

Can Agents Add and Subtract When Forming Beliefs?

Experimental and Field Evidence



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Zoom-Link:

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Abstract

Bayes' Theorem has an implicit, fundamental rule of how subjects should incorporate informationally equivalent signals of opposite direction: two opposite-directional signals should cancel out such that prior beliefs remain constant. In this study, we test whether agents always follow this simple counting heuristic. We find that this is not the case. Whenever a sequence of signals that go in the same direction is interrupted by a signal of opposite direction, agents violate the simple counting heuristic and strongly overreact to the signal of opposite direction. In contrast to that, subjects correctly follow the counting heuristic whenever opposite-directional signals alternate.

1. Introduction

- Much evidence that people **do over-/underinfer** when incorporating new information in beliefs (Benjamin, 2019)
- Less clear: **When** one may observe one versus the other?

Research Question:

How do agents incorporate confirming and disconfirming signals when sequentially updating their beliefs?

- Sequential Bayesian Updating:

$$P_t^{Bayes} = P(G|\delta_t)^{Bayes} = \frac{\theta^{\delta_t}}{\theta^{\delta_t} + (1-\theta)^{\delta_t}}, \quad \delta_t = g_t - b_t$$

θ : Diagnosticity, g_t : # of good signals, b_t : # of bad signals

Assuming that every signal is equally informative, it should hold that:

- After observing a disconfirming signal, individuals should reduce their prior beliefs by the same magnitude than they previously increased their beliefs after having observed a confirming signal
- The order in which signals are observed is inconsequential for the belief updating process

2. Empirical Framework

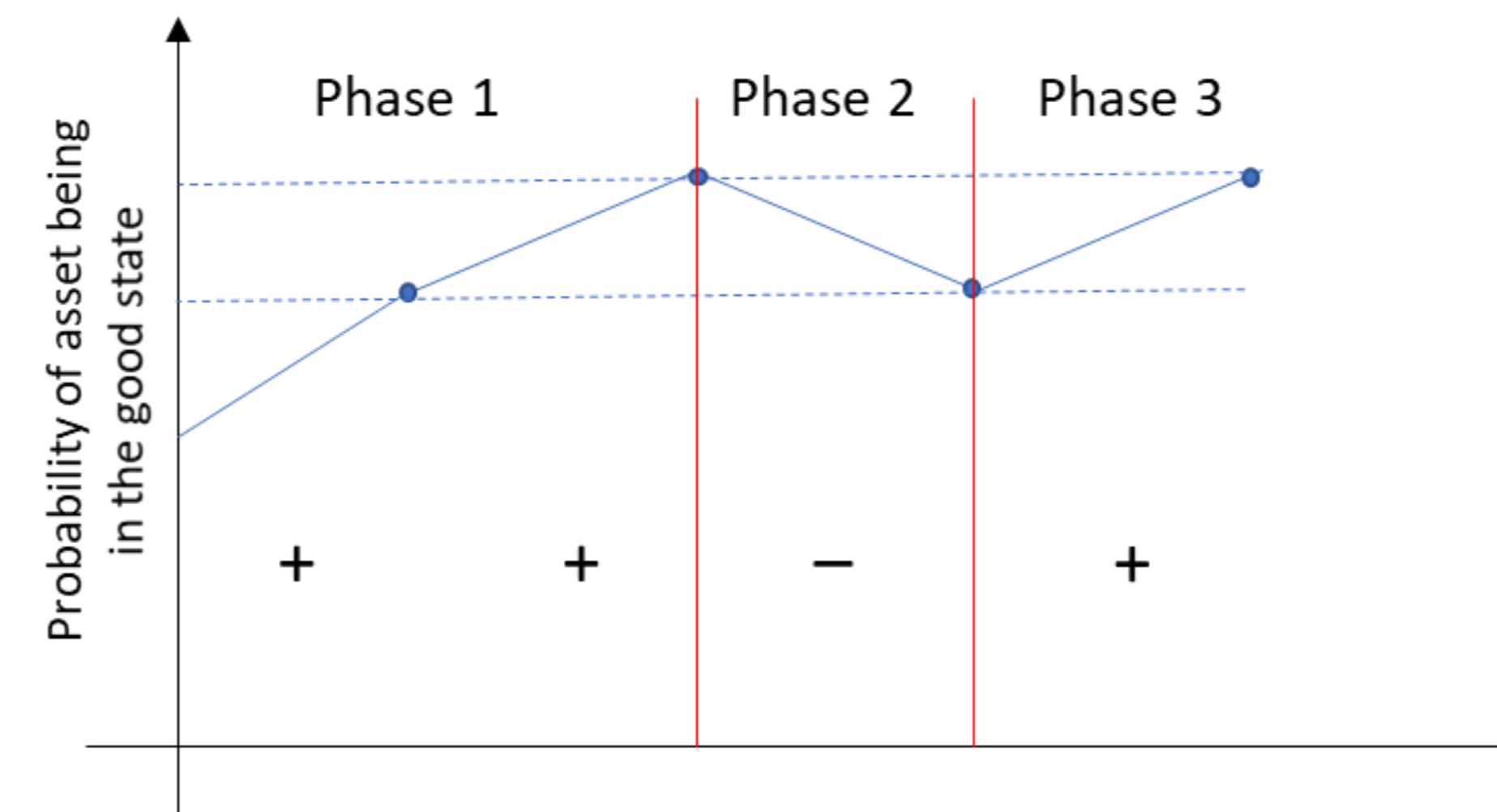
- Standard updating paradigm (Grether, 1980)
 - One risky asset, binary signals, good and bad distribution

Framework:

Phase 1: Sequence of same-directed signals

Phase 2: Interruption by one opposite-directed signal

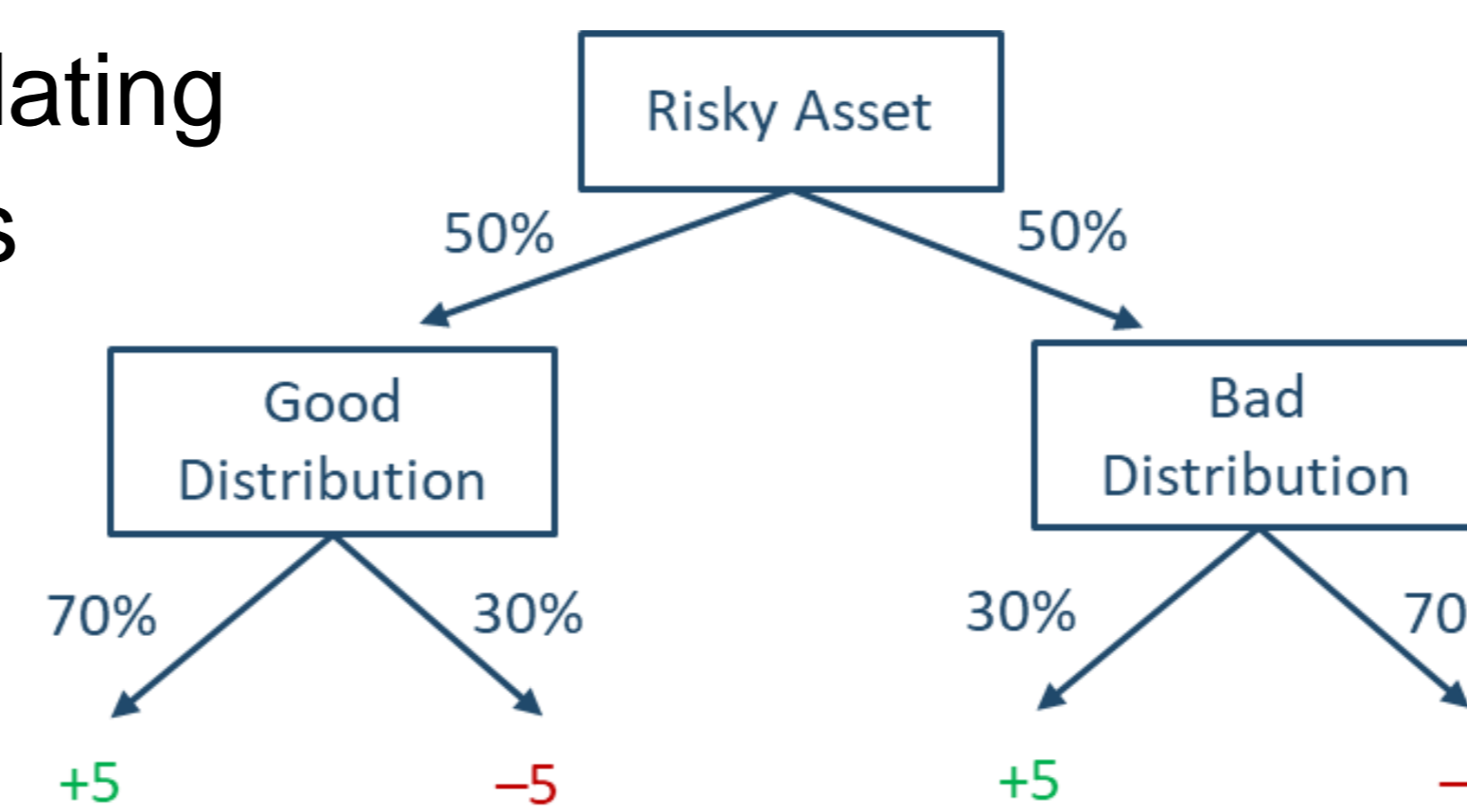
Phase 3: Reversion/Correction of opposite-directed signal



3. Experimental Design

Baseline experiment:

- Sequential belief updating
- 6 consecutive rounds
- Structure:
 - Payoff
 - Probability estimate
 - Confidence

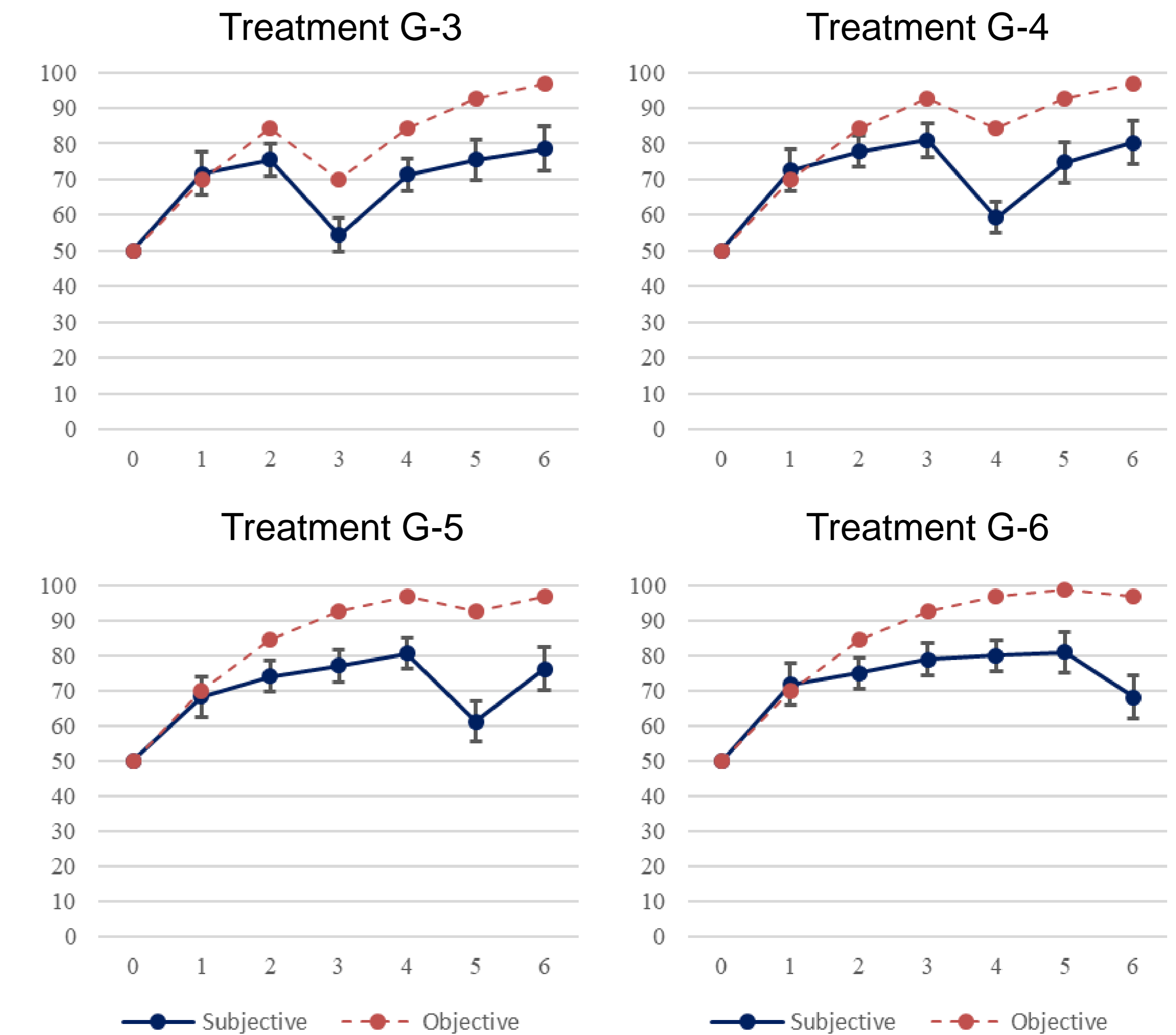


- Manipulation of the number of same-directed signals prior to interruption**

Treatment	Good Distribution					
	1	2	3	4	5	6
G-1	-	+	+	+	+	+
G-2	+	-	+	+	+	+
G-3	+	+	-	+	+	+
G-4	+	+	+	-	+	+
G-5	+	+	+	+	-	+
G-6	+	+	+	+	+	-

4. Results

- 3 Experiments with N=1807**



- Rule out diagnosticity and surprise

5. Discussion

- Predictable overreactions whenever agents violate the Bayesian counting rule
- Systematic underreactions (conservatism) when individuals adhere to the counting rule

References

Benjamin, D. J. (2019). Errors in probabilistic reasoning and judgment biases. In Handbook of Behavioral Economics: Applications and Foundations 1, volume 2, pages 69–186. Elsevier.

Grether, D. M. (1980). Bayes rule as a descriptive model: The representativeness heuristic. *The Quarterly Journal of Economics*, 95(3):537–557.