



Practices for Data Transparency and Reproducibility

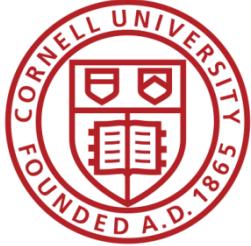
+ some thoughts on the role of institutions

Lars Vilhuber

Cornell University

Presentation at **Brookings**, December 2020

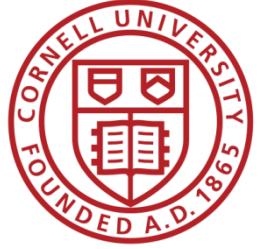
The opinions expressed in this talk are solely the authors, and do not represent the views of the U.S. Census Bureau, the American Economic Association, or any of the funding agencies.



Themes in today's talk

- What we do at the AEA
 - Pre-publication verification of reproducibility
 - Archiving
 - Provenance documentation
- Why we do what we do
- Impediments to reproducibility
 - Data access
 - Scale
 - Skill

Possible role for institutions



What we do at the AEA



American Economic Review



The *American Economic Review* is a general-interest economics journal. Established in 1911, the AER is among the nation's oldest and most respected scholarly journals in economics.

Journal of Economic Literature



The *Journal of Economic Literature* (JEL), first published in 1969, is designed to help economists keep abreast of and synthesize the vast flow of literature.

American Economic Journal: Applied Economics



American Economic Journal: Applied Economics publishes papers covering a range of topics in applied economics, with a focus on empirical microeconomic issues.

American Economic Journal: Macroeconomics



American Economic Journal: Macroeconomics focuses on studies of aggregate fluctuations and growth, and the role of policy in that context.

AMERICAN ECONOMIC ASSOCIATION

American Economic Review: Insights



AER: Insights is designed to be a top-tier, general-interest economics journal publishing papers of the same quality and importance as those in the *AER*, but devoted to publishing papers with important insights that can be conveyed succinctly.

Journal of Economic Perspectives



The *Journal of Economic Perspectives* (JEP) fills the gap between the general interest press and academic economics journals.

American Economic Journal: Economic Policy

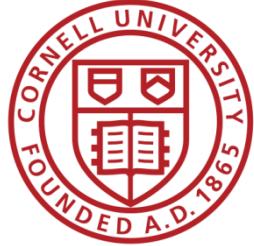


American Economic Journal: Economic Policy publishes papers covering a range of topics, the common theme being the role of economic policy in economic outcomes.

American Economic Journal: Microeconomics

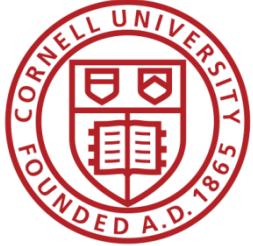


American Economic Journal: Microeconomics publishes papers focusing on microeconomic theory; industrial organization; and the microeconomic aspects of international trade, political economy, and finance.



Current efforts at the AEA

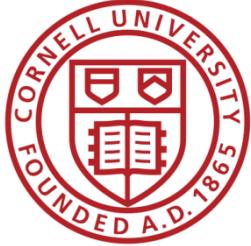
- Pre-emptively improve code archives
- Better archives
- Better provenance tracking



AEA Data & Code Availability Policy (2019)

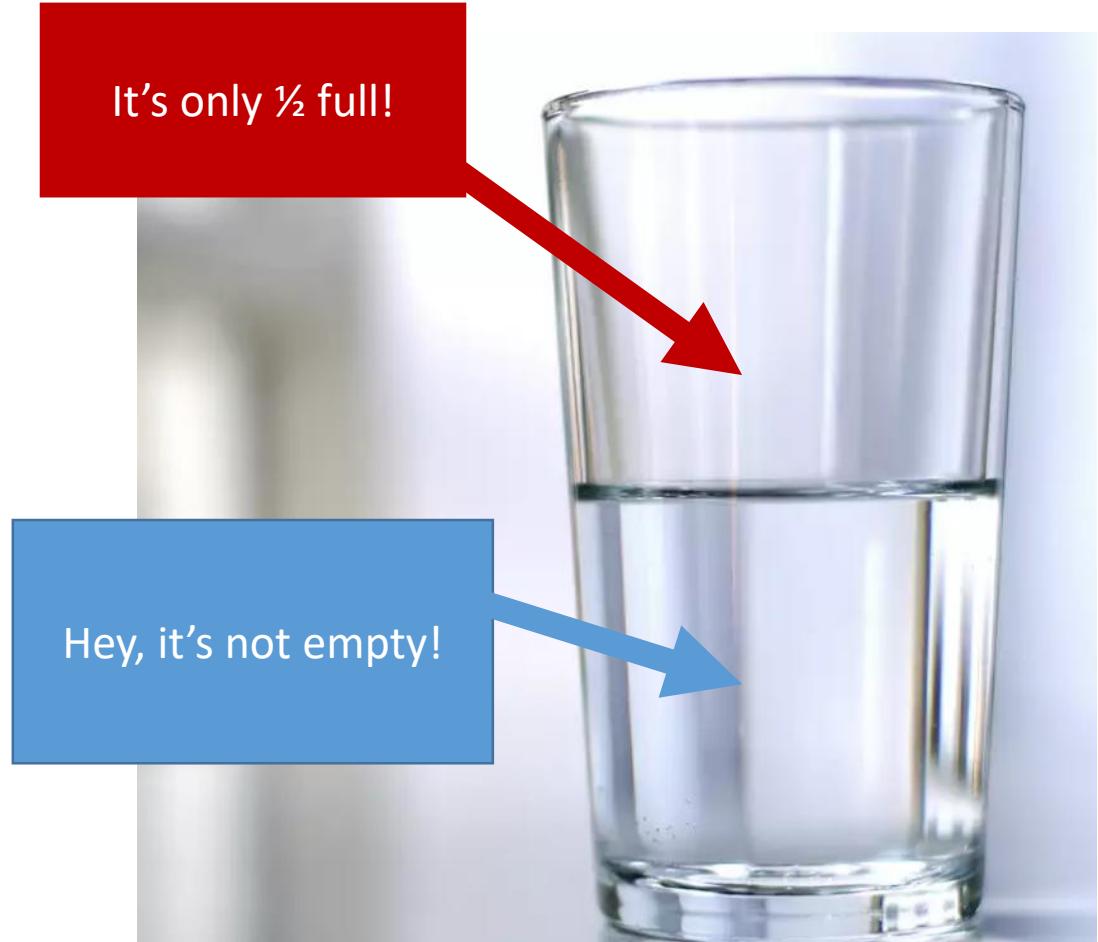
- It is the policy of the American Economic Association to publish papers only if the data used in the analysis are **clearly and precisely documented** and **access to the data and code is clearly and precisely documented and is non-exclusive to the authors.**
- Authors of accepted papers that contain empirical work, simulations, or experimental work must **provide, prior to acceptance**, the data, programs, and other details of the computations **sufficient to permit replication**, as well as **information about access to data and programs**.

Why we do what
we do



In previous analysis

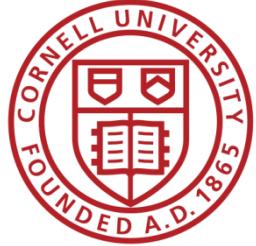
- **40%** use restricted-access data
- **25%** use public-use data and are mostly or completely reproducible
- **25%** use public-use data and are only partially reproducible
- **10%** fail to yield useful results



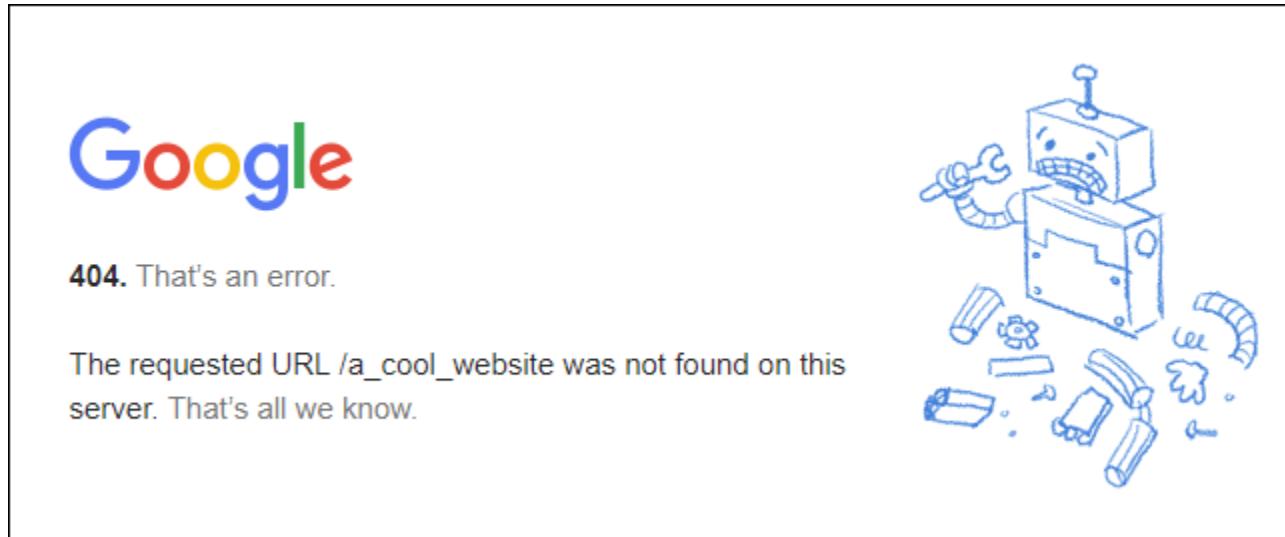
It's only $\frac{1}{2}$ full!

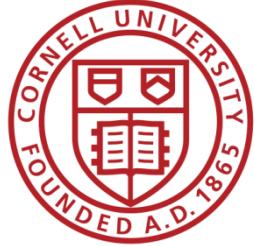
Hey, it's not empty!

Why?



Failure to curate





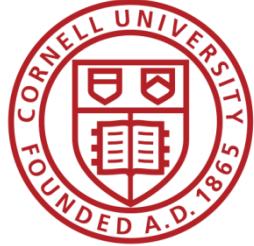
Poor coding practices

- **Manual/non-automation**

Code produces no meaningful output

- **Lack of robustness:**

Bugs in the code



Poor citation practices

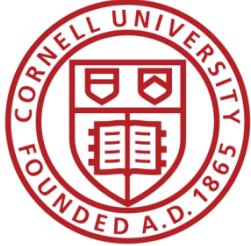
- **Macrodata:**

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

- **Microdata:**

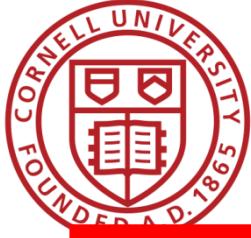
“... this paper uses data from
the Current Population Survey...”

Actions



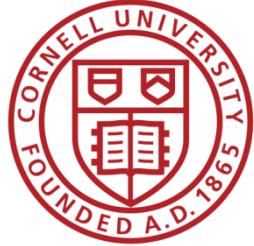
Current efforts at the AEA

- **Pre-emptively improve code archives**
 - By conducting reproducibility checks when we can
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 - Leave code where it is when appropriate
 - Leave data where it is almost always
 - Display that information



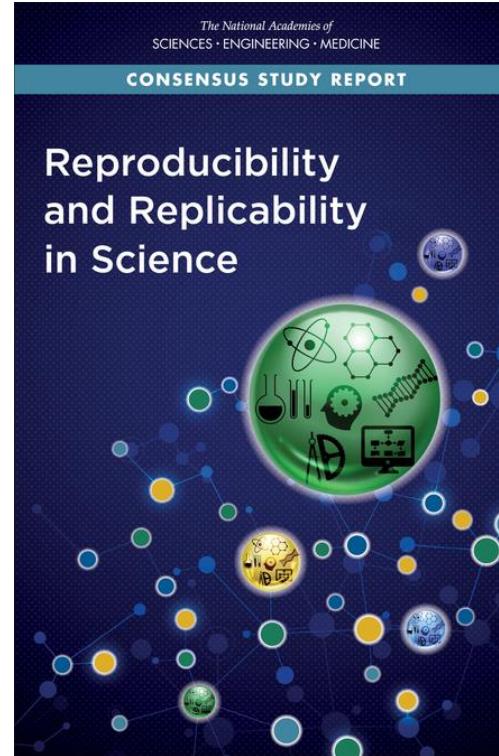
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Replication continuum

<https://doi.org/10.17226/25303>



Reproducibility

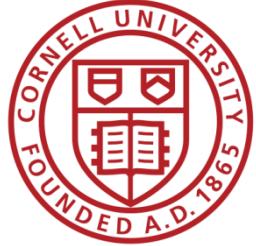
- Narrow Replication (Pesaran 2003)
- Pure Replication (Hamermesh 2007)
- Verification (Clemens 2015)

Replicability

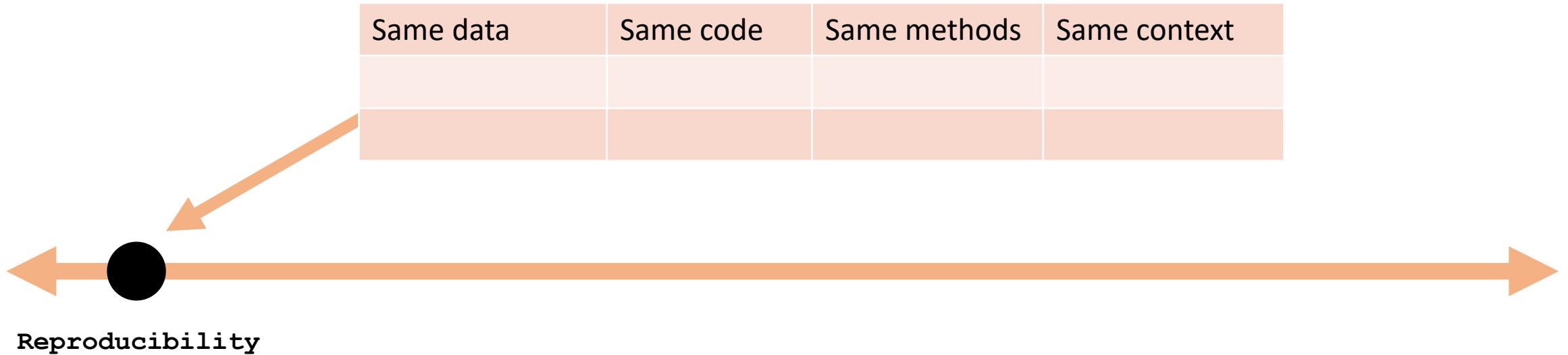
- Wide Replication (Pesaran 2003)
- Statistical Replication (Hamermesh 2007)
- Reproduction/Reanalysis (Clemens 2015)

Generalizability

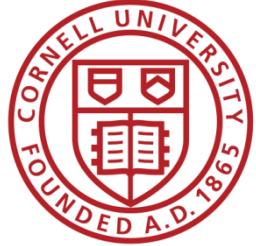
- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)



Replication continuum

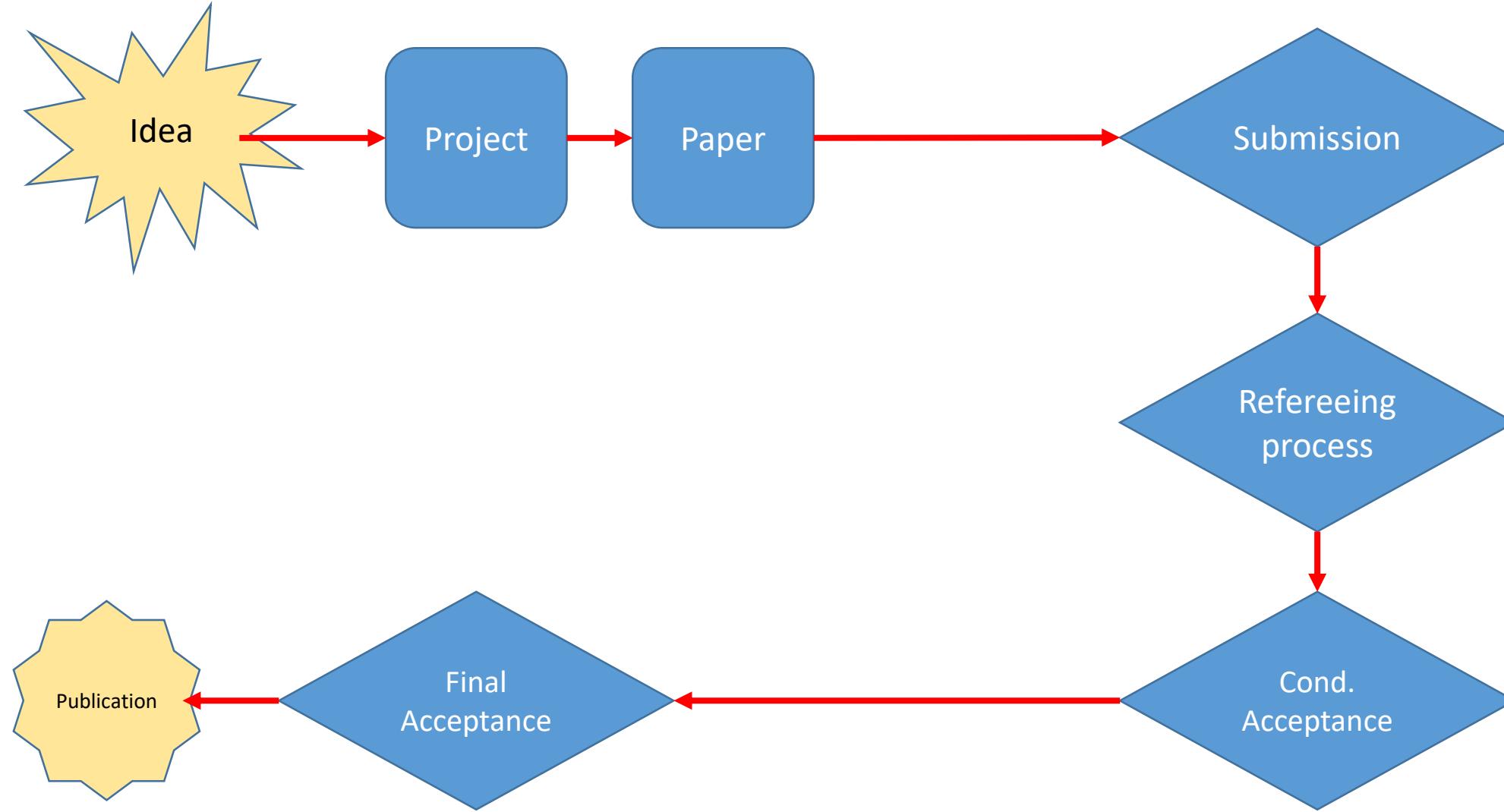


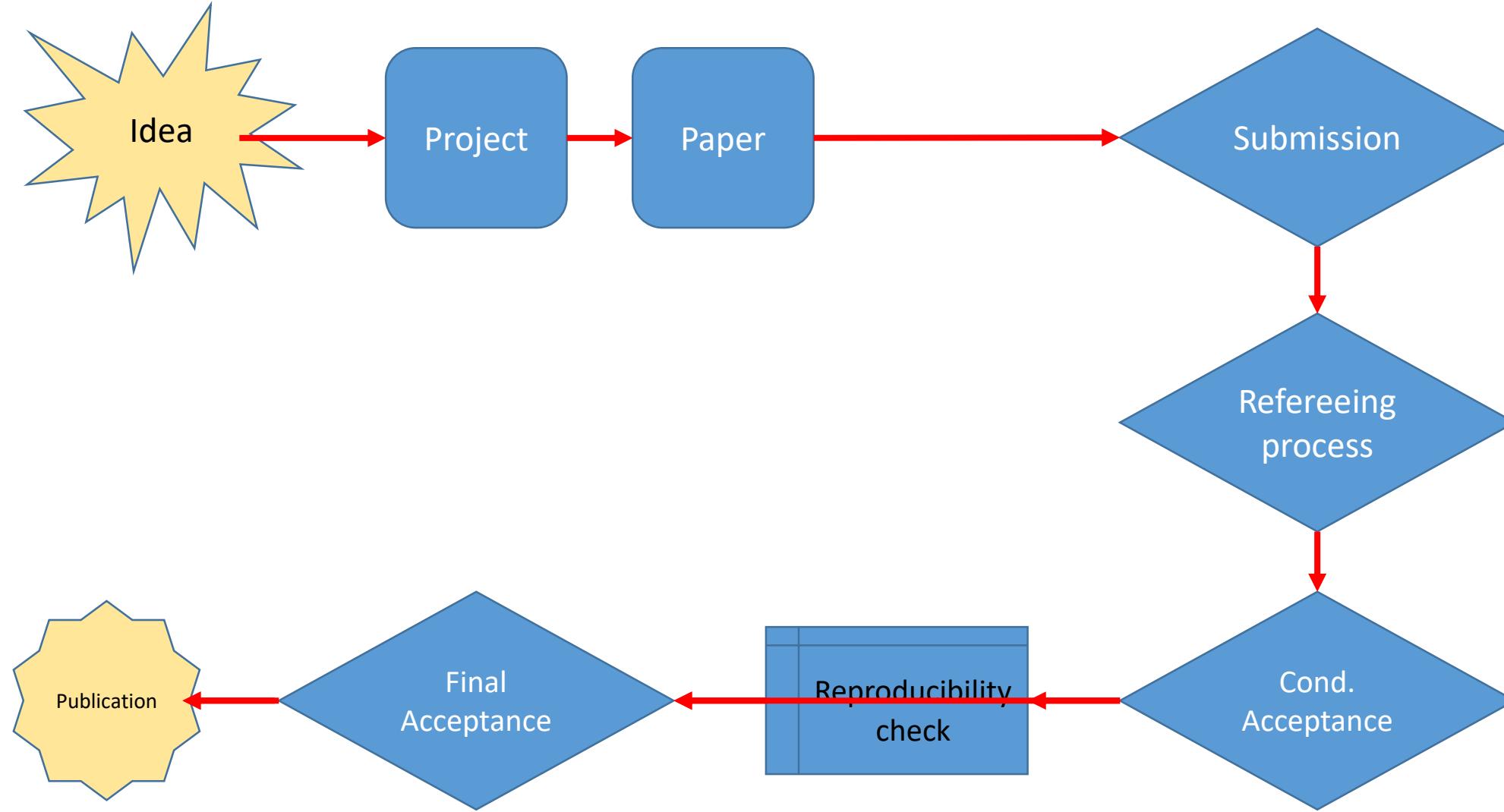
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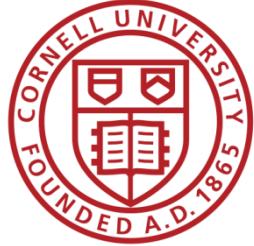


AEA Pre-Publication Verification

- Every paper that receives a “conditional acceptance” is verified
 - *Data citations*
 - *Quality of README
(Data Availability Statement)*
 - *Quality of code*
 - *Reproducibility of code*
 - *Quality of metadata in the repository*







Action: Reproducibility Check



Data and Code Guidance by Data Editors

Guidance for authors wishing to create data and code supplements, and for replicators.

Verification guidance

On this page:

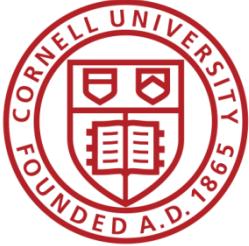
- Overview
- Review the README file
- For each listed data source
- For each listed table, figure, in-text number
- Conduct a code verification, if data is available
- Examples

Overview

This document describes

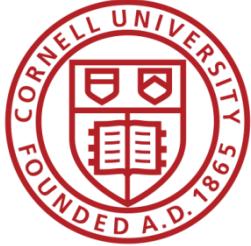
- what authors should check before providing data and code to journals
- what verifier teams should check for in the data and code provided to them for the purpose of verification





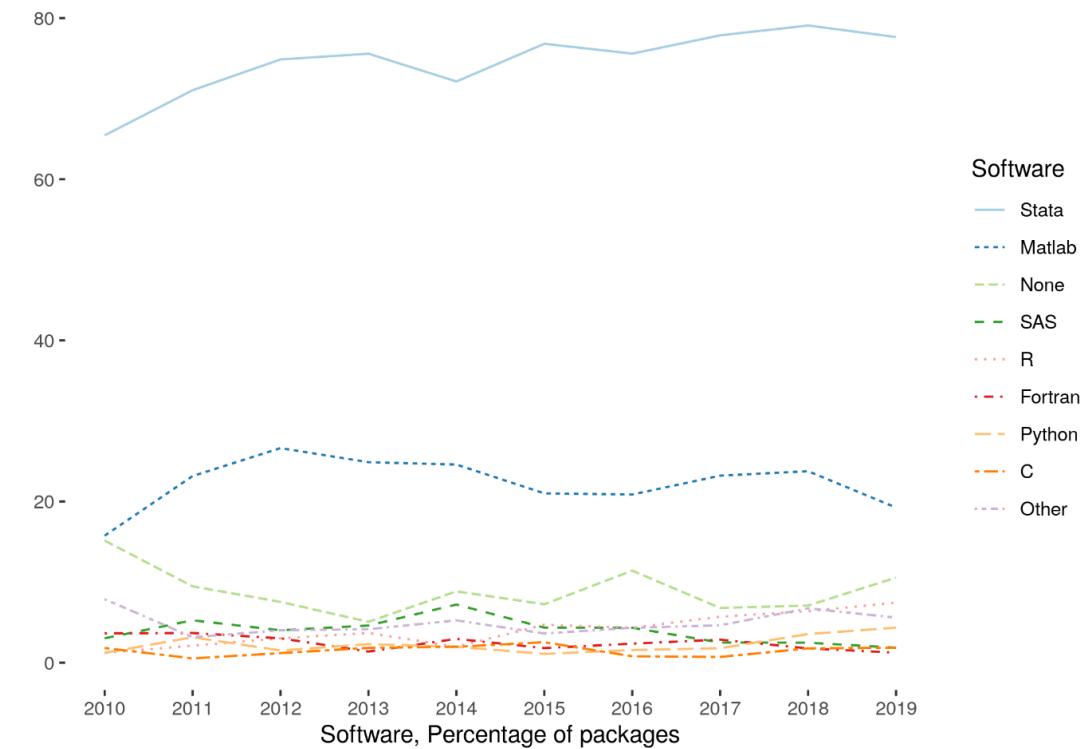
Who is doing that?

- Earlier reproducibility work: **Flavio Stanchi** (now at AirBnb), **Sylverie Herbert** (Banque de France), **Hautahi Kingi** (Impaq)
- Assistant: **Michael Darisso**
- Current lead graduate student: **Harry Son** (since Aug 2020)
- Current and past undergraduate students: Alexia Ge, Anthony Peraza, **Craig Schulman**, Elijah B. Ruiz, Gabriel Bond, Jason S. Katz, Jeong Hyun Lee, Jiayin Song, John Park, **Joshua Passel**, Kirubeal T. Wondimu, Linchen Zhang, **Louis Liu**, Luis Lopez Cabrera, Luke O'Leary, Mary-Jo Ajiduah, Naomi Li, Nicholas Swan, Nishat Peuly, **Ryan Ali**, Samuel Frey, Siyang (Elaine) Yu, **Steve Yeh**, **Weilun Shi**, William Hernandez, Yanyun (Iris) Chen, Yuan-Hsuan (Sharon) Lin, Zebang Xu, Xing Su, Jiazen Tan, Xueshi Su, Vendela Norman, Anderson Park, **Nehedin Juarez**, Rubal Mistry, Syon Verma, William Silverman, **Zechariah Karsana**, Franklin Omullo, **Liam P. Cushen**, Ololade Omotoba, Lydia Reiner, **Xiangru Li**, Melanie **Chen**, Peter Rafael Sanchez, Jill Crosby, Matthew H. Wang, Daniella Pena, Julia Zimmerman, **Kate Hofer**, **Tarangana Thapa**
- Former graduate students: **David Wasser**, **Meredith Welch**, Aviv Caspi, Leah Kim



Very little diversity in software

- **Stata** is the most popular statistical software in the journals of the AEA
(72.96% of all supplements)
- followed by **Matlab** (**22.45%**)



Code

Issues 1

Pull requests 0

Actions

Wiki

Security

Insights

Settings

Branch: master ▾

replication-template / REPLICATION.md

[Find file](#) [Copy path](#)

larsvilhuber Minor edits to the report - clarifications about data preparation pro...

e9ad1f8 10 days ago

1 contributor

195 lines (135 sloc) | 10.3 KB

[Raw](#)[Blame](#)[History](#)

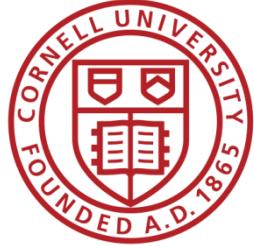
[MC number] [Manuscript Title] Validation and Replication results

INSTRUCTIONS: Once you've read these instructions, DELETE THESE AND SIMILAR LINES. In the above title, replace [Manuscript Title] with the actual title of the paper, and [MC number] with the Manuscript Central number (e.g., AEJPol-2017-0097) Go through the steps to download and attempt a replication. Document your steps here, the errors generated, and the steps you took to alleviate those errors.

You may want to consult [Unofficial Verification Guidance](#) for additional tips and criteria.

SUMMARY

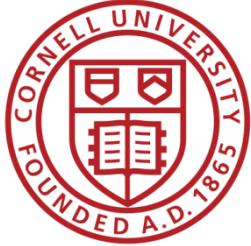
INSTRUCTION: The Data Editor will fill this part out. It will be based on any [REQUIRED] and [SUGGESTED] action



Stats on reproduced articles

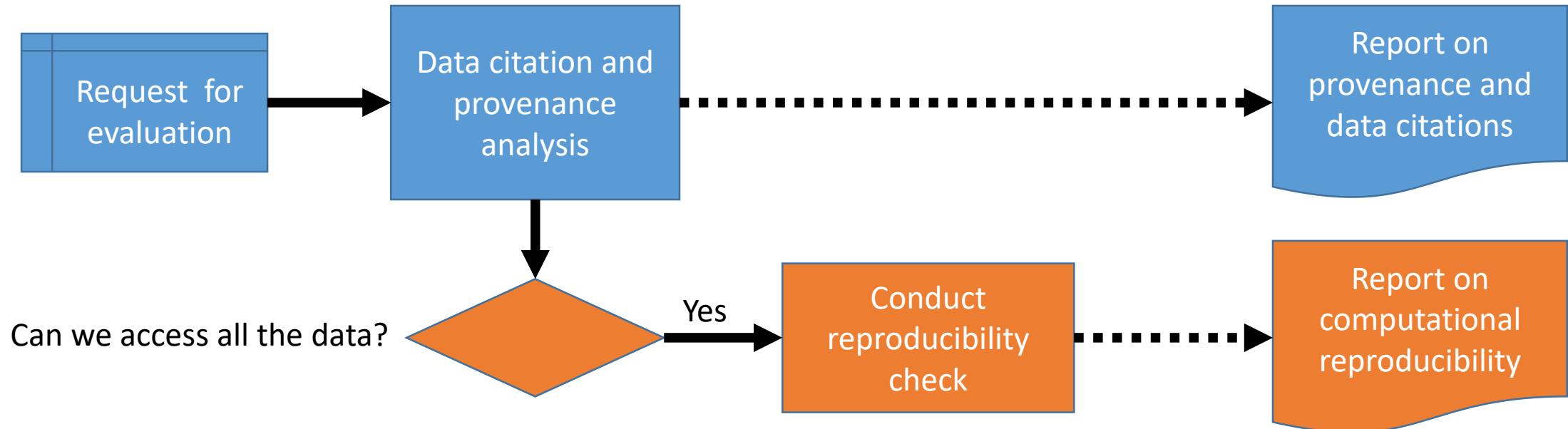
Between Dec 1, 2019 and Nov 30, 2020, the AEA Data Editor team processed

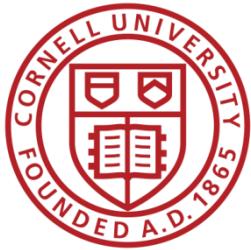
- **854 assessment requests**



Current efforts at the AEA

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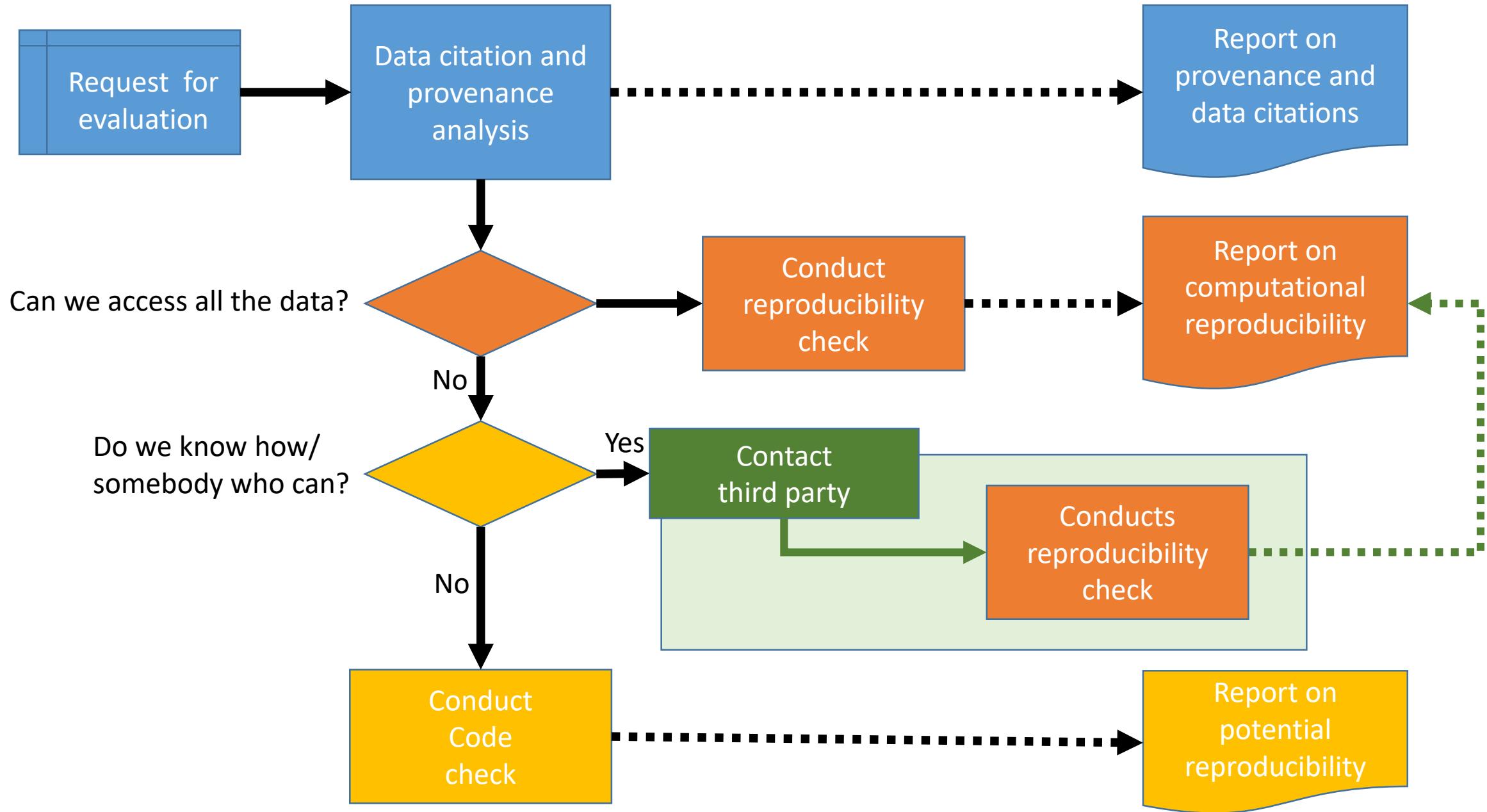
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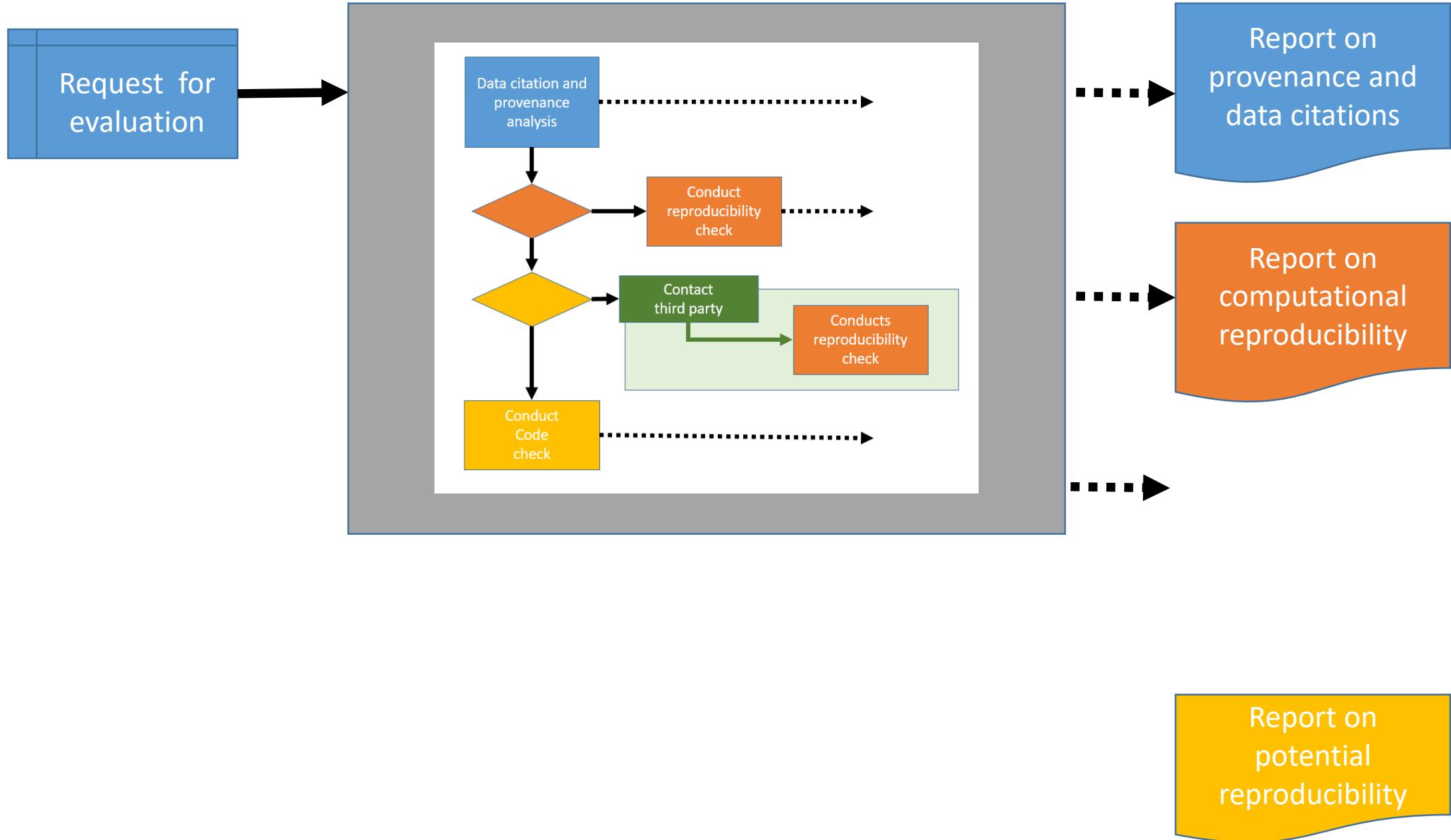
Restricted-access data pose a challenge

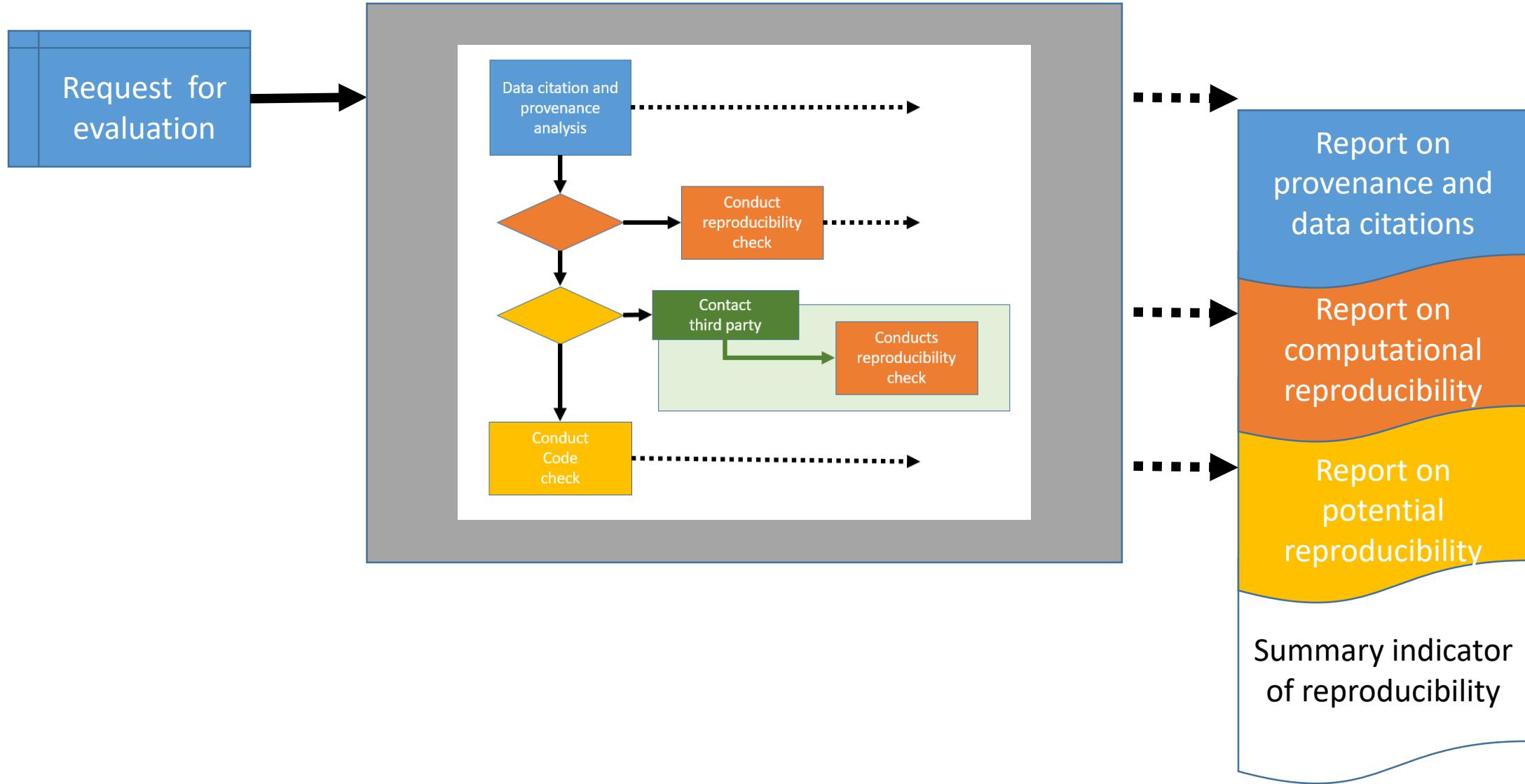
How do you check code when the data access is complex?

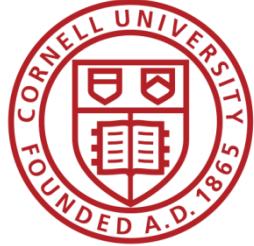
How do you improve archives when you do not control data management?

How do you document data provenance when you cannot provide the data?

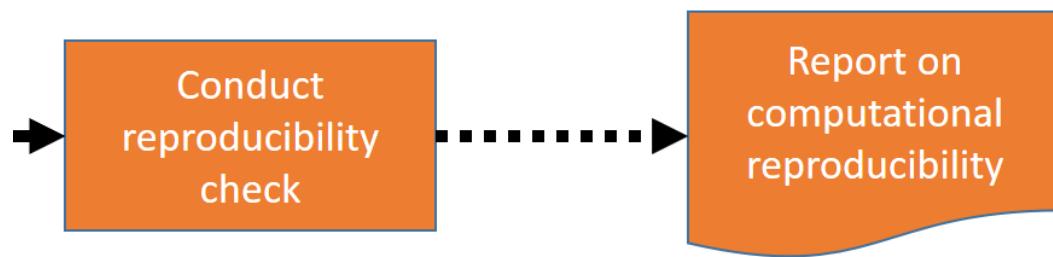






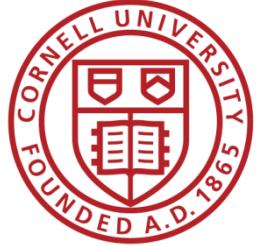


What is the reproducibility check?

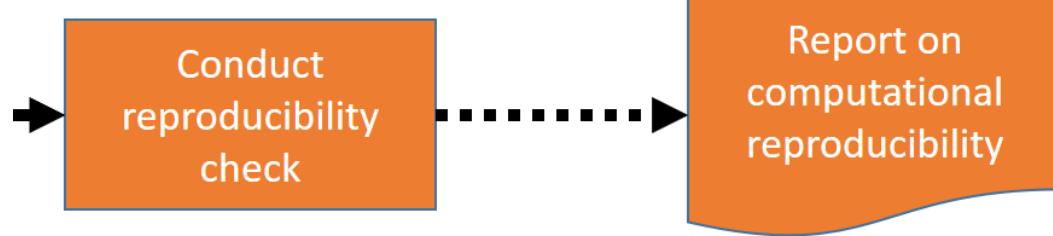


A screenshot of a GitHub repository page for "AEADataEditor / replication-template". The repository is described as a "Template". The "Code" tab is selected. The main file shown is "REPLICATION.md". The commit history shows a single commit by "larsvihuber" adding a field to capture data preparation code. The file content includes instructions for validation and replication, a summary section, and links for official and unofficial verification guidance.

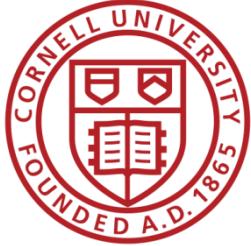
```
Search or jump to... Pull requests Issues Marketplace Explore  
AEADataEditor / replication-template Template  
Code Issues Pull requests Actions Wiki Security Insights Settings  
master → replication-template / REPLICATION.md Go to file ...  
larsvihuber Adding a field to capture data preparation code in particular Latest commit ea87412 22 days ago History  
Ax 2 contributors  
290 lines (195 sloc) 15.2 kB Raw Blame ⌂ ⓘ  
[MC number] [Manuscript Title] Validation and Replication results  
INSTRUCTIONS: Once you've read these instructions, DELETE THESE AND SIMILAR LINES. In the above title, replace [Manuscript Title] with the actual title of the paper, and [MC number] with the Manuscript Central number (e.g., AEIPol-2017-0097) Go through the steps to download and attempt a replication. Document your steps here, the errors generated, and the steps you took to alleviate those errors.  
Some useful links:  
• Official Data and Code Availability Policy  
• Unofficial Verification Guidance for additional tips and criteria.  
SUMMARY
```



What is the reproducibility check?



- Data checks
- Code description
- Requirements
 - As stated by author
 - As encountered by replicator
- Verbose description of steps to replicate
- Findings
 - Compare tables
 - Compare figures
 - Compare in-text numbers



Current efforts at the AEA

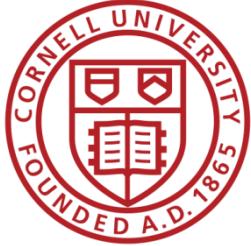
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How do you check code when the data access is complex?

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We work with 3rd parties

- cascad – Using confidential data!
 - DADS
 - French customs data
- CISER (R-Squared)
- Various contributors with access to confidential data
 - Authors
 - Their institutions
 - Network of known groups with access (less frequent)



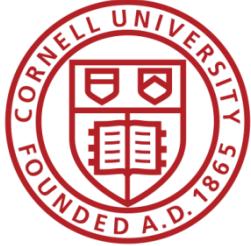
A cascad certification allows researchers to signal the reproducibility nature of their research to their peers



Home > Research > Results Reproduction (R-squared)

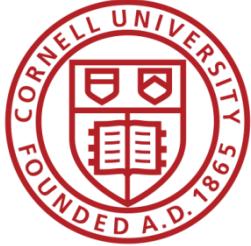
RESULTS REPRODUCTION (R-SQUARED)

Results Reproduction (R-Squared) is a service that computationally reproduces the results of your research to ensure Reproducibility and Transparency – think of it as *enhanced proofreading for your Data and Code*.



Also work with 3rd parties

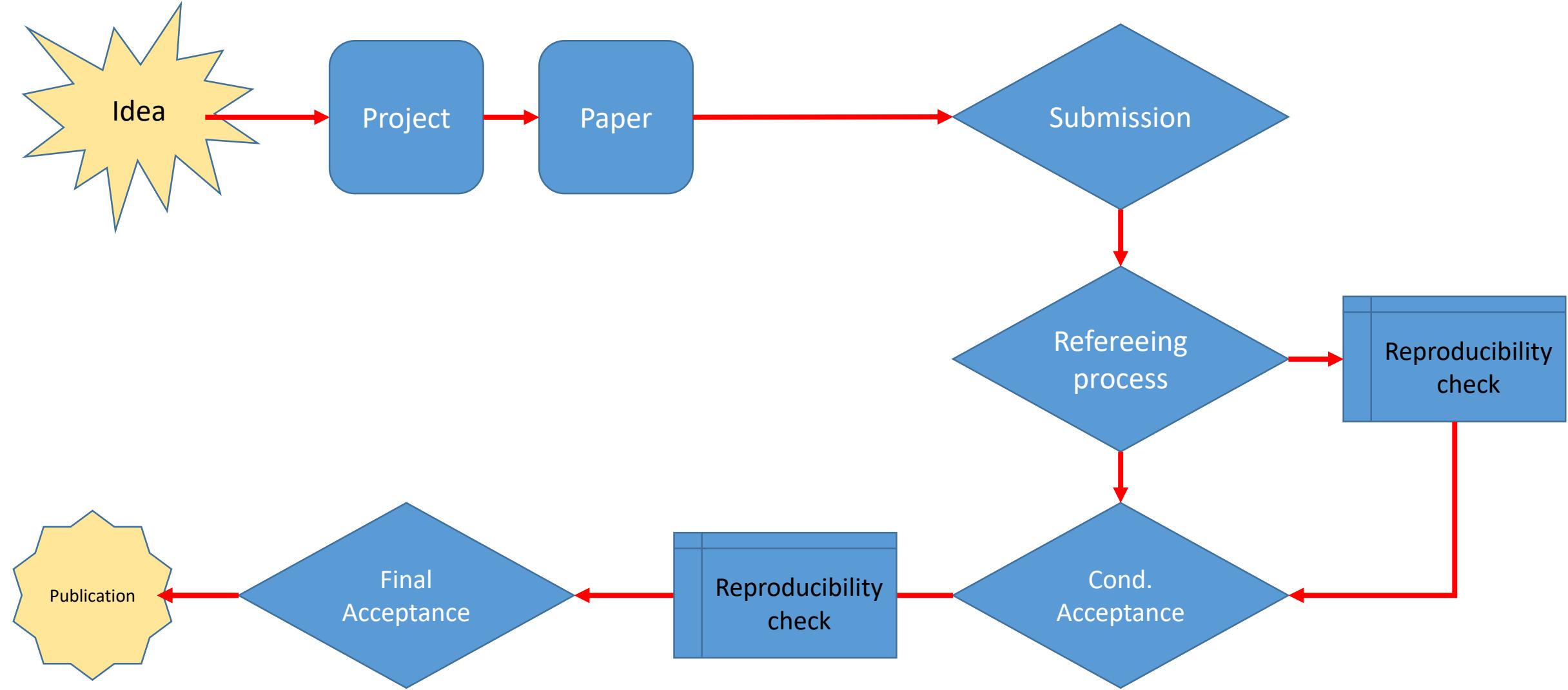
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 - French customs data
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 - Various contributors with access to confidential data
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 - Network of known groups with access (less frequent)
- Some examples:
- IFAU (Swedish data)
 - Fed Board (proprietary data)
 - Upjohn Institute (US admin data)
 - JCT (US tax data)
 - Banco do Portugal (LEED)
 - IAB (German data)
 - *Graduate students* at Wharton, Chicago, Yale, Wisconsin, Cornell

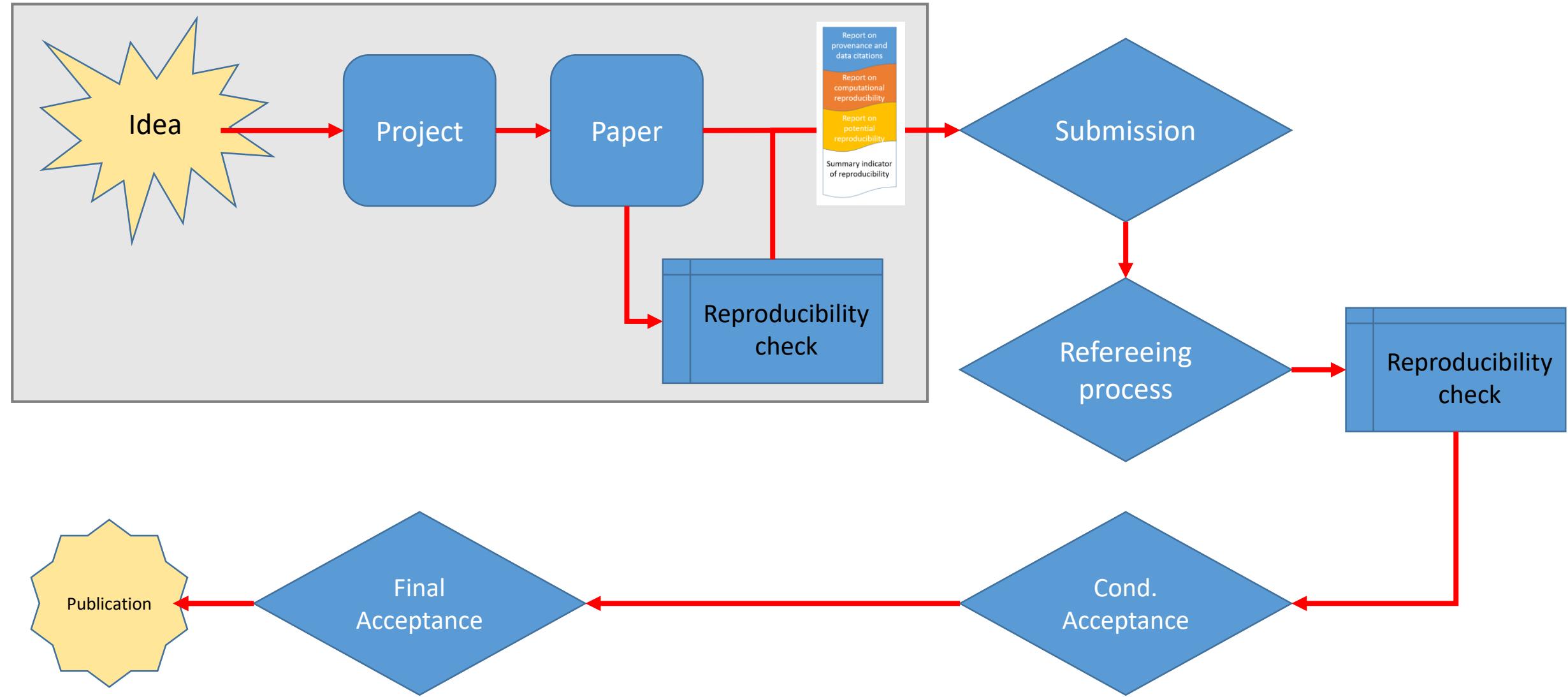


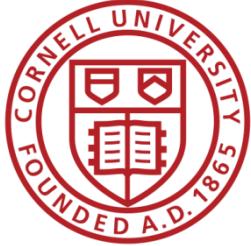
A role for institutions?

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- Institutions can have their own reproducibility teams
- Checks can be part of due diligence checks
- Checks should be conducted when results are to be used in critical publications
- Institution-specific workflows can incorporate reproducible practices



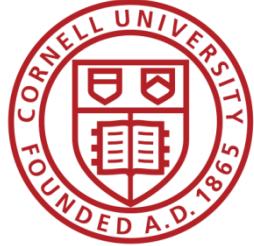




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Why we do what
we do



Action: Data citations and metadata

What is FAIR?

- Findable,
- Accessible,
- Interoperable, and
- Re-usable



The Future of Research Communications and e-Scholarship

ABOUT ▾

COMMUNITY ▾

CODE OF CON

FORCE11 » Groups » The FAIR Data Principles

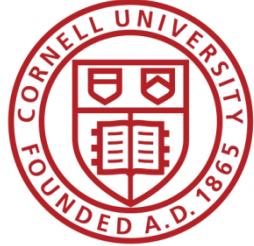
THE FAIR DATA PRINCIPLES

JOIN IN THE DISCUSSION - LEA

FAIR Data Principles

Preamble

One of the grand challenges of data-intensiv



Opacity of traditional journal replication packages

Replication data for: "Constrained Discretion and Transparency"

Version 1.2

Bianchi, Francesco; Melosi, Leonardo, 2016, "Replication data for: "Constrained Discretion and Central Bank Transparency""¹, <https://doi.org/10.7910/DVN/PXAFCW>, Harvard Dataverse, V1

Cite Dataset ▾ Learn about Data Citation Standards.

Description Replication data for: "Constrained Discretion and Central Bank Transparency"
Subject Social Sciences
Related Publication Review of Economics and Statistics, Volume 100, Issue 1 (March 2018), pp.187-202. doi: 10.1162/REST_a_00659

Files Metadata Terms Versions

There are no files in this dataset.

Zip files or
no files

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Journals

American Economic Review

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Saleem Bahaj
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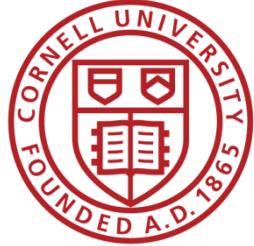
AMERICAN ECONOMIC REVIEW
VOL. 110, NO. 7, JULY 2020
(pp. 2225-70)

Article Information

Online Appendix (877.50 KB)

Author Disclosure Statement(s) (322.66 KB)

G31 Capital Budgeting; Fixed Investment and Inventory Studies; Capacity



Full-featured repository

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Depositing Data in the AEA Data and Code Repository

The *American Economic Association journals* require authors to deposit data and materials with a community-recognized or general repositories. The *AEA Data and Code Repository at ICPSR* serves that purpose. Please see the AEA's [Data and Code Availability Policy](#) and data citation guidance at the [Sample References](#) page for more details. **Authors are required to include a citation pointing to the deposit in the reference section of the final version of the article sent to the AEA.** The *openICPSR* repository automatically generates a citation when the data are "published."

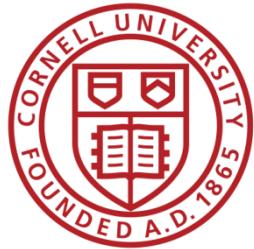
Deposits should include all data, annotated program code, command files, and documentation that is needed to replicate the findings from the authors' submitted article.

- **Data** should be comprehensively documented (see ICPSR's [Guide to Social Science Data Preparation and Archiving, 5th Edition](#) for guidance). The **author** is responsible for removing identifying information from the data to protect [confidentiality](#). Neither the AEA nor ICPSR review submissions for disclosure risk.
- **Program** code and command files should be annotated to facilitate replication and ensure clear correspondence between code and figures, tables, and analyses in the published article.
- Authors retain ownership and copyright to the data and code. Authors are required to affirm that they have the right to publish and redistribute the material. However,
 - ICPSR requires a license for distribution of data.
 - An **open license** is required by the AEA, in order to allow others to re-use the data and code, in particular for replication. Authors can select from several license options, including CC-BY 4.0 for data and Modified BSD for software and code. If an author would like to use multiple licenses or create a customized license, she should select the "Other" license option and upload a LICENSE file alongside the data and documentation.

By depositing in the AEA Data and Code Repository, the depositors allow the AEA staff to add keywords and other metadata which are important for proper indexing in linking. Any other changes are subject to the license chosen for the materials.

[View more extensive \(unofficial\) guidance.](#)

[Start Your Deposit](#)



FAIR data principles rely on metadata

— Scope of Project

Subject Terms ?

Do not copy/paste multiple terms into this field. Terms must be entered individually.

[✖ Russia](#) [✖ Industry](#) [✖ Factories](#) [✖ Russian Empire](#) [✖ Corporations](#)

JEL Classification ?

[✖ L20 General](#) [✖ N63 Europe: Pre-1913](#) [✖ O43 Institutions and Growth](#)

Manuscript Number ?

AER-2015-1656.R3 [edit](#) [remove](#)

Geographic Coverage ? [+ add value](#)

European Russia (Russian Empire) [edit](#) [remove](#)

Time Period(s) ? [+ add value](#)

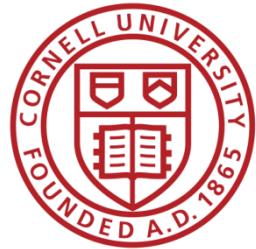
1894 – 1908 (Three years: 1894, 1900, and 1908) [edit](#) [remove](#)

Collection Date(s) ? [+ add value](#)

Universe ?

Manufacturing establishments in the European part of the Russian Empire. [edit](#) [remove](#)

Data Type(s) ?

[Find Data](#) / [Imperial Russian Factory Database, 1894-1908](#)

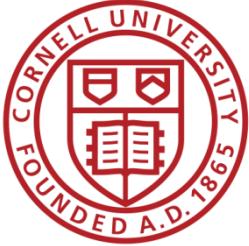
Imperial Russian Factory Database, 1894-1908

Principal Investigator(s): Amanda Gregg, Middlebury College

Version: V1



Name ▾	File Type ▾	Size ▾	Last Modified ▾
1894MicroData.xlsx	application/vnd.openxmlformats-officedocument.spreadsheetml.sheet	4.5 MB	08/08/2019 11:01:AM
1900AggregatesForCorps.dta	application/x-stata	2.1 MB	07/16/2019 12:54:PM
1900MicroData.xlsx	application/vnd.openxmlformats-officedocument.spreadsheetml.sheet	1.6 MB	08/07/2019 08:53:AM
1908MicroData.xlsx	application/vnd.openxmlformats-officedocument.spreadsheetml.sheet	2.3 MB	08/07/2019 11:06:AM
AG_Corp_CleaningandDatabaseCompiler.do	text/x-stata-syntax	23.4 KB	08/08/2019 11:02:AM
AG_Corp_Prod_AppendixCode.do	text/x-stata-syntax	42.2 KB	12/09/2019 09:19:AM
AG_Corp_Prod_Code.do	text/x-stata-syntax	26.6 KB	12/12/2019 03:01:AM
AG_Corp_Prod_Database.dta	application/x-stata	11 MB	08/07/2019 08:55:AM
	application/x-stata	11.9 MB	10/08/2014

[Find Data](#) / [Imperial Russian Factory Database, 1894-1908](#)

Imperial Russian Factory Database, 1894-1908

Principal Investigator(s): Amanda Gregg, Middlebury College

Version: V1



Name	File Type	Last Modified
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Project Citation:

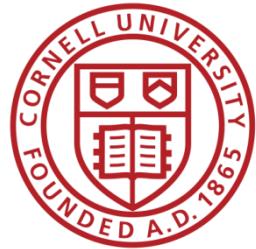
Gregg, Amanda. Imperial Russian Factory Database, 1894-1908. Nashville, TN: American Economic Association [publisher], 2020. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2020-01-29. <https://doi.org/10.3886/E110681V1>

AG_Corp_CleaningandDatabaseCompiler.do	text/x-stata-syntax	23.4 KB	08/08/2019 11:02:AM
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Related Publications

The following publications are supplemented by the data in this project.

- Gregg, Amanda. "Factory Productivity and the Concession System of Incorporation in Late Imperial Russia, 1894-1908." *American Economic Review* 110, no. 2 (February 2020): 401-27. <https://doi.org/10.1257/aer.20151656>.

[Find Data](#) / [Imperial Russian Factory Database, 1894-1908](#)

Imperial Russian Factory Database, 1894-1908

Principal Investigator(s): Amanda Gregg, Middlebury College

Version: V1

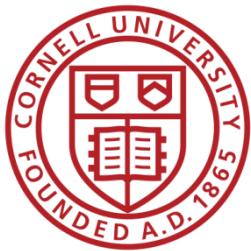


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<meta name="DC.creator" content="Amanda Gregg, Middlebury College" />

<meta name="DC.publisher" content="Inter-university Consortium for Political and Social Research (ICPSR)" />
<meta name="DC.date" content="2020-01-29" />
<meta name="DC.type" content="Dataset" />
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	officedocument.spreadsheetml.sheet			08:53:AM
	1908MicroData.xlsx	application/vnd.openxmlformats-officedocument.spreadsheetml.sheet	2.3 MB	08/07/2019 11:06:AM
	AG_Corp_CleaningandDatabaseCompiler.do	text/x-stata-syntax	23.4 KB	08/08/2019 11:02:AM
	AG_Corp_Prod_AppendixCode.do	text/x-stata-syntax	42.2 KB	12/09/2019 09:19:AM
	AG_Corp_Prod_Code.do	text/x-stata-syntax	26.6 KB	12/12/2019 03:01:AM
	AG_Corp_Prod_Database.dta	application/x-stata	11 MB	08/07/2019 08:55:AM
		application/x-stata	11.9	10/08/2014

[Find Data](#) / [Imperial Russian Factory Database, 1894-1908](#)

Imperial Russian Factory Database, 1894-1908

Principal Investigator(s): Amanda Gregg, Middlebury College



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KB 11:02:AM

[AG_Corp_Prod_AppendixCode.do](#)

text/x-stata-syntax

42.2 KB 12/09/2019
09:19:AM [AG_Corp_Prod_Code.do](#)

text/x-stata-syntax

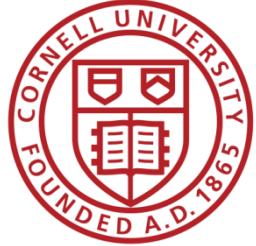
26.6 KB 12/12/2019
03:01:AM [AG_Corp_Prod_Database.dta](#)

application/x-stata

11 MB 08/07/2019
08:55:AM [AG_Corp_Prod_Database.dta](#)

application/x-stata

11 MB 10/08/2014



... and findability relies on metadata

Google



imperial russian factory



1 dataset found



Imperial Russian Factory
Database, 1894-1908

www.openicpsr.org
search.datacite.org
+1more



Updated Jan 29, 2020



Not seeing a result you expected?
[Learn](#) how you can add new
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AMERICAN
ECONOMIC
ASSOCIATION

Imperial Russian Factory Database, 1894-1908

[Explore at openICPSR](#)

[Explore at search.datacite.org](#)

[Explore at www.da-ra.de](#)

2 scholarly articles cite this dataset ([View in Google Scholar](#))



Unique identifier

<https://doi.org/10.3886/E110681V1>

Dataset updated Jan 29, 2020

Dataset provided by

[American Economic Association](#)

Authors

Amanda Gregg

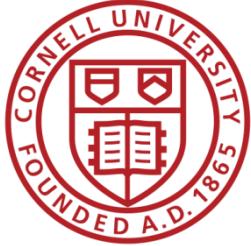
License

[Attribution 4.0 \(CC BY 4.0\)](#)

License information was derived automatically

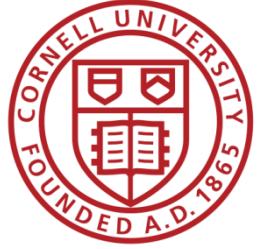
Area covered

European Russia (Russian Empire)

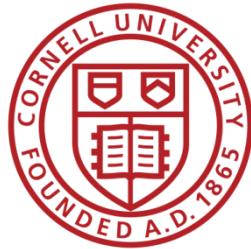


A role for institutions?

- **Pre-emptively improve code archives**
 - By conducting reproducibility checks when we can
 - By working with groups that conduct reproducibility checks when we cannot
- **Better archives**
 - Greater transparency of the code and data archives
- **Better provenance tracking**
 - Leave code where it is when appropriate
 - Leave data where it is almost always
 - Display that information
- Institutions can (must?) provide infrastructure for archives
 - Internal-only (dark)
 - Internal with public metadata (FAIR!)
 - Public
 - Mix of the above
- Institutions provide researchers with information (citation, access protocols)



An example with data



Example 4: German Restricted-access



RESEARCH DATA CENTRE (FDZ)
of the German Federal Employment Agency (BA)
at the Institute for Employment Research (IAB)

[Home](#) | [Newsletter](#) | [Jobs](#) | [Contact](#) | [Data Privacy](#) | [Imprint](#)



Data Version	DOI (Link to Description of Data Version)	Availability (yyyy-mm-dd)
BHP 7518 v1 (current)	10.5164/IAB.BHP7518.de.en.v1	2020-01-13
BHP 7517 v1	10.5164/IAB.BHP7517.de.en.v1	2018-12-12
BHP 7516 v1	10.5164/IAB.BHP7516.de.en.v1	2018-04-11

External data

Data Archive

Data Access

Campus Files

Publications

Events

Projects of FDZ users

FDZ Projects

Complaint point of the
RatSWD

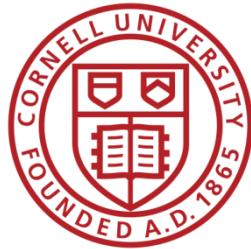
Figures of the FDZ

employees, both in total and broken down by gender, age, occupational status, qualification and nationality. Means and medians of wages for full-time employees are given, too. Additional datasets providing information about (gross) worker flows and about foundations and closures of establishments are available on request.

Data Versions

Old versions are only available for replication studies and only in justified exceptional cases for new Projects.

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BHP 7517 v1	10.5164/IAB.BHP7517.de.en.v1	2018-12-12
BHP 7516 v1	10.5164/IAB.BHP7516.de.en.v1	2018-04-11

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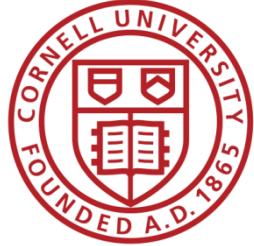
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BHP 7518 v1 (current)	10.5164/IAB.BHP7518.de.en.v1	2020-01-13



Example 4: German Restricted-access

Establishment History Panel (BHP) – Version 7518 v1

DOI: 10.5164/IAB.BHP7518.de.en.v1

Summary

Data source:

Data Access

The IAB Establishment Panel is available via the following ways of access:

- On-site use at the FDZ. Further information on Applying for [on-site use](#).
- Remote data Access. Further information on Applying for [remote data access](#).

nationality. Means and medians of wages for full-time employees are given, too. Additional datasets providing information about (gross) worker flows and about foundations and closures of establishments are available on request.

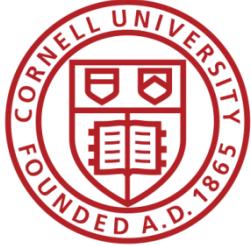
Dataset Descriptions and Frequencies

German

- DOI: [10.5164/IAB.FDZD.2001.de.v1](https://doi.org/10.5164/IAB.FDZD.2001.de.v1)
-  [FDZ-Datenreport 01/2020](#)
-  [Fallzahlen und Labels](#)

English

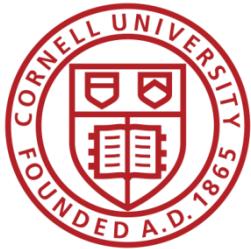
- DOI: [10.5164/IAB.FDZD.2001.en.v1](https://doi.org/10.5164/IAB.FDZD.2001.en.v1)



Current efforts at the AEA

- **Pre-emptively improve code archives**
 - By conducting reproducibility checks when we can
 - By working with groups that conduct reproducibility checks when we cannot
- **Better archives**
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 - Leave code where it is when appropriate
 - Leave data where it is almost always
 - Display that information

Why we do what
we do



perceived criteria of importance.

1. Importance

Data should be considered legitimate, citable products of research. Data should be accorded the same importance in the scholarly record as citat research objects, such as publications[1].



Data Citation Principles

2. Credit and Attribution

Data citations should facilitate giving scholarly credit and normative and le attribution to all contributors to the data, recognizing that a single style or of attribution may not be applicable to all data[2].

3. Evidence

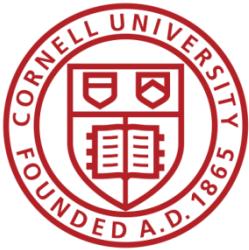
In scholarly literature, whenever and wherever a claim relies upon data, the corresponding data should be cited[3].

4. Unique Identification

A data citation should include a persistent method for identification that i actionable, globally unique, and widely used by a community[4].

5. Access

Data citations should facilitate access to the data themselves and to such metadata, documentation, code, and other materials as are necessary for



perceived criteria of importance.

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Data Citation Principles

2. Credit and Attribution

1 | **Bureau of Labor Statistics.** 2000–2010. “Current Employment Statistics: Colorado, Total Nonfarm, Seasonally adjusted - SMS080000000000000001.” United States Department of Labor. <http://data.bls.gov/cgi-bin/surveymost?sm+08> (accessed February 9, 2011).

corresponding data should be cited[3].

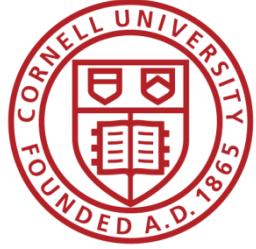
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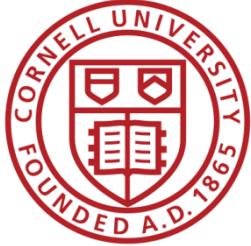
5. Access

Data citations should facilitate access to the data themselves and to such metadata, documentation, code, and other materials as are necessary for

Data Citation Synthesis Group: Joint Declaration of Data Citation Principles. Martone M. (ed.) San Diego CA: FORCE11; 2014 [<https://www.force11.org/group/joint-declaration-data-citation-principles-final>].



Data citations are hard

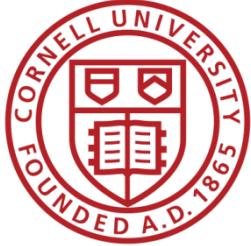


Data citations are perceived as hard

- Authors provide “their” data
- Authors don’t know where their data came from
- Authors describe the data provenance in generic terms
 - Which may be in line with journalistic standards, but not academic

 Poor citation practices

- **Macrodata:**
“We use data downloaded from the Bureau of Economic Analysis...”
- **Microdata:**
“... this paper uses data from the Current Population Survey...”



Data citations

- Creating specific guidance in the absence of strong discipline-specific guidance



Data and Code Guidance by Data Editors

Guidance for authors wishing to create data and code supplements, and for replicators.

Guidance on Data Citations

On this page:

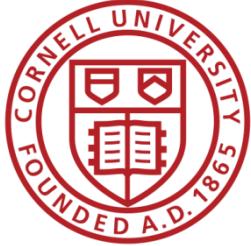
- Better
- Websites
- Online databases
- Data distributed as supplementary data
- Producer
- Distributor
- Dates
- Offline access mechanism
- Confidential databases
- No formal access mechanism

One of the most vexing issues is how to cite data. This document goes through a few common scenarios not covered elsewhere.

What is not a data citation

Many authors initially neglect to add data citations, or do not know how to add a data citation. Often, we see authors cite papers with supplementary data, but not databases or other data:

<https://social-science-data-editors.github.io/guidance/addtl-data-citation-guidance.html>



Current efforts at the AEA

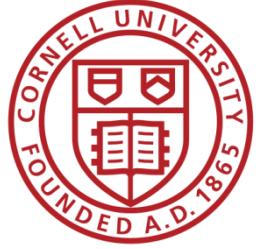
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 - Leave code where it is when appropriate
 - Leave data where it is almost always
 - Display that information

Restricted-access data pose a challenge

How do you check code when the data access is complex?

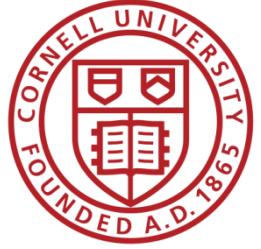
How do you improve archives when you do not control data management?

How do you document data provenance when you cannot provide the data?



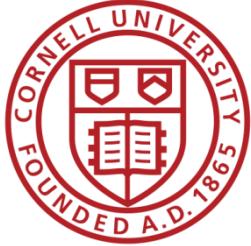
Citing restricted-access data

“Well, I can’t download the data, so I can’t cite it.”



How do you document provenance
when you cannot use the data?

Wrong question!



Current efforts at the AEA

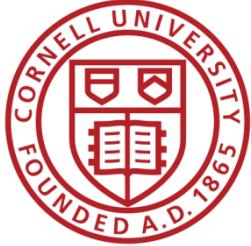
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Restricted-access data pose a challenge

How do you check code when the data access is complex?

How do you improve archives when you do not control data management?

How do you document data provenance when you don't control the process?

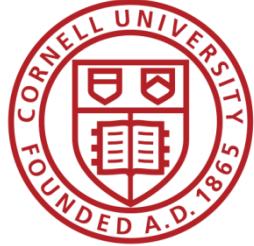


How did you get the data in first place?

- You **applied** for the data through a process
- You **purchased** the data from a provider
- You signed an **Non-Disclosure Agreement (NDA)** with a company
- Your **university** has an **agreement** with a data provider

...

A screenshot of the Refinitiv Eikon website. At the top, there's a navigation bar with links for "Contact us", "Private Network Users", and "Sign in & Download". The main header features the Refinitiv logo and the word "EIKON". Below the header, there's a large image of multiple computer monitors displaying various financial data visualizations like charts and graphs. To the right of the image, there's a "Welcome" message and a link to "Find out more here". Below the image, there are three main sections: "PC Requirements", "System and Network Test", and "Web Access". Each section has a brief description and a "View" or "Run" button. The "PC Requirements" section says "View the recommended PC requirements for Refinitiv Eikon." The "System and Network Test" section says "Ensure your computer and network meet the requirements to install and run Refinitiv Eikon." The "Web Access" section says "Compare features with the desktop application and check system requirements." There are also "Sign in" buttons for both the desktop application and the web access.

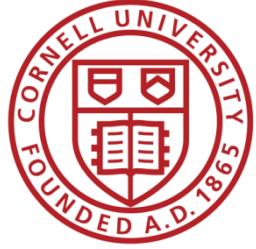


You must have described the data

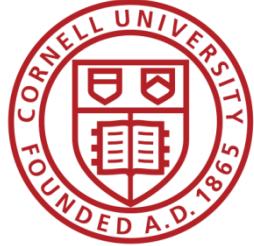
- You must have named the dataset you wanted
- You downloaded the data from from an online query system
- You specified the extract from a company database (in words, in SQL, etc.)

...

The screenshot shows the DataBank interface for the World Development Indicators. At the top, there are tabs for Variables, Layout, Styles, Save, Share, and Embed. Below these are sections for Database, Country, Series, and Time. The Country section is expanded, showing a list of countries with checkboxes. A search bar at the top of the list allows entering keywords. To the right of the list, there is a preview area with a 'Preview' button and a sidebar for selecting variables. The sidebar includes a message about selecting variables from dimensions like Country, Series, and Time, and a 'Please select variables...' button.

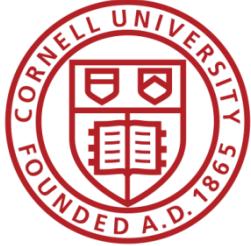


How do you document data provenance
when you don't control the process?



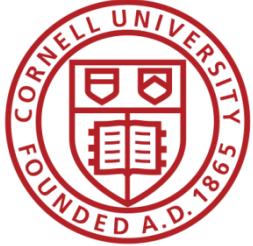
How do you document data provenance?

- What do you need to request?
 - Name, specification, DOI, etc.
- Where do you need to request it?
 - Website, your local CRDCN, a Freedom of Information Act officer, etc.
- Details, details:
 - Copy of your request form?
 - Copy of your request letter?
 - Etc.
- Don't assume (too much) prior knowledge!



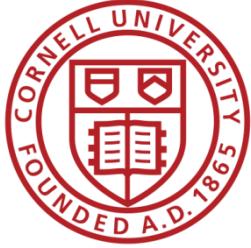
A role for institutions?

- **Pre-emptively improve code archives**
 - By conducting reproducibility checks when we can
 - By working with groups that conduct reproducibility checks when we cannot
- **Better archives**
 - Greater transparency of the code and data archives
- **Better provenance tracking**
 - Leave code where it is when appropriate
 - Leave data where it is almost always
 - Display that information
- Institutions (data librarian!) can provide researchers with
 - The necessary information about original sources
 - Conveying the necessary access information
 - Arrange for permission to redistribute extracts
- Data providers can
 - Provide suggested citations
 - Be clear about original sources!
 - Information about persistence
 - Potentially be clearer about the rights to redistribute



AEA “Data Availability Policy” (2019)

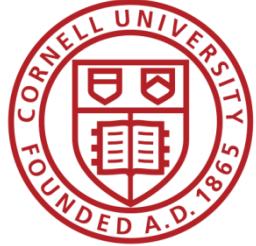
- It is the policy of the American Economic Association to publish papers only if the data used in the analysis are **clearly and precisely documented and access to the data and code is clearly and precisely documented and is non-exclusive to the authors.**
- Authors of accepted papers that contain empirical work, simulations, or experimental work must **provide, prior to acceptance**, the data, programs, and other details of the computations **sufficient to permit replication**, as well as **information about access to data and programs.**



Every manuscript is checked

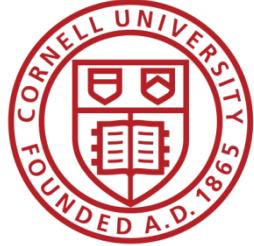
- What datasets are used
- Are they cited?
- Is there additional information access?
 - → URL leads to exact data?
 - → URL leads to application procedure?
 - → other access procedure is described?





Every manuscript is checked

- What datasets are used
- Are they cited?
- Is there additional information on access?
- Is there license/ data use information?
 - → Should the author provide the data?
 - → Is the author allowed to provide data?



Example 2: Academic data publisher

 **ECONOMIC POLICY UNCERTAINTY**

Home Methodology Media Research & Applications About Us

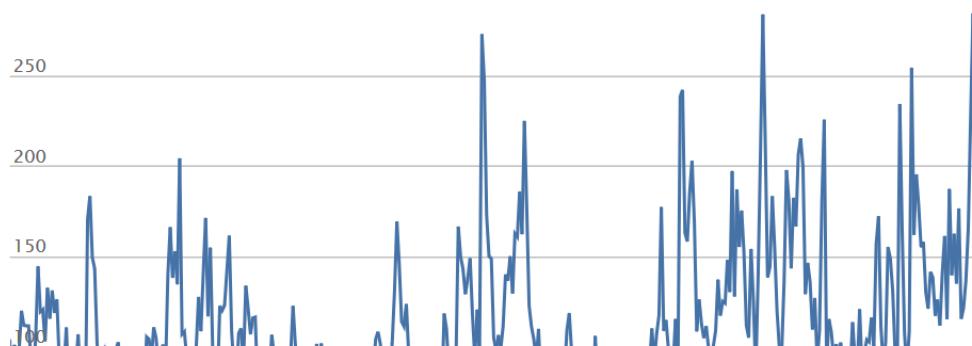
EPU Indices	
All Country-Level Data	
Global	USA
Australia	Brazil
Canada	Chile
China	Colombia
Croatia New	France
Germany	Greece
Hong Kong	India
Ireland	Italy
Japan	South Korea

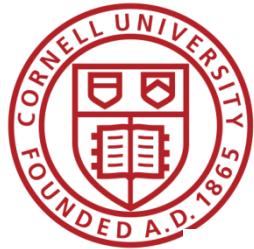
Economic Policy Uncertainty Index

We develop indices of economic policy uncertainty for countries around the world.

Monthly US Economic Policy Uncertainty Index

Zoom [1m](#) [3m](#) [6m](#) [1y](#) [7y](#) [All](#)





Example 2: Academic data publisher

https://www.policyuncertainty.com/index.html SEP DEC JAN
103 captures 14 2018 2019 2020
18 Aug 2012 - 14 Dec 2019

ECONOMIC POLICY UNCERTAINTY [Home](#) [Methodology](#) [Media](#) [Research & Applications](#) [About Us](#)

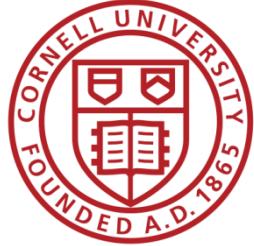
EPU Indices **Economic Policy Uncertainty Index**

All Country-Level Data We develop indices of economic policy uncertainty for countries around the world.

Globe Australia Canada China Croatia France Germany Greece Hong Kong India Ireland Italy Japan South Korea

© 2012-2018 by Economic Policy Uncertainty

The chart displays a highly volatile line graph representing the Economic Policy Uncertainty Index. The y-axis ranges from 100 to 200, and the x-axis spans from approximately 2012 to 2018. The index fluctuates significantly, with major peaks around 2013, 2015, and 2017, and troughs around 2014, 2016, and 2018.



Example 2: Academic data publisher-new!

 **ECONOMIC POLICY UNCERTAINTY**

[Home](#) [Methodology](#) [Media](#) [Research & Applications](#) [About Us](#)

EPU Indices

[All Country-Level Data](#)

Global [USA](#)

Economic Policy Uncertainty Index

We develop indices of economic policy uncertainty for countries around the world.

Monthly US Economic Policy Uncertainty Index

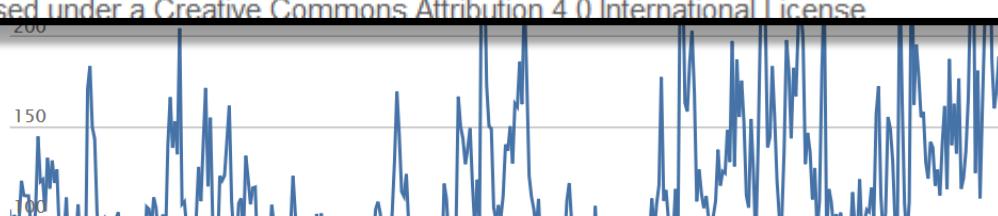
This work is licensed under a Creative Commons Attribution 4.0 International License

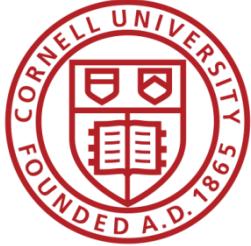
Germany [Greece](#)

[Hong Kong](#) [India](#)

[Ireland](#) [Italy](#)

[Japan](#) [South Korea](#)





And we check them!

- If the URL does not work, we make a note.
- If the site requires registration, we try it out.
 - How long?
 - Any requirements?

- What does the site say?

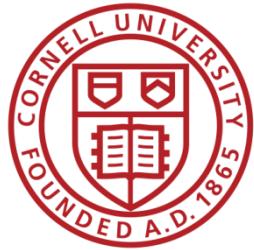
Please use the following citation when referring to this file in the different versions:

Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). 2014. World Values Survey: Round Six - Country-Pooled Datafile Version:

www.worldvaluessurvey.org/WVSDocumentationWV6.jsp.

Madrid: JD Systems Institute.

- Is that in the README / Paper/ Appendix?



And we check them!

In order to download the file you are asked to fill the following registration form and agree on the "Conditions of Use". Please read it carefully before proceeding to the download.

PERSONAL DATA

Title (position):

Full name:

Company/Institution:

E-mail:

FILE USAGE

Project title:

Intended use:

Brief description of the purpose of application:

CONDITIONS OF USE

1. Restrictions

These data files are available without restrictions, provided

a) that they are used for non-profit purposes; and

b) correct citations are provided and sent to the World Values Survey Association for each publication or results based in part entirely on these data files. This citation will be made freely available; and

c) [the data files themselves are not redistributed.](#)

2. Correct citation

- What does the site say?

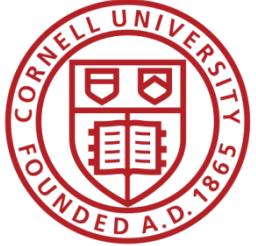
Please use the following citation when referring to this file in the different versions:

Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). 2014. World Values Survey: Round Six - Country-Pooled Datafile Version:

www.worldvaluessurvey.org/WVSDocumentationWV6.jsp.

Madrid: JD Systems Institute.

- Is that in the README / Paper/ Appendix?
- Are all the conditions met/described?



Data Availability

- A statement about **data availability**
 - DOI assigned
 - But longer
- A statement about **usage rights**
 - Not every dataset is in the public domain
 - Not everybody knows that U.S. Government data are usually in the public domain



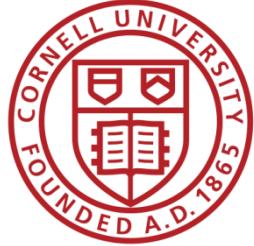
Data Availability Statements (DAS)

- A statement about **where data** supporting the results reported in a published article can be

o publicly
ated during
y providing a
l restrictions,

Provide data citations (in manuscript) and data availability statements (in README or appendix)

Take-away

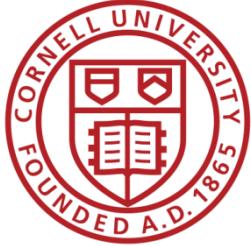


Role for institutions: Help establish provenance

- Create internal and external archives
 - FAIR metadata
 - Clear access protocols
- Provide researchers with robust information on corporate data sources
 - Where do they come from
 - How can somebody access them
 - Ability to redistribute

- Clearly shared resources
- Relevant for internal purposes (reliability of results)
- Requires real resources, expertise
- Can rely on established standards and tools

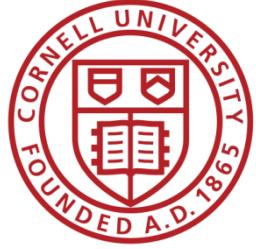
- Requires awareness of licensing and contracting
- Conveyed to people who are not aware of those things
- Requires awareness of others' abilities and access
(who can afford a Bloomberg subscription?)



Role for institutions: Help establish computational reproducibility

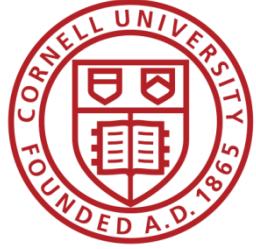
- Provide training to researchers
 - Provide training to RAs
 - Provide RAs to researchers
 - Provide standardized project setups
 - Example World Bank ([DIME](#))
 - Provide reproducibility checks
 - On-demand by journals
 - As a regular part of publication procedures (working papers, documents, etc.)
 - As part of regular internal (peer-) review processes
- Already done for the AEA on an ad-hoc basis!

The role for
journals



Goal: Transportability

Any standards, tools, methods: must be transportable across journals (no custom solutions)



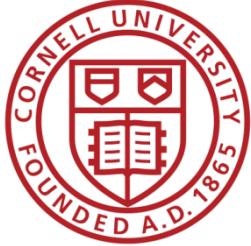
Social science “guild”



[https://
social-science
-data-editors.
github.io/
guidance/](https://social-science-data-editors.github.io/guidance/)

Thank you!

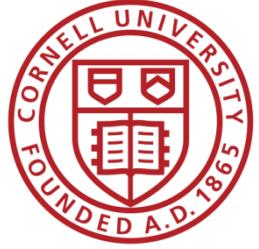
<https://doi.org/10.5281/zenodo.4311917>



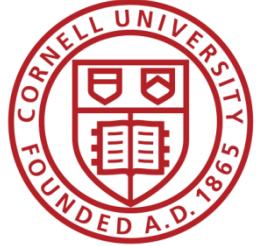
Some resources

- <https://social-science-data-editors.github.io/guidance/>
- <https://aeadataeditor.github.io/aea-de-guidance/>
 - template README
 - discussion of licensing
 - data citation guidance
- German example:
 - Establishment History Panel (BHP) DOI: [10.5164/IAB.BHP7516.de.en.v1](https://doi.org/10.5164/IAB.BHP7516.de.en.v1)
- French verification service “cascad” within French RDC CASD
 - <https://www.casd.eu/en/le-centre-dacces-securise-aux-donnees-casd/certification-de-resultats-casad-casd/>





Extras



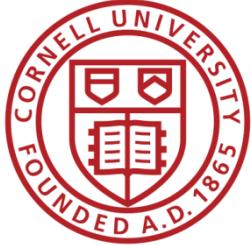
Element of a (data) citation

ICPSR notes that a citation should include the following items:

- Author
- Title
- Distributor
- Date
- Version
- Persistent identifier

Suggested Citation:

S&P Dow Jones Indices LLC, *S&P 500 [SP500]*, retrieved from FRED, Federal Reserve Bank of St. Louis;
<https://fred.stlouisfed.org/series/SP500>, June 26, 2020.



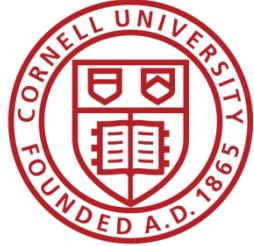
Element of a (data) citation

ICPSR notes that a citation should include the following items:

- Author
- Title
- Distributor
- Date
- Version
- Persistent identifier

Constructed Citation:

Institute for Employment Research (IAB), Establishment History Panel 1975-2018. Accessed via the Research Data Centre (FDZ) of the German Federal Employment Agency DOI: 10.5164/IAB.BHP7518.de.en. v1 June 26, 2020.

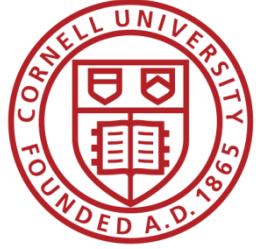


Element of a (data) citation

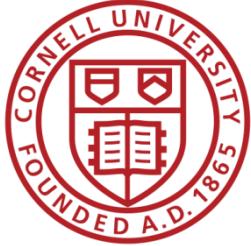
ICPSR notes that a citation should include the following items:

- Author
- Title
- Distributor
- Date
- Version
- Persistent identifier

Constructed Citation:
US Census Bureau,
Longitudinal Business
Database (LBD) 1975-
2018. Last accessed via
the Federal Statistical
Research Data Centre
(FSRDC) June 26, 2020.



What is the reproducibility check?



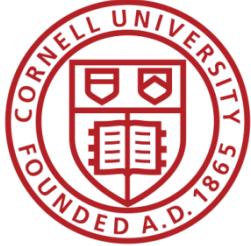
What is the reproducibility check?

- **Data checks**

- Code description
- Requirements
 - As stated by author
 - As encountered by replicator
- Verbose description of steps to replicate
- Findings
 - Compare tables
 - Compare figures
 - Compare in-text numbers

INSTRUCTIONS: When data are present, run checks:

- **Can data be read** (using software indicated by author)?
- Is data in **archive-ready formats** (CSV, TXT) or in custom formats (DTA, SAS7BDAT, Rdata)?
- Does the dataset **have variable labels?**
- Run **check for PII**. Apply judgement.

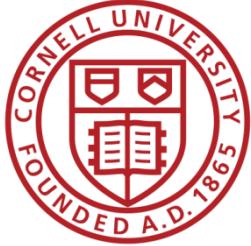


What is the reproducibility check?

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 - Compare tables
 - Compare figures
 - Compare in-text numbers

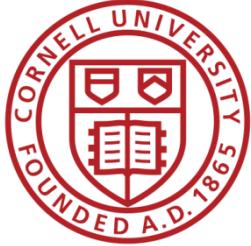
INSTRUCTIONS:

- **Review the code** (but do not run it yet).
- Identify programs that create "analysis files" ("**data preparation code**").
- Identify **programs that create tables and figures**. Not every deposit will have separate programs for this.
 - Identify all Figure, Table, and any in-text numbers.



What is the reproducibility check?

- Data checks
- Code description
- Requirements
 - As stated by author
 - As encountered by replicator
- Verbose description of steps to replicate
- Findings
 - Compare tables
 - Compare figures
 - Compare in-text numbers
- Software Requirements
 - Version of software (Stata 15, Matlab R2019b, etc.)
 - Complete list and version of packages!
- Computational Requirements
 - Type, vintage, memory size, speed of computer
 - Disk space!
- Time Requirements
 - Minutes, hours, days, weeks, months?

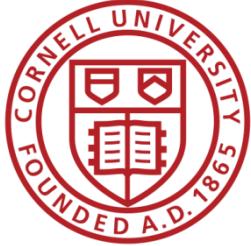


What is the reproducibility check?

- Data checks
- Code description
- Requirements
 - As stated by author
 - As encountered by replicator
- **Verbose description** of steps to replicate
- Findings
 - Compare tables
 - Compare figures
 - Compare in-text numbers

INSTRUCTIONS

- Provide details about your process of accessing the code and data.
- DO describe actions that you did as per instructions
- DO describe any other actions you needed to do ("I had to make changes in multiple programs")
- Findings come later



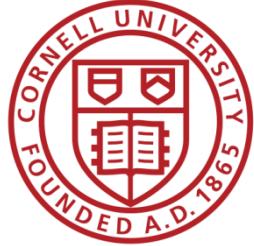
What is the reproducibility check?

- Data checks
- Code description
- Requirements
 - As stated by author
 - As encountered by replicator
- **Verbose description of steps to replicate**
- **Findings**
 - Compare tables
 - Compare figures
 - Compare in-text numbers

INSTRUCTIONS:

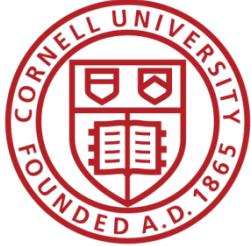
- Describe your findings both positive and negative in some detail, for each **Data Preparation Code, Figure, Table, and any in-text numbers**.
- When errors happen, be as precise as possible.
 - For differences in figures, provide screenshot of manuscript figure, as well as the figure produced by the code you ran.
 - For differences in numbers, provide both the number as reported in the manuscript, as well as the number replicated.

Coding for Reproducibility



Streamlining replication packages

- Master script preferred
 - Least amount of manual effort
- No manual manipulation
 - “Change the parameter to 0.2,
then run the code again” 
- No manual copying of results
 - Write out/save tables and figures
using packages
 - Compute all numbers in package
- No manual install of packages
 - Use a script to create all
directories, install all necessary
packages/requirements/etc.
- Clear instructions!

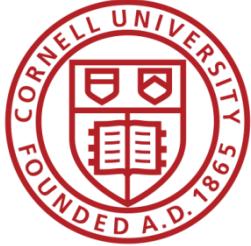


Some tips from the “frequently gotten wrong” bin

- Set the project directory **ONCE** in code, or **NEVER** (Stata, R, Python)
- Use **placeholders** (globals, libnames, etc.) for common locations (\$CONFDATA, \$TABLES, \$CODE) (Stata, R, Python, SAS)
- **Write out all tables, figures**, and in-text numbers into separate files

If you need to **manually** modify the code to obtain a series of tables/figures/columns, you’re doing something wrong:

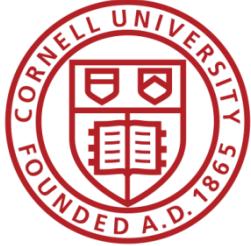
- Use **functions**, **ado files**, **programs**, **macros**, **subroutines**
- Use **loops**, **parameters**, **parameter files** to call those subroutines



Some tips from the “frequently gotten wrong” bin

Cleanly separate

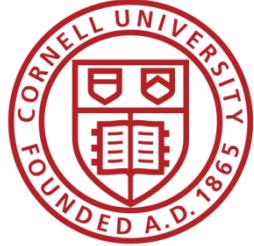
- Confidential data and public use data
 - You are going to have to provide copies of the public use data without compromising confidentiality
 - Confidential parameters and the rest of the code
 - Reduces need to redact programs
- Use placeholders (globals, libnames, etc.) for common locations (\$CONFDATA, \$TABLES, \$CODE) ([Stata](#), [R](#), [Python](#), [SAS](#))



Some tips from the “frequently gotten wrong” bin

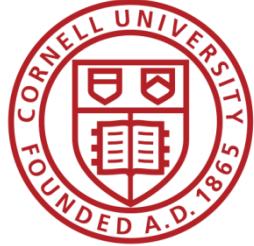
Have “computational empathy”

- Consider cross-platform programming practices
 - Consider that the replicator can learn from the process
 - They probably don’t have the same knowledge
 - Consider that the replicator might not have the same modules/packages/etc.
-
- Path and filenames:
 - Stata: always use forward slashes, even on Windows
use “\$data/path/data.dta”
 - R: use “file.path()”
`x <-
read(file.path(data, "data.dta"))`
 - SAS: use filename and libname to abstract
`data DATALIB.step1;
set CONFLIB.slid_1996;`



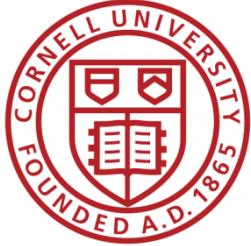
Extreme examples

- Matlab-based simulation
- Real example, 10 figures, 4 panels each
- For Figure 5a, comment line 52, uncomment line 151, run the code, then copy the figure into your document.
- For Figure 5b, comment line 151 again, leave line 52 commented, and change the parameter on line 75 to “3”
-



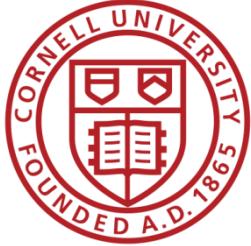
Extreme examples

- Stata-based estimation
- 4 variants
- Run the data creation programs, then copy the data to Folder A
- Copy programs “b.do” and “c.do” from Folder A to Folder B, but modify “c.do” on line 20
- Once done, convert the output from “d.do” to a Matlab file, and run the simulation in Folder B/C
-



Ideal setup

- 1 program to prepare the setup
 - Installs all packages
 - Creates all directories
 - 1 program (or a very small number) that creates the rest
 - Possibly with macros/ ado files/ subroutines
 - Possibly with parameter files that might differ per directory
 - All tables and figures are output programmatically
-
- Setting up can be done in all languages
 - Matlab, Stata, R, Python, Fortran
 - Subroutines exist in all languages
 - You might need to learn how!
 - Ability to output figures and tables (Excel, LaTeX) exist in all languages



How to prepare the replication package

- README
- Now ask an [RA/ colleague](#)/

AEA Data and Code Guidance



AMERICAN
ECONOMIC
ASSOCIATION

Guidance for authors,
data and code sup-
replicators.

Steps for the Third-party Replicator

- Download the author's replication archive(s) from the designated URL (public, or privately shared)
- Ensure access to any confidential files that are described in the replication archive's README
 - The replicator should consider whether a third-party person not familiar with the original environment could reasonably rely on the instructions in the

That's our Protocol!

- Follow the [checklist](#) to conduct the reproducibility exercise, relying exclusively on the README for instructions and guidance.
- Write a [report](#)
- Send the report to the AEA Data Editor
- Report any interactions with the author in the course of conducting the reproducibility exercise (help, assistance, clarifications)