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)
‘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 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
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