A Field Experimental Comparison of Races and Tournaments

Notes for our Research

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THE OBJECTIVES OF OUR RESEARCH

Definition of Races & Tournaments

- In a **race**, individuals or groups compete to be first to achieve a particular objective.

- In a **tournament**, individuals or groups compete to carry out the best performance in achieving a particular objective.

Races & Tournaments are wide spread

- Races & tournaments are widely used as a mean to incentivize innovation:

  - **Races**: Longitude Prize (1714), Orteig Prize (1919) Ansari X-Prize (2004), Netflix Prize (2009)

  - **Tournaments**: NIH research grants, Goldcorp Challenge (2001), Super Bowl Ads Challenge (2012), Algorithmic contests on Top Coder, Kaggle, etc.

Key differences in theory

- Key differences:
    - Being “the best ranked” is not enough to win a race, the objective has to be achieved (performance levels matter).
    - Being highly skilled is not enough to win a race, having an early start is also important (complex dynamics of entry/exit).

Why not a tournament with reserve?

- If the key concern is that of having a competition in which performance levels matter, then this can be achieved by simply imposing a minimum-level of performance on a traditional tournament, reserving prizes for those achieving at least a particular score.

- We rarely observe such types of tournaments.

- Races are much more common, why so?

Experimental Design

- We want to compare outcomes of three treatments:
- A **race (R)**
- A **tournament (T)**
- A **tournament with reserve (TWR)**

Theoretical Hypothesis

1. Final performance levels achieved
2. Effect of Group Size
3. Risk preferences
4. Overall efficiency
5. Competition dynamics
6. Experimentation patterns

Hypothesis 1 - Performance

Moldovanu & Sela (2001).

Holding constant the prize structure, we expect that TWR should (weakly) dominate both R and T in terms of the (max) quality of the final outcomes.

There is no clear dominance between R and T.

Hypothesis 2 - Group Size

Effort. As group size increases, there is more effort in T than in R.

Performance. In the limit, when group size is very small (e.g., only one participant) the max outcome of TWR converges to that of R, whereas the max outcome of T is zero. By contrast, when group size is very large (e.g., infinite participation) the max outcome of TWR converges to that of T, whereas the max outcome of R is the threshold.

Hypothesis 3 - Risk preferences

Theory is of no help, but we can make conjectures following List et al. (2014).

The model predicts the same uncertainty on rewards across R, T and TWR (i.e., always the best wins), but the equilibrium level of costs is quite different.

It is also possible that agents obtain more information about rivals during R, and this can reduce uncertainty as well.

Hypothesis 4 - Efficiency

There are two sources of potential inefficiency here.

One kind of inefficiency occurs when the winner is not the competitor with the lowest costs. This type of inefficiency is ruled out by theory in all settings.

There is an other type of inefficiency which is due to “over-investment” and to the fact that high-cost competitors’ efforts are generally wasted (e.g., we are in a second-best world).

Such “over-investment” & “wasted resources” should be lower in TWR and in R than in T, because of a lower level of entry.

Hypothesis 5 - Competition Dynamics

The strategic implications of the dynamic game played by agents in both tournaments & races are not very well understood in general (lack dynamic framework).

One common issue in the literature of patent races, as well as that of dynamic tournaments, is to understand what happens when someone takes the lead during the contest.

We can consider to delay this kind of information (e.g., update the leaderboard periodically, say, every 24h) so as to examine the reactions to one player taking the lead (e.g., as in panel data)

Hypothesis 6 - Experimentation Patterns

It is conceivable that the competitive pressure to be first will lead to different experimentation patterns of the space of possible solutions.

We can consider to have an ex-post survey question about the approaches used to solve the problem.

References

Theoretical Literature

Races: Loury (1979); Lee and Wilde (1980); Reinganum (1983) provide early models of patent races where they assume poisson arrival rate of innovation, and no deadlines (infinite- time horizon). Grossman and Shapiro (1987); Harris and Vickers (1987) consider models of multi-stages patent races, whereby one agent can eventually be ahead in the race, and then rivals can decide whether to try to catch up or exit the competition.

Tournaments: Lazear and Rosen (1981); Green & Stokey (1983) early model of rank-order contests with symmetric contestants and random shocks on the outcomes (static models). Moldovanu & Sela (2001) develop a model of contests with incomplete information on the costs of effort (isomorphic to all-pay auction). Siegel (2009) considers all-pay contest but with complete information.

Experimental Literature

Bull et al. (1987) early laboratory experiment on the theory of tournaments. Orrison et al. (2004) other paper of lab. exp. on tournaments that considers also handicapped players. List et al. (2014) combine field and lab experiments to investigate the role of the size tournaments (based on Green and Stokey, 1983). Boudreau et al. (2014) first paper to estimate from observational data the incomplete information model of Moldovanu and Sela (2001). Dechenaux et al. (2012) survey over 230 experiments on the theory of contests. Zizzo (2001) experiment on races, not in line with theoretical predictions.