Component — Metrics (RTP, Hit-rate, Variance)

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Definitions (bet = 1)

$$\mu(p) = \mathrm{RTP}(p) = \sum_{i=0}^{k} r_i p_i, \tag{1}$$

$$h(p) = \mathrm{Hit}(p) = \sum_{i=0}^{k} \mathbf{1}[r_i > 0]\, p_i, \tag{2}$$

$$\mathrm{Var}(p) = \sum_{i=0}^{k} r_i^2 p_i - \mu(p)^2. \tag{3}$$

Differentials (with

$\sum_i \delta p_i = 0$)

Sanity Checks

$0 \le \mu(p) \le \max_i r_i$, $0 \le h(p) \le 1$. Shifting mass from mid-tier to high-tier payouts at constant μ tends to increase Var.

Analytic vs Monte Carlo

For N i.i.d. draws $X_j \in \{r_i\}$ with $\mathbb{P}[X = r_i] = p_i$,

$$\hat{\mu}_N = \frac{1}{N}\sum_{j=1}^{N} X_j \xrightarrow{a.s.} \mu(p), \qquad \widehat{\mathrm{Var}}_N \xrightarrow{a.s.} \mathrm{Var}(p). \tag{4}$$

Confidence intervals should contain analytic values at the declared level.