Online Appendix:
LLMs Can Play (Global) Games

Khaled Eltokhy

1 Decomposition: Which Channel Drives the Stability Effect?

The stability design manipulates three channels simultaneously (direction, clarity, dissent). To determine which drives the effect, I run three single-channel treatments, each activating only one manipulation while holding the other two at baseline.

The direction channel produces the largest average treatment effect at +2.4 pp, with effects concentrated near θ^*. The dissent channel contributes +1.6 pp uniformly. The clarity channel produces only +0.3 pp with a non-monotone pattern.

The sum of single-channel effects is +4.3 pp, far smaller than the full stability design effect (+19.5 pp). This implies strong complementarities: combining ambiguity (clarity), softened direction, and mixed-valence cues shifts behavior much more than the sum of each channel in isolation.

2 Robustness Details

2.1 Agent Count Variation

I vary the number of agents per period ($n \in \{5, 10, 25, 50, 100\}$) using Mistral Small Creative. The correlation is stable: $r = +0.60$ ($n = 5$), $r = +0.63$ ($n = 10$), $r = +0.67$ ($n = 25$), $r = +0.65$ ($n = 50$), $r = +0.65$ ($n = 100$). The slight increase from $n = 5$ to $n = 25$ likely reflects reduced discretization noise.

2.2 Network Topology

I compare the baseline communication network ($k = 4$) with a denser network ($k = 8$). The denser network produces $r = +0.66$ (vs. +0.68 for $k = 4$), with a slightly lower mean join rate of 0.41 (vs. 0.45). Additional contacts do not substantially amplify coordination.

2.3 Mixed-Model Games

A five-model mixed-population game produces $r = +0.77$ (pure) and $r = +0.75$ (communication)—if anything, higher than single-model correlations. Equilibrium alignment is not an artifact of model homogeneity.

2.4 Calibration Robustness Across Models

The main experiments calibrate a single parameter (cutoff center) per model to center the sigmoid at $z = 0$. A natural concern is whether the monotone threshold pattern is an artifact of this calibration step. To test this, I run the pure global game with default parameters (cutoff center = 0, no calibration) for three architecturally distinct models. The correlation between regime strength θ and join fraction remains strongly negative for all three: Mistral Small Creative ($r = -0.865$, $p < 10^{-30}$), Llama 3.3 70B ($r = -0.875$, $p < 10^{-32}$), and Qwen3 235B ($r = -0.857$, $p < 10^{-29}$). All three exceed $|r| > 0.85$ with default parameters, confirming that the sigmoid relationship is an emergent property of how these models process narrative signals rather than an artifact of the calibration procedure. Calibration shifts the center of the response function but does not create the monotone structure (Table **??**).
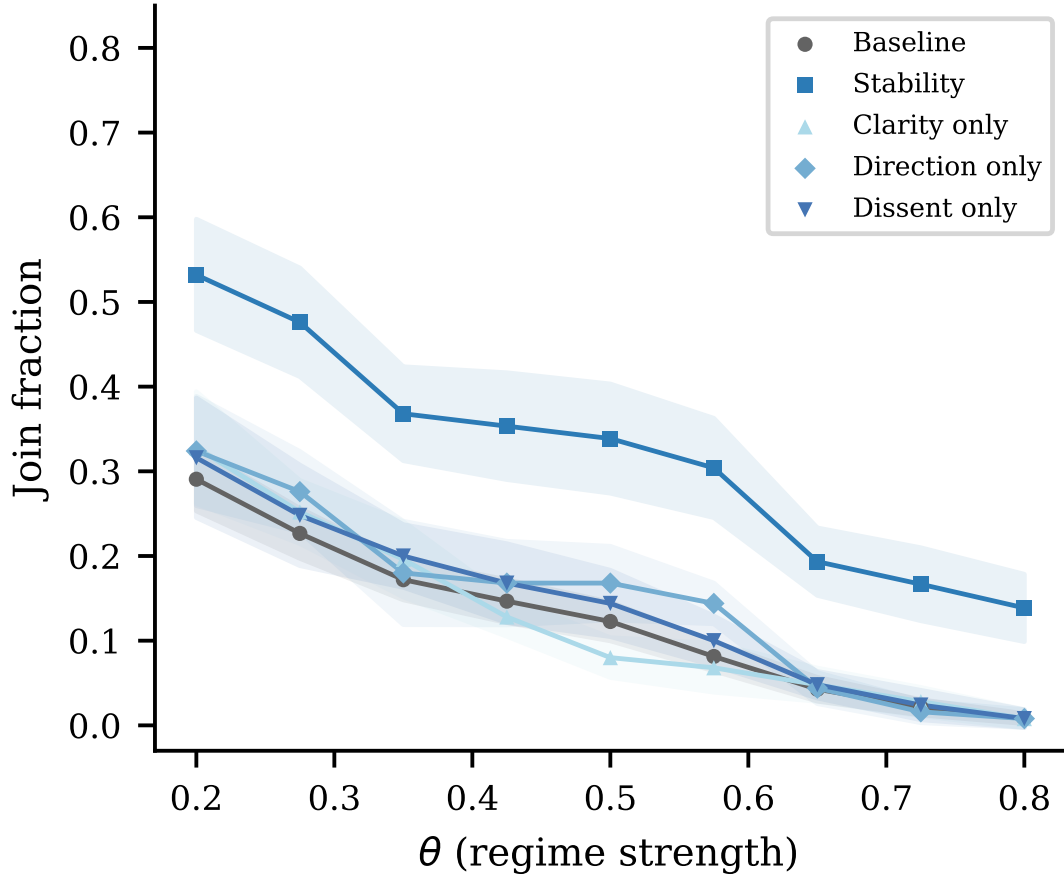
Figure 1: Single-channel decomposition of the stability design. Each panel shows the treatment effect $\Delta(\theta)$ for one channel in isolation.

2.5 Bandwidth Sensitivity

Qualitative treatment effects are robust across bandwidths, though magnitudes vary—especially for the stability design, whose effect peaks at the baseline bandwidth. The baseline bandwidth of 0.15 is approximately optimal for detecting treatment effects on the experimental grid.

2.6 Cross-Model Replication of Information Design

Table 3 reports cross-model replication of information design treatments. The flip inversion replicates across all models tested ($r > +0.43$ for all six). The scramble test shows more heterogeneity: Mistral, GPT-OSS, and Qwen3 235B show clean collapse ($r \approx 0$), but Llama 3.3 70B and Ministral 3B retain baseline-level correlations under scramble ($r = -0.81$ and $r = -0.66$), suggesting these models extract signal from features the scramble does not disrupt (e.g., within-country narrative coherence). OLMo shows an attenuated baseline relationship, while Qwen3 30B shows a large reduction in correlation under scramble and a clear flip effect.

2.7 Information Design with Communication

Under baseline information design with communication, mean join rate is 3.0% (-9.3 pp vs. baseline without communication). Communication *reduces* join rates across all information design conditions—superficially counterintuitive, but resolved by noting that additional information from others' messages tends to reveal that the regime is strong (the θ grid extends upward from θ^*).

Table 1: Single-channel decomposition of the stability design (primary model: Mistral Small Creative).

Channel	Mean	r	Δ
Full stability	0.319	-0.626	$+0.195$
Clarity only	0.126	-0.857	$+0.003$
Direction only	0.148	-0.826	$+0.024$
Dissent only	0.140	-0.837	$+0.016$
Sum of channels	—	—	$+0.043$
Full design	—	—	$+0.195$

Table 2: Uncalibrated robustness: models run without calibration adjustment. r is the Pearson correlation between θ and join fraction.

Model	N	Mean join	$r(\theta, J)$	p
Mistral Small Creative	100	0.382	-0.865	0.0000
Llama 3.3 70B	100	0.422	-0.875	0.0000
Qwen3 235B	100	0.445	-0.857	0.0000

3 Implementation Details

3.1 LLM Decoding Parameters

All LLM calls use temperature $= 0.7$ and `max_tokens` $= 512$. Each agent produces a single sample per decision (no majority voting or averaging). The API provider is OpenRouter; all calls use the same endpoint and parameters across models.

3.2 Prompt Templates

Decision prompt (pure treatment).

> You are a citizen deciding whether to JOIN an uprising or STAY home.
>
> You only have your private briefing below. You do not know how many others will JOIN.
>
> Start your first line with exactly JOIN or STAY, then give 1--2 concise sentences of reasoning.

Communication prompt.

> You are a citizen in a country with an authoritarian regime. You have received a private intelligence briefing. You are now in contact with a small number of trusted people. Based on your briefing, write a brief message (1--2 sentences) to share your read of the situation. Be natural---you're talking to people you trust.

Surveillance communication prompt. Identical to the communication prompt, with the addition:

> IMPORTANT: You have reason to believe that your communications are being monitored by regime security services. Messages deemed subversive could have serious consequences for you and your contacts.

3.3 Randomization

Each country–period draws θ from $\mathcal{N}(\bar{z}, 0.05^2)$, where $\bar{z}$ is itself drawn once per country. Private signals are $x_i = \theta + \varepsilon_i$, $\varepsilon_i \sim \mathcal{N}(0, \sigma^2)$ with $\sigma = 0.3$. The communication network is a Watts–Strogatz small-world graph with $k = 4$ neighbors and rewiring probability $p = 0.3$, regenerated each period. All random draws use NumPy's default `Generator` with no fixed seed; exact sequences are logged in per-run JSON files included in the replication archive.
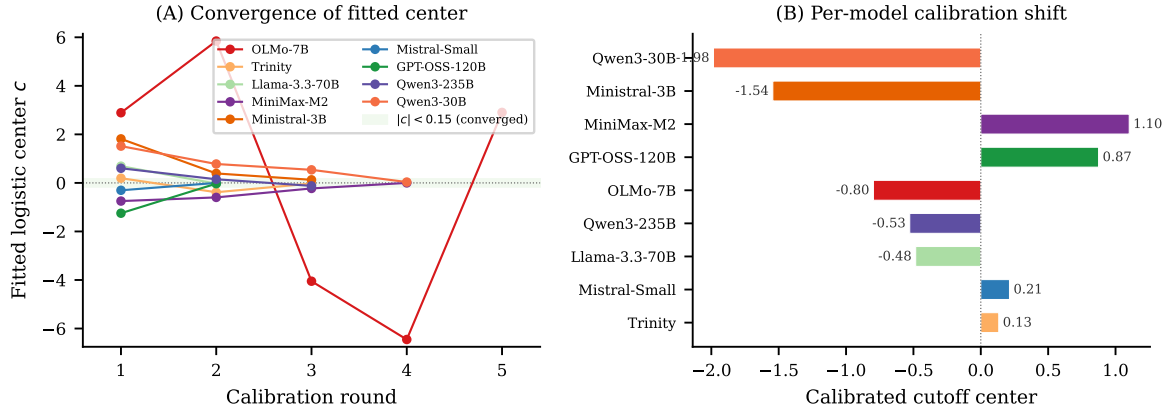
Figure 2: Calibration convergence. *Left:* Trajectory of the fitted logistic center c across autocalibration rounds for each model. The green band marks the convergence criterion ($|c| < 0.15$). All models converge within 2–3 rounds. *Right:* Final calibrated cutoff center per model. Most models require only modest shifts ($|c| < 0.3$).

Table 3: Bandwidth robustness: mean join rates (primary model: Mistral Small Creative).

Design	BW=0.05	BW=0.15	BW=0.30
Baseline	0.054	0.124	0.061
Stability	0.061	0.319	0.070
Upper cens.	0.116	0.309	0.114
Lower cens.	0.155	0.390	0.157

3.4 Code and Data Availability

All code, prompts, cached LLM responses, and output data are available at https://github.com/keltokhy/llm-global-games.
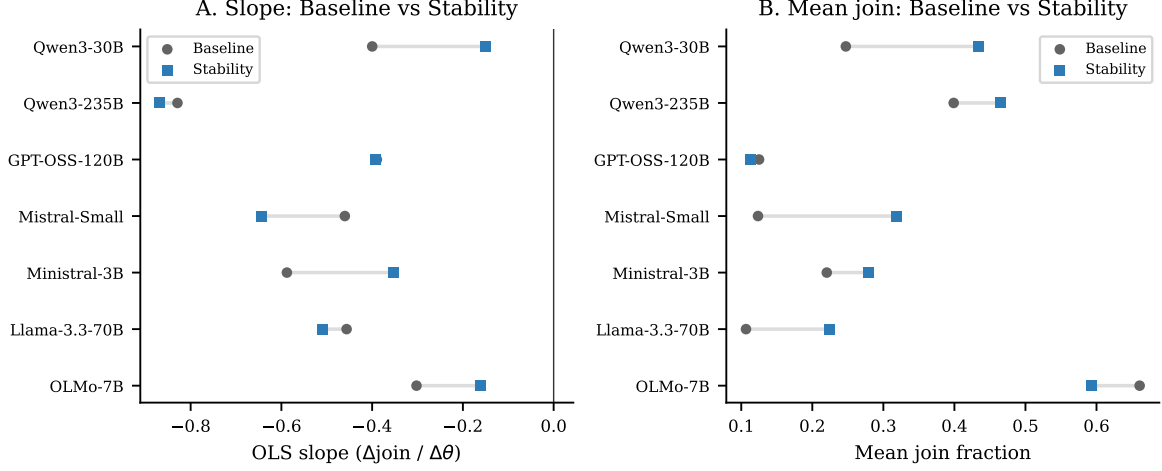
Figure 3: Cross-model replication of information design treatments. Each panel shows join fraction vs. θ for one model under baseline, stability, scramble, and flip conditions.

Table 4: Cross-model replication of key information design conditions. r is the correlation between θ and join fraction.

Model	Baseline		Scramble		Flip	
	Mean	r	Mean	r	Mean	r
Mistral Small Creative	0.124	−0.812	0.121	+0.036	0.663	+0.823
GPT-OSS 120B	0.127	−0.801	0.132	+0.080	0.677	+0.754
Llama 3.3 70B	0.107	−0.809	0.105	−0.810	0.887	+0.717
Ministral 3B	0.220	−0.632	0.118	−0.658	0.804	+0.847
Qwen3 30B	0.247	−0.612	0.279	−0.119	0.784	+0.848
Qwen3 235B	0.399	−0.878	0.394	−0.020	0.430	+0.871
OLMo 3 7B	0.718	−0.329	0.592	−0.294	0.839	+0.452