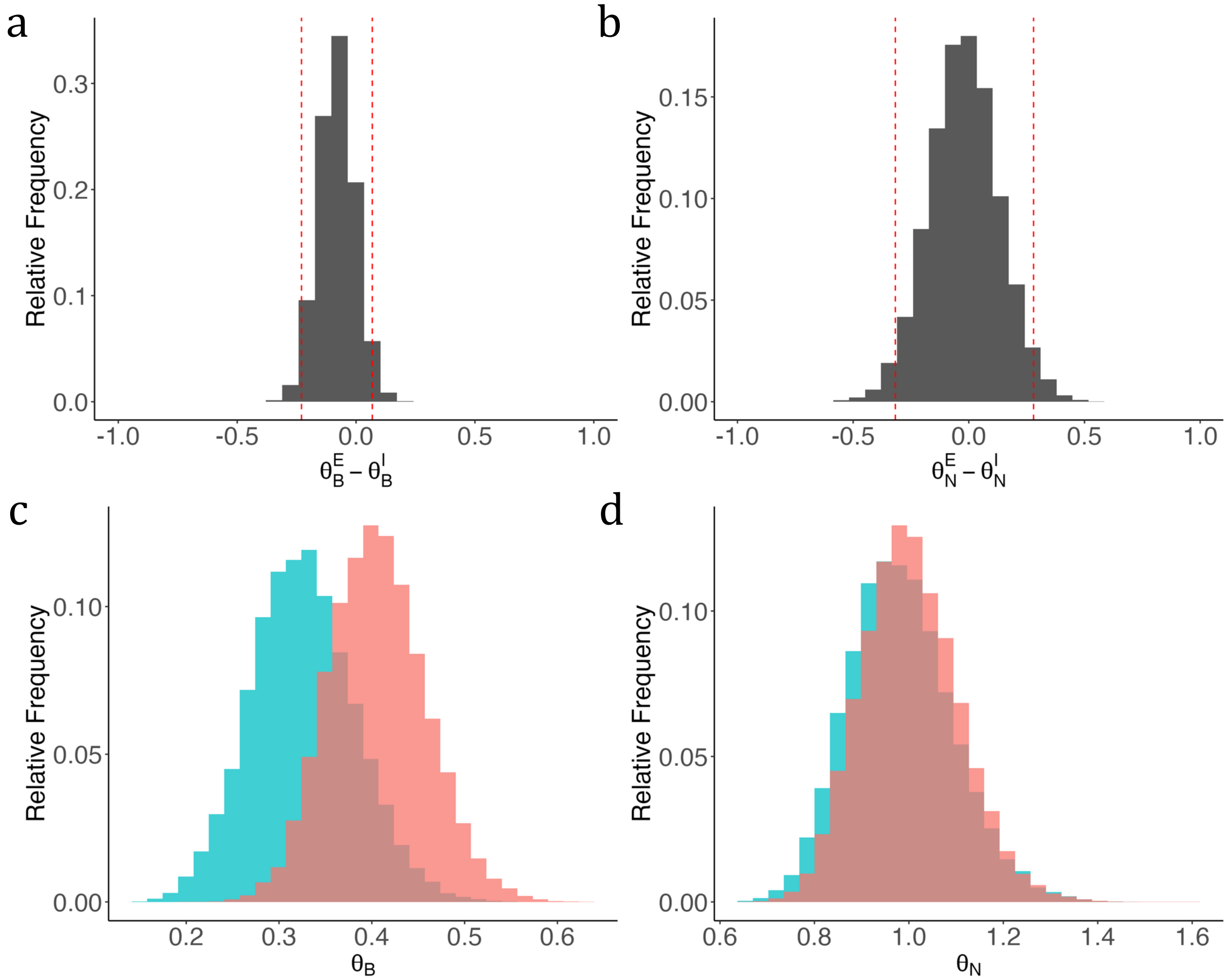

Figure S16. Distributions of HSSM parameters in Study 2. The discount on the buy option is stronger in the explicit (vs. implicit) condition (a, c). The 95% confidence interval (red dashed lines) on the difference in θ_B between the conditions (a) is [–0.23, 0.07]. The 95% confidence intervals for θ_B (c) are: explicit = [0.22, 0.44]; implicit = [0.31, 0.51]. The discount on the do-not-buy option is roughly equivalent in the two conditions (b, d). The 95% confidence interval (red dashed lines) on the difference in θ_N between the conditions (b) is [–0.32, 0.28]. The 95% confidence intervals for θ_N (d) are: explicit = [0.79, 1.22]; implicit = [0.82, 1.22].