The benefits of Randomization Mechanisms in Counter-Strike: Global Offensive

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February 20, 2019

Loot Boxes

- Many video games have chosen to sell cosmetic alterations to their games using randomization mechanisms called "loot boxes"
- Economic Literature tells us that there is no benefit to randomization for risk-neutral consumers, so the benefit must come from risk-loving consumers.
- What aspect of these lotteries is generating the revenue for the companies selling them?
- How much more revenue-generating is this compared to traditional selling mechanisms?

Why do we care?

- We are interested in discovering what drives this market to feature randomization mechanisms.
- Are consumers inherently more risk-loving when they play video games?
- Is this driven by consumers over-weighting tiny probabilities as cumulative prospect theory suggests?
- Are consumers weighing benefits and losses differently?
- What is the magnitude of these gains from randomization?

The Data

- Contains complete market history for all items sold in the Steam Community Market for *Counter-Strike: Global Offensive*
- Market history is specific to the hour for the last 30 days, specific to the day for the remaining time the item has existed.
- Contains all active buy and sell orders for each of these items as of March 31^{st} 2018.
- Number of active players per day and unique twitch viewers per day

Discrete Choice - Berry (1994)

Utility for these lotteries is quasi-linear

$$u_{ijt} = V(x_{jt}, p_{jt}; \theta) + \xi_{jt} + \epsilon_{ij} \quad \epsilon_{ij} \sim Gumbel$$

Consumers choose the lottery that has the highest utility for them:

$$\Pr(i \to j) = \frac{\exp(V(x_{jt}, p_{jt}; \theta) + \xi_{jt})}{\sum_{k \in \mathcal{F}} \exp(V(x_{jt}, p_{jt}; \theta) + \xi_{kt})}$$

Using an outside option that is normalized so that it has zero utility:

$$\log s_{jt} - \log s_{0t} = V(x_{jt}, p_{jt}; \theta) + \xi_{jt}$$

Cumulative Prospect Theory

- Four main components: Reference dependence, loss aversion, diminishing sensitivity, and probability weighting

$$\Pi_{s_i} = \sum_{j=1}^{s_i} \pi_{s_j}$$

$$v(x) = \begin{cases} x^{\alpha} & x \geq 0 \\ -\lambda(-x)^{\alpha} & x < 0 \end{cases}$$

$$w(P) = \frac{P^{\delta}}{(P^{\delta} + (1-P)^{\delta})^{\frac{1}{\delta}}}$$

$$F(x_i) = [w(\Pi_{s_i}) - w(\Pi_{s_i - 1})]\, v(x_i - p_j - 2.50)$$

Estimation

- Price is determined by intersection of supply and demand and is therefore endogenous
- Instrument with the changes in daily player base from the average number of players

$$\xi_{jt} = \log s_{jt} - \log s_{0t} - V(x_{jt}, p_{jt}; \theta)$$

Using the orthogonality of ξ_{jt} to the instruments and exogenous parameters:

$$\min_{\boldsymbol{\xi}_{j,t}, \xi_{j,t}} \sum_{j,t} \boldsymbol{\xi}'_{j,t} \Omega \boldsymbol{\xi}_{j,t}$$

$$\text{subject to: } \xi_{j,t} = \log s_{jt} - \log s_{0t} - V(x_{jt}, p_{jt}; \theta)$$

$$\boldsymbol{\xi}_{j,t} = \xi_{j,t} \boldsymbol{Z}_{j,t}$$