Regret, Feedback and Risk Taking Behavior

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Introduction

$$A \rightarrow \quad 50 \quad [1] \qquad \text{and} \qquad B \begin{array}{l} \nearrow \\ \searrow \end{array} \begin{array}{cc} 100 & [0,5] \\ 0 & [0,5] \end{array}$$

Non-informative feedback.

Did the decision-maker chooses the safe option because they're risk-averse? Or because they're regret-averse?

Relevant literature

Bell D.E (1982) Regret in decision making under uncertainty. *Operations Research* 30(5), 961–981.

Gabillon E (2020) When choosing is painful: Anticipated regret and psychological opportunity cost. *Journal of Economic Behavior & Organization* 178, 644–659.

Loomes G, Sugden R (1982) Regret theory: an alternative theory of rational choices under uncertainty. *Economic Journal* 63(368), 805–824.

Quiggin J (1994) Regret theory with general choice sets. *Journal of Risk and Uncertainty* 8(2), 153–165.

Sugden R (1993) An axiomatic foundation for regret theory. *Journal of Economic Theory* 60(1), 159–180.

The basic model, Gabillon (2020)

Gabillon (2020) proposed a model that makes it possible to consider any level of feedback on the foregone alternative payoffs.

Let $\Phi = \{X, Y_1, .., Y_N\}$ denote the set of $N+1$ risky alternatives.

Let θ denote the realized payoffs $x, y_1, .., y_N$ and θ_{-X} the foregone realized payoffs $y_1, .., y_N$ when alternative X has been adopted.

Let $p(\theta)$ denote the prior probability distribution of θ.

After alternative X is adopted, the DM receives a signal M_X on state of nature θ and revises their prior accordingly.

The basic model, Gabillon (2020)

Definition

The c-utility function, defined as $v(x) = u(x, x)$, measures the satisfaction generated by the consumption of payoff x.

After observing the signal M_X, the DM revises their prior probability $p(\theta)$ in a Bayesian way. The DM evaluates the $N+1$ alternatives with the posterior probability distribution and the c-utility function. We can compute the posterior Arrow-Pratt certainty equivalent of a foregone alternative Y_n with the marginal posterior probability distribution $p(y_n | M_X)$:

$$v\left(CE_{Y_n}^{v,M_X}\right) = E\left[v(Y_n) | M_X\right], \qquad (1)$$

The basic model, Gabillon (2020)

Definition

The preferences of a regret-averse DM are given by

$$E\left[u\left(X, R^{M_X}\right)\right] = E\left[u\left(\underbrace{X}_{+}, \underbrace{Max\left\{X, CE_{Y_1}^{v,M_X}, ..., CE_{Y_N}^{v,M_X}\right\}}_{-}\right)\right].$$

The basic model, Gabillon (2020)

Consider a decision between playing Lottery X or Lottery Y.

$$X \begin{matrix} \nearrow & 40 & [0,5] \\ \searrow & 0 & [0,5] \end{matrix} \quad \text{and} \quad Y \begin{matrix} \nearrow & 20 & [0,5] \\ \searrow & 10 & [0,5] \end{matrix}$$

If a DM chooses Lottery X, the DM compares the result of Lottery X with the value of Lottery Y calculated based on the information M_X available after making the choice.

In this example, regardless of the informativeness of M_X, we have $CE_Y^{v,M_X} \in [10, 20]$. Regret is systematically felt when $X = 0$ since $0 < CE_Y^{v,M_X}$.

$$R^{M_X} = Max\left\{0, CE_Y^{v,M_X}\right\} = CE_Y^{v,M_X} > 0$$

The basic model, Gabillon (2020)

Definition

The feedback F_Φ, associated to the choice set $\Phi = \{Y_1, .., Y_{N+1}\}$, consists of the signals associated with each alternative in the choice set:
$F_\Phi = \{M_{Y_1}, ..., M_{Y_{N+1}}\}$

Definition

F_Φ is said to be non-informative if $\forall Y_n \in \Phi, M_{Y_n}$ is non-informative. A non-informative feedback will be denoted by F_Φ^{ni}.
F_Φ is said to be perfectly informative if $\forall Y_n \in \Phi, M_{Y_n}$ is perfectly informative. A perfectly informative feedback will be denoted by F_Φ^{pi}.
F_Φ is said to be imperfectly informative in all other situations.

Main results, Gabillon (2025)

Proposition

When the feedback is non-informative, a regret-averse DM exhibits a preference for certainty regardless of their risk preferences: $\Pi_Y^{u,F_\Phi^{ni}} > \Pi_Y^v$.

The risk premium is higher when anticipated regret is considered in decision-making than when it is not. We will call this property **'the preference for certainty'**.

A regret-averse DM is less likely to take risks than a vNM DM. Regret aversion under a non-informative feedback increases the proportion of seemingly risk-averse people. Risk-neutral DMs exhibit a positive risk premium, and so do some risk lovers.

Main results, Gabillon(2025)

$A \rightarrow \quad 50 \quad [1]$ and $B \begin{cases} \nearrow & 100 \quad [0,5] \\ \searrow & 0 \quad [0,5] \end{cases}$

Main results, Gabillon (2025)

Let F_Φ^a and F_Φ^b two possible feedbacks associated to the choice set $\Phi = \{Y_1, .., Y_{N+1}\}$.

Definition

F_Φ^a is sufficient for F_Φ^b if, $\forall Y_n \in \Phi$, $M_{Y_n}^a$ is Blackwell sufficient for $M_{Y_n}^b$ relative to θ_{-X}.

Signal M_X^a is Blackwell sufficient for signal M_X^b means that M_X^a is at least as good as M_X^b for learning about θ_{-X}.

Proposition

F_Φ^{pi} is sufficient for any feedback. Any feedback is sufficient for F_Φ^{ni}.

Main results, Gabillon (2025)

Definition

M_X^a is Blackwell sufficient for M_X^b relative to θ_{-X} if there exits a stochastic transformation $\pi\left(m_X^b \,|m_X^a\right)$ such that

$$\forall \theta \in \Omega^{N+1}, \forall m_X^b \in \mathcal{M}_X,$$
$$p\left(m_X^b \,|\theta\right) = \sum_{m_X^a \in \mathcal{M}_X} \pi\left(m_X^b \,|m_X^a\right) p\left(m_X^a \,|\theta\right)$$

with $\sum_{m_X^b \in \mathcal{M}_X} \pi\left(m_X^b \,|m_X^a\right) = 1, \forall m_X^a \in \mathcal{M}_X.$

Main results, Gabillon (2025)

In this paper, we introduce the definition of feedback aversion:

Definition

If F_{Φ}^{a} is sufficient for F_{Φ}^{b} then a feedback-averse DM prefers F_{Φ}^{b} to F_{Φ}^{a}: $\forall X \in \Phi, E\left[u\left(X, Max\left(X, R^{M_X^a}\right)\right)\right] \leq E\left[u\left(X, Max\left(X, R^{M_X^b}\right)\right)\right]$.

A feedback-averse DM prefers to minimize their exposure to future feedback about the foregone alternatives.

Corollary

Among all feedbacks, F_{Φ}^{pi} represents the worst feedback for a feedback-averse DM. Among all feedbacks, F_{Φ}^{ni} is the preferred feedback.

Main results, Gabillon (2025)

Proposition

A DM who is reference-point-risk-averse $u_{22}(x, r) \leq 0$ *and risk-averse* $v''(x) \leq 0$ *(with* $v(x) = u(x, x)$*) is feedback-averse.*

Main results, Gabillon (2025)

Proposition

Under feedback aversion, if F_Φ^a is sufficient for F_Φ^b, we have $\Pi_Y^{u,F_\Phi^a} \leq \Pi_Y^{u,F_\Phi^b}$.

As the feedback becomes informative, choosing the sure payoff offers less protection against feedback and anticipated regret. The sure payoff that a regretful DM would accept instead of the risky alternative Y increases with the informativeness of the feedback, and the risk premium decreases.

Corollary

Under feedback aversion, $\forall F_\Phi$, $\Pi_Y^{u,F_\Phi^{pi}} \leq \Pi_Y^{u,F_\Phi}$ *and* $\Pi_Y^{u,F_\Phi} \leq \Pi_Y^{u,F_\Phi^{ni}}$.

It is under a perfectly informative feedback that a feedback-averse DM is the most risk-taker and it is under a non-informative feedback that they are the less.

Main results, Gabillon (2025)

$$A \rightarrow \quad 50 \quad [1] \qquad \text{and} \qquad B \begin{matrix} \nearrow & 100 & [0,5] \\ \searrow & 0 & [0,5] \end{matrix}$$

Thank you for your attention!