



Before we start

- Please fill out the following survey:

<https://lars.vilhuber.com/s/mtl>



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

- Background
- 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?



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)

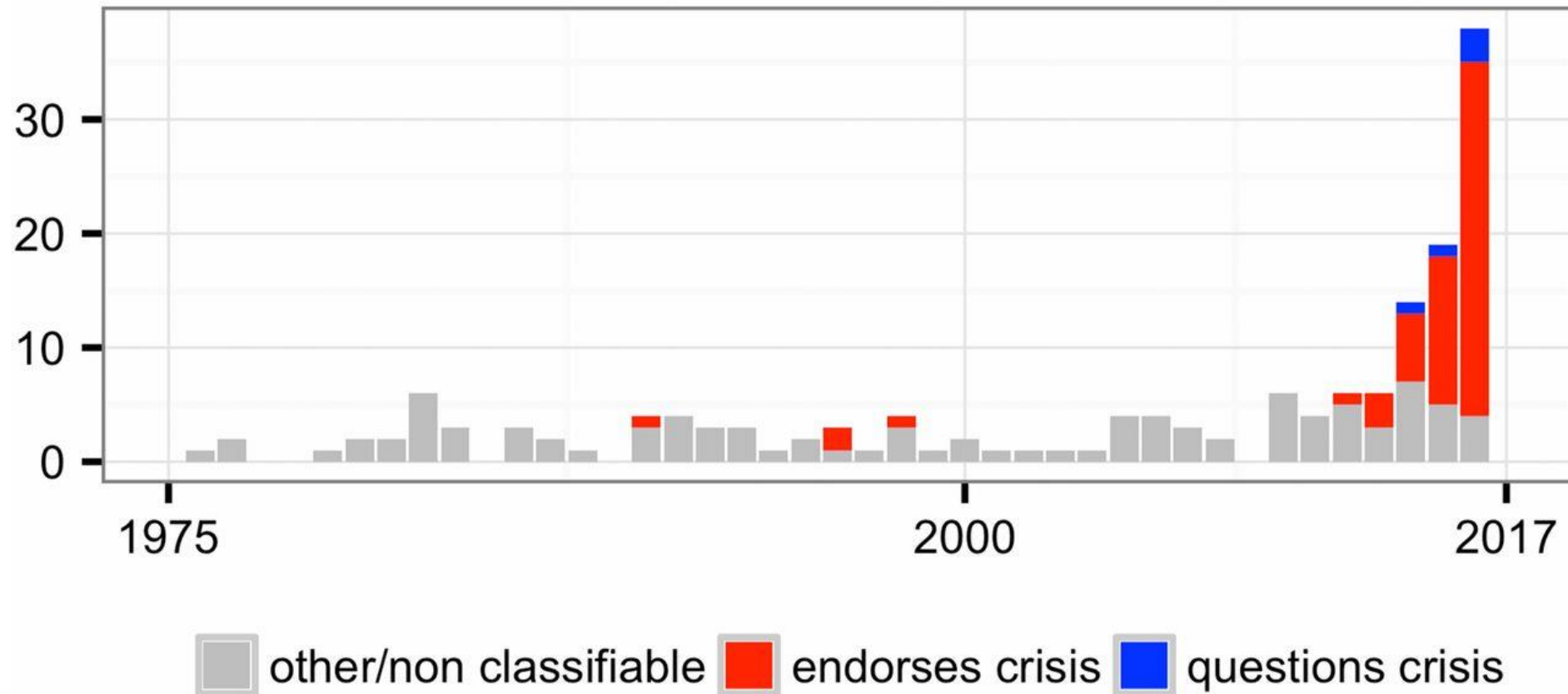


Introducing: The Reproducibility “Crisis”



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

Frequency of Crisis Narrative in Web of Science Records





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

Source: Nosek
Sackler talk 2017



The crisis in the 1980s in Economics

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

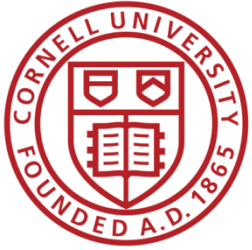


The crisis in the 2010s

- Ioannides (2016)
- Ioannidis, Stanley, Doucouliagos (2017): bias, low power
- Miguel et al (2014)
- Chang & Li (2015)
- Zimmermann (2015): Calls for a replication journal
- Many others...



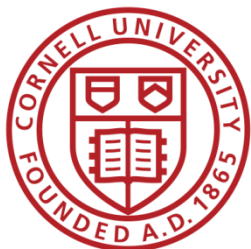
But there has also been
improvement



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... lead to changes


- Lead directly to
 - Data availability policies in Economics (1996: JMCB)
 - Replication section (Journal of Applied Econometrics, 2003)
 - More robust code archives
(Goffe and Parks (1997), Eddelbüttel (1997): CodEC -> SSC)



Statistical Software Components

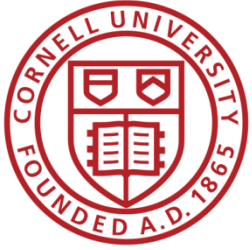
From [Boston College Department of Economics](#)
Boston College, 140 Commonwealth Avenue, Chestnut Hill MA 02467 U:
Contact information at [EDIRC](#).
Bibliographic data for series maintained by Christopher F Baum ([baum@](#)

[Access Statistics](#) for this software series.
Track citations for all items by [RSS feed](#)
Is something missing from the series or not right? See the [RePEc data series](#).

[GAPPORT: Stata module to calculates seats in party-list representation](#)  [downloads](#)
Ulrich Kohler

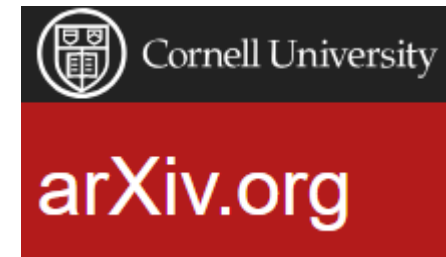
[GCLSORT: Stata module to sort a single variable via egen](#)
Philippe Van Kerm

[GPROD: Stata module to extend egen for product of obs](#)
Philip Ryan



The crisis in the 1990s... lead to changes

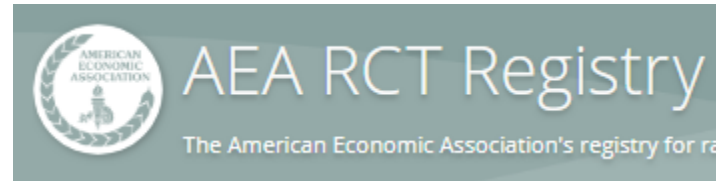
- Coincidental:
 - Better public-use data (IPUMS: Sobek and Ruggles, 1999)
 - Better open-source software (R Core Team, 2000)
 - New methods of exchanging manuscripts (working papers/ **preprints**) (early 90s, but publications: Ginsparg, 1997, Halpern 1998: arXiv; Krichel, 1997, others: RePEc/WoPEc)





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





So 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



Maybe it's only a tantrum...



Efficiency of scholarly 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 scholarly discourse?

- Early publications (20th century) contained **tables of data**, and the **math** was simple (maybe)
- **Data** became electronic, was no longer **included** or **cited**
- **Math** was transcribed to **code**, and was no longer **included**



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)



Efficiency of scholarly discourse!

**Modern publications thus need
the same transparency and completeness
as in the old days
to facilitate replicability**



What IS reproducibility?



Replication continuum (Bollen et al. 2015)





Replication continuum

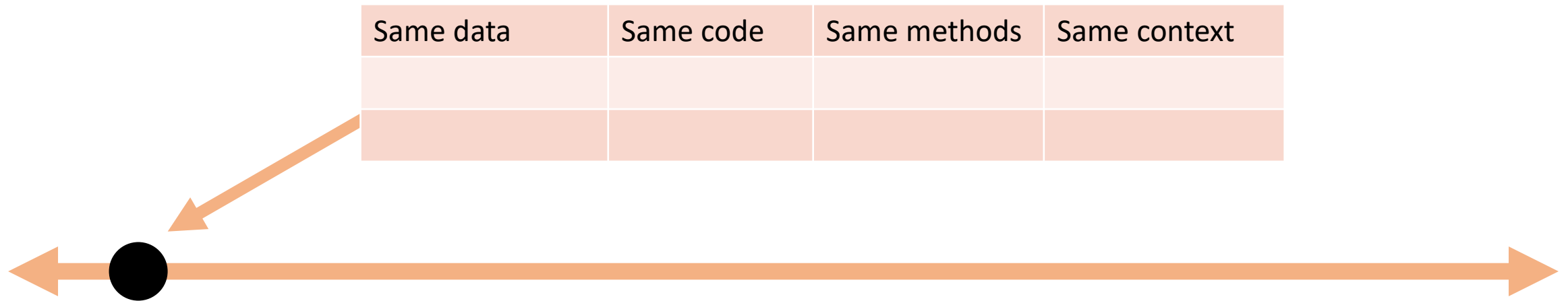


Reproducibility

- 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)



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

Same data	Different code or software	Same methods	Same context



Reproducibility

Replicability

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

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



Replication continuum

New data collection	Same code	Same methods	Same context



Reproducibility

Replicability

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

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



Replication continuum



Reproducibility

- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
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Replicability

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

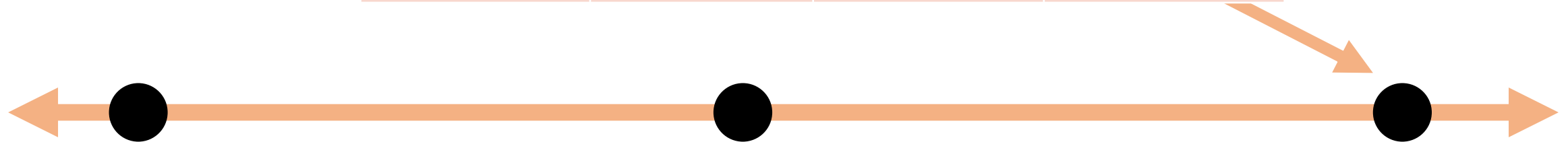
Generalizability

- 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

Replicability

Generalizability

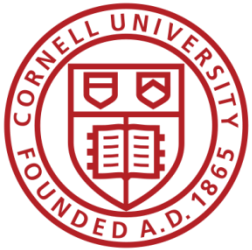
- Narrow Replication (Pesaran 2003)
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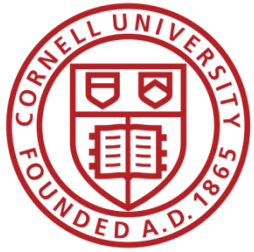


What is a
“Data Availability Policy”?



AEA “Data Availability Policy” (2018)

- 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.

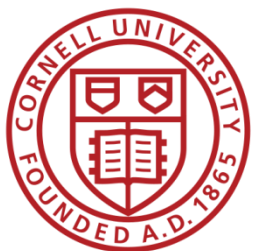


What does progress look like?



First round (2005-2012)

- Adding data availability requirements
 - AEA, 2005
 - Other journals (econ, others) follow
 - 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)



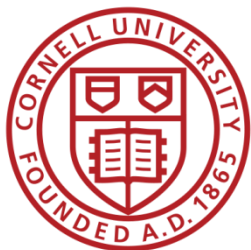
Second round (2012-)

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



Second round (2012-)

- 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



Preregistration

AEA RCT Registry (2011)

AEA RCT Registry
The American Economic Association's registry for randomized controlled trials

Create Account Sign in

AboutRegistration GuidelinesFAQ

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

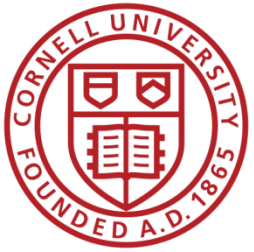
LAST REGISTERED ON JANUARY 25, 2019

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 ...



When to pre-register

- Ideally before the start of the study
- Alternatively, prior to seeing the data
- Also (currently) accepted prior to submission



Why pre-register

- “That information is especially helpful in research that emphasizes null hypothesis significance testing.
- A thorough preregistration promotes transparency and openness and **protects researchers from suspicions of p-hacking.**”



Second round (2012-)

Registered Reports

- <https://cos.io/rr>
- Chambers (2014)
- Nosek & Lakens (2014)



- Close cousin: Results-blind review



Second round (2012-)

Preprints in other sciences

- bioRxiv (2013)
- PsyArXiv (2016)

bioRxiv

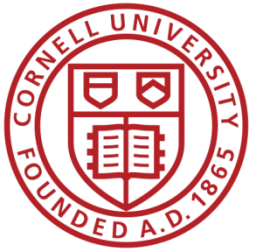
THE PREPRINT SERVER FOR BIOLOGY

Search



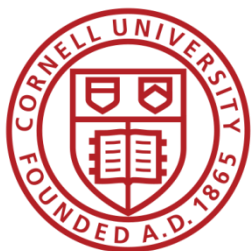
[Advanced Search](#)



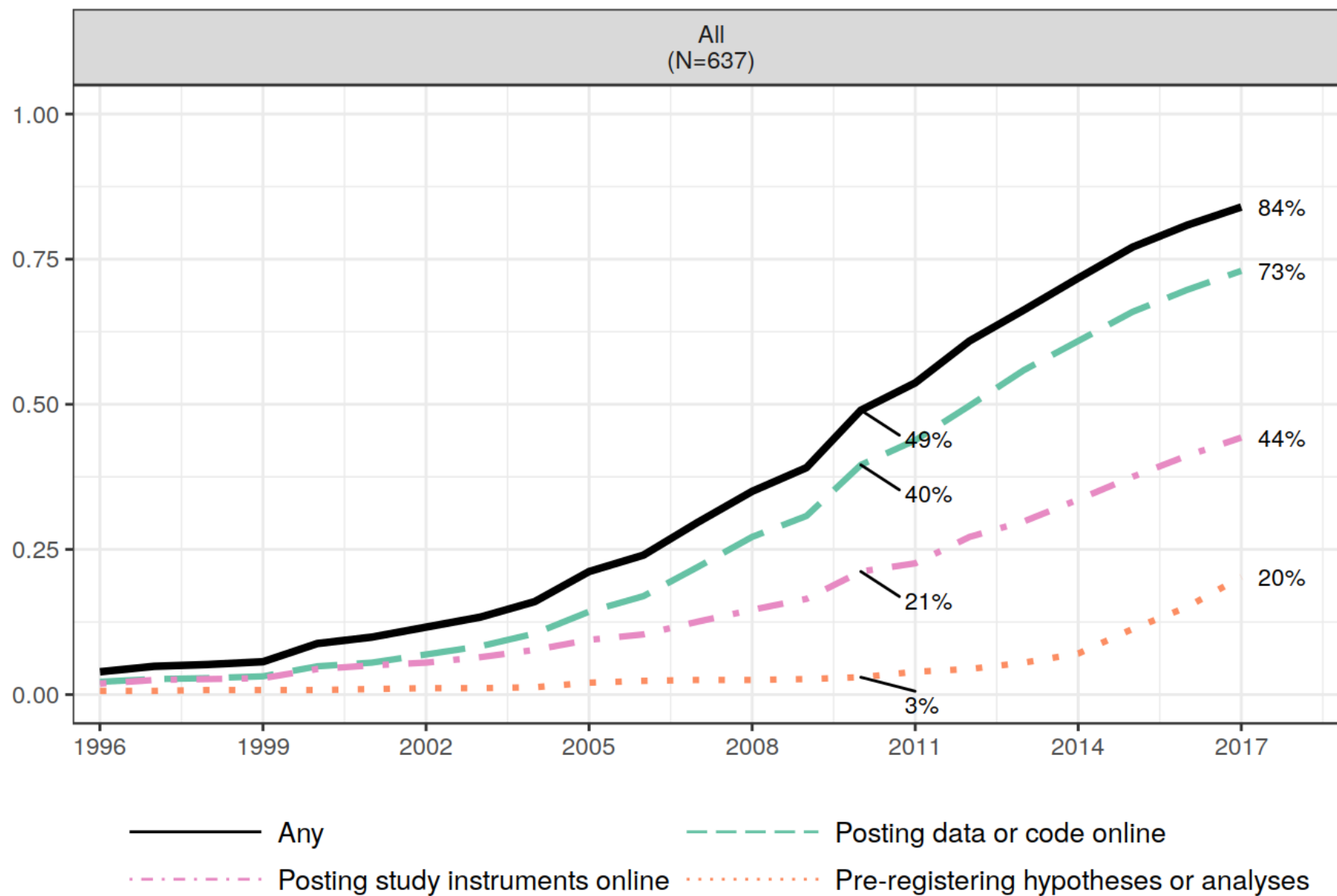


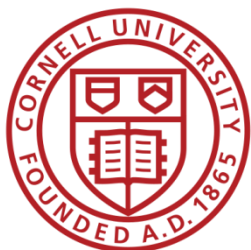
Economics: Positive attitudes?

- Often liberal sharing of data and code (via email, networks)
- Sharing of articles prior to publication (RePEc/WoPEc since 1990s, working papers since 1970s)

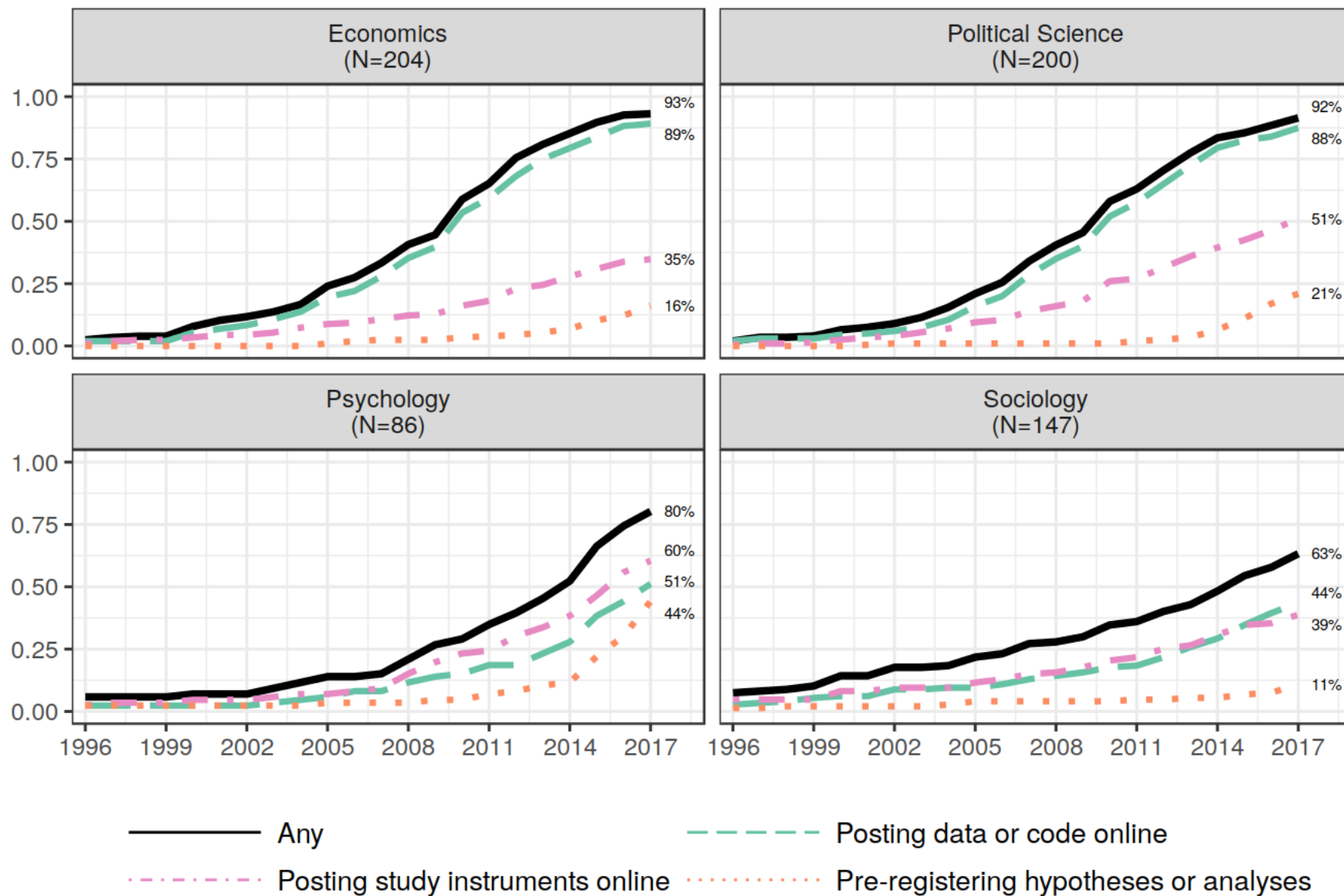


Share of Published Authors (PhD < 2010) Adopting Practice





Share of Published Authors (PhD < 2010) Adopting Practice





Wide use of public-use data

- **Macrodata:**

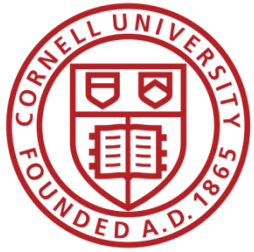
“We use data downloaded from the Bureau of Economic Analysis...”

- **Microdata:**

“... this paper uses data from the Current Population Survey...”



And yet, there are issues



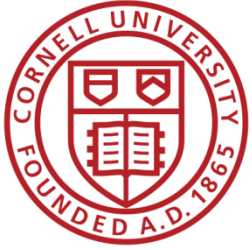
Wide use of public-use data

- **Macrodata:**

“We use data downloaded from the Bureau of Economic Analysis...”

- **Microdata:**

“... this paper uses data from the Current Population Survey...”



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**.”

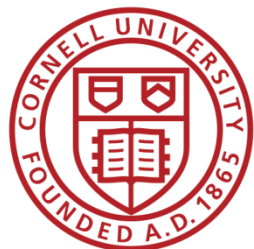
“The author might not realize all the data/subroutine files that his code utilizes, and **forget to include** said data/subroutine in his replication files.”



Making RELIABLE archives

Many datasets

- Are imperfectly described
- Are badly documented
- Have no (permanent) location defined
- All of the above



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](https://doi.org/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.



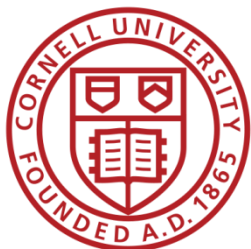
Risk



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





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](https://doi.org/10.1016/j.jeconom.2010.09.008)

PMCID: PMC3079891

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

[John M. Abowd](#) and [Lars Vilhuber](#)

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Abstract

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

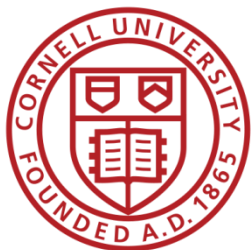
Press for the NBER; 2009. pp. 149–230.

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


 **Dataverse**

Search About

Lars Vilhuber Dataverse (Cornell University)

Harvard Dataverse > Lars Vilhuber Dataverse >

Replication data for: National estimates of gross employment and job flows from the Quarterly Workforce Indicators with der

 Metrics 4 Downloads

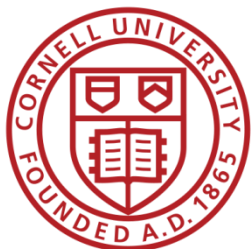
Replication data for: National estimates of gross employment and job flows from the Q Indicators with demographic and industry detail

Abowd, John M.; Vilhuber, Lars, 2014, "Replication data for: National estimates of gross employment and job flows from the Quarterly Workforce Indicators with demographic and industry detail", <http://dx.doi.org/10.7910/DVN/27923>, Harvard Dataverse, V2

If you use these data, please add this citation to your scholarly resources. Learn about [Data Citation Standards](#).

Description

The Quarterly Workforce Indicators are local labor market data produced and released by the Bureau of Economic Analysis. Unlike any other local labor market series produced in the U.S. or the rest of the world, the QWIs provide flows for workers (accession and separations), jobs (creations and destructions) and earnings (by occupation and sex), economic industry (NAICS industry groups), and detailed geography (county, Census Workforce Investment Area, as well as experimental, unreleased block-level estimates). The QWIs are the first national compilation of the existing public-use data (and only those public-use data) to construct the first national important enhancement to existing series because they include demographic and industry information compiled from data that have been integrated at the micro-level by the Longitudinal Employment Dynamics (LEDS) project.



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 Work 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 Work 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 Work 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/>





Using personal websites

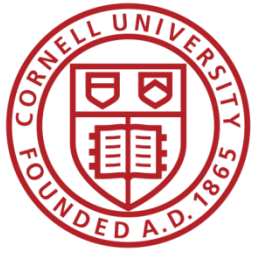
Don't even think about
using personal websites!



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**

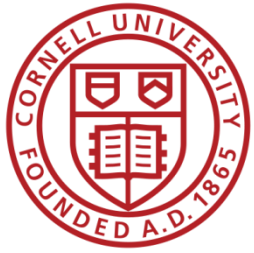
“This field experiment was made possible by the collaboration of a large-scale, nationwide firm in the retail sector.”

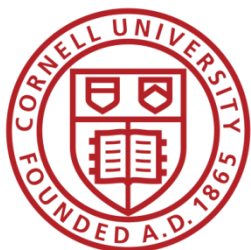
Damon doi:10.1257/app.2.2.147



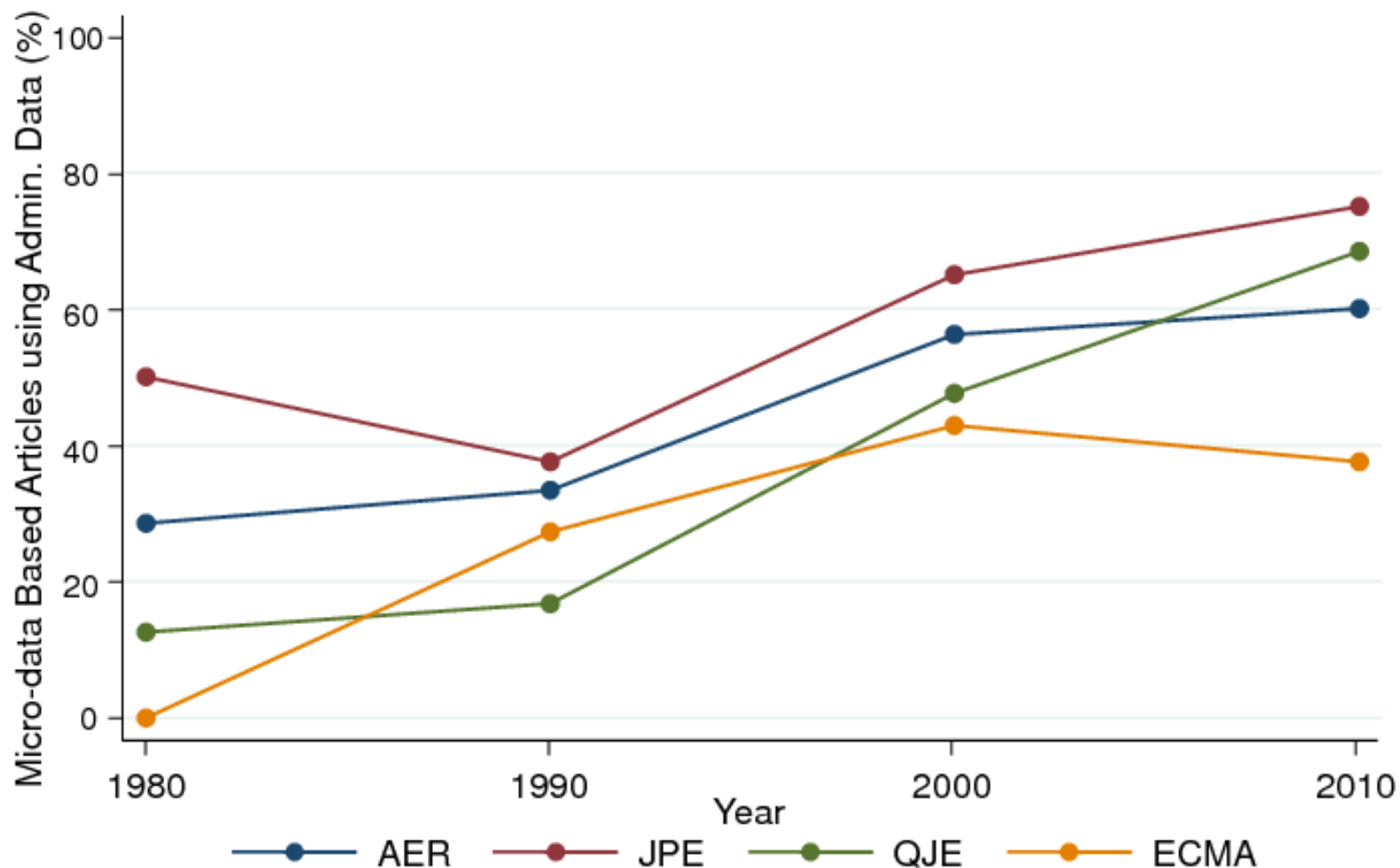
Death Knell for Public-use Data?

- 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.





Use of Administrative Data in Publications in Leading Journals, 1980-2010



Note: "Administrative" datasets refer to any dataset that was collected without directly surveying individuals (e.g., scanner data, stock prices, school district records, social security records). Sample excludes studies whose primary data source is from developing countries.



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 **$\sim 200 * 13 = 2600$** 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)*

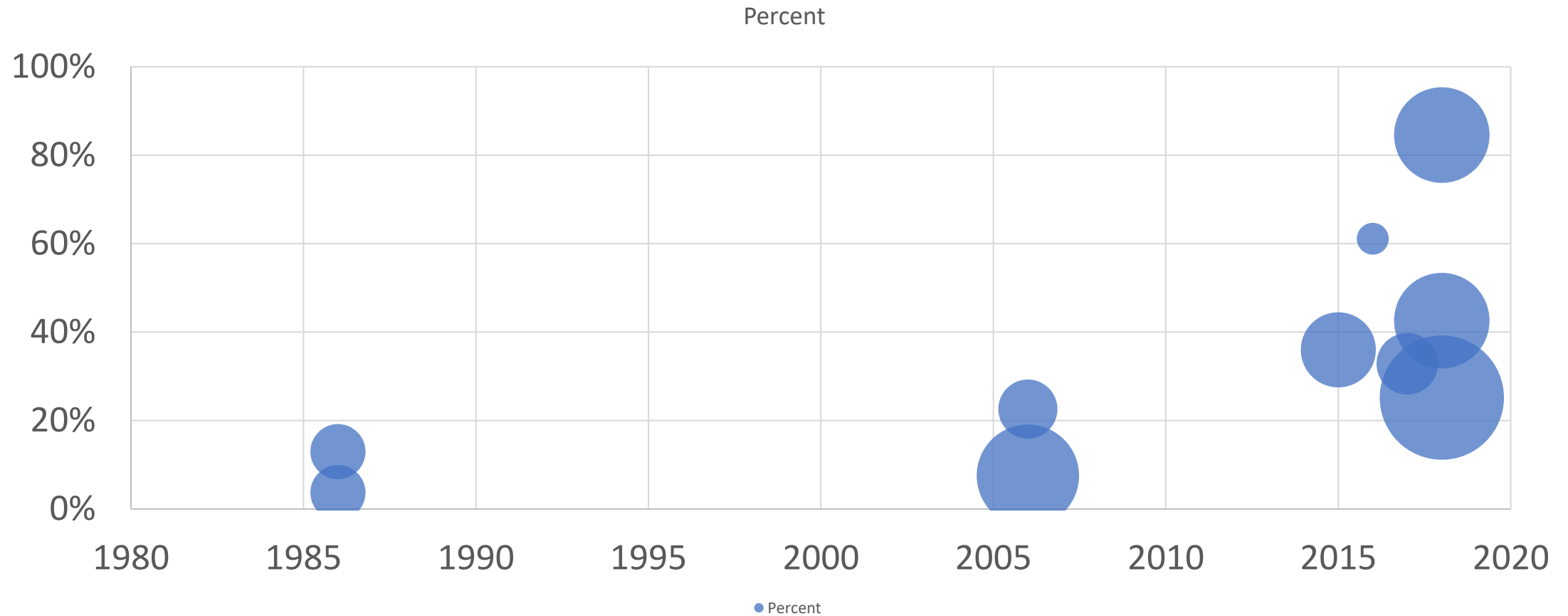


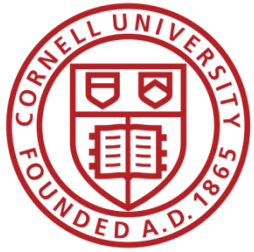
Explicit Replications and Reproduction Attempts

- 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

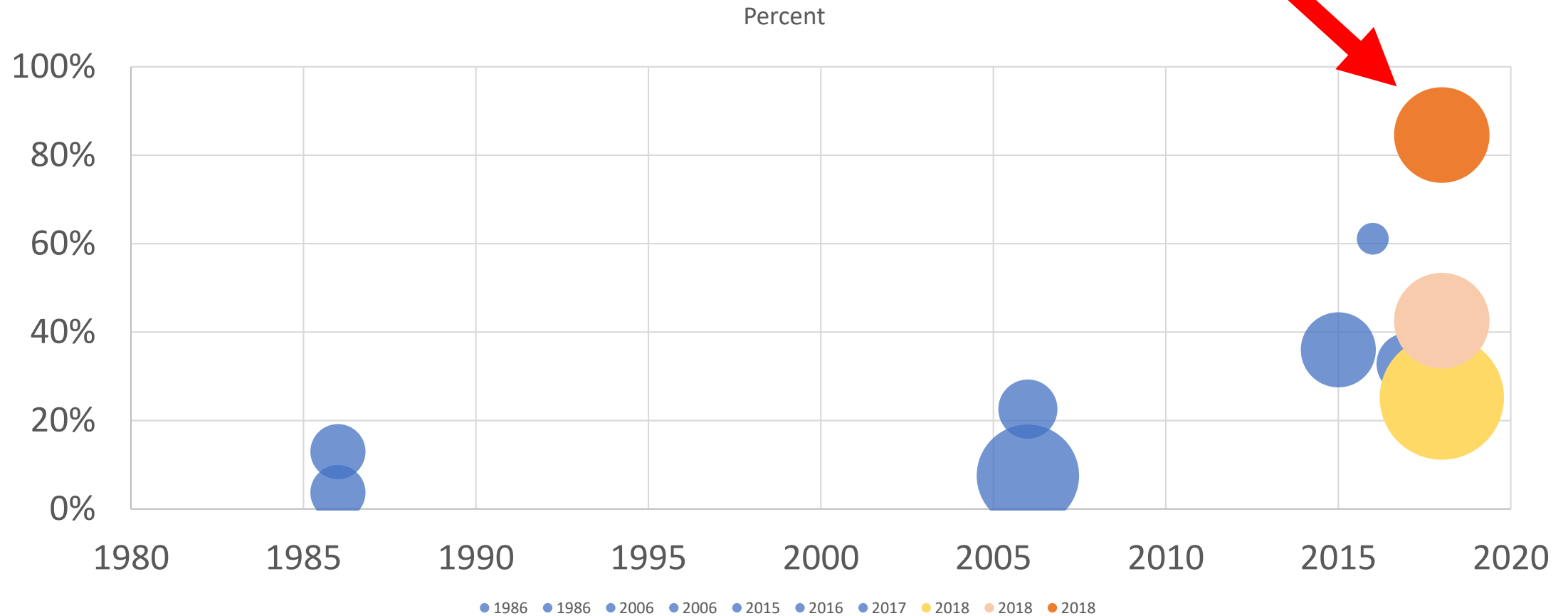


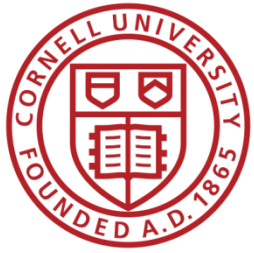
Some key statistics





Some key statistics





Cornell Replication Lab

2014 - 2018





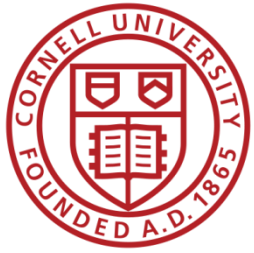
Cornell Replication Lab

2014 - 2018



Economics
Comp Sci.
OpRe





Cornell Replication Lab

2014 - 2018



Economics

Comp Sci.

OpRe



Reproduction

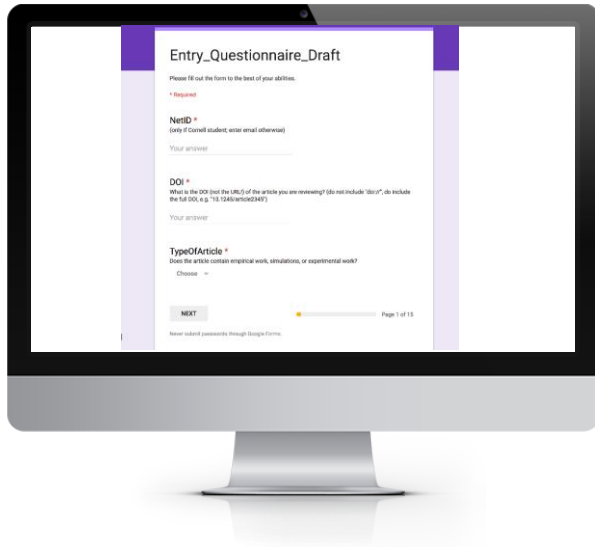
VCS

Cloud Computing





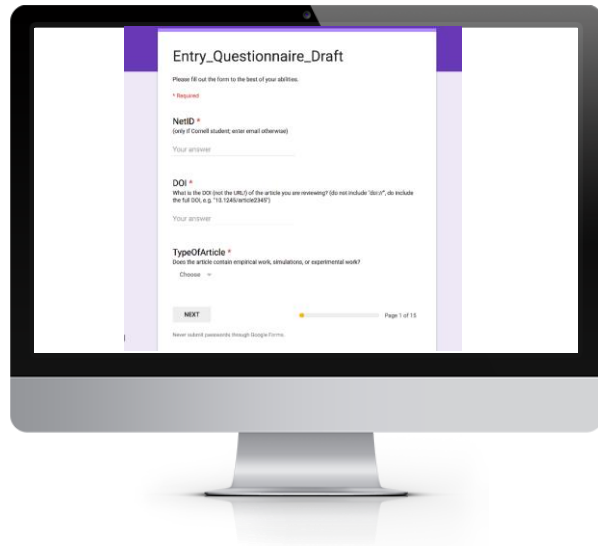
Method



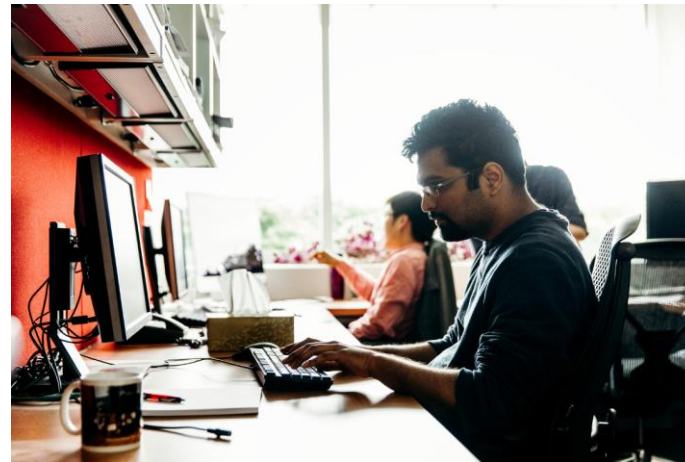
≡ Assessment Form



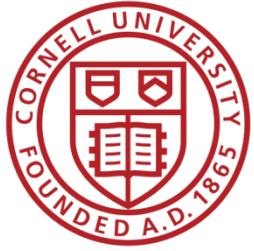
Method



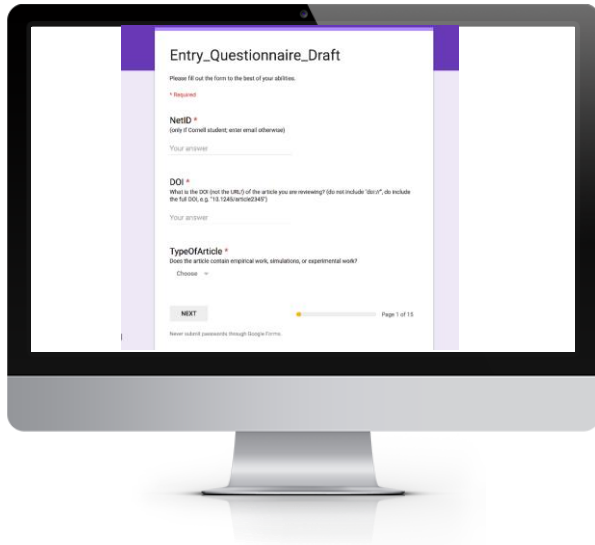
≡ Assessment Form



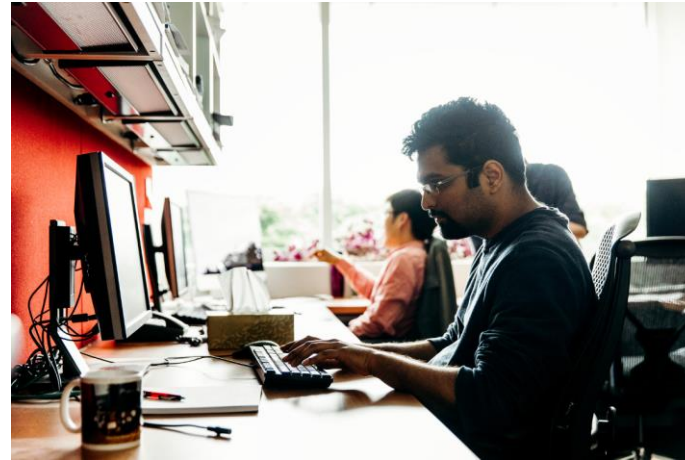
≡ Reproduction Exercise



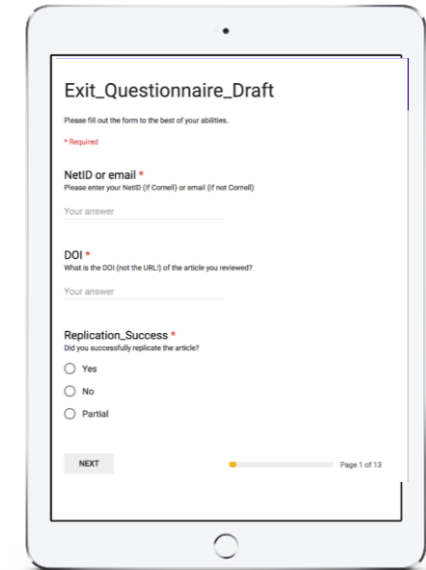
Method



≡ Assessment Form



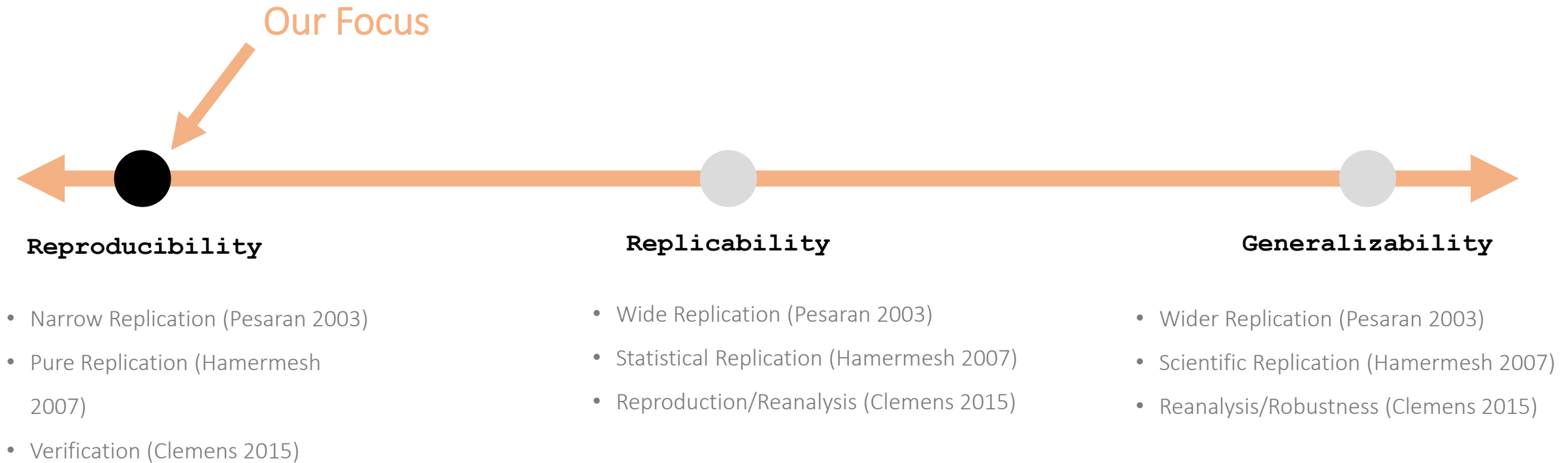
≡ Reproduction Exercise

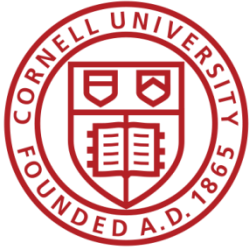


≡ Exit Questionnaire

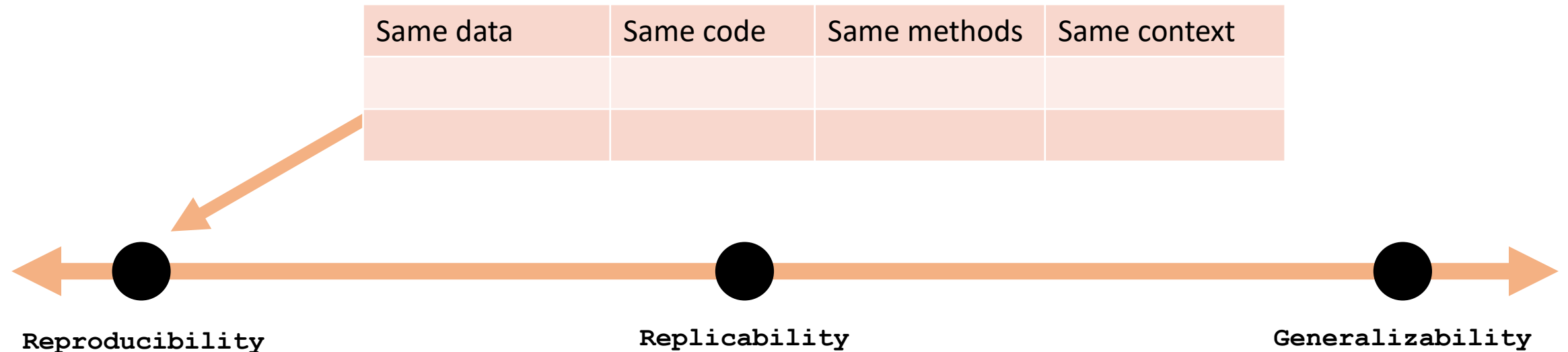


Replication continuum





Replication continuum



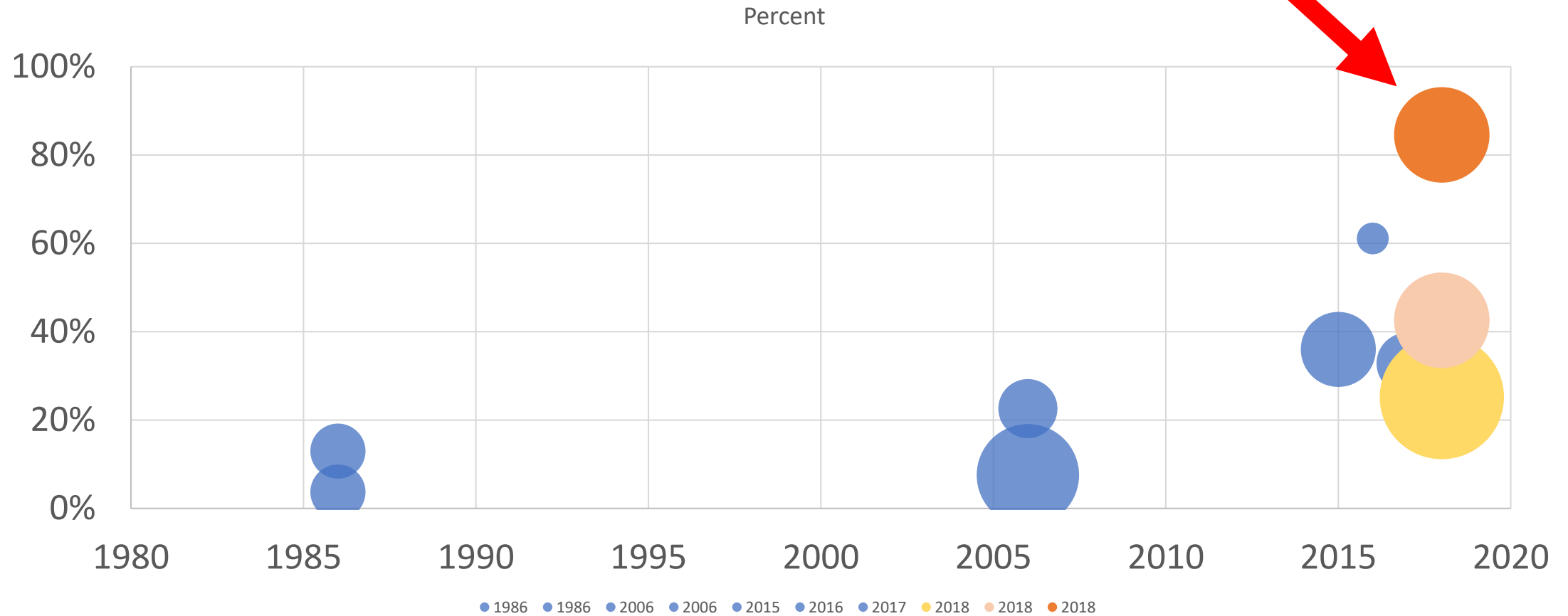
- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

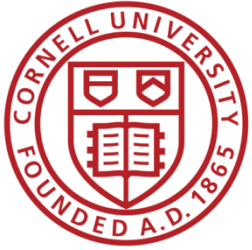
- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

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



Results?

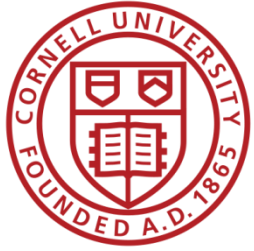




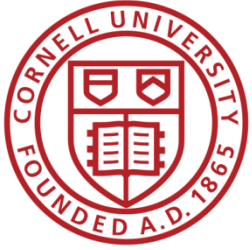
Some key statistics

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	2017	67	22				33%	Macroeconomics
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.



Current efforts at the AEA



Current efforts at the AEA

- Provide more transparency
 - To assist replication efforts
 - By better linking to paper-related resources (data, code, registration, etc.)
- Pre-emptively improve code archives
 - By conducting reproducibility checks
 - By working with groups that conduct reproducibility checks
- Better archives
 - Greater transparency of the code and data archives



AEA “Data Availability Policy” (2018)

- 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.

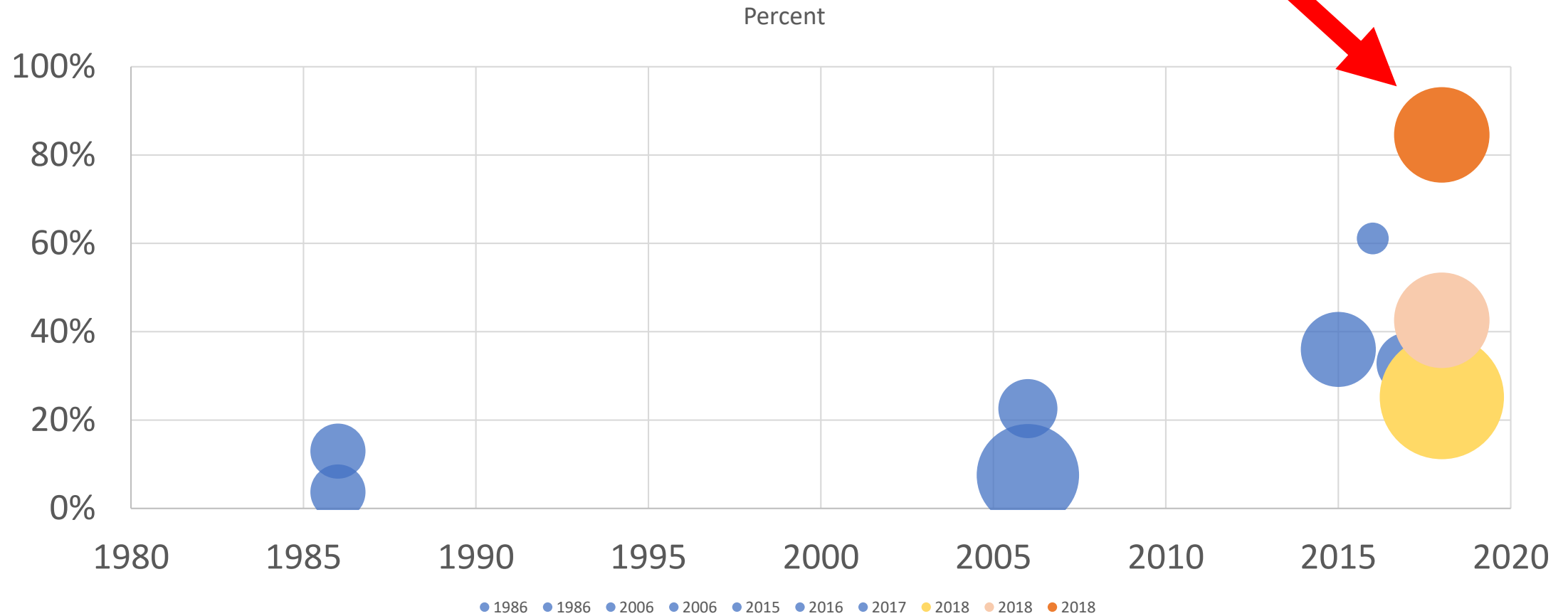


AEA “Data Availability Policy” (2019)

- 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.
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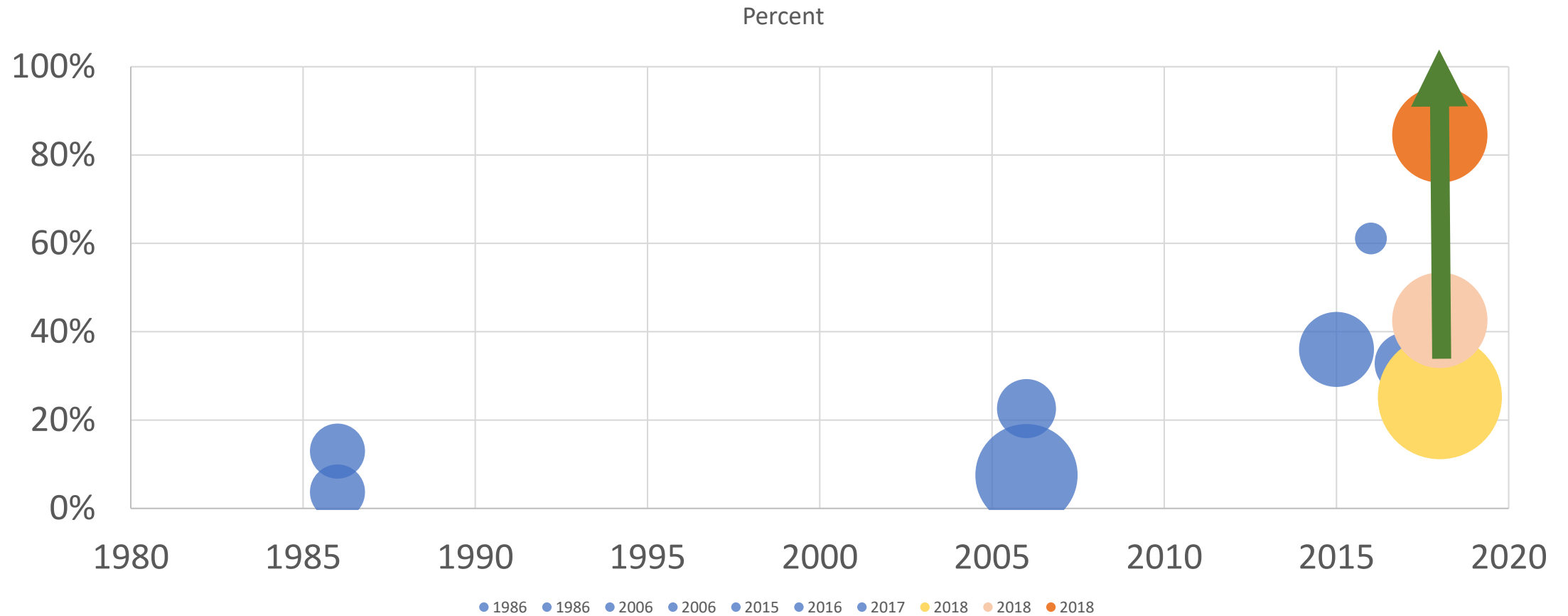


Results?





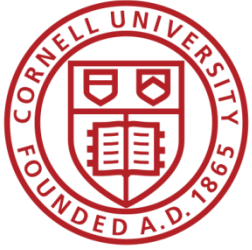
Results?





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

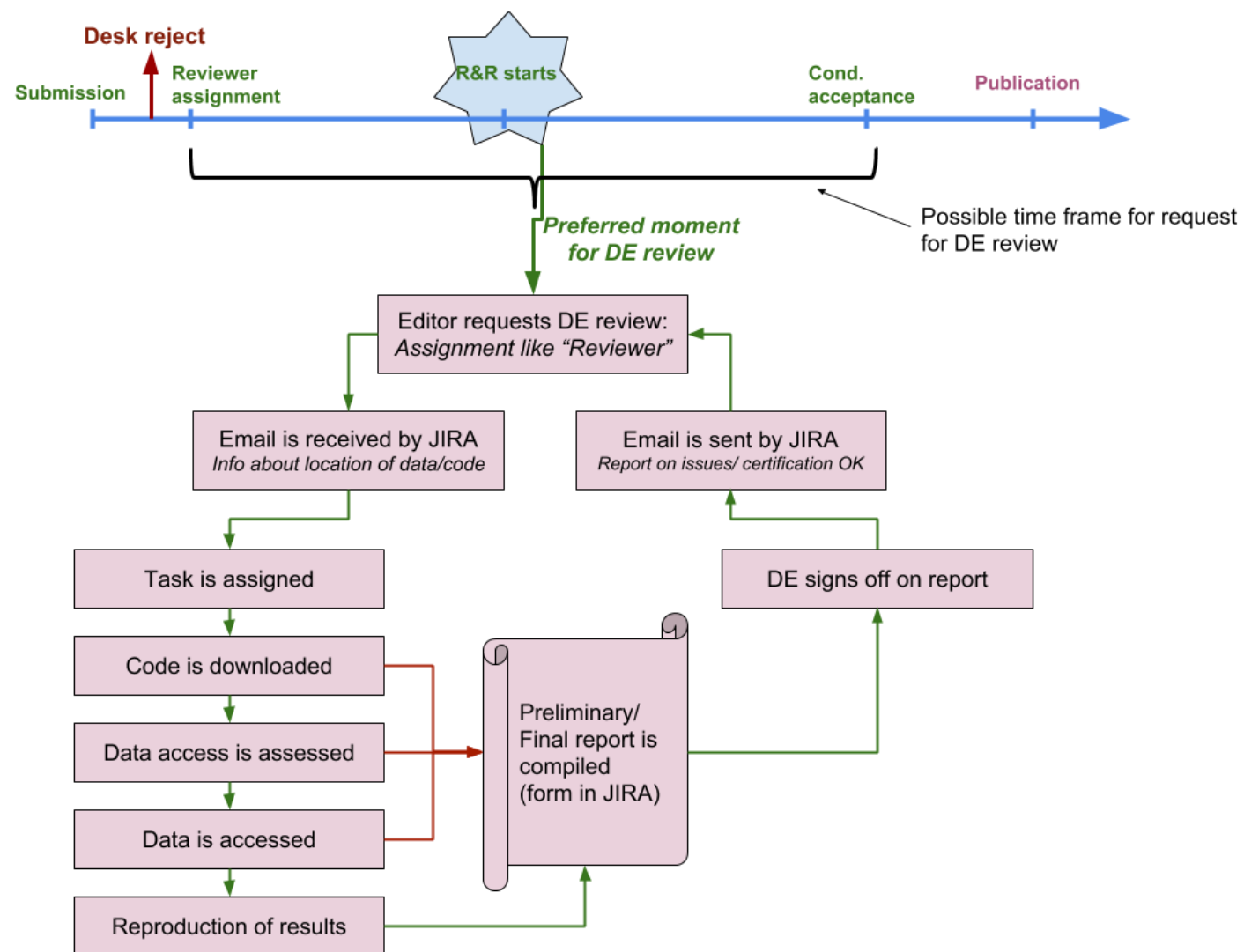
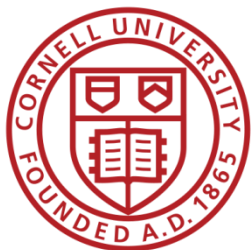
Dear [AUTHOR]:

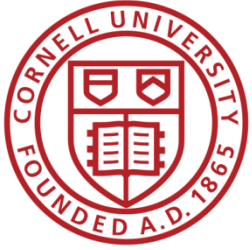
I am writing about your paper [MC ID]. I am ready to give you a "conditional accept" on the paper.

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.





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.



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)



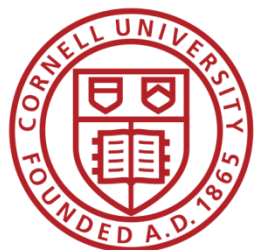
More and easier data deposit

- 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*



Moving from this:

Citation

Aaronson, Daniel, Fabian Lange, and Bhashkar Mazumdar
"Fertility Transitions along the Extensive and Intensive Margin"
American Economic Review, 104 (11): 3701-24.

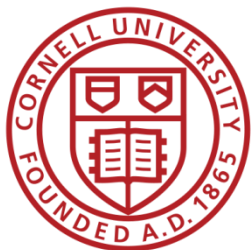
DOI: 10.1257/aer.104.11.3701

Choose Format:



Additional Materials

Data Set (142.98 MB)



... to this

Replication data: Total Error and Variability Measures for QWI and LODES

Principal Investigator(s): Kevin L. McKinney, United States Department of Commerce. Bureau of the Census; Andrew S. Green, Cornell University; Lars Vilhuber, Cornell University; John M. Abowd, Cornell University; John M. Abowd, United States Department of Commerce. Bureau of the Census

Version: V1

Version Title: Original version

Name	File Type	Size	Last Modified
README.txt	text/x-web-markdown	1.7 KB	12/14/2017 04:11:AM
qwiv_ak_sa_f_gc_ns_op_u.csv.gz	application/gzip	7 MB	12/14/2017 04:14:AM
qwiv_ak_sa_f_gc_ns_oslp_u.csv.gz	application/gzip	8 MB	11/14/2014 05:06:PM
qwiv_al_sa_f_gc_ns_op_u.csv.gz	application/gzip	21.1 MB	11/14/2014 05:07:PM
qwiv_al_sa_f_gc_ns_oslp_u.csv.gz	application/gzip	23.5 MB	11/14/2014 05:06:PM
qwiv_all_d_f_gc_ns_op_u.csv.gz	application/gzip	85.4 MB	11/14/2014 05:06:PM
qwiv_all_d_f_gc_ns_oslp_u.csv.gz	application/gzip	93.6 MB	11/14/2014 05:07:PM

DOWNLOAD THIS PROJECT

Usage Metrics

Overall Project Metrics

566

Views

2

Downloads

1

Publications

[Download Detailed Metrics](#)

Published Versions

[V1 \[2017-12-15\]](#)

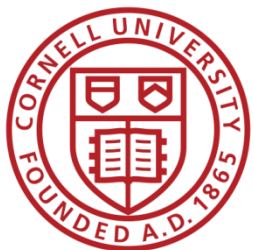


... complete history...

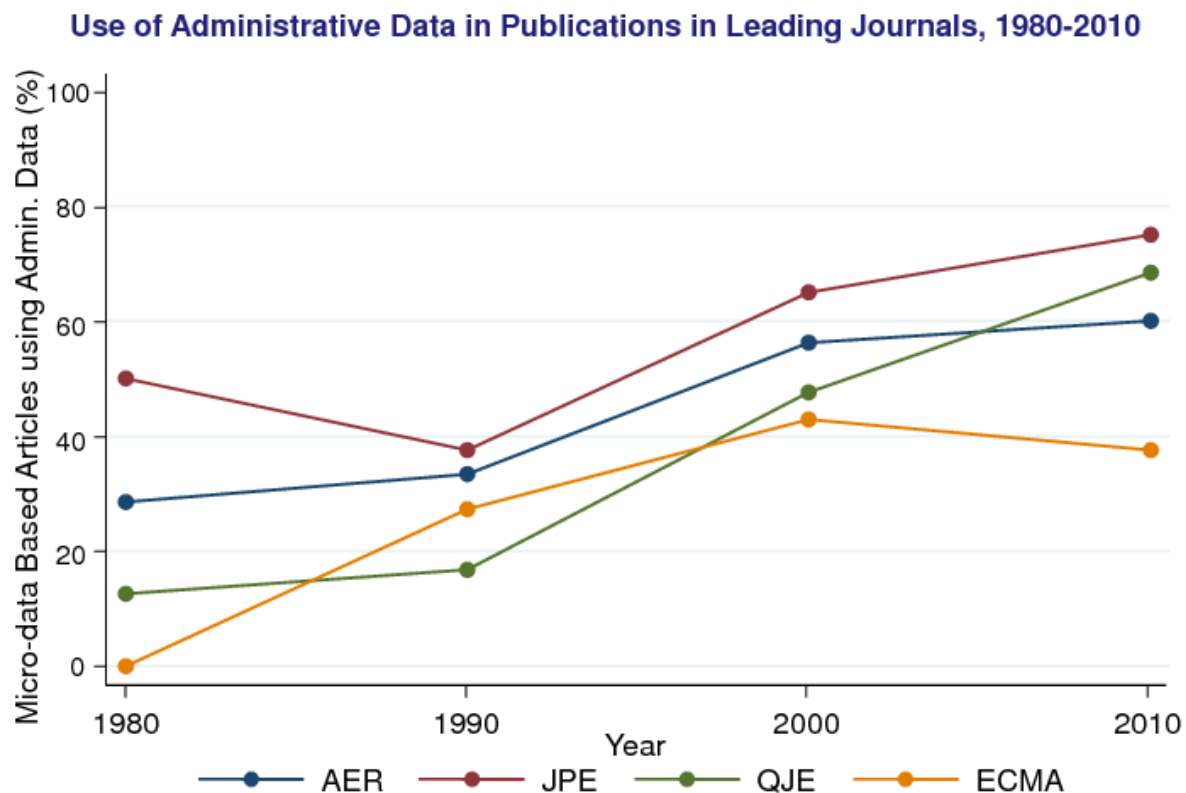
- All 2672 archives (as of June 2018)
- All 171 GB (only?)
- Browsable interface
- Searchable interface

And then we'll kill it

Let me explain...



Remember this figure?



Note: "Administrative" datasets refer to any dataset that was collected without directly surveying individuals (e.g., scanner data, stock prices, school district records, social security records). Sample excludes studies whose primary data source is from developing countries.



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”

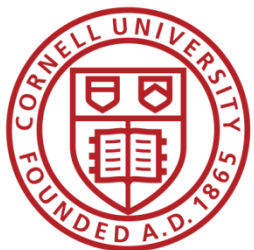
even if the *Data Owner*
has already deposited it



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,
CRDCN files, Danish data

can others
not *access it*?



Illustration

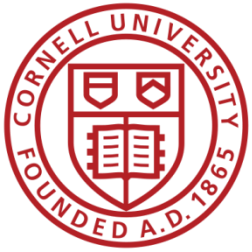
If you used files at
the National Archives,

would we ask you to
“deposit” them?



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)



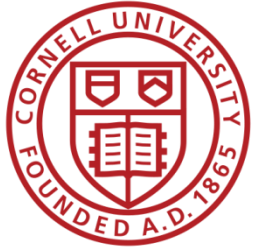
Best practices

- 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)



Evolving Journal and Data Infrastructure

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



Evolving Journal and Data Infrastructure

Use them!



Challenges?



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?**



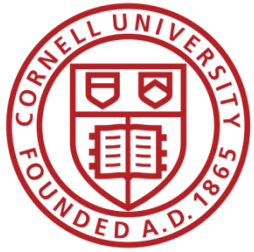
Verifying Data and Code Deposits

- 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 restricted-access repositories a reliable repository?



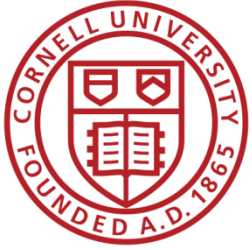
The goal at the AEA

- 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



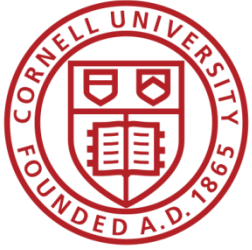
Future efforts

AEA, Social Sciences, elsewhere



Better support for researchers

- Training in methods (with various centers, institutions, etc.)
 - For current researchers
 - For integration into curriculums
- Tools to streamline the process
 - A few technical things (not described here)
 - Coordinate among journals (no duplicate effort)
- Awareness
 - Consider badges/ certification
 - Address issues with confidential data



Confidential data

- Highlight where confidential data already require replicability
 - IAB
 - Remote processing servers (Canada, NCHS, Australia, etc.)
- Work with Research Data Centers to facilitate transparency and reproducibility
 - Training (secure programming guidelines)
 - Standardize archives within RDCs + transparency



Pre-registration



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



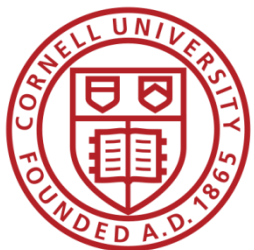
Goal 5 of the sustainable development goals adopted by the United Nations in 2015 aims to eliminate all forms of discrimination and violence against women in public and private spheres and to undertake reforms to give women equal rights to economic resources and access to ownership of property. Government 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

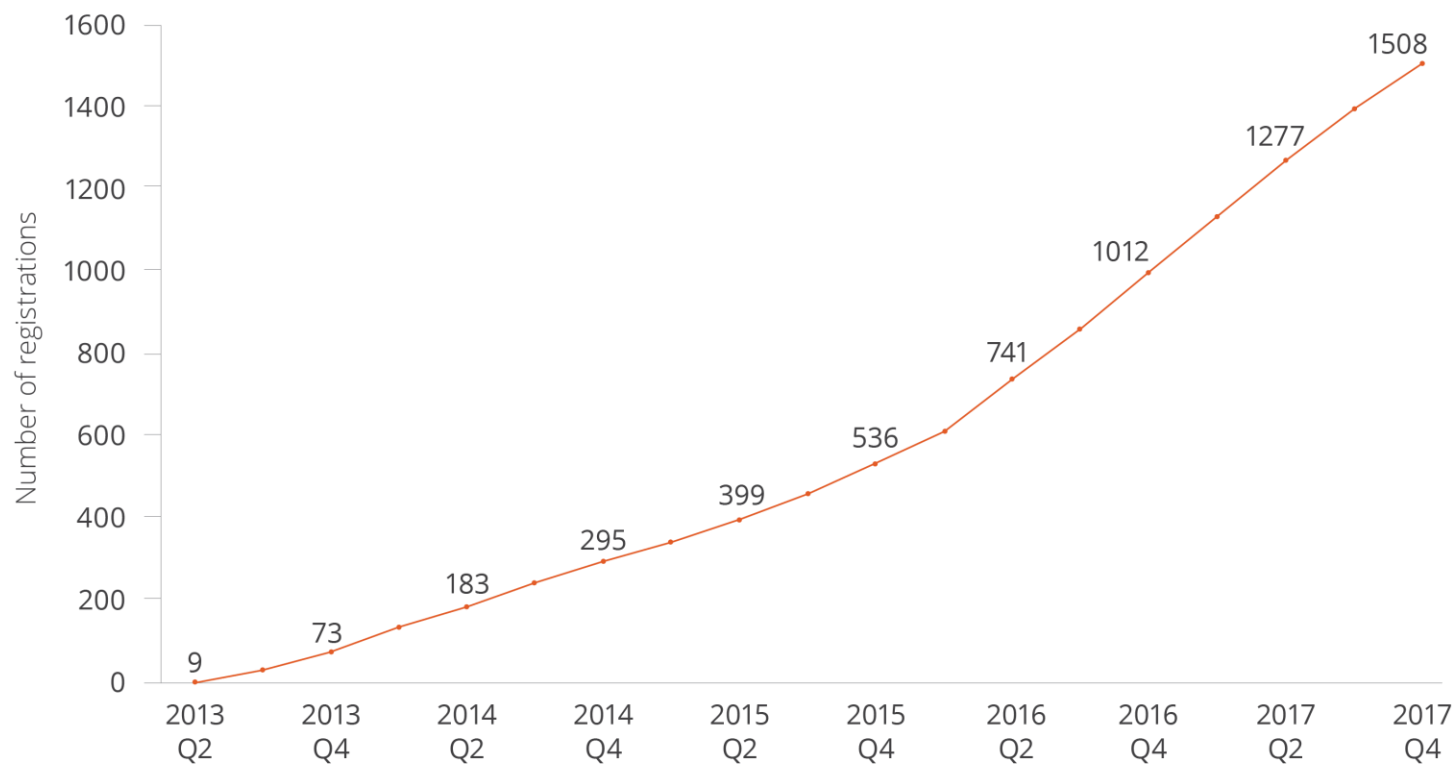


The economics and education literatures traditionally view human capital as an individual's stock of knowledge and skills. In this project, we posit an additional potential component: the capacity for sustained attention. In cognitive psychology, the mind's ability to direct and sustain attention is 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

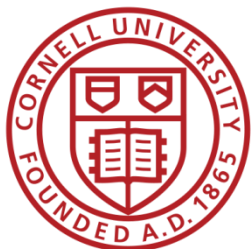
Cumulative registrations over time





Plans at the AEA

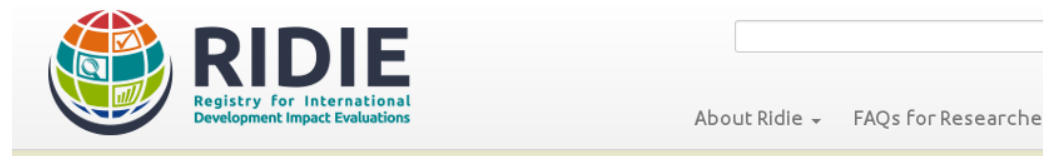
- Integrate registrations more robustly
 - Cite through DOI
 - Link more robustly (not just citation!)
 - Highlight through badges?



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](#)



The Registry for International Development Impact Evaluations

Welcome to the Registry for International Development Impact Evaluations (RIDIE), a project of the International Initiative for Impact Evaluation (3ie). RIDIE is a registry of impact evaluations related to development in low and middle income countries. The purpose of the registry is to enhance the transparency and quality of evaluation research as well as to provide a repository of impact evaluation studies for researchers, funders, and others.

RIDIE will register any development impact evaluation that rigorously attempts to estimate the causal impacts of a program, including but not limited to randomized control trials. It is intended to be a **prospective** registry in which researchers and evaluators can record information about their evaluation designs before conducting the analysis, as well as

[ration](#) [Should I Register My Study?](#)



Create a new AsPredicted pre-registration

[CREATE](#)

See your existing AsPredicteds (e.g. approve, make public)

Your email address (used in AsPredicted)

[SEE OWN](#)

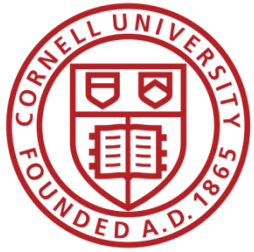
What's an AsPredicted?

It is a standardized pre-registration that requires only what's necessary to separate exploratory from confirmatory analyses. You will easily generate a pre-registration document that takes less effort to evaluate than it takes to evaluate the published study itself.

[About](#) [Terms of use](#)

How does it work?

- One author briefly answers 9 questions.
- All participating authors receive an email asking for approval.
- If everyone approves, it is saved and stays private until an author acts to make it public, or it remains private forever. ([Why?](#))
- Authors may share anonymous .pdf with reviewers.



Scalability and sustainability



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



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



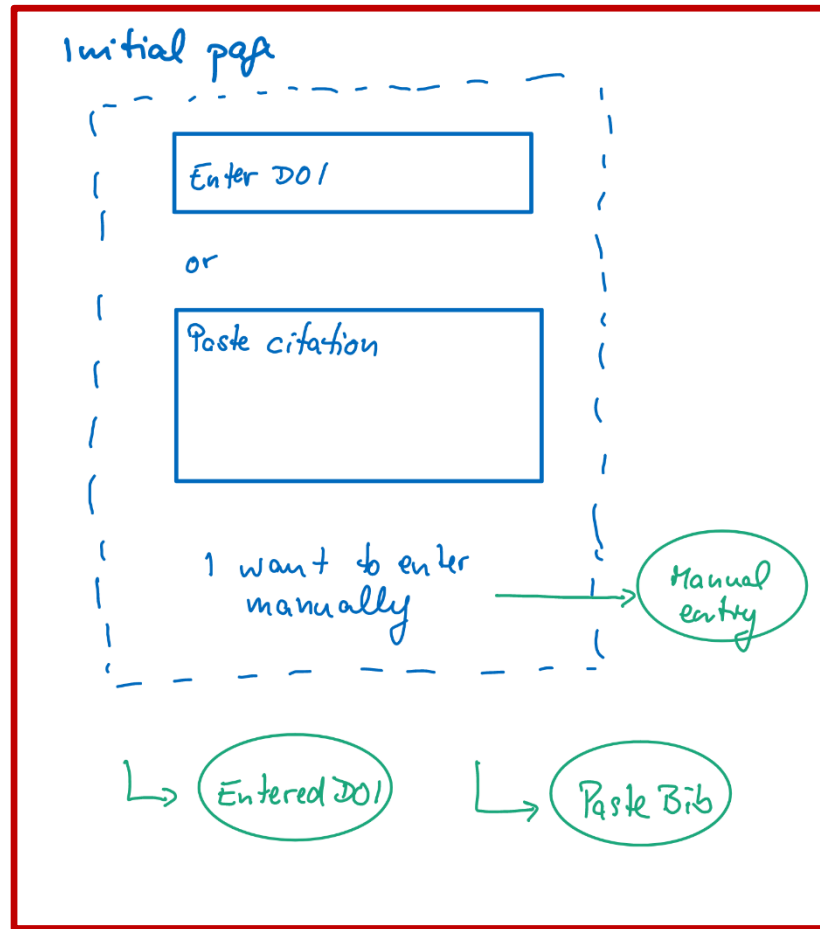


AEA: improve transparency of all data deposits

- 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



Richer metadata, more transparency



American Economic Association

← return to AEAweb

Predation, Protection, and Productivity: A Firm-Level Perspective.

Abstract References Online appendix **Supplementary materials** Notes

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](https://doi.org/10.1257/mac.20160120.data)
cite!
 - ☒ Data is freely accessible at [10.1257/mac.20160120.data](https://doi.org/10.1257/mac.20160120.data) under [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/).
 - ☒ Code verified under [AEA guidelines 2.0](https://www.aeaweb.org/conferences/2018/replication-guidelines).
- Data
Statistics Norway. 2015. "Firm-level statistics 1975-2013 [dataset]" Norwegian Data Archive [curator], v2. DOI: [10.7654/nda::7643A::34](https://doi.org/10.7654/nda::7643A::34)
cite!
 - ☐ Data restricted-access (has residency requirement, has citizenship requirement), accessible at [Norwegian Data Archive in Oslo, Norway](https://www.data.no/), under [Norwegian Data Access license](https://www.data.no/en/licenses).
 - ☐ Code could not be verified due to [access restrictions](#).

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Abstract



References



Online appendix



Supplementary
materials



Notes

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](https://doi.org/10.1257/mac.20160120.data)

cite! ▼

- ☒ Data is freely accessible at [10.1257/mac.20160120.data](https://doi.org/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](https://doi.org/10.7654/nda::7643A::34)

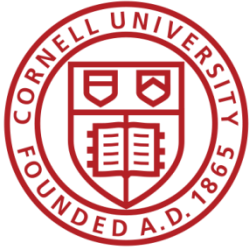
cite! ▼

- ☐ 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?



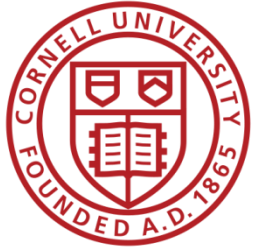
Really brief licensing primer

- 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!



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*)

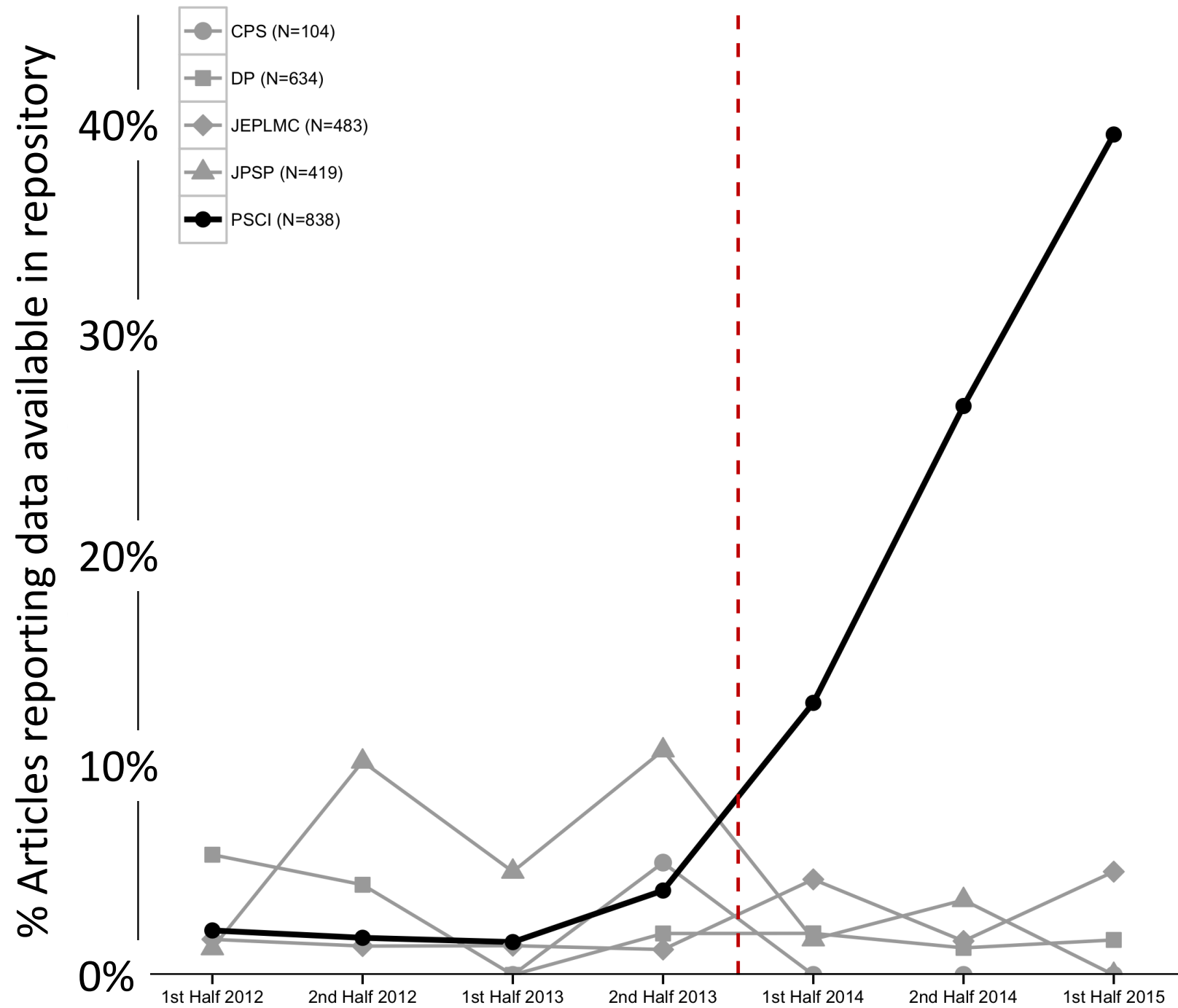


Other initiatives

Center for Open Science Badges



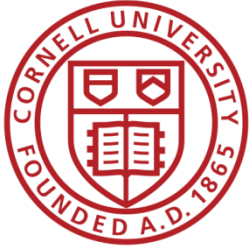
<https://cos.io/our-services/open-science-badges/>; 53 adopting journals (18 as of 2017)
Kidwell et al., 2016





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**?*

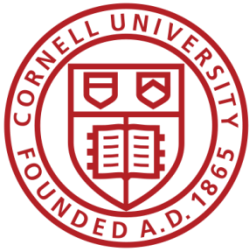


Example: COS disclosures



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



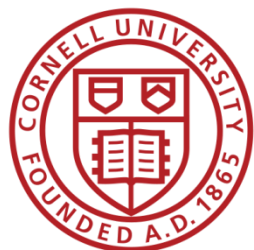
Open Materials: Authors complete two disclosure items for each Open Materials badge application:

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



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Registered Reports

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Berkeley Initiative for
Transparency in the Social Sciences

[Research](#)[Education](#)[Network](#)[Publishing](#)[Open Policy Analysis](#)[Resources](#)[Blog](#)

Registered Reports at
the JDE

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[FAQs for Authors](#)

[FAQs for Reviewers](#)

[Policy Updates](#)

[RR Peer Review Flowchart](#)

[Stage 1 Proposal Template](#)

[JDE's Submissions Portal](#)

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](#)

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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?



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"



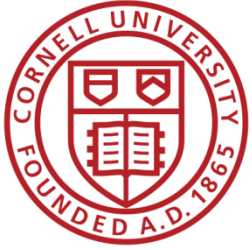
Students and Faculty: New skills to learn

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



An example: These presentations

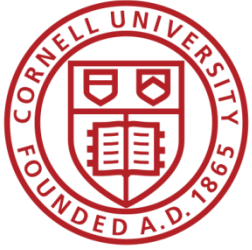
- Archive: [10.5281/zenodo.2573123](https://zenodo.org/record/2573123)
- Live: <https://github.com/labordynamicsinstitute/replicability-presentation2019>



Another (simple) example

- Archive: <https://doi.org/10.5281/zenodo.400356>
- Live: <https://github.com/larsvilhuber/jobcreationblog>

Note: If you tried this now, it would fail.... because the Census Bureau doesn't maintain complete archives of its data products...



Faculty: New skills 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



Faculty: New skills to teach



Faculty: New skills to teach

- How to incorporate reproducible practices into your workflow
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- When to pre-register, and when not to
- Document early, and often

- **Need to be taught at undergraduate level**
- **Need to be taught at the graduate level**



University: New support infrastructure



Faculty: New skills to teach

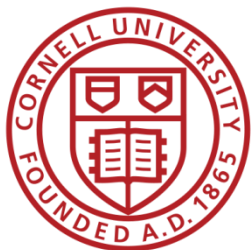
- How to incorporate reproducible practices into your workflow
- How to structure your code and your data with an eye on reproducibility
- How to license your contributions!
- When to pre-register, and when not to
- Document early, and often

- **Need to be taught at undergraduate level**
- **Need to be taught at the graduate level**

- New **courses**?
- New **curricula**?
- New/expanded **support services** on campus:
 - **Pre-submission** verification
 - Institutional **repositories** (expanded or outsourced)
 - Professional **data curation**



Details of new data and code availability policy



Policy A.2

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 Data and

Policy B

Data and Code Availability Policy

It is the policy of the American Economic Association to publish papers only if the data and code used in the analysis are clearly and precisely documented;

access to the data and code is clearly and precisely documented,

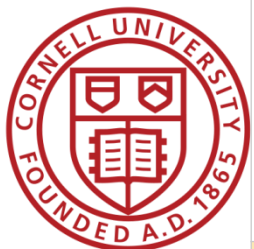
and is non-exclusive to the authors.

Authors of accepted papers that contain empirical work, simulations, or experimental work must provide,

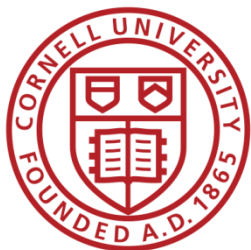
prior to acceptance,

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.

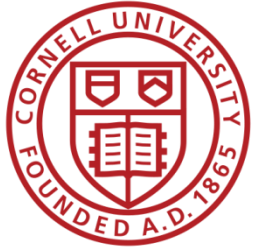
Data and programs should be archived in



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 <i>TBD</i> .	Data and programs should be archived in community-recognized or general repositories , including the AEA Data and Code Repository at <i>TBD</i> .
	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 <i>TBD</i> .
	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.



DOI and metadata



Digital Object Identifier (DOI)

Fertility Transitions along the Extensive and Intensive Margins

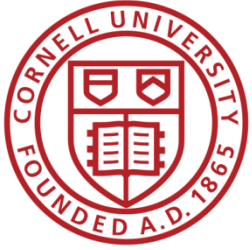
Daniel Aaronson

Fabian Lange

Bhashkar Mazumder

AMERICAN ECONOMIC REVIEW
VOL. 104, NO. 11, NOVEMBER 2014
(pp. 3701-24)

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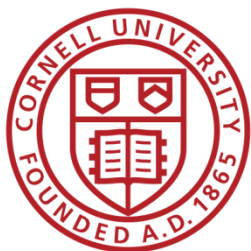
Fertility Transitions along the Extensive and Intensive Margins

Citation

Aaronson, Daniel, Fabian Lange, and Bhashkar Mazumder. 2014.
"Fertility Transitions along the Extensive and Intensive Margins."
American Economic Review, 104 (11): 3701-24.

DOI: 10.1257/aer.104.11.3701

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content.version	character [1]	'vor'



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 - **Article:** titles, publication_date (year), doi_data
- *Recommended Elements*
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