

Designing Scientific Grants

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Science Funding

Traditional markets induce inefficient investment in research

- Nelson (1959), Arrow (1962), Jones and Summers (2021), ...

Widespread agreement **that** research should be funded

- NSF and NIH with annual budget of around USD 58 billion
- Horizon Europe with budget EUR 95.5 billion for 2021-2027

Less obvious **how** to fund; various coexisting instruments

- Prizes, patents, grants, ...

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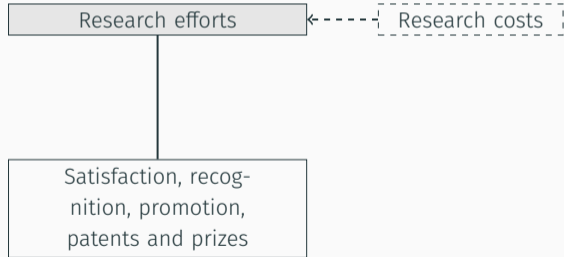
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4. Research findings generate **positive externalities**
 - Ex-post limitations in access to findings (e.g. through patents) undesirable

Overview of Our Perspective





Grant funding



Research efforts

Research costs

Satisfaction, recognition, promotion, patents and prizes



Application decision

Merit and application costs



Funding decision



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Prospective evaluation

Evaluation noise



Funding decision



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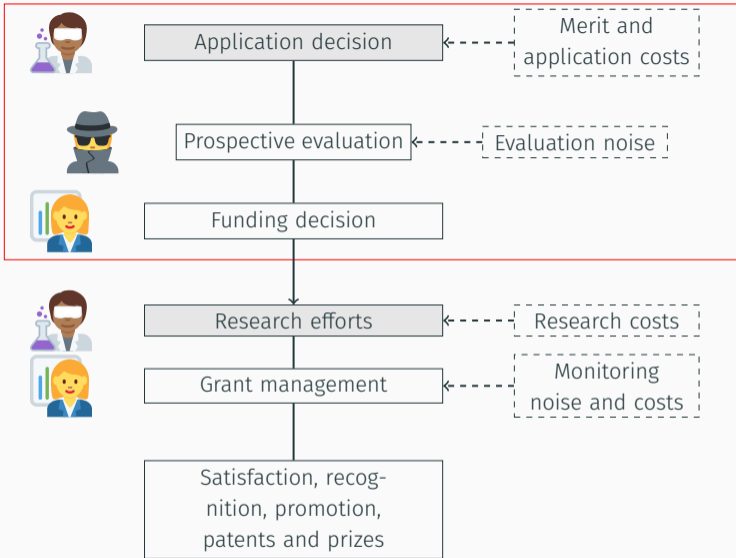
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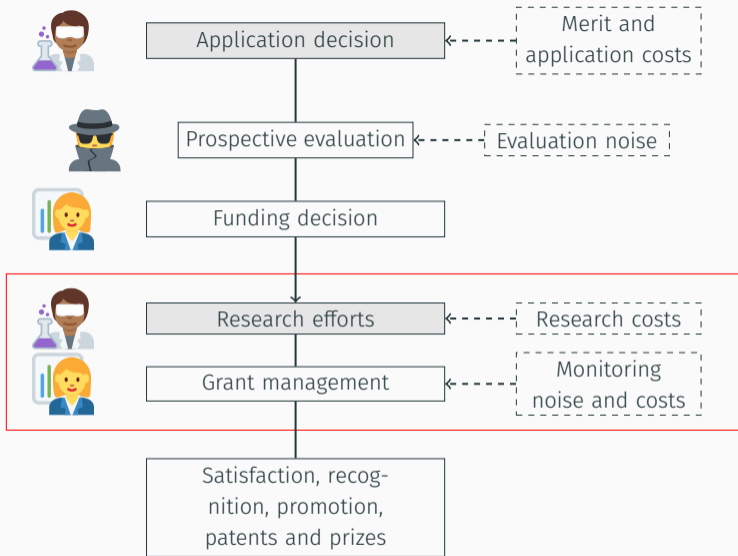


Grant management

Monitoring noise and costs

Satisfaction, recognition, promotion, patents and prizes





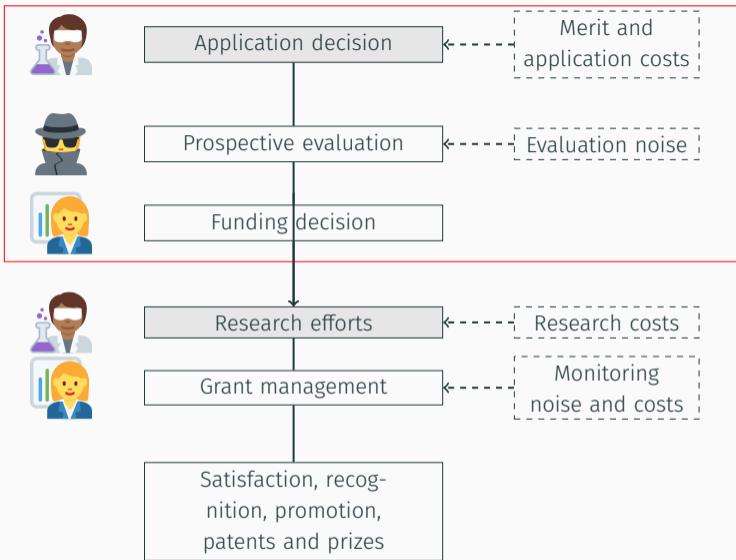
Our Approach to Grant Funding

Interpret these problems as asymmetric information problems:

1. Researchers have more precise information about merit than funder.
→ hidden information models
2. Researchers take actions that are not directly observed/contractible.
→ hidden action models

Insights from information economics and mechanism design about grant funding.

The Application Process



Researchers with **heterogeneous merit**.

Funder wants to fund highest-merit researchers, but:

- funder observes **noisy signal** about merit (e.g., a panel evaluation), and
- funder has **limited budget**.

Timing:

1. Researchers, knowing their merit, apply at a cost.
2. Funder observes signals and decides who receives funding.

Funding and Application Decision

Funder awards grant to applicants evaluated sufficiently positively.

- Better evaluation \Rightarrow higher expected merit
- Funder funds best-evaluated-applicants until budget exhausted.

Funding and Application Decision

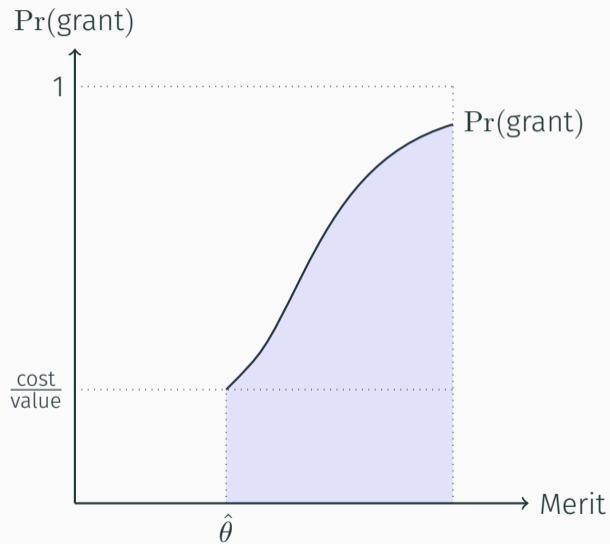
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Researchers apply only if merit is sufficiently high.

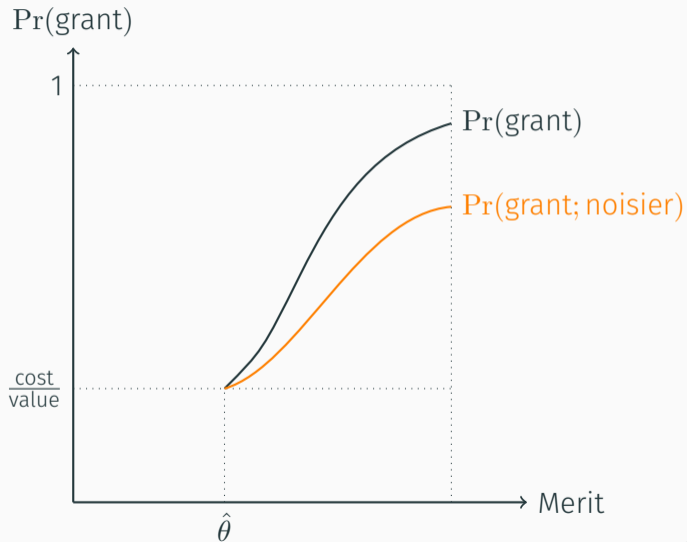
- Higher-merit researchers expect better evaluation \Rightarrow higher grant probability
- Only sufficiently high-merit researchers find application costs worthwhile.

What happens if evaluation becomes noisier?



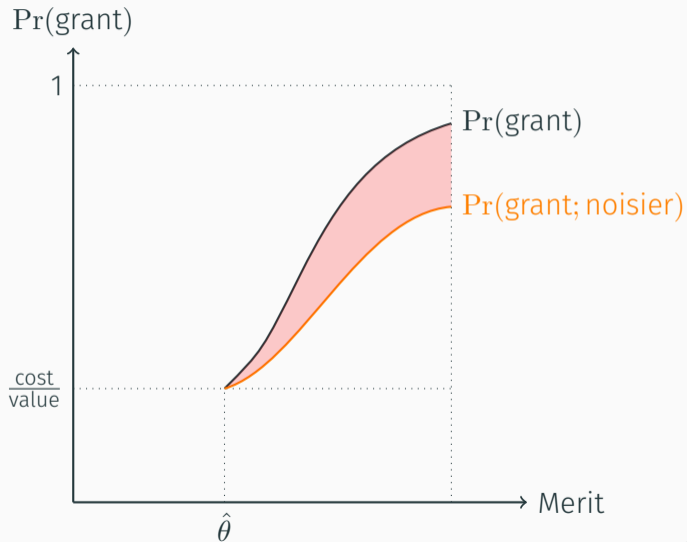
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Less meritocratic evaluation
Applicants' grant probability \downarrow



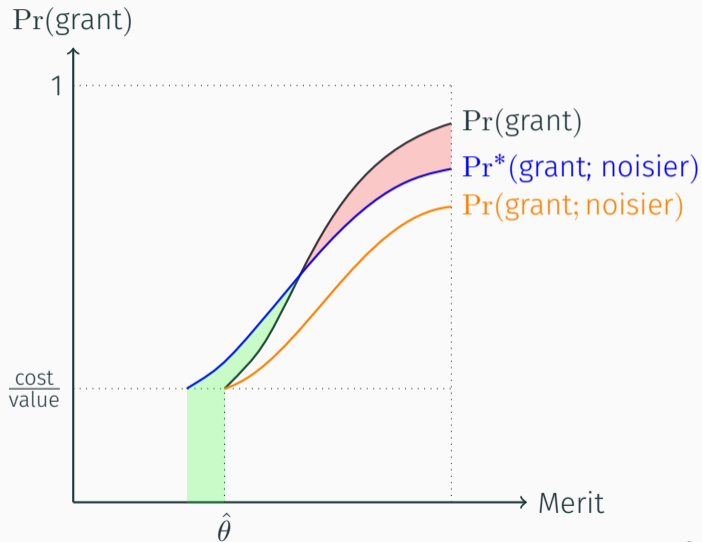
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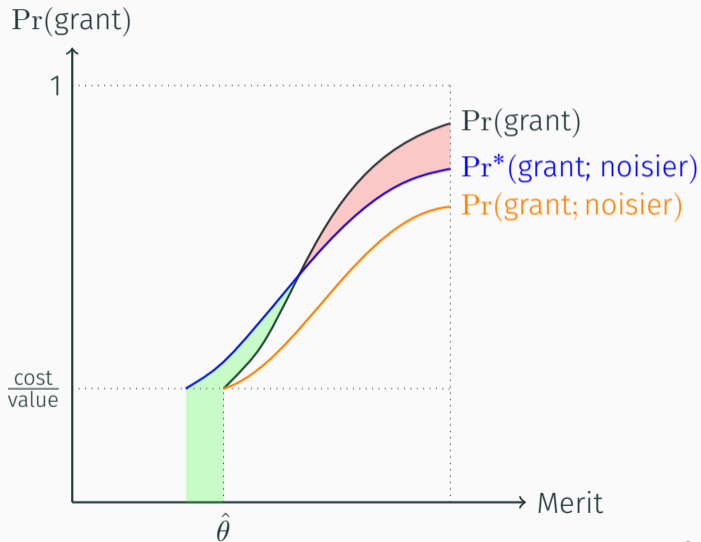
Less meritocratic evaluation

Applicants' grant probability \downarrow

Expected grants below budget

Funder gets more applications

More applications, lower merit



Budget Allocation Across Fields

Many large institutions allocate budgets across fields based on applications.

- For example, NIH and ERC use proportional budget allocation rules.

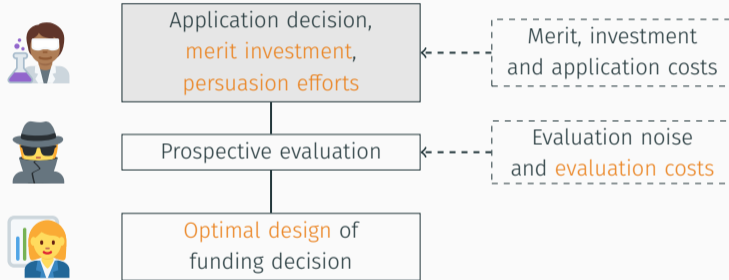
What happens if budget is allocated across fields proportionally to applications?

1. Noisy fields receive more applications than precise fields.
2. Budget of noisy fields increases, budget of precise fields declines.
3. Noisy fields receive more applications, precise fields fewer.

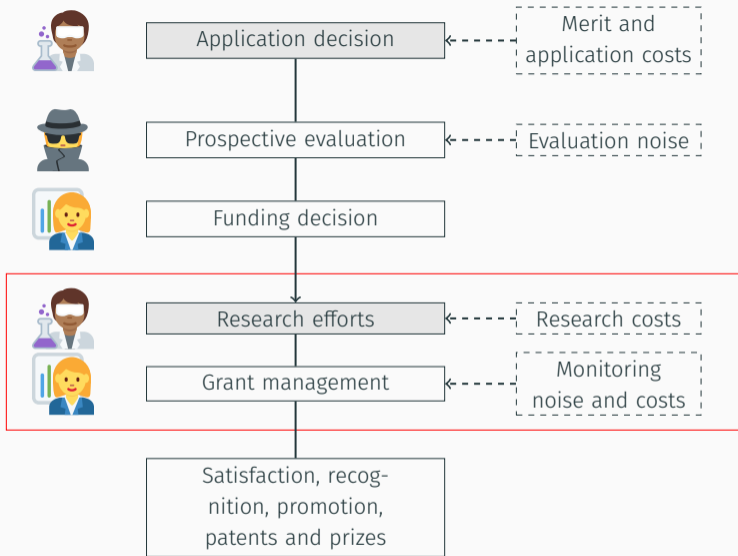
Note. Fields with perfect evaluation might not receive any applications.

Slides/ERCratioTime.pdf

The Application Process — Further Topics



Retrospective Evaluation and Post-Award Management



Grant Management as Hidden Action Problem

After receiving grant, grantee chooses how to use funds.

Potential conflict of interest between grantee and funder.

- Privately optimal action; e.g., continue old agenda
- Socially optimal action; e.g., initiate novel agenda

Conflict arises if:

old agenda \succ_R novel agenda

and

old agenda \prec_F novel agenda

How can funder align incentives of researcher with funder's incentives?

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Suppose funder observes a research outcome that reveals grantee's choice.

- For example, publications related to old agenda.

Funder can introduce tools to affect grantee's incentives; e.g., by

- (temporary) exclusion from future grant calls (Maurer & Scotchmer, 2004),
- splitting grant into stages.

If well-designed, grantee's incentives align with funder's preferences:

old agenda – **punishment** $<_R$ novel agenda
and old agenda $<_F$ novel agenda.

Takeaways and Open Questions

Randomization/Lotteries

- Provide incentives for honest applications
- Allow economizing on evaluation costs
- May interfere with incentives to investment in merit.

Staging of grant and temporary exclusion from future calls

- Tool for funder to align incentives of grantee and funder; for example
 1. mitigate consequences of hidden action problem
 2. provide incentives for honest applications

Open Questions

