

Research Design Memo v2: The Information Precision Valley Under Tight Bargaining

February 12, 2026 · Status: Pre-experiment · Iteration of v1

Research Question

Does tightening the zone of possible agreement (ZOPA) reveal an “information valley” in deal rates — where range information about opponent valuations *reduces* deal rates below both exact-information and no-information baselines?

The v1 experiment (`info_precision_bargaining`) tested this hypothesis under generous ZOPAs (\$10–\$25) and found 100% deal rates across all conditions — a ceiling effect. However, it also found a large, significant monotonic price gradient ($F(2, 27) = 7.99, p = 0.002, d = 1.54$), confirming that information precision shifts surplus. The v2 design shrinks the ZOPA to \$2–\$5 and reduces rounds from 6 to 3, creating a regime where aggressive offers can cause impasse.

The core mechanism is **feasibility uncertainty**: when a buyer is told the seller’s cost is \$35–\$50 but the buyer only values the item at \$42, the range includes values (\$43+) where no deal is profitable. This makes the buyer doubt whether a deal even exists, leading to pessimistic anchoring and demands outside the true ZOPA.

Causal Model

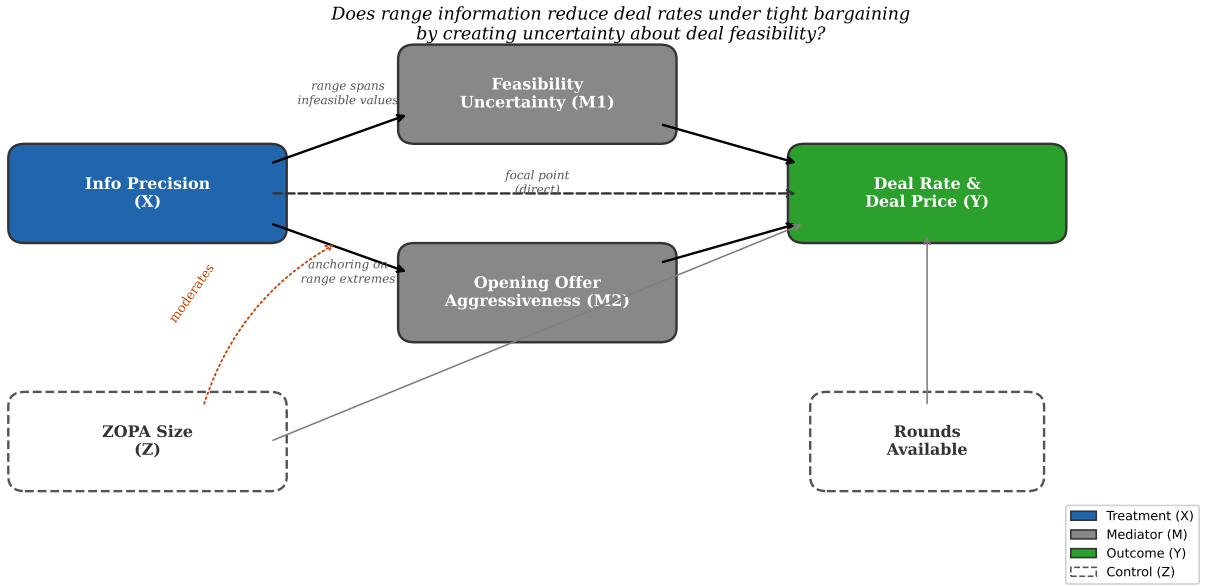


Figure 1: Causal DAG. Information precision (X) affects deal rate (Y) through feasibility uncertainty (M1: range spans infeasible values) and offer aggressiveness (M2: anchoring on range extremes). ZOPA size (Z) moderates X→M1: under tight ZOPA, feasibility uncertainty dominates; under generous ZOPA (v1), it is irrelevant.

Variable	Type	Operationalization
Info Precision (X)	Treatment	None / Range (\$35–\$50) / Exact
Feasibility Uncertainty (M1)	Mediator	Range includes infeasible seller costs ($>$ buyer value)
Offer Aggressiveness (M2)	Mediator	First offer distance from ZOPA midpoint
Deal Rate (Y1)	Outcome	Binary: deal reached within 3 rounds
Deal Price (Y2)	Outcome	Continuous: agreed price (if deal)
ZOPA Size (Z)	Moderator	\$2 ($b_v=42$) or \$5 ($b_v=45$)

Testable Implications

1. **Valley in deal rates:** Range Info deal rate $<$ No Info deal rate $<$ Exact Info deal rate
2. **No-info resilience:** Uninformed buyers still reach deals at moderate rates (they don’t anchor on infeasible values)
3. **Exact-info efficiency:** Exact-info pairs converge quickly to ZOPA midpoint, highest deal rate
4. **ZOPA moderation:** Valley is deeper under \$2 ZOPA than \$5 ZOPA (more of the range is infeasible)

Identification Strategy

- **Randomize:** Info precision (between-subjects, 3 game folders). ZOPA size (within-subject, buyer_value sequence)
- **Hold constant:** Seller cost (\$40), rounds (3), alternating offers, AI goal and guardrails, price range (\$0–\$100)
- **Rules out:** Differences in game mechanics, AI behavior, or round count as confounds
- **Key design choice:** Ranges \$35–\$50 (buyer about seller) and \$38–\$55 (seller about buyer) are fixed to span infeasible values when $b_v = 42$

Experimental Design

Condition Descriptions

No Info (`bargain_tight_none`): Neither player knows the other’s valuation. The buyer knows only their own value (\$42 or \$45); the seller knows only their cost (\$40). Neither is given any information about the opponent.

Range Info (`bargain_tight_range`): The buyer is told the seller’s cost is somewhere between \$35 and \$50 (true cost: \$40). The seller is told the buyer’s value is somewhere between \$38 and \$55. Critically, when $b_v = 42$, the buyer’s range includes \$43–\$50 where no profitable deal exists. This is the “feasibility uncertainty” mechanism.

Exact Info (`bargain_tight_exact`): Both players know both values. The buyer knows the seller’s cost is \$40; the seller knows the buyer’s value. The ZOPA (\$2 or \$5) and fair price are common knowledge.

	No Info	Range Info	Exact Info
Buyer info about seller	Nothing	Cost is 35-50	Cost is exactly \$40
Seller info about buyer	Nothing	Value is 38-55	Value is exactly \$X
Seller cost	\$40 (fixed)	\$40 (fixed)	\$40 (fixed)
Buyer value	42or45	42or45	42or45
ZOPA	2or5	2or5	2or5
Max rounds	3	3	3
AI goal	Max earnings	Max earnings	Max earnings
Valid prices	0-100	0-100	0-100

Yellow = treatment manipulation (differs across conditions)

Figure 2: Design matrix. Yellow cells indicate the treatment manipulation (information disclosure). All other parameters are held constant across conditions. Key v1→v2 changes: ZOPA shrunk to \$2/\$5, rounds reduced to 3.

Outcome Measures

Outcome	Type	Measurement
Deal rate	Binary (primary)	GAME OVER with positive earnings
Deal price	Continuous	Agreed price from transcript
Rounds to deal	Count	Round number when deal closes
AI opening offer	Continuous	First price offered by AI
Surplus efficiency	Ratio	Total surplus / ZOPA
Buyer surplus share	Ratio	Buyer earnings / total surplus

Analysis Plan

Primary analysis: Logistic regression of deal rate on info-condition dummies (Range, Exact, with No Info as baseline) and ZOPA-size indicator, plus interaction terms. The valley prediction requires $\beta_{\text{Range}} < 0$ (Range worse than No Info) and $\beta_{\text{Exact}} > 0$ (Exact better than No Info).

Secondary analyses: (1) Conditional deal price analysis (OLS on deals only). (2) AI opening offer by condition. (3) Fisher’s exact test for deal rate pairwise comparisons. (4) ZOPA \times info interaction on deal rate.

Power: With $N = 15$ per cell (30 per condition, 90 total), assuming deal rates of 65% (No Info), 35% (Range), 80% (Exact) under tight ZOPA, a chi-squared test has $\approx 80\%$ power to detect the Range vs. No Info difference at $\alpha = 0.05$.

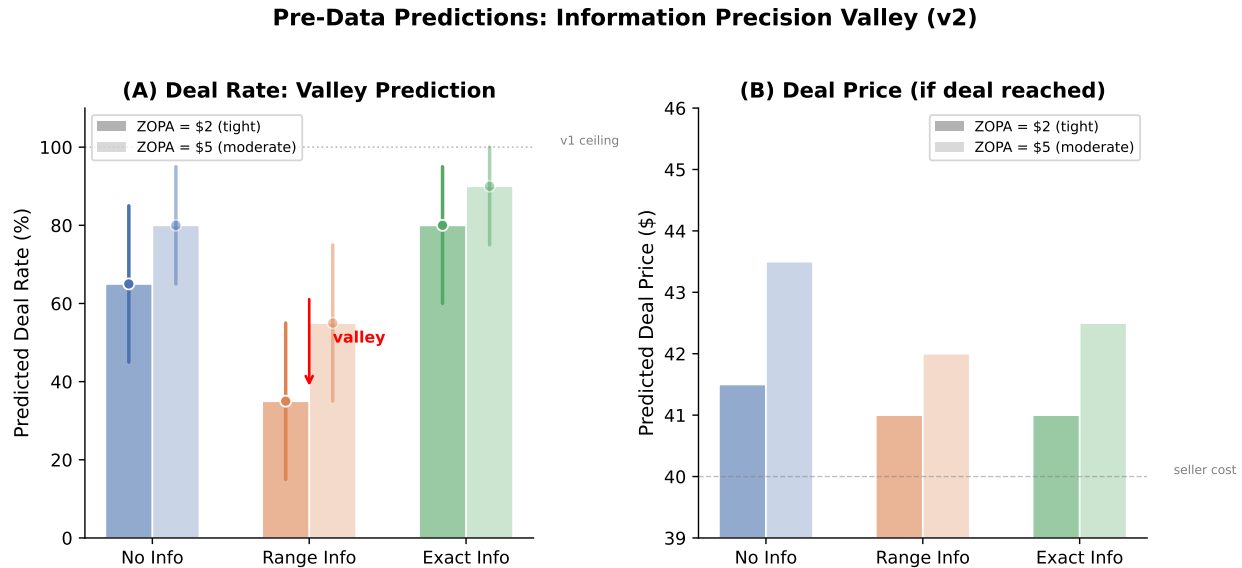


Figure 3: Pre-data predictions. (A) The core “valley” prediction: Range Info yields the lowest deal rate, with the valley deepest under \$2 ZOPA (dark bars). The v1 ceiling (100%) is shown for reference. (B) Deal price conditional on deal: compressed range due to tight ZOPA, but same directional pattern as v1. No fake data — bars represent plausible ranges.

Game Implementations

Game folder	Condition	Treatment
bargain_tight_none	No Info	Neither knows opponent’s value
bargain_tight_range	Range Info	Ranges spanning infeasible values
bargain_tight_exact	Exact Info	Full information

All three share: seller_cost = fixed(40), buyer_value = sequence([42, 45]), zopa = derived, fair_price = derived. Max 3 rounds, alternating offers (AI odd, human even).

Limitations

- **LLM rationality:** AI agents may compute optimal offers directly, muting the aspiration-inflation mechanism that depends on heuristic anchoring.
- **Fixed ranges:** The \$35–\$50 and \$38–\$55 ranges are not randomly drawn. Different range boundaries might produce different results.
- **3-round limit:** With only 3 rounds (2 AI offers, 1 human offer), the game is almost an ultimatum — there is minimal room for negotiation dynamics.
- **Extreme ZOPA:** A \$2 ZOPA (\$40–\$42) may produce high impasse rates across *all* conditions, masking the treatment effect. If baseline deal rates are $< 30\%$, the valley cannot be

detected.

- **Simulated humans:** gpt-5-nano may not exhibit the behavioral heuristics (anchoring, loss aversion) that drive the feasibility uncertainty mechanism in human subjects.