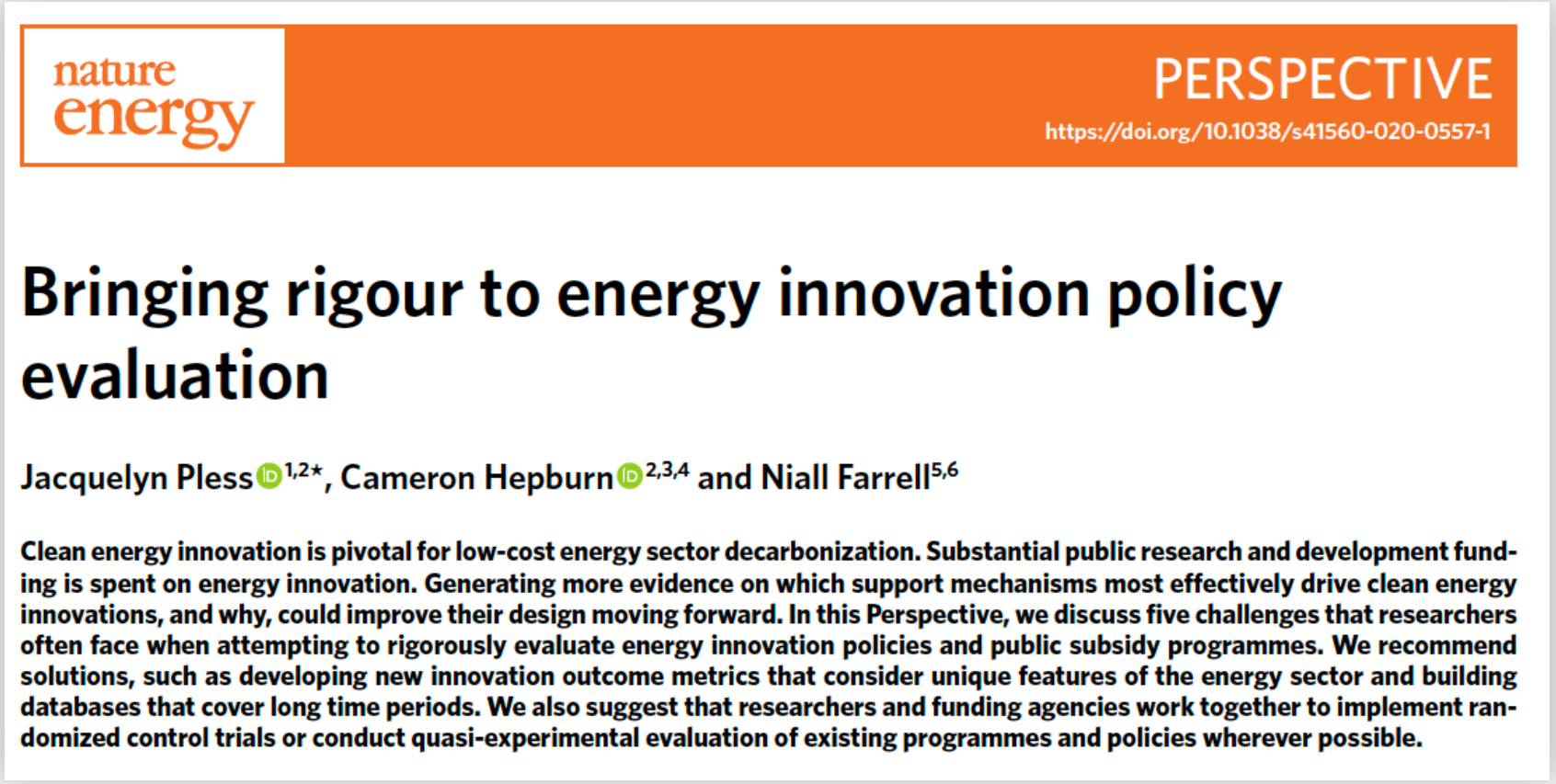
Randomization, Correlation, and **Somewhere in Between?**

Jacquelyn Pless

MIT Sloan School of Management

May 23, 2023

Shameless self-promotion



nature energy

PERSPECTIVE

https://doi.org/10.1038/s41560-020-0557-1

Bringing rigour to energy innovation policy evaluation

Jacquelyn Pless[1,2*], Cameron Hepburn[2,3,4] and Niall Farrell[5,6]

Clean energy innovation is pivotal for low-cost energy sector decarbonization. Substantial public research and development funding is spent on energy innovation. Generating more evidence on which support mechanisms most effectively drive clean energy innovations, and why, could improve their design moving forward. In this Perspective, we discuss five challenges that researchers often face when attempting to rigorously evaluate energy innovation policies and public subsidy programmes. We recommend solutions, such as developing new innovation outcome metrics that consider unique features of the energy sector and building databases that cover long time periods. We also suggest that researchers and funding agencies work together to implement randomized control trials or conduct quasi-experimental evaluation of existing programmes and policies wherever possible.

Randomized Controlled Trials (RCTs):
the "gold standard" for estimating **causal effects**

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Often barriers to RCTs in energy innovation settings or worries that they're impractical **but….**

Successes in other big, capital-intensive, heavily regulated industry contexts

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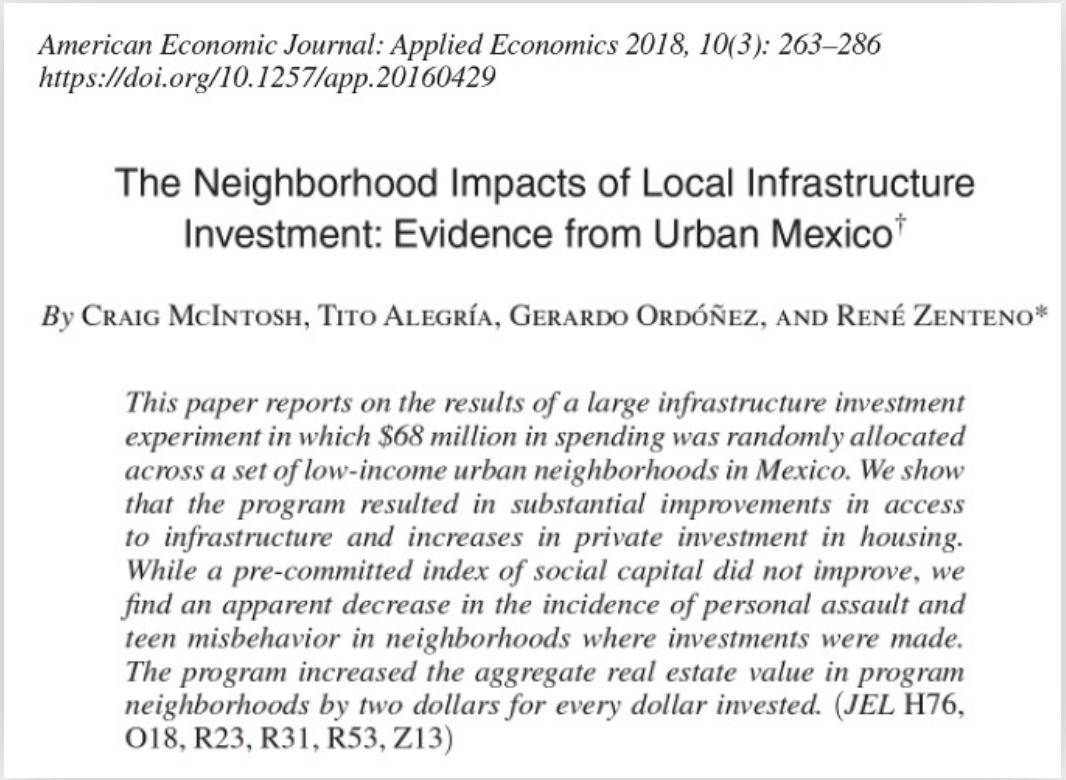
American Economic Journal: Applied Economics 2018, 10(3): 263–286
https://doi.org/10.1257/app.20160429

The Neighborhood Impacts of Local Infrastructure Investment: Evidence from Urban Mexico†

By Craig McIntosh, Tito Alegría, Gerardo Ordóñez, and René Zenteno*

This paper reports on the results of a large infrastructure investment experiment in which $68 million in spending was randomly allocated across a set of low-income urban neighborhoods in Mexico. We show that the program resulted in substantial improvements in access to infrastructure and increases in private investment in housing. While a pre-committed index of social capital did not improve, we find an apparent decrease in the incidence of personal assault and teen misbehavior in neighborhoods where investments were made. The program increased the aggregate real estate value in program neighborhoods by two dollars for every dollar invested. (*JEL* H76, O18, R23, R31, R53, Z13)

Successes in other big, capital-intensive, heavily regulated industry contexts



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$68m in infrastructure investment randomly allocated to poor neighborhoods in Mexico

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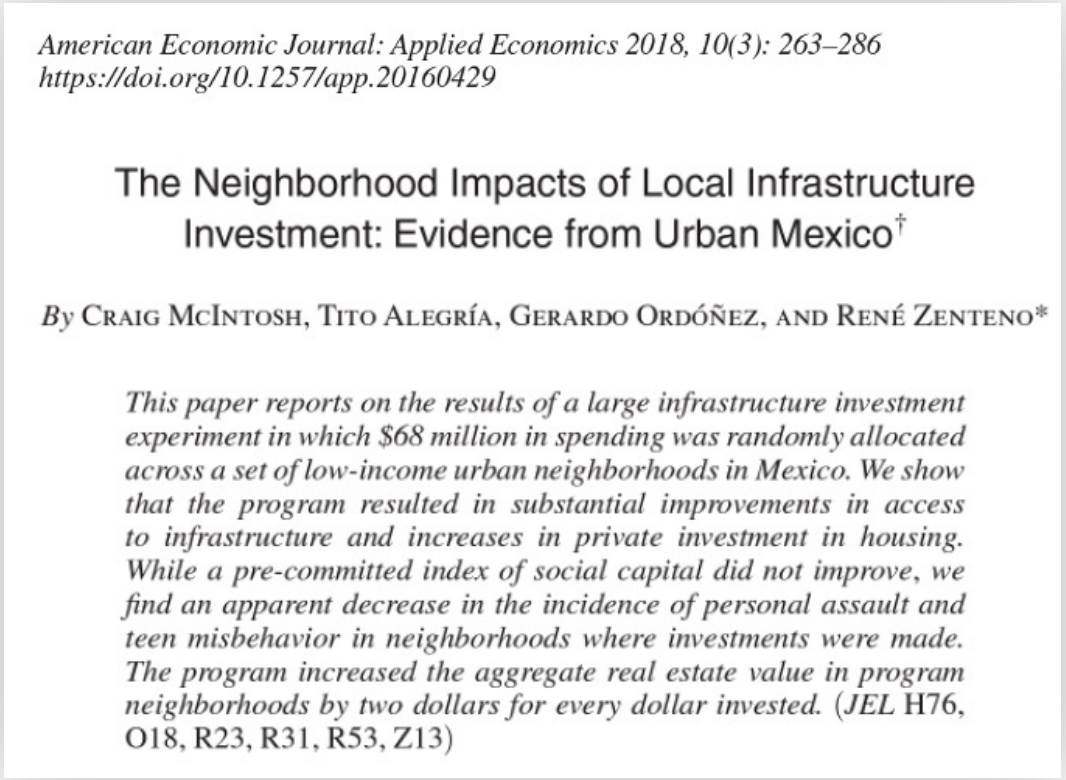

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Detailed HH survey on outcomes

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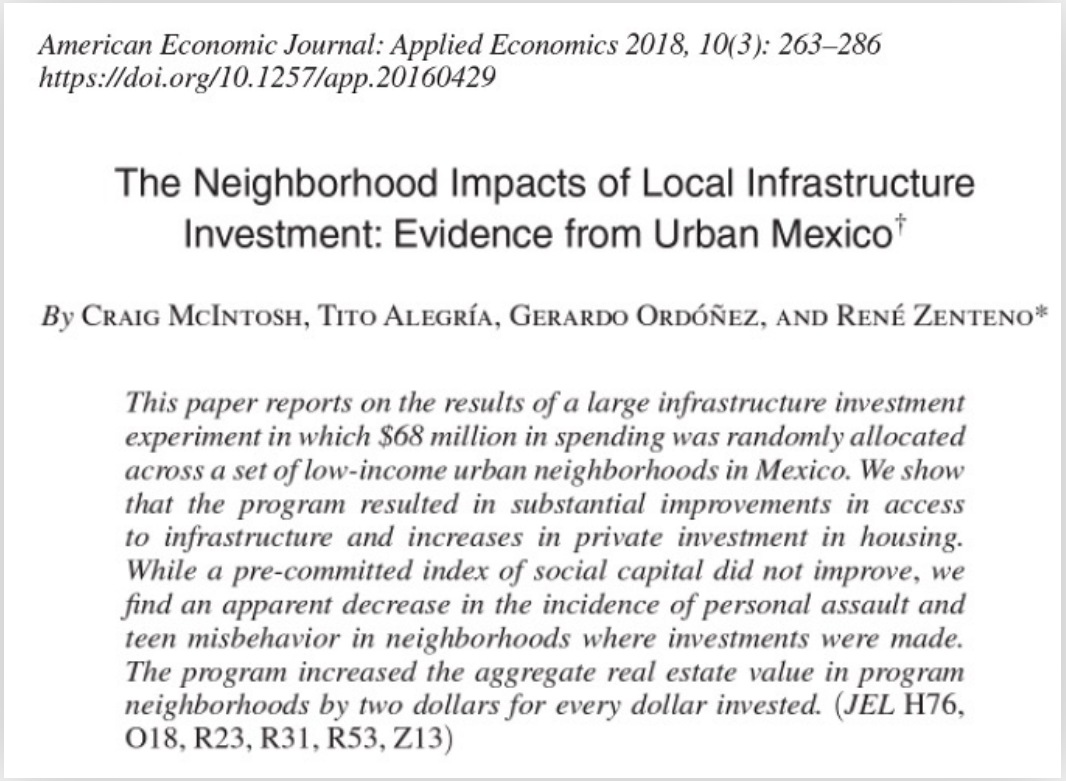

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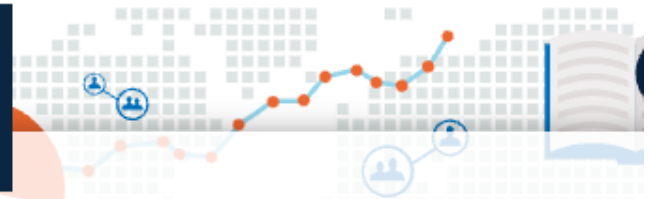
$68m in infrastructure investment randomly allocated to poor neighborhoods in Mexico

Detailed HH survey on outcomes

Large improvements in infrastructure quality index (that the researchers committed as core outcome upfront)

IGL Trials Database

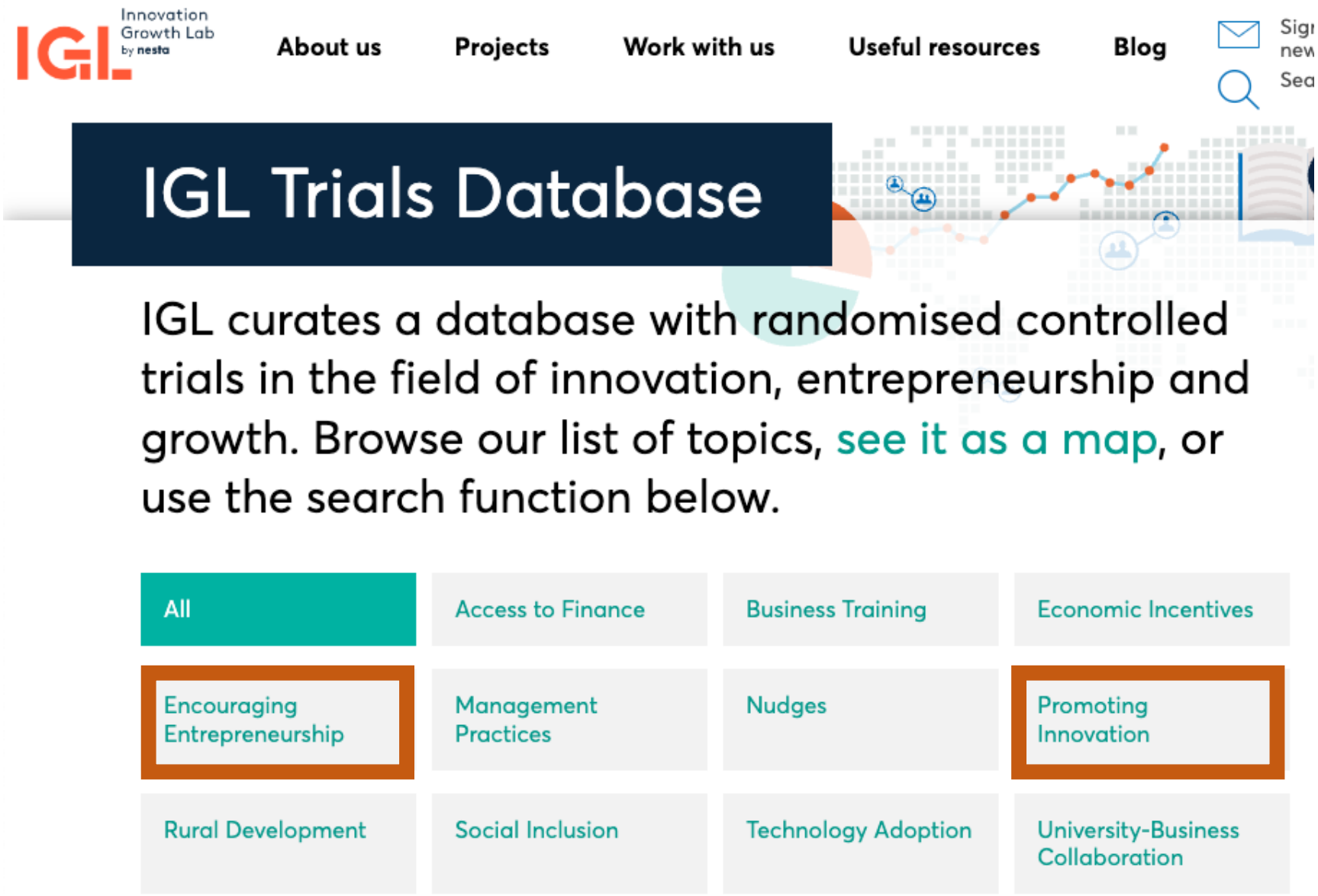


IGL curates a database with randomised controlled trials in the field of innovation, entrepreneurship and growth. Browse our list of topics, see it as a map, or use the search function below.

All | Access to Finance | Business Training | Economic Incentives

Encouraging Entrepreneurship | Management Practices | Nudges | Promoting Innovation

Rural Development | Social Inclusion | Technology Adoption | University-Business Collaboration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Can vary features to learn about ***why*** some programs and policies "work" (to inform **program design**)

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The Effects of Prize Structures on Innovative Performance

Graff Zivin, J., Lyons, E.

This paper compares how two common incentive schemes affect innovative performance in a field experiment run in partnership with a large life sciences company.

Organizing for Entrepreneurship: Field-Experimental Evidence on the Performance Effects of Autonomy in Choosing Project Teams and Ideas

Boss, V., Ihl, C., Dahlander, L., Jayaraman, R.

Quasi-experimental approaches

Can take advantage of **other quirks** (intentional or not) and/or can **proactively embed** them

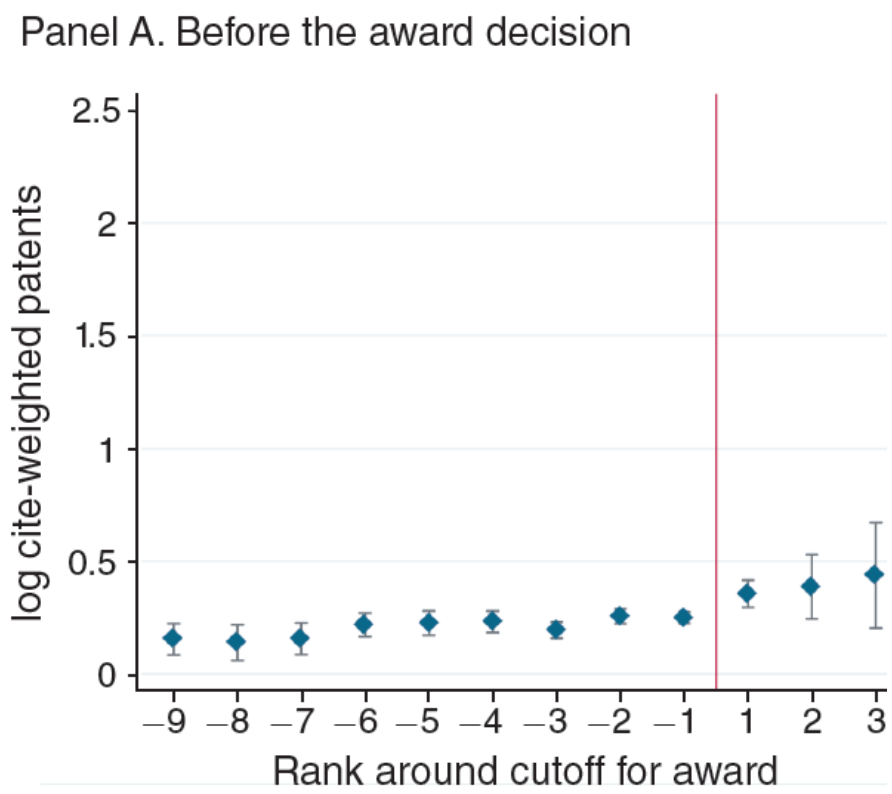
American Economic Review 2017, 107(4): 1136–1164
https://doi.org/10.1257/aer.20150808

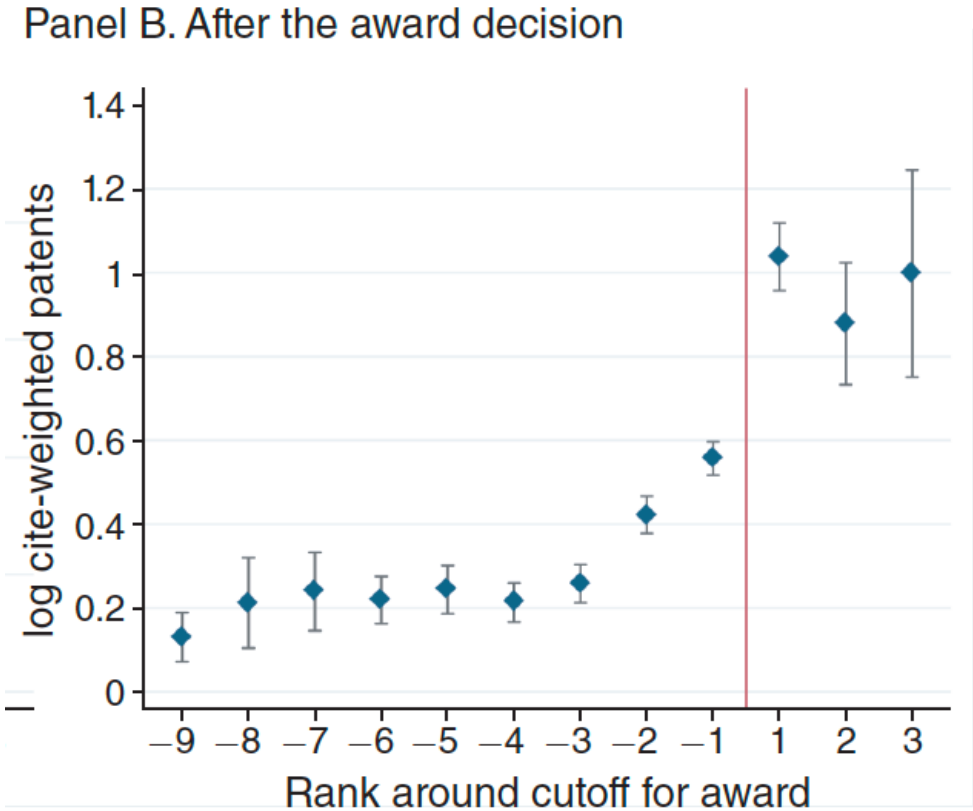
Financing Innovation: Evidence from R&D Grants†

By SABRINA T. HOWELL*

Governments regularly subsidize new ventures to spur innovation. This paper conducts the first large-sample, quasi-experimental evaluation of R&D subsidies. I use data on ranked applicants to the US Department of Energy's SBIR grant program. An early-stage award approximately doubles the probability that a firm receives subsequent venture capital and has large, positive impacts on patenting and revenue. These effects are stronger for more financially constrained firms. Certification, where the award contains information about firm quality, likely does not explain the grant effect. Instead, the grants are useful because they fund technology prototyping. (*JEL* D22, G24, G32, L53, O31, O34, O38)

Howell (2017) compares outcomes of those just **above/below ranking cutoff** determining funding





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Develop and implement **data collection** and management processes upfront (data on both **outcomes** and **inputs**)

What can funders do to enable rigorous analyses? Important measures to take **upfront**

Can (should?) **embed** "random" variation in program design

Define **objectives** and identify potential **intermediate outcome proxies** upfront

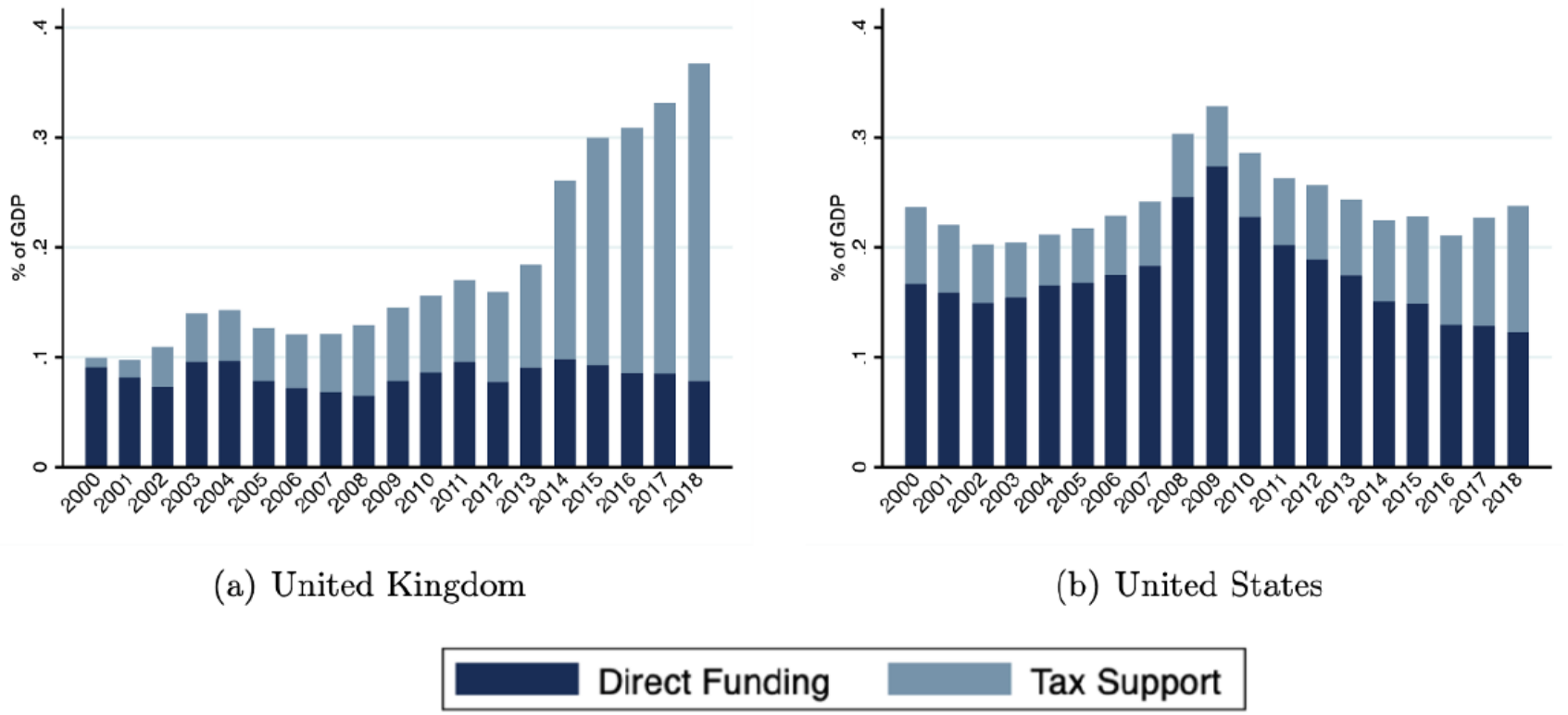
Develop and implement **data collection** and management processes upfront (data on both **outcomes** and **inputs**)

To extent possible, **track** outcomes of **both winners and losers**, but still can do some things **w/o data on losers** as well…

Estimating effects w/o data on “losers”?

Estimating effects w/o data on “losers”? Example from studying policy interactions

R&D subsidies come in **various forms**



(a) United Kingdom

(b) United States

Note: Created using data from the OECD Main Science and Technology Indicators database.

Estimating **policy *interaction* effects** is not easy but also not impossible

Are "Complementary Policies" Substitutes? Evidence from R&D Subsidies in the UK

Jacquelyn Pless*

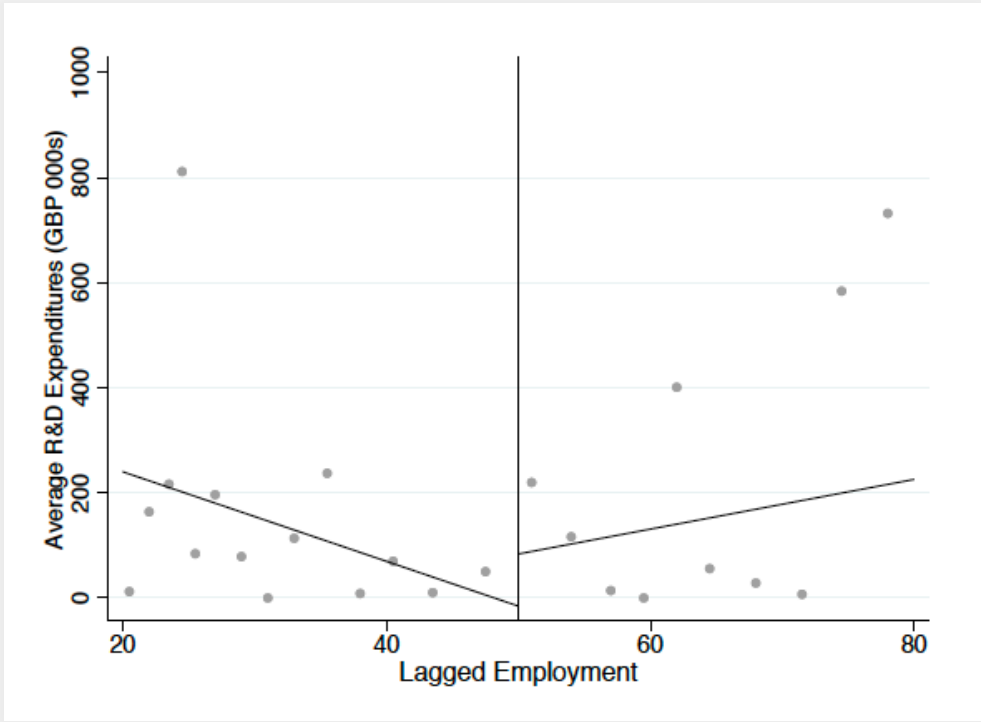
June 1, 2022

Abstract

Governments often subsidize private R&D using both grants and tax incentives. This paper studies whether they are complements or substitutes. I take a difference-in-discontinuities approach to examine small firms in the United Kingdom and find that increasing tax credit generosity enhances the effect of

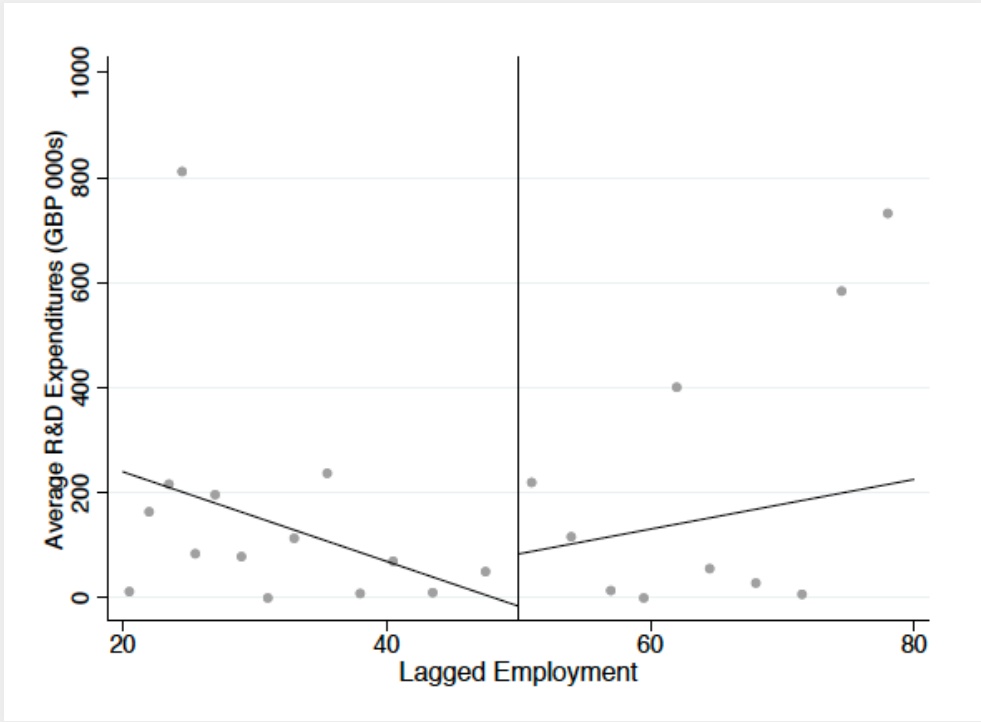
Difference-in-discontinuity design:

Difference-in-discontinuity design: grants and tax credits in the UK found to be **complements** for ***small* firms**



Grant funding effect on R&D with **lower tax credit** (2008-2012)

Difference-in-discontinuity design: grants and tax credits in the UK found to be **complements** for ***small* firms**



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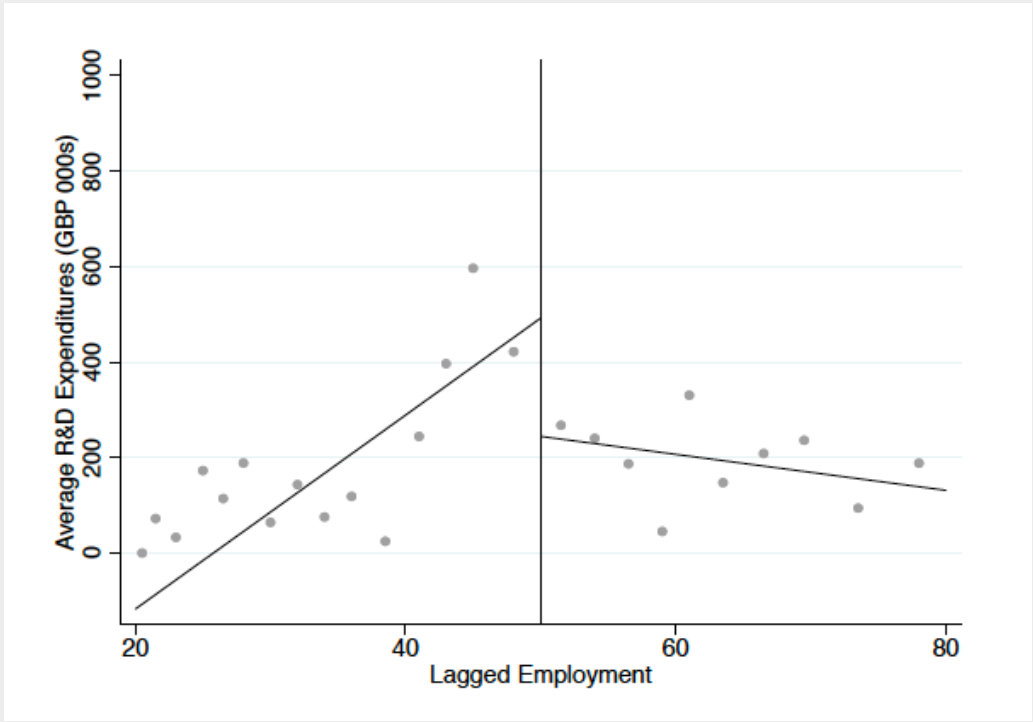

Grant funding effect on R&D with **higher tax credit** (2013-2017)

Takeaway #1: can be proactive upfront to **embed quasi-experimental variation** and develop processes to systematically **collect data** on **inputs** and **outcomes**.

Takeaway #2: evaluation helpful not just for understanding causal effect of $$ but also informing **program and policy *design*** (the "why")

Thank you!

Jacquelyn Pless
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