

An Empirical Model of R&D Contests: An Analysis of the DoD SBIR Program

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Summary

- ▶ Paper exploits the component of SBIR program related to DoD (Navy) areas of interest to study the effect of competition and investment on R&D process
- ▶ SBIR program funds research by small businesses
- ▶ Objective of this program is to increase availability of innovative products to DoD
- ▶ Funding is allocated on competitive basis, takes into account commercial potential of invention
- ▶ Successful SBIR contests result in products which can be sold to military or in private sector

Model Structure

- ▶ Model links eventual profitability of invention to competitive pressure/incentives and funding provided by SBIR at various contest stages
- ▶ The author formalizes the setting by separating the “surplus” generated by invention into the value and the cost of delivery
- ▶ These components are uncovered sequentially
- ▶ Success and the cost of delivery is stochastically monotone in investment

Model Structure

- ▶ Investment is assumed to be equal to SBIR payment
- ▶ Investment is monotone in value (payment/investment optimality is needed to recover bargaining parameter)
- ▶ The contest results in winning if invention is associated with positive surplus

Contributions

- ▶ Timely effort at thinking about how to optimally structure contests aimed at developing new products
- ▶ Recently see more contests run by government and private firms to develop best design / best innovative concept (Hyperloop Pod competition)
- ▶ Model is designed to take maximum advantage of the limited data
- ▶ Interesting identification strategy: nicely leverages features of bargaining environment in the presence of threshold participation

Some concerns about measurement issues:

- ▶ Value / surplus / profitability:
 - ▶ How do we think of the 'transfer' (third-stage) payment: is it an overall (life-long) profit from investment or is it per unit profit?
 - ▶ Model seems more in line with per unit profit
 - ▶ However, investment may reflect lifelong profitability potential (may take the expected demand for quantity into account)

Some concerns about measurement issues:

- ▶ Value / surplus / profitability:
 - ▶ Invention may have profitability channels which are separate from military uses (private market, contributing factor for other inventions)
 - ▶ Optimal investment may exceed SBIR payment if other uses are possible – a bit worrisome since use investment to recover responsiveness of cost to investment
 - ▶ Social surplus would be mis-measured if this is the case
 - ▶ Maybe useful to refine the set projects (exclude computer games?)

Some concerns about measurement issues:

- ▶ Competitors:
 - ▶ SBIR only finances research by small businesses; 'winning' product may have to compete with product produced by other competitors
 - ▶ This may impact government 'threat' point in bargaining
 - ▶ Important to take into account when thinking about optimal investment
 - ▶ Get a sense of potential competition from non-SBIR DoD acquisitions related to SBIR topics

Some concerns about measurement issues:

- ▶ Selection in the distribution of values
 - ▶ SBIR participation imposes certain restrictions on use of innovation (export is not allowed, free licensing to government of any patent related to innovation)
 - ▶ These restrictions may induce selection into participation
 - ▶ May be important for policy analysis (selection may change if the rules change)

Measure of Social Surplus?

- ▶ 'Losing' ideas may positively contribute to social surplus – result in published knowledge, patents and thus serve as basis for future research
- ▶ If inventions have other uses (not just DoD) even losing invention may be profitable

Alternative Model?

- ▶ If richer data become available it maybe worthwhile to think of an alternative modeling frameworks:
 - ▶ Not unreasonable to expect that the value and cost of delivery are determined simultaneously
 - ▶ Perhaps, in the first stage an informative signal value value is obtained, and it is refined in the second stage when firm works on building a prototype
 - ▶ Investment may still be monotone function of the first stage signal; would need an alternative identification argument since the award depends on actual value rather than signal

Technical Issue

- ▶ Unobserved contest heterogeneity potentially plays an important role in this setting
 - ▶ In the paper contest heterogeneity is captured as a scale effect which impacts value, costs and DoD payments in the same way
 - ▶ Convenient for implementation, other specifications may not be feasible given the data
 - ▶ Worthwhile thinking about other possible specifications, e.g. value and costs may have different scaling factors
 - ▶ Another variable would be needed to control for unobserved heterogeneity in cost distribution – can we use costs estimates submitted by contestants?

Conclusion

- ▶ Interesting and thought-provoking paper
- ▶ Hope to see more research in this area