

Problem Set 1
GR6493 [Dean]
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Question 1 For those of us that may have forgotten what NIAS and NIAC are, define:

$$\left[P_A(a \mid \omega) \equiv \sum_{\gamma \in \Gamma(A)} \pi_A(\gamma \mid \omega) C_A(a \mid \gamma) \right] \quad \left[g(\gamma, A) \equiv \max_{a \in A} \sum_{\omega \in \Omega} \gamma(\omega) u(a, \omega) \right] \quad \left[G(\pi, A) \equiv \sum_{\gamma \in \Gamma(\pi)} P(\gamma) g(\gamma, A) \right]$$

NIAS For every chosen action a ,

$$\sum \mu(\omega) P_A(a \mid \omega) [u(a(\omega)) - u(b(\omega))] \geq 0, \quad \forall b \in A \quad (1)$$

NIAC For an observed sequence of decision problems A_1, \dots, A_K , and associated revealed information structures $\bar{\pi}^1, \dots, \bar{\pi}^K$,

$$G(A^1, \bar{\pi}^1) - G(A^1, \bar{\pi}^2) + \dots + G(A^K, \bar{\pi}^K) - G(A^K, \bar{\pi}^1) \geq 0.$$

We claim that the data generated by Gabaix's model does not necessarily satisfy the NIAS condition. We will demonstrate this using a counterexample. The counterexample we present is a one-dimensional version of the quadratic utility example presented in section II.A of Gabaix's paper.

Let a be the agent's choice of action, x the true unobserved state, and m the agent's attention strategy. Fix any choice of $m \in (0, 1)$ (i.e., the agent is not paying full attention). Let the agent's prior belief regarding x given by $\mu(x)$. By assumption, the mean and variance of this distribution exist and are given by 0 and σ^2 , respectively. Define quadratic utilities as

$$u(a, x) = -\frac{1}{2}(a - cx)^2$$

where $c > 0$ is some given constant. Define $x^s \equiv mx$. According to Gabaix's model, the agent chooses

$$a = \arg \max_a u(a, x^s) = cx^s = cmx.$$

Define $b \equiv cx$. Referring back to our utility function, we know $u(b, x) = 0$ for all x . Now, fix any given realization of the state x . We know that

$$u(a, \omega) = -\frac{1}{2}(cmx - cx)^2 < 0 = u(b, \omega)$$

The above inequality holds strictly since we assumed $m \in (0, 1)$. So, for any prior μ , we have

$$\int_{-\infty}^{\infty} \mu(x) [u(a(\omega) - u(b(\omega))] dx = \int_{-\infty}^{\infty} \mu(x) - \frac{1}{2}(cmx - cx)^2 dx < 0$$

Thus, we conclude that NIAS fails.

Question 2

1. First, let's establish notation. Each decision problem $D \in \{8, 9, 10, 11\}$ in this experiment has two possible actions—denote these by a_D and b_D (so, for $D = 9$, we have $a_D = 12$ and $b_D = 13$). Let the typical state be denoted by $\omega \in \Omega \equiv \{1, 2, 5, 6\}$.

The NIAS condition (1) for this experiment requires the following conditions to hold for all D

$$\sum_{\omega \in \Omega} P(a_D | \omega) [u(a_D(\omega)) - u(b_D(\omega))] \geq 0 \quad (2a)$$

$$\sum_{\omega \in \Omega} P(b_D | \omega) [u(b_D(\omega)) - u(a_D(\omega))] \geq 0 \quad (2b)$$

Since there are only two possible actions in each decision problem, we have

$$P(a_D | \omega) + P(b_D | \omega) = 1, \forall \omega \in \Omega.$$

Using this, and the definition $\Delta_\omega \equiv u(a_D(\omega)) - u(b_D(\omega))$ allows (2) to be written as

$$\begin{aligned} \sum_{\omega \in \Omega} P(a_D | \omega) \Delta_\omega &\geq 0 \\ \sum_{\omega \in \Omega} (1 - P(a_D | \omega)) (-\Delta_\omega) &\geq 0, \end{aligned}$$

i.e.,

$$\begin{aligned} \sum_{\omega \in \Omega} P(a_D | \omega) \Delta_\omega &\geq 0 \\ \sum_{\omega \in \Omega} P(a_D | \omega) \Delta_\omega &\geq \sum_{\omega \in \Omega} \Delta_\omega, \end{aligned}$$

which combine to form the (still necessary and sufficient) condition for NIAS:

$$\sum_{\omega \in \Omega} P(a_D | \omega) \Delta_\omega \geq \min \left\{ \sum_{\omega \in \Omega} \Delta_\omega, 0 \right\} = 0$$

where the last equality follows from the symmetry of the specific payoffs of this experiment.

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I have two ideas for testing.

- i. Test this condition for each person. Then, take the mean and standard deviation of those probabilities to do a standard t-test (or whatever... mean/sd)
- ii. Bootstrapping. Drop observations that aren't state omega. Then sample (with replacement) from this pool and calculate the condition. Then use the s.d. of those bootstrapped probabilities to do a t-test.

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Question 3

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