Anxiety and the Framing Effect: Intolerance of Uncertainty Predicts Frame-consistent Choice Patterns

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Introduction

- The risky framing effect is a well-documented bias: People tend to be risk averse for gains and risk seeking for losses.
- De Martino, Kumaran, Seymour, & Dolan (2006) showed neural activity active during frame-consistent decision making was similar to patterns related to anxiety in both frames.
- The present study tests whether measures of anxiety can predict frame-consistent choice patterns, as opposed to generalized risk-aversion.
- Also tested for differences between
  - framing and reflection paradigms
  - subjective certainty and probability estimation procedures
- Primary Hypothesis: **anxiety measures will predict more robust frame-consistent choice patterns; greater risk aversion for gains *and* greater risk seeking for losses**

Methods

Sample: 161 Qualtrics Participants; 76% female; mean age = 39.0 yrs (SD=14.5)

Procedure: For each frame (gains and losses), 5 subjective certainty and 5 subjective probability elicitation blocks via bisection algorithm, with 2-6 individual comparisons per block. Each block consisted of all or nothing $100 lotteries with starting EVs of $5, $25, $50, $75, $95. Mean total individual comparisons per participant = 89.68

Manipulations:
- Within: Frame (gains vs. losses) and elicitation target (subjective certainty vs. probability estimates)
- Between: Item type (framing vs. reflection, framing represents true violations of invariance and reflection absolute magnitudes across the reference point).
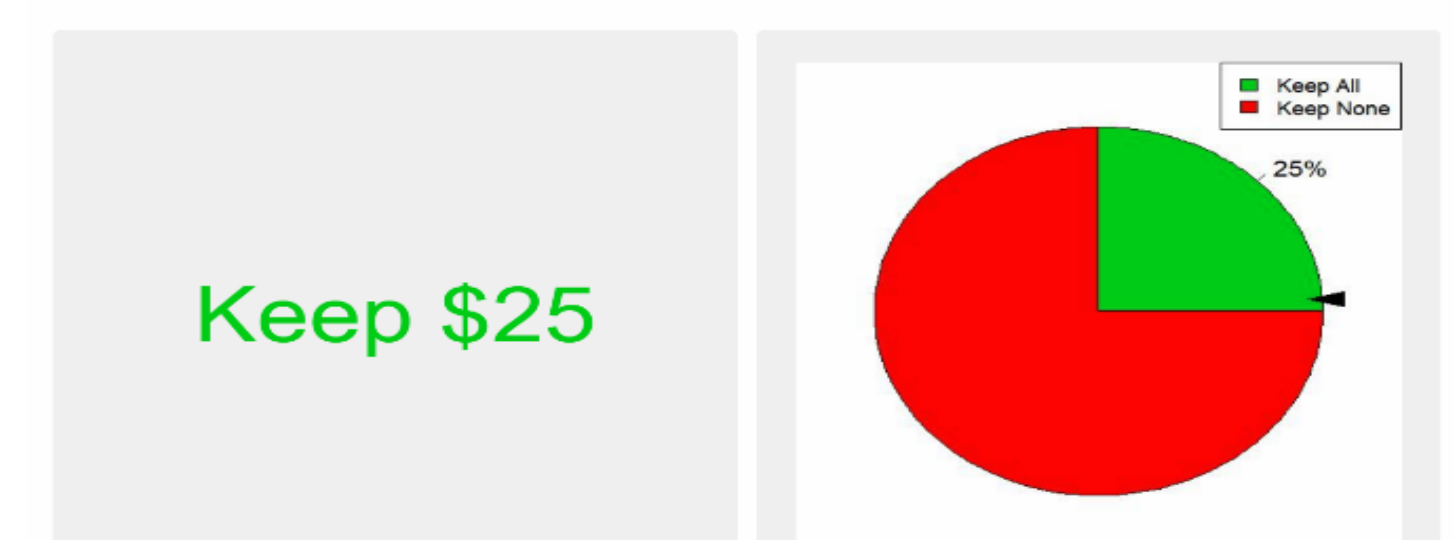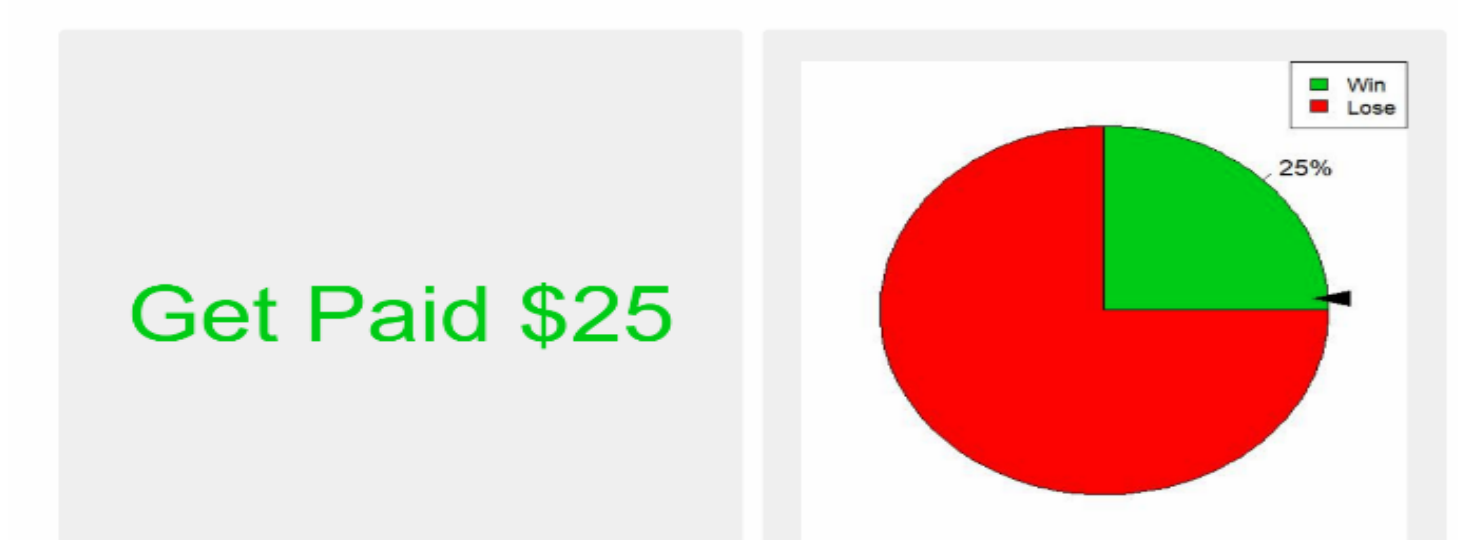
Measures of Anxiety: Intolerance of Uncertainty Scale (IUS), Behavioral Inhibition/Activation Scale (BIS/BAS)
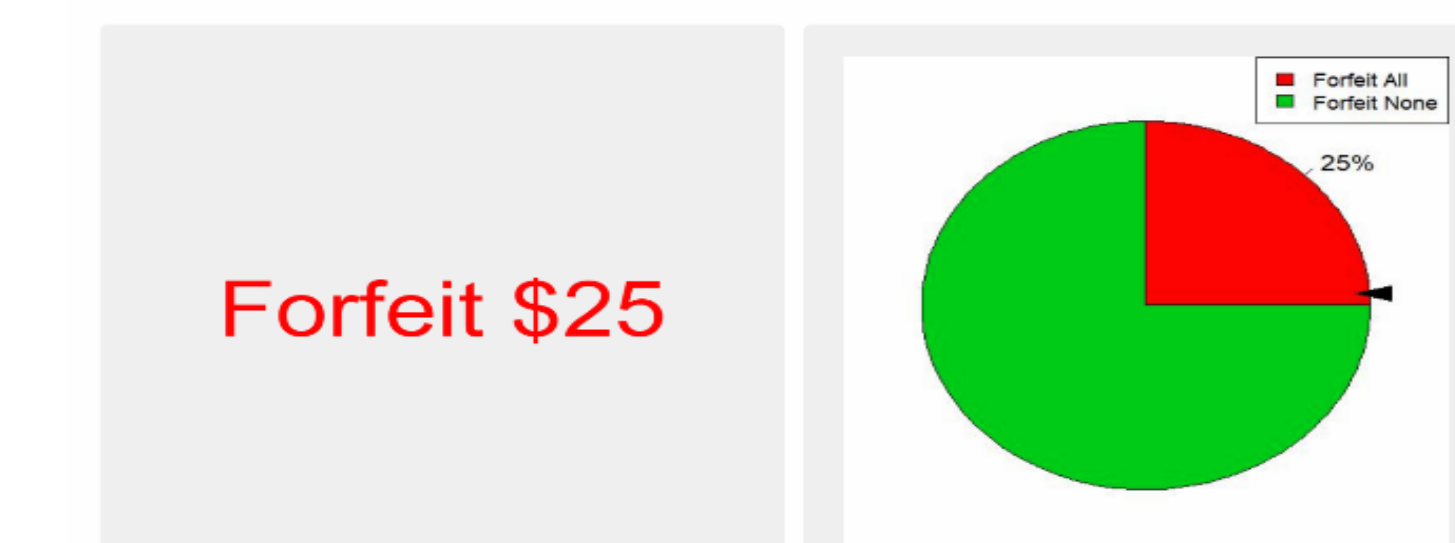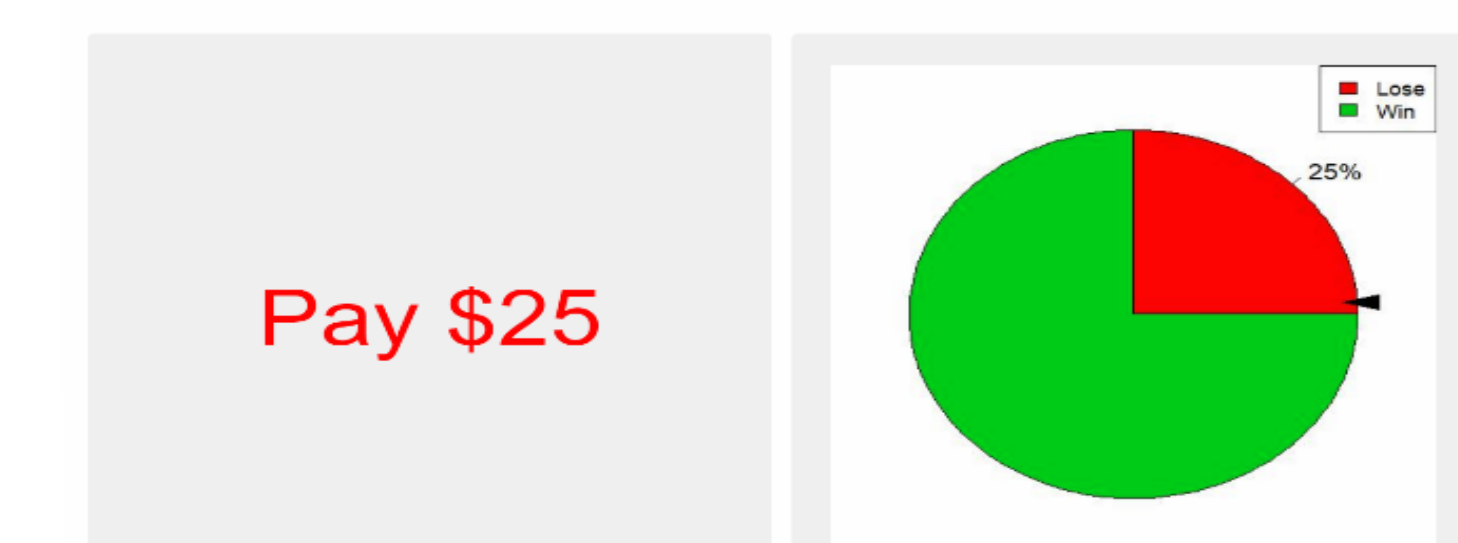

Comparison between item type and frame (1) Reflection + Gain item. (2) Framing + Gain item. (3) Reflection + Loss item. (4) Framing + Loss Item

Non-risky Option	Risky Option	Non-risky Option	Risky Option
$75	75% chance of $100	$25	25% chance of $100
$38	**75% chance of $100**	$25	**62% chance of $100**
$56	75% chance of $100	$25	44% chance of $100
$47	**75% chance of $100**	$25	**34% chance of $100**
$52	**75% chance of $100**	$25	**39% chance of $100**
Term Step: $54	75% chance of $100	Term. Step: $25	37% chance of $100
$53	**Inferred SCE**	**Inferred SPE**	38% chance of $100

Stepwise certainty (left) and probability (right) elicitation examples, with selected items in **bold**.
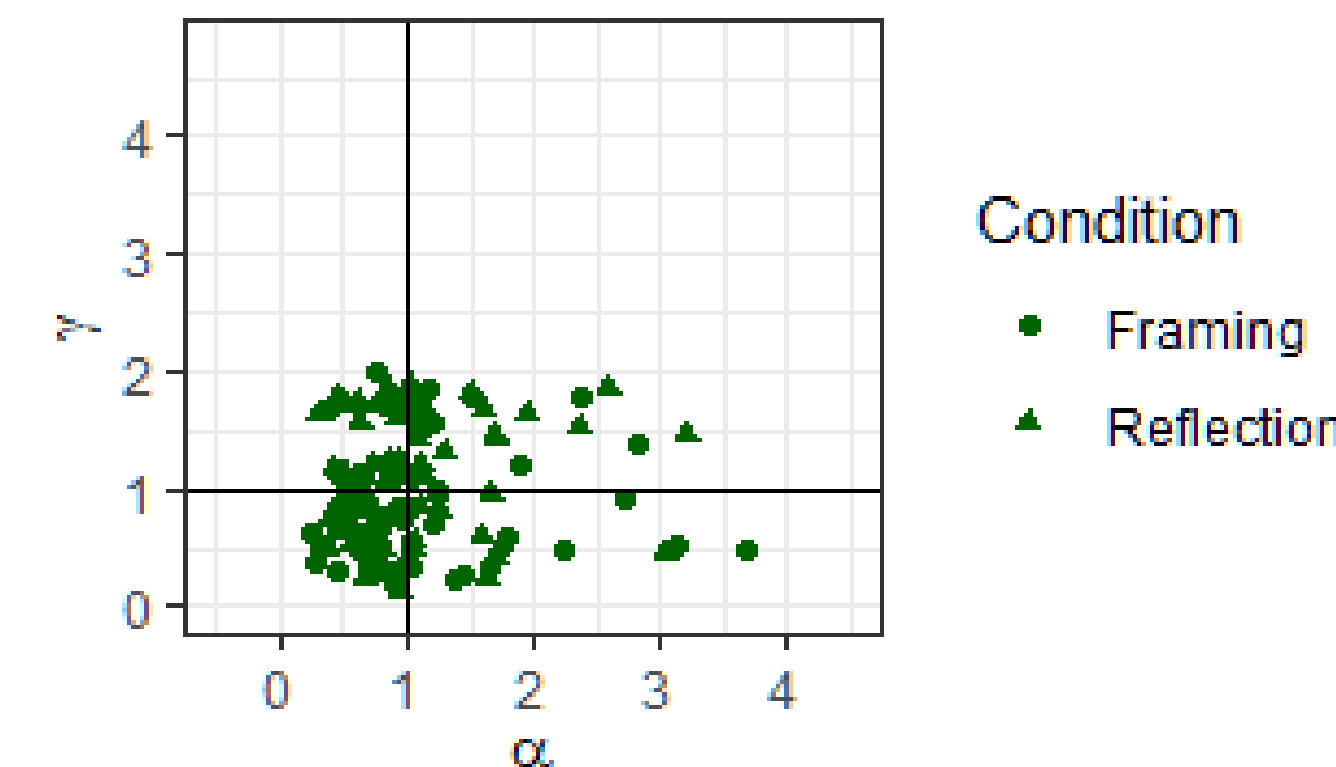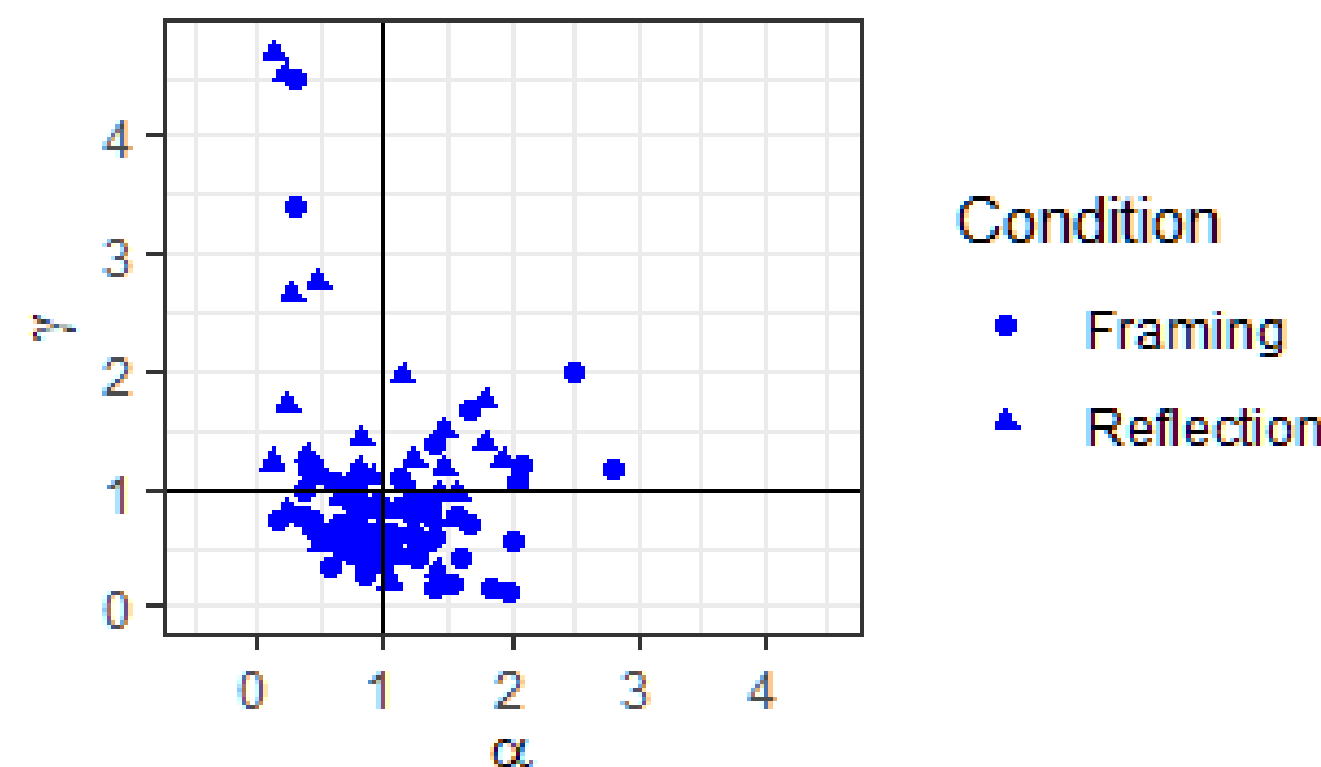
Effects of Condition and Elicitation Target
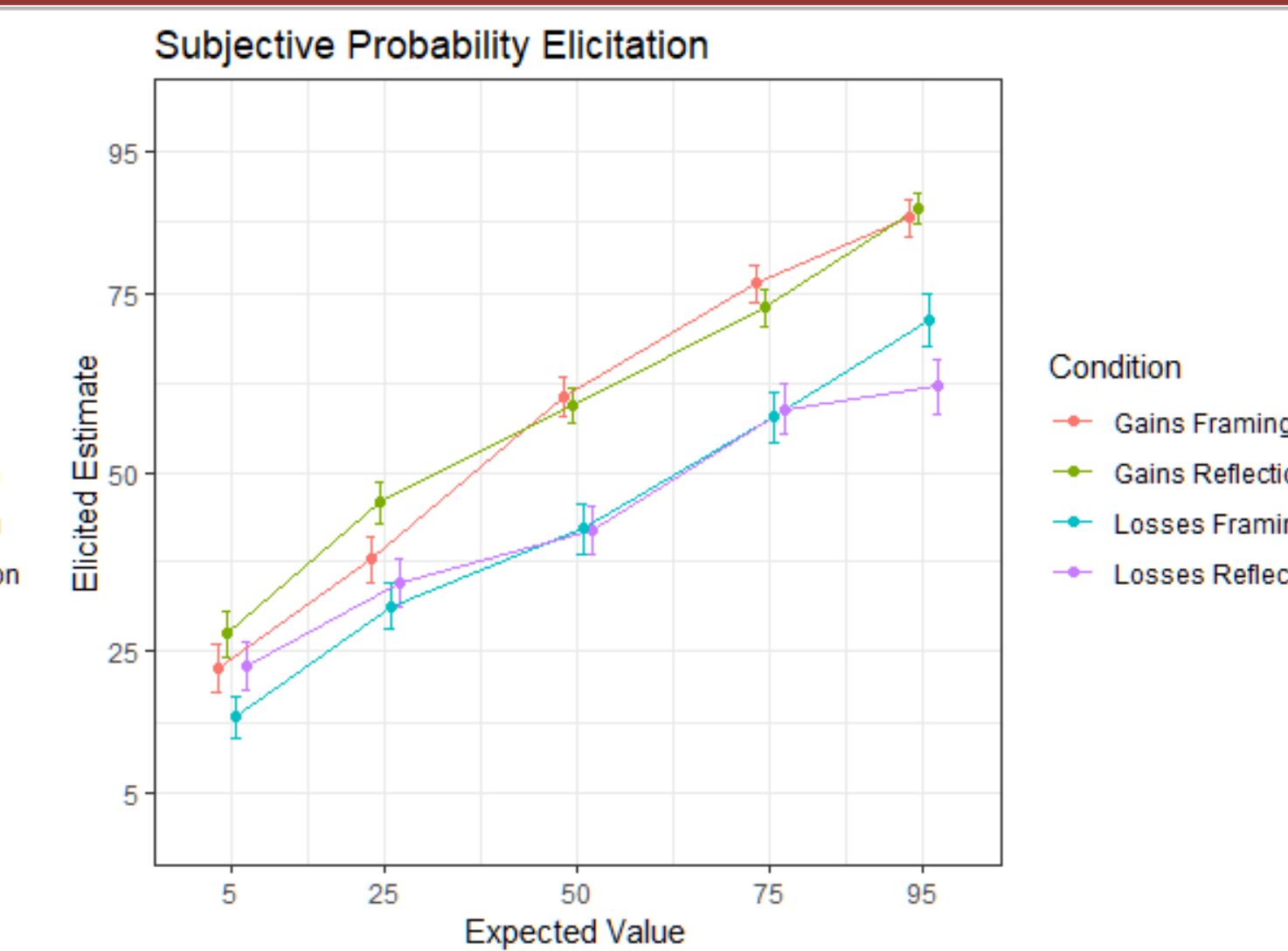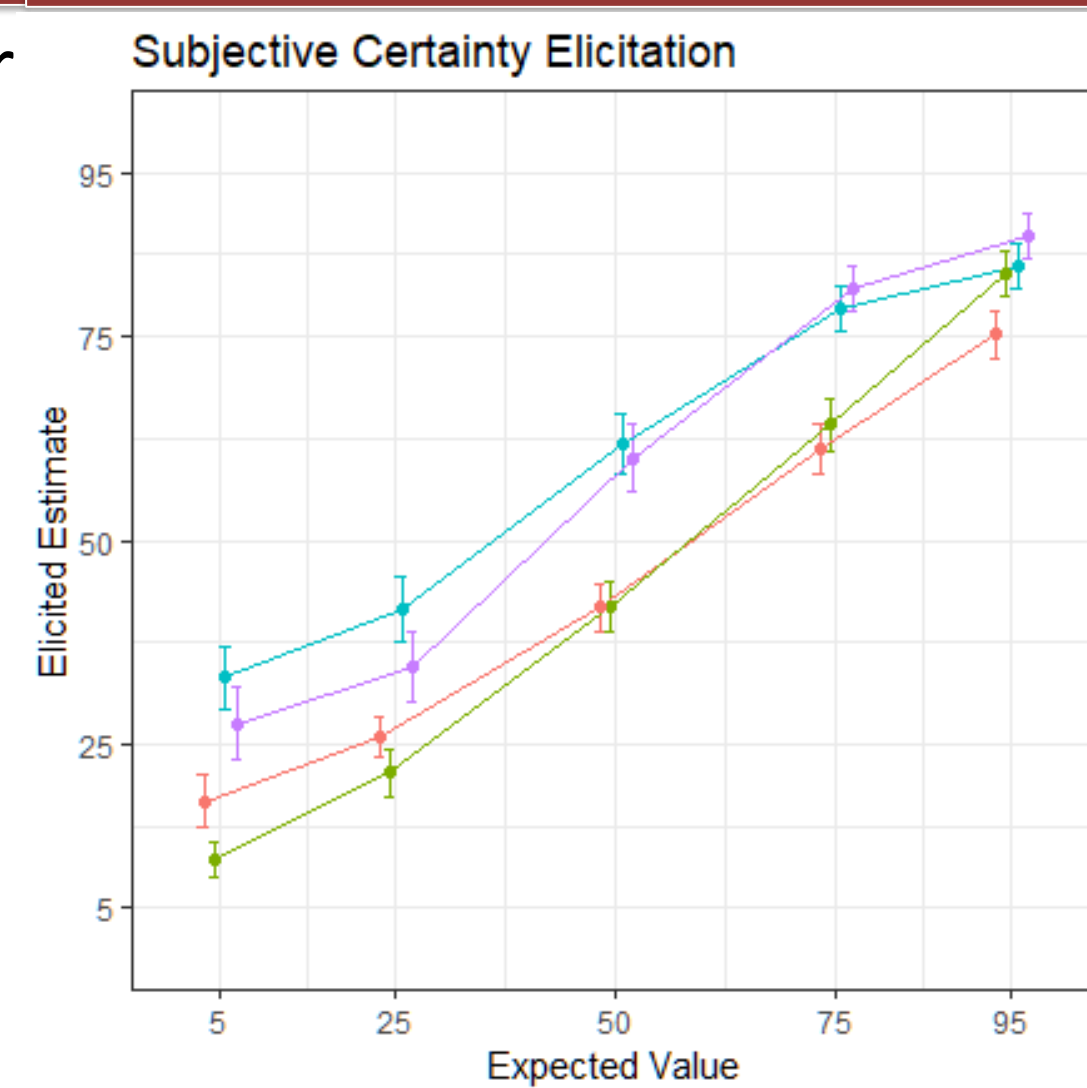
Group means for SCE. A significant interaction was detected between EV and Item Type.

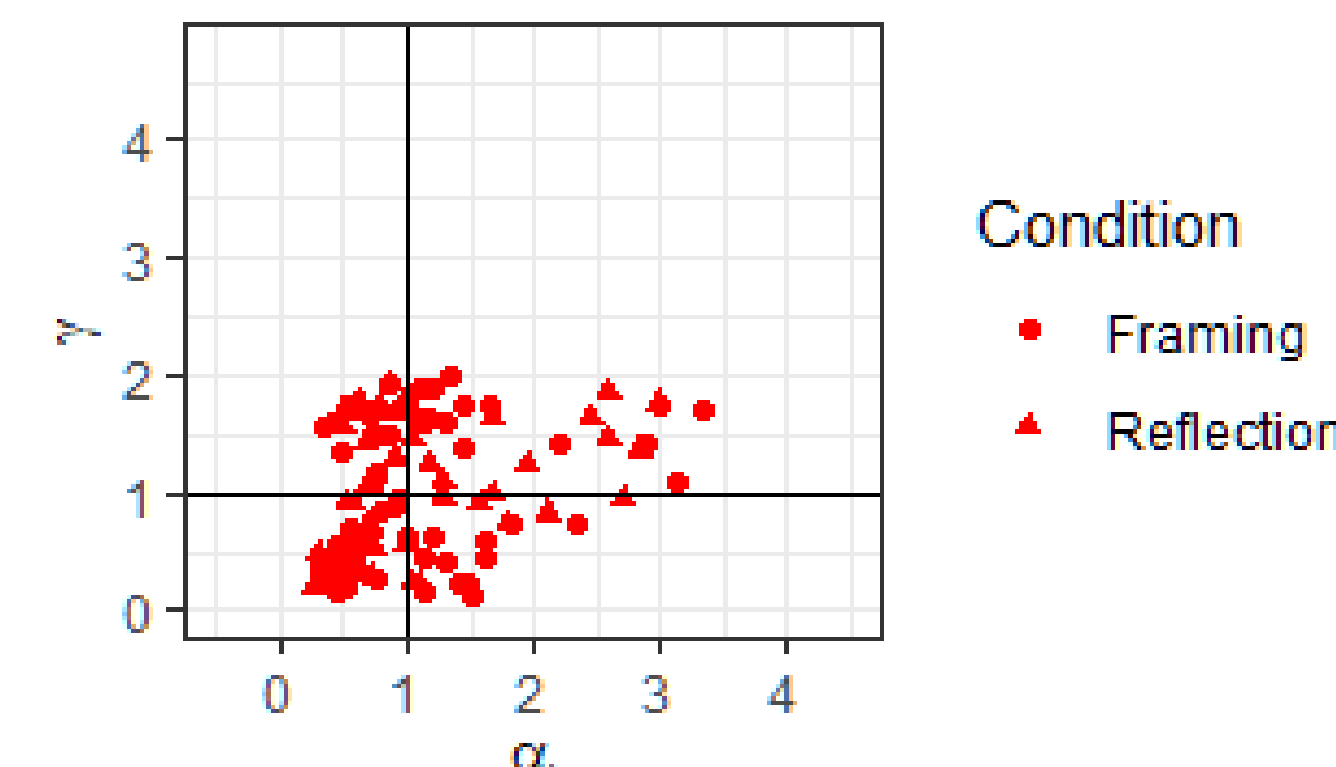Group means for SPE. Significant interactions were detected between EV and Item Type, and between EV

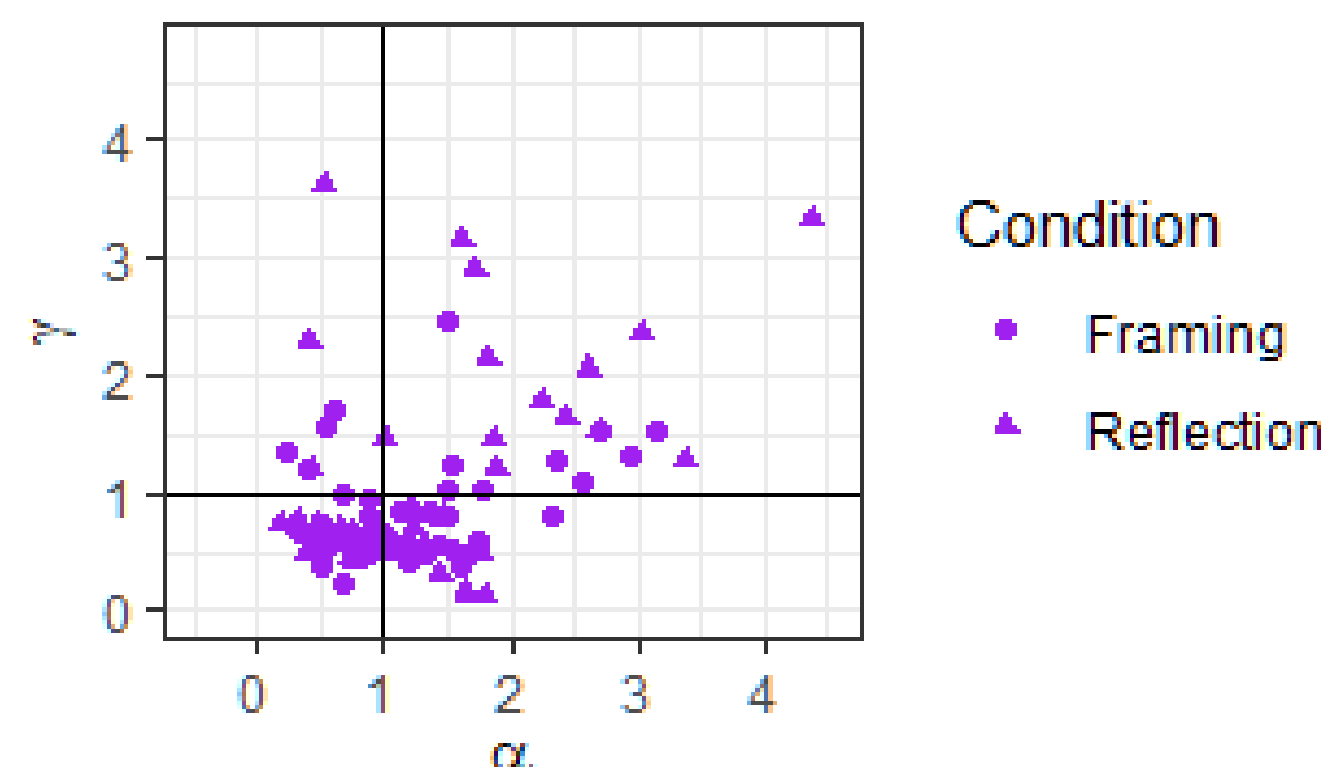Estimated Prospect Theory parameter estimates by elicitation target and condition, where α = exponential parameter for subjective utility and γ = probability weighting parameter.
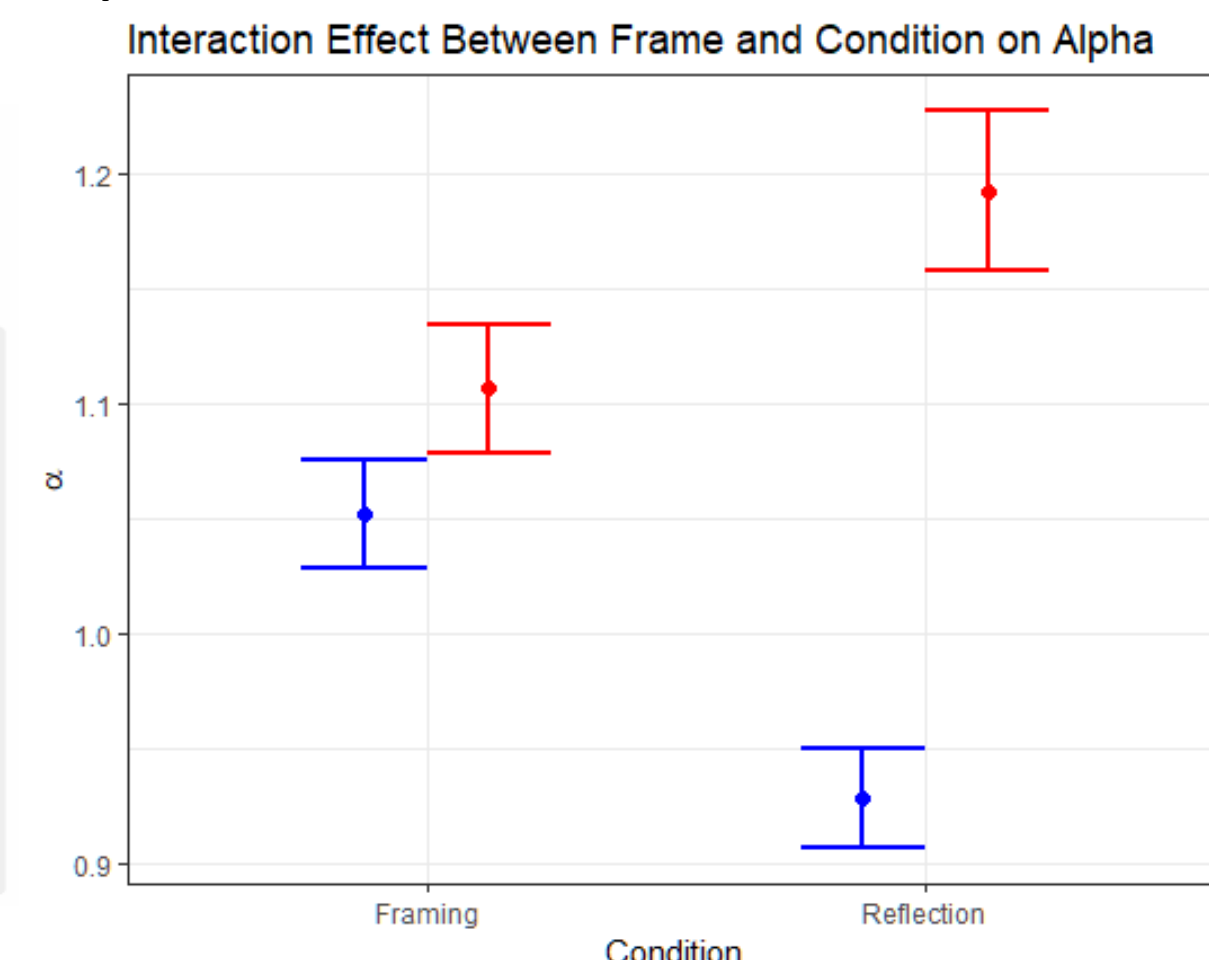
Significant interaction between Condition and Frame on α.

Tentative Conclusion: There is a meaningful behavioral difference between framing and reflection, even if general patterns are similar. No effect of elicitation target was detected.

Effects of Anxiety Measures

Modeling Approach: Generalized Linear Mixed Effects Model at item level predicting log odds of selecting risky option, including covariates for risky and non-risky expected values (E_r and E_{nr} respectively).

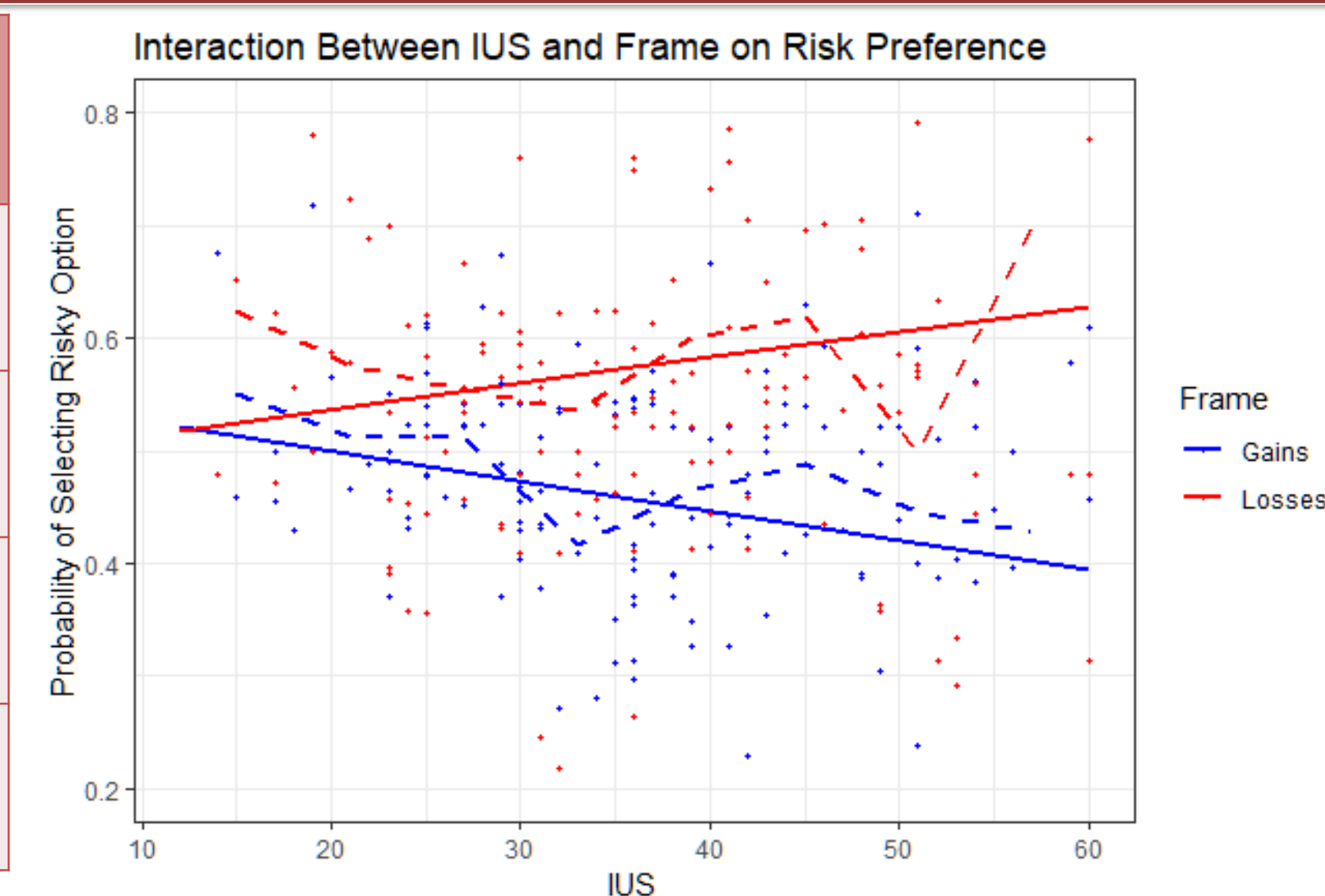**Highest order Terms at Level-1 (item level):** $(E_r)(E_{nr})$(Frame)
Highest order Terms at Level-2 (participant level): $(Frame_i)(IUS), (Frame_i)(BIS)(BAS_j)$
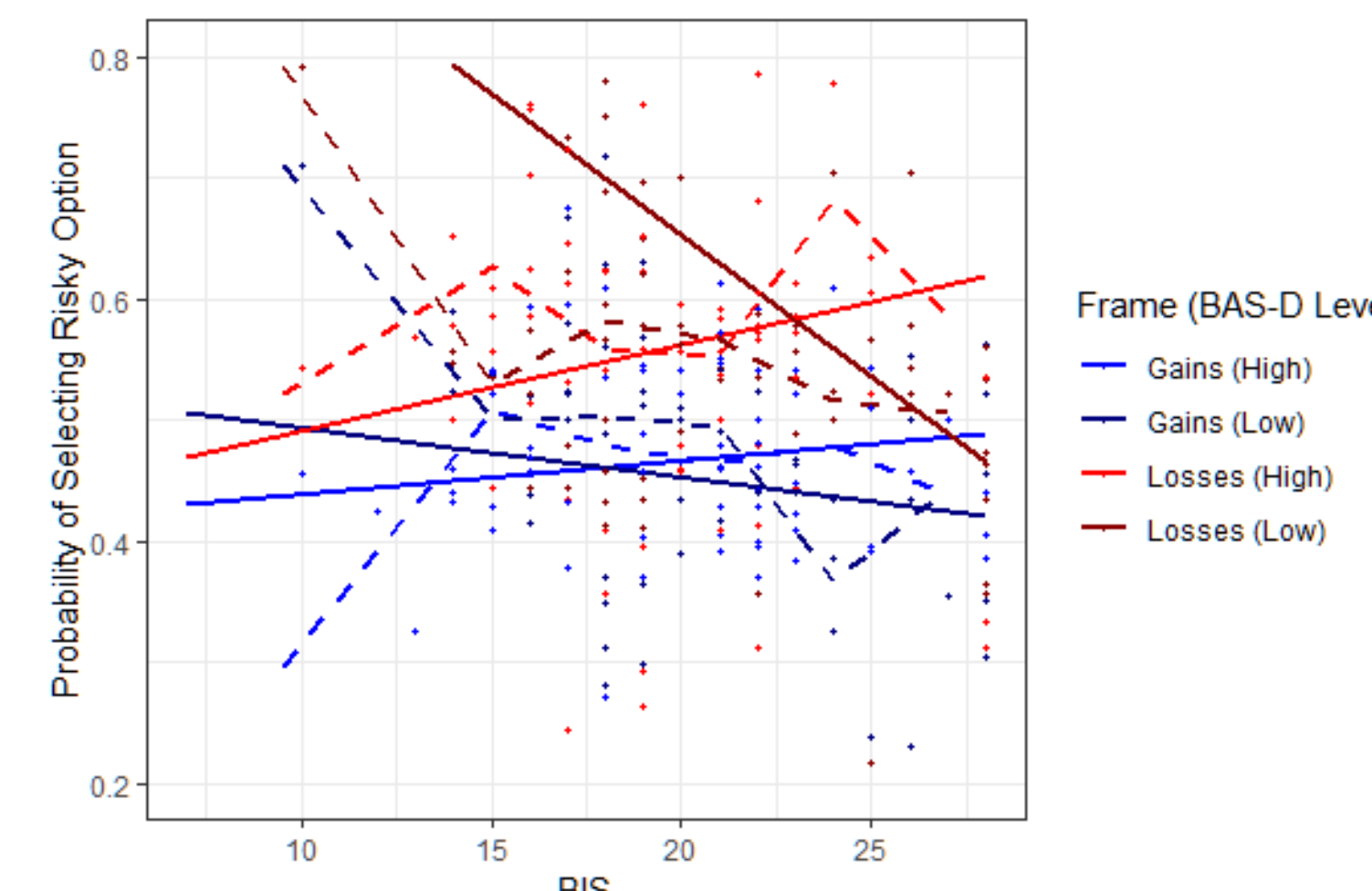**Random Intercepts:** Participant
Random Slopes: Frame

Key Results

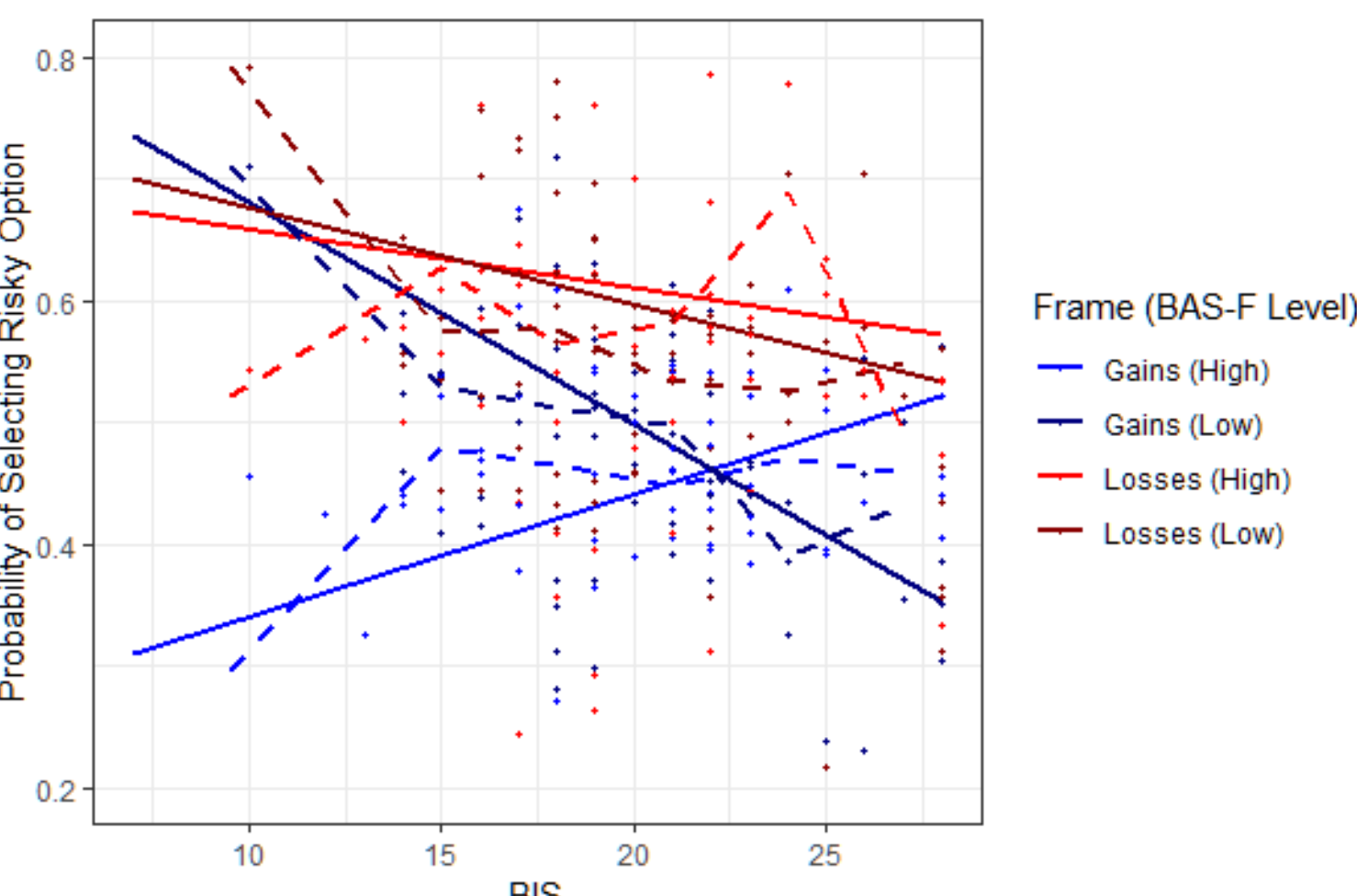| Interaction	G^2	p
Frame x IUS	5.56	.02
Frame x BIS	1.04	.31
Frame x BIS x BAS-D	3.91	.05
Frame x BIS x BAS-F	4.28	.04

Solid lines represent model predictions. Points are participants' empirical means for risk preference, and dotted lines are binned mean empirical traces; however, empirical data representation does not factor for covariates.

Conclusion: IUS predicts robustness of frame consistency, BIS does not

Differential Effects of Covariates Across Frame

To focus on IUS effects, we fit model including interaction term between Frame, IUS, E_r and E_{nr}; interaction was statistically significant $G^2(1) = 12.01$, p < .001. Suggests effects of covariates vary across frame by IUS level.

Model Predictions
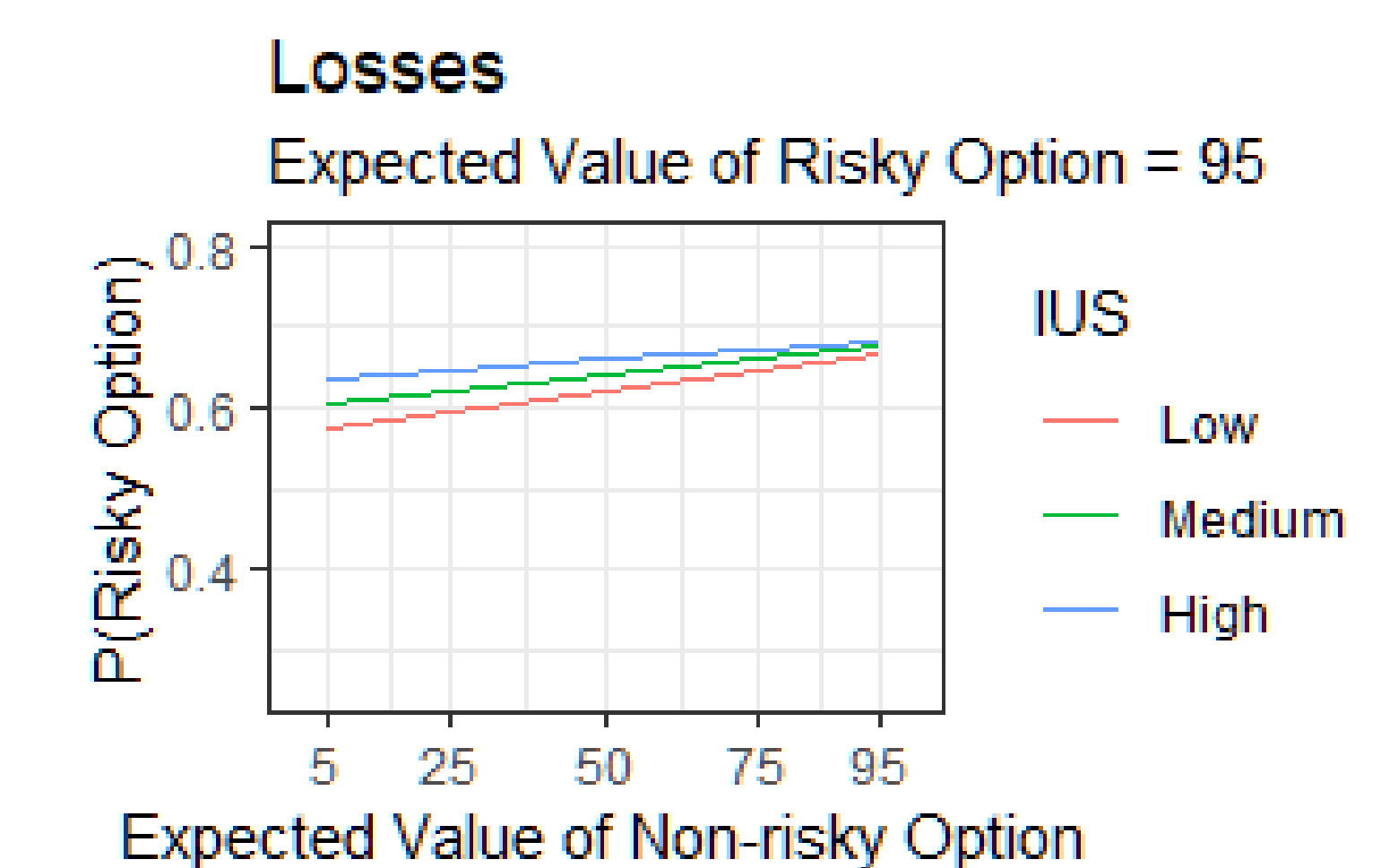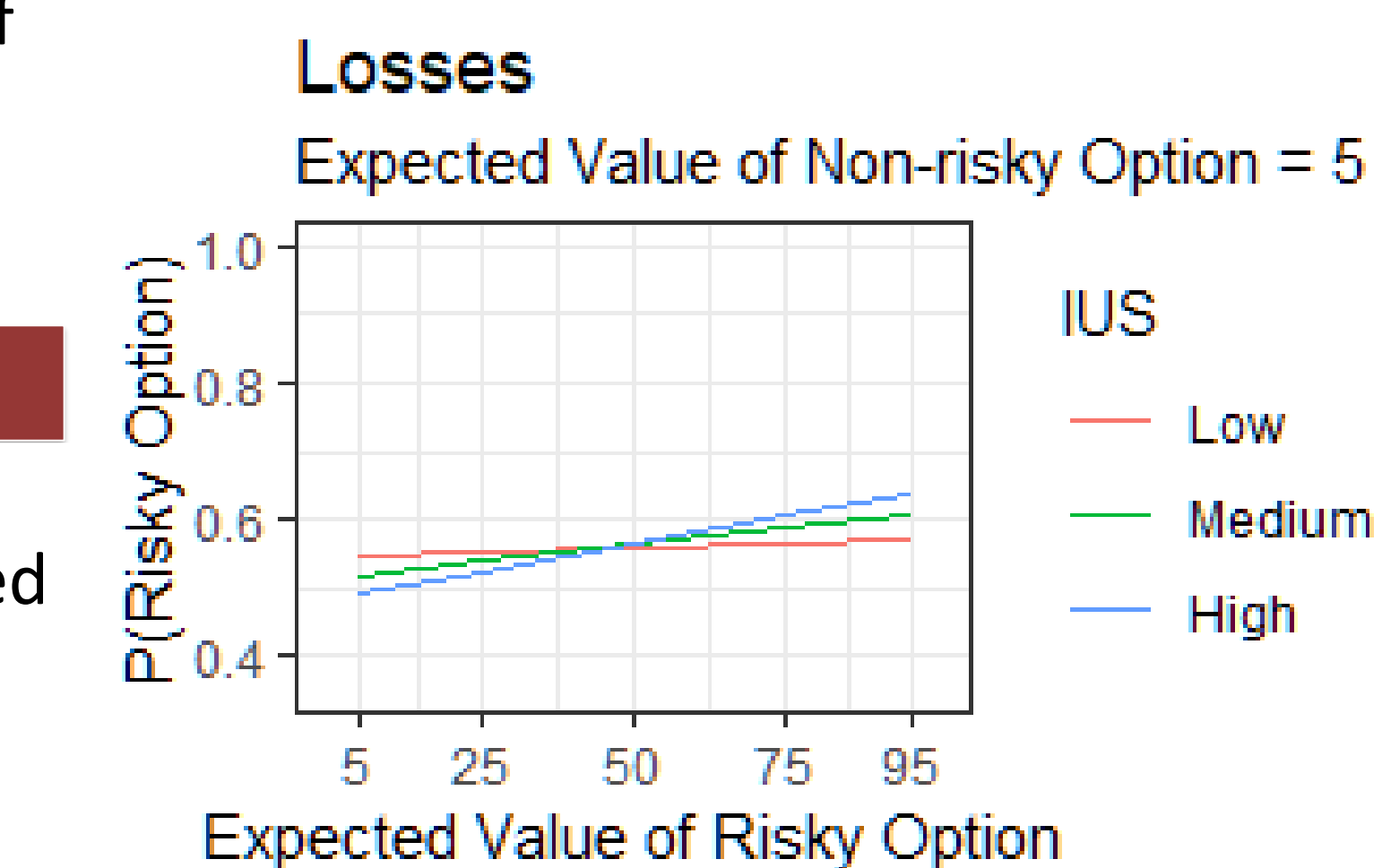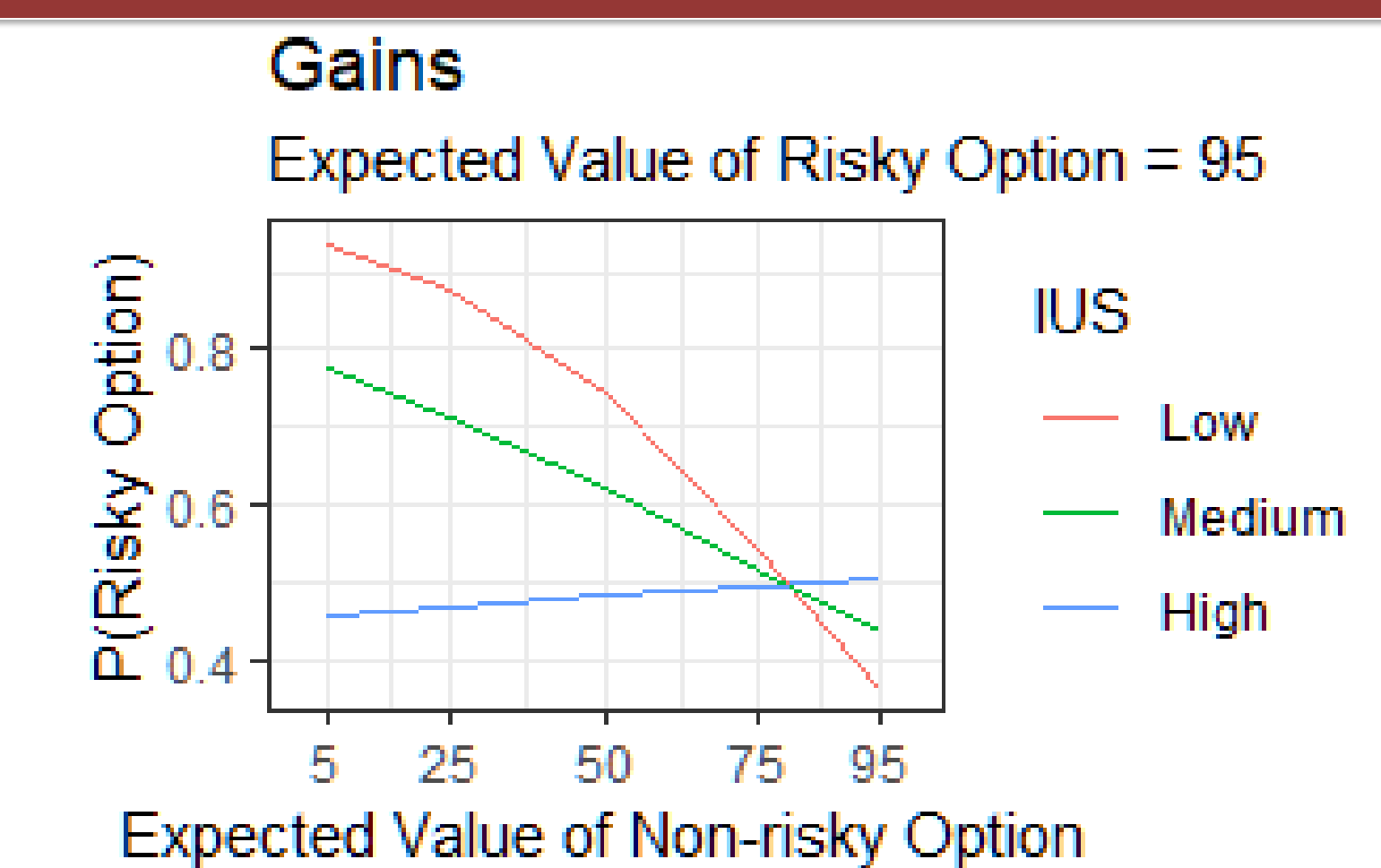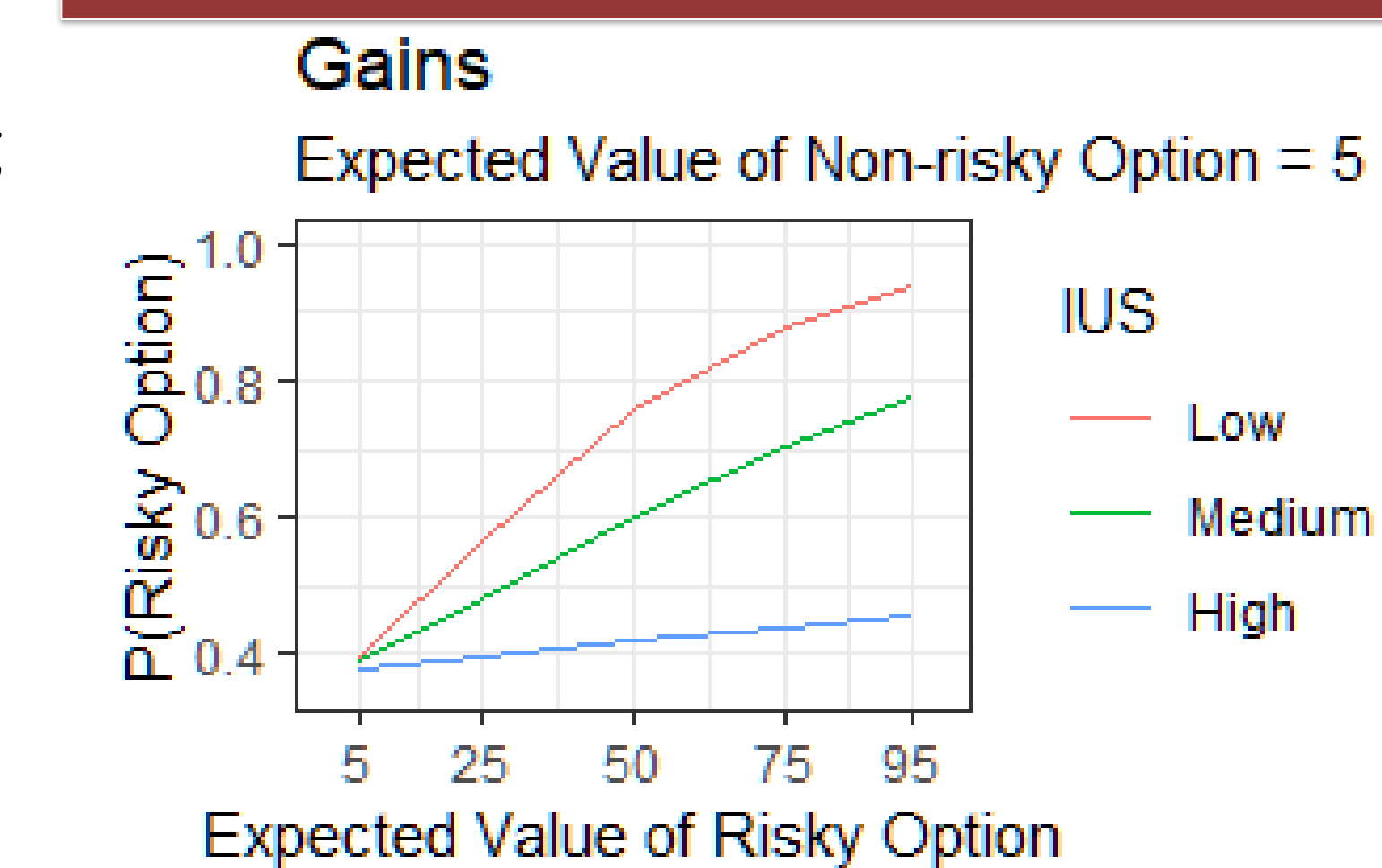
Conclusion: Differential effect of IUS, primarily for gains, where high IUS predicts reflexivity. In loss frame, flat slopes across IUS levels indicate **all participants** showed high reflexivity. Loss frame may induce anxiety/intolerance of uncertainty.