

Managerial exploration-exploitation tradeoffs - Two business simulations (#44459)

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1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

2) What's the main question being asked or hypothesis being tested in this study?

Subjects play a 100-rounds three-arms bandit game twice. We expect that the sampling strategy of subjects in the first game differs from their sampling strategy in the second game. We assess subjects' sampling strategies using several dependent variables.

3) Describe the key dependent variable(s) specifying how they will be measured.

We test several sets of dependent variables. First, we test descriptive measures of sampling strategy, such as the percentage of participants switching between the arms of the bandit in each round, the proportion of participants choosing the arm with the highest average reward in each round, or alternatively, the percentage of suboptimal arms sampled by subjects in each round. Second, we test model-based measures of sampling strategies: we expect differences in the distributions of the baseline probability of staying in exploration, exploitation or inertia, and in the baseline probabilities of moving to between the three states, when participants do the first bandit experiment compared to when participants do the second bandit experiment. We also expect differences in the belief-updating mechanism of subjects. For instance, we expect differences in the sensitivity parameter in the exploitation stage between the first and the second bandit experiment.

4) How many and which conditions will participants be assigned to?

Two conditions, in a within-subjects design. Participants engage in the same 100-rounds three-armed bandit experiment twice. The rewards distributions are similar in the two bandit experiments.

5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

To test differences in the descriptive measures, we will use ANOVAs with the two conditions as explanatory variable. We will use logistic regression to predict the probability of switching between arms as a function of lagged rewards and the experimental condition. We expect that the lower the lagged rewards, the more likely subjects are to switch arms, and that effect is stronger in the first compared to the second bandit experiment.

We assess sampling strategies using a three-state non-homogeneous hidden Markov model where we predict subjects' likelihood of switching between an exploration, an exploitation and an inertia strategy. Disappointing outcomes impact subjects' transitions between these three sampling strategies. When in exploitation, subjects update their beliefs about the reward distributions of the three arms of bandit experiment following the experience-weighted attraction model. We use this model to infer subjects' probabilities to transition between the three states, and the parameters governing their belief-updating behavior, and compare parameter estimates across the two experimental conditions.

6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

We do not plan to exclude any observations.

7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We will collect data from 100 subjects.

8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

We will also test whether there are differences in the total rewards between the two conditions, and with the rewards subjects could have obtained if they followed an optimal sampling path. We use the Gittins Index to compute the optimal path in the three-armed bandit experiments used for the two conditions.