

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

Lars Vilhuber

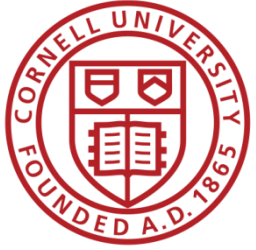
Cornell University

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.

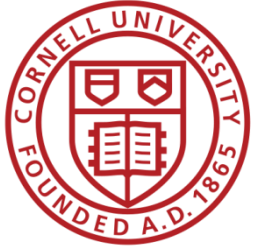
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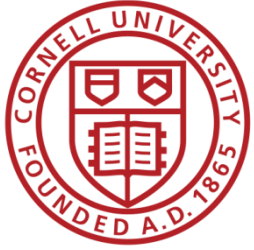


3 Lessons (and many solutions)

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



Let me expand that a bit...



For students and researchers

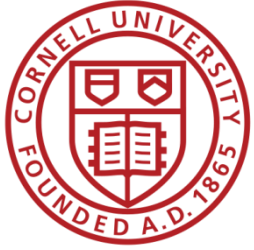
0. *Do not necessarily learn from previous papers*
1. Have computational empathy for ...
2. Track data whenever used
3. Learn the basic ... of programming
4. Learn to automate
5. Preserve it all (and version it too)



For institutions

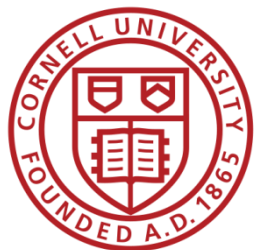
(departments, schools, libraries, IT, universities)

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 ASSOCIATION

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.

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 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.

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: 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: 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: Macroeconomics



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

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.**



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 submitted to them for the purpose of verification





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

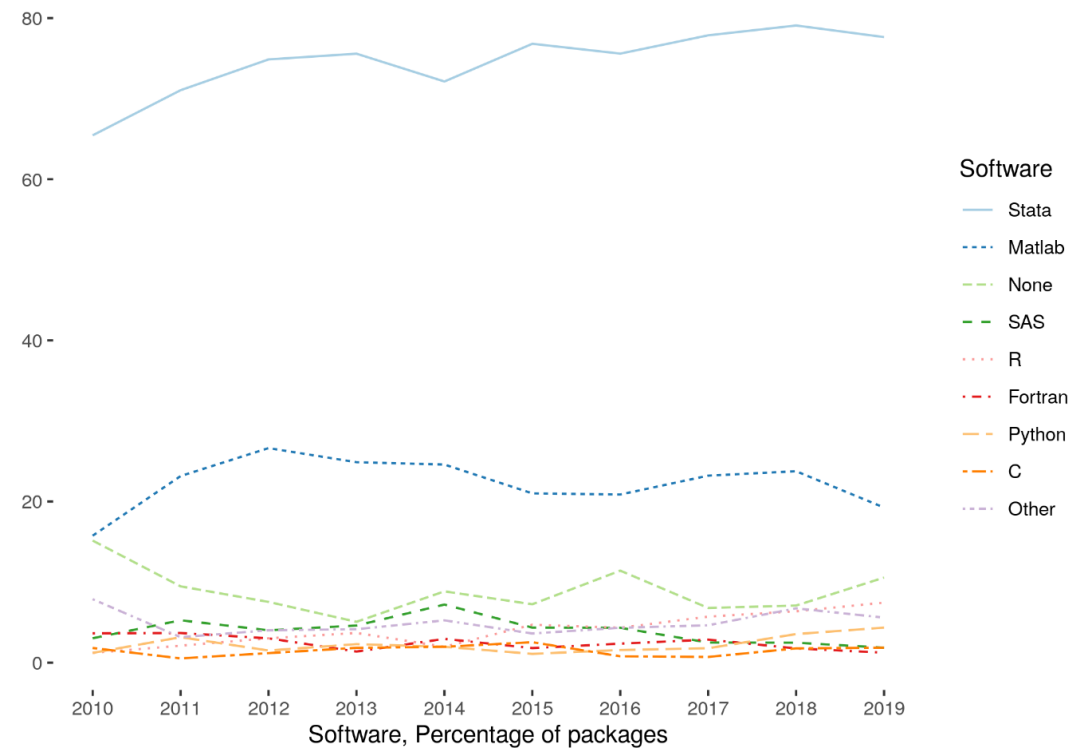


[Show this thread](#)



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.

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



Back in 2019...



Poor citation practices

- **Macrodata:**

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

- **Microdata:**

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



Failure to curate



404. That's an error.

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



Poor coding practices

- **Manual/non-automation**

Code produces no meaningful output

- **Lack of robustness:**

Bugs in the code

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)



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?

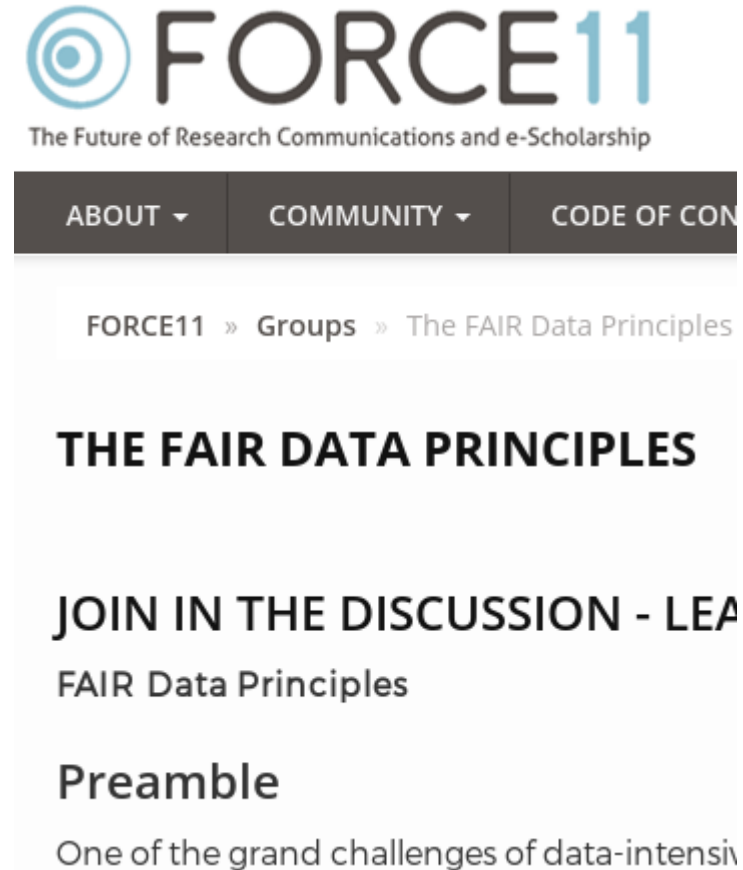
Data provenance



Action: Data citations and metadata

What is **FAIR**?

- **F**indable,
- **A**ccessible,
- **I**nteroperable, and
- **R**e-usable





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](#)

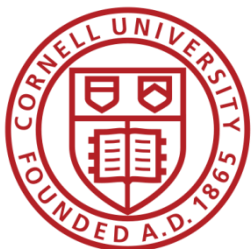
1894 – 1908 (Three years: 1894, 1900, and 1908) [✎ edit](#) [✕ remove](#)

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



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Name	File Type		Last Modified
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Project Citation:

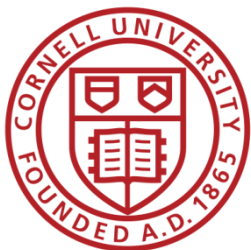
Gregg, Amanda. Imperial Russian Factory Database, 1894-1908. Nashville, TN: American Economic Association [publisher], 2020. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2020-01-29. <https://doi.org/10.3886/E110681V1>

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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

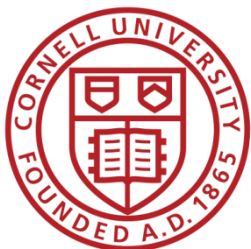
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	AG_Corp_Prod_Code.do	text/x-stata-syntax	26.6 KB	12/12/2019 03:01:AM
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Imperial Russian Factory Database, 1894-1908

Principal Investigator(s): Amanda Gregg, Middlebury College

Version: V1



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. 1908 years also include information on the factory's total machine power. The dataset was constructed to study why some Russian firms chose to become c  
consuming concession system. Note that the final analysis files exclude factories located outside of European Russia and, in the main data files, facto  
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application/x-stata

11.9

09/08/2014



... and findability relies on metadata



imperial russian factory

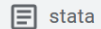


1 dataset found



Imperial Russian Factory
Database, 1894-1908

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



stata

Updated Jan 29, 2020



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



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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](#))



stata

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)



The Future of Research Communications and e-Scholarship

English

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PUBLIC

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 citable research objects, such as publications[1].

DC¹
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

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



The Future of Research Communications and e-Scholarship

Search

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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).

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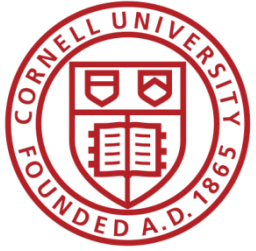
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[\[https://www.force11.org/group/joint-declaration-data-citation-principles-final\]](https://www.force11.org/group/joint-declaration-data-citation-principles-final).



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
- 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 Kören, Joan Llull, Marie Connolly, Peter Morrow

This project is maintained at social-science-data-editors/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/. Specific releases can be found at https://github.com/social-science-data-editors/template_README/releases.

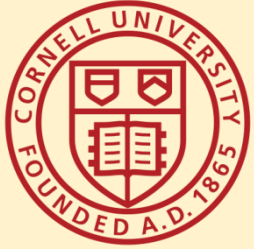
Formats

The template README is available in a variety of formats:

- HTML (best for reading)
- LaTeX
- Word
- PDF
- Markdown

Description

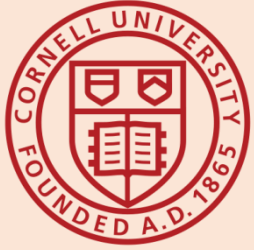
The typical README in social science journals serves the purpose of guiding a reader through the available material and a route to replicating the results in the research paper, including the description of the origins of data and/or description of programs. As such, a good README file should first provide 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.



Solution 1: Computational Empathy

Use the Social Science Data Editors'
template README

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



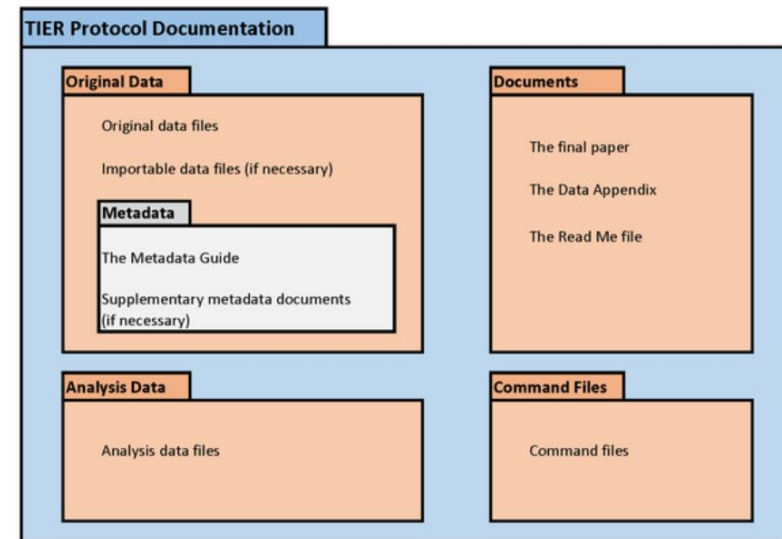
Keeping track: Students and Researchers

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



Help us improve this section of the site. Can we get your feedback? [Click here >](#) 

This page is in [English](#) [Español](#) [Français](#) [عربي](#) [中文](#)

DataBank World Development Indicators

Variables

Layout

Styles

Save

Share

Embed

Database

Available 85 | Selected 1




Country


Available 266 | Selected 0


All


Countries

Aggregates


  


Enter Keywords for: 








A B C D E F G H I J K L M N O P Q R S T U V W X Y Z


 ☐ Afghanistan


 ☐ Albania


 ☐ Algeria


 ☐ American Samoa


 ☐ Andorra


 ☐ Angola

 ☐ Antigua and Barbuda

 ☐ Argentina

 ☐ Armenia

 ☐ Aruba

 Preview

[Clear Selection](#) | [Add Country \(0\)](#) [Add Series \(0\)](#) [Add Time \(0\)](#)

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.

☐ Country

☐ Series

☐ Time

[Apply Changes](#)



API? But the interface is so cool!

- IPUMS

A screenshot of the IPUMS USA web interface. The header is dark blue with the IPUMS USA logo on the left, navigation links (HOME | SELECT DATA | MY DATA | SUPPORT) in the center, and a "DATA CART" box on the right showing "0 VARIABLES" and "0 SAMPLES". Below the header is a row of buttons: "SELECT SAMPLES" (blue), "SELECT HARMONIZED VARIABLES" (dark blue) which contains dropdowns for "HOUSEHOLD", "PERSON", and "A-Z", a "SEARCH" button, and radio buttons for "HARMONIZED VARIABLES" (selected) and "SOURCE VARIABLES". To the right of these is a "DISPLAY OPTIONS" button and a "HELP" link with an external link icon. The background of the interface features a faint, repeating pattern of a long alphanumeric string.

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](#)

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](#)

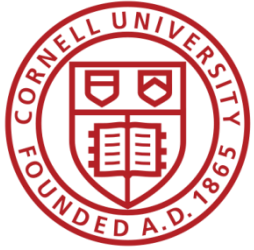
USER GUIDE



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)

IPUMS Developer Portal [Get started](#) [API Program](#) [Workflows & Code](#) [Reference](#) [Forum](#)

[Get Started](#)[API Program](#)

[Available IPUMS APIs](#)

[IPUMS APIs for USA](#)[IPUMS APIs for CPS](#)[IPUMS APIs for NHGIS](#)

[Beta Program Access](#)[API Client Libraries](#)[IPUMS API Roadmap](#)[Workflows & Code](#)[Reference](#)

IPUMS API CLIENT LIBRARIES

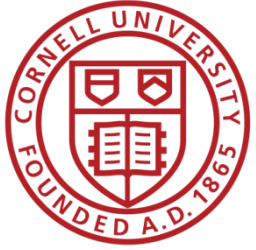
In order to help foster onboarding of API users and reduce the learning curve, we aim to provide client libraries that allow users to work with our APIs in ways that are more native to / idiomatic for their language of choice. For our first client libraries we are focusing on the languages Python (`ipumspy`) 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)...



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

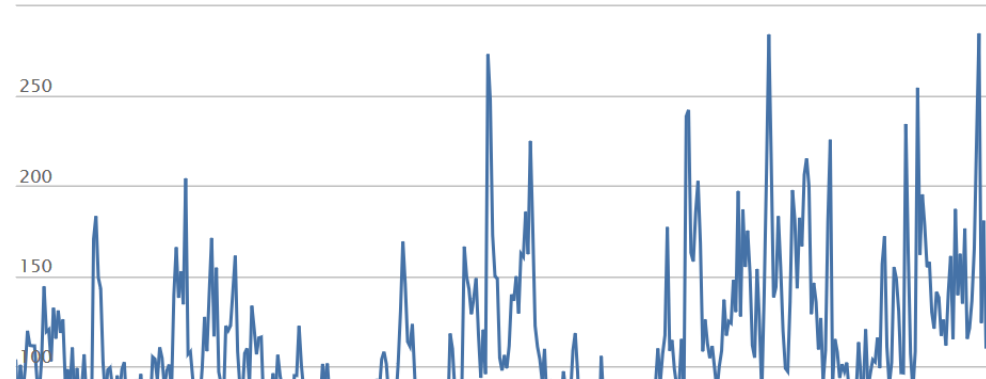
Economic Policy Uncertainty Index

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

INTERNET ARCHIVE
WayBack Machine

<https://www.policyuncertainty.com/index.html>

Go

SEP DEC JAN

[103 captures](#)

18 Aug 2012 - 14 Dec 2019

2018 2019 2020



ECONOMIC POLICY UNCERTAINTY

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[Media](#)

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EPU Indices

[All Country-Level Data](#)

[Global](#)

[Australia](#)

[Canada](#)

[China](#)

[Croatia](#)

[Germany](#)

[Hong Kong](#)

[Ireland](#)

[Japan](#)

[France](#)

[Greece](#)

[India](#)

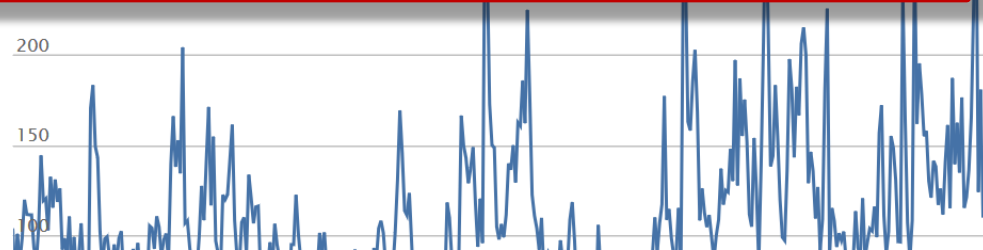
[Italy](#)

[South Korea](#)

Economic Policy Uncertainty Index

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

© 2012-2018 by Economic Policy Uncertainty





Example 2: Academic data publisher-new!





Rights to use data

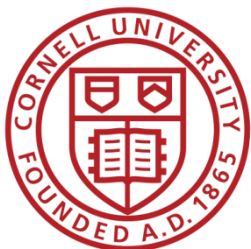
- You browsed a website
- You purchased the data
- You signed a data use agreement
- You created the data (lab experiment)
- You had survey respondents consent to use (IRB approval!)



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.



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.

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



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](#)
-  [FDZ-Datenreport 01/2020](#)
-  [Fallzahlen und Labels](#)

English

- DOI: [10.5164/IAB.FDZD.2001.en.v1](#)



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 or 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?

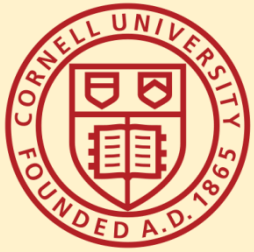
Please use the following citation when referring to this file in the different versions:

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.

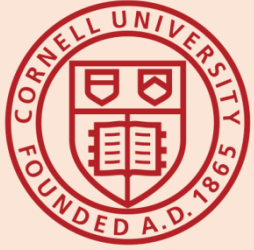
Madrid: JD Systems Institute.

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



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

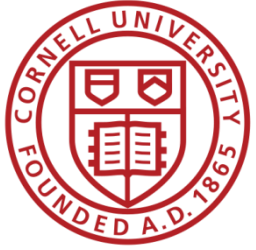
1. Computational empathy

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




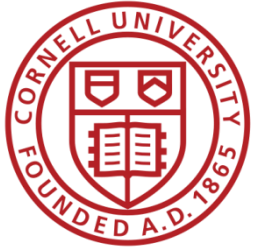
Lesson 1: Computational empathy

= “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



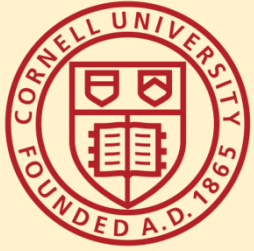
Assume replicators can access the data

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

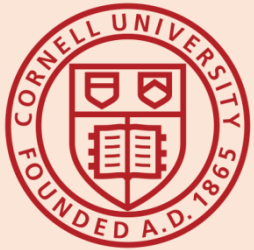
even when using API, especially when manually downloading, keep in mind what the next downloader may see/find/receive, terms of use

3. Learn the basics of programming

code reproducibly, use parameter files, re-usable 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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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

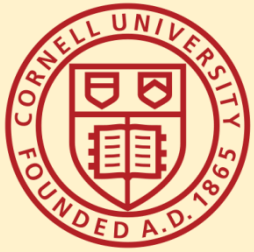
- Data provenance and preservation would be a lot easier to implement if scripted
 - Need for APIs both for upload and download (usage)
 - Some progress: Zenodo and Dataverse (usually Python, sometimes R)



Lesson 3: Support by institutions is insufficient

Integration of computational resources with data resources is highly inadequate

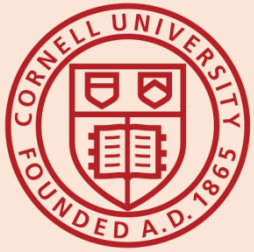
- Most journals have “data” policies, but all research compendia have code – this is a problem with many publishers
- Most data repositories are optimized for ... data. Support for computational code or actual execution is at best preliminary
 - See CodeOcean, WholeTale, efforts around Dataverse
 - See 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

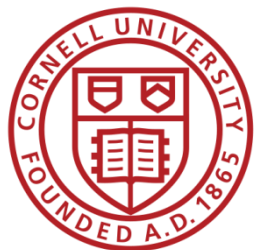
Nasser Lubega, Abigail Anderson, [Nicole Nelson](#)

The role for journals



Goal: Transportability

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



Social science “guild”



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



Office of the AEA Data Editor

[START REPLICATION PACKAGE](#)

[FAQ](#)

[Blog Posts](#)

[Talks](#)

[Projects](#)

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[Publications](#)

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!](#)

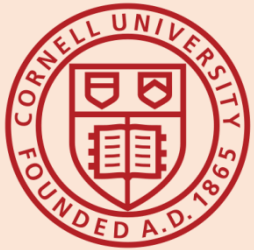
3

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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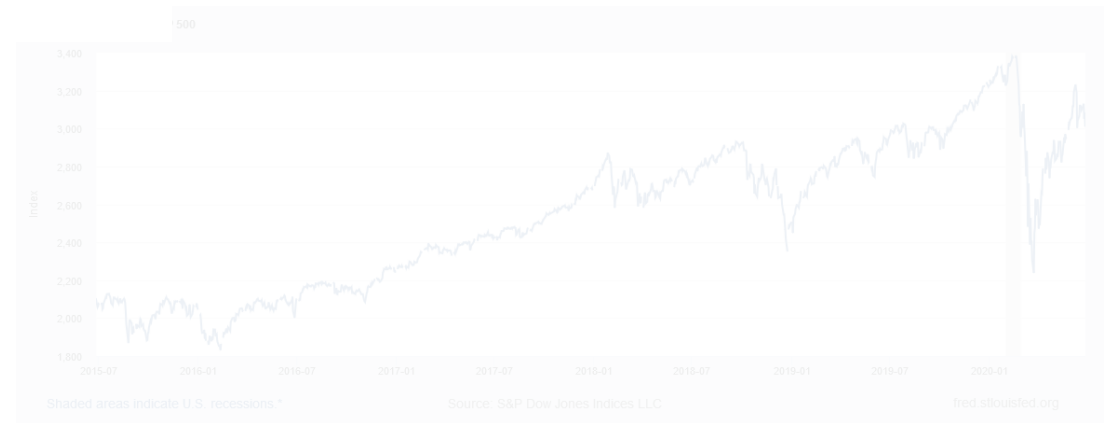


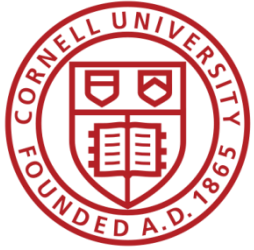
Example of data provenance



“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

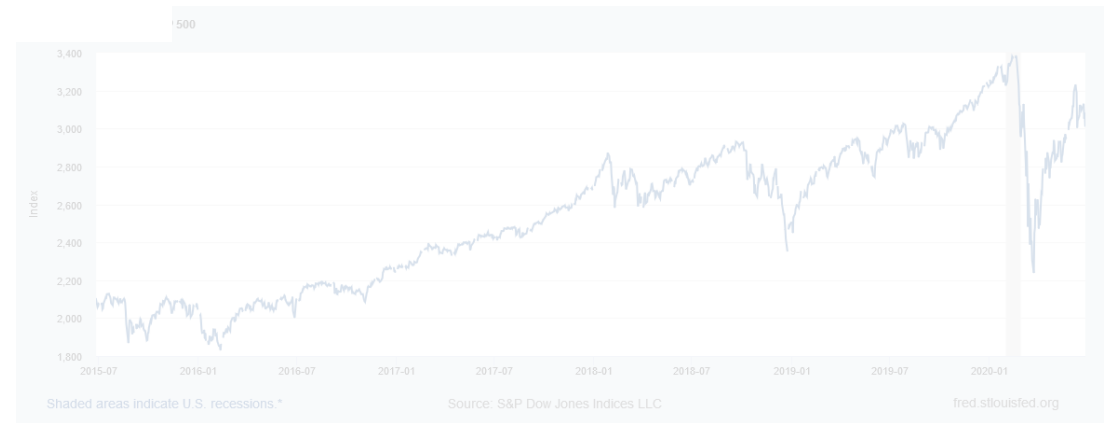
S&P 500, Index, Daily,
Not Seasonally Adjusted

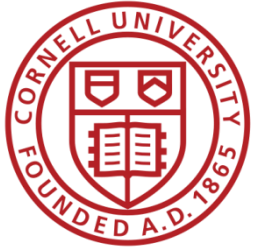
Frequency: Daily, Close

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

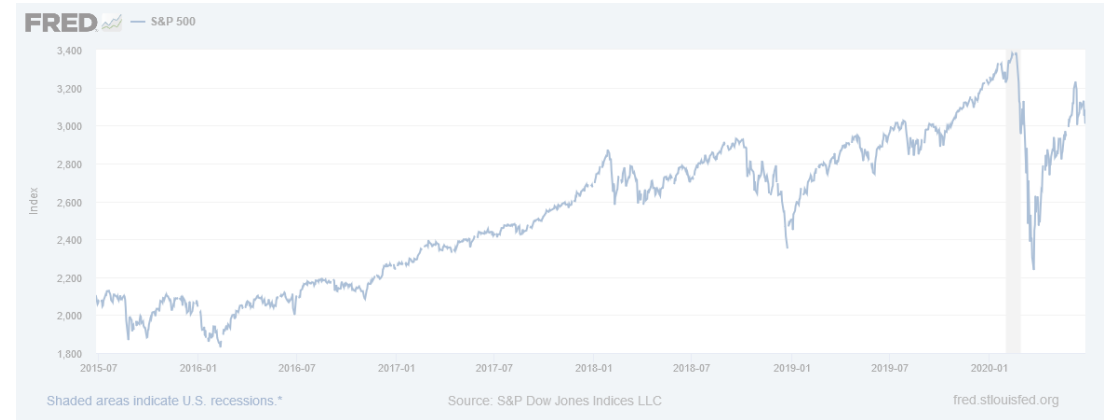
S&P 500, Index, Daily,
Not Seasonally Adjusted

Frequency: Daily, Close

observation_date

SP500

2015-06-26	2101.49
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
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“It’s a file called SP500.xlsx, downloaded from FRED.”

SP500 S&P 500, Index, Daily,
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SP500

2015-06-26	2101.49
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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

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.





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

SP500 S&P 500, Index, Daily,
Not Seasonally Adjusted

Frequency: Daily, Close
observation_date

SP500

2015-06-26	2101.49
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2015-06-30	2063.11
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2015-07-03	0
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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

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



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

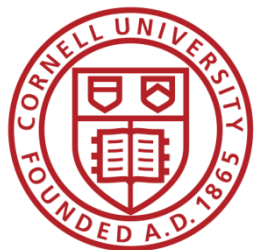
Describes data file, where to get it, how to get it, and any conditions of obtaining it

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.



2015-07-15	2107.40
2015-07-16	2124.29
2015-07-17	2126.64
2015-07-20	2128.28



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:

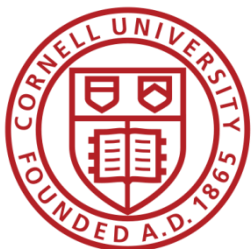
- Better
- Websites
- Online databases
- Data distributed as supplementary data
- Producer
- Distributor
- Dates
- Offline access mechanism
- Confidential databases
- No formal access mechanism

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)
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.

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



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

2015-07-08	2101.49
2015-07-09	2057.64
2015-07-10	2063.11
2015-07-13	2075.12
2015-07-14	2076.78
2015-07-15	2076.78
2015-07-16	2068.76
2015-07-17	2081.34
2015-07-20	2046.68
	2051.31
	2076.62
	2099.60
	2108.95
	2107.40
	2124.29
	2126.64
	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.





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.



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.

Cite this page as: Social Science Data Editors. 2022. "Guidance on Data Citations". *Data and Code Guidance by Data Editors*. Accessed at <https://social-science-data-editors.github.io/guidance/addtl-data-citation-guidance.html> on 2022-06-30.

Contributors: Lars Vilhuber

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

Disclaimer

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 Statements (DAS)

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

to publicly
ated during

y providing a

I restrictions,

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



Data Availa

- A statement about **availability**
 - DOI assigned
 - But long
- 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



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)