



BERKELEY INITIATIVE FOR TRANSPARENCY
IN THE SOCIAL SCIENCES

Research
Transparency
in the Social
Sciences
Christensen

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Ethical
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Registrations
Publication Bias
Registrations

Pre-Analysis
Plans
P-Hacking
Pre-Analysis Plan

Replication
Project Protocol,
Reporting Standards
Workflow
Version Control
Data Sharing
Conclusion

Research Transparency in the Social Sciences

Garret Christensen¹

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Berkeley Initiative for Transparency in the Social Sciences
Berkeley Institute for Data Science

IDB, March 2018
Slides available online at

<http://www.github.com/BITSS/IDBMarch2018>



Outline

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ICPSR



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Ethical Research

- Transparency is part of being an ethical researcher.
- Scientific values espoused by Robert Merton (Merton 1942):
 - Universalism: anyone can make a claim regardless of status.
 - Communism: open sharing of knowledge.
 - Disinterestedness: truth as motivation, not financial gains (COI).
 - Organized skepticism: peer review, replication.



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Ethical Research

- Fraud exists (Simonsohn 2013), but mostly we should admit that we're human, subject to bias and motivated reasoning, transparency can help with this (Nosek, Spies, Motyl 2012).
- Those of us who run experiments or use data with personal identifying information should take IRBs seriously as part of transparency (Ch. 11–13 Morton & Williams 2010, Desposato 2014).



Ethical Research

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Why we worry:

- (Anderson, Martinson, De Vries 2007)
- (John, Loewenstein, Prelec 2011)

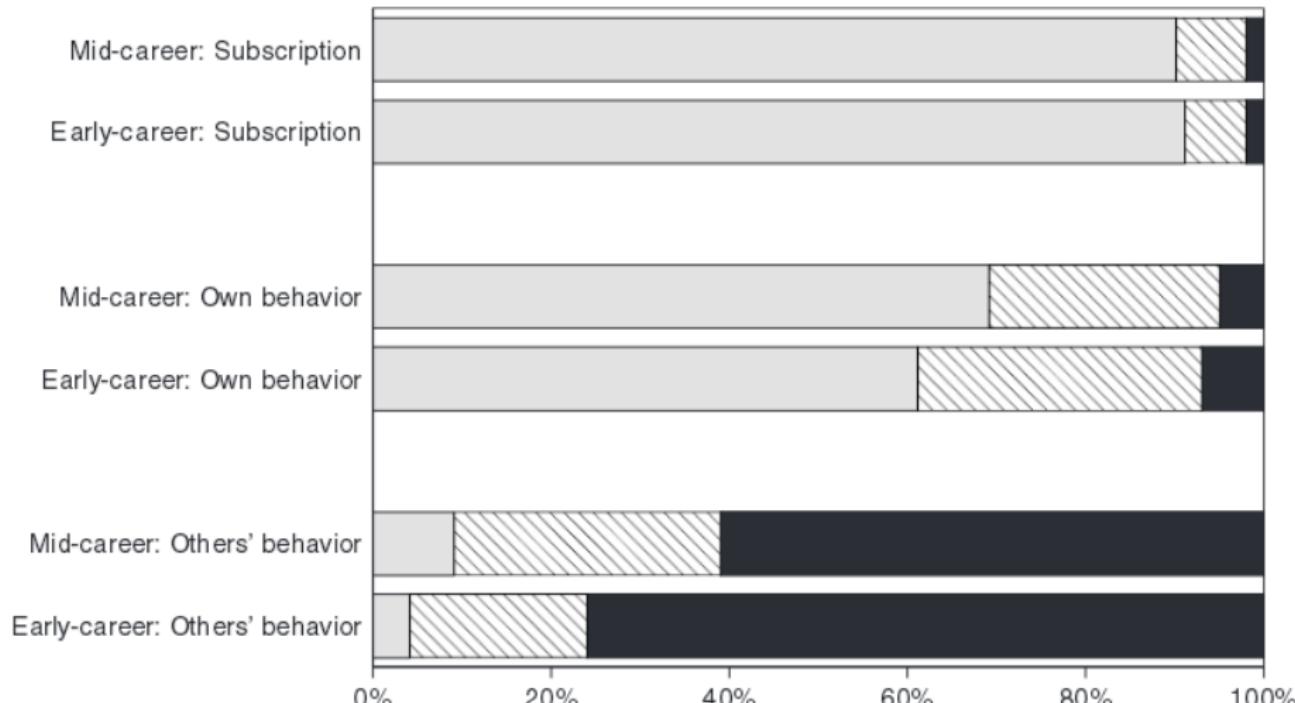


FIG. 3. Norm versus Counternorm Scores: Percent with Norm > Counternorm (dotted), Norm = Counternorm (striped), Norm < Counternorm (solid).

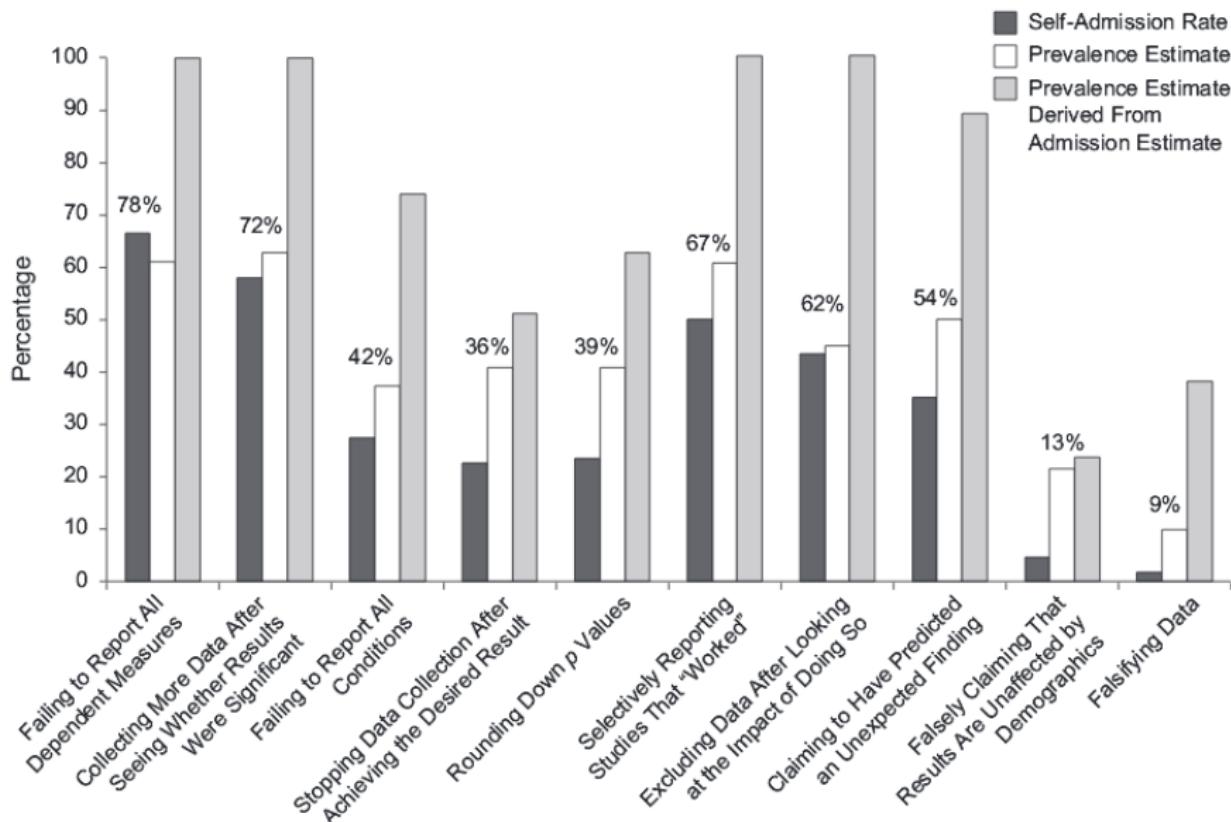


Fig. 1. Results of the Bayesian-truth-serum condition in the main study. For each of the 10 items, the graph shows the self-admission rate, prevalence estimate, prevalence estimate derived from the admission estimate (i.e., self-admission rate/admission estimate), and geometric mean of these three percentages (numbers above the bars). See Table I for the complete text of the items.



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Publication Bias

Existence of the problem:

- Effect sizes diminish with sample size (Gerber, Green, Nickerson 2001)
- There is a higher fraction of rejected hypothesis tests in social compared to hard sciences (Fanelli 2010).
- Published null results are disappearing over time, in all disciplines (Fanelli 2011).
- Data on the complete set of experiments run shows strong results are 40pp more likely to be published, and 60pp more likely to be written up. The file drawer problem is large. (Franco, Malhotra, Simonovits 2014)



All Fields

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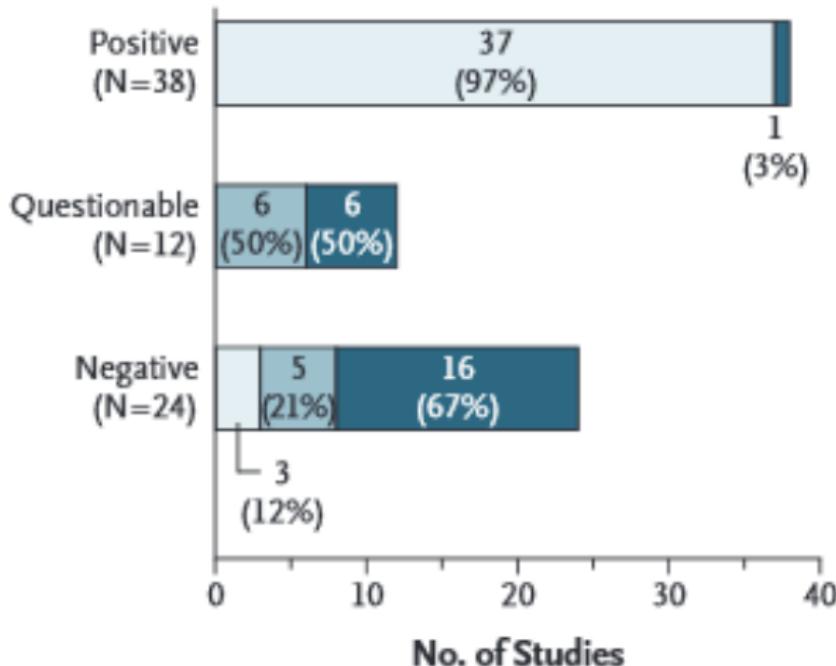
Conclusion

- Medicine: (Turner et al. 2008)
- Social Sciences: (Franco, Malhotra, Simonovits 2014)
- Economics: (Brodeur et al. 2016)
- Sociology: (Gerber and Malhotra 2008)
- Political Science: (Gerber and Malhotra 2008)

- Published, agrees with FDA decision
- Published, conflicts with FDA decision
- Not published

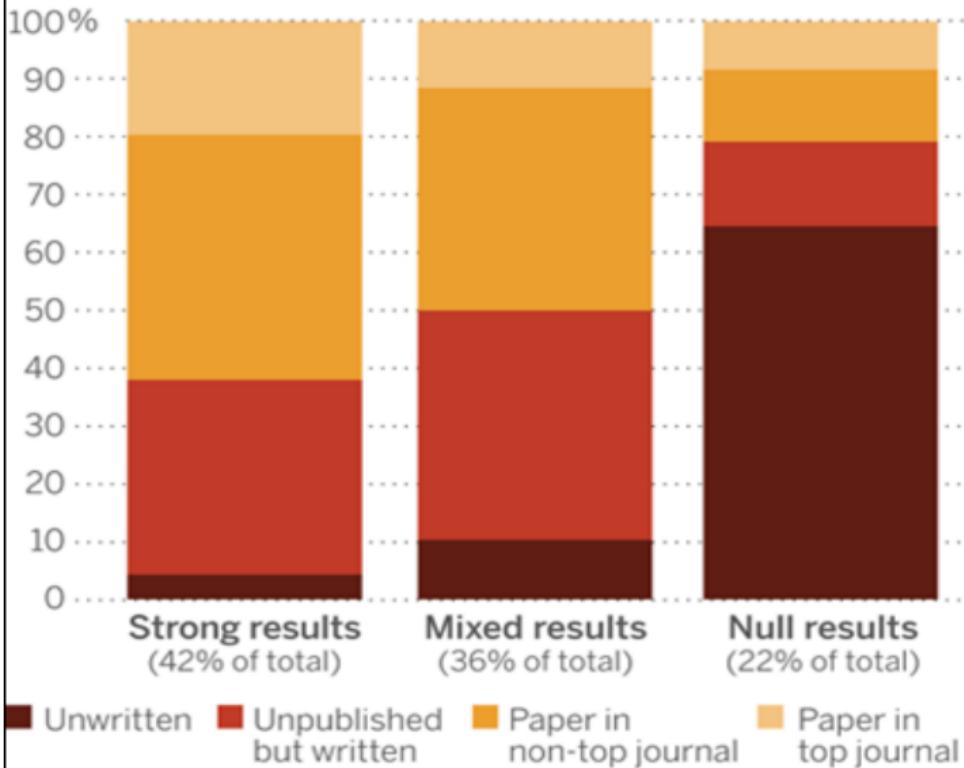
A Studies (N=74)

FDA Decision



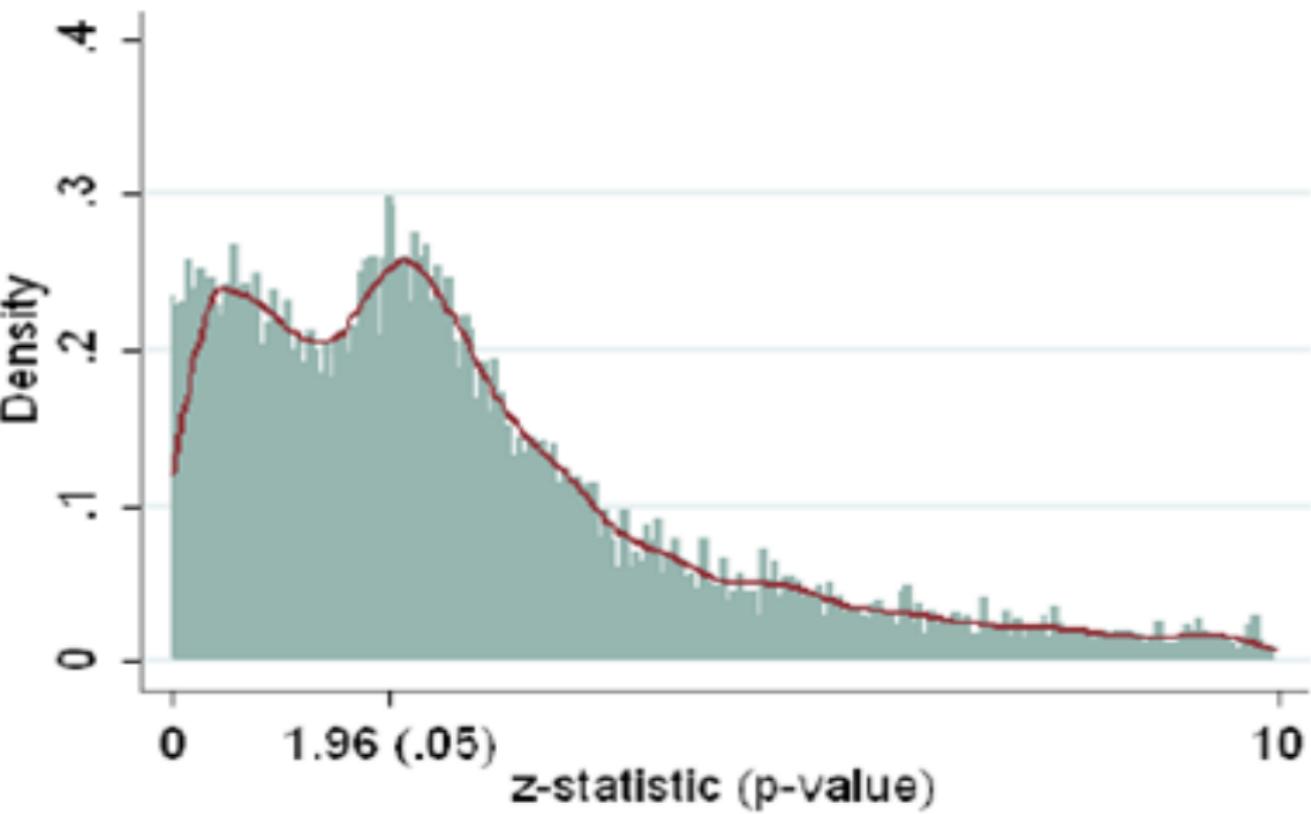
Most null results are never written up

The fate of 221 social science experiments

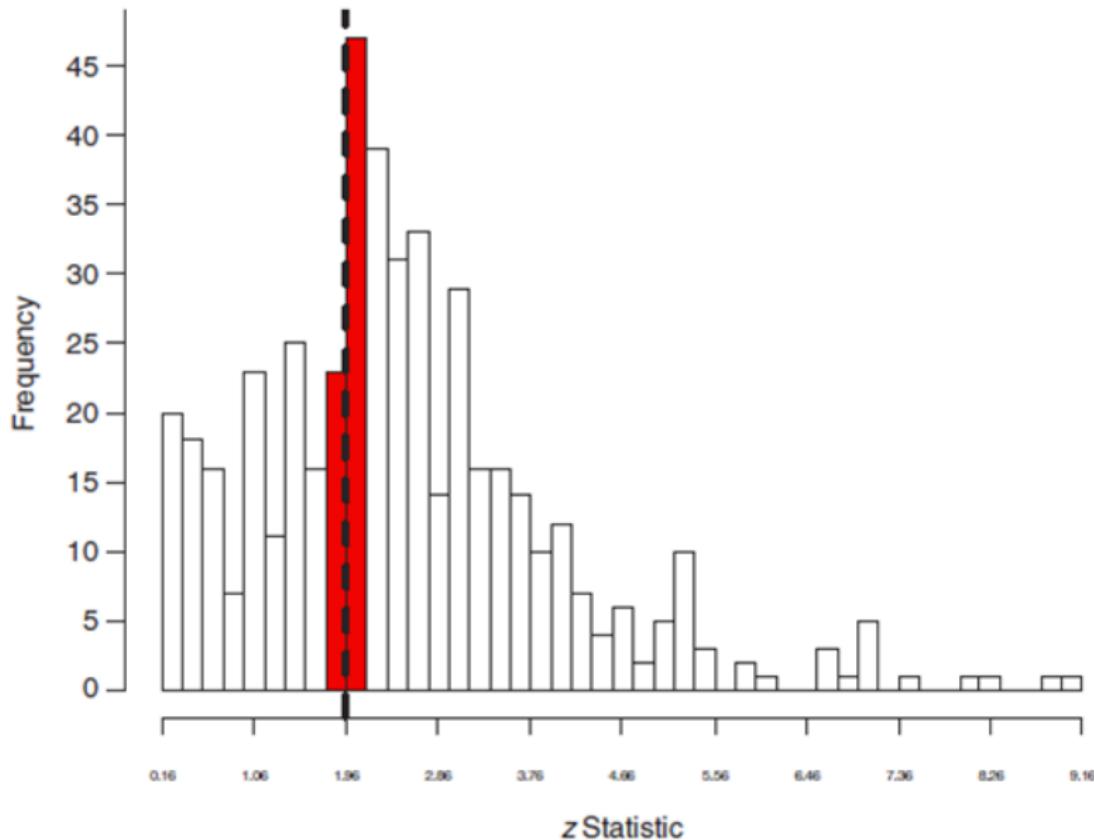


Source: A. Franco et al., *Science* (28 August)

(b) Unrounded distribution of z-statistics.



Histogram of z Statistics From the *American Sociological Review*, the *American Journal of Sociology*, and *The Sociological Quarterly* (Two-Tailed)



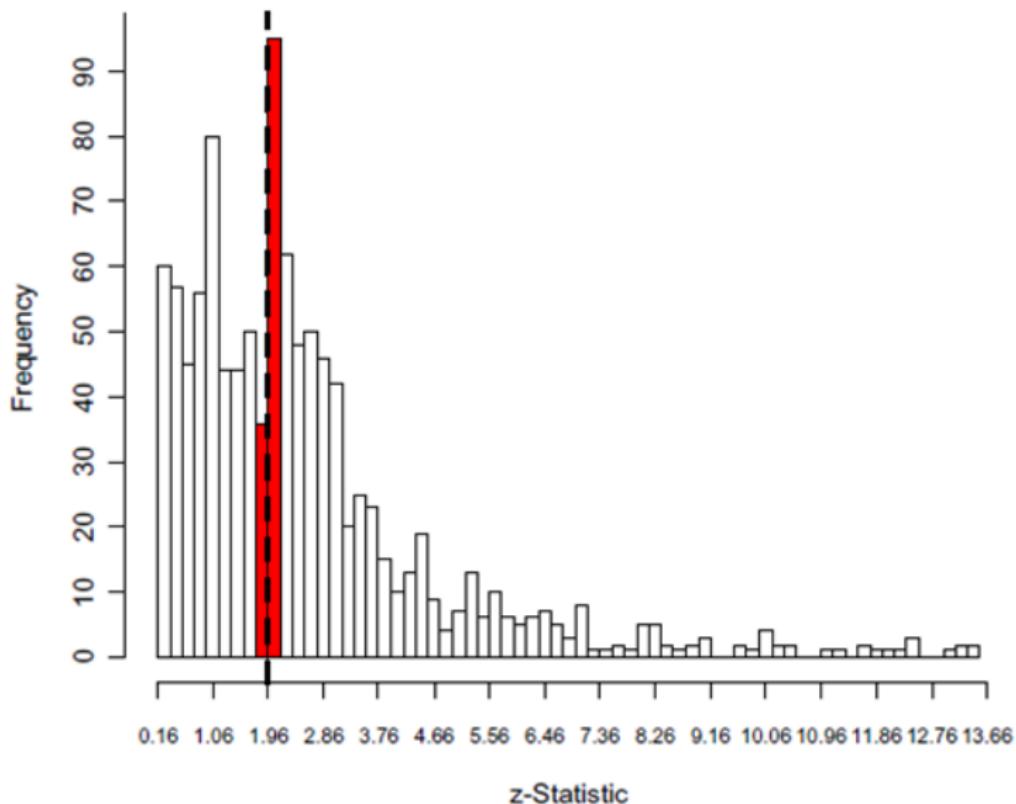


Figure 1(a). Histogram of z -statistics, *APSR* & *AJPS* (Two-Tailed). Width of bars (0.20) approximately represents 10% caliper. Dotted line represents critical z -statistic (1.96) associated with $p = 0.05$ significance level for one-tailed tests.



Publication Bias

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If we only write up/publish significant results, and we have no record of all the insignificant results, we have no way to tell if our ‘significant’ results are real, or if they’re the 5% we should expect due to noise.



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Registration

Registration as Solution to Publication Bias:

- Publicly stating all research you will do, what hypotheses you will test, prospectively.
- Near universal adoption in medical RCTs. Top journals (ICMJE) won't publish if it's not registered.
<http://clinicaltrials.gov>
- Even better if registry requires outcomes from after study. Currently limited, but NIH is moving on this.



Registration

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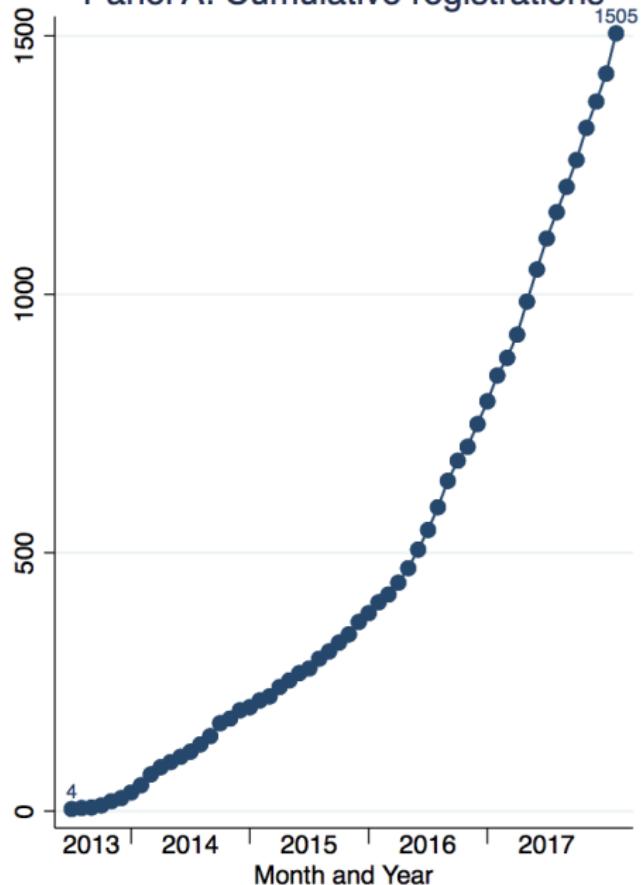
Data Sharing

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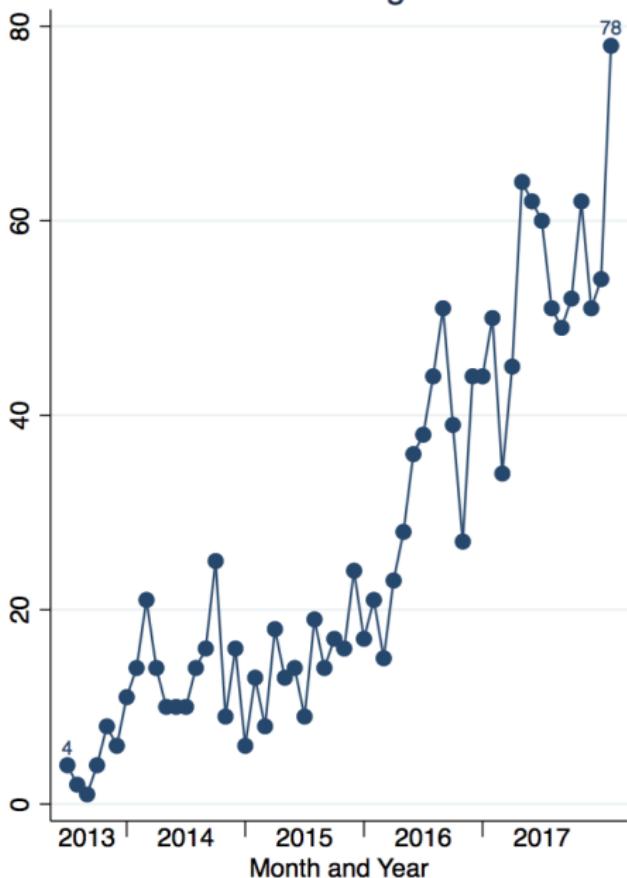
Newer to social sciences, but:

- AEA registry, currently only for RCTs.
<http://socialscienceregistry.org>
- EGAP registry
<http://egap.org/design-registration>
- 3ie registry, for developing country evaluations.
<http://ridie.3ieimpact.org>
- Open Science Framework
<http://osf.io>
 - Open format
 - Will soon sync with above
- Simple: <http://aspredicted.org>

Panel A: Cumulative registrations



Panel B: New registrations





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Design-Based Publication

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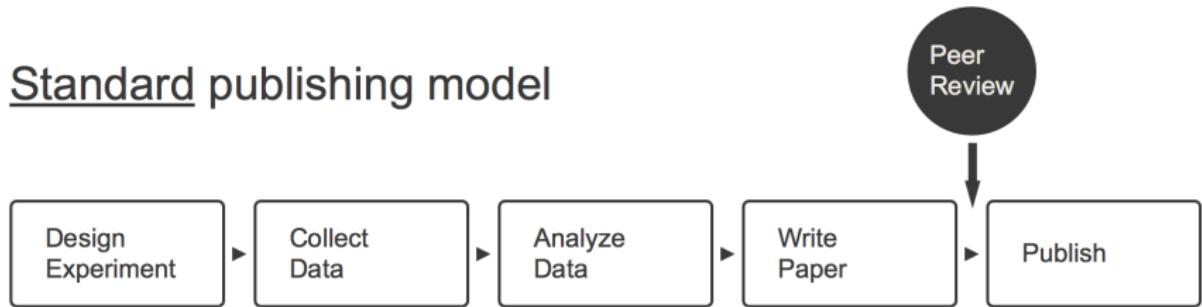
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AKA Registered Reports, moves peer review before data gathering, results, and analysis.

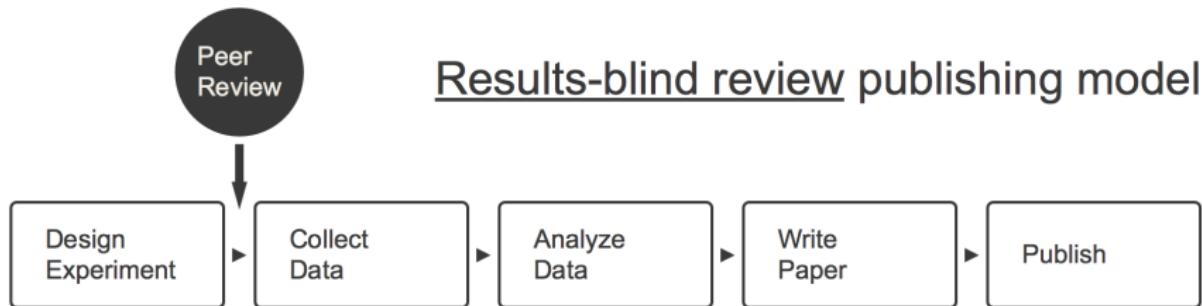
- 1 Design a project
- 2 Submit
- 3 Reviewed based on importance of question and quality of design
- 4 Get in-principle acceptance
- 5 Follow through, and nulls get published

75 Journals, 20 more with Special Issues [Link](#)

Standard publishing model



Results-blind review publishing model





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Review & Submit

[Guide for Authors](#)

Enter Manuscript Information

To begin, select an issue from the dropdown list.

Issue:

Select an article type from the dropdown list. Enter the required information into the fields that then appear.

Article Type:

- Select Article Type
- Full Length Article
- Registered Report Stage 2: Full Article
- Registered Report Stage 1: Proposal



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Power & Meta-Analysis

- Many studies are underpowered. (Ioannidis, Stanley, Doucouliagos 2017) Low power leads to false negatives *and* false positives. (Ioannidis 2005)
- Adjust for multiple hypothesis testing.
- Combine and synthesize results systematically with meta-analysis

Organizations:

- Cochrane Collaboration (Medicine)
- Campbell Collaboration (Policy)
- What Works Clearinghouse (US Gov't, Education)
- CLEAR (US Gov't, Labor)
- MAER-NET (Economics)

THE POWER OF BIAS IN ECONOMICS RESEARCH*

John P. A. Ioannidis, T. D. Stanley and Hristos Doucouliagos

We investigate two critical dimensions of the credibility of empirical economics research: statistical power and bias. We survey 159 empirical economics literatures that draw upon 64,076 estimates of economic parameters reported in more than 6,700 empirical studies. Half of the research areas have nearly 90% of their results under-powered. The median statistical power is 18%, or less. A simple weighted average of those reported results that are adequately powered ($\text{power} \geq 80\%$) reveals that nearly 80% of the reported effects in these empirical economics literatures are exaggerated; typically, by a factor of two and with one-third inflated by a factor of four or more.

Statisticians routinely advise examining the power function, but economists do not follow the advice.

McCloskey (1985, p. 204)



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Meta-Analysis

Tools:

- Funnel plots of sample size vs. effect size or precision (Card & Krueger 1995)
- Funnel Asymmetry Test (Stanley & Doucouliagos 2012)
- P-curve (Simonsohn et al. 2014)
 - ▶ Online App
 - One for all P-checker
 - ▶ Shiny App

P-Hacking

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Define the problem:

- Also called fishing, researcher degrees of freedom, or data-mining.
- Definition: flexibility in data analysis allows portrayal of *anything* as below an arbitrary p-value threshold; significance loses its meaning.
- Not something only evil people do. It's subconscious, or simply built into statistics (Gelman, Loken 2013).



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P-Hacking is fun!

- “Science isn’t Broken” —538 journalism piece with interactive demo [Link](#)
- Train your p-hacking skills R/Shiny App. [Link](#)
- An Exact Fishy Test [Link](#)

ONE DATA SET, MANY ANALYSTS

Twenty-nine research teams reached a wide variety of conclusions using different methods on the same data set to answer the same question (about football players' skin colour and red cards).

78.7*

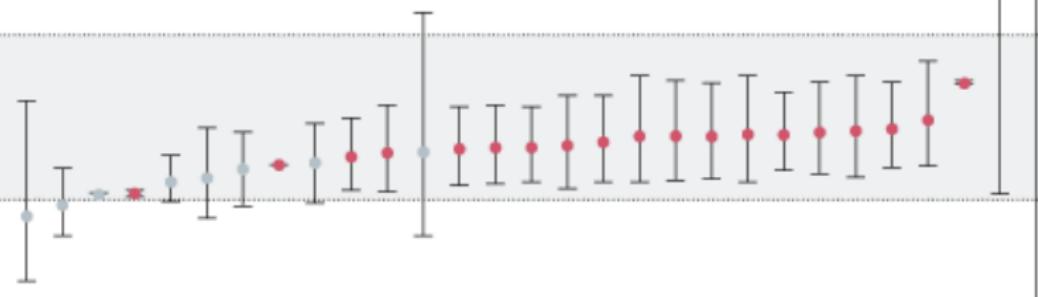
115*

Dark-skinned
players four times
more likely than
light-skinned
players to be
given a red card.

- Statistically significant effect
- Non-significant effect

Twice as likely

Equally likely



Point estimates and 95% confidence intervals. *Truncated upper bounds.



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Pre-Analysis Plan

Explain the solution:

- From 3ie: “A pre-analysis plan is a detailed description of the analysis to be conducted that is written in advance of seeing the data on impacts of the program being evaluated. It may specify hypotheses to be tested, variable construction, equations to be estimated, controls to be used, and other aspects of the analysis. A key function of the pre-analysis plan is to increase transparency in the research. By setting out the details in advance of what will be done and before knowing the results, the plan guards against data mining and specification searching. Researchers are encouraged to develop and upload such a plan with their study registration, but it is not required for registration.”



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Origin: FDA's Guidance for Industry

“E9 Statistical Principles for Clinical Trials” (1998) Link

§V Data Analysis Considerations

- 1 Prespecification of the Analysis
- 2 Analysis Sets
- 3 Missing Values and Outliers
- 4 Data Transformation
- 5 Estimation, Confidence Intervals, and Hypothesis Testing
- 6 Adjustment of Significance and Confidence Levels
- 7 Subgroups, Interactions, and Covariates
- 8 Integrity of Data and Computer Software Validity



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Glennerster, Takavarasha Suggestions

Running Randomized Evaluations

- 1 the main outcome measures,
- 2 which outcome measures are primary and which are secondary,
- 3 the precise composition of any families that will be used for mean effects analysis,
 - Explain mean effects, FWER, FDR using Anderson (JASA 2008).
- 4 the subgroups that will be analyzed,
- 5 the direction of expected impact if we want to use a one-sided test, and
- 6 the primary specification to be used for the analysis.



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McKenzie Suggestions

World Bank Development Impact Blog

- 1 Description of the sample to be used in the study
- 2 Key data sources
- 3 Hypotheses to be tested throughout the causal chain
- 4 Specify how variables will be constructed
- 5 Specify the treatment effect equation to be estimated
- 6 What is the plan for how to deal with multiple outcomes and multiple hypothesis testing?
- 7 Procedures to be used for addressing survey attrition
- 8 How will the study deal with outcomes with limited variation?
- 9 If you are going to be testing a model, include the model
- 10 Remember to archive it

Examples

- J-PAL Hypothesis Registry (11), see <http://www.povertyactionlab.org/Hypothesis-Registry>
6 published papers:
 - Sierra Leone CDD, Oregon Medicare, Turkey Job Training, El Salvador TOMS, two in Indonesia (Olken et al.)
 - Psychology: Hawkins, Fitzgerald, Nosek—Conception Risk and Prejudice

Wide range of when exactly to write and how detailed to make the plan. At the extreme level of detail you would have your entire code already written before you got any data.

Outcome variable	(1) Mean for controls	(2) Treatment effect
Panel A: GoBifo “weakened” institutions		
Attended meeting to decide what to do with the tarp	0.81	-0.04 ⁺
Everybody had equal say in deciding how to use the tarp	0.51	-0.11 ⁺
Community used the tarp (verified by physical assessment)	0.90	-0.08 ⁺
Community can show research team the tarp	0.84	-0.12*
Respondent would like to be a member of the VDC	0.36	-0.04*
Respondent voted in the local government election (2008)	0.85	-0.04*
Panel B: GoBifo “strengthened” institutions		
Community teachers have been trained	0.47	0.12 ⁺
Respondent is a member of a women’s group	0.24	0.06**
Someone took minutes at the most recent community meeting	0.30	0.14*
Building materials stored in a public place when not in use	0.13	0.25*
Chiefdom official did not have the most influence over tarp use	0.54	0.06*
Respondent agrees with “Responsible young people can be good leaders” and not “Only older people are mature enough to be leaders”	0.76	0.04*
Correctly able to name the year of the next general elections	0.19	0.04*



THE PREREGISTRATION CHALLENGE

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- Debated in public health/epidemiology.
- Difficult, but not impossible, to verifiably pre-specify.
- Example: Government data releases
- Example: Minimum Wage (Neumark 2001)
- Example: US, Italian Elections

The Employment Effects of Minimum Wages: Evidence from a Prespecified Research Design

DAVID NEUMARK*

This article presents evidence on the employment effects of recent minimum wage increases from a prespecified research design that entailed committing to a detailed set of statistical analyses prior to “going to” the data. The limited data to which the prespecified research design can be applied may preclude finding many significant effects. Nonetheless, the evidence is most consistent with disemployment effects of minimum wages for younger, less-skilled workers.

NOVEMBER 8, 2016. WHAT REALLY HAPPENED?

[REGISTER A DESIGN \(closed\)](#)

[OFFICIAL RULES](#)

[GET TWITTER UPDATES](#)

An opportunity for scholars studying elections:

- Preregister a research design for a study of the 2016 general election using ANES data *before* the data are publicly released. **UPDATE (3/31/17): ANES DATA RELEASED.** **THE REGISTRY IS CLOSED. THANK YOU FOR YOUR PARTICIPATION!**
1. **Submit an article including this design to a participating journal**, which will consider your submission *before* data are available.
 2. **Win a cash award for publishing your article.**

Replication

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- 1 Lack of replicability in code:**
 - 1986: JMJC Project
 - 2018: Gertler, Galiani, Romero
- 2 Also a lack of replicability in experiments: Camerer et al 2016, Many Labs, Reproducibility Project: Psychology**
- 3 Project Protocol, Reporting Standards**
- 4 Organizing Workflow**
- 5 Code & Data Sharing**

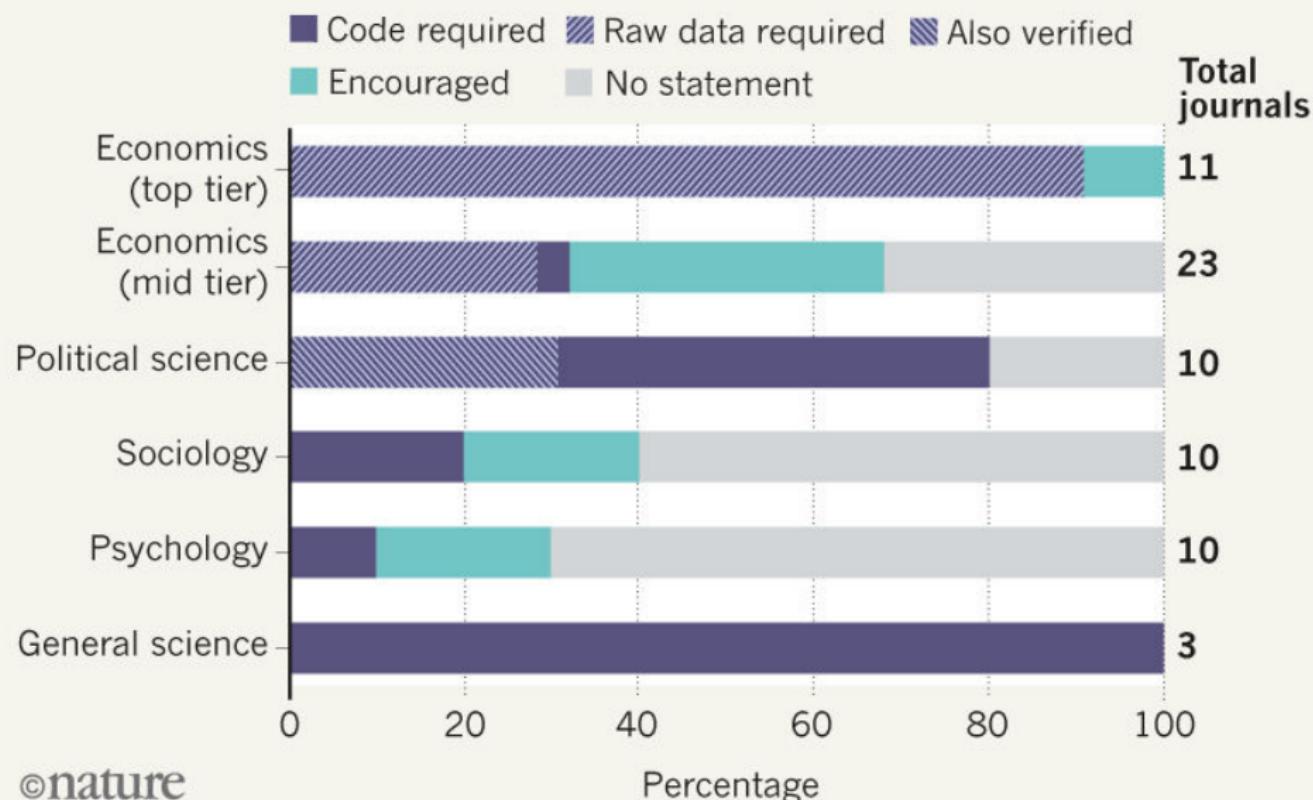
Replication in Empirical Economics: The *Journal of Money, Credit and Banking* Project

*By WILLIAM G. DEWALD, JERRY G. THURSBY, AND RICHARD G. ANDERSON**

This paper examines the role of replication in empirical economic research. It presents the findings of a two-year study that collected programs and data from authors and attempted to replicate their published results. Our research provides new and important information about the extent and causes of failures to replicate published results in economics. Our findings suggest that inadvertent errors in published empirical articles are a commonplace rather than a rare occurrence.

DATA CHECKED?

In a survey of 67 journals, most of the political-science and top-tier economics titles required authors to submit software code and data to editors before publication. Journals in sociology and psychology rarely did so.

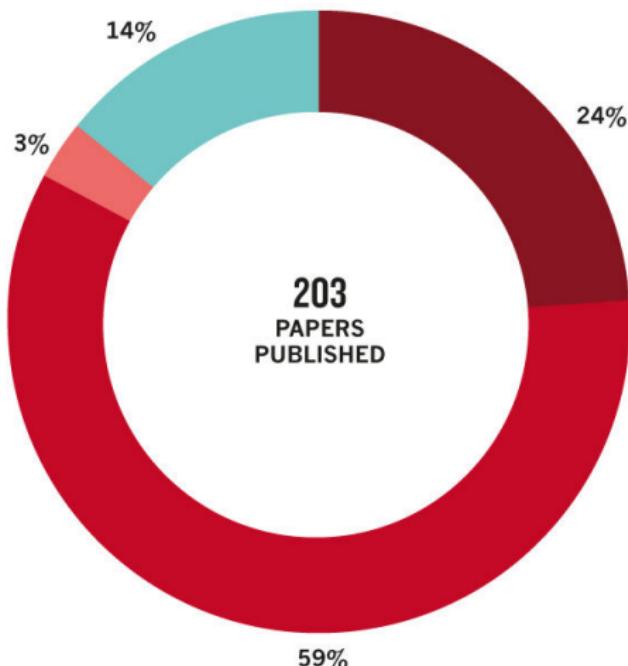


REPLICATION RARELY POSSIBLE

An analysis of 203 economics papers found that fewer than one in seven supplied the materials needed for replication.

ELEMENTS PROVIDED*:

- None ■ One or more missing
- All, code doesn't run ■ All, code runs



*The elements assessed were raw data, raw code, estimation data and estimation code.



An economics study featuring a performance by Robin Williams failed to replicate after the actor's death.

Bonnie Schiffman/Touchstone/The Kobal Collection

About 40% of economics experiments fail replication survey

By John Bohannon | Mar. 3, 2016, 2:00 PM

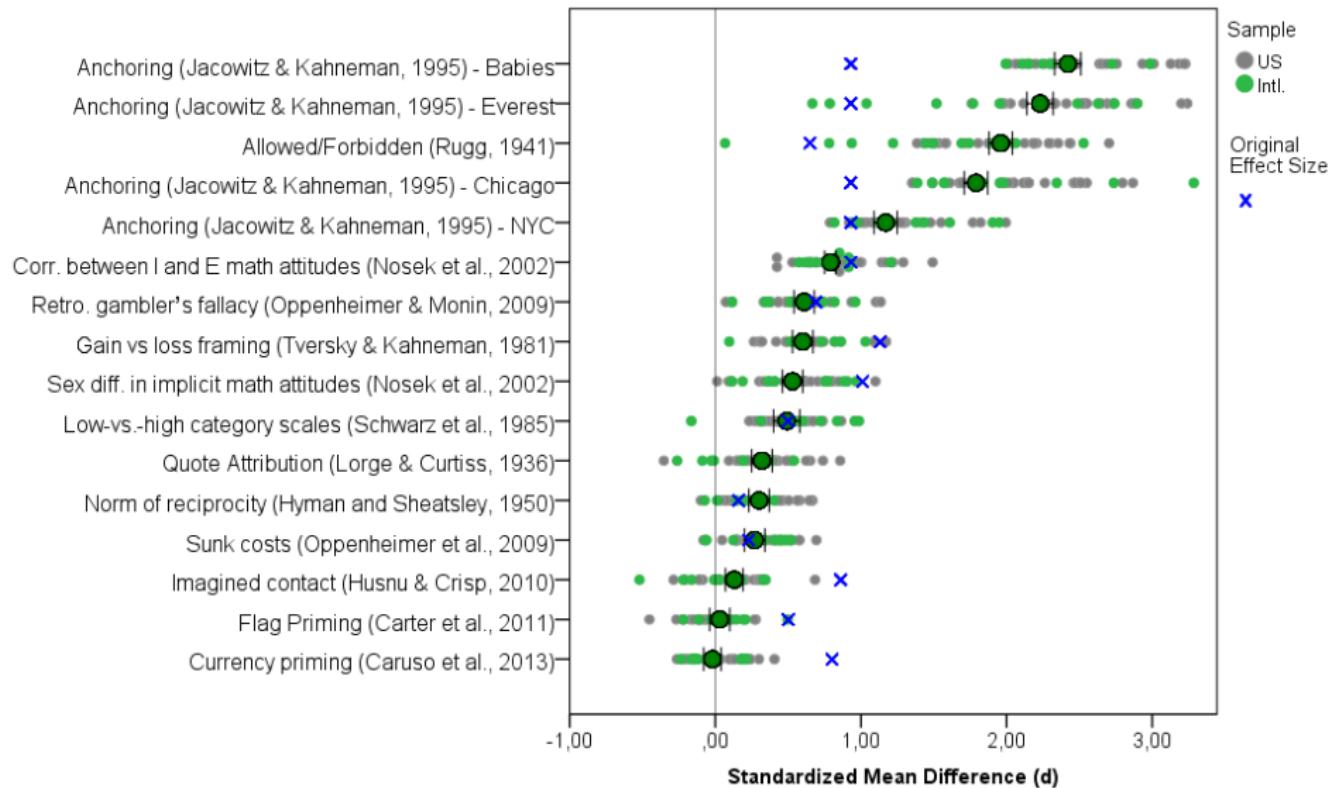
Another social science looks at itself

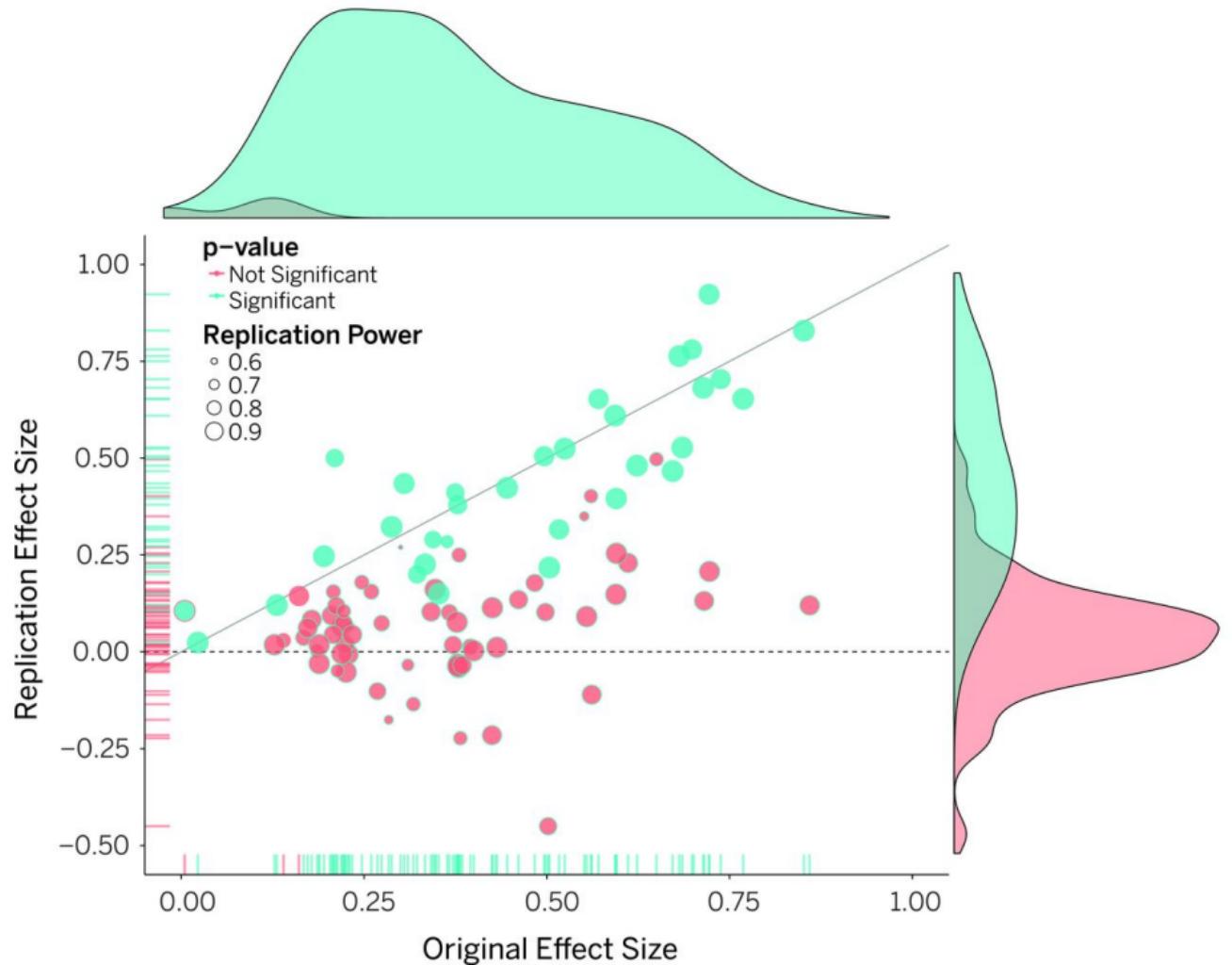
Experimental economists have joined the reproducibility discussion by replicating selected published experiments from two top-tier journals in economics. Camerer *et al.* found that two-thirds of the 18 studies examined yielded replicable estimates of effect size and direction. This proportion is somewhat lower than unaffiliated experts were willing to bet in an associated prediction market, but roughly in line with expectations from sample sizes and P values.

Science, this issue p. 1433

Abstract

The replicability of some scientific findings has recently been called into question. To contribute data about replicability in economics, we replicated 18 studies published in the *American Economic Review* and the *Quarterly Journal of Economics* between 2011 and 2014. All of these replications followed predefined analysis plans that were made publicly available beforehand, and they all have a statistical power of at least 90% to detect the original effect size at the 5% significance level. We found a significant effect in the same direction as in the original study for 11 replications (61%); on average, the replicated effect size is 66% of the original. The replicability rate varies between 67% and 78% for four additional replicability indicators, including a prediction market measure of peer beliefs.





Project Protocol, Reporting Standards

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Make sure you report everything another researcher would need to replicate your research.

- Find the appropriate reporting standard for your field and follow it: <http://www.equator-network.org>
- Report the nuts and bolts of the project implementation in a detailed protocol:
<http://www.spirit-statement.org>
- Transparency and Openness Promotion (TOP) Guidelines: <http://cos.io/top>

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Promoting an open research culture



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“Reproducibility is just collaboration with people you don’t know, including yourself next week”

—Philip Stark, UC Berkeley Statistics

Workflow

Research Transparency in the Social Sciences

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- Practical coding and organizational suggestions
 - Making any changes to a file that has been posted/shared means it gets a new name.
 - Use version commands to ensure others get same results.
 - Long (2008) *The Workflow of Data Analysis Using Stata*
- Literate programming (extensive commenting, making the aim of code reading by a human)
- Version Control
- Dynamic Documents

Version Control

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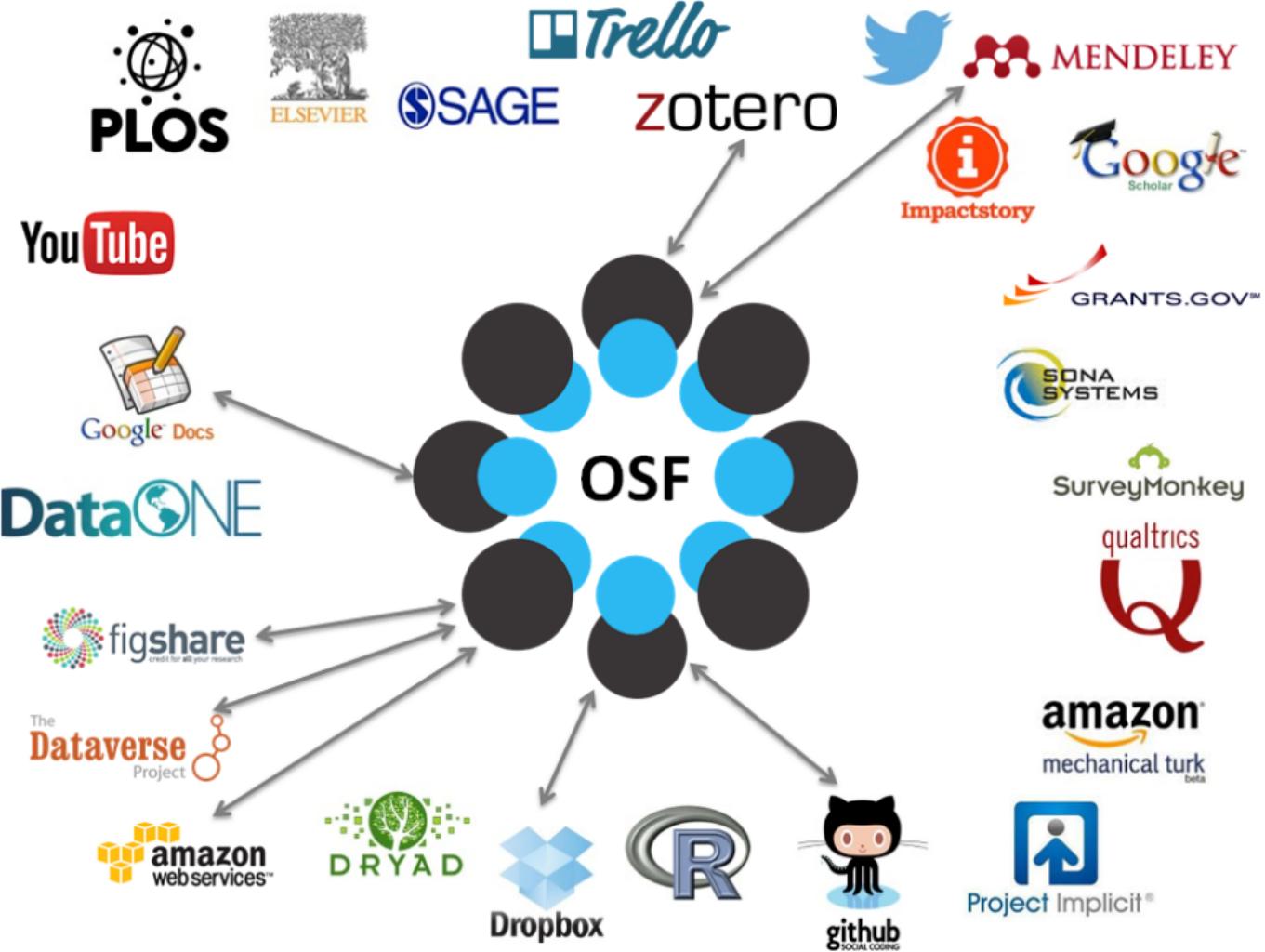
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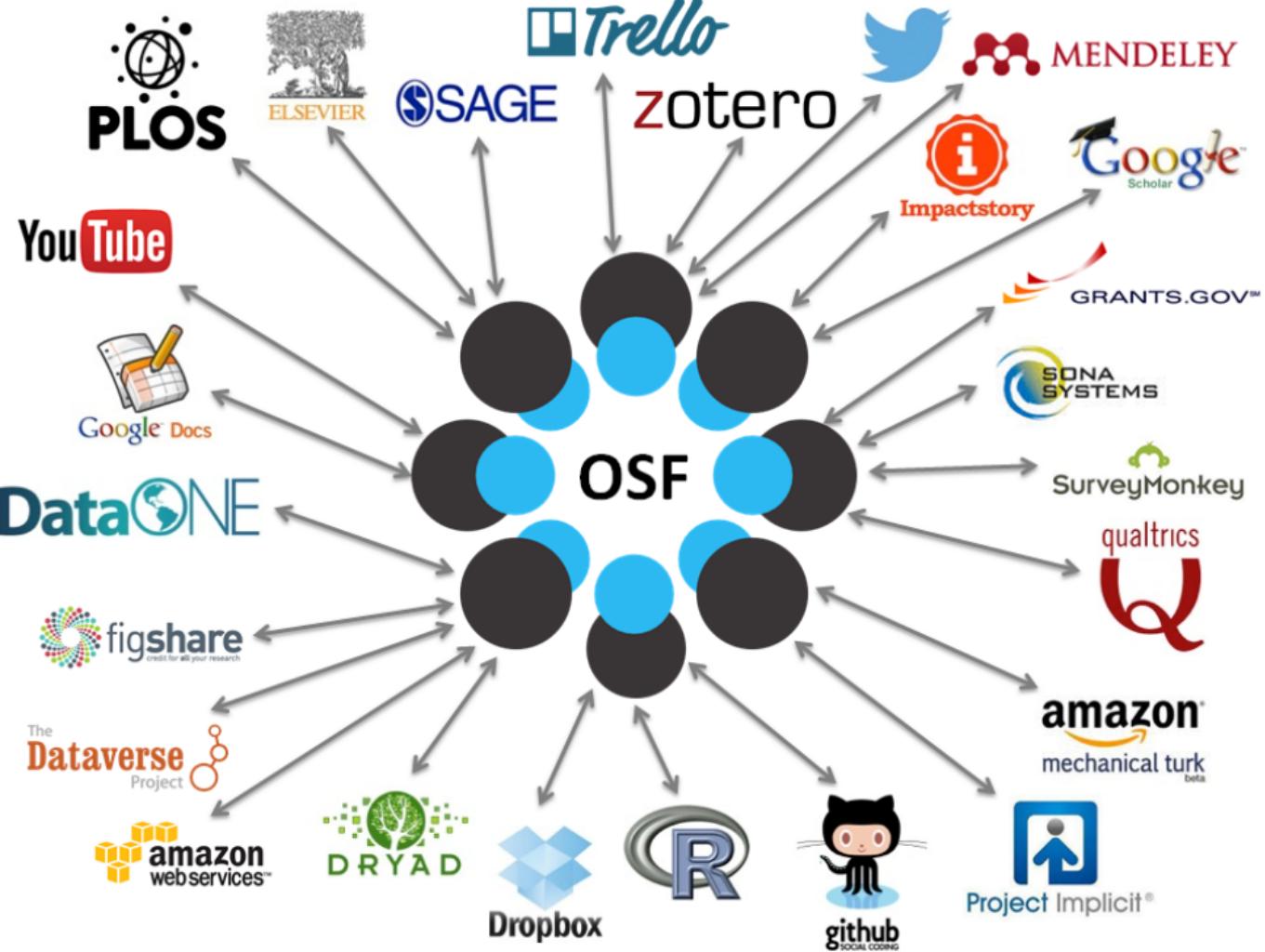
- Using version control (AKA revision control) can help to make your work more reproducible.
- What is version control?

Version control is a system that records changes to a file or set of files over time so that you can recall specific versions later. For the examples in this book you will use software source code as the files being version controlled, though in reality you can do this with nearly any type of file on a computer.

—Git, About Version Control









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Dynamic Documents

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Write your code and your paper in the same file so you won't lose information or make copy and paste mistakes.
Possible in R and Stata.

- Include tables by linking to a file, instead of a static image.
- Include number by linking to a value calculated by an analysis file, instead of a static number typed manually.
- Automatically update tables and numbers.
- Produce entire paper with one or two clicks.

The logo for Jupyter consists of the word "jupyter" in a bold, black, sans-serif font, centered within a white circle. The circle is partially overlaid by two thick, orange, curved bands that meet at the top and bottom, creating a smile-like effect. Four small, dark gray circles are positioned at the intersections where the curves meet the circle.

jupyter





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Data Sharing

Post your code and your data in a trusted public repository.

- Find the appropriate repository:
<http://www.re3data.org/>
- Repositories will last longer than your own website.
- Repositories are more easily searchable by other researchers.
- Repositories will store your data in a non-proprietary format that won't become obsolete.

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OK, I'm convinced. How do I implement this in my own research?

- Read the manual I wrote. [▶ Link](#)
- Read our JEL piece. [▶ Link](#)
- Subscribe to the BITSS blog & E-mail list [▶ Link](#)
- Apply for our NIH Research Transparency & Reproducibility Training (RT2). [▶ Link](#)

Research Transparency & Reproducibility Training (RT2)

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Three days of training in April in Amsterdam or September in Seattle.





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Questions?

Thank you!