Replication and Reproducibility in Social Sciences and Statistics: Context, Concerns, and Concrete Measures **when Data are Confidential**

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

Disclaimer

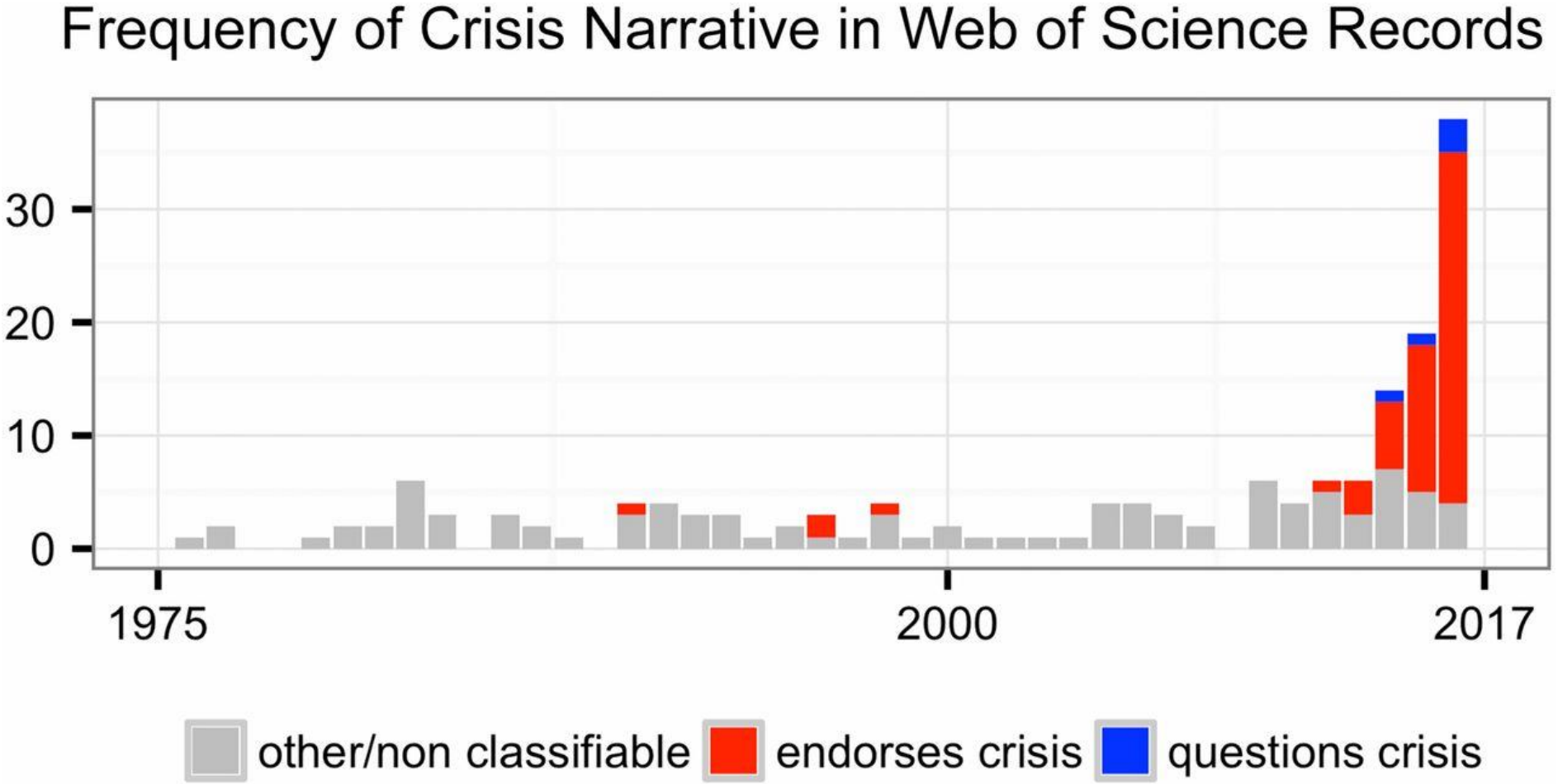
My opinions

Not Census Bureau

Not American Economic Association

No confidential data was abused in this talk

This reproducibility crisis thing….



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

The “crisis” in the 60s and 70s

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

Low power

Flexibility in analysis

Selective reporting

Ignoring nulls

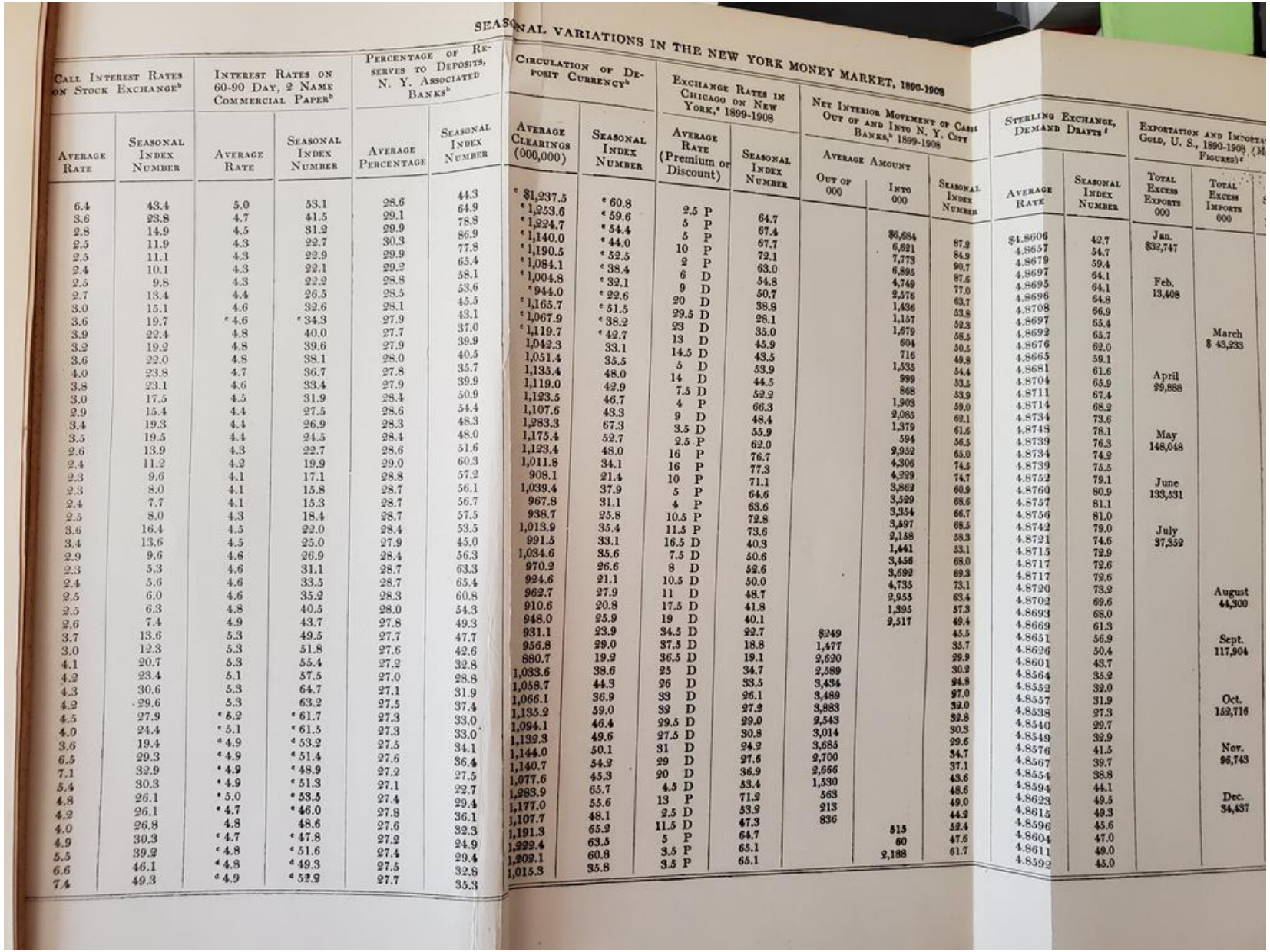
Lack of replication

Misuse of statistics

Source: Nosek Sackler talk 2017

Efficiency of scholary discourse?

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



SEASONAL VARIATIONS IN THE NEW YORK MONEY MARKET, 1890-1908

Call Interest Rates on Stock Exchange[b]		Interest Rates on 60-90 Day, 2 Name Commercial Paper[b]		Percentage of Reserves to Deposits, N. Y. Associated Banks[b]		Circulation of Deposit Currency[b]		Exchange Rates in Chicago on New York,[c] 1899-1908		Net Interior Movement of Cash Out of and Into N. Y. City Banks,[b] 1899-1908			Sterling Exchange, Demand Drafts[d]		Exportation and Importation of Gold, U. S., 1890-1908 (Minus Figures)[e]	
Average Rate	Seasonal Index Number	Average Rate	Seasonal Index Number	Average Percentage	Seasonal Index Number	Average Clearings (000,000)	Seasonal Index Number	Average Rate (Premium or Discount)	Seasonal Index Number	Average Amount Out of 000	Average Amount Into 000	Seasonal Index Number	Average Rate	Seasonal Index Number	Total Excess Exports 000	Total Excess Imports 000
6.4	43.4	5.0	53.1	28.6	44.3	[c] $1,237.5	[c] 60.8	2.5 P	64.7		$6,684	87.2	$4.8606	42.7	Jan. $32,747	
3.6	23.8	4.7	41.5	29.1	64.9	[c] 1,253.6	[c] 59.6	5 P	67.4		6,621	84.9	4.8657	54.7		
2.8	14.9	4.5	31.2	29.9	78.8	[c] 1,224.7	[c] 54.4	5 P	67.7		7,773	90.7	4.8679	59.4		
2.5	11.9	4.3	22.7	30.3	86.9	[c] 1,140.0	[c] 44.0	10 P	72.1		6,895	87.6	4.8697	64.1	Feb. 13,408	
2.5	11.1	4.3	22.9	29.9	77.8	[c] 1,190.5	[c] 52.5	2 P	63.0		4,749	77.0	4.8695	64.1		
2.4	10.1	4.3	22.1	29.2	65.4	[c] 1,084.1	[c] 38.4	6 D	54.8		2,576	63.7	4.8696	64.8		
2.5	9.8	4.3	22.2	28.8	58.1	[c] 1,004.8	[c] 32.1	9 D	50.7		1,436	53.8	4.8708	66.9		
2.7	13.4	4.4	26.5	28.5	53.6	[c] 944.0	[c] 22.6	20 D	38.8		1,157	52.3	4.8697	65.4		
3.0	15.1	4.6	32.6	28.1	45.5	[c] 1,165.7	[c] 51.5	29.5 D	28.1		1,679	58.5	4.8692	65.7		March $ 43,233
3.6	19.7	[c] 4.6	[c] 34.3	27.9	43.1	[c] 1,067.9	[c] 38.2	23 D	35.0		604	50.5	4.8676	62.0		
3.9	22.4	4.8	40.0	27.7	37.0	[c] 1,119.7	[c] 42.7	13 D	45.9		716	49.8	4.8665	59.1		
3.2	19.2	4.8	39.6	27.9	39.9	1,042.3	33.1	14.5 D	43.5		1,535	54.4	4.8681	61.6		
3.6	22.0	4.8	38.1	28.0	40.5	1,051.4	35.5	5 D	53.9		999	53.5	4.8704	65.9	April 29,888	
4.0	23.8	4.7	36.7	27.8	35.7	1,135.4	48.0	14 D	44.5		868	53.9	4.8711	67.4		
3.8	23.1	4.6	33.4	27.9	39.9	1,119.0	42.9	7.5 D	52.2		1,903	59.0	4.8714	68.2		
3.0	17.5	4.5	31.9	28.4	50.9	1,123.5	46.7	4 P	66.3		2,085	62.1	4.8734	73.6		
2.9	15.4	4.4	27.5	28.6	54.4	1,107.6	43.3	9 D	48.4		1,379	61.6	4.8748	78.1	May 148,048	
3.4	19.3	4.4	26.9	28.3	48.3	1,283.3	67.3	3.5 D	55.9		594	56.5	4.8739	76.3		
3.5	19.5	4.4	24.5	28.4	48.0	1,175.4	52.7	2.5 P	62.0		2,952	65.0	4.8734	74.2		
2.6	13.9	4.3	22.7	28.6	51.6	1,123.4	48.0	16 P	76.7		4,306	74.5	4.8739	75.5		
2.4	11.2	4.2	19.9	29.0	60.3	1,011.8	34.1	16 P	77.3		4,229	74.7	4.8752	79.1	June 133,531	
2.3	9.6	4.1	17.1	28.8	57.2	908.1	21.4	10 P	71.1		3,863	69.9	4.8760	80.9		
2.3	8.0	4.1	15.8	28.7	56.1	1,039.4	37.9	5 P	64.6		3,529	68.6	4.8757	81.1		
2.4	7.7	4.1	15.3	28.7	56.7	967.8	31.1	4 P	63.6		3,354	66.7	4.8756	81.0		
2.5	8.0	4.3	18.4	28.7	57.5	938.7	25.8	10.5 P	72.8		3,497	68.5	4.8742	79.0	July 37,352	
3.6	16.4	4.5	22.0	28.4	53.5	1,013.9	35.4	11.5 P	73.6		2,158	58.3	4.8721	74.6		
3.4	13.6	4.5	25.0	27.9	45.0	991.5	33.1	16.5 D	40.3		1,441	53.1	4.8715	72.9		
2.9	9.6	4.6	26.9	28.4	56.3	1,034.6	35.6	7.5 D	50.6		3,456	68.0	4.8717	72.6		
2.3	5.3	4.6	31.1	28.7	63.3	970.2	26.6	8 D	52.6		3,692	69.3	4.8717	72.6		
2.4	5.6	4.6	33.5	28.7	65.4	924.6	21.1	10.5 D	50.0		4,735	73.1	4.8720	73.2		August 44,300
2.5	6.0	4.6	35.2	28.3	60.8	962.7	27.9	11 D	48.7		2,955	63.4	4.8702	69.6		
2.5	6.3	4.8	40.5	28.0	54.3	910.6	20.8	17.5 D	41.8		1,395	57.3	4.8693	68.0		
2.6	7.4	4.9	43.7	27.8	49.3	948.0	25.9	19 D	40.1		2,517	49.4	4.8669	61.3		
3.7	13.6	5.3	49.5	27.7	47.7	931.1	23.9	34.5 D	22.7	$249		45.5	4.8651	56.9		Sept. 117,904
3.0	12.3	5.3	51.8	27.6	42.6	956.8	29.0	37.5 D	18.8	1,477		35.7	4.8626	50.4		
4.1	20.7	5.3	55.4	27.2	32.8	880.7	19.2	36.5 D	19.1	2,620		29.9	4.8601	43.7		
4.2	23.4	5.1	57.5	27.0	28.8	1,033.6	38.6	25 D	34.7	2,589		30.2	4.8564	35.2		
4.3	30.6	5.3	64.7	27.1	31.9	1,058.7	44.3	26 D	33.5	3,434		24.8	4.8552	32.0		
4.2	29.6	5.3	63.2	27.5	37.4	1,066.1	36.9	33 D	26.1	3,489		27.0	4.8557	31.9		Oct. 152,716
4.5	27.9	[c] 5.2	[c] 61.7	27.3	33.0	1,135.2	59.0	32 D	27.2	3,883		32.0	4.8538	27.3		
4.0	24.4	[c] 5.1	[c] 61.5	27.3	33.0	1,094.1	46.4	29.5 D	29.0	2,543		32.8	4.8540	29.7		
3.6	19.4	[d] 4.9	[d] 53.2	27.5	34.1	1,132.3	49.6	27.5 D	30.8	3,014		30.3	4.8549	32.9		
6.5	29.3	[d] 4.9	[d] 51.4	27.6	36.4	1,144.0	50.1	31 D	24.2	3,685		29.6	4.8576	41.5		Nov. 96,743
7.1	32.9	[d] 4.9	[d] 48.9	27.2	27.5	1,140.7	54.2	29 D	27.6	2,700		34.7	4.8567	39.7		
5.4	30.3	[d] 4.9	[d] 51.3	27.1	22.7	1,077.6	45.3	20 D	36.9	2,666		37.1	4.8554	38.8		
4.8	26.1	[d] 5.0	[d] 53.5	27.4	29.4	1,283.9	65.7	4.5 D	53.4	1,530		43.6	4.8594	44.1		
4.2	26.1	[d] 4.7	[d] 46.0	27.8	36.1	1,177.0	55.6	13 P	71.2	563		48.6	4.8623	49.5		Dec. 34,437
4.0	26.8	4.8	48.6	27.6	32.3	1,107.7	48.1	2.5 D	53.2	213		49.0	4.8615	49.3		
4.9	30.3	[c] 4.7	[c] 47.8	27.2	24.9	1,191.3	65.2	11.5 D	47.3	836		44.2	4.8596	45.6		
5.5	39.2	[c] 4.8	[c] 51.6	27.4	29.4	1,222.4	63.5	5 P	64.7		513	52.4	4.8604	47.0		
6.6	46.1	[d] 4.8	[d] 49.3	27.5	32.8	1,202.1	60.8	3.5 P	65.1		60	47.6	4.8611	49.0		
7.4	49.3	[d] 4.9	[d] 52.2	27.7	35.3	1,015.3	35.8	3.5 P	65.1		2,188	61.7	4.8592	45.0		

From @sdellavi
AER 1911

Efficiency of scholary discourse!

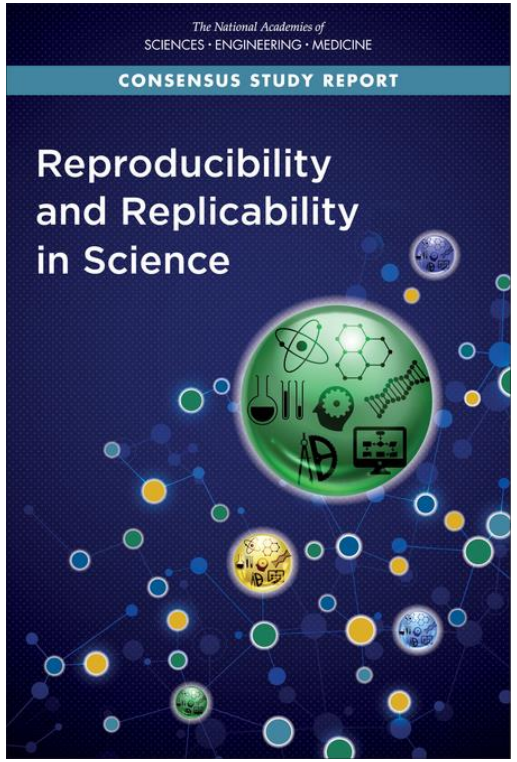
Modern publications thus need
the same transparency and completeness
as in the old days

to facilitate replicability

Replication?

Replication continuum

https://doi.org/10.17226/25303



Reproducibility

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

Replication continuum

Same data	Same code	Same methods	Same context

Reproducibility

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

Replication continuum

Reproducibility

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

Replicability

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

Replication continuum

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

Reproducibility

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

Replicability

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

Replication continuum

New data collection	Same code	Same methods	Same context

Reproducibility

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

Replicability

- Wide Replication (Pesaran 2003)
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Replication continuum

Reproducibility

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Replicability

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Generalizability

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

Replication continuum

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

Reproducibility

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

Replicability

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Progress

Progress

- Replication archives and Data (Code) Availability policies

Progress

- Replication archives and Data (Code) Availability policies
- Shared open source software

Statistical Software Components

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

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

GAPPORT: Stata module to calculates seats in party-list representation downloads
Ulrich Kohler

GCLSORT: Stata module to sort a single variable via ege
Philippe Van Kerm

GPROD: Stata module to extend egen for product of obs
Philip Ryan

Progress

- Replication archives and Data (Code) Availability policies
- Shared open source software
- Better public-use and shared data

CASD

CRDCN Canadian Research Data Centre Network

FSRDC

IAB INSTITUT FÜR ARBEITSMARKT- UND BERUFSFORSCHUNG
Die Forschungseinrichtung der Bundesagentur für Arbeit

CIQSS | QICSS
CENTRE INTERUNIVERSITAIRE QUÉBÉCOIS DE STATISTIQUES SOCIALES
QUEBEC INTER-UNIVERSITY CENTER FOR SOCIAL STATISTICS

Progress

- Replication archives and Data (Code) Availability policies
- Shared open source software
- Better public-use and shared data
- Better ways of accessing preprints/ grey literature

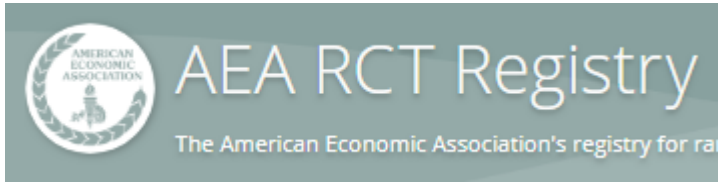
RePEc

Cornell University

arXiv.org

Progress

- Replication archives and Data (Code) Availability policies
- Shared open source software
- Better public-use and shared data
- Better ways of accessing preprints/ grey literature
- Pre-registration of trials, experiments, and analyses



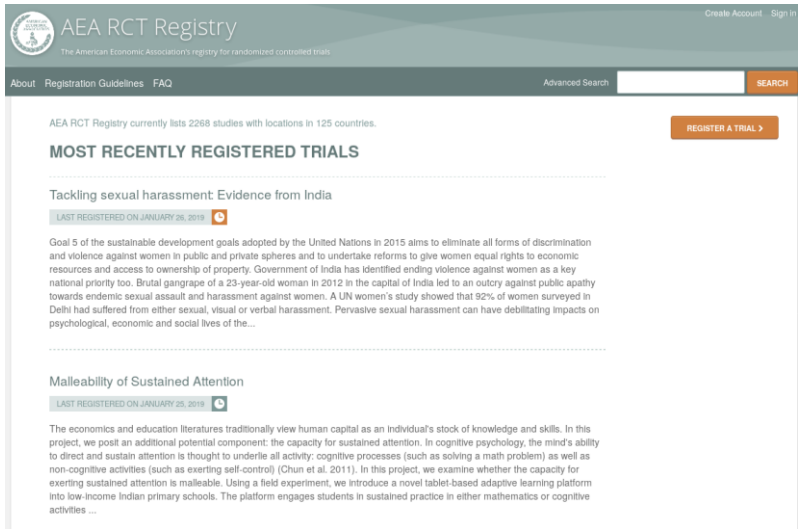
More recently…

Second round (2012-)

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

Pre-registration

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



https://www.psychologicalscience.org/publications/psychological_science/preregistration

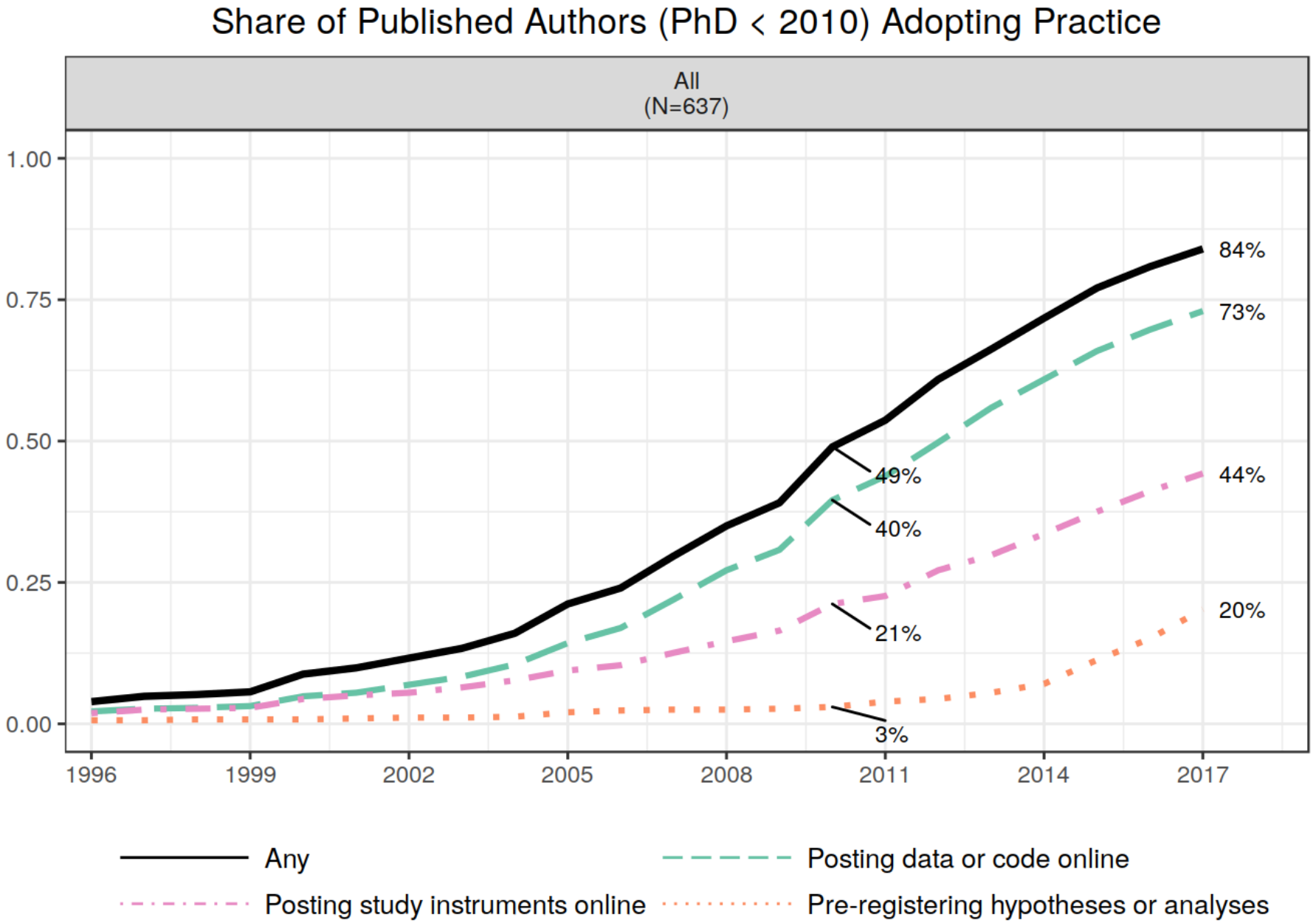
Registered Reports

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

- Close cousin: Results-blind review

Preprints in other sciences

- bioRxiv (2013)
- PsyArXiv (2016)



Paluck (2018) https://osf.io/kvbnh/

Restricted-Access Data Pose Problems

Challenges

- **Documentation**
  - How can others learn about the data?
- **Verifiability**
  - How can others obtain access?
- **Persistence**
  - How are data and programs preserved?

Challenges

Documentation

How can others learn about the data?

- How can others obtain access?

- **Persistence**
  - How are data and programs preserved?

Lack of proper dataset citation or identification

Economics makes wide use of public-use data

- **Macrodata:**

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

- **Microdata**:

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

Relevant example

Using Business Dynamics Statistics (BDS), we follow cohorts of firms, starting from their year of entry. The data span all US nongovernment sectors and cover

Page 5 of Online Appendix:

not credible. These establishments are excluded from the change calculations in a given year" (http://www.census.gov/ces/dataproducts/bds). Therefore, we check whether our

The manuscript, the online appendix, and the README contain no reference to the data location or the fact that the U.S. Census Bureau publishes the Business Dynamics Statistics.

Sedláček & Sterk (2017)
10.1257/aer.20141280

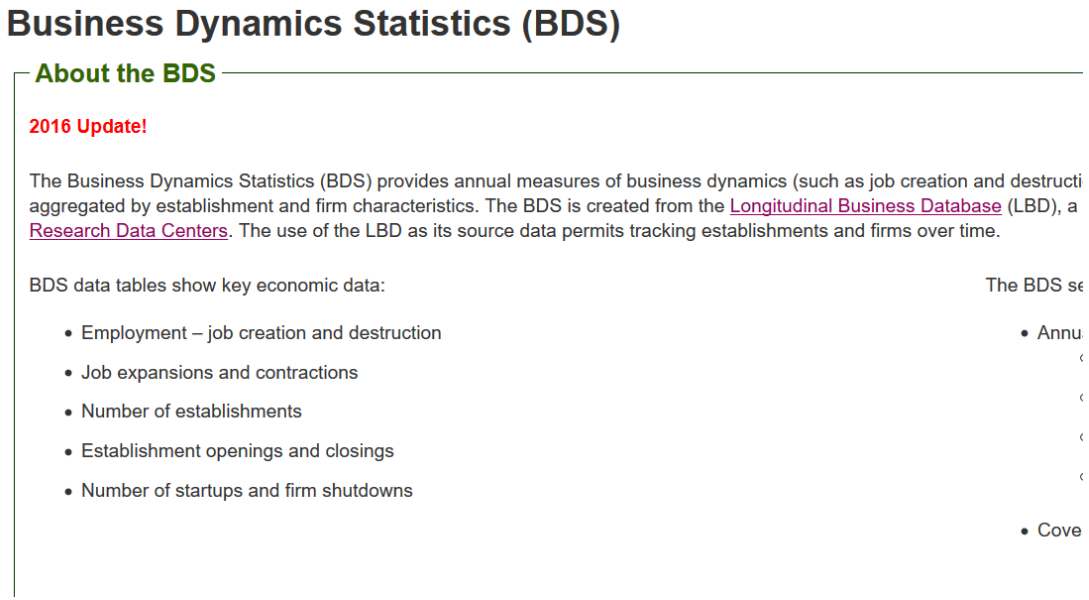
This should be easy!

Problems Making RELIABLE archives

Many datasets

- Are imperfectly described
  - Very few data citations
- Are badly documented
- Have no (permanent) location defined
  - Even for data from high-profile organizations!
- All of the above

Example: BDS



Business Dynamics Statistics (BDS)

About the BDS

2016 Update!

The Business Dynamics Statistics (BDS) provides annual measures of business dynamics (such as job creation and destructi aggregated by establishment and firm characteristics. The BDS is created from the Longitudinal Business Database (LBD), a Research Data Centers. The use of the LBD as its source data permits tracking establishments and firms over time.

BDS data tables show key economic data:

- Employment – job creation and destruction
- Job expansions and contractions
- Number of establishments
- Establishment openings and closings
- Number of startups and firm shutdowns

The BDS se

- Annu
- Cove

- No DOI or permanent URL
- No suggested data citation
- No versioned data releases

Doesn’t make it easy!

<sidenote>

What is a data citation?

Benefits for data producers:

- provides proper attribution and credit
- creates a bibliographic "trail", connecting publications and supporting data
- demonstrates the impact of their work and establishes research data as an important contribution to the scholarly record

Benefits for data users:

- citation makes it easier to find datasets
- supports persistence of datasets
- encourages the reuse of data for new research questions

https://data.research.cornell.edu/content/data-citation

What is a data citation?

Benefits for everyone:

- increases transparency and reproducibility

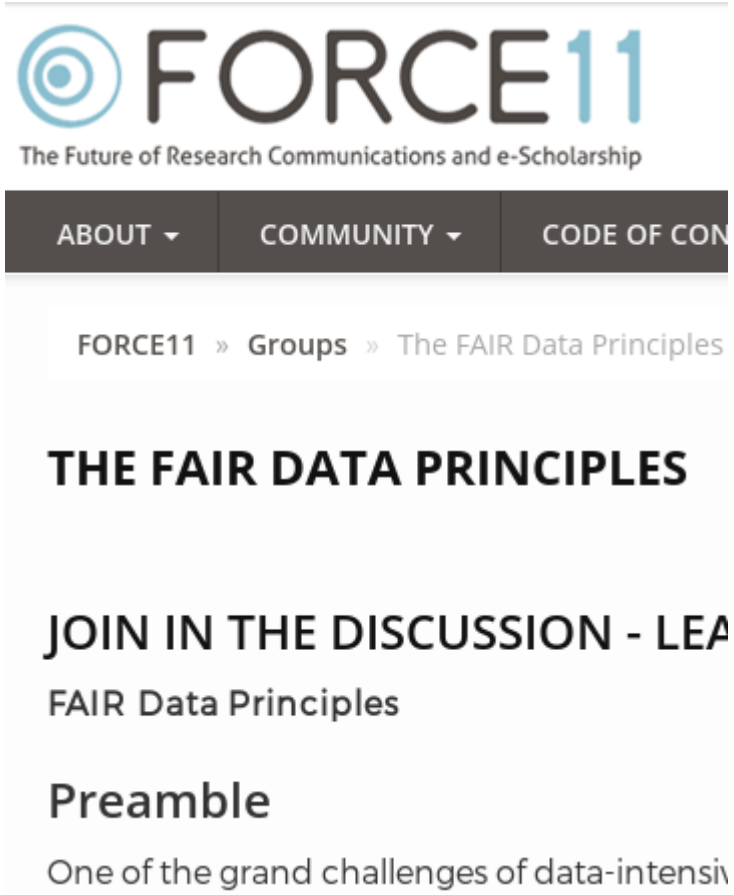
Smith, Tom W., Peter V. Marsden, and Michael Hout. 2011. *General Social Survey, 1972-2010 Cumulative File*. ICPSR31521-v1. Chicago, IL: National Opinion Research Center. Distributed by Ann Arbor, MI: Inter-university Consortium for Political and Social Research. doi:10.3886/ICPSR31521.v1

https://data.research.cornell.edu/content/data-citation

Action: Data citations and metadata

What is **FAIR**?

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



FAIR principles rely on metadata

Subject Terms
Do not copy/paste multiple terms into this field. Terms must be entered
× Rural roads

JEL Classification
× J43 Agricultural Labor Markets × O12 Microeconomic Analyses of
× O18 Urban, Rural, Regional, and Transportation Analysis • Housing

Manuscript Number
AER-2018-0268.R1 edit remove

Geographic Coverage + add value
India edit remove

Time Period(s) + add value
2000 – 2013 edit remove

Collection Date(s) + add value

Universe
Villages in India without paved roads in 2000. edit remove

</sidenote>

Example: BDS

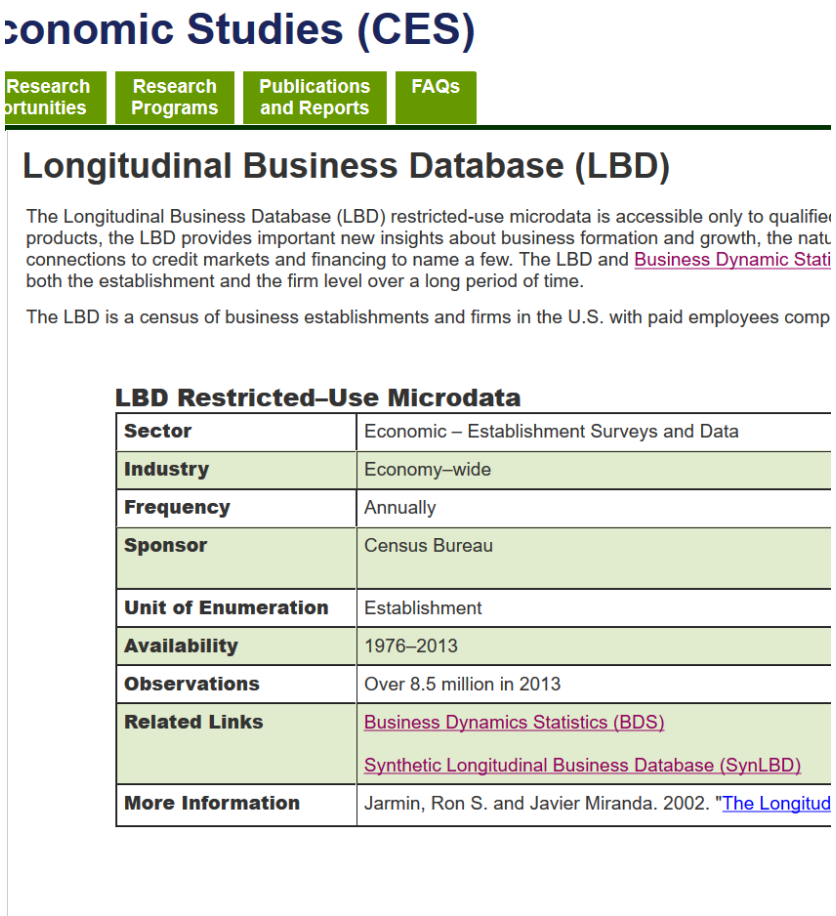
Name	Last modified	Size	Description
Parent Directory		-	
2015/	14-Sep-2017 09:41	-	
2016/	11-Oct-2018 14:19	-	
estab/	06-Sep-2016 07:50	-	
firm/	06-Sep-2016 07:47	-	

Note on versioned releases

- Recent releases are for "additional years of coverage" (2016 = data for 2016)
- Does not account for the possibility of re-releases or corrections of data

Especially problematic for confidential data

Example: LBD



conomic Studies (CES)

Research ortunities | Research Programs | Publications and Reports | FAQs

Longitudinal Business Database (LBD)

The Longitudinal Business Database (LBD) restricted-use microdata is accessible only to qualifie products, the LBD provides important new insights about business formation and growth, the natu connections to credit markets and financing to name a few. The LBD and Business Dynamic Stati both the establishment and the firm level over a long period of time.

The LBD is a census of business establishments and firms in the U.S. with paid employees comp

LBD Restricted–Use Microdata

Sector	Economic – Establishment Surveys and Data
Industry	Economy–wide
Frequency	Annually
Sponsor	Census Bureau
Unit of Enumeration	Establishment
Availability	1976–2013
Observations	Over 8.5 million in 2013
Related Links	Business Dynamics Statistics (BDS) Synthetic Longitudinal Business Database (SynLBD)
More Information	Jarmin, Ron S. and Javier Miranda. 2002. "The Longitud

- No DOI
- No suggested data citation
- No public summary statistics
- No public codebook

It can be done

6. **Publishing the results**

Researchers' publications based on FDZ data must include a reference to the datasets used (name of the datasets and mode of the data access).

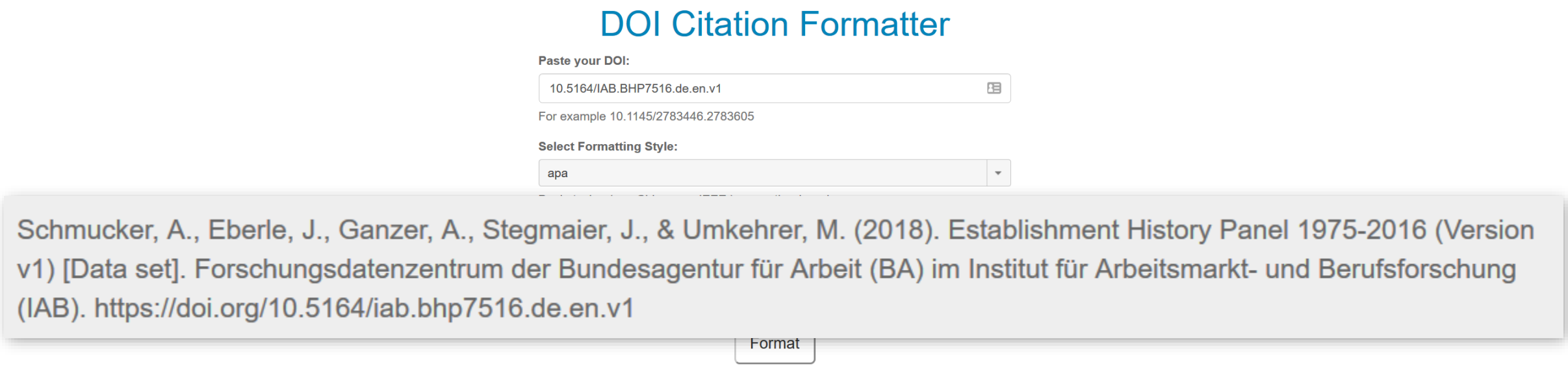
PDF Citation of the data in publications

Please submit one copy of every publication (including so-called 'grey literature') in digital or printed form to the FDZ.

Data (version BHP 7516)

'This study uses the weakly anonymous Establishment History Panel 1975-2016, DOI: 10.5164/IAB.BHP7516.de.en.v1. Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and/or remote data access.'

Formatted citation



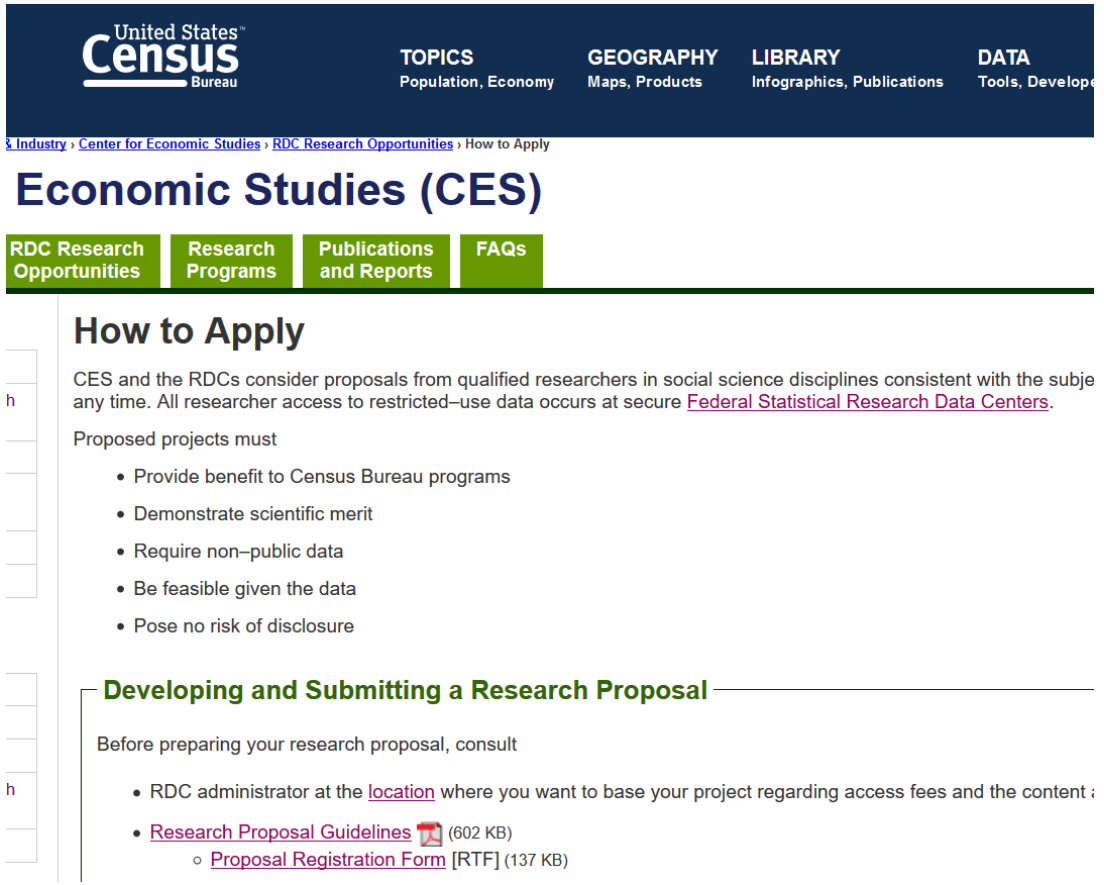
Documenting access

Just as important as describing what data you used: how can others access the data?

- May be the same way you accessed the data
- May differ, have changed

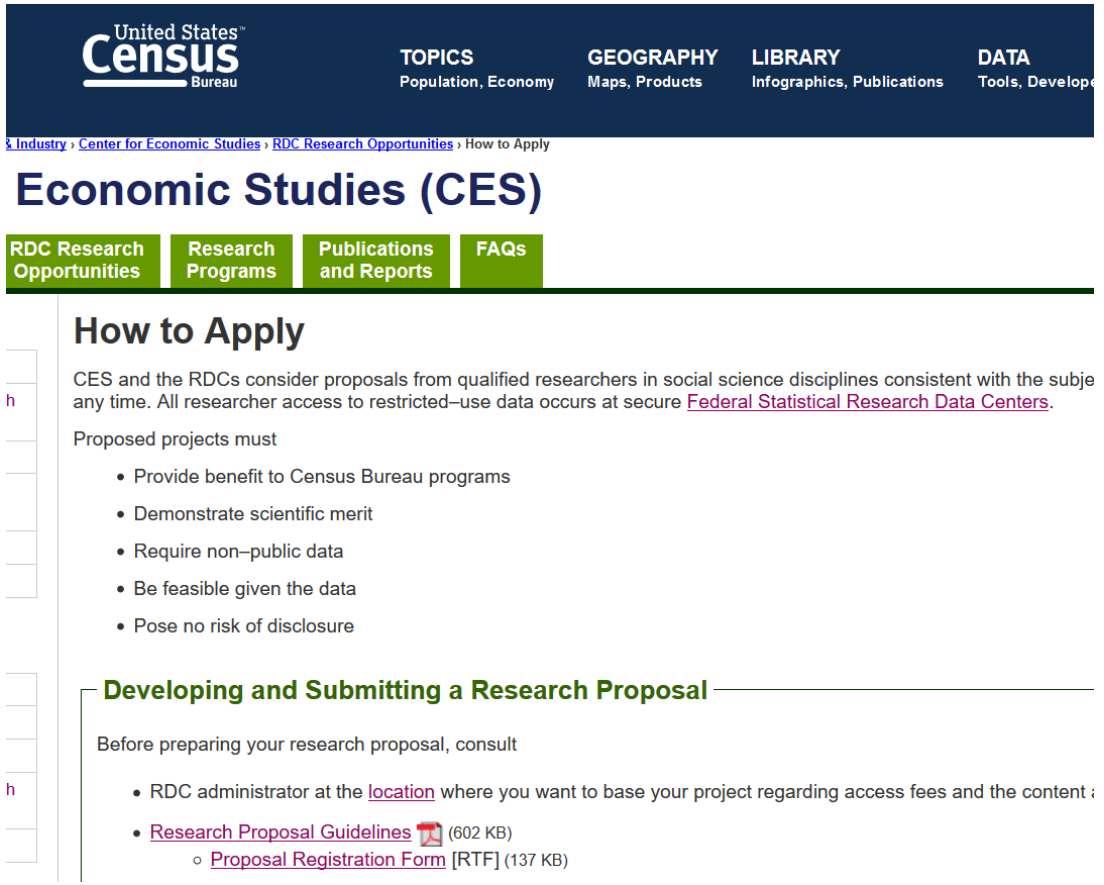
How to keep up to date?

- Link to the agency page ("Application portal")!



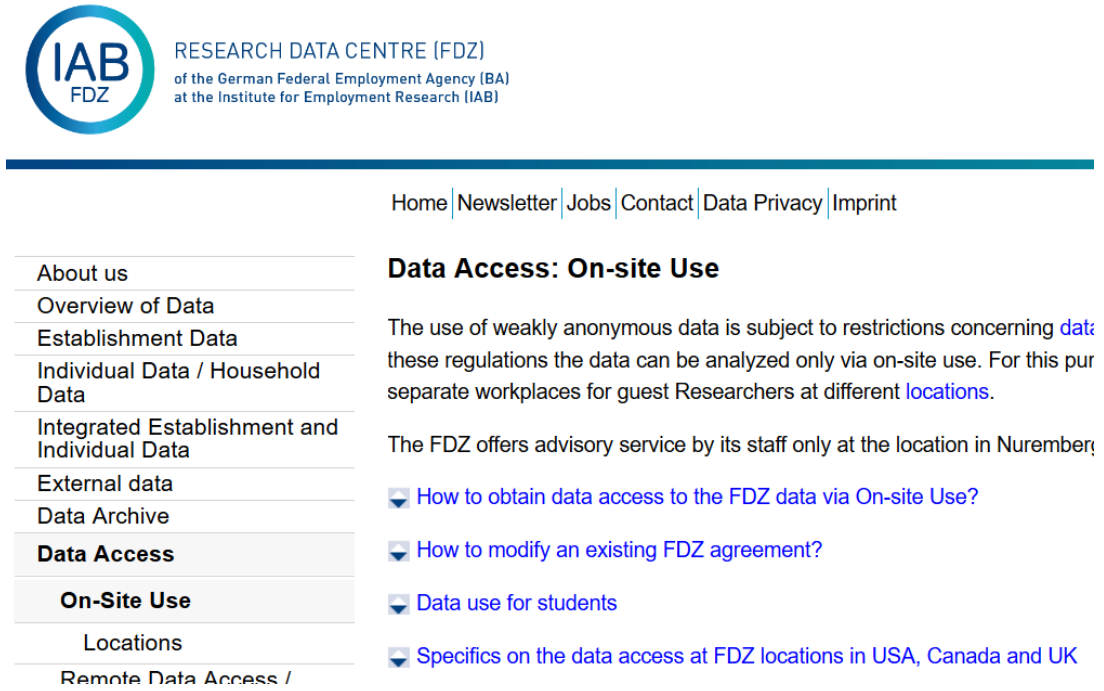
Documenting access

"The Longitudinal Business Database can be accessed by authorized users through the Federal Statistical Research Data Centers. For more information, see https://www.census.gov/ces/rdcresearch/howtoapply.html



Documentating access

"Data can be accessed via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB. For more information and requirements, see https://fdz.iab.de/en/FDZ_Data_Access/FDZ_On-Site_Use.aspx



How to improve?

- Agencies should provide template language for researchers to use
- Agencies should provide data citations (see IAB example)
- Agencies should provide DOI
- Agencies should provide public documentation
  - Database schema/ structure/ codebook
  - Generic summary statistics

Challenges

- Documentation
- **Verifiability**
  - How can others obtain access?
- Persistence
  - How are data and programs preserved?

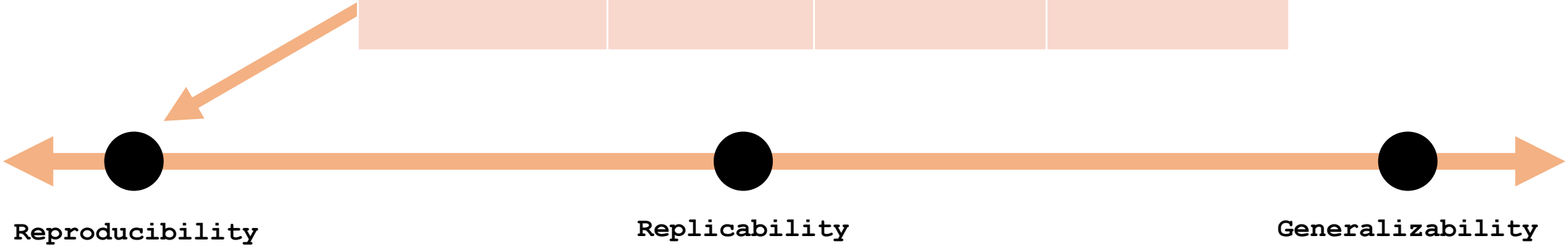
Reproducibility problems

1. Is it reproducible in the first place?
2. How can I prove it to others?

Not enough articles are reproducible

Replication continuum

Same data	Same code	Same methods	Same context



Reproducibility

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

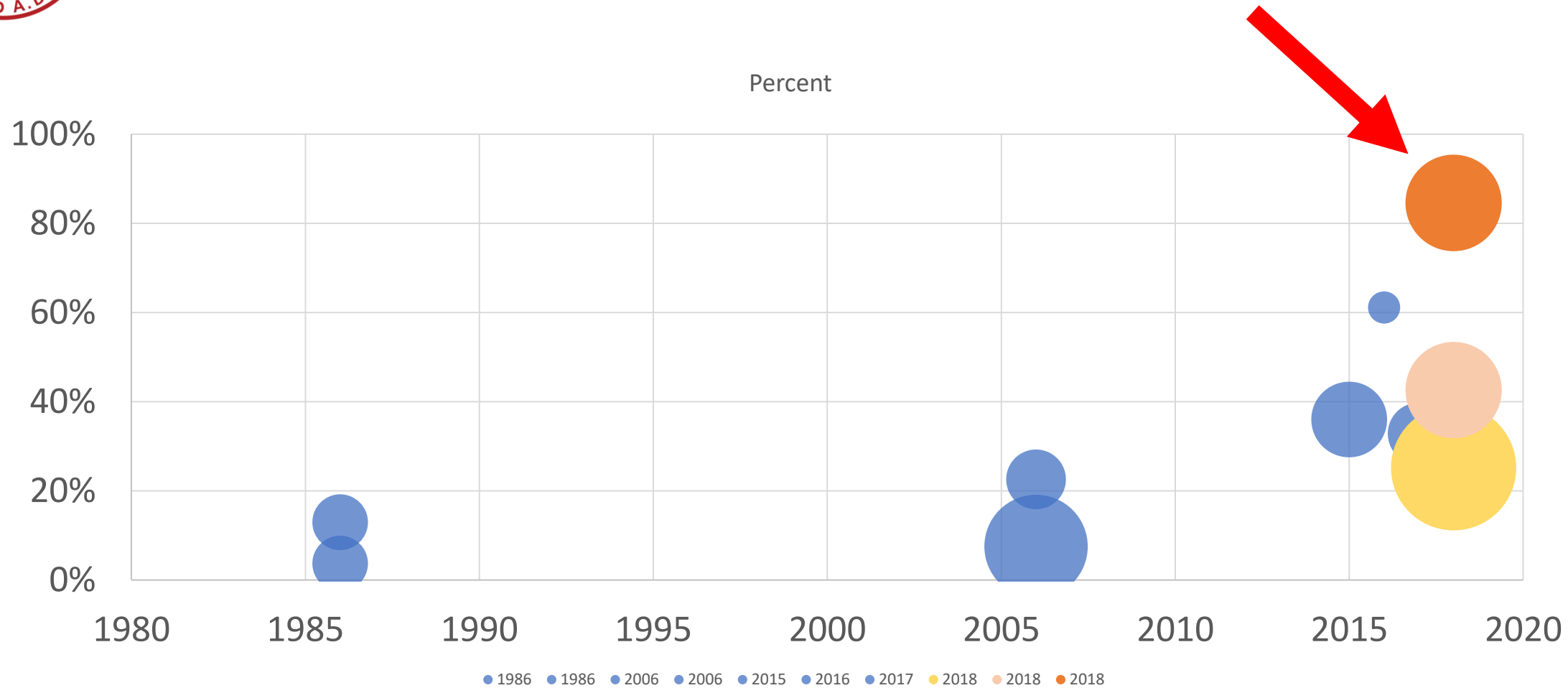
Replicability

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

Generalizability

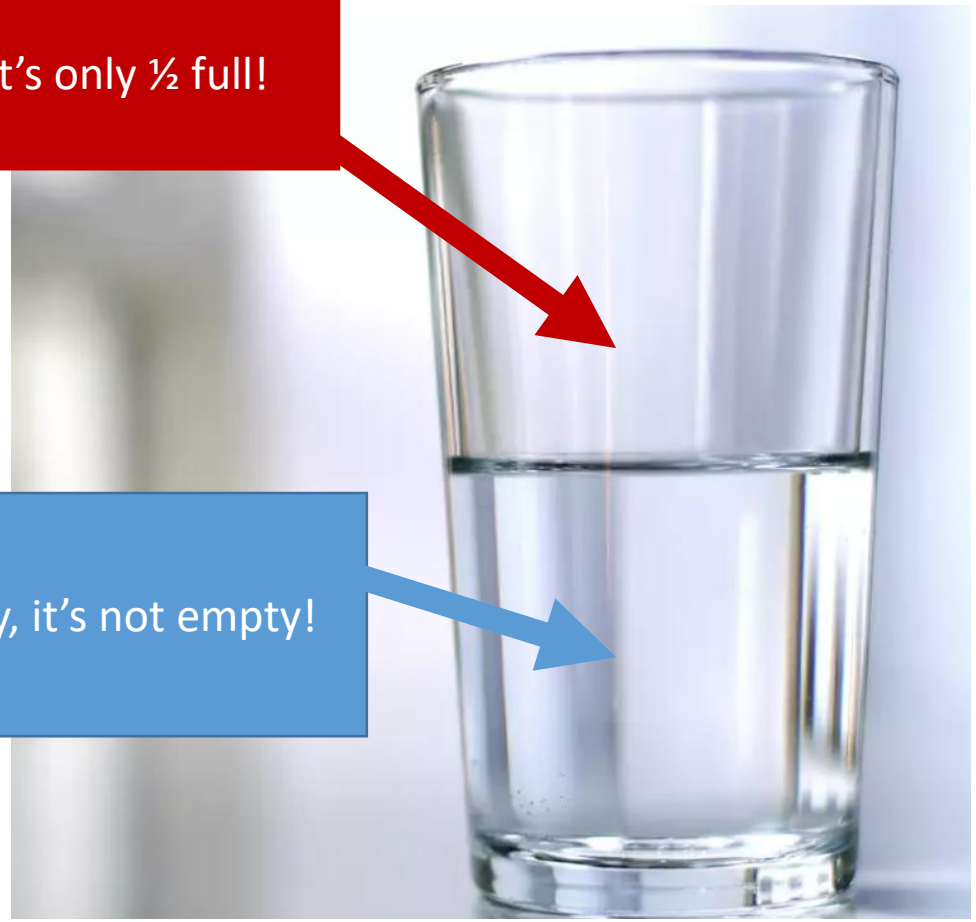
- Wider Replication (Pesaran 2003)
- Scientific Replication (Hamermesh 2007)
- Reanalysis/Robustness (Clemens 2015)

Results?


Percent
100%
80%
60%
40%
20%
0%
1980
1985
1990
1995
2000
2005
2010
2015
2020
1986
1986
2006
2006
2015
2016
2017
2018
2018
2018

In a nutshell

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



Reproducibility is harder than it should be

- Often done piecemeal
  - At different times
    - By different people
- Software versions
  - Stata 9? 15? 42?
    - rdrobust 2014? 2016? 2018 bug fix?
- Compilers and exotic software

Most frequent problem

Making USEFUL archives

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

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

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

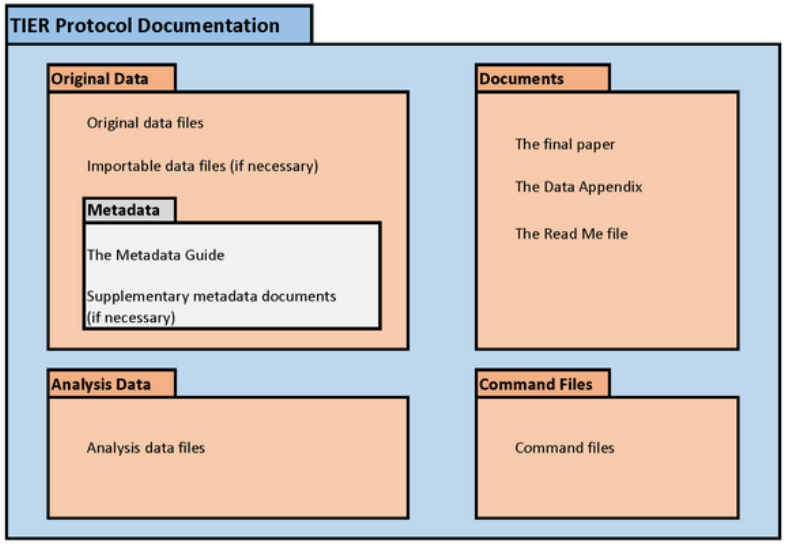
Especially true in FSRDC…

Issues in RDCs

- Changes in file locations and directory
- Changes in computing architecture
- Not specific to RDCs:
  - Change in RA team
  - Data flow management
  - Broken dependencies

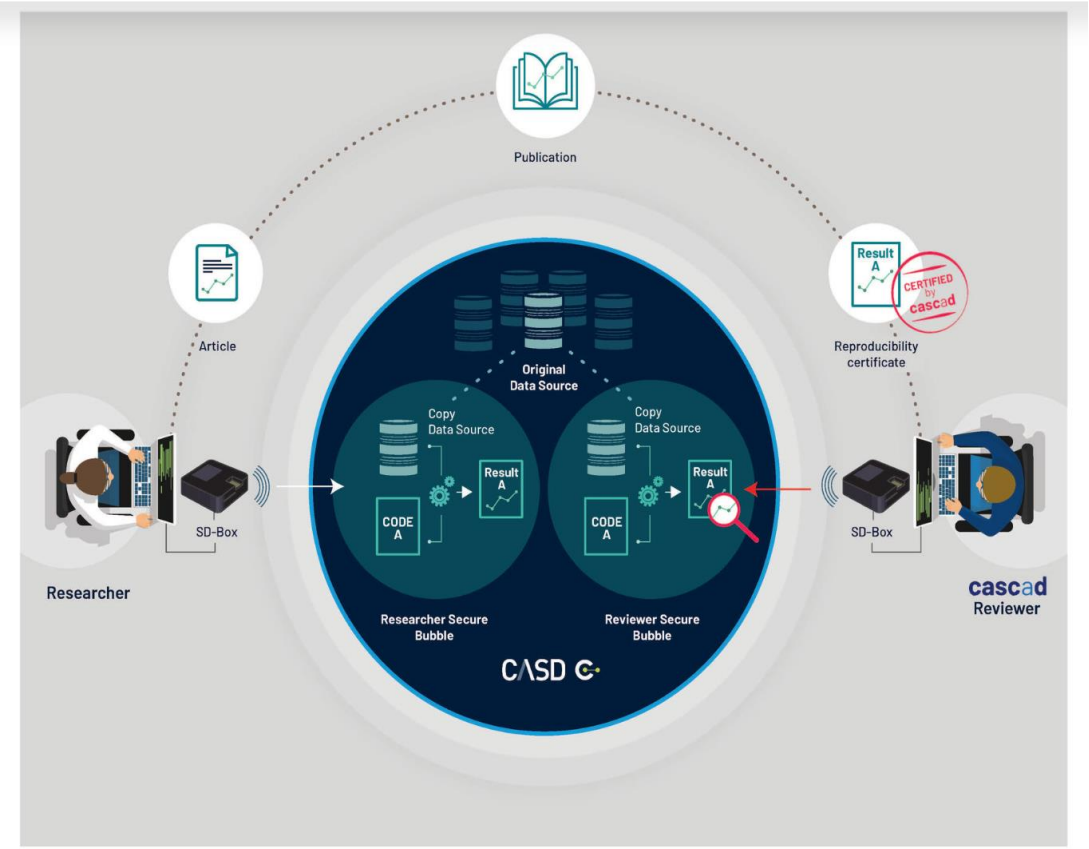
Use best practices for reproducibility

- TIER Protocol
- Versioning of code (and data!)
- Robust programming techniques (configuration files, modular code)
- Secure programming techniques! (no confidential parameters in core code)



How can others verify reproducibility?

How can others verify reproducibility?



cascad

the first certification agency for scientific code & data

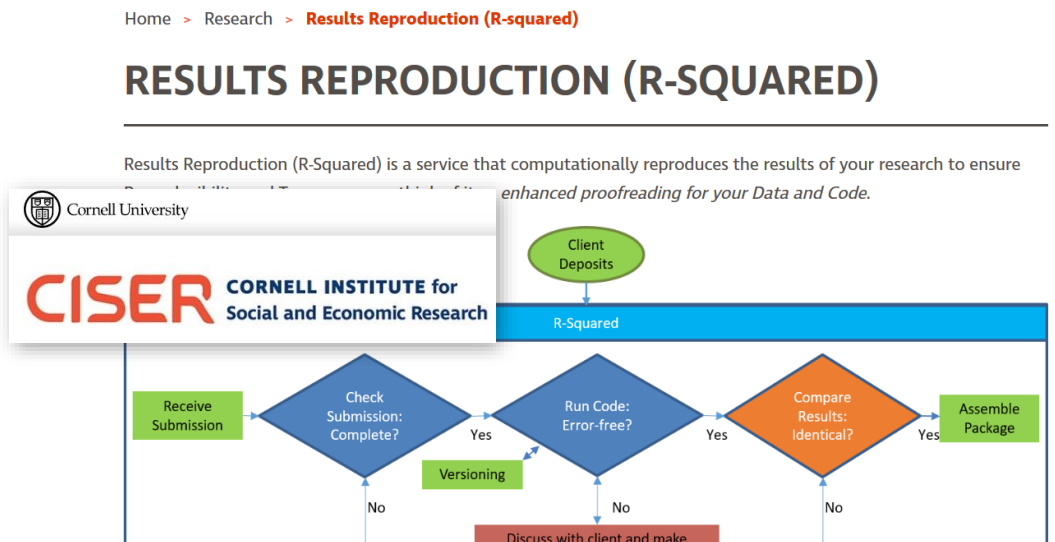
A cascad certification allows researchers to signal the reproducibility nature of their research to their peers

Verification service

- Permanently accredited staff with access to confidential data
- On-demand, arms-length verification of code and results
- Effectiveness rests on credibility of the service
- Similar to existing services that perform pre-submission verification within universities and research institutes, but with access to confidential data

J-PAL
ABDUL LATIF JAMEEL POVERTY ACTION LAB

ipa
INNOVATIONS FOR POVERTY ACTION



Embed within disclosure avoidance system

- Researchers develop code interactively (thin client, web application)
- Request to have results released
- IAB, not researcher, re-executes codes, and releases results produced by the code
- **Implicitly certifies reproducibility!**

IAB Certificate?

IAB FDZ
FORSCHUNGSDATENZENTRUM
der Bundesagentur für Arbeit im Institut für Arbeitsmarkt- und Berufsforschung

Certificate of computational reproducibility

The following programs were executed:

- `master.do`
- `Reg1.do`
- `Reg2.do`
- `Graph1.do`

and produced the following output:

- `Table 1.xlsx`
- `Table 2.csv`
- `Figure 1-data.csv`

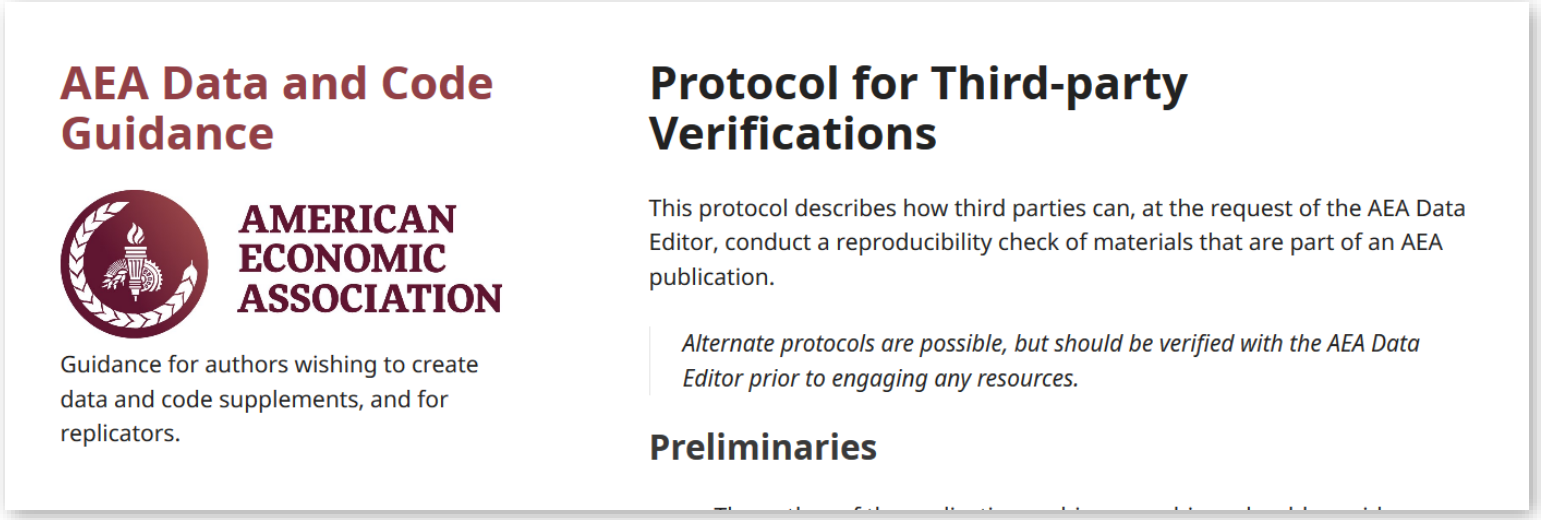
Checksum of all files:

- `SHA256: 1234567890ABCDE`
- `PK Signature: 12345 ABCDE 56789 BCDE1`

Our public key can be found on our website at **`doi.org/10.5164/IAB.PK.2019.v1`**.

Ad-hoc or peer-to-peer

- Journal Data Editor may ask for suggestions of reviewers with access to the same data
- Journal Data Editor may ask for permission for reviewers to access the data
- Protocol to be followed
- Case by case
- Effort?



AEA Data and Code Guidance

AMERICAN ECONOMIC ASSOCIATION

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

Protocol for Third-party Verifications

This protocol describes how third parties can, at the request of the AEA Data Editor, conduct a reproducibility check of materials that are part of an AEA publication.

> *Alternate protocols are possible, but should be verified with the AEA Data Editor prior to engaging any resources.*

Preliminaries

Other options

- Cryptographic signatures
- Blockchain
- All of the previous

Image by VIN JD on Pixabay

This is an unsolved problem.

Challenges

- **Documentation**
  - How can others learn about the data?
- **Verifiability**

Persistence

How are data and programs preserved?

A public-use data solution

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

PMCID: PMC3079891
NIHMSID: NIHMS246950

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

John M. Abowd and Lars Vilhuber

Author information ► Copyright and License information ►

Abstract Go to:

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

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

An example: not cited…

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

PMCID: PMC3079891
NIHMSID: NIHMS246950

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

John M. Abowd and Lars Vilhuber

Author information ► Copyright and License information ►

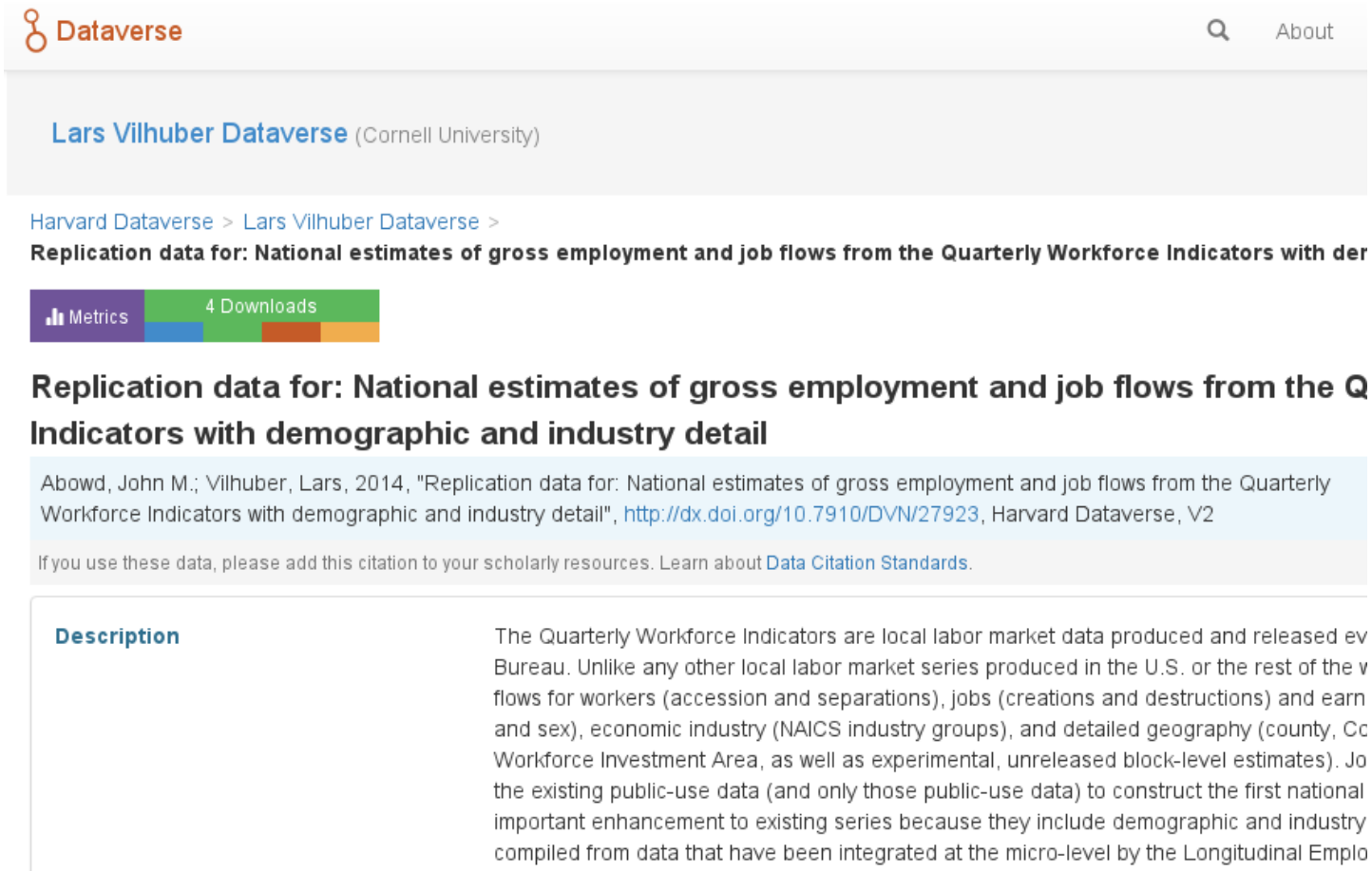
Abstract Go to:

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

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

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

We went back, archived it



We went back, archived it, linked it back

Dataverse

About

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

But: Encourage Best Practices

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

Deposit as soon as you can

Find Data / Replication data: Total Error and Variability Measures for QWI and LODES

Replication data: Total Error and Variability Measures

Principal Investigator(s): Kevin L. McKinney, United States Department of Commerce. Bureau of the C
Cornell University; John M. Abowd, Cornell University; John M. Abowd, United States Department of Comm

Version: V1

Version Title: Original version

Name	File Type
README.txt	text/x-web-m

Project Citation:

McKinney, Kevin L., Green, Andrew S., Vilhuber, Lars, Abowd, John M., and Abowd, John M. Replication data: Total Error and Variability Measures for QWI and LODES. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2017-12-15. https://doi.org/10.3886/E100590V1

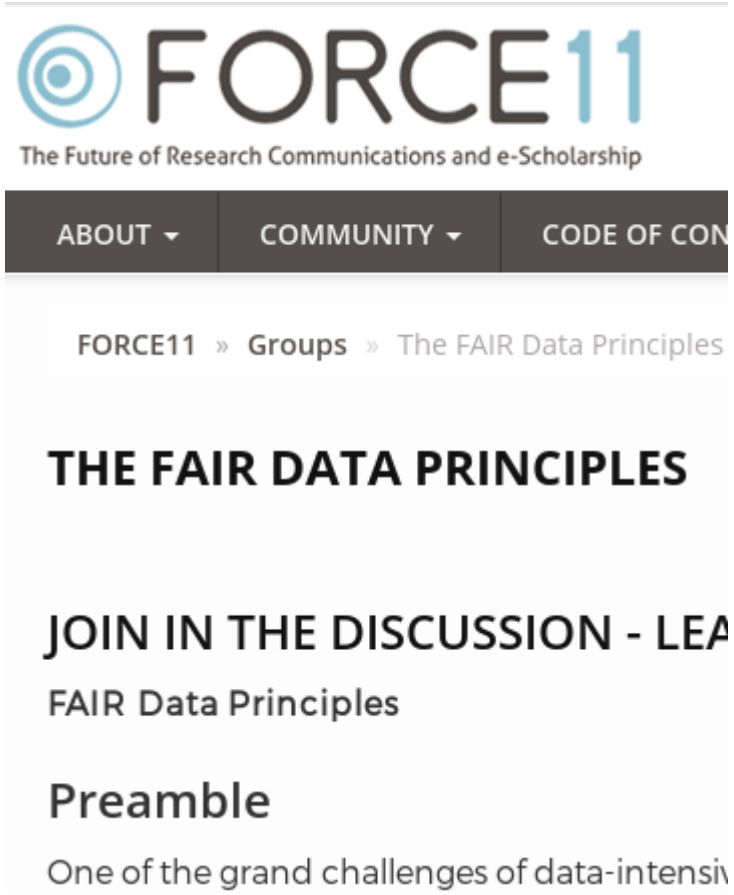
Persistent URL: http://doi.org/10.3886/E100590V1

This doesn’t work in RDC!

Action: Data citations and metadata

What is **FAIR**?

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



Preserving data in restricted access centers

- Use existing procedures
- Release as much non-sensitive information to public repositories
- Reveal the existence of confidential/sensitive information

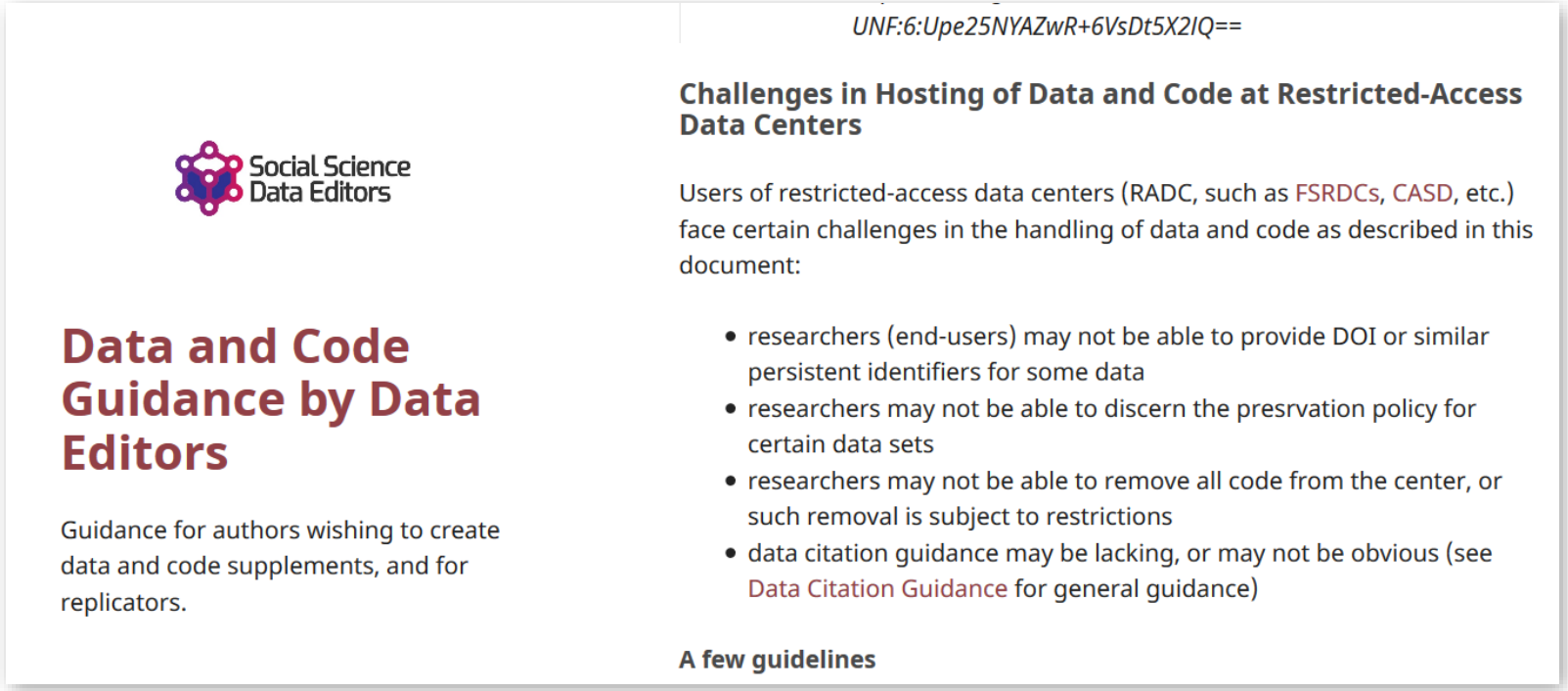
Use existing procedures

- Version your code (git or svn work without Gitlab or Github!)
- Leverage disclosure avoidance procedures
  - tie “code releases” and “tables” to specific “disclosure avoidance numbers”
- Allow (10-year) backup to “archive” files
  - Make those files findable!
  - Tie to some DOI or findable tag

RDCs: Create infrastructure to support

- Publish/ archive/ DOI for code/data releases?
- Publish (version!) preservation policy for
  - Accessible files (“BHP 2016 v1” – how long when v2 is released?)
  - Researcher-generated files (How long are project files kept after end of project)
- Record such policies (re3data.org)
- Provide DOI for archives of researcher-generated files (-> public landing pages -> FAIR)

Some guidance



UNF:6:Upe25NYAZwR+6VsDt5X2IQ==

Social Science Data Editors

Data and Code Guidance by Data Editors

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

Challenges in Hosting of Data and Code at Restricted-Access Data Centers

Users of restricted-access data centers (RADC, such as FSRDCs, CASD, etc.) face certain challenges in the handling of data and code as described in this document:

- researchers (end-users) may not be able to provide DOI or similar persistent identifiers for some data
- researchers may not be able to discern the presrvation policy for certain data sets
- researchers may not be able to remove all code from the center, or such removal is subject to restrictions
- data citation guidance may be lacking, or may not be obvious (see Data Citation Guidance for general guidance)

A few guidelines

- https://social-science-data-editors.github.io/guidance/Requested_information_hosting.html#challenges-in-hosting-of-data-and-code-at-restricted-access-data-centers

Some more extensive guidance

Making Confidential Data Part of Reproducible Research

Lars Vilhuber, *Cornell University*
Carl Lagoze, *University of Michigan*

https://digitalcommons.ilr.cornell.edu/ldi/41/

Cornell University
ILR School

Cornell University ILR School
DigitalCommons@ILR

Labor Dynamics Institute | Centers, Institutes, Programs

8-21-2017

Making Confidential Data Part of Reproducible Research

Lars Vilhuber
Cornell University, lv39@cornell.edu

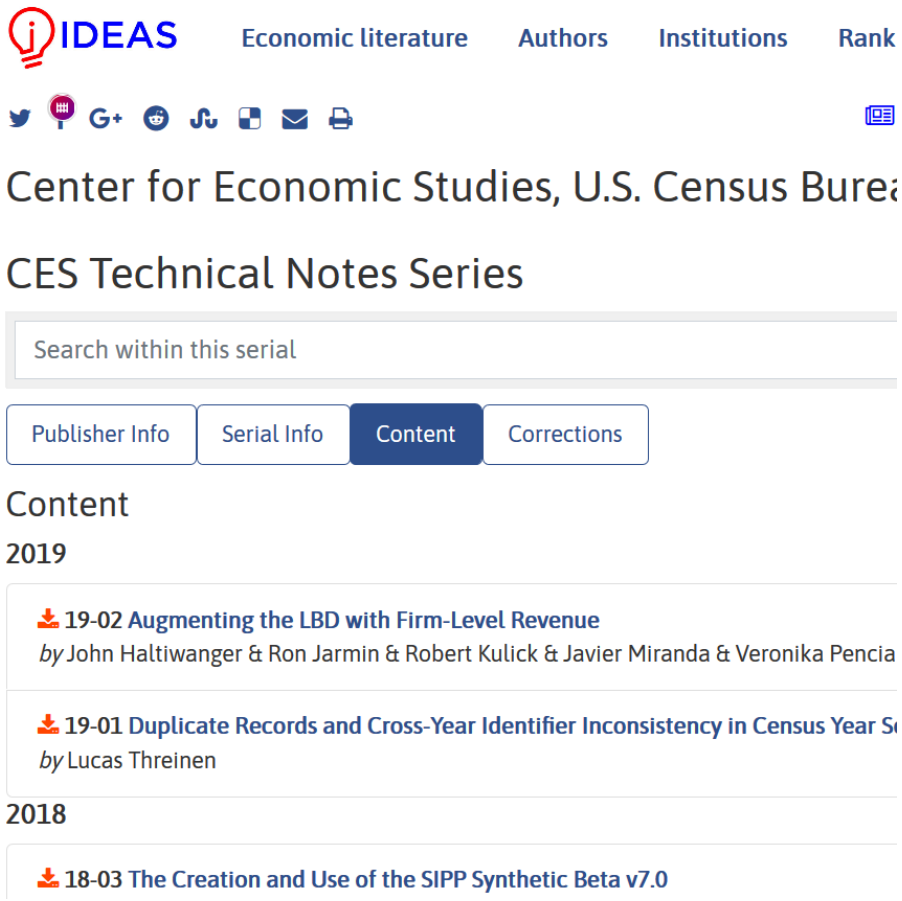
Carl Lagoze
University of Michigan, clagoze@umich.edu

Surfacing additional information

- For documents:
  CES Technical Notes Series

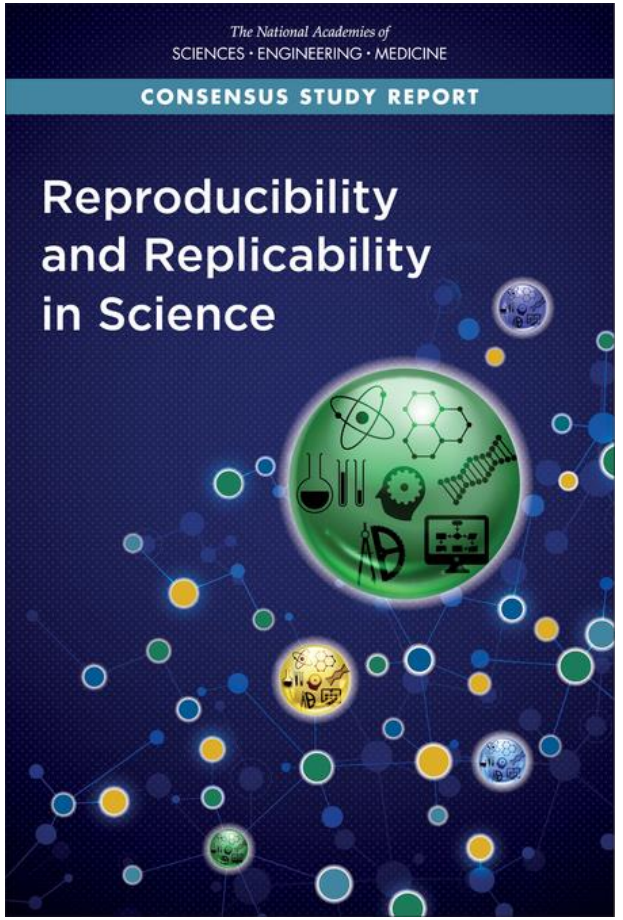
"CES Technical Notes may contain confidential data and, thereby, disclosure is prohibited. Researchers on approved with the correct permissions can request full text notes from (EMAIL)"

- Exploring ability to attach data and code archives



Even better: repositories

- report's *Recommendation 6-5* encourages NSF to create "***code and data repositories for long-term archiving and preservation of digital artifacts that support claims made in the scholarly record***."
- **These should also be implemented within non-public areas (e.g., FSRDC, etc.)**



https://doi.org/10.17226/25303

Evolving Journal and Data Infrastructure

Treat all archives symmetrically!

Evolving Journal and Data Infrastructure

Goal: Use any repository!

(subject to conditions)

Data (and Code) Availability Statements

- A statement about where data supporting the results reported in a published article can be found
  - including unique identifiers linking to publicly archived datasets analyzed or generated during the study.
- DASs can increase transparency by providing a reason why data cannot be made (immediately) available
  - need for registration, ethical or legal restrictions, or because of an embargo period

Some positives

Some random notes

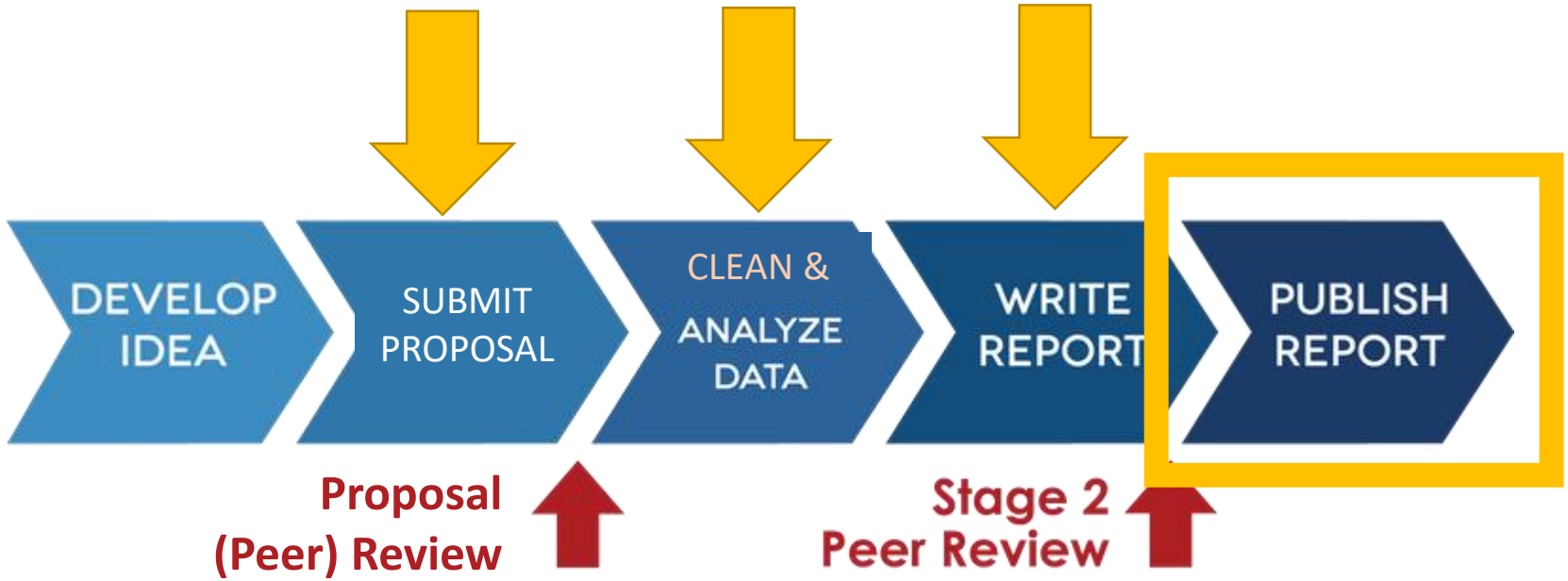
- **Pre-release verification** conducted within the disclosure avoidance mechanism?
- Analogy between **grant** or **RDC proposal** and **pre-registration**
- Incentives of stats agencies: **transparency** = **credibility**
- From **pre-acceptance verification** to **pre-submission verification** (university or institute services)

Registered Reports

- Close cousin: Results-blind review

Registered Reports

- Close cousin: **RDC access mechanism**



Interesting thought

Could the RDC proposal and access mechanism be combined with a registered-report mechanism?

Collaboration

Goal: Transportability

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

Social science “guild”

Social Science Data Editors

Data and Code Guidance by Data Editors

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

Authors: Lars Vilhuber

This project is maintained by social-science-data-editors

Disclaimer

Unofficial guidance on various topics by Social Science Data Editors

Guidance on creating replicable data and program archives

This guidance is for the author wanting to create a replication archive.

See Requested information for the information the Data Editor may request from you, prior to the acceptance of your paper for publication.

Guidance on testing replicability of code

This guidance has two audiences:

- the author wanting to verify whether her code passes muster as a replicable archive
- the replicator wanting to verify the replicability of such an archive

See Verification guidance

FAQ

See our growing FAQ. If you have questions or answers to add, please notify us by creating a new issue.

https://social-science-data-editors.github.io/guidance/

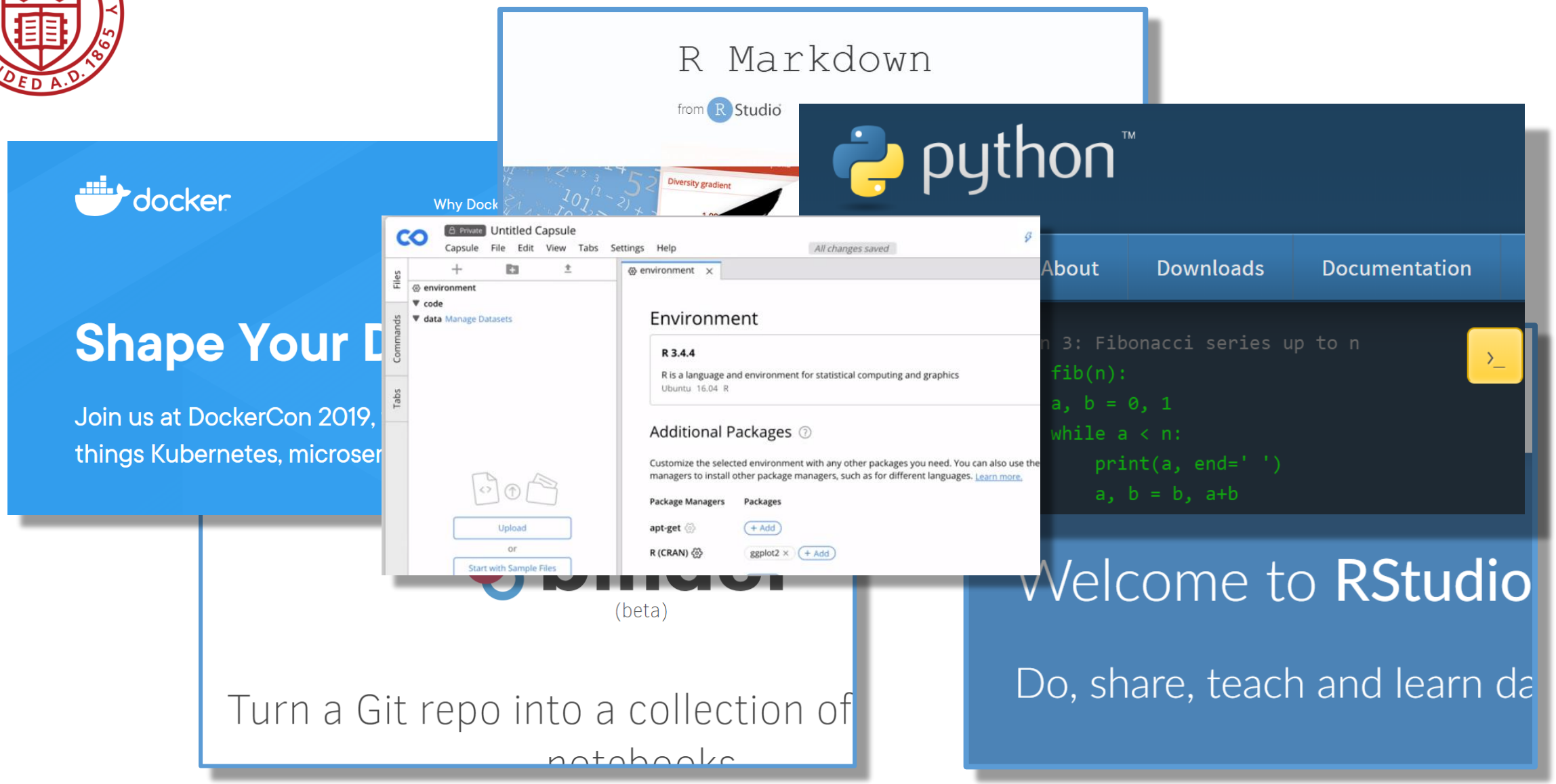
Challenges?

You…

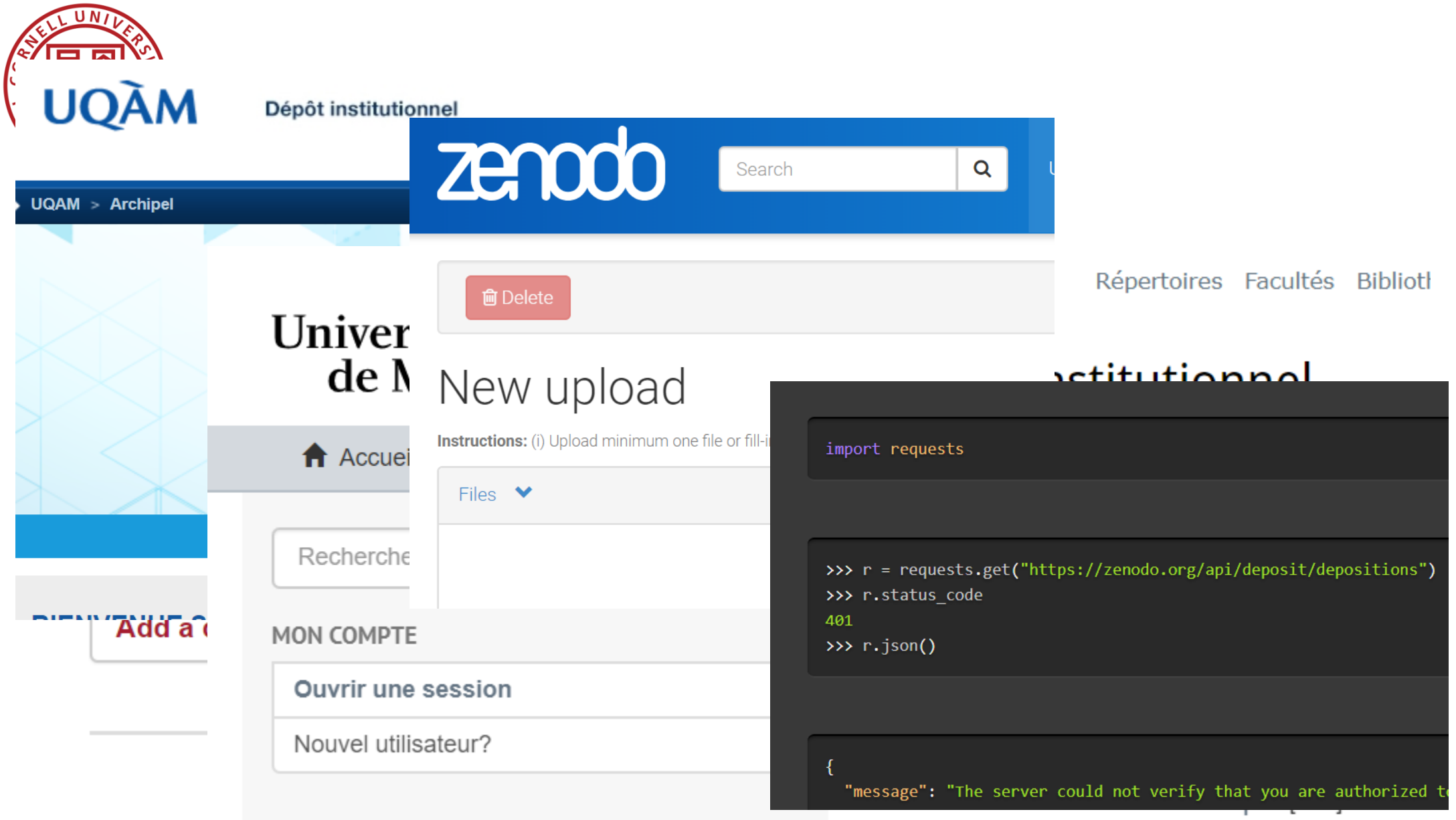
Me…

Change ingrained habits…

New skills to learn…


R Markdown
from RStudio
Diversity gradient
python™
docker
Why Dock
Shape Your D
Join us at DockerCon 2019,
things Kubernetes, microser
Private Untitled Capsule
Capsule File Edit View Tabs Settings Help
All changes saved
Files
Commands
Tabs
environment
code
data Manage Datasets
Upload
or
Start with Sample Files
environment
Environment
R 3.4.4
R is a language and environment for statistical computing and graphics
Ubuntu 16.04 R
Additional Packages
Customize the selected environment with any other packages you need. You can also use the
managers to install other package managers, such as for different languages. Learn more.
Package Managers
Packages
apt-get
+ Add
R (CRAN)
ggplot2 ×
+ Add
About
Downloads
Documentation
n 3: Fibonacci series up to n
fib(n):
a, b = 0, 1
while a < n:
print(a, end=' ')
a, b = b, a+b
(beta)
Turn a Git repo into a collection of
notebooks
Welcome to RStudio
Do, share, teach and learn da

New methods to use …


UQÀM
Dépôt institutionnel
UQAM > Archipel
zenodo
Search
Delete
New upload
Instructions: (i) Upload minimum one file or fill-i
Files
Répertoires
Facultés
Bibliotl
Accuei
Recherche
MON COMPTE
Ouvrir une session
Nouvel utilisateur?
import requests
>>> r = requests.get("https://zenodo.org/api/deposit/depositions")
>>> r.status_code
401
>>> r.json()
{
"message": "The server could not verify that you are authorized t

Researchers: New skills to learn/teach

- How to **incorporate reproducible practices** into your workflow
- When to **pre-register**, and when not to
- **Document** early, and often (better READMEs!)
- How, where, and when to **archive data and code**
- How to **license** your contributions!

Summary

Challenges

- **Documentation**
  - How can others learn about the data?
- **Verifiability**
  - How can others obtain access?
- **Persistence**
  - How are data and programs preserved?

Possible solutions

- **Documentation**
  - Better support, more consistency, new publication tools
- **Verifiability**
  - Intriguing possibilities, not yet solved
- **Persistence**
  - Acceptable workarounds, need for robust infrastructure

Thank you!

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