Before we start

- Please fill out the following survey:

https://bit.ly/2G9oCmy

or

https://lars.Vilhuber.com/s/abs

Replication and Reproducibility in Social Sciences and Statistics: Context, Concerns, and Concrete Measures

Lars Vilhuber

Cornell University

Partial funding acknowledged under NSF-#1131848 (NCRN) and a grant from the Alfred P. Sloan Foundation. The opinions expressed in this talk are solely the authors, and do not represent the views of the U.S. Census Bureau, the American Economic Association, or any of the funding agencies.

Overview

- Crisis, what crisis?
- A brief history of reproducibility and replicability
- What seems different today?
- Economics and other social sciences
- What are we doing in Economics? (at the AEA, in general)
- What are we going to do in Economics?
- What will you be doing going forward?

Introducing:
The Reproducibility Crisis

Replicability in Economics

- Ragnar Frisch, editor of the first issue of Econometrica (1933), noted

"the original data will, as a rule, be published, unless their volume is excessive… to stimulate criticism, control, and further studies."

- Publication of data, however, was discontinued early in the journal's history.

Frisch (1933)

The “crisis” in the 60s and 70s

Sterling, 1959; Cohen, 1962; Lykken, 1968; Tukey, 1969; Greenwald, 1975; Meehl, 1978; Rosenthal, 1979

Low power

Flexibility in analysis

Selective reporting

Ignoring nulls

Lack of replication

Misuse of statistics

The crisis in the 1980s in Economics

- Dewald, Thursby, Anderson (AER, 1986)
- Leamer's (1983) 'Let's take the con out of econometrics'

Citing data sources

"Many authors cited only general sources such as *Survey of Current Business*, *Federal Reserve Bulletin*, or *International Financial Statistics*, but did not identify the specific issues, tables, and pages from which the data had been extracted."

(Dewald Thursby Anderson **1986**, p. 591)

Making USEFUL archives

- From analysis of code from 1996 to 2003 (MMH2006):

"Other authors seem to think that the entire world shares the exact same hard drive layout, with "C:\MYDATA\MYPROJECT\" **sprinkled liberally** throughout their code. Of course, a would-be replicator has to **find and change all these**."

"The author might not realize all the data/subroutine files that his code utilizes, and **forget to include** said data/subroutine in his replication files."

The crisis in the 1980s … lead to changes

- 1976- JPE Section on Confirmation and Contradictions
- 1988 Replication archive at the Journal of Applied Econometrics

The crisis in the 1990s

- Anderson and Dewald (1994) [Economics]
- King (1995) “Replication, replication” [Political Science]
- McCloskey and Ziliak, 1996: Do economists consider power calculations?
- McCullough and Vinod (1999): call for replication archives

The crisis in the 1990s… lead to changes

- Lead directly to
  - Data availability policies in Economics (1996: JCMB)
  - Replication section (Journal of Applied Econometrics, 2003)
  - More robust code archives
    (Goffe and Parks (1997), Eddelbüttel (1997): CodEC -> SSC)
- Coincidental:
  - Better public-use data (IPUMS: Sobek and Ruggles, 1999)
  - Better open-source software (R Core Team, 2000)
  - New methods of exchanging manuscripts
    (early 90s, but publications: Ginsparg, 1997: arXiv; Krichel, 1997, Halpern 1998)

The crisis in the 2000s

- McCullough & Vinod (2003) [Econometrics]
- Ziliak and McCloskey (2004)
- Anderson et al (2005, 2008), Vinod (2005)
- Ioannides (2005)
- McCullough et al (2006) Lessons learned JMCB, McCullough (2007)
- Hamermesh (2007)
- Koenker and Zeileis (2009)

The crisis in the 2000s… lead to changes

- Lead directly to
  - Data availability policies in Economics (2005: AER)
  - Subsequently to many other top journals
  - Social Science Registry (2011) for pre-registration

The newest crisis

- Ioannides (2016)
- Ioannidis, Stanley, Doucouliagos (2017): bias, low power
- Miguel et al (2014)
- Chang & Li (2015)
- Zimmermann (2015)
- Many others…

> "statistically significant, novel, and theoretically tidy results are published more easily than null, replication, or perplexing results"

But is it a "crisis"?

- crisis [kri´sis] (pl. *cri´ses*) (*L.*)

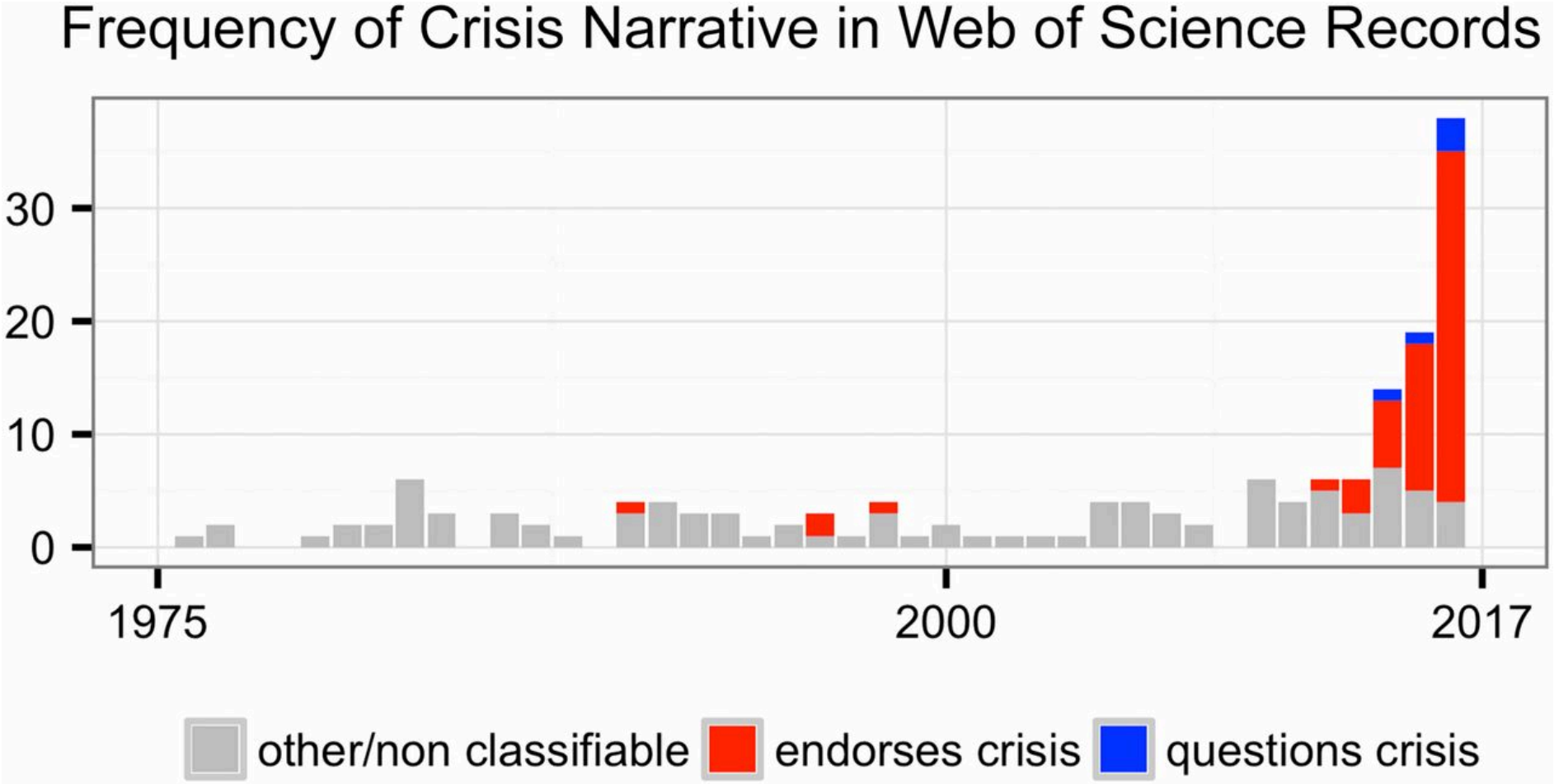
  1. the **turning point** of a disease for better or worse; especially a sudden change, usually for the better, in the course of an acute disease.

  2. a **sudden paroxysmal intensification** of symptoms in the course of a disease.

Scholarly Communications are Meant to Communicate

- In the 17th century, scholars communicated by letter exchange
- Collections of letters + editing became the first journals
- Peer review was incorporated
- But the review of a manuscript by an editor and two peers cannot possibly be equivalent to a full vetting
- Rather, the back and forth in the pages of academic journals IS the discourse
- In this view (also Hamermesh, 2007) bad publications (including those that do not privately replicate) die out, good publications withstand those tests

Fanelli (2018), Is science really facing a reproducibility crisis, and do we need it to?



https://doi.org/10.1073/pnas.1708272114

Fanelli (2018), Is science really facing a reproducibility crisis, and do we need it to?

In fact, Fanelli finds that

"researchers that publish at **higher frequency**, **in journals with higher impact factor**, and in countries where **pressures to publish are high**,

are

equally or more likely to **correct** their work, **less likely** to publish papers that are **retracted**, **less likely** to author papers that contain **duplicated** images, and **less likely** to author papers reporting **overestimated** effects"

Maybe it’s only a tantrum…

Efficiency of scholary discourse?

- If publishing is part of a discourse (and not the final truth), then it must be made efficient
- When publication was exchange of ideas, the exchange of papers (1600s!) included everything necessary

Efficiency of scholary discourse?

- Early publications (20th century) contained tables of data, and the math was simple (maybe)
- Data became electronic, was no longer **included** or **cited**
- Modern publications thus need the same transparency and completeness

Efficiency of scholary discourse!

- Reproducibility helps to teach others
- Data became electronic, was no longer **included** or **cited**
- Modern publications thus need the same transparency and completeness

What IS reprodubility?

Replication continuum (Bollen et al. 2015)

Replication continuum

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replication continuum

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Replication continuum

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Replication continuum

Same data	Same code	Same methods	Same context

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Replication continuum

Same data	**Different code or software**	Same methods	Same context

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Replication continuum

New data collection	Same code	Same methods	Same context

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Replication continuum

Different data	Different code	**Different**	**Different**
	or software	**methods**	**context or**
			country

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

What is a “Data Availability Policy”?

- **It is the policy of the American Economic Association to publish papers only if the data used in the analysis are clearly and precisely documented and are readily available to any researcher for purposes of replication.**
- Authors of accepted papers that contain empirical work, simulations, or experimental work must **provide**, prior to publication, the **data, programs, and other details of the computations sufficient to permit replication.** These will be posted on the AEA website. The Editor should be notified at the time of submission if the data used in a paper are proprietary or if, for some other reason, the requirements above cannot be met.

Today is different

What is different?

- Technical infrastructure supporting openness
  - More and easier archives with self-service options (Figshare, Zenodo, OpenICPSR)
  - Github & Co.
  - Making science more easily reproducible
- Institutions
  - Center for Open Science / Open Science Framework (OSF)
  - BITSS, J-PAL, etc.
  - Registries
- New methods to do replications at scale
  - Collaborative efforts
  - Use of Mechanical Turk, Odesk, and other mechanisms

Nosek: “Why ineffective?”

“Strategy”

Study the issue	Knowing what to change
Education & training	Knowing how to change
Inculcate the values	Wanting to change

Additions

Infrastructure	Technology to enable change
Reward system	Incentives to embrace change

Fanelli (2018): Opportunities

"These [information and communication] technologies promise to make research

- **more accurate, powerful,**
- **open, democratic,**
- **transparent, and**
- **self-correcting**

than ever before. At the same time, this technological revolution creates **new expectations and new challenges** that metaresearchers are striving to address."

What does progress look like?

First round (2005-2015)

- Adding data availability requirements
  - AEA, 2005 others follow
  - Which have led to code availability as well
- Experiments in post-publication discussion
  - AEA: Comments on articles

Broad adherence to AEA policy

Journals (Publisher)	Type of policy	Archive	Confidential data
AER and Journals (self)	AEA	Journal website	Exemption
QJE (OUP)	AEA	Dataverse	Exemption
ReStud (OUP)	Generic + assistance	Journal website	Exemption
ReStat (MIT)	Own	Dataverse	"… way to apply for data…"
J Applied Econometrics	Own	Own (Queens, 1988-)	Exemption
Econometrica	Own	Journal website	Exemption with "…reasonable effort…"
JOLE (Chicago)	AEA	Journal website	Exemption
JPE (Chicago)	AEA	Journal website	Exemption
JMCB	Own (barebones)	Journal website	--

Second round (2012-)

- Broad replication projects in Psychology
  - Open Science Collaboration (2015, others)
- Replication projects in Behavioral Economics
  - Camerer et al (2016)

Second round (2013-)

- New data (and code) availability policies
  - 2012, AJ Political Science
  - 2016, QJE (last top journal)

Second round (2013-)

- Greater enforcement of data (and code) availability
  - 2015, AJ Political Science
  - 2016, Data Editor for ASA Software Section
  - 2016, Statistical review added Science
  - 2017: AEA appoints Data Editor, with mandate to do similar activities

Second round (2013-)

- Registered Reports https://cos.io/rr
  - Chambers (2014)
  - Nosek & Lakens (2014)

- Close cousin: Results-blind review

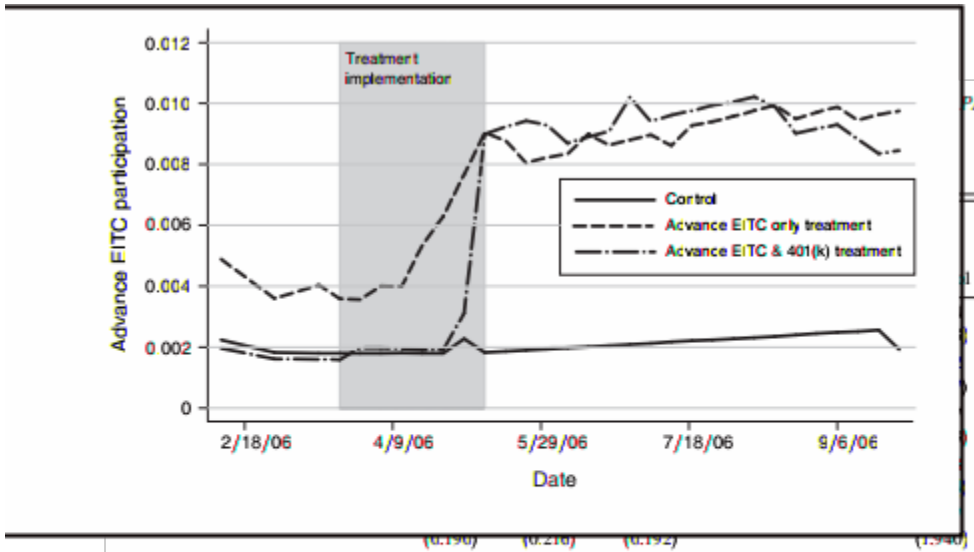
Second round (2013-)

- Preprints in other sciences
  - bioXxiv (2013)
  - PsyArXiv (2016)

Economics and other social sciences

A brief retrospective

Analysis in Economics



						Advance EITC only treatment	Advance EITC & 401(k) treatment
						32.749	28.027
						(11.215)	(5.936)
						19.766	25.883
						(5.631)	(6.481)
						6.334	9.369
						(2.964)	(1.825)
						0.854	0.834
						(0.506)	(0.123)**
						30.503	29.655
						(1.778)	(1.875)
Median wage	7.646	7.257	7.634	Female	80.457	77.448	80.945
	(0.041)	(0.028)***	(0.101)		(1.710)	(2.082)	(1.351)
Weekly hours	24.766	25.374	25.772	Southern	40.879	67.026	66.217
	(1.022)	(0.914)	(0.587)	region	(19.268)	(19.752)	(20.250)
W-4 Allowances	1.291	1.676	1.441	Store size	42.019	44.753	44.251
	(0.160)	(0.461)	(0.262)		(3.064)	(3.074)	(2.051)
Age	34.368	33.669	34.782	Weekly turnover	0.270	0.361	0.398
	(0.780)	(0.505)	(0.569)	rate	(0.078)	(0.103)	(0.113)
N	2,231	2,226	2,519	*N*	2,231	2,226	2,519

Wide use of public-use data

- **Macrodata:**

"We use data downloaded from the Bureau of Economic Analysis…"

- **Microdata**:

"… this paper uses data from the Current Population Survey…"

Positive attitudes?

- Often liberal sharing of data and code (via email, networks)
- Sharing of articles prior to publication (RePEc)

And yet, there are issues

An example

J Econom. Author manuscript; available in PMC 2012 Mar 1.
Published in final edited form as:
J Econom. 2011 Mar 1; 161(1): 82–99.
doi: 10.1016/j.jeconom.2010.09.008

PMCID: PMC3079891
NIHMSID: NIHMS246950

National Estimates of Gross Employment and Job Flows from the Quarterly Workforce Indicators with Demographic and Industry Detail

John M. Abowd and Lars Vilhuber

Author information ► Copyright and License information ►

Abstract

Go to:

The Quarterly Workforce Indicators (QWI) are local labor market data produced and released every quarter by

No confidential data were used in this paper. All public-use Quarterly Workforce Indicators data can be accessed from http://www.vrdc.cornell.edu/news/data/qwi-public-use-data/. The national indicators developed in this paper can be accessed from http://www.vrdc.cornell.edu/news/data/qwi-national-data/. We are grateful for the comments and suggestions of many of our colleagues, past and present, too numerous to list here and thus listed at the website above and in the working paper version of this article. The opinions expressed in this paper are those of the authors and not the U.S. Census Bureau nor any of the research sponsors.

An example: not cited…

J Econom. Author manuscript; available in PMC 2012 Mar 1.
Published in final edited form as:
J Econom. 2011 Mar 1; 161(1): 82–99.
doi: 10.1016/j.jeconom.2010.09.008

PMCID: PMC3079891
NIHMSID: NIHMS246950

National Estimates of Gross Employment and Job Flows from the Quarterly Workforce Indicators with Demographic and Industry Detail

John M. Abowd and Lars Vilhuber

Author information ► Copyright and License information ►

Abstract Go to:

The Quarterly Workforce Indicators (QWI) are local labor market data produced and released every quarter by

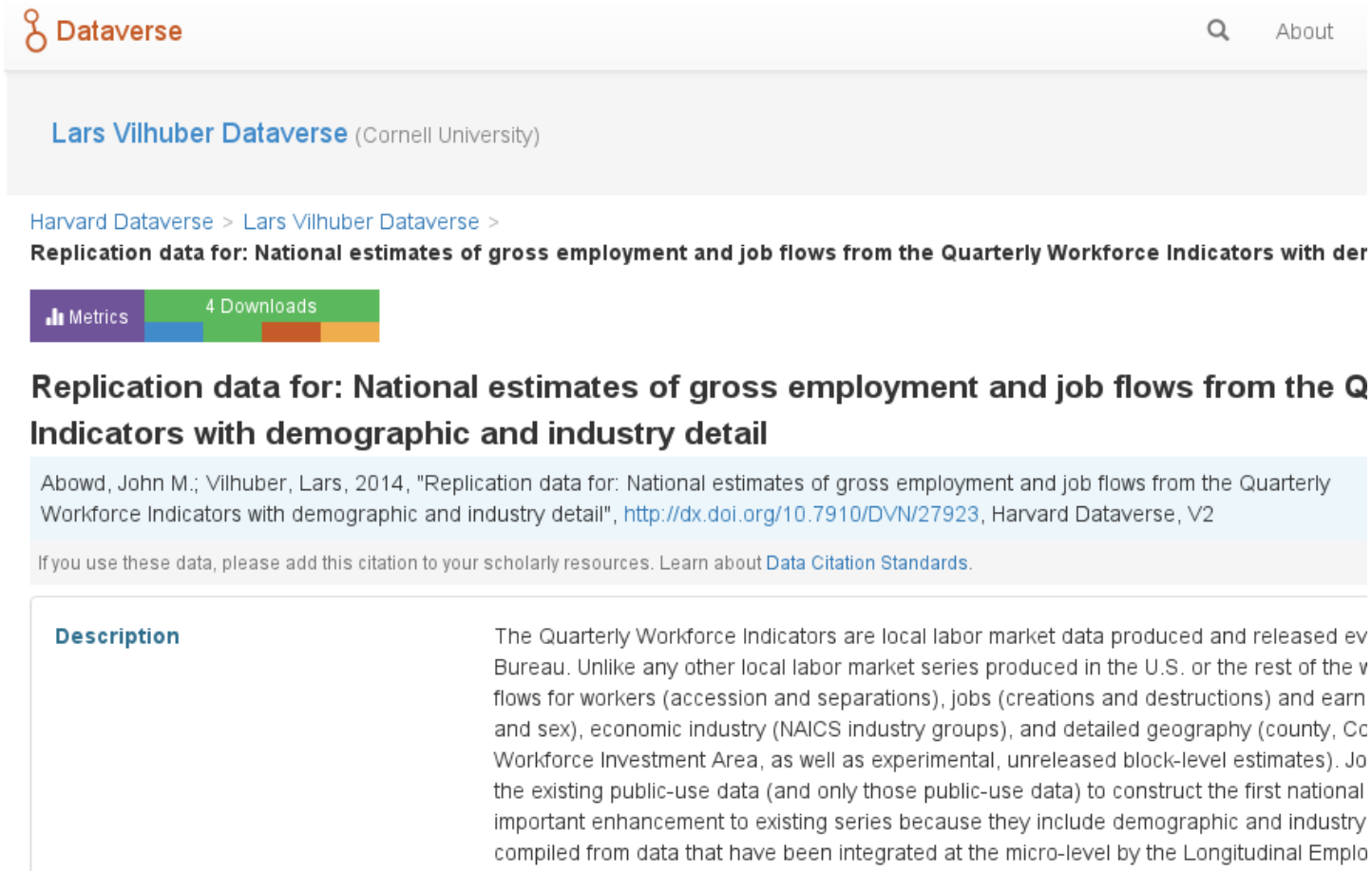
Press for the NBER; 2009. pp. 149–230.

5. Abowd JM, Vilhuber L. The sensitivity of economic statistics to coding errors in personal identifiers. Journal of Business and Economic Statistics. 2005;23(2):133–152.
6. Abowd JM, Zellner A. Estimating Gross Labor Force Flows. Journal of Business and Economic Statistics. 1985;3:254–283.

Data not attached to article

- J of Econometrics Data Policy at the time could not accommodate 50MB file
  - Data was not attached to paper.
- Today's J of Econometrics policy suggests using third-party repositories
  - We will get to that later

We went back, archived it



We went back, archived it, linked it back

Dataverse

About

Keyword	Employment Dynamics
Topic Classification	Economics
Related Publication	John M. Abowd and Lars Vilhuber, "National estimates of gross employment and job flows from the Quarterly Wor with demographic and industry detail," Journal of Econometrics, vol. 161, iss. 1, pp. 82-99, 2011. doi: 10.1016/j.jeconom.2010.09.008 http://www2.vrdc.cornell.edu/news/data/qwi-national-data/ John M. Abowd and Lars Vilhuber, "National estimates of gross employment and job flows from the Quarterly Wor with demographic and industry detail," Journal of Econometrics, vol. 161, iss. 1, pp. 82-99, 2011. doi: 10.1016/j.jeconom.2010.09.008 http://www2.vrdc.cornell.edu/news/data/qwi-national-data/ John M. Abowd and Lars Vilhuber, "National estimates of gross employment and job flows from the Quarterly Wor with demographic and industry detail (with color graphs)," Center for Economic Studies, U.S. Census Bureau, Wc 11, 2010. http://ideas.repec.org/p/cen/wpaper/10-11.html
Producer	Labor Dynamics Institute (Cornell University) (LDI) http://www2.vrdc.cornell.edu/news/data/qwi-national-data/

But journal and data infrastructure are incomplete

- While Dataverse allows to manually link back…
- … the article itself reveals none of that
- True for most journals, and most data archives
  - ICPSR (manual linking to articles)
  - RePEc (no linkage possible)
- Infrastructure starting to emerge
  - If article cites data (DOI!)
  - If archive and/or journal leverages infrastructure

DataCite

Crossref

Using personal websites

Don’t even think about using personal websites!

Google

404. That's an error.

The requested URL /a_cool_website was not found on this server. That's all we know.

source

Yielding to the temptation of "administrative"data

- **State-level data**

  "Our analysis draws on administrative records from the Detroit Work First program linked with unemployment insurance (UI) wage records for the State of Michigan"

  Autor/Houseman doi:10.1257/app.2.3.96

- **School-district data**

  "confidential student-level panel dataset provided by the School Board of Alachua County in Florida"

  Carrel and Hoekstra doi:10.1257/app.2.1.211

… yielding…

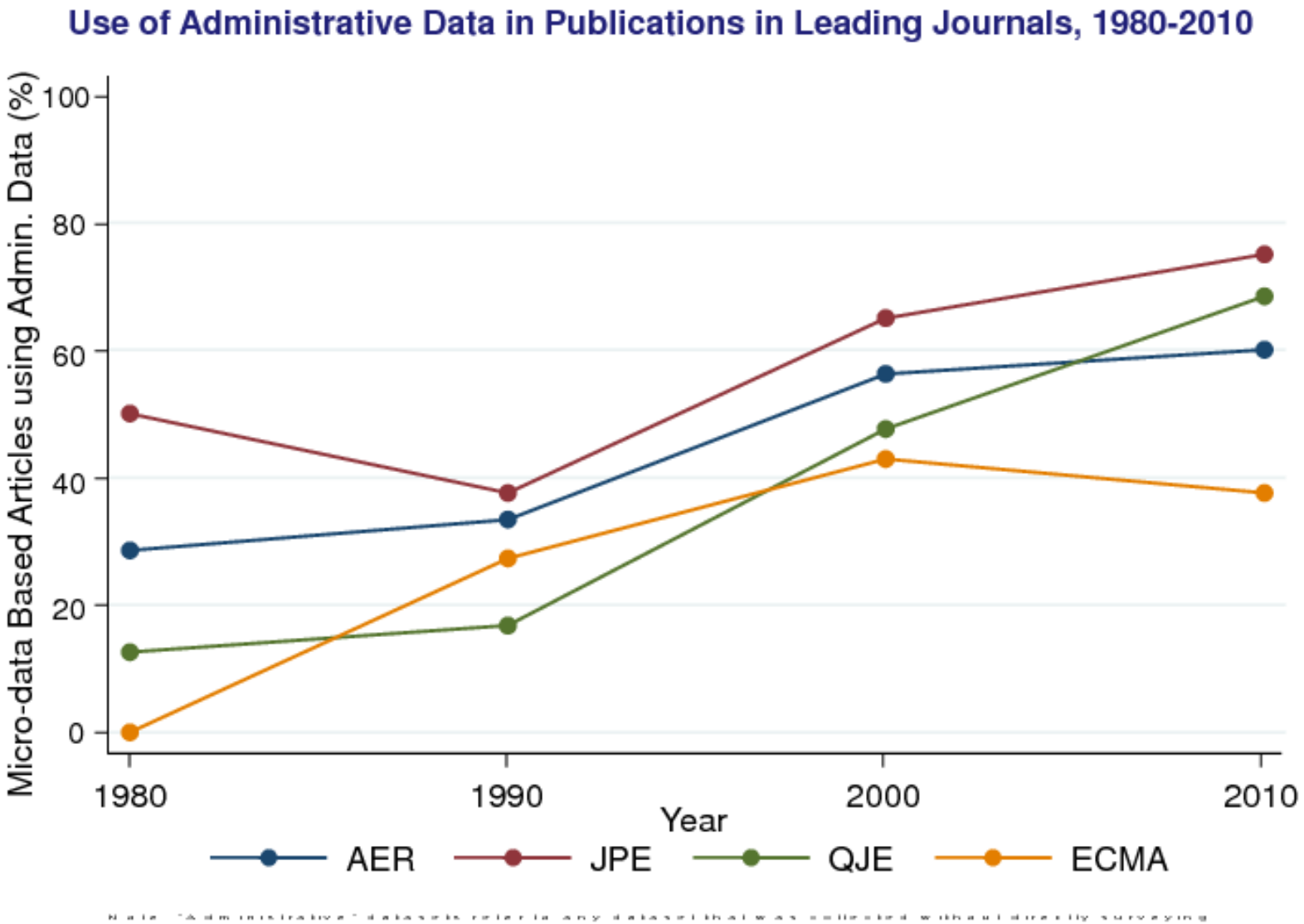
- **Proprietary data**

"This field experiment was made possible by the collaboration of a large-scale, nationwide firm in the retail sector. "

Damon doi:10.1257/app.2.2.147

Death Knell for Public-use Data?

- Sounded by young scholars pursuing research programs that mandate inherently identifiable data:
  - Geospatial relations,
  - Exact genome data,
  - Networks of all sorts,
  - Linked administrative records
- These researchers acquire authorized, generally unfettered, restricted access to the confidential, identifiable data and perform their analyses in secure environments.
- But: generally don’t leave behind the scientific trail that has made public-use files so important.

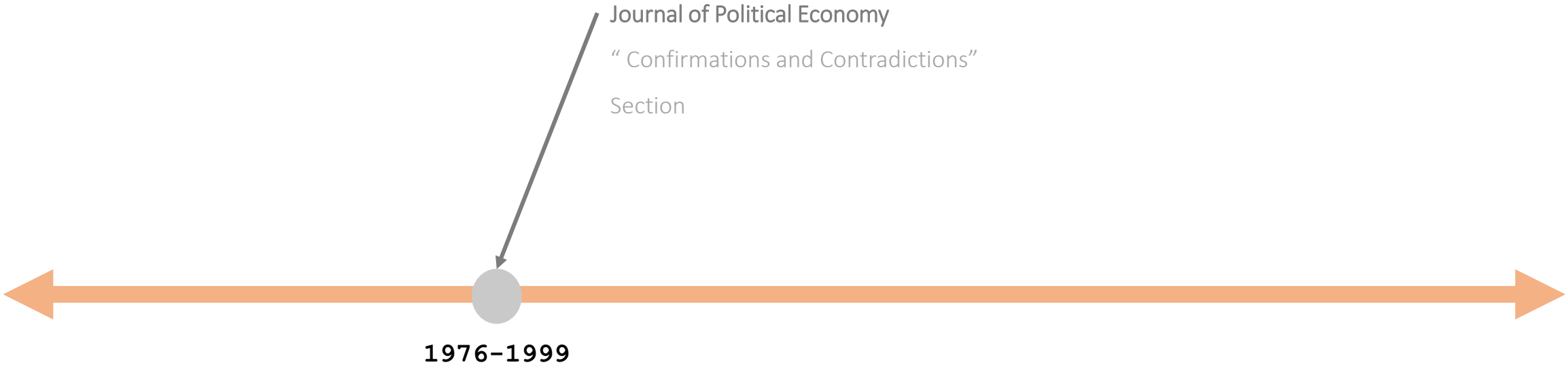


individuals (e.g., scanner data, stock prices, school district records, social security records).
Sample excludes studies whose primary data source is from developing countries.

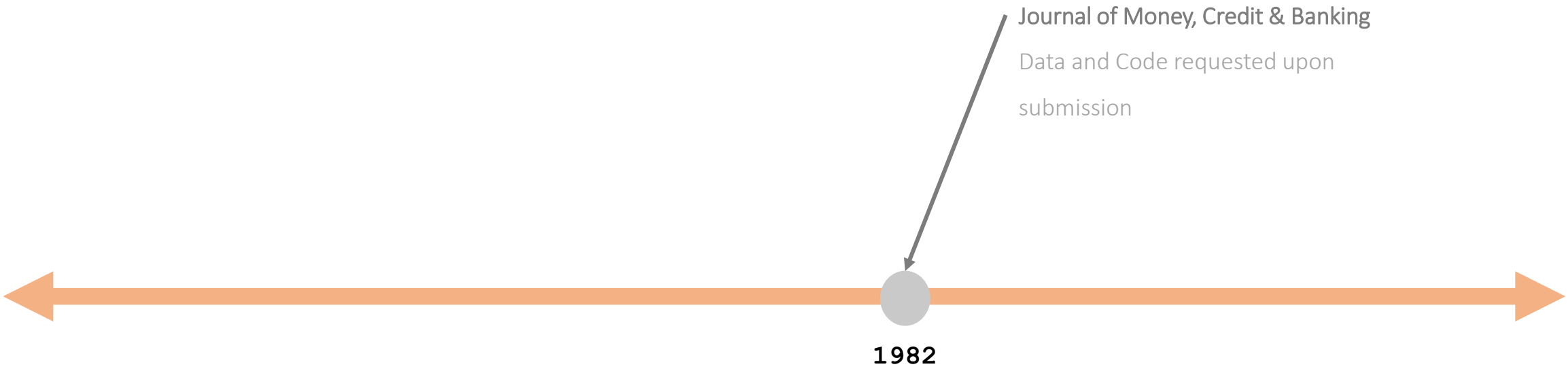
Progress in Economics

Increasing transparency in economics journals

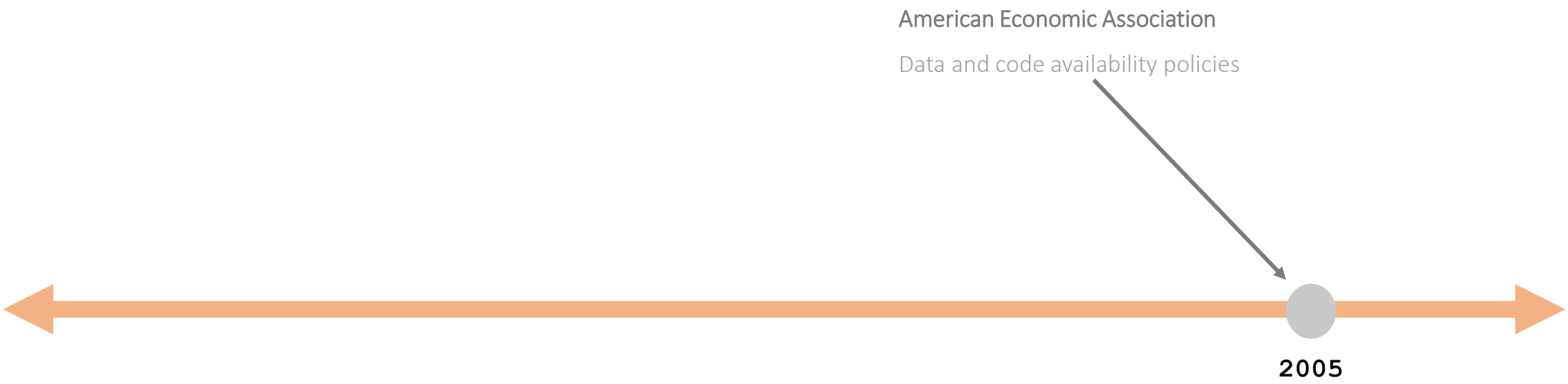
Increasing transparency in economics journals



Increasing transparency in economics journals



Increasing transparency in economics journals



Increasing transparency in economics journals

Promoting Transparency in Social Sciences

Miguel et al (Science)

10.1126/science.1245317

- Greater transparency
- Registration and pre-analysis plans
- Open data and materials

Increasing transparency in economics journals

Explicit replication remains rare

How common is replication in economics?

- 0.1% of 126,505 “top 50” published articles 1974-2014 are replications

  – Mueller-Langer et al. (2018)

- 6.2% of 1,138 “top 10” development articles 2000-2015 were subjects of replications

  - Sukhtankar (2017)

Replications and Reproducibility Checks Remain Rare

- No significant replication journal
- ReplicationWiki identifies **44** "Comments" in the AER as "replications" of some sort, out of **~200*13 = 2600** articles (2004-2016) = **1.7%**

Explicit replication remains rare

Or are they?

"Dark Web" of Replications

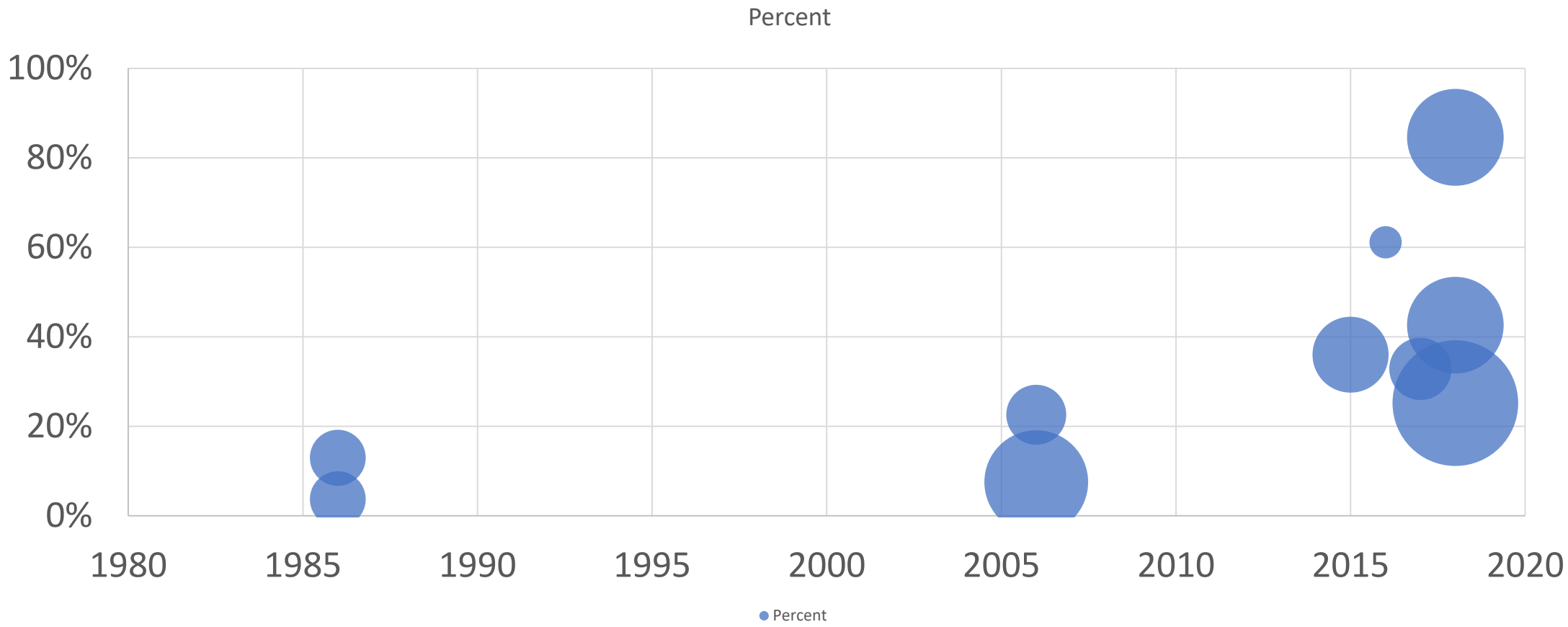
- Personal communication: lots of micro, labor, macro Ph.D. classes have students run (successful) replications
- Hamermesh (2007): papers that do not replicate do not get cited (… over time)
- Projects (…) to provide replications (in the broad sense) by "swapping country"

(Do the results of Paper A
– run on data from country B –
work in country C)

Explicit Replications and Reproduction Attempts

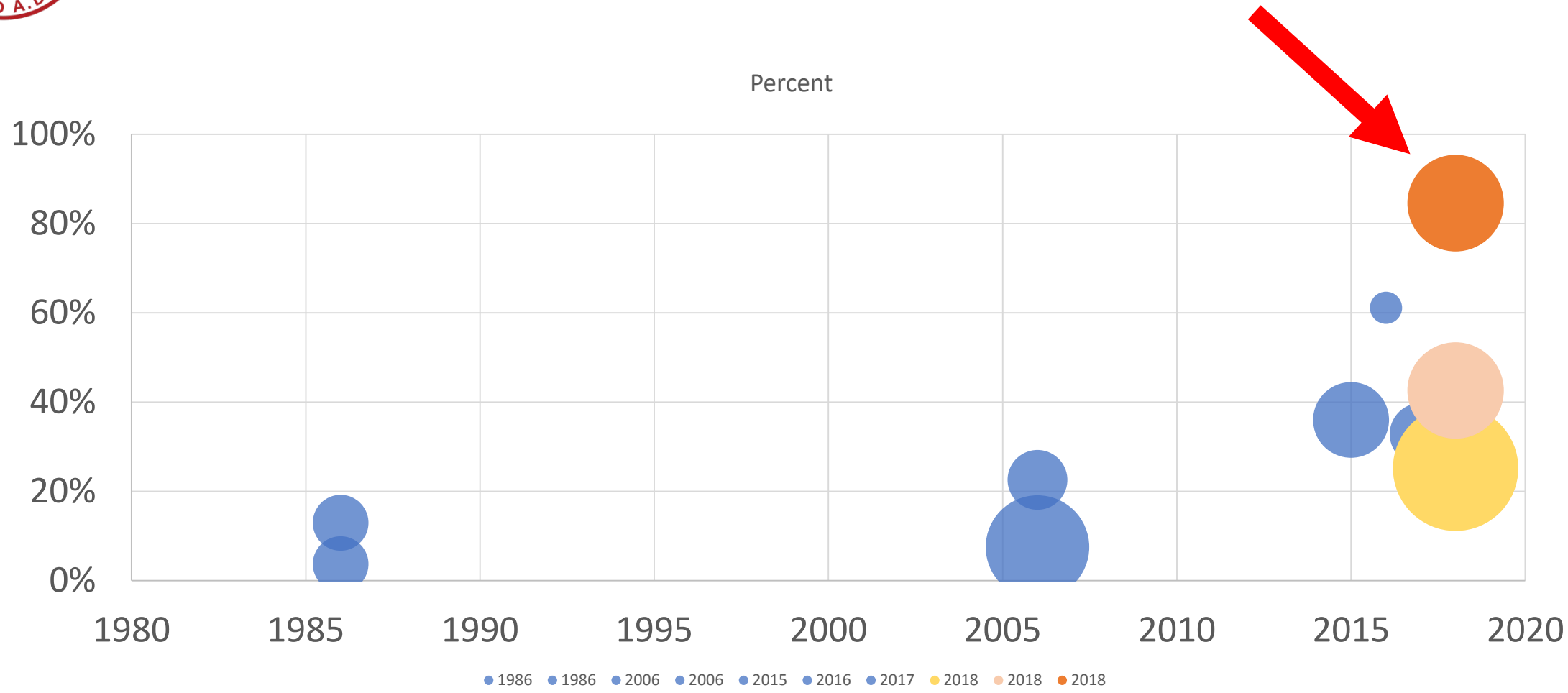
- Vary in how they assess the exercise
  - Replication or Reproducibility
  - Denominator: Data available, or all articles?
    Prevalence of restricted-access data!
  - Numerator: Partial or full reproduction/ replication?
    Who makes the assessment? How?
  - Quantity/ domain

Some key statistics



Current efforts at the AEA

Remember this?



Method

Undergraduate Summer Research Assistants

2014 - 2018

Undergraduate Summer Research Assistants

2014 - 2018

Economics

Comp Sci.

OpRe

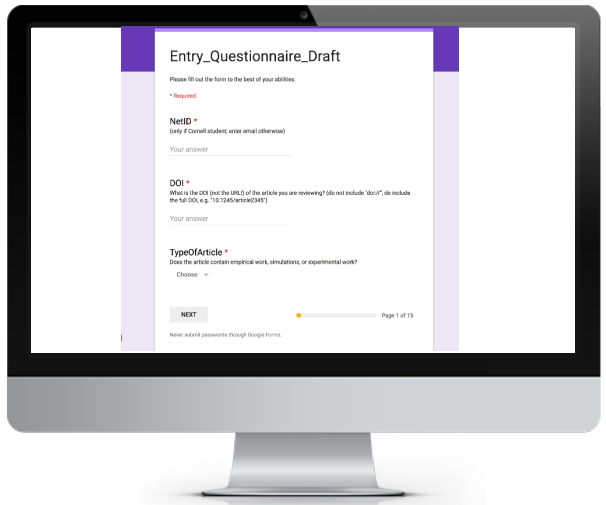
Undergraduate Summer Research Assistants

2014 - 2018

Economics
Comp Sci.
OpRe

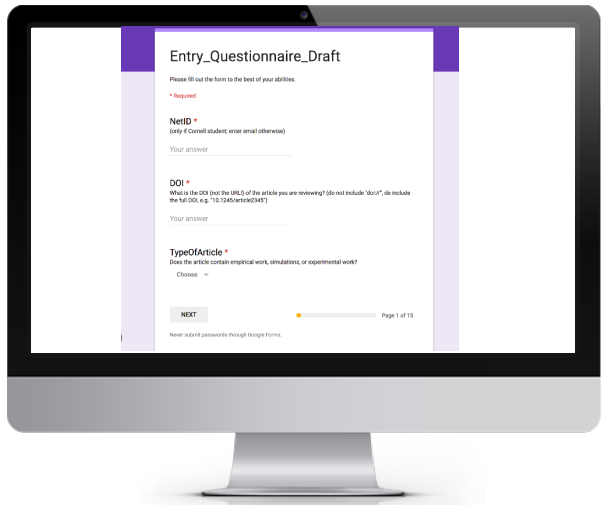
Reproduction
VCS
Cloud Computing

Method



- Assessment Form

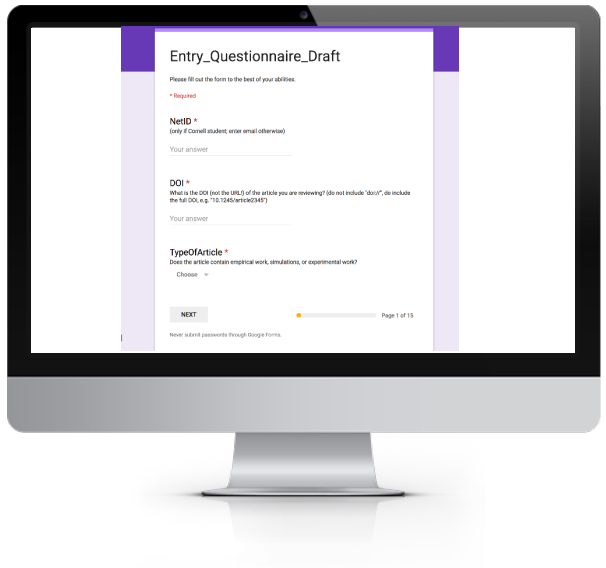
Method



- Assessment Form

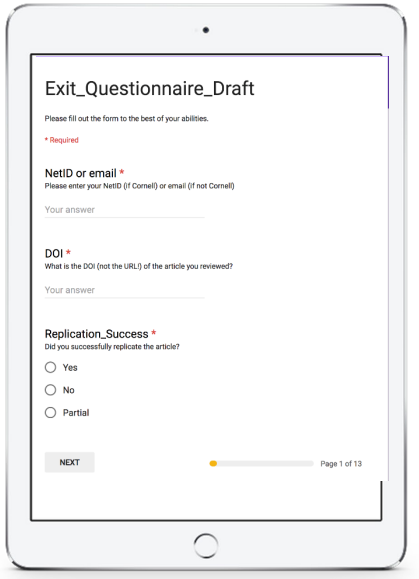
- Reproduction Exercise

Method



- Assessment Form

- Reproduction Exercise



- Exit Questionnaire

Replication continuum

Our Focus

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Replication continuum

Same data	Same code	Same methods	Same context

Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

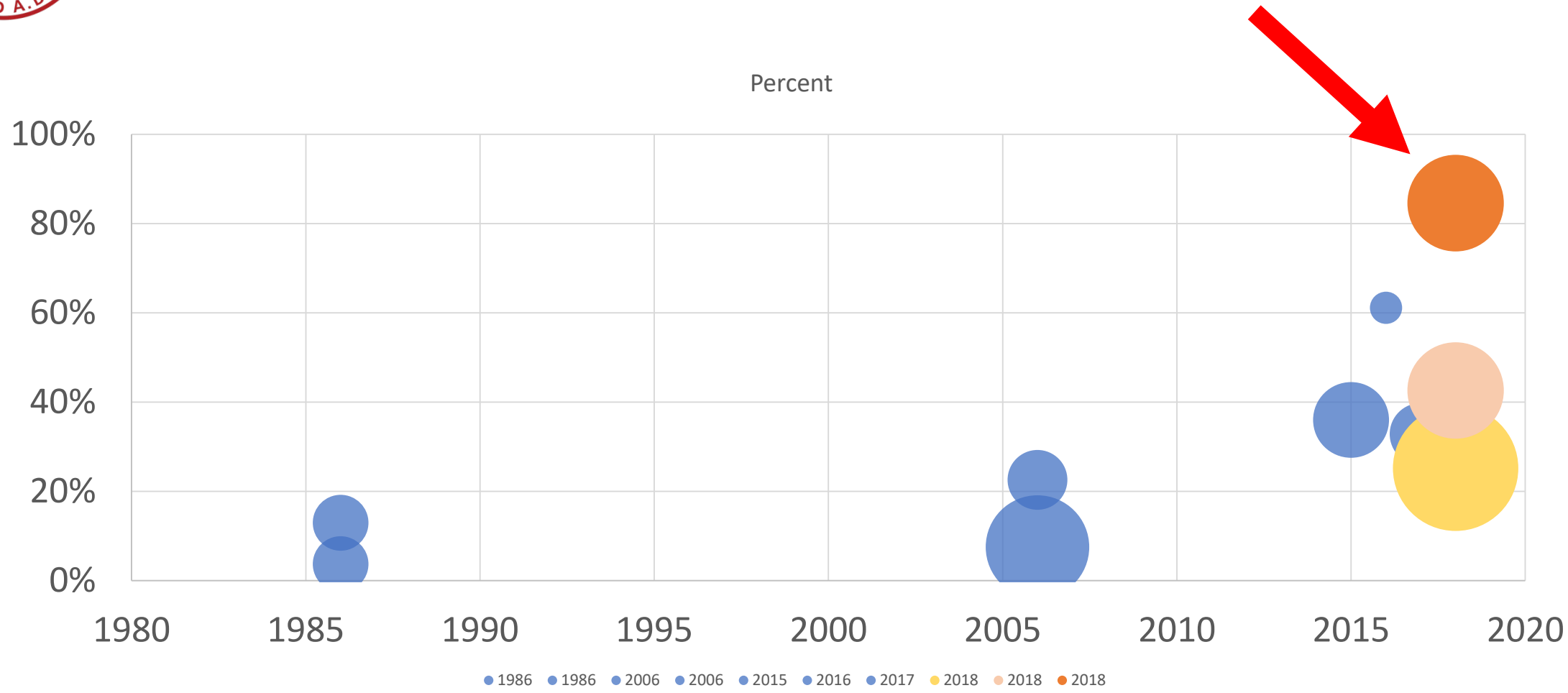
- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)


© Nick photography

Remember this?



Some key statistics

Study	Year	N	Success	Type	Type-R	Type-Data	Percent	Field
Dewald Thursby Anderson	1986	54	2	Complete	Reproducibility	Avail	4%	Economics
Dewald Thursby Anderson	1986	54	7	Partial	Reproducibility	Avail	13%	Economics
McCullough McGeary Harrison	2006	186	14	Complete	Reproducibility	All	8%	Economics
McCullough McGeary Harrison	2006	62	14	Complete	Reproducibility	Avail	23%	Economics
Nosek et al	2015	100	36	Complete	Replication		36%	Psychology
Camerer et al	2016	18	11	Complete	Replication		61%	Experimental Econ
Chang Li								Macroeconomi
Kingi et al	2018	274	69	Complete	Reproducibility	All	25%	Economics
Kingi et al	2018	162	69	Complete	Reproducibility	Avail	43%	Economics
Kingi et al	2018	162	137	Partial	Reproducibility	Avail	85%	Economics

Kingi et al numbers are preliminary. Do not cite or quote.

From Post- to Pre-Publication Verification

- Cornell Replication Lab has been verifying published articles
- Now switching to manuscripts in the submission workflow
- For now pilot
  - *Authors have submitted prior to announcement of new data policy*

Email during pilot phase

Dear [AUTHOR]:
I am writing about your paper [MC ID]. I am ready to give you a "conditional accept" on the paper.
The condition is simply to work with the AEA's data co-editor, Lars Vilhuber (copied on this email), to prepare the data and code for publication. The data is an important contribution of the paper. He is copied on this email.
Thank you for submitting your work.
I am looking forward to seeing the paper in print.

Future efforts

AEA, Social Sciences, elsewhere

Evolving Journal and Data Infrastructure

- More self-deposit repositories in the social sciences
  - Dataverse
  - Figshare
  - openICPSR
  - Zenodo
  - Qualitative Data Repository (QDR)
  - Others…

More and easier data deposit

- More integration into **Journal Workflows**
  - AJPS + Dataverse
  - QJE, Restat (both Harvard…) + Dataverse
- Data deposit occurring during submission

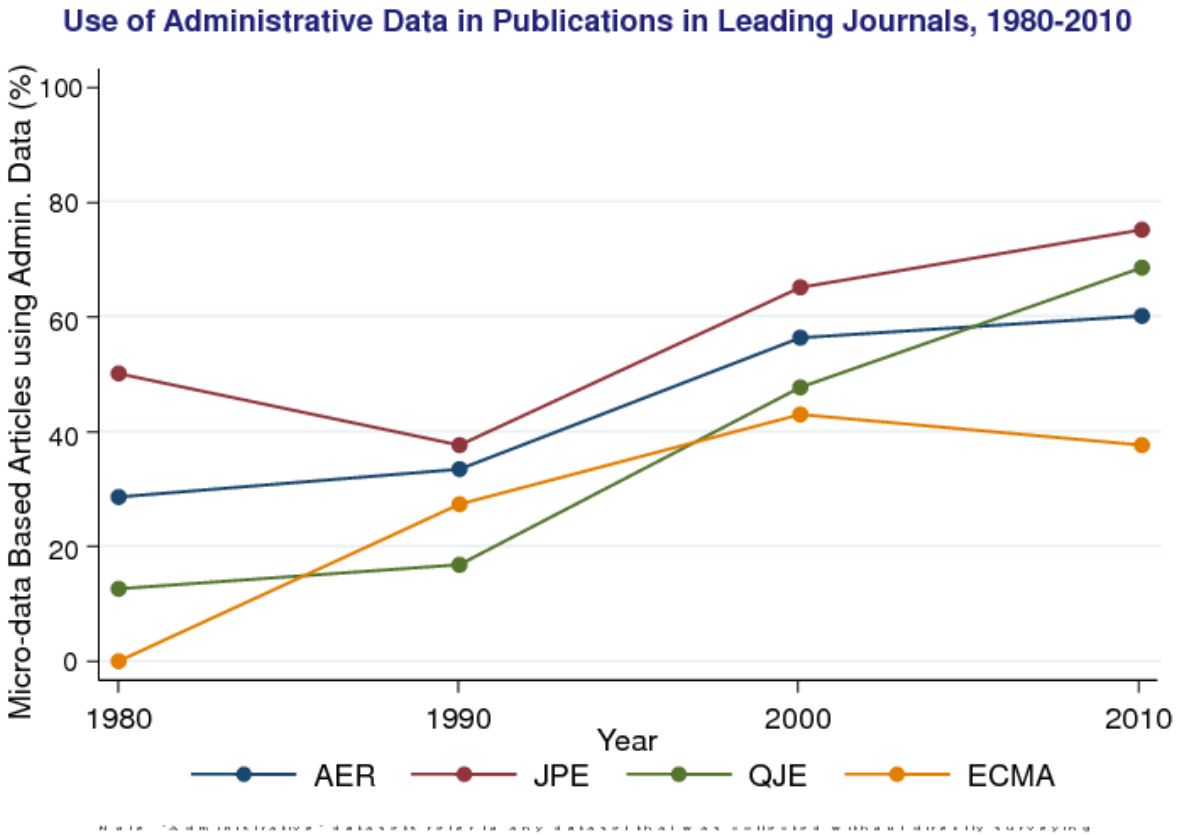
At the AEA…

- We will create a journal-specific repository for AEA journals
  - *Open for deposit 2019 Q1*
- We will migrate **all historical supplements** to the archive
  - *Explode the ZIP files: greater transparency*

And then we’ll kill it

Let me explain…

Remember this figure?



individuals (e.g., scanner data, stock prices, school district records, social security records).
Sample excludes studies whose primary data source is from developing countries.

Assessing accessibility

- Chetty's assessment was entirely manual
  - Download the article
  - Read what kind of data is used
- And yet does not provide information such as
  - Who can access?
  - How long can you access?
  - Characteristics of the data
- … and not for want of trying, but because that information is not required and not provided

From earlier examples

- **Costly access but good intentions:**

"researchers could submit programs that [...] research assistants would run. Alternatively, researchers wishing to work directly with the data could come and work on the Institute's premises."

Autor/Houseman doi:10.1257/app.2.3.96

- **Uncertain access**

"Data [...] is proprietary and owned by the Alachua County, Florida School District. The corresponding author [...] holds the deidentified dataset [...] and will provide copies to authors who receive written permission from the Alachua County Public Schools."

Current Data Availability Policies are Broken

- If the Data is
  not open-access,

  no systematic information is collected
  (“exemption”)

Current Data Availability Policies are Broken

- If the Data is
  not open-access,

  even if the *Data Owner*
  has already deposited it

Current Data Availability Policies are Broken

- If the Data **is open-access**,
  you are asked to deposit the data in the "journal repository"

  even if the *Data Owner*
  has already deposited it

Current Data Availability Policies are Broken

- If the Data **is open-access**,
  you are asked to deposit the data in the "journal repository"

  even if you have followed *best practices* and
  have already deposited it

Illustration

If you used the ACS,

should you deposit it ***again***?

Illustration

If you used the LEHD,

has the Census Bureau not ***already archived it***?

Illustration

If you used the LEHD,

can others
not ***access it***?

Illustration

If you used files at
the National Archives,

are they not
already archived?

Best practices

- Deposit and archive early
  - If you collect data, archive it *(possibly privately)*
  - If you finish the manuscript, deposit the analysis files *(possibly privately)*

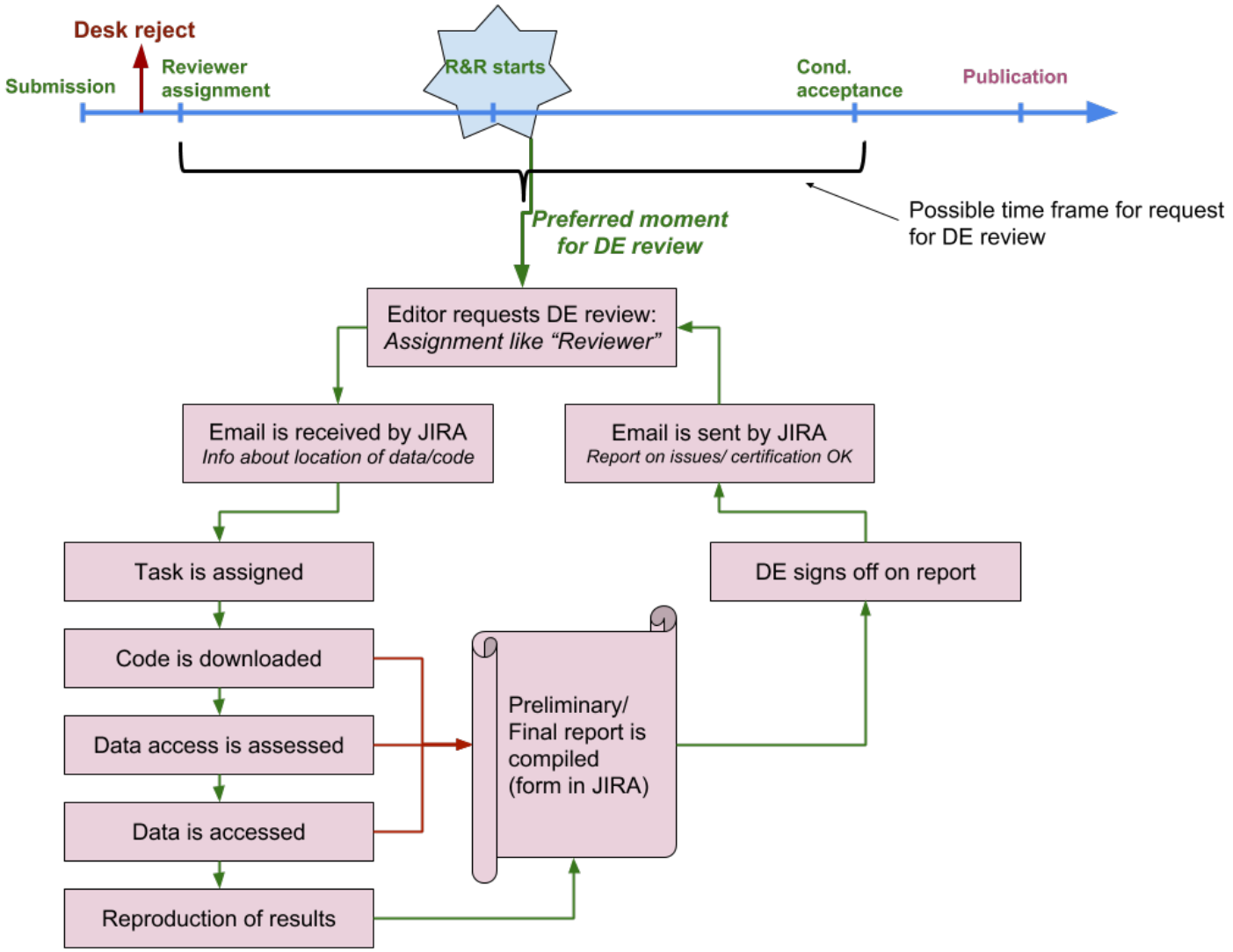
Best practices

- Follow robust coding
  - Ensure that code reliably produces results *(possibly automated)*
  - Before you finish the manuscript, run all analysis code again *(if not too onerous)*

The goal at the AEA

- Ensure **reproducibility** of computational code
- Encourage **best practices**
- Not require double-work
  - If you have deposited your work *(in a reliable location)*, leave it there
  - If you have had your code verified *(by a reliable third party)*, we will accept that

Ensuring scalable reproducibility


Desk reject
Submission
Reviewer assignment
R&R starts
Cond. acceptance
Publication
Preferred moment for DE review
Possible time frame for request for DE review
Editor requests DE review:
Assignment like "Reviewer"
Email is received by JIRA
Info about location of data/code
Email is sent by JIRA
Report on issues/ certification OK
Task is assigned
Code is downloaded
Data access is assessed
Data is accessed
Reproduction of results
Preliminary/ Final report is compiled (form in JIRA)
DE signs off on report

New AEA Data and Code Availability Policy

Dear [AUTHOR]:
I am writing about your paper [MC ID]. I am ready to give you a "conditional accept" on the paper.
The condition is simply to work with the AEA's data co-editor, Lars Vilhuber (copied on this email), to prepare the data and code for publication. The data is an important contribution of the paper.
Thank you for submitting your work.
I am looking forward to seeing the paper in print.

New AEA Data and Code Availability Policy

Dear [AUTHOR]:
I am writing about your paper [MC ID]. I have received two referee reports, which you will find attached. We would like you to **revise and resubmit** your paper. […]
As you revise the paper, please also work with the AEA's data co-editor, Lars Vilhuber (copied on this email), to document and verify the reproducibility of the data and code. The data is an important contribution of the paper.
Thank you for submitting your work.
I am looking forward to seeing the revised paper.

Policy A.2	Policy B
Data Availability Policy	Data and Code Availability Policy
It is the policy of the American Economic Association to publish papers only if	**It is the policy of the American Economic Association to publish papers only if**
the data used in the analysis are clearly and precisely documented	**the data and code used in the analysis are clearly and precisely documented;**
and are readily available to any researcher for purposes of replication.	access to the data and code is clearly and precisely documented, **and is non-exclusive to the authors.**
Authors of accepted papers that contain empirical work, simulations, or experimental work must provide,	Authors of accepted papers that contain empirical work, simulations, or experimental work must provide,
prior to publication,	**prior to acceptance,**
the data, programs, and other details of the computations sufficient to permit replication.	information about the data, programs, and other details of the computations sufficient to permit replication, as well as information about access to data and programs.
These will be posted on the AEA Data and	Data and programs should be archived in

prior to publication,	**prior to acceptance,**
the data, programs, and other details of the computations sufficient to permit replication.	information about the data, programs, and other details of the computations sufficient to permit replication, as well as information about access to data and programs.
These will be posted on the AEA Data and Code Repository at *TBD*.	**Data and programs should be archived in community-recognized or general repositories**, including the AEA Data and Code Repository at *TBD*.
	Authors will provide access to editors and reviewers, if requested, to both data and programs prior to acceptance.
The Editor should be notified at the time of submission if the data used in a paper are proprietary or if, for some other reason, the requirements above cannot be met.	The Editor should be notified at the time of submission if access to the data used in a paper is restricted or limited, or if, for some other reason, the requirements above cannot be met.
The AEA Data Editor will assess compliance with this policy.	The AEA Data Editor will assess compliance with this policy,
	and will verify the accuracy of the information

	repositories, including the AEA Data and Code Repository at *TBD*.
	Authors will provide access to editors and reviewers, if requested, to both data and programs prior to acceptance.
The Editor should be notified at the time of submission if the data used in a paper are proprietary or if, for some other reason, the requirements above cannot be met.	The Editor should be notified at the time of submission if access to the data used in a paper is restricted or limited, or if, for some other reason, the requirements above cannot be met.
The AEA Data Editor will assess compliance with this policy.	**The AEA Data Editor will assess compliance with this policy,**
	and will verify the accuracy of the information prior to acceptance by the Editor.
	A statement describing compliance with this policy will be posted alongside the article.

Goal: earlier provision of data and code

"Arguably, the replication files should be submitted when the paper is **initially submitted** so that they will be available for inspection by the **referees**, if the referees so desire."

(McCullough et al, 2006)

Scalability and sustainability

Scalability of Verification

- 500+ articles per year at AEA *(not all have code or data)*
- Financing:
  - $100 submission fee minus $100 per referee report (x2)
  - Undergraduate student (~$15/h) spends 10-20 hours on most verifications *(would be far less if automated)*
    = $200 extra
  - Most journals are run at a loss *(but maybe Elsevier has the funds…)*

Scalability of Verification

- Third party verification services already exist!
  - For research institutes and groupings (J-PAL, NBER, etc.)
  - At universities (Cornell, etc.)
  - Because authors already do it
- Even at restricted-access centers
  - Explicitly: France
  - Implicitly: German IAB data, other restricted-access data (remote processing at NCHS, Statistics Canada)
  - Interest in other institutions (including Census Bureau)

Scalability of Verification

Third party verification

- How to fund
  - similar to open-access submission fees?
  - Requirement by funders?
- How to certify third-party certifiers?
  - How reliable is their service? What do they check?
  - Who certifies? *(Association of Data Editors?)*
- These are **open questions**
- They need to be solved for persistence of the effort

Verifying Data and Code Deposits

Why do journals like affiliated repositories (or website deposits)?

- They can ensure **longevity/ persistence**
- They can ensure **access**
- They can ensure **availability**

Verifying Data and Code Deposits

- Not every data repository is created equal
  - Github, Dropbox, etc. are not data or code repositories
  - Is the institutional repository at the University of Southern Venezuela a reliable repository?
  - Is the institutional repository at Cornell University a reliable repository?
  - Is the institutional repository at Harvard University (Dataverse!) a reliable repository?
  - **Are the National Archives a reliable repository?**

Verifying Data and Code Deposits

- Not every data repository is created equal
  - The Second Bank of Third City credit card data is not a data/code repository
  - Is the School Board of Third City a reliable repository?
  - Is the JPMC Institute a reliable repository?
  - Is the US Census Bureau a reliable repository?
  - **Are any restriced-access repositories a reliable repository?**

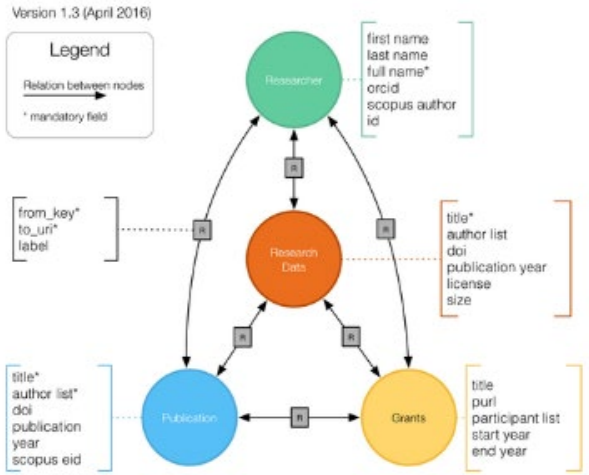
Linking objects (data, programs), articles and researchers

- Reminder: currently a very manual process
  - Only really works if the article cites the data
- Infrastructure starting to emerge
  - If article cites data (DOI!)
  - If archive and/or journal leverages infrastructure

DataCite

Crossref

ResearchGraph



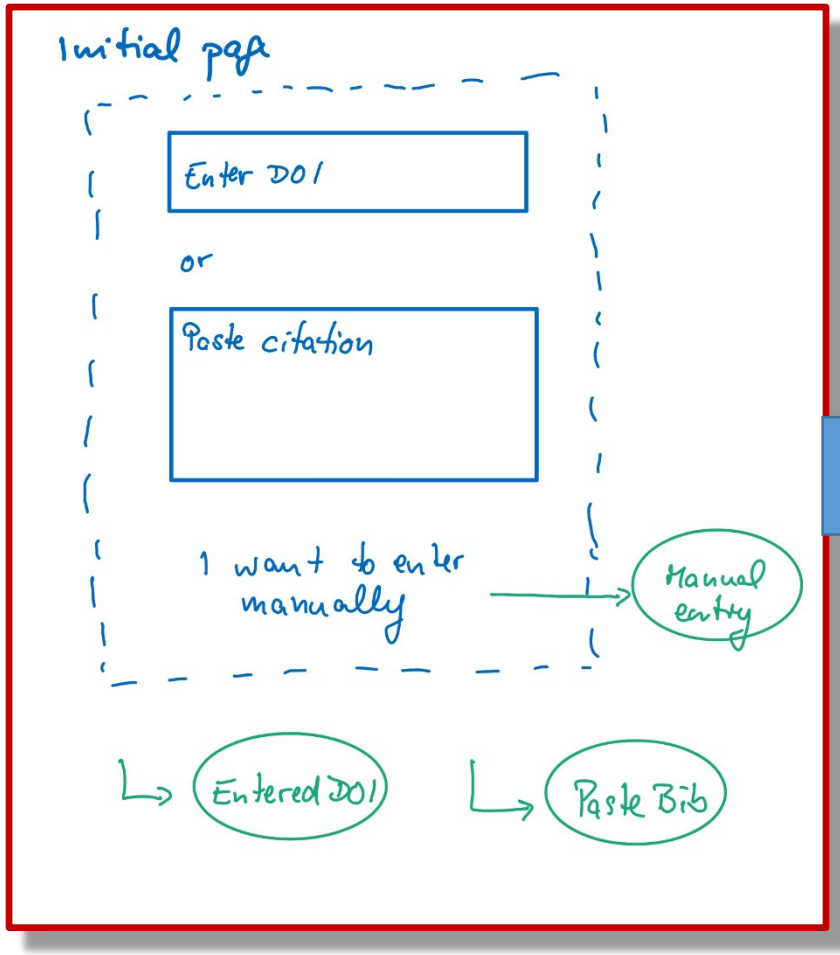
AEA: improve transparency of all data deposits

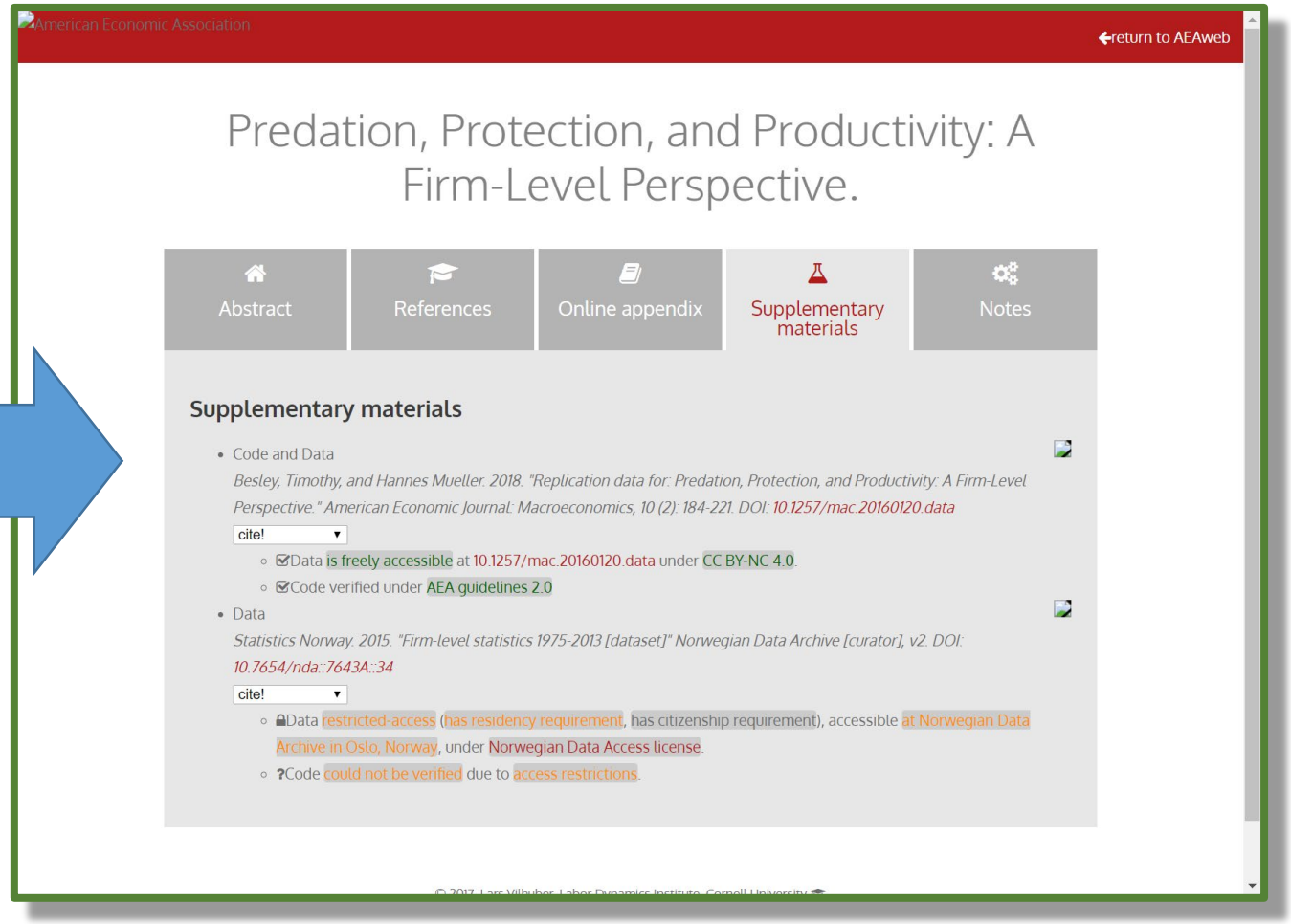
- Developed a schema to collect relevant information
  - **Relies** as much as possible on lookups of **existing data**
  - **Collects only** as much information **as necessary**
  - **Replaces existing** documentation efforts
  - Can be done **early** in research workflow

AEA: improve transparency of all data deposits

- Developed a schema to collect relevant information
  - **Uniformly applied** to public-use and restricted-access data
  - Can be added at low-cost to existing journal websites
  - Can be data-mined

Richer metadata, more transparency





Supplementary materials

- Code and Data

  Besley, Timothy, and Hannes Mueller. 2018. "Replication data for: Predation, Protection, and Productivity: A Firm-Level Perspective." American Economic Journal: Macroeconomics, 10 (2): 184-221. DOI: 10.1257/mac.20160120.data

  cite!

  - ☑Data is freely accessible at 10.1257/mac.20160120.data under CC BY-NC 4.0.
  - ☑Code verified under AEA guidelines 2.0

- Data

  Statistics Norway. 2015. "Firm-level statistics 1975-2013 [dataset]" Norwegian Data Archive [curator], v2. DOI: 10.7654/nda::7643A::34

  cite!

  - 🔒Data restricted-access (has residency requirement, has citizenship requirement), accessible at Norwegian Data Archive in Oslo, Norway, under Norwegian Data Access license.
  - ?Code could not be verified due to access restrictions.

New problem: Licensing of code and data

Do you know what license your journal supplements are under?

Really brief licensing primer

- Software licenses:
  - *Copyright*
  - *protecting yourself* from being held liable
- US: copyright is automatic
  - if you don't choose a license for your software, *no one else can use it!*
- Journals: Usually acquire copyright
  - Most likely, you also assigned the copyright to the supplement to the journal!

Source: http://kbroman.org/steps2rr/pages/licenses.html

Did you know?

- The AEA acquired the copyright to the supplements when you assigned the article copyright
- The AEA did ***not grant a default license***
- Thus, all replication and reproduction attempts are infringing on the AEA's copyright!

We're fixing that…

Best practices in licensing

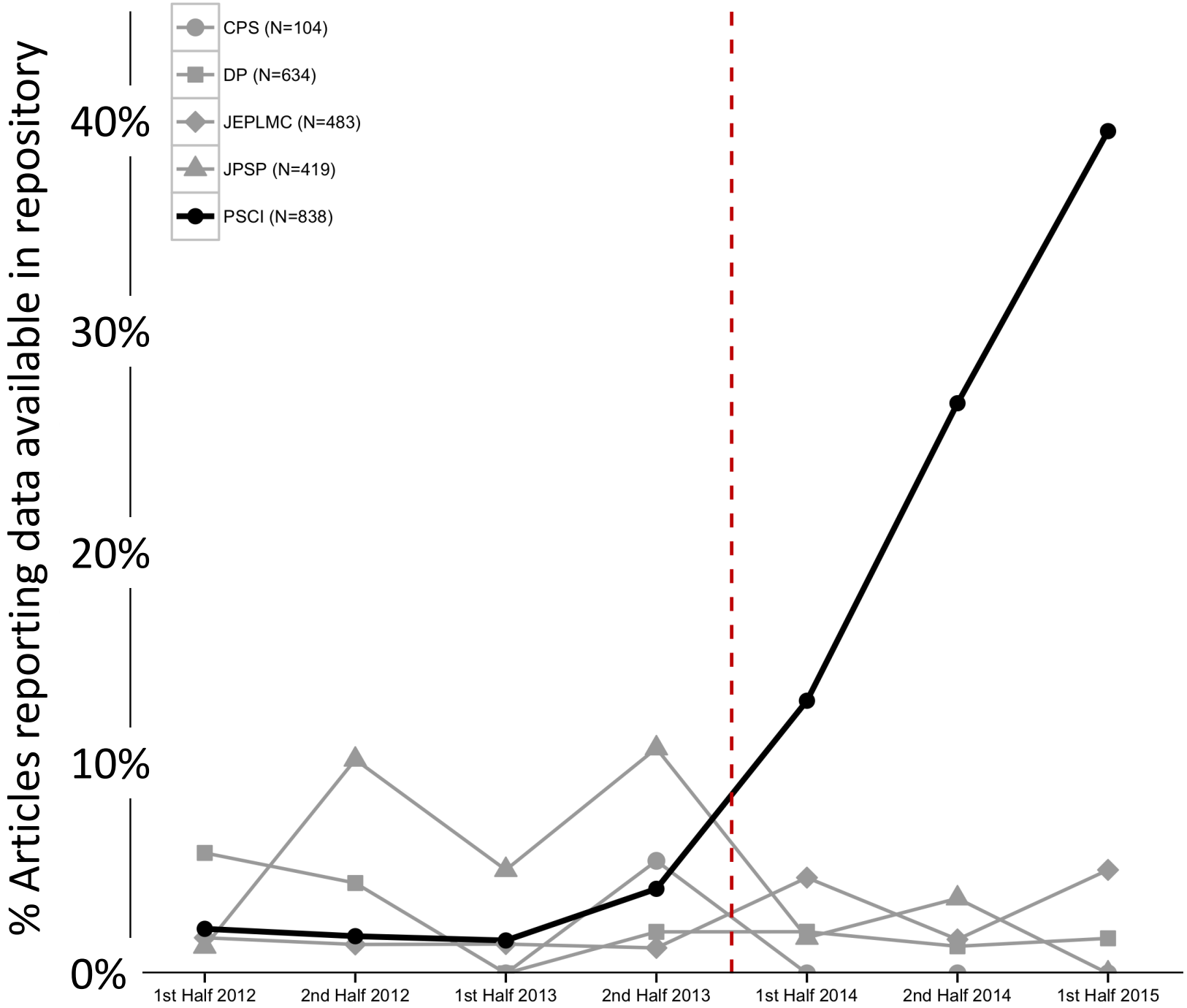
- Data: Creative Commons Attribution (**CC-BY**) and variants
  - Non-commercial (NC)
  - Share-alike (SA)
- Code: various Open Source licenses
  - GPL: GNU Public License *(restrictive)*
  - MIT or **(modified) BSD** license *(less restrictive)*

Other initiatives

Center for Open Science Badges

https://cos.io/our-services/open-science-badges/; 53 adopting journals (18 as of 2017)

Kidwell et al., 2016


CPS (N=104)
DP (N=634)
JEPLMC (N=483)
JPSP (N=419)
PSCI (N=838)
% Articles reporting data available in repository
40%
30%
20%
10%
0%
1st Half 2012
2nd Half 2012
1st Half 2013
2nd Half 2013
1st Half 2014
2nd Half 2014
1st Half 2015

Signals? Badges? Transparency!

- Positives:
  - Give credit for previously invisible activities
  - Can be assessed quickly
- Negatives:
  - Need to be known in order to be effective
  - May bias outcomes!
  - Require effort for verification?

Example: COS disclosures

Open Data: Authors complete two disclosure items for each Open Data badge application:

1. Provide the URL, DOI, or other **permanent** path for accessing the data in a public, **open access** repository.

- *How do I know it is open access? **Verify**!*
- *How do I know the data is permanent? **Verify**?*
- *What do I do when **access is possible**, but **not** **open access**?*

Example: COS disclosures

Open Data: Authors complete two disclosure items for each Open Data badge application:

2. Is there **sufficient** information for an independent researcher to reproduce the reported results? If no, explain.

   - All researchers **claim** the information is sufficient -> our results

Example: COS disclosures

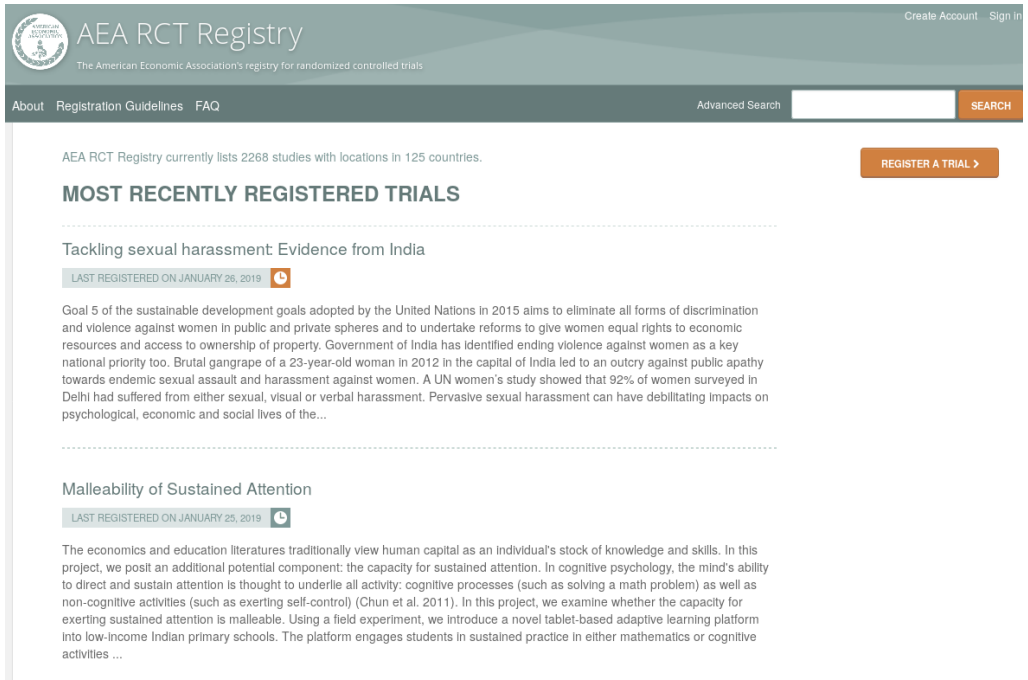
Open Materials: Authors complete two disclosure items for each Open Materials badge application:

1. Provide the URL, DOI, or other permanent path for accessing the materials in a public, open access repository.
2. Is there sufficient information for an independent researcher to reproduce the reported methodology? If no, explain.

Similar concerns as before

Pre-registration

Preregistration



AEA RCT Registry

The American Economic Association's registry for randomized controlled trials

Create Account Sign in

About Registration Guidelines FAQ Advanced Search SEARCH

AEA RCT Registry currently lists 2268 studies with locations in 125 countries.

REGISTER A TRIAL >

MOST RECENTLY REGISTERED TRIALS

Tackling sexual harassment: Evidence from India

LAST REGISTERED ON JANUARY 26, 2019

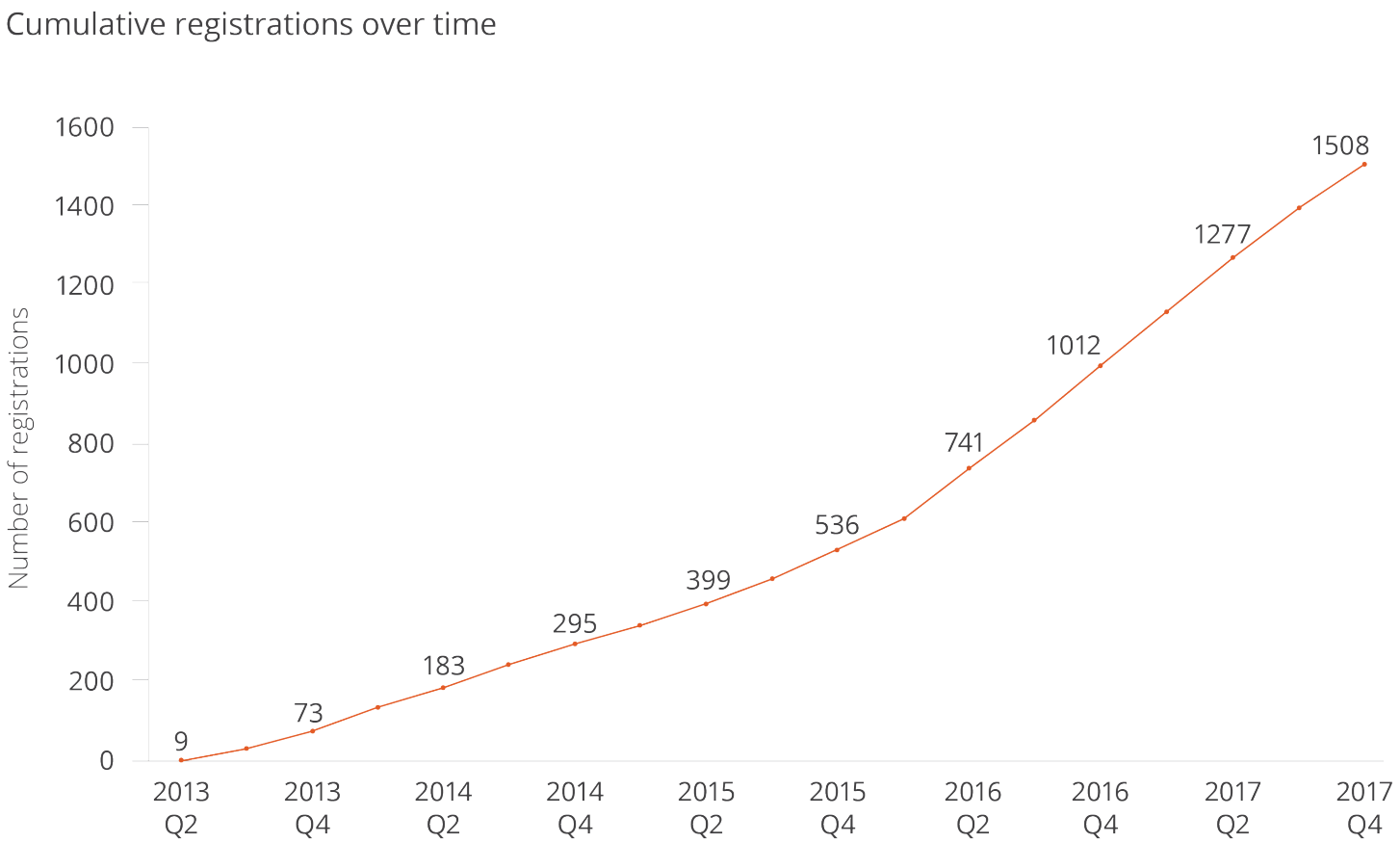
Goal 5 of the sustainable development goals adopted by the United Nations in 2015 aims to eliminate all forms of discrimination and violence against women in public and private spheres and to undertake reforms to give women equal rights to economic resources and access to ownership of property. Government of India has identified ending violence against women as a key national priority too. Brutal gangrape of a 23-year-old woman in 2012 in the capital of India led to an outcry against public apathy towards endemic sexual assault and harassment against women. A UN women's study showed that 92% of women surveyed in Delhi had suffered from either sexual, visual or verbal harassment. Pervasive sexual harassment can have debilitating impacts on psychological, economic and social lives of the...

Malleability of Sustained Attention

LAST REGISTERED ON JANUARY 25, 2019

The economics and education literatures traditionally view human capital as an individual's stock of knowledge and skills. In this project, we posit an additional potential component: the capacity for sustained attention. In cognitive psychology, the mind's ability to direct and sustain attention is thought to underlie all activity: cognitive processes (such as solving a math problem) as well as non-cognitive activities (such as exerting self-control) (Chun et al. 2011). In this project, we examine whether the capacity for exerting sustained attention is malleable. Using a field experiment, we introduce a novel tablet-based adaptive learning platform into low-income Indian primary schools. The platform engages students in sustained practice in either mathematics or cognitive activities ...

Registrations at the AEA Registry



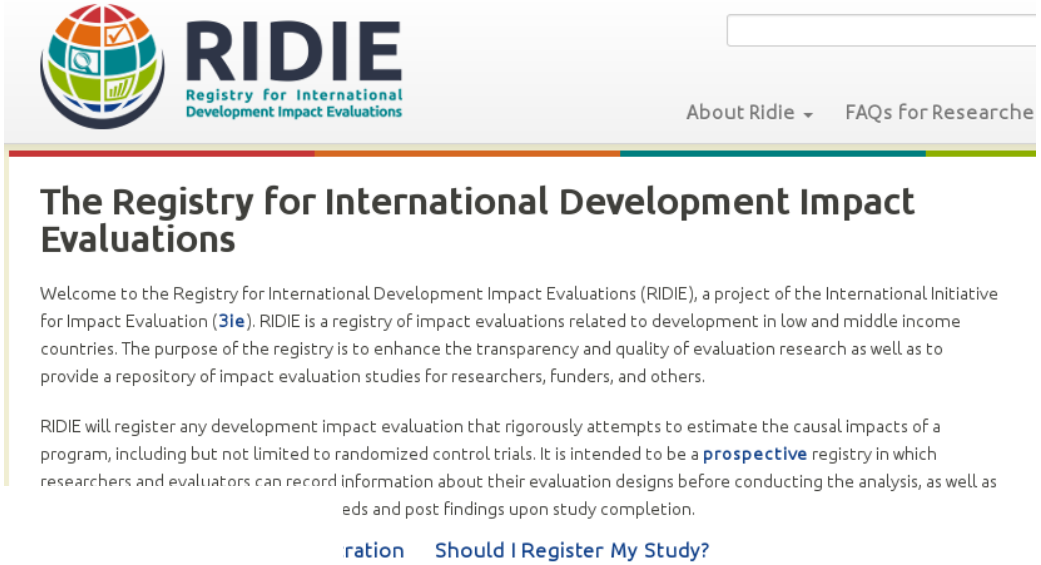
Plans at the AEA

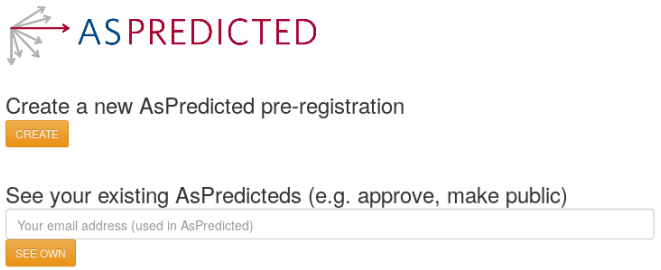
- Integrate registrations more robustly
  - Cite through DOI
  - Link more robustly (not just citation!)
  - Highlight through badges?

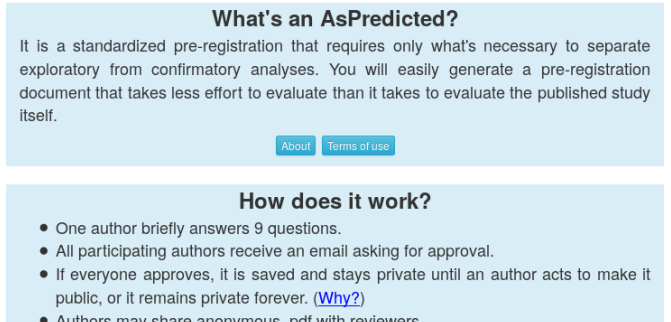
Plans at the AEA

Not just the AEA Registry

- OSF registrations
- Int'l Initiative for Impact Evaluation (3ie)'s RIDIE registry
- Evidence in Governance And Politics (EGAP)'s registry
- As-Predicted







Registered Reports

Registered Reports

Berkeley Initiative for Transparency in the Social Sciences

Registered Reports at the *Journal of Development Economics*

As part of a pilot project, the *Journal of Development Economics* (JDE) now offers authors the opportunity to submit empirical research designs for review and approval *before* the results of the study are known. The *pre-results review* track is designed to award well-designed and well-executed studies regardless of whether their empirical results yield clear interpretations.

This is among the first attempts to introduce pre-results peer review in an economics journal. However, more than 156 academic journals in biology, medicine, political science, psychology, and other disciplines are

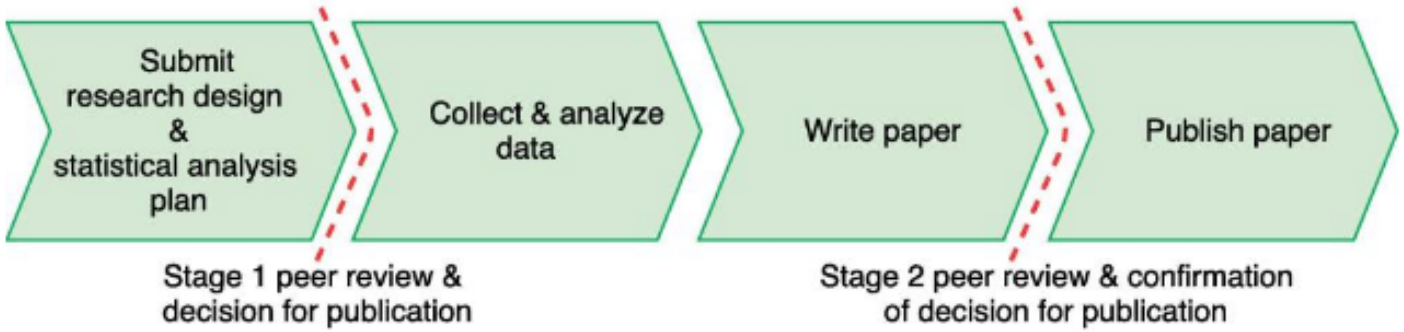
FAQs for Reviewers
Policy Updates
RR Peer Review Flowchart
Stage 1 Proposal Template
JDE's Submissions Portal
Prospective Articles
Contact us

empirical results yield clear interpretations.

This is among the first attempts to introduce pre-results peer review in an economics journal. However, more than 156 academic journals in biology, medicine, political science, psychology, and other disciplines are already implementing pre-results review, with the subsequent published articles usually called 'Registered Reports' (RR).

What is Pre-Results Review?

Pre-results review splits the peer review process into two stages. In Stage 1, authors submit an introduction, methods, and analysis plan for a prospective empirical study for which data have yet to be collected (or accessed) and analyzed. This submission is evaluated based on the importance of the research question(s), the soundness of the theoretical reasoning, and the credibility and feasibility of the research design.



The publishing process for pre-results review submissions at the JDE

Positively evaluated submissions are **accepted based on pre-results review.** This constitutes a commitment by the journal to publish the full paper, regardless of the nature of the empirical results. Authors then collect and analyze their data, and submit the full paper (including results and analysis) for final review and publication (Stage 2). The final Stage 2 review provides quality assurance and ensures alignment with the research design peer reviewed in Stage 1.

Your turn!

Sharing of code and data is coming

Are you ready?

New skills (to learn, to teach)

- How to incorporate reproducible practices into your workflow
- How to structure your code and your data with an eye on reproducibility
- How to license your contributions!
- When to pre-register, and when not to
- Document early, and often

It is good practice

- Hamermesh (2007) already said:

"the payoff is in the influence of one's ideas: having other scholars base their work on those ideas, having students learn from them, and […] having public policy influenced by them […] our ideas are unlikely to be taken seriously if our empirical research is not credible"