# Expected Earnings Per Hour in Indie Game Development: A Probabilistic Framework

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**Abstract**

Indie game studios face extreme outcome dispersion and platform intermediation. This paper formalizes expected earnings per hour (EV/hr) using probabilistic outcome models that incorporate platform revenue shares, variable costs, fixed costs, and hours invested. We derive studio-level and project-level expressions, contrast "one big bet" versus "many small bets," and discuss learning effects and diversification. A four-bucket outcome model (bust/ok/good/hit) illustrates tail dependence and sensitivity to hit probability. We conclude with decision-theoretic guidance and a caution on survivorship bias and psychological miscalibration.

## 1 Setup and Notation

Let outcomes be indexed by $i \in \{1, \ldots, n\}$ with probabilities $p_i$ satisfying $\sum_i p_i = 1$ and $p_i \geq 0$.

- $R_i$: gross revenue conditional on outcome $i$.
- $s \in [0, 1)$: platform revenue share (e.g., $s = 0.30$ on Steam).
- $c_i$: variable cost under outcome $i$ (e.g., server, marketing spend tied to scale).
- $F$: fixed cost (sunk before outcomes realize; salaries, baseline tools).
- $H$: total developer hours invested (can be per project or across a portfolio).

Net profit conditional on outcome $i$:

$$\pi_i = (1 - s)R_i - c_i - F. \tag{1}$$

Expected profit:

$$\mathbb{E}[\pi] = \sum_i p_i \pi_i = \sum_i p_i \big[(1 - s)R_i - c_i\big] - F. \tag{2}$$

Expected profit per hour (EV/hr):

$$\text{EV/hr} = \frac{\mathbb{E}[\pi]}{H} = \frac{\sum_i p_i \big[(1 - s)R_i - c_i\big] - F}{H}. \tag{3}$$

Variance of profit (to capture risk):

$$\mathrm{Var}[\pi] = \sum_i p_i(\pi_i - \mathbb{E}[\pi])^2. \tag{4}$$

A risk-adjusted objective could use mean-variance:

$$\mathrm{EV/hr}_\lambda = \frac{\mathbb{E}[\pi] - \lambda \mathrm{Var}[\pi]}{H}, \quad \lambda \geq 0. \tag{5}$$

Higher $\lambda$ penalizes volatility, reflecting risk aversion or funding constraints.

# 2 A Four-Bucket Outcome Model

Let outcomes $\{B, O, G, H\}$ denote bust, ok, good, hit with probabilities $\{p_B, p_O, p_G, p_H\}$ summing to 1. Let corresponding revenues $\{R_B, R_O, R_G, R_H\}$ with $R_B \ll R_O < R_G \ll R_H$ and variable costs $\{c_B, c_O, c_G, c_H\}$.

$$\mathbb{E}[\pi] = \sum_{k\in\{B,O,G,H\}} p_k\big[(1-s)R_k - c_k\big] - F, \tag{6}$$

$$\mathrm{EV/hr} = \frac{\mathbb{E}[\pi]}{H}. \tag{7}$$

Long-tail structure: typically $p_H$ is small but $R_H$ is large, driving both upside and variance. Platform cut $s$ linearly reduces each revenue term.

## 2.1 Sensitivity to Hit Probability

Holding other parameters fixed, differentiate EV/hr with respect to $p_H$:

$$\frac{\partial(\mathrm{EV/hr})}{\partial p_H} = \frac{(1-s)R_H - c_H - \big[(1-s)R_B - c_B\big]}{H}, \tag{8}$$

using $p_B = 1 - p_O - p_G - p_H$ to preserve the simplex (shifting mass from busts). This shows EV/hr is highly levered to $p_H$ and the revenue gap between hits and busts. Graphically, one would plot EV/hr against $p_H$ for plausible ranges (e.g., 0.1%–5%) to illustrate convexity.

# 3 Studio-Level vs Project-Level Models

## 3.1 Single Project

Equation (3) applies directly with project hours $H^{(1)}$ and fixed cost $F^{(1)}$.

## 3.2 Multi-Project Studio

Consider $m$ projects indexed by $j$. For each project $j$, define probabilities $p_i^{(j)}$, revenues $R_i^{(j)}$, variable costs $c_i^{(j)}$, fixed costs $F^{(j)}$, and hours $H^{(j)}$. Let shared studio overhead be $F^{\text{studio}}$ and shared hours $H^{\text{studio}}$ (management, tooling).

$$\mathbb{E}[\Pi] = \sum_{j=1}^{m} \sum_{i} p_i^{(j)} \big[(1-s)R_i^{(j)} - c_i^{(j)}\big] - \sum_{j=1}^{m} F^{(j)} - F^{\text{studio}}, \tag{9}$$

$$H_{\text{tot}} = \sum_{j=1}^{m} H^{(j)} + H^{\text{studio}}, \tag{10}$$

$$\text{EV/hr}_{\text{studio}} = \frac{\mathbb{E}[\Pi]}{H_{\text{tot}}}. \tag{11}$$

If outcomes are independent across projects, variance aggregates as a sum of variances; correlations increase portfolio risk:

$$\text{Var}[\Pi] = \sum_j \text{Var}[\pi^{(j)}] + 2\sum_{j<k} \text{Cov}(\pi^{(j)}, \pi^{(k)}). \tag{12}$$

# 4 Portfolio Structure: One Big Bet vs Many Small Bets

## 4.1 One Big Bet

A single project with large $H$, large $F$, and potentially higher $R_H$. Benefits: focus, brand cohesion. Risks: concentrated variance; failure wipes the slate.

## 4.2 Many Small Bets

Multiple smaller projects with lower per-project $H^{(j)}$ and $F^{(j)}$, potentially smaller $R_H^{(j)}$, but diversified outcomes. Portfolio EV/hr can be higher if correlation is low and if cumulative hours do not explode due to context switching. Diversification gains arise when downside events are not perfectly correlated.

## 4.3 Decision-Theoretic Comparison

Let $\text{EV/hr}_{\text{big}}$ and $\text{EV/hr}_{\text{many}}$ be the two strategies. A risk-neutral studio prefers whichever EV/hr is larger. A risk-averse studio compares (5) across strategies, with $\lambda$ capturing cash-flow fragility. Graph description: plot EV/hr and $\text{EV/hr}_{\lambda}$ for varying $\lambda$ to show when diversification dominates.

# 5 Learning Effects

Suppose probabilities improve with cumulative experience or shipped titles. Let $t$ index project order; model an increasing hit probability $p_H(t) = p_H^{(0)} + \alpha t$ capped below 1, or logistic $p_H(t) = \sigma(a + bt)$. EV/hr becomes path-dependent:

$$\text{EV/hr}(T) = \frac{\sum_{t=1}^{T} \sum_i p_i(t)\big[(1-s)R_i - c_i\big] - \sum_{t=1}^{T} F^{(t)}}{\sum_{t=1}^{T} H^{(t)}}. \tag{13}$$

Graph description: show EV/hr vs project index $t$ under different $\alpha$ (learning rates), highlighting that early projects may have negative EV/hr but later ones improve.

## 6 Platform Cuts and Cost Structure

Platform share $s$ scales revenue multiplicatively. Variable costs $c_i$ can increase with outcome quality (e.g., server or marketing scale). Fixed costs $F$ are sunk and reduce EV/hr inversely with $H$. Sensitivity to $s$:

$$\frac{\partial \mathrm{EV/hr}}{\partial s} = -\frac{\sum_i p_i R_i}{H}, \tag{14}$$

which is proportional to expected gross revenue per hour; high-earning studios are more sensitive to platform cuts.

## 7 Worked Numerical Illustrations

These are stylized and avoid fabricated statistics; choose plausible magnitudes for indie scope.

### 7.1 Single Project Example

Assume:

- $p_B = 0.55$, $p_O = 0.25$, $p_G = 0.15$, $p_H = 0.05$.
- Revenues (USD): $R_B = 5{,}000$, $R_O = 75{,}000$, $R_G = 300{,}000$, $R_H = 3{,}000{,}000$.
- Variable costs: $c_B = 2{,}000$, $c_O = 10{,}000$, $c_G = 40{,}000$, $c_H = 200{,}000$.
- Platform share $s = 0.30$.
- Fixed cost $F = 180{,}000$; hours $H = 6{,}000$.

Compute outcome profits:

$$\begin{aligned}
\pi_B &= 0.7(5{,}000) - 2{,}000 - 180{,}000, \\
\pi_O &= 0.7(75{,}000) - 10{,}000 - 180{,}000, \\
\pi_G &= 0.7(300{,}000) - 40{,}000 - 180{,}000, \\
\pi_H &= 0.7(3{,}000{,}000) - 200{,}000 - 180{,}000.
\end{aligned}$$

Expected profit:

$$\mathbb{E}[\pi] \approx 0.55\pi_B + 0.25\pi_O + 0.15\pi_G + 0.05\pi_H \approx \$34{,}250.$$

EV/hr $\approx$ \$5.7 per hour. Variance is large; most mass lies in low outcomes while expectation is supported by hits.

### 7.2 Hit-Probability Sensitivity

Increase $p_H$ from 0.05 to 0.07, reducing $p_B$ to keep $\sum p_i = 1$. Recompute:

$$\Delta\mathrm{EV/hr} \approx \frac{0.02\big[(1-s)R_H - c_H - ((1-s)R_B - c_B)\big]}{H} \approx +\$6.5/\mathrm{hr},$$

illustrating steep sensitivity to small changes in $p_H$.

### 7.3 Portfolio Example: Three Small Bets

Assume three projects with $H^{(j)} = 2{,}000$ each, $F^{(j)} = 70{,}000$, similar buckets but with $R_H^{(j)} = 1{,}000{,}000$ and $p_H^{(j)} = 0.03$. Independent outcomes imply diversification: EV/hr may rise modestly, while variance per hour falls because downside is spread. Correlation in discovery algorithms (e.g., all Steam titles) can raise covariance and erode benefits.

## 8 Decision-Theoretic Interpretation

- **Risk-neutral**: maximize EV/hr in (3).
- **Risk-averse**: maximize (5) or use certainty equivalents with concave utility $u(\pi)$; cash-poor studios have higher effective $\lambda$.
- **Capital constraints**: even with positive EV/hr, variance can cause ruin; buffers or revenue-sharing deals mitigate ruin risk.

## 9 Psychological Miscalibration and Outliers

Indie developers often overweight salient successes (availability bias) and underweight base rates of busts. Long-tail outliers distort intuitive expectations because median outcomes are far below the mean. Survivorship bias (visibility of hits, silence of failures) inflates perceived $p_H$. Planning should anchor on conservative $p_H$ and stress-test EV/hr under lower-hit scenarios.

## 10 Limitations

- Data scarcity: true $p_i$ and $R_i$ are rarely observed; platform dashboards reveal realized, not counterfactual, outcomes.
- Correlated shocks: discovery algorithm changes, seasonality, or macro demand shocks create covariance across projects.
- Scope creep and crunch: hours $H$ and fixed costs $F$ often exceed plan, lowering realized EV/hr.
- Tail risk: models truncate extreme upside; real distributions may be heavier-tailed than four-bucket approximations.

## 11 Practical Guidance

- Calibrate $p_i$ using conservative priors and adjust only with evidence.
- Map $s$ to platform policies (e.g., typical 30% cut; lower with certain thresholds).
- Track $H$ and $F$ in real time; EV/hr is sensitive to overruns.
- Use small prototypes to learn ($\alpha > 0$), then re-estimate $p_H(t)$ before scaling.

- Diversify when possible; beware correlated marketing channels that erode diversification.

## 12 Conclusion

Expected earnings per hour for indie studios can be expressed compactly via outcome probabilities, platform shares, and cost structure. Tail outcomes dominate EV/hr, making hit probability and platform terms pivotal. Diversification and learning can improve risk-adjusted EV/hr, but psychological biases and survivorship bias threaten calibration. Decision-theoretic framing clarifies when to pursue concentration versus spreading bets, especially under capital constraints and variance sensitivity.

**Graph concepts (no figures included):**

- EV/hr vs $p_H$: upward-sloping, convex; illustrates leverage to hit probability.
- Risk-adjusted EV/hr vs $\lambda$: declining curves; diversification flattens the slope.
- EV/hr over project index $t$: rising with learning rate $\alpha$, showing delayed payoff.

## References

[1] Industry documentation on standard platform revenue shares (e.g., Steam, console storefronts).

[2] Public postmortems and publisher reports discussing indie hit rates and long-tail revenues.

[3] Basic portfolio theory texts on mean-variance trade-offs applied to creative industries.