

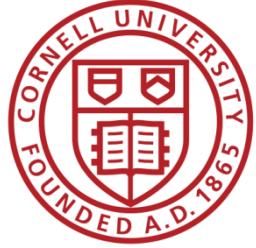
# Transparency and Reproducibility in Economics: Lessons learned from 1,000 papers

Lars Vilhuber

Cornell University

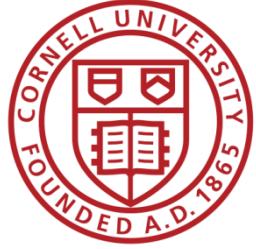
*Hamilton, ON – 2022-12-02*

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.

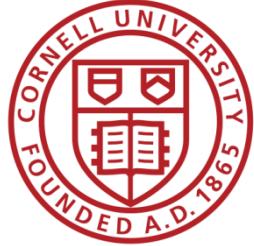


# 3 Lessons (and many solutions)

- Lesson 1: Computational empathy
- Lesson 2: Data acumen
- Lesson 3: Role of institutions

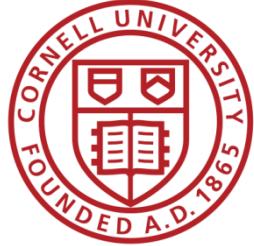


Let me expand that a bit...



# For students and researchers

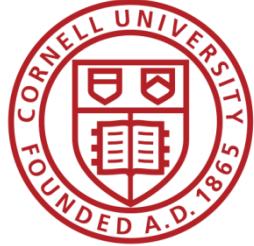
0. *Do not necessarily learn from previous papers*
1. Have computational empathy for ...
2. Track data whenever used
3. Learn the basic ... of programming
4. Learn to automate
5. Preserve it all (and version it too)



# For institutions

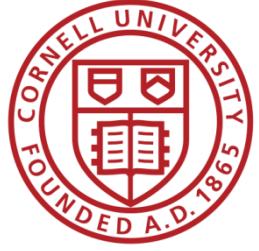
*(departments, schools, libraries, IT, universities)*

1. Offer training in adapted tools
2. Highlight appropriate community or university sites
3. Provide streamlined access to some frequently used (open/commercial) tools



# For faculty

1. Encourage students to learn skills you don't know
2. Demand reproducibility when reviewing  
*(articles, theses, intermediate reports from students, etc.)*
3. Incentivize reproducibility



# A bit of background



#### 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

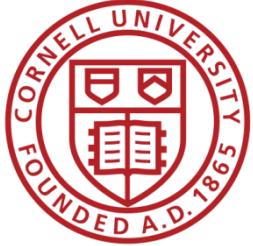


*American Economic Journal: Economic Policy* publishes papers covering a range of topics, the common theme being the role of economic policy in economic outcomes.

#### American Economic Journal: Microeconomics

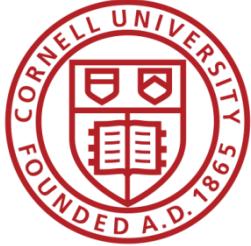


*American Economic Journal: Microeconomics* publishes papers focusing on microeconomic theory; industrial organization; and the microeconomic aspects of international trade, political economy, and finance.



# 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**.



# Stats on reproduced articles

Between July 16, 2019, and June 20, 2022, the AEA Data Editor team conducted

- **1900 assessments**
- for **1050 manuscripts**  
(full papers)



**AEA Data Editor** @AeaData · 1h  
Normal 0%

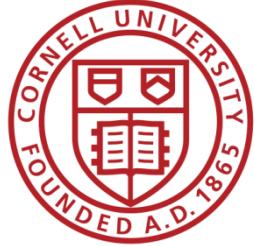
At the start of summer of 2022, we have prepared about 1900 reports on about 1300 manuscripts (about 1050 if excluding the P&P). To infinity and beyond!



5



[Show this thread](#)



# Reproducibility Verification



## 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:

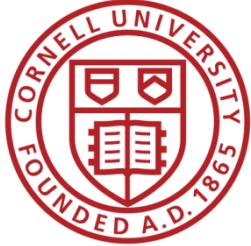
- Overview
- Review the README file
- For each listed data source
- For each listed table, figure, in-text number
- Conduct a code verification, if data is available
- Examples

### Overview

This document describes

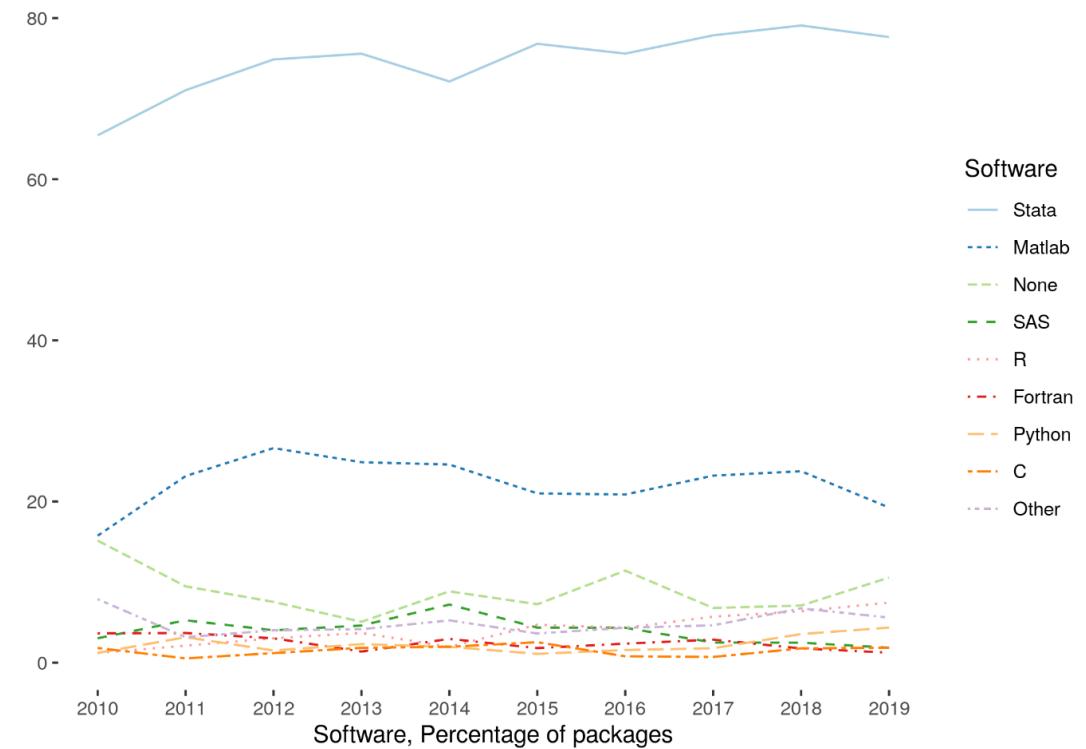
- what authors should check before providing data and code to journals
- what verifier teams should check for in the data and code provided to them for the purpose of verification





# Very little diversity in software

- **Stata** is the most popular statistical software in the journals of the AEA (**72.96%** of all supplements, 2010-2019)
- followed by **Matlab** (**22.45%**)



# Defining “reproducible research”

“Reproducibility” refers to the ability of a researcher to duplicate the results of a prior study using the **same materials** and **procedures** as were used by the original investigator.

Bollen et al. 2015. “Social, Behavioral, and Economic Sciences Perspectives on Robust and Reliable Science.”

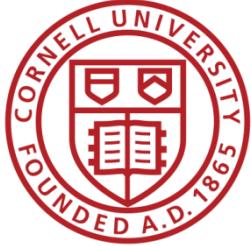
National Science Foundation.[https://www.nsf.gov/sbe/AC\\_Materials/SBE\\_Robust\\_and\\_Reliable\\_Research\\_Report.pdf](https://www.nsf.gov/sbe/AC_Materials/SBE_Robust_and_Reliable_Research_Report.pdf).

# Ingredients of “research”

1. “Procedures” = computer code
2. “Materials (1)” = data
3. “Materials (2)” = computers



# Lessons?



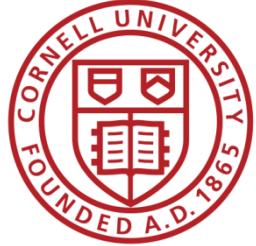
# Observation 0

Researchers don't...

- Re-run their code before submitting
- Don't streamline (automate) enough
- Are not careful about how they document data sources
- Fail to curate their own data

# Lessons!

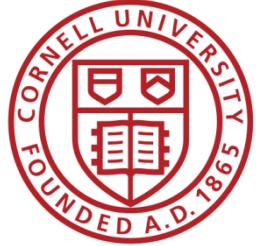
Computational  
empathy



# Lesson 1: Computational empathy

In the words of the slogan popularized by Buckheit and Donoho (1995),

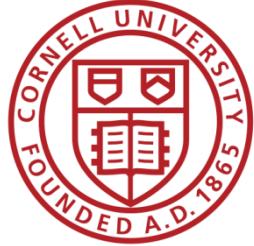
***“a scientific publication is [...] merely advertising of the scholarship: [...] the complete software development environment and the complete set of instructions which generated the figures.”***



# Lesson 1: Computational empathy

Put yourself in the position of the reader of the research compendium:

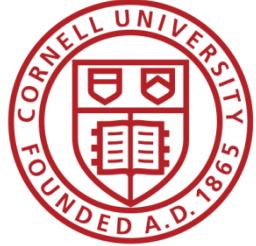
- Can they understand those instructions?
- Under what premises/ shared common knowledge?
- What might they assume about the computing environment?
- How concise or diffuse are the instructions?



# Lesson 1: Computational empathy

## Potential readers

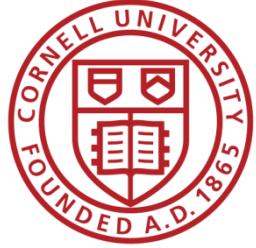
- **You** (*in 4 years, between prepping 2 new courses, an R&R, a new child, and tenure coming up in 2 years*)
- Your RA (*in 4 years, because you are... see above*)
- Your future readers who will cite you (*in 4-10 years, who may want to extend or replicate your study, but won't if it is too complex*)



# Lesson 1: Computational empathy

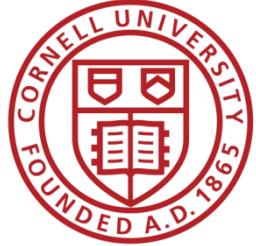
= “Pity the poor replicator”

# Intermezzo



# Observation 1

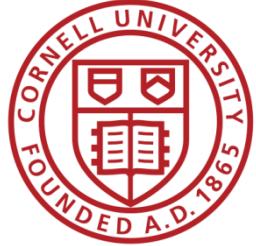
Social scientists do not  
read the manual  
(beyond the first few pages)



# Observation 1: Please read the manual

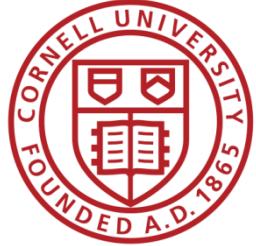
Persistent misconceptions

- About setting **working directories**
- How to record **pathnames**
- How to leverage **loops**
- How to leverage **subroutines**
- How to pass **parameters**
- How (and if) to use **controller scripts**



## Observation 2

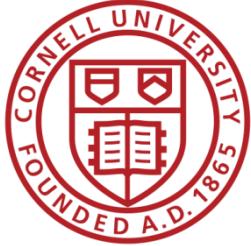
Social scientists  
love  
point-and-click interfaces  
(which are hard to reproduce)



# Observation 2: point-and-click interfaces

This is reflected in

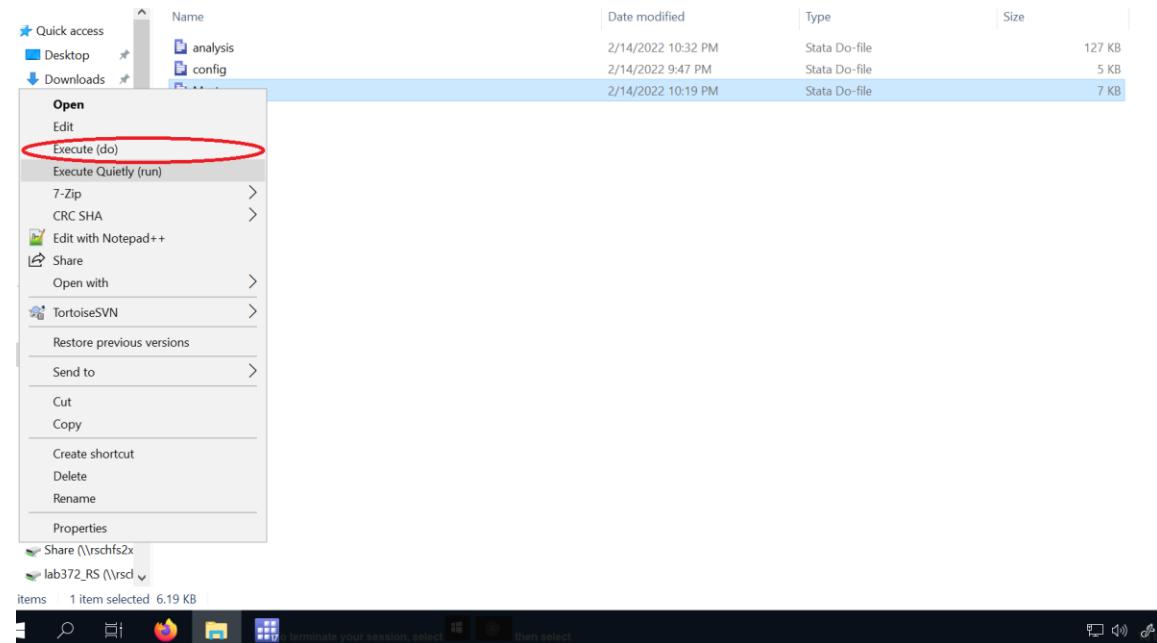
- **GIS (maps)** that appear in papers
- **Data extraction tools**
- **How to run software** (any software)

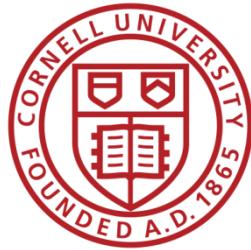


# Ask yourself: how do you run....

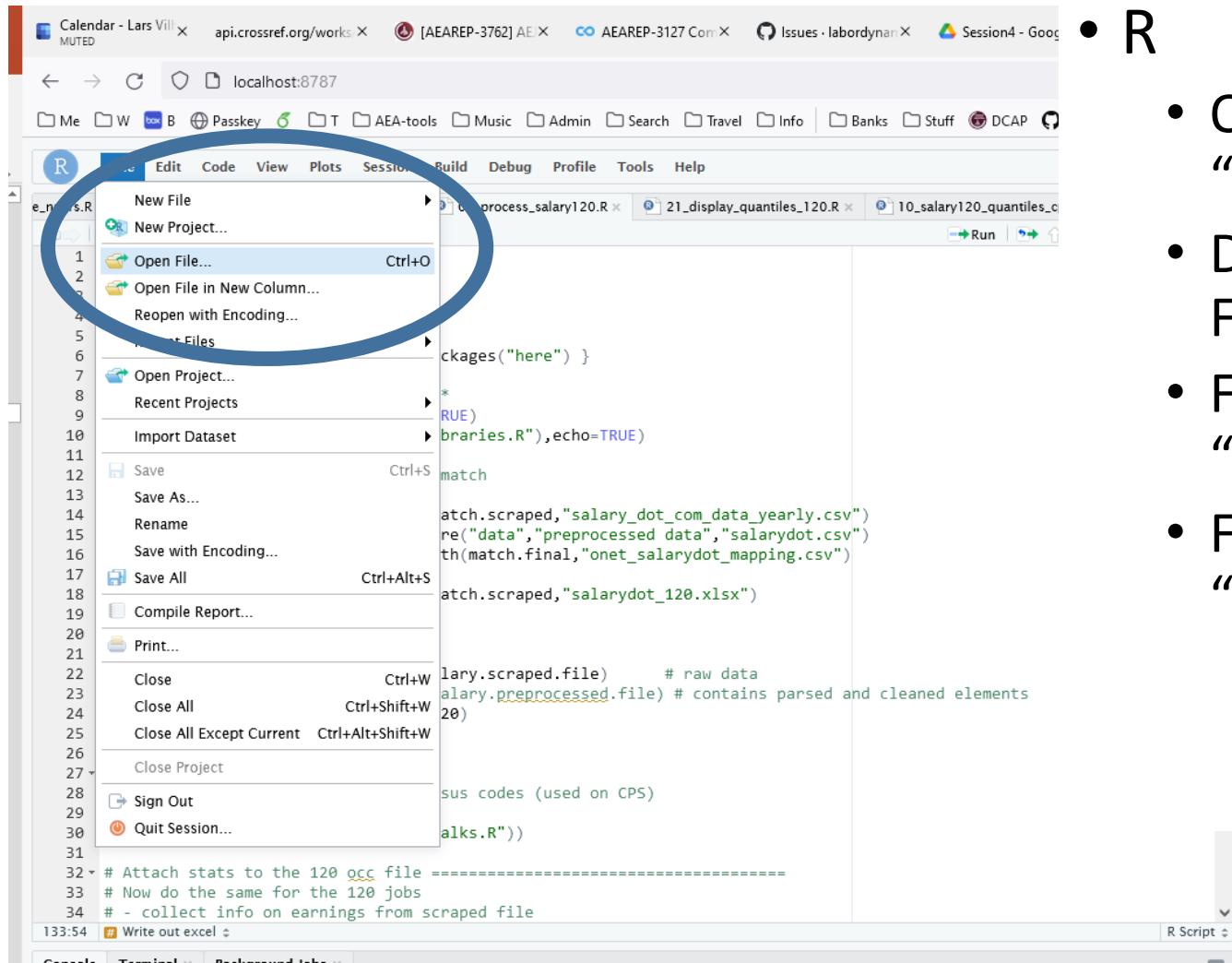
- Stata

- Open Stata, find file, Select-all, click on green arrow thingy
- Right-click on file, choose “Execute”
- At the bash prompt, type “stata -b file.do”





# Ask yourself: how do you run....

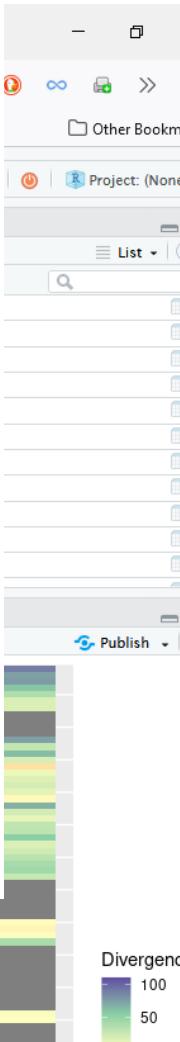


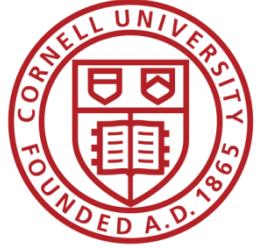
The screenshot shows the RStudio interface with the 'File' menu open. A blue circle highlights the 'Source' button in the 'File' menu. The menu also includes options like 'New File', 'Open File...', 'Recent Projects', and 'Import Dataset'. The main workspace shows an R script with code related to salary data processing.

```
1 packages("here") }
2
3 # Load libraries
4 library(tidyverse)
5 library(dplyr)
6 library(readr)
7 library(openxlsx)
8
9 # Set working directory
10 setwd("C:/Users/larsvill/Desktop/120 OCC Data")
11
12 # Read scraped data
13 salary_scraped <- read_csv("salary_dot_com_data_yearly.csv")
14
15 # Preprocess data
16 salary_scraped <- salary_scraped %>%
17   mutate(scraped = "salary_dot_com_data_yearly.csv")
18
19 # Read mapping file
20 onet_salarydot_mapping <- read_csv("onet_salarydot_mapping.csv")
21
22 # Merge data
23 salary_preprocessed <- left_join(salary_scraped, onet_salarydot_mapping, by = "onet_soc_code")
24
25 # Save preprocessed data
26 write_xlsx(salary_preprocessed, "salarydot_120.xlsx")
27
28 # Read preprocessed data
29 salary_preprocessed <- read_xlsx("salarydot_120.xlsx")
30
31 # Attach stats to the 120 occ file
32 attach.stats <- read_csv("120_occ.csv")
33
34 # Now do the same for the 120 jobs
35 # - collect info on earnings from scraped file
36
37 # Write out excel
38
```

- R

- Open Rstudio, open File, click on “Source” button
- Double-click on Rproj file, open File, click on “Source” button
- From bash prompt, type “R CMD BATCH file.R”
- From bash prompt, type “Rscript file.R”

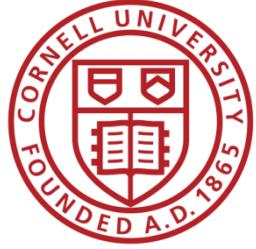




# All these methods can work

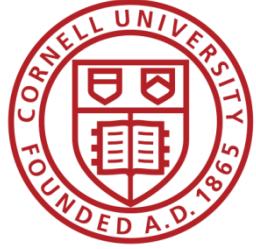
But

- They will yield different vestiges of running (log files, etc.)
- They will require programs to be written differently! (working directories, etc.)
- They are not necessarily compatible with each other



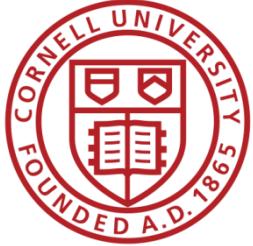
Observation 1 and 2 are the result of a  
**lack of Computational Empathy,**  
and lead to  
**high burden**  
of reproducibility and replicability

# Solutions?



Hold that thought, we will get there.

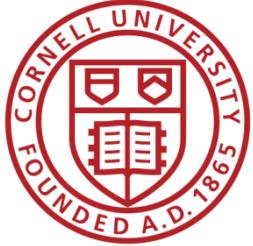
# Data acumen



# Data acumen

“the ability to understand data, to make good judgments about and good decisions with data, and to use data analysis tools responsibly and effectively”

National Academies of Sciences, Engineering, and Medicine. 2018. Data Science for Undergraduates: Opportunities and Options. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25104>.

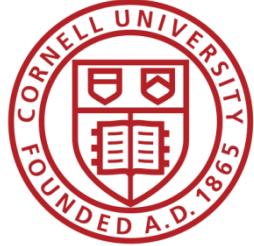


# Lesson 2: Data acumen in the context of reproducibility

Two key components

- **Data provenance**
  - Where did the data come from which I used?
- **Data preservation**
  - Where do I put the data I generated?
  - What if the data I used are not “robustly preserved”?
  - What do you mean by that?

Data  
provenance



# Action: Data citations and metadata

## What is FAIR?

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

The FORCE11 logo features a blue circular icon with a white target-like pattern next to the word "FORCE11". Below it is the tagline "The Future of Research Communications and e-Scholarship". A navigation bar below the logo includes "ABOUT", "COMMUNITY", and "CODE OF CON".

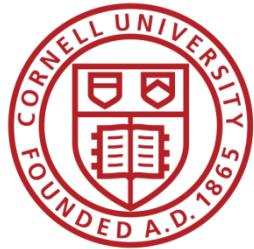
FORCE11 » Groups » The FAIR Data Principles

## THE FAIR DATA PRINCIPLES

JOIN IN THE DISCUSSION - LEARN  
FAIR Data Principles

### Preamble

One of the grand challenges of data-intensiv



# 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](#)

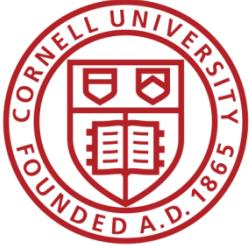
1894 – 1908 (Three years: 1894, 1900, and 1908) [edit](#) [remove](#)

### 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



AMERICAN  
ECONOMIC  
ASSOCIATION

Name	File Type	Last Modified
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## Project Citation:

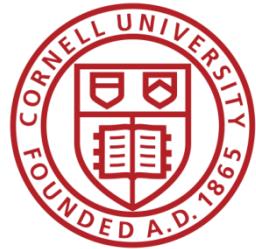
Gregg, Amanda. Imperial Russian Factory Database, 1894-1908. Nashville, TN: American Economic Association [publisher], 2020. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2020-01-29. <https://doi.org/10.3886/E110681V1>

<a href="#">AG_Corp_CleaningandDatabaseCompiler.do</a>	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

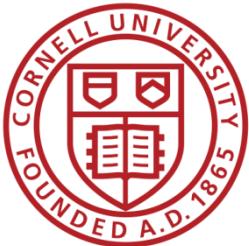


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<meta name="DC.title" content="Imperial Russian Factory Database, 1894-1908" />

<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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	<a href="#">AG_Corp_CleaningandDatabaseCompiler.do</a>	text/x-stata-syntax	23.4 KB	08/08/2019 11:02:AM
	<a href="#">AG_Corp_Prod_AppendixCode.do</a>	text/x-stata-syntax	42.2 KB	12/09/2019 09:19:AM
	<a href="#">AG_Corp_Prod_Code.do</a>	text/x-stata-syntax	26.6 KB	12/12/2019 03:01:AM
	<a href="#">AG_Corp_Prod_Database.dta</a>	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

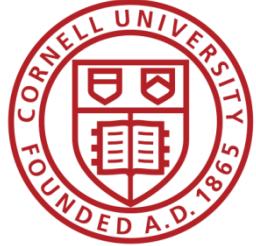
Imperial Russian Factory Database, 1894-1908

Principal Investigator(s):  Amanda Gregg, Middlebury College



```
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	<a href="#">AG_Corp_Prod_AppendixCode.do</a>	text/x-stata-syntax	42.2 KB	12/09/2019 09:19:AM
	<a href="#">AG_Corp_Prod_Code.do</a>	text/x-stata-syntax	26.6 KB	12/12/2019 03:01:AM
	<a href="#">AG_Corp_Prod_Database.dta</a>	application/x-stata	11 MB	08/07/2019 08:55:AM
		application/x-stata	11.9 KB	10/08/2014 09:45:AM



# ... and findability relies on metadata

Google



imperial russian factory



1 dataset found



Imperial Russian Factory  
Database, 1894-1908

[www.openicpsr.org](http://www.openicpsr.org)  
[search.datacite.org](http://search.datacite.org)  
+1more



Updated Jan 29, 2020



Not seeing a result you expected?  
[Learn](#) how you can add new  
datasets to our index.



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

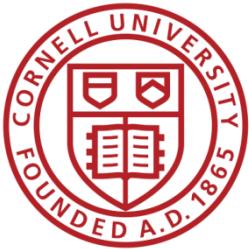
License

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

License information was derived automatically

Area covered

European Russia (Russian Empire)



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

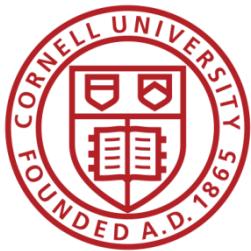
In scholarly literature, whenever and wherever a claim relies upon data, the corresponding data should be cited[3].

## 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.

## 1. Importance

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



*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].

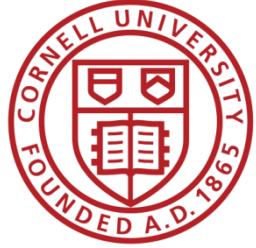
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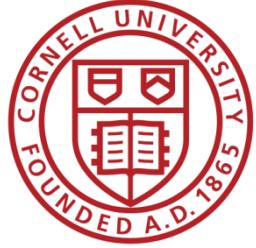
Data citations should facilitate access to the data themselves and to such metadata, documentation, code, and other materials as are necessary for

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>].



# Observation 3

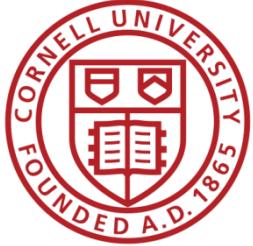
Social scientists  
are not trained  
to cite data



# Citing restricted-access data

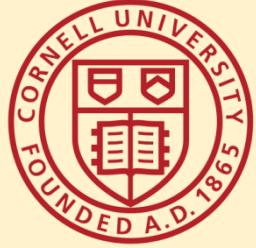
“Well, I can’t download the data, so I can’t cite it.”

Some practical tips  
(based on 1000 articles)



# 1. Computational empathy

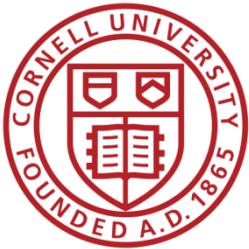
- Focal reader: your next RA in 4 years (or maybe you...)
- Interaction: you hand them your README, but don't have time to go through all the details...
- Budget constraint: It shouldn't take too many RA hours
- Time constraint: It shouldn't take more than 1 week to “get it”



# Solution 1: Computational Empathy

Use the Social Science Data Editors'  
**template README**

<https://doi.org/10.5281/zenodo.4319999>



# 1. Computational empathy

- Focal reader: your next RA in 4 years (or maybe you...)
- Interaction: you hand them your README, but don't have time to go through all the details...
- Budget constraint: It shouldn't take too many RA hours
- Time constraint: It shouldn't take more than 1 week to “get it”



## A template README for social science replication packages.

The template README provided on this website is in a form that follows best practices as defined by a number of data editors at social science journals.

Authors: Lars Vilhuber, Miklos Kóren,  
Joan Llull, Marie Connolly, Peter Morrow

This project is maintained at [social-science-data-editors/template\\_README](https://social-science-data-editors.github.io/template_README/)

*Disclaimer*

DOI: [10.5281/zenodo.4319999](https://doi.org/10.5281/zenodo.4319999)

## A template README for social science replication packages

The template README provided on this website is in a form that follows best practices as defined by a number of data editors at social science journals. A full list of endorsers is listed in [Endorsers](#).

### Versions

The most recent version is available at [https://social-science-data-editors.github.io/template\\_README/](https://social-science-data-editors.github.io/template_README/). Specific releases can be found at [https://github.com/social-science-data-editors/template\\_README/releases](https://github.com/social-science-data-editors/template_README/releases).

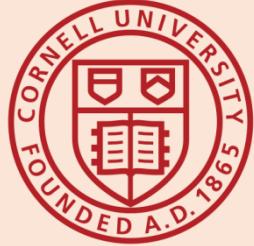
### Formats

The template README is available in a variety of formats:

- [HTML](#) (best for reading)
- [LaTeX](#)
- [Word](#)
- [PDF](#)
- [Markdown](#)

### Description

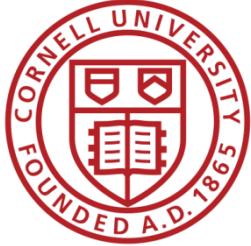
The typical README in social science journals serves the purpose of guiding a reader through the available material and a route to replicating the results in the research paper, including the description of the origins of data and/or description of programs. As such, a good README file should first provide a brief overview of the available material and a brief guide as to how to proceed from beginning to end, before then diving into the specifics.



# Keeping track: Students and Researchers

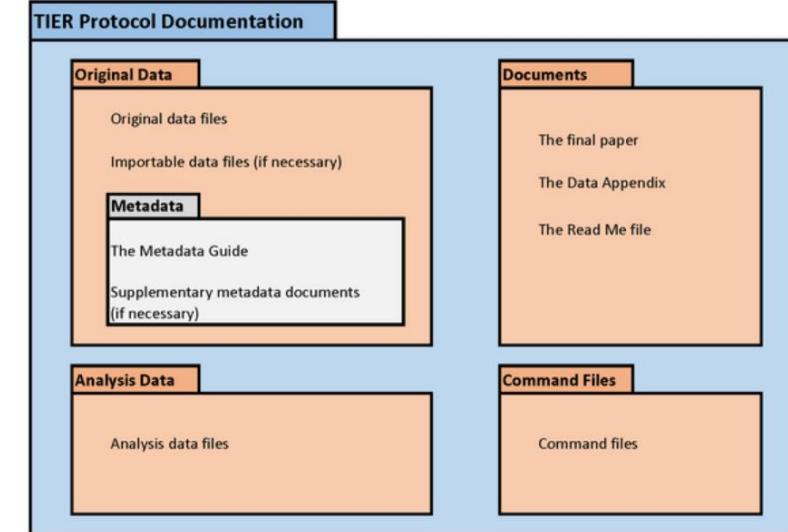
## 1. Computational empathy

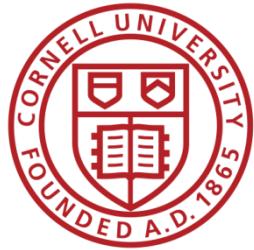
*Consider the next person to run the analysis, and don't assume too much*



## 2. Keeping track of data: Data provenance

- Keep all information as you collect data
  - See [TIER Protocol](#) for good and simple guidance
- If you must use a point-and-click tool, keep detailed instructions
  - Also: obsolescence
- Try to use API, bulk download, or packages that allow for extraction
  - Also: obsolescence of API





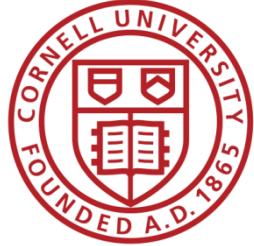
# API? But the interface is so cool!

- World Development Indicators

The screenshot shows the DataBank | World Development Indicators interface from The World Bank. The top navigation bar includes the The World Bank logo, a feedback link ("Help us improve this section of the site. Can we get your feedback? Click here"), and language options (English, Español, Français, 中文).

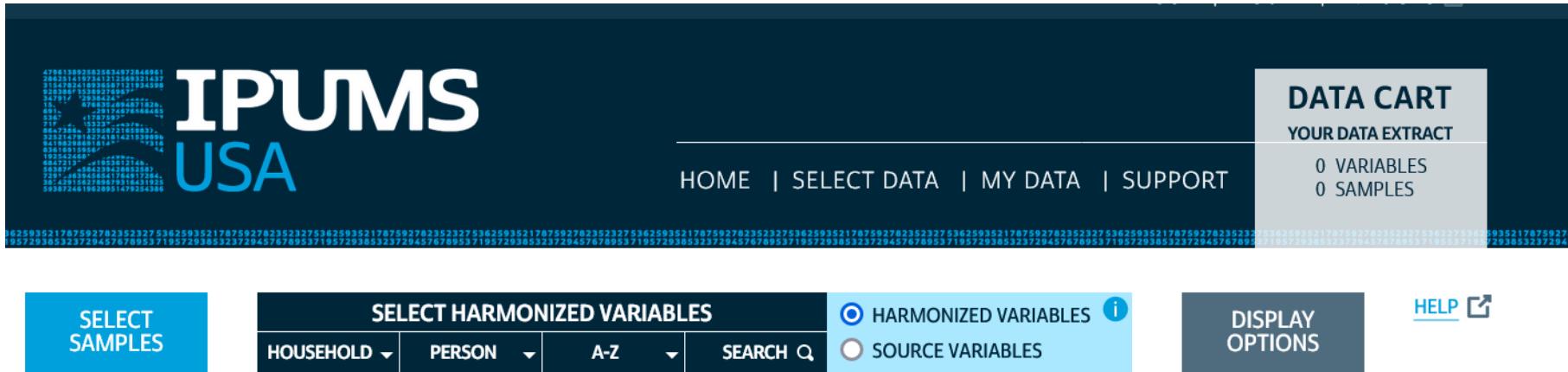
The main interface features a left sidebar for "Variables" (Layout, Styles, Save, Share, Embed) and a "Database" section. Under "Database", there are sections for "Country" (Available 266, Selected 0), "Series" (Available 85, Selected 1), and "Time". A search bar allows users to "Enter Keywords for:" and a dropdown menu provides filtering options.

The right side of the interface is titled "Preview" and displays a message: "Please select variables from each of the following dimensions to view a report. You can select from left panel or by clicking the links above." It lists three dimensions: "Country", "Series", and "Time". At the bottom right of this preview area is a blue "Apply Changes" button.



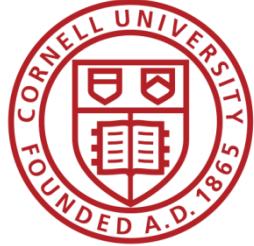
# API? But the interface is so cool!

- IPUMS



The screenshot shows the IPUMS USA data extraction interface. At the top left is the IPUMS USA logo, which includes a stylized American flag made of numbers. The top right features a "DATA CART" section titled "YOUR DATA EXTRACT" showing "0 VARIABLES" and "0 SAMPLES". The top navigation bar includes links for "HOME", "SELECT DATA", "MY DATA", and "SUPPORT". Below the navigation is a search bar labeled "SELECT HARMONIZED VARIABLES" with dropdown menus for "HOUSEHOLD", "PERSON", "A-Z", and a search field. To the right of the search bar are two radio buttons: "HARMONIZED VARIABLES" (selected) and "SOURCE VARIABLES", each with an information icon. On the far right are "DISPLAY OPTIONS" and a "HELP" link with a question mark icon. A large, semi-transparent watermark of the same "0 VARIABLES 0 SAMPLES" text is visible across the middle of the page.

Select **samples** and **variables** to build a data extract.



# API or Bulk Download

- World Development Indicators

## Access Data

### Bulk Downloads

Download bulk Excel and CSV file versions of the World Development Indicators database, including metadata. The files are revised whenever the WDI is updated.



[Excel download](#) | [CSV download](#)

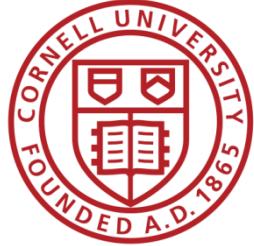
USER GUIDE

### API Documentation

The World Bank indicators API allows users to programmatically access all the WDI indicators and query the data in several ways, using parameters to specify the request.



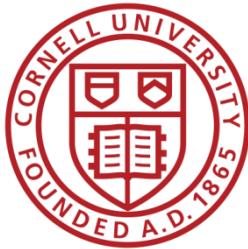
[Documentation](#)



# API or Bulk Download

- World Development Indicators

```
. ssc install wbopendata  
. wbopendata, country(ago;bdi;chi;dnk;esp) indicator(sp.pop.0610.fe.un) ///  
> year(2000:2010) clear long
```



# API or Bulk Download

- IPUMS (beta)

The screenshot shows the IPUMS Developer Portal homepage. The top navigation bar includes links for "Get started", "API Program" (which is currently selected), "Workflows & Code", "Reference", and "Forum". A search bar is also present. The main content area has a sidebar on the left with links for "Get Started", "API Program" (expanded to show "Available IPUMS APIs", "IPUMS APIs for USA", "IPUMS APIs for CPS", "IPUMS APIs for NHGIS", "Beta Program Access", "API Client Libraries" - which is the active page, "IPUMS API Roadmap", "Workflows & Code" (expanded to show "IPUMSR"), and "Reference". The main content area features a section titled "IPUMS API CLIENT LIBRARIES" with text explaining the purpose of client libraries and their development. It also mentions the "ipumspy" and "ipumsr" tools and their goals. Below this, there's information about the "ipumsr" library and its history.

**IPUMS API CLIENT LIBRARIES**

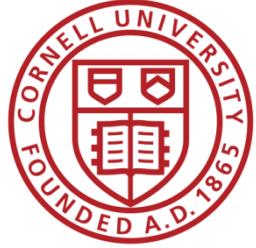
In order to help foster onboarding of API users and reduce the learning curve, we aim to provide client libraries that allow users to work with our APIs in ways that are more native to / idiomatic for their language of choice. For our first client libraries we are focusing on the languages Python (`ipumspy`) and R (`ipumsr`). Our goal with these client tools is to enable users to interact with IPUMS APIs by simply making function/method calls, abstracting away all of the http and JSON details that happen behind the scenes.

In addition, we intend to develop these modules as open source software, inviting collaboration from IPUMS users to help us build and extend these tools to make them as useful as possible for our community, while still providing stewardship and user support as we do with all of the other components of the IPUMS data collections.

For users that do prefer to interact directly with the API using http and JSON, and for users using other languages, we will also provide API workflow examples using curl, as well as complete OpenAPI specification reference material for our APIs.

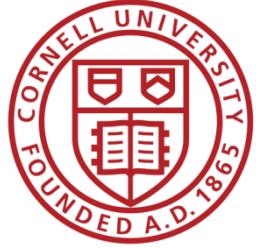
**IPUMSR**

`ipumsr` was first released in 2017. It launched with support for unpacking “traditional” IPUMS microdata and aggregate data extracts into R data structures, and provided a number of convenience functions for working with the data once unpacked. In 2021 we added support for the IPUMS Data Extract API for USA and CPS to `ipumsr`. Now `ipumsr` can be used to construct, submit, monitor and retrieve USA and CPS extracts using native R code. In the future we hope to add support



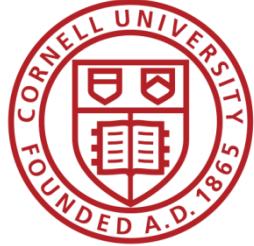
2. Keeping track of data:

Don't forget to check the  
TERMS of USE!



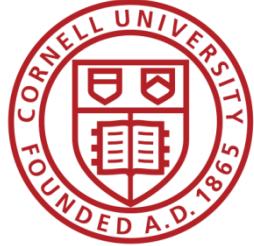
# Observation 4

(Academic)  
Social scientists  
do not read  
the terms of use



Because you may not be able to provide others with a copy of the data (legally)...\*

\* A recent set of court cases in the US can be thought to authorize web scraping, but my interpretation is that it only says “web scraping is not the same as computer hacking” which is illegal, but does NOT say that web scraping is allowed. See [Bryan et al \(2022\)](#).



# Example 2: Academic data publisher

 **ECONOMIC POLICY UNCERTAINTY**

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Home   Methodology   Media   Research & Applications   About Us

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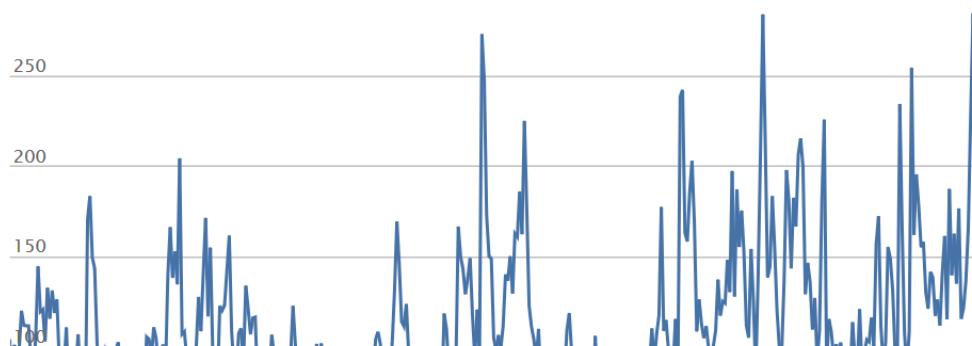
EPU Indices	
<a href="#">All Country-Level Data</a>	
<a href="#">Global</a>	<a href="#">USA</a>
<a href="#">Australia</a>	<a href="#">Brazil</a>
<a href="#">Canada</a>	<a href="#">Chile</a>
<a href="#">China</a>	<a href="#">Colombia</a>
<a href="#">Croatia</a> New	<a href="#">France</a>
<a href="#">Germany</a>	<a href="#">Greece</a>
<a href="#">Hong Kong</a>	<a href="#">India</a>
<a href="#">Ireland</a>	<a href="#">Italy</a>
<a href="#">Japan</a>	<a href="#">South Korea</a>

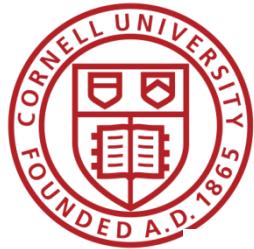
### Economic Policy Uncertainty Index

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

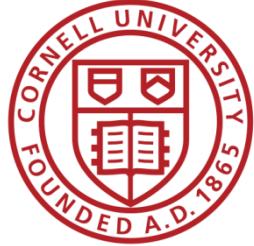
EPU Indices Economic Policy Uncertainty Index

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

A line chart showing the Economic Policy Uncertainty Index over time from 2012 to 2018. The y-axis ranges from 100 to 200. The x-axis shows years from 2012 to 2018. The index fluctuates significantly, with major peaks around 2013, 2015, and 2017, and a general upward trend towards the end of the period.



# Example 2: Academic data publisher-new!

 **ECONOMIC POLICY UNCERTAINTY**

---

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

[EPU Indices](#)

All Country-Level Data

Global   [USA](#)

[Monthly US Economic Policy Uncertainty Index](#)

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

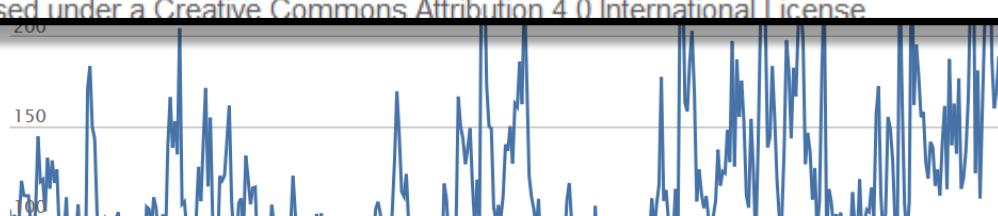
This work is licensed under a Creative Commons Attribution 4.0 International License

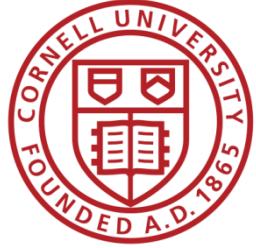
Germany   [Greece](#)

[Hong Kong](#)   [India](#)

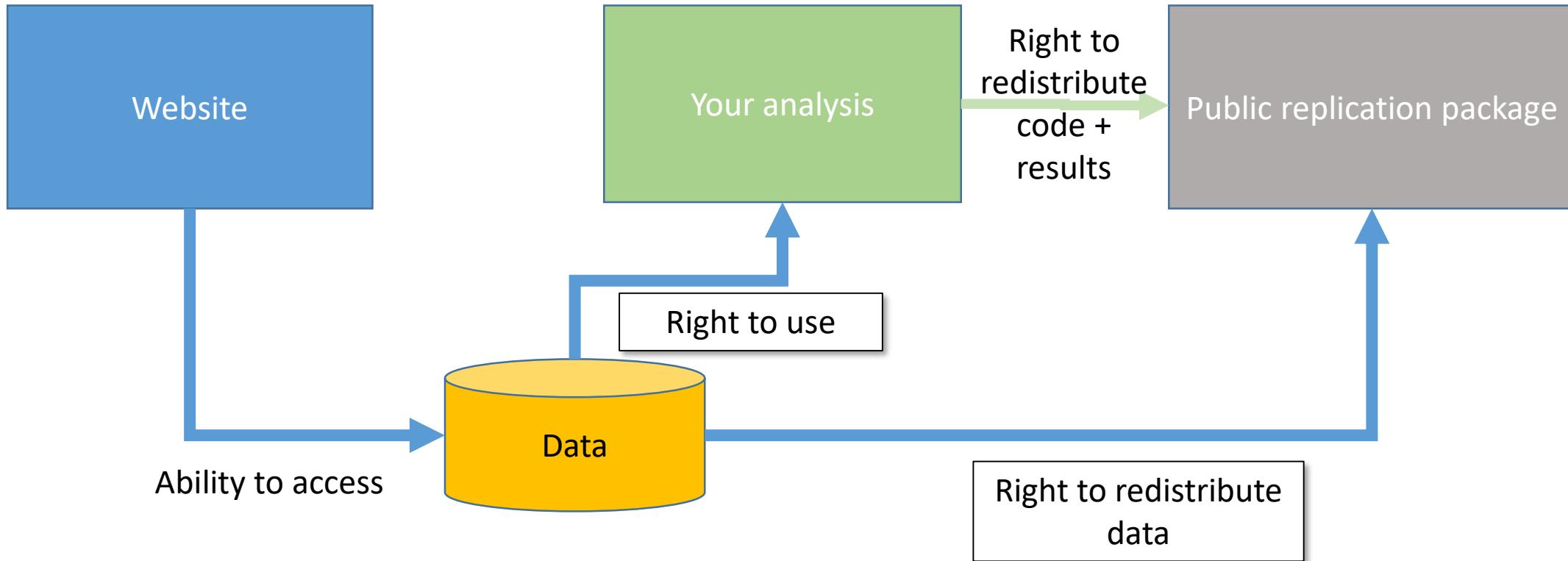
[Ireland](#)   [Italy](#)

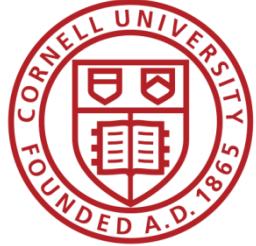
[Japan](#)   [South Korea](#)





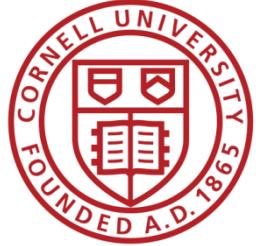
# Distinguish right to use from right to provide to others





# Rights to use data

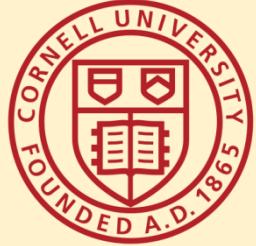
- You browsed a website
- You purchased the data
- You signed a data use agreement
- You created the data (lab experiment)
- You had survey respondents consent to use (IRB approval!)



# Rights to distribute the data

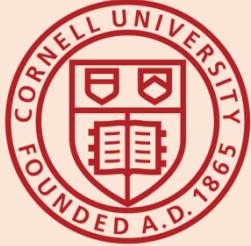
- If you created the data, you decide.
- If you got it from somewhere else:

READ THE TERMS OF USE / DATA USE  
AGREEMENT / CLICK-THROUGH / ETC.



## Solution 2: Data Provenance

- Keep detailed notes
- script as much as possible
- (also: Use the Social Science Data Editors' template README)



# Keeping track: Students and Researchers

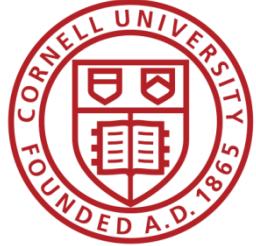
## 1. Computational empathy

*Consider the next person to run the analysis, and don't assume too much*

## 2. Track data (provenance)

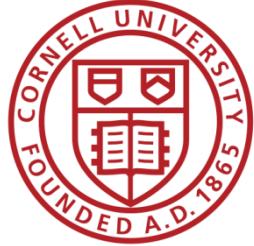
*even when using API, especially when manually downloading, keep in mind what the next downloader may see/find/receive, terms of use*

# Coding for Reproducibility



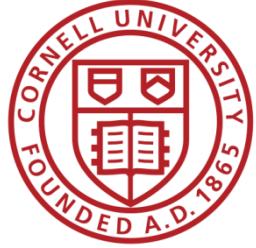
# Lesson 1: Computational empathy

= “Pity the poor replicator”



# Streamlining replication packages

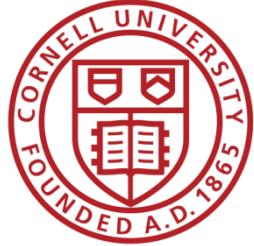
- Master script preferred
  - Least amount of manual effort
- No manual manipulation
  - “Change the parameter to 0.2,  
then run the code again” 
- No manual copying of results
  - Write out/save tables and figures  
using packages
  - Compute all numbers in package
- No manual install of packages
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



# Observation 5

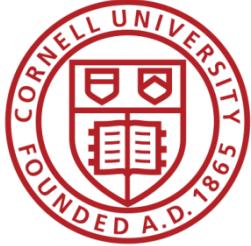
(Academic)  
Social scientists  
do not read  
the manual...

*(or at least not some key parts)*



# 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”
- ....



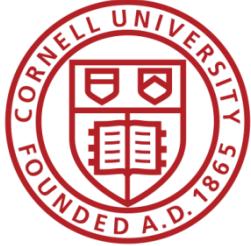
# Extreme examples

- Matlab-based simulation
  - ...
- For Figure 5a, comment line 52,  
uncomment line 151 run the

Write re-usable code

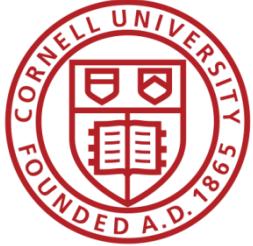
Use primitive I/O to read parameter  
files

- ....



# 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
- ....



# Extreme examples

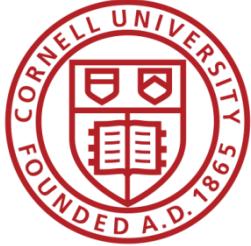
- Stata-based estimation
- ...
- Run the data creation programs,  
then copy the data to Folder A

## Re-use code files (ado)

## Use relative or root-relative paths

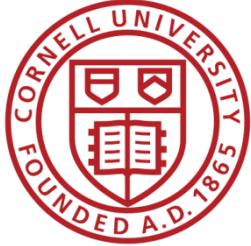
Once done, convert the output  
from “d.do” to a Matlab file, and  
run the simulation in Folder B/C

- ....



# 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



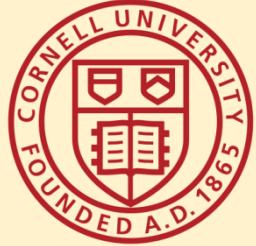
# Assume replicators can access the data

Sometimes we (=AEA) cannot

- We will still check if the code seems complete
- We will still verify that all data that \*can\* be provided have been provided
- Plausibility checks

Sometimes we can:

- In the past, we have worked with
  - French, Brazilian, and US confidential admin data
  - Purchased commercial data (Twitter, Indian GDP)
  - Proprietary data under NDA/DUA (Ebay)
  - Data with application procedure (Chinese Panel, Demographic and Health Survey, European establishment data)
  - Remotely or locally

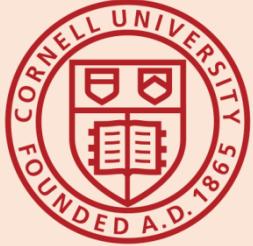


# Solution 3: Learn basics of programming

## Code reproducibly

(and do so right from the start)

(also: way easier to describe in the  
Social Science Data Editors' template README)



# Keeping track: Students and Researchers

## 1. Computational empathy

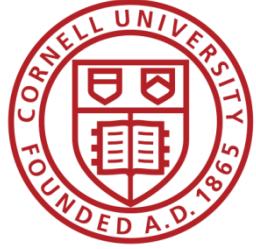
*Consider the next person to run the analysis, and don't assume too much*

## 2. Track data

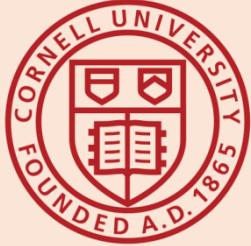
*even when using API, especially when manually downloading, keep in mind what the next downloader may see/find/receive, terms of use*

## 3. Learn the basics of programming

*code reproducibly, use parameter files, reusable code, robust file structure*



That's a lot of stuff to learn and remember...  
I want to focus on the economics!



# Keeping track: Students and Researchers

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*Consider the next person to run the analysis, and don't assume too much*

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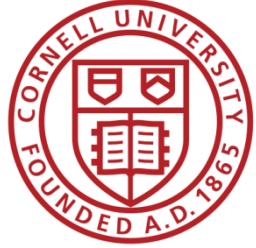
*code reproducibly, use parameter files, reusable code, robust file structure*

## 4. Learn to automate

*Run all code again and again, use APIs to download, use conditional processing to handle various aspects*

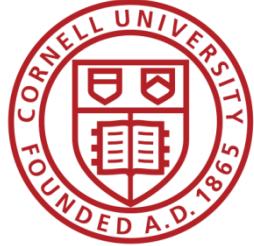
## 5. Preserve it all

*Use version control, tag releases, preserve data (separately), understand the difference between sharing and preserving*



That's a lot of stuff to learn and remember...  
**I want to focus on the economics!**

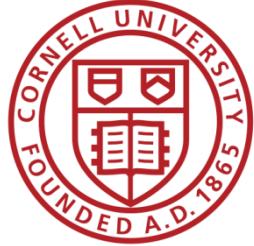
# Support by Institutions



# Lesson 3: Support by institutions is insufficient

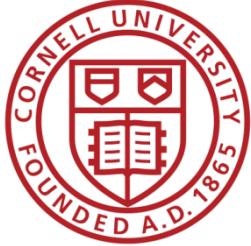
- When should these skills be taught?
  - These are core “tools of the trade”!
  - Undergrad, core part of graduate curricula
  - In other disciplines: students learn how to collect use a pipette, how to tag field mice in the wild...





# Lesson 3: Support by institutions is insufficient

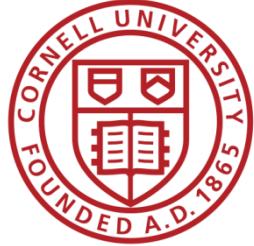
- Should all of these skills be taught?
  - How to deposit data
  - How to set up a compute cluster
- Some of these skills fall into other categories, but
  - Data librarians are understaffed, and not trained in discipline-specific practices
  - Campus IT has highly varying funding and consulting time
  - Cross-campus IT practices are nowhere close to compatible



# Lesson 3: Support by institutions is insufficient

Institutional funding and mandates are not adequate

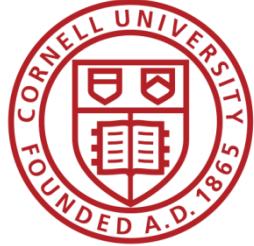
- Most grant funding in social sciences does not require (or allow!) for this kind of budgeting
  - Earmarked portions of funds would be great!
  - (This is slowly coming, NSF and NIH are making progress)
- (Most) Universities consider this an external mandate, not part of their “overhead”
  - “Provide us with an account, and we will do it”
  - Leads to highly scattershot infrastructure



# Lesson 3: Support by institutions is insufficient

Disciplinary institutions need funding

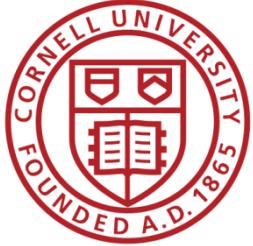
- Direct funding: should archives be treated like infrastructure?
  - This is the case in many NIH archives
  - Not quite as ubiquitous in social sciences
  - Where do you want to preserve 1TB per user per day for the next 50 years?  
It's not free...
- Indirect funding (via grants)
  - See previous slide



# Lesson 3: Support by institutions is insufficient

All institutions need to consider the user experience

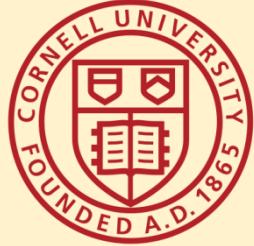
- Data provenance and preservation would be a lot easier to implement if scripted
  - Need for APIs both for upload and download (usage)
  - Some progress: Zenodo and Dataverse (usually Python, sometimes R)



# Lesson 3: Support by institutions is insufficient

Integration of computational resources with data resources is highly inadequate

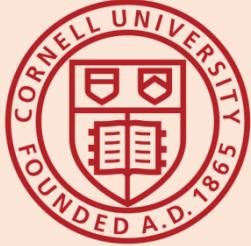
- Most journals have “data” policies, but all research compendia have code – this is a problem with many publishers
- Most data repositories are optimized for ... data. Support for computational code or actual execution is at best preliminary
  - See CodeOcean, WholeTale, efforts around Dataverse
  - See various “continuous integration” using Github, Travis CI, etc. but difficult to integrate data



# Solution 6: Institutional support

*(departments, schools, libraries, IT, universities)*

1. Offer training in adapted tools  
*(not sufficient to just show how to do a Rmarkdown document)*
2. Highlight appropriate community (*Zenodo, Dataverse, others*) or university sites
3. Provide streamlined access to some frequently used (open/commercial) tools  
*(AWS/GCS/Azure, CI on Github/others, etc.)*



# Some thoughts for the role of Faculty

1. Encourage students to learn new skills outside of economics

*Even or especially if you do not have the time to do so*

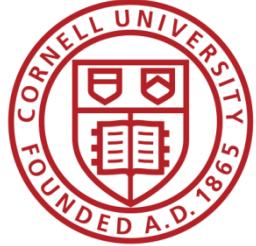
2. Demand reproducibility when reviewing

*(articles, theses, intermediate reports from students, etc.)*

*automated re-runs on Github, which particular release to review, refusing emailed copies*

3. Incentivize reproducibility

*For robustness, for efficiency, but also training for exposure to the discipline.  
Example: Replication Challenges*



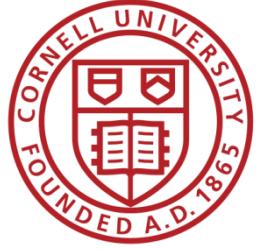
# Please don't produce irreproducible articles!

 MetaArXiv Preprints Submit a Preprint

Experience of irreproducibility as a risk factor for poor mental health in biomedical science doctoral students: A survey and interview-based study

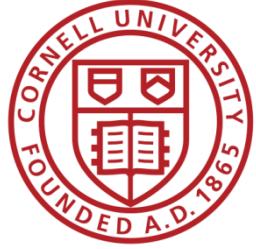
AUTHORS  
Nasser Lubega, Abigail Anderson, Nicole Nelson

The role for  
journals



# Goal: Transportability

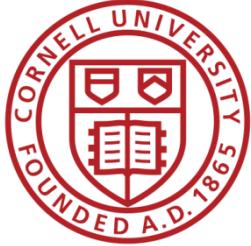
Any standards, tools, methods: must be transportable across journals (no custom solutions)



# Social science “guild”



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



# Some resources

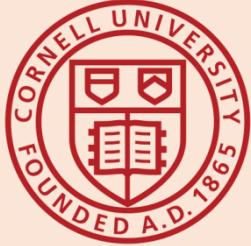
- <https://social-science-data-editors.github.io/guidance/>
  - template README
  - discussion of licensing
  - data citation guidance
- <https://aeadataeditor.github.io/>



The following steps outline what you should expect after conditional acceptance of your manuscript, in compliance with the [AEA Data and Code Availability Policy](#):

- 1 Prepare**  
Prepare your data and code replication package (including data citations and provenance information). You can do this at any time, even before submitting to the AEA journals.  
[Start](#)
- 2 Upload**  
Provide metadata and upload the replication package. This step simultaneously prepares the materials for the verification process as well as for subsequent publication.  
[Do it!](#)
- 3 Submit**  
Submit the [Data and Code Availability Form](#) together with your manuscript native files as instructed, and as per guidelines at your journal (for example, [AER guidelines](#)). Only once these materials have been received by the editorial office are [verification checks started](#).  
[Ready to submit?](#)

Thank you!



# Reminder: Students and Researchers

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*Consider the next person to run the analysis, and don't assume too much*

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*even when using API, especially when manually downloading, keep in mind what the next downloader may see/find/receive, terms of use*

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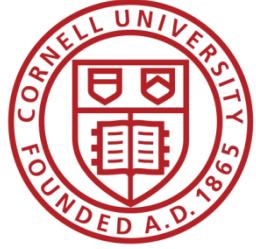
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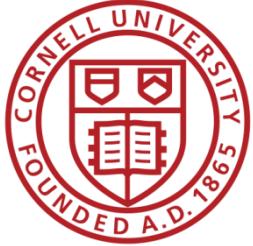
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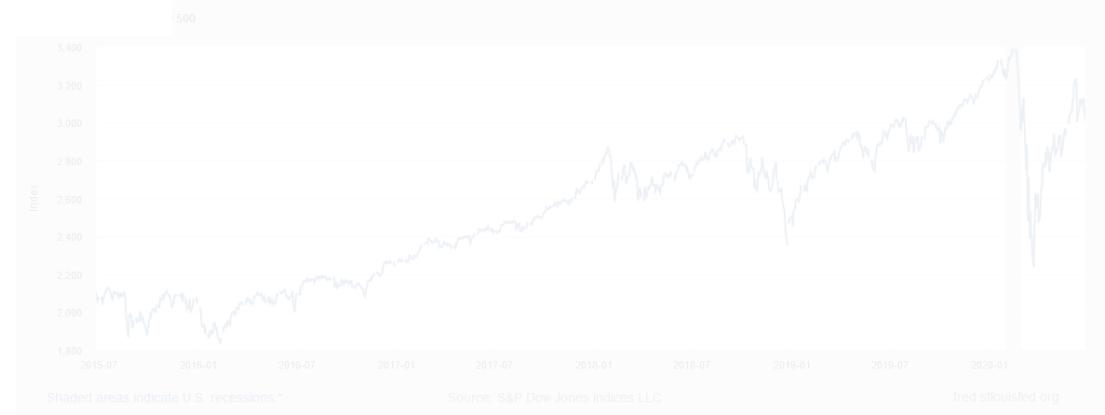


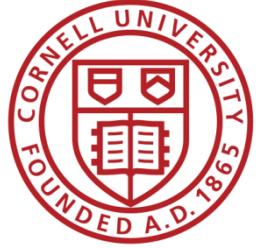
# Example of data provenance



# “It’s a file called stockmarket.xlsx”

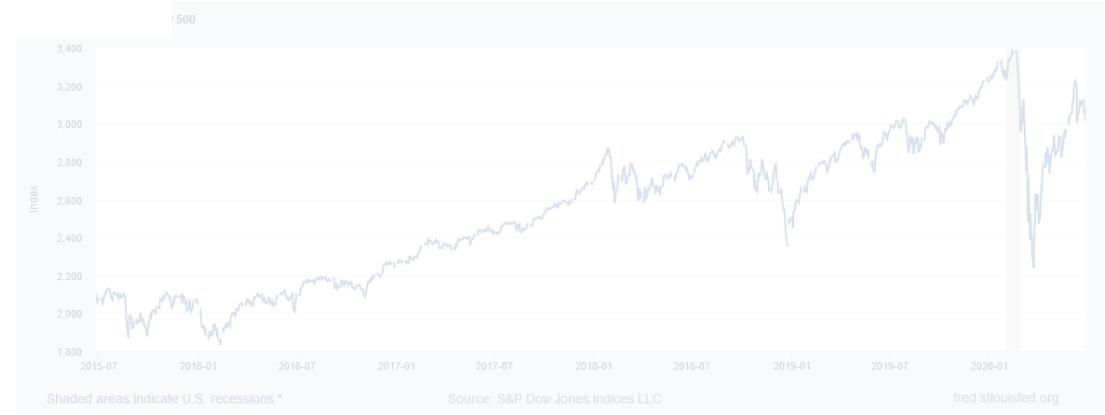
2101.49  
2057.64  
2063.11  
2077.42  
2076.78  
0  
2068.76  
2081.34  
2046.68  
2051.31  
2076.62  
2099.60  
2108.95  
2107.40  
2124.29  
2126.64  
2128.28  
2119.21  
2114.15  
2102.15  
2079.65  
2067.64  
2093.25  
2108.57  
2108.63  
2103.84

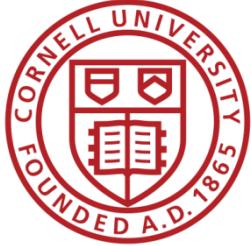




# “It’s a file called SP500.xlsx”

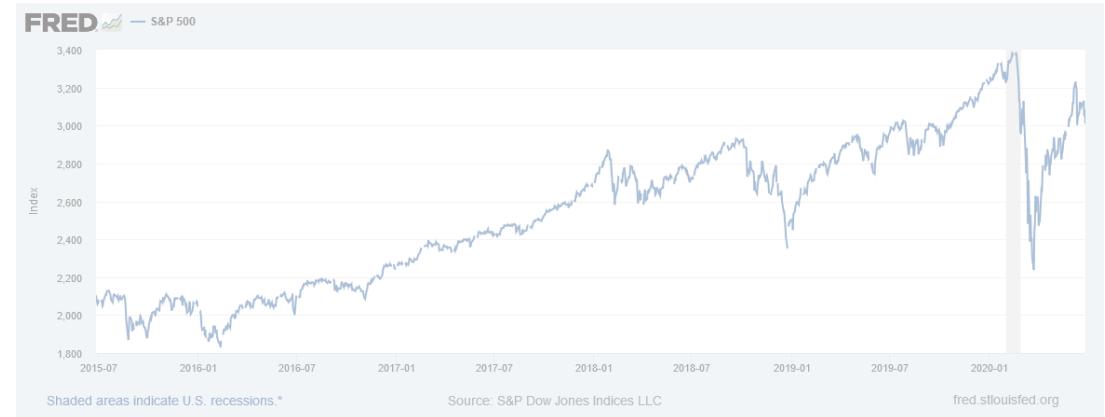
SP500	S&P 500, Index, Daily, Not Seasonally Adjusted
observation_date	SP500
2015-06-26	2101.49
2015-06-29	2057.64
2015-06-30	2063.11
2015-07-01	2077.42
2015-07-02	2076.78
2015-07-03	0
2015-07-06	2068.76
2015-07-07	2081.34
2015-07-08	2046.68
2015-07-09	2051.31
2015-07-10	2076.62
2015-07-13	2099.60
2015-07-14	2108.95
2015-07-15	2107.40
2015-07-16	2124.29
2015-07-17	2126.64
2015-07-20	2128.28

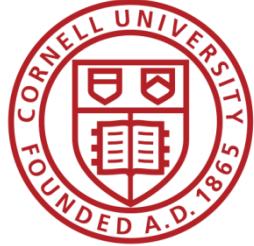




# “It’s a file called SP500.xlsx, downloaded from FRED.”

SP500	S&P 500, Index, Daily, Not Seasonally Adjusted
Frequency: Daily, Close	
observation_date	SP500
2015-06-26	2101.49
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2015-07-17	2126.64
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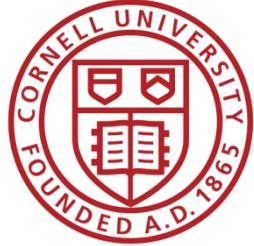


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2015-07-17	2126.64
2015-07-20	2128.28

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



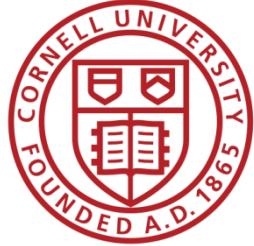


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2015-07-16	2124.29
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S&P Dow Jones Indices LLC. 2020. “*S&P 500 [SP500] [dataset]*”, retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/SP500>, June 26, 2020.





# Data Availability Statements

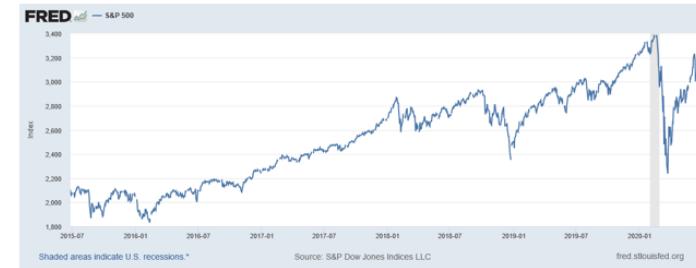
Describes data file, where to get it, how to get it, and any conditions of obtaining it

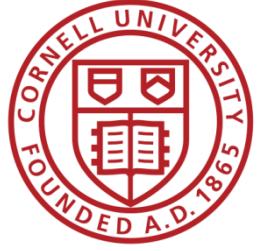
2015-07-15	2107.40
2015-07-16	2124.29
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2015-07-20	2128.28

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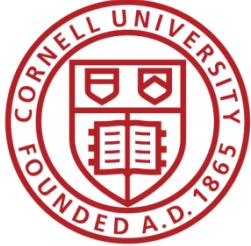
S&P 500  
Index, Daily,  
Not Seasonally Adjusted

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





# Data Citations



# 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:

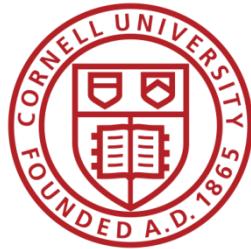
- Better
- Websites
- Online databases
- Data distributed as supplementary data
- Producer
- Distributor
- Dates
- Offline access mechanism
- Confidential databases
- No formal access mechanism

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>



# 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)
<b>BHP 7518 v1 (current)</b>	<a href="https://doi.org/10.5164/IAB.BHP7518.de.en.v1">10.5164/IAB.BHP7518.de.en.v1</a>	2020-01-13
<b>BHP 7517 v1</b>	<a href="https://doi.org/10.5164/IAB.BHP7517.de.en.v1">10.5164/IAB.BHP7517.de.en.v1</a>	2018-12-12
<b>BHP 7516 v1</b>	<a href="https://doi.org/10.5164/IAB.BHP7516.de.en.v1">10.5164/IAB.BHP7516.de.en.v1</a>	2018-04-11

#### External data

Data Archive

Data Access

Campus Files

Publications

Events

Projects of FDZ users

FDZ Projects

Complaint point of the  
RatSWD

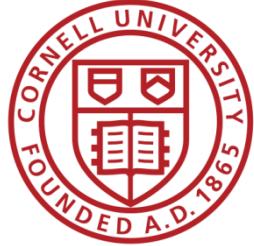
Figures of the FDZ

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.

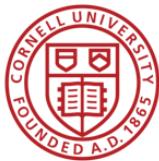
#### Data Versions

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

Data Version	DOI (Link to Description of Data Version)	Availability (yyyy-mm-dd)
<b>BHP 7518 v1 (current)</b>	<a href="https://doi.org/10.5164/IAB.BHP7518.de.en.v1">10.5164/IAB.BHP7518.de.en.v1</a>	2020-01-13



# Data Citation



“SP500.xlsx, from S&P (2020). Not provided as part of replication package because © S&P.”

Attributes the file to  
the proper source

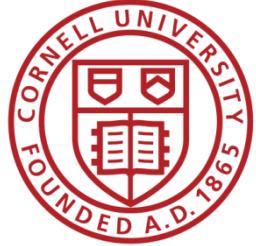
SP500

S&P 500, Index, Daily,  
Not Seasonally  
adjusted

Date	Value
2015-07-08	2101.49
2015-07-09	2057.64
2015-07-10	2063.11
2015-07-13	2074.42
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S&P Dow Jones Indices LLC. 2020. “S&P 500 [SP500] [dataset]”, retrieved from FRED, Federal Reserve Bank of St. Louis; <https://fred.stlouisfed.org/series/SP500>, June 26, 2020.





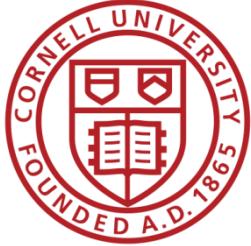
# Element of a (data) citation

ICPSR notes that a citation should include the following items:

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

## **Suggested Citation:**

S&P Dow Jones Indices LLC, *S&P 500 [SP500]*, retrieved from FRED, Federal Reserve Bank of St. Louis;  
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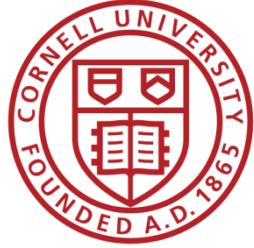
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Institute for Employment Research (IAB), Establishment History Panel 1975-2018. Accessed via the Research Data Centre (FDZ) of the German Federal Employment Agency DOI: 10.5164/IAB.BHP7518.de.en. v1 June 26, 2020.

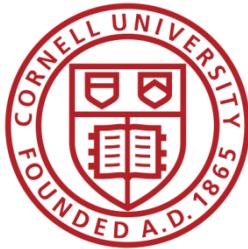


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- Date
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- Persistent identifier

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



# Try it out yourself

- Construct an (approximate) data citation
- <https://social-science-data-editors.github.io/guidance/addtl-data-citation-guidance.html#try-it-out>

## Data and Code Guidance by Data Editors

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

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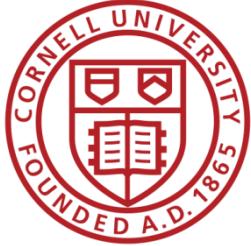
This project is maintained by [social-science-data-editors](#)

In some cases, the data provider (often a firm) must remain anonymous. This does not prevent citation, and the provider should be mentioned in much the same way as when there is no formal access mechanism:

Anonymous Firm. 1999. "Personnel records of windowshield installers." Unpublished data. Accessed February 29, 2000.

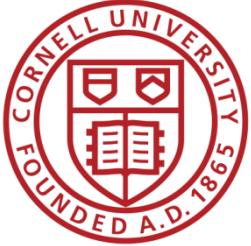
## Try it out

Authors or Producer:	<input type="text" value="Author"/>
Title:	<input type="text" value="Title"/>
Date of publication:	<input type="text" value="2022"/>
Distributor:	<input type="text" value="Distributor"/>
Version:	<input type="text" value="V1"/>
Persistent identifier or URL:	<input type="text" value="https://doi.org/123/345"/>
Date of access:	<input type="text" value="2022-01-22"/>
Accessed or downloaded?	<input type="radio"/> Accessed <input type="radio"/> Downloaded
<input type="button" value="Compute citation"/>	



# Data: Citations, Access, Rights

- Any data can be cited – even if you can't download it
- Any data that you accessed ... can have that access be described
  - But caution: It should be such that others can also repeat the access!
- Just because you “have” the data does not mean you can give it to others
  - Also: distinguish between “sharing” and “publishing”
  - Know your terms of use!



## 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)

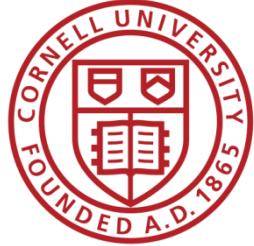
- A statement about **where data** supporting the results reported in a published article can be

o publicly  
ated during

y providing a

I restrictions,

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



# Solution 3: Data Citations

Cite every data source

(not only the paper that  
describes the source!)

(also: add them to the  
Social Science Data Editors' template README)