

Open Science in Economics

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larsvilhuber.github.io/zbw-open-science-2026/



Who am I?



Lars Vilhuber

Executive Director of the **Labor Dynamics Institute** and Research Professor in the **Economics Department** at **Cornell University**, and the **American Economic Association's** Data Editor.



Lars Vilhuber

Data Editor of the AEA

2791 Manuscripts and 4440 Reports, approx. 4900 authors reached.

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.

American Economic Journal: Microeconomics



American Economic Journal: Microeconomics publishes papers focusing on microeconomic theory;



What is Open Science?



What is Open Science?

Usually described along several pillars:

- Open **access** to publications
- Open **data**
- Open **code / software**
- Open **methods** and **peer review**



Open Science and Credibility

Open Science facets are seen as **good**, and a (possibly) necessary part of **credible research**



Open Science and Policy

Should policy be based on **credible** research, and thus on **open science**?

Why Data Access Is the Hard Part

- **Manuscripts**: increasingly open (preprints, open access mandates)
- **Code**: cheap to share, easy to version, low legal risk
- **Data**: the sticking point



Recent Evidence

A 2026 issue of *Nature* on social science reproducibility:

- Headline: **"Half of social-science studies fail replication test"**
 - But: only **30% of articles yielded data**

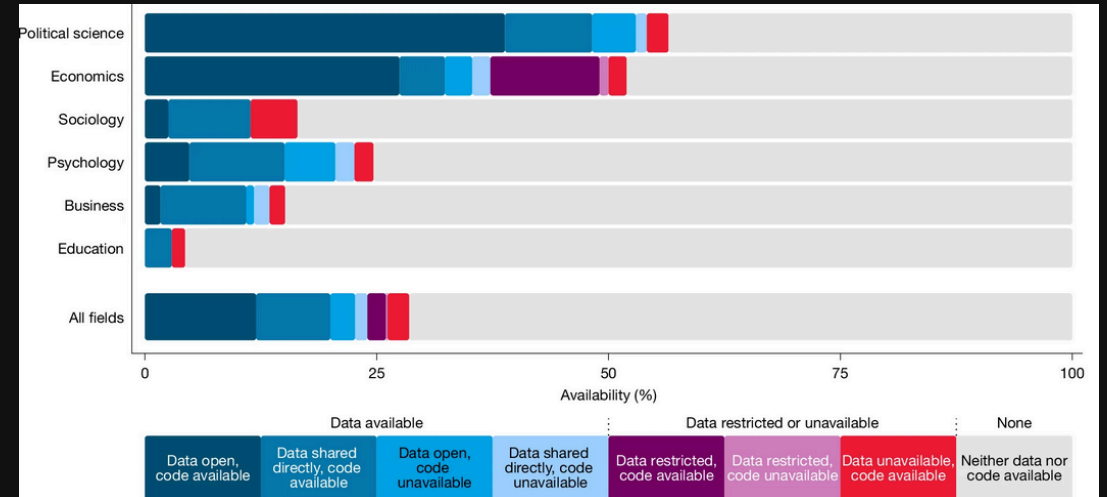


Fig 2, Tyne et al. (2026)

Let's make that a bit bigger

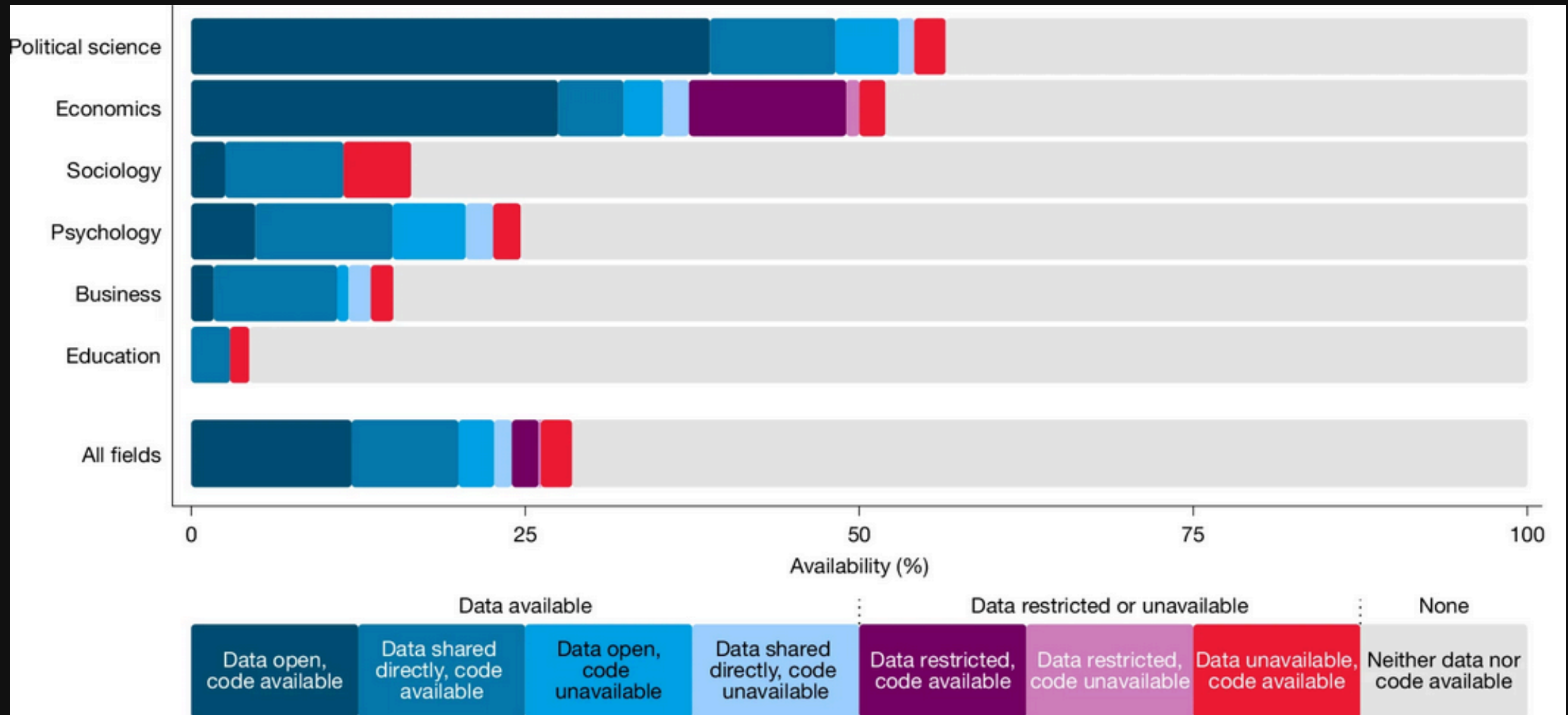


Fig 2, Tyne et al. (2026), data from 2009 to 2018



Why is data not always open?

- Data withheld for **ethical**, legal, or contractual reasons
- May be **confidential**, proprietary, or administrative



Ask yourself!

Would you want

- your complete medical history
- your precise address

to be made **public**?



Probably not



So: Open Science and Policy

Should policy be based on *credible* research, and thus on **open science**,...

when

open science == open data?

Open Access and Politics

But this is exactly what certain critics of **environmental** policies have suggested in the US.

Open Access and Politics

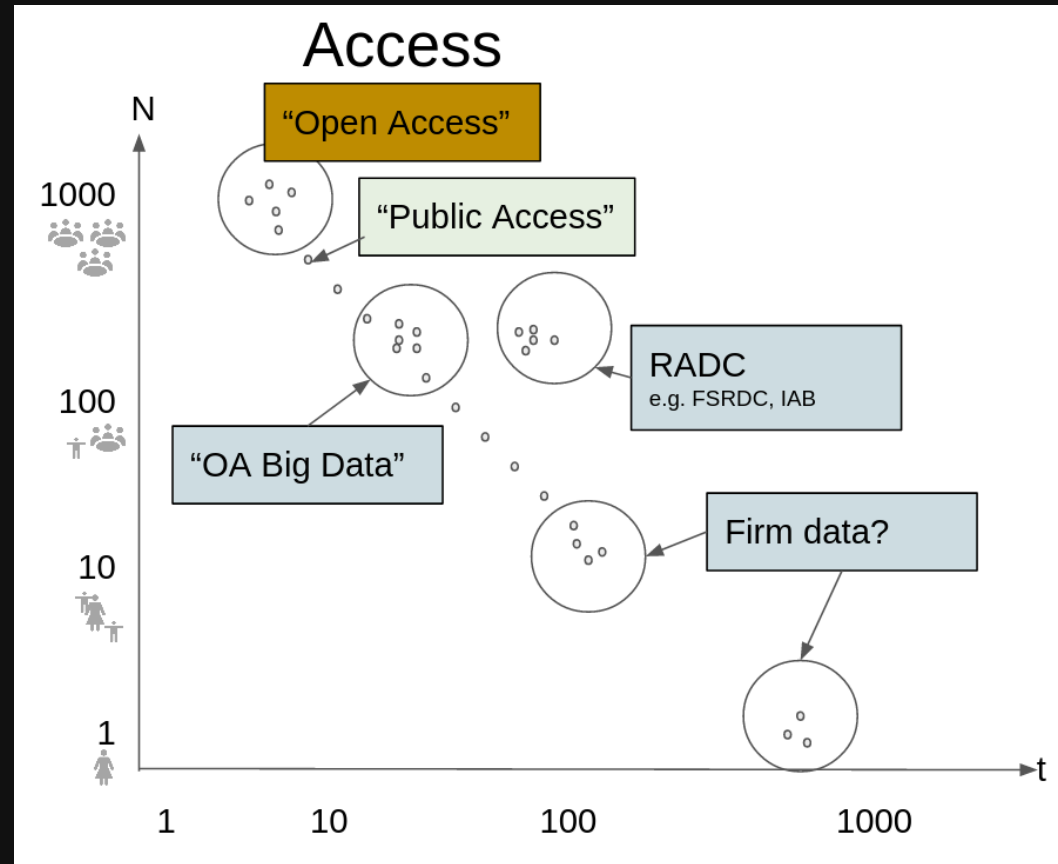
No health data... no health effects of pollution... no “costly” environmental regulations

Data Access as the Bottleneck

- **Access** — not mere existence — determines whether findings can be verified

Without access to the underlying data, **code and methods alone cannot establish reproducibility** — verification becomes much harder.

How do you do open science when data are not “freely available”?



Shades of access



The Problem



Recent Evidence

A 2026 issue of *Nature* on social science reproducibility:

- Headline: “Half of social-science studies fail replication test”
 - But: only 30% of articles yielded data; **only 24% were attempted**

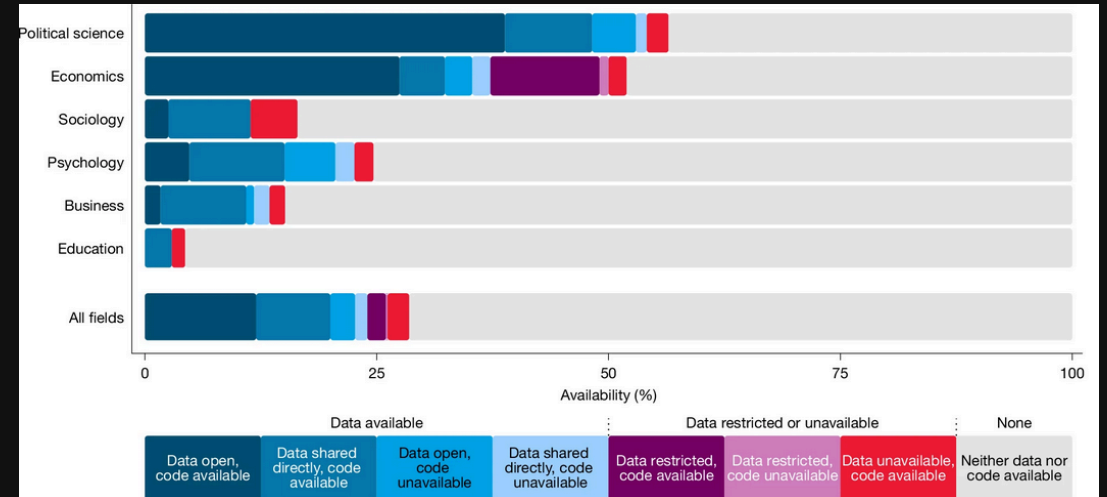


Fig 2, Tyne et al. (2026)

Recent Evidence

A 2026 issue of *Nature* on social science reproducibility:

- Headline: **"Half of social-science studies fail replication test"**
 - But: only 30% of articles yielded data; only 24% were attempted
 - **74% of those attempted** were exactly or approximately **reproducible**

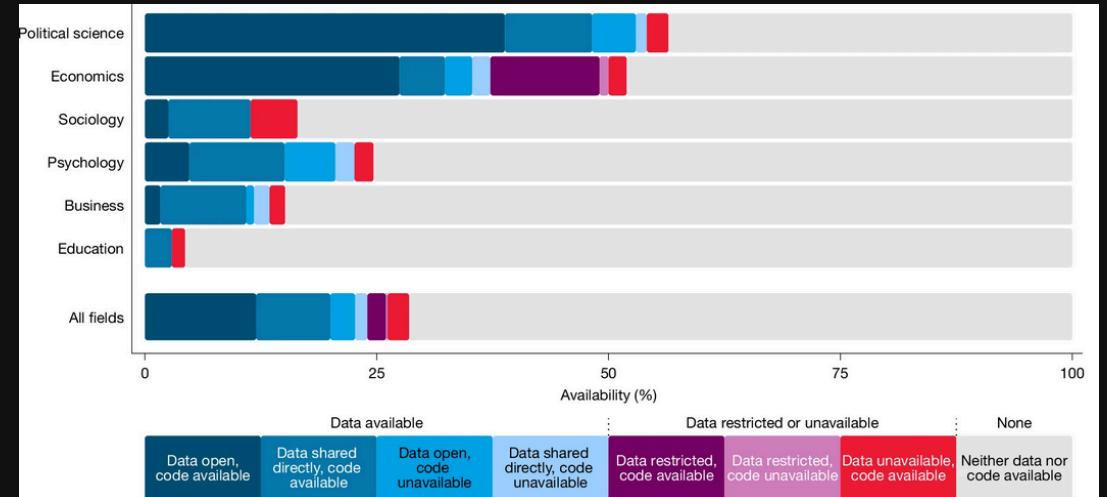


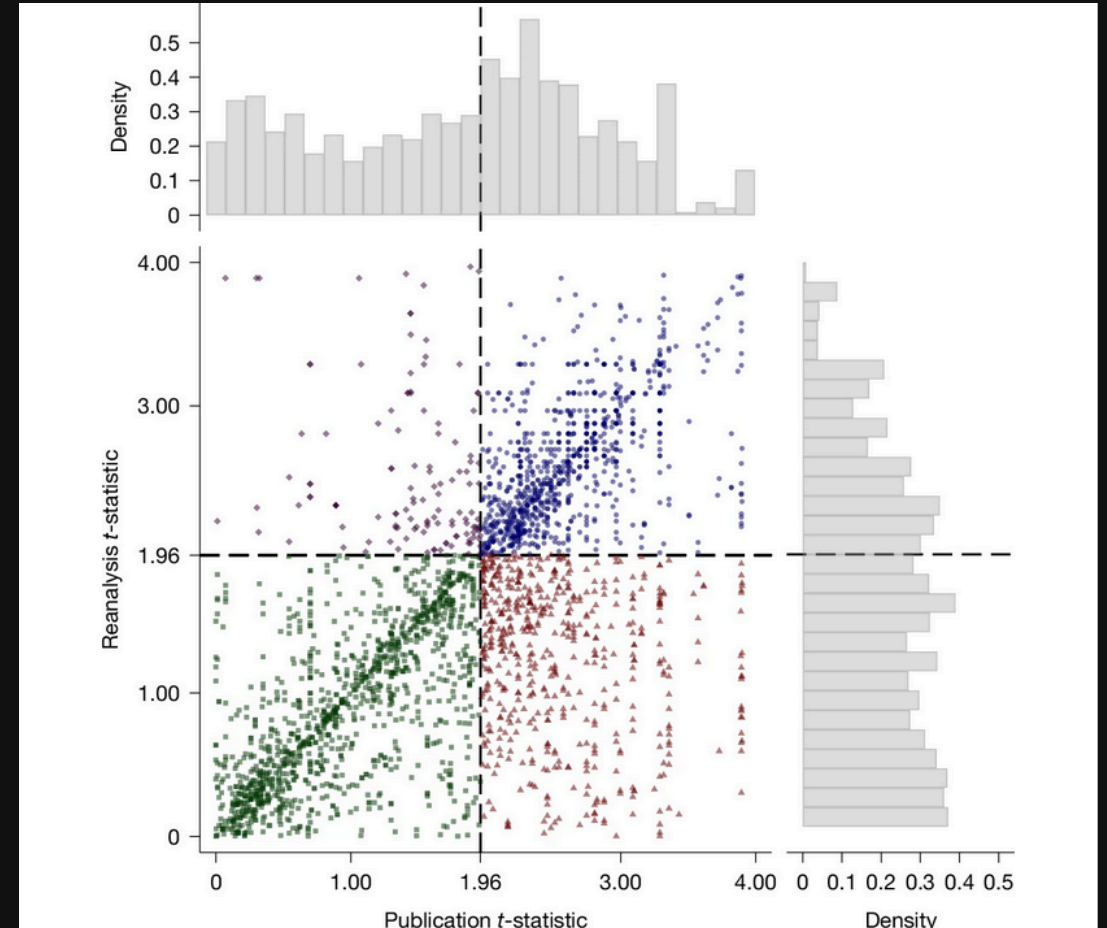
Fig 2, Tyne et al. (2026)



Enormous effort

A 2026 issue of *Nature* on social science reproducibility:

- Brodeur et al. (2026), crowdsourced:
 - **85% of 110 articles** (2022–2023) were reproducible
 - Required **80 replication games** and **3,500+ researchers**



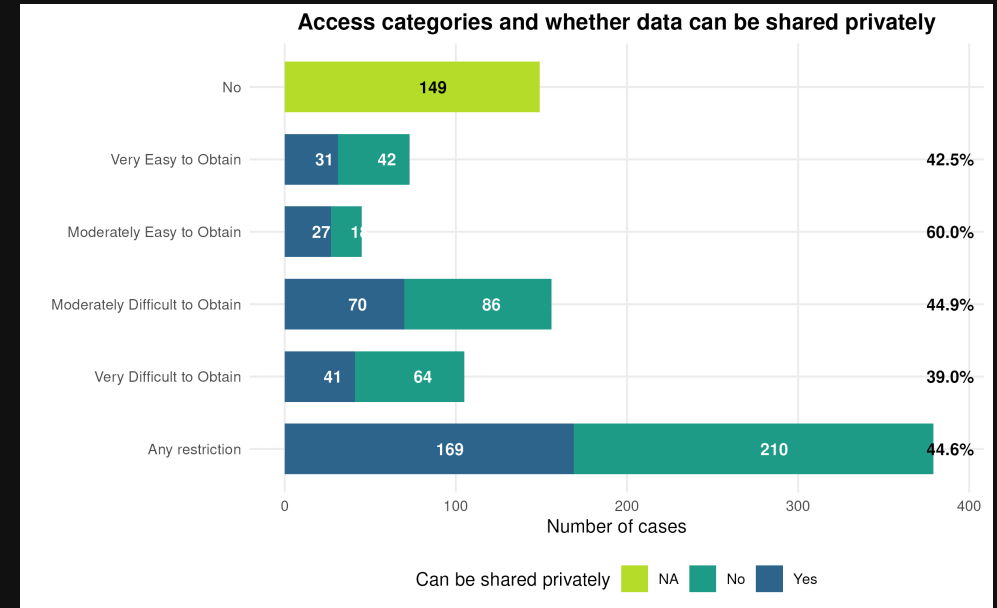
But: Restricted Data Remains Unassessed

None of these studies could access restricted data — entire swaths of social science literature remain outside scope.

The Scale of the Challenge

From the AEA Data Editor's experience (2025, 384 papers assessed):

- **38%** used data with no access restrictions — *in scope for replication studies*
- **62%** used data subject to access restrictions

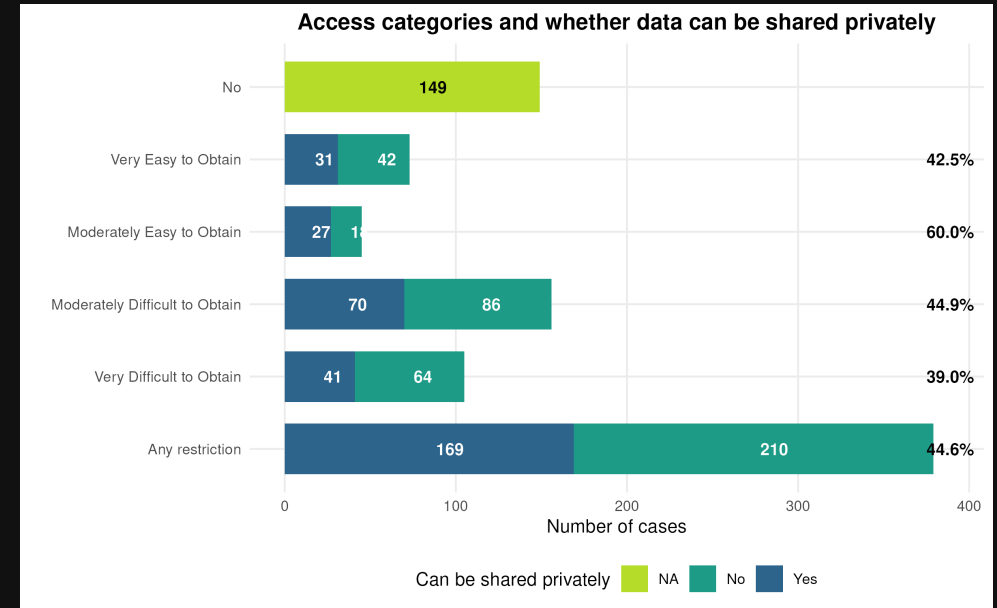


Access categories and data sharing

The Scale of the Challenge

Of those restricted papers:

- The AEA team obtained private access to **45%** of the 62%
- Conducted reproducibility checks despite data not being in public packages



Access categories and data sharing



An information and trust problem



An information and trust problem

- Verification at large cannot ascertain whether replication packages are reproducible.
- Yet many of those same packages are reproducible.
- That fact might rely on trust in data editors, or others.

The Key Question

What if it were possible to credibly demonstrate that the original execution of the computational artifacts occurred in a transparent fashion, even when data cannot be published, and is consistent with the deposited computational artifacts (code) and outputs (figures and tables)?

The Key Question

What if it were not necessary to re-run the code?



Certification

If reproducibility can be **certified at the source**, then:

- Readers can trust results and focus on **robustness**, not reproduction
- Researchers can convey **credibility** even when data cannot be shared
- The **scale** of verification effort **shrinks** dramatically

Certification is not new



Services now provide active verification:

Service	Approach
<i>cascad</i>	Certification service, access to confidential data
World Bank	Internal service, access to confidential data
Codeocean	Containerized capsules with manual compliance checking

The Transparency Gap

When a reproducibility service has re-run code and issued a certificate — **what actually happened?**



The Transparency Gap

Questions that remain unanswered:

- Was work done with input/influence from authors, or in isolation?
- Was internet access available during the run?
- What state was a database in when first queried vs. when the service ran it?
- Was code modified (inadvertently or intentionally) by verifiers?

Absent **standardized protocols or vocabularies**, services remain opaque.

Readers, journals, and researchers cannot compare:

- Codeocean vs. World Bank
- cascad vs. AEA



The TRACE Framework



What is TRACE?

TRACE = Transparency Certified

A framework that allows inquiry into the reproducibility workflow **at any stage** — without requiring re-running the code.



Key insight

Document the **process**, not just the **outputs**

- **File arrangements** (manifests with checksums)
- **Processing steps** (software, timing, method, isolation)
- **Cryptographic signatures** by certifying organizations



Result

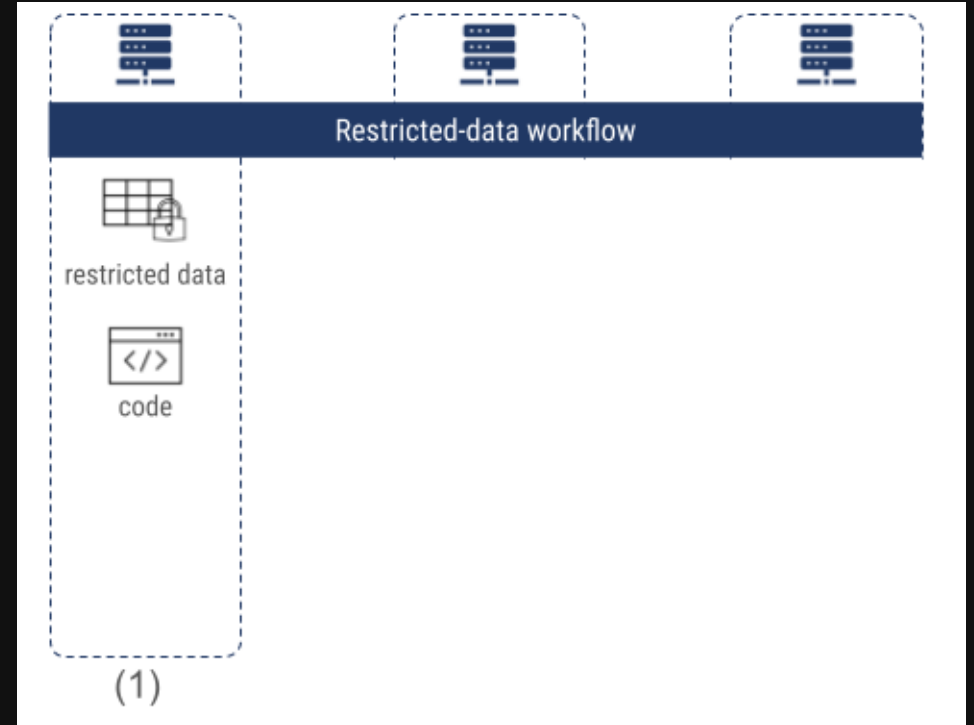
TRACE-compliant packages can be:

- Compared across services (Codeocean vs. World Bank)
- Inspected both by humans and automated scripts
- Trusted via organizational credibility chains

Generic Workflow (Before TRACE)

Consider a researcher using confidential data in a Restricted Access Data Center (RADC):

1. Researcher gets environment with confidential data, writes code

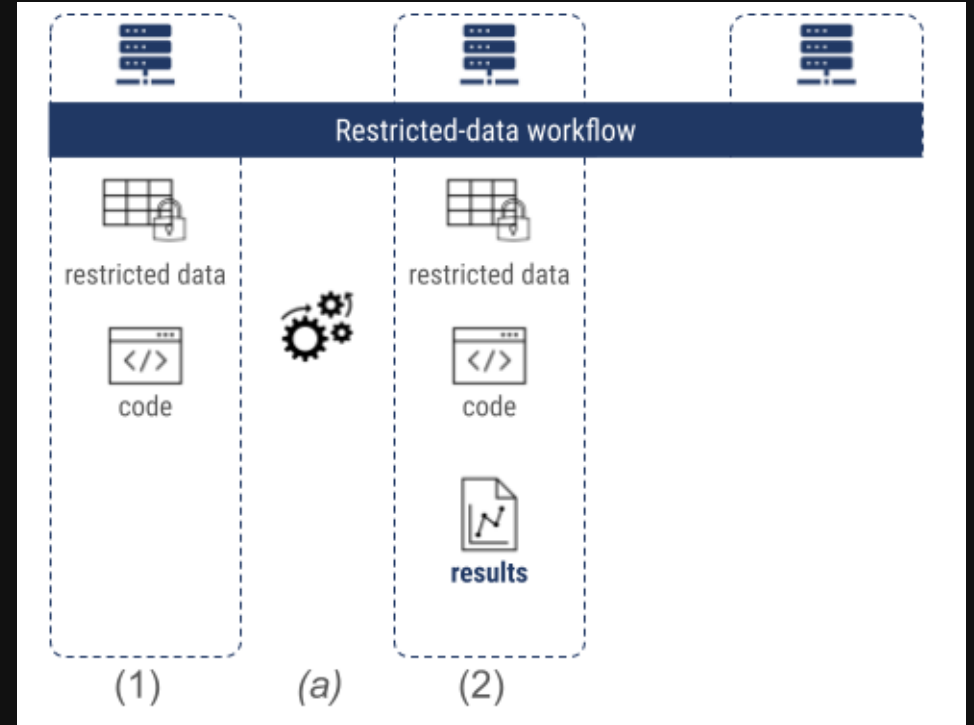


Generic workflow with confidential data

Generic Workflow (Before TRACE)

Consider a researcher using confidential data in a Restricted Access Data Center (RADC):

1. Researcher gets environment with confidential data, writes code
2. Code is executed (a) → output produced

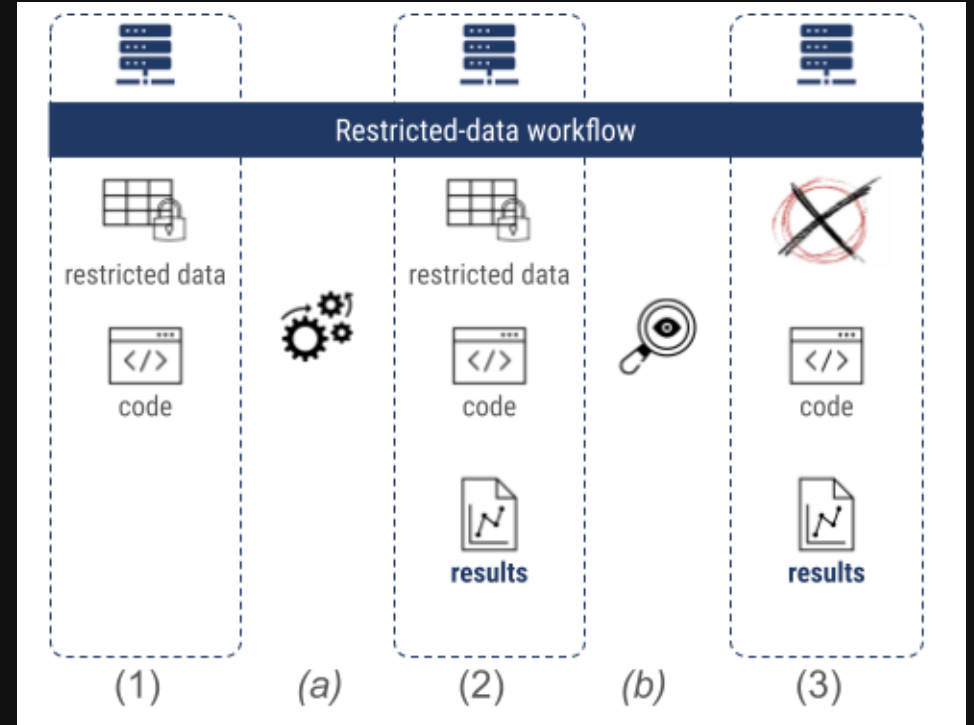


Generic workflow with confidential data

Generic Workflow (Before TRACE)

Consider a researcher using confidential data in a Restricted Access Data Center (RADC):

1. Researcher gets environment with confidential data, writes code
2. Code is executed (a) → output produced
3. Data custodian inspects, removes confidential data (b)
4. Researcher receives code + output only (arrangement 3)



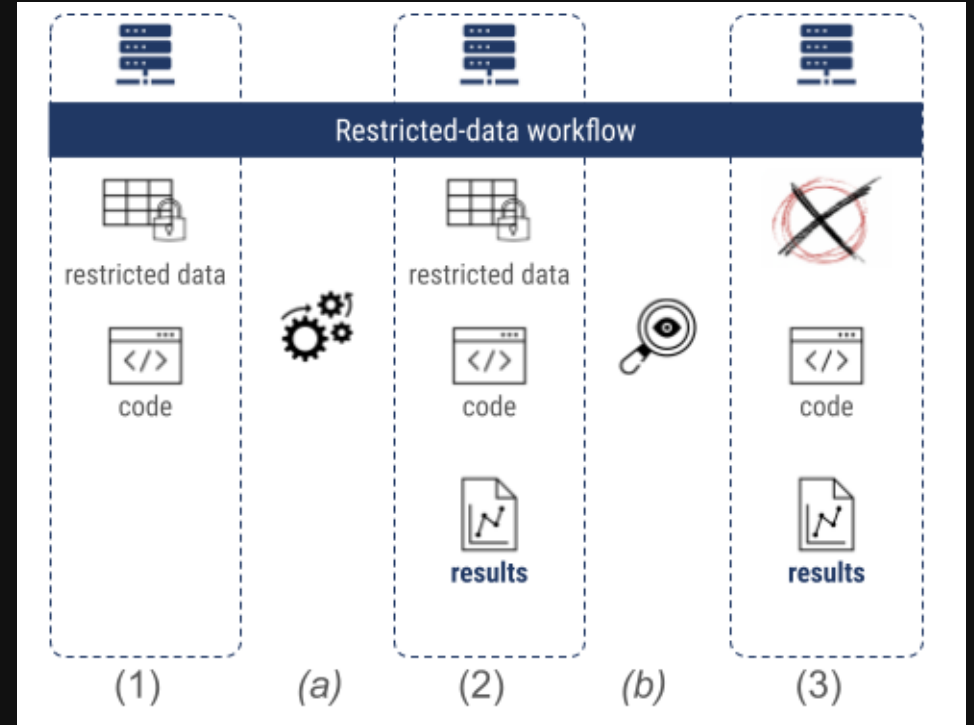
Generic workflow with confidential data

Generic Workflow (Before TRACE)

Problem:

- The World Bank certificate states in English that this process was followed.
- Codeocean points to an FAQ.

Neither is verifiable or machine-readable.



Generic workflow with confidential data

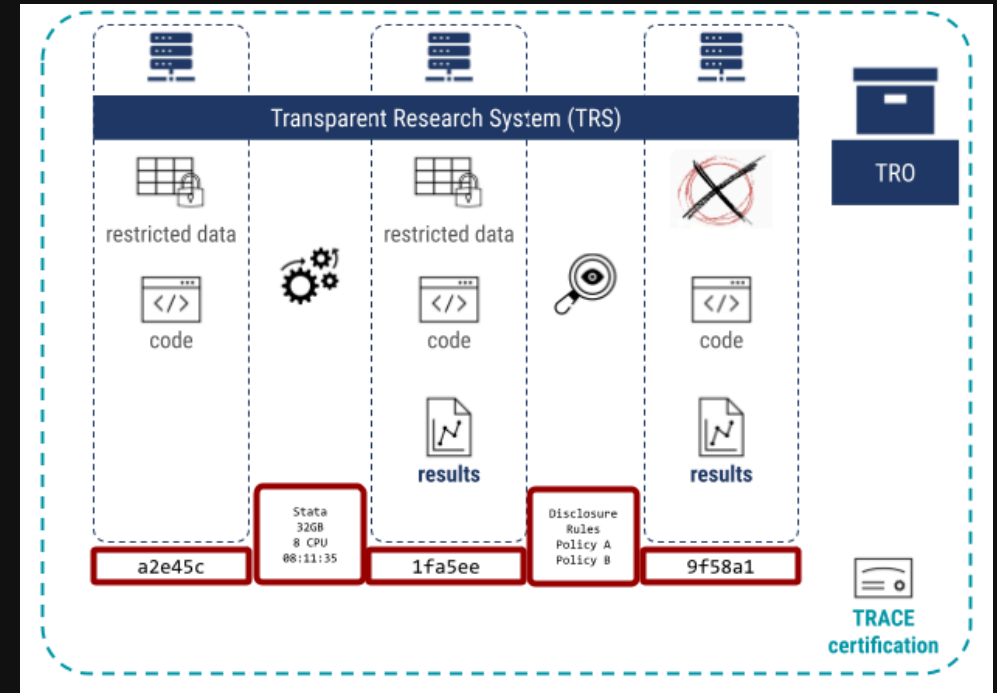
Making a Workflow TRACE-Compliant



Making a Workflow TRACE-Compliant

Add a few computationally easy steps:

1. Document each **file arrangement** (1, 2, 3) with manifests + checksums
2. Describe each **processing step** (software-driven or manual) with salient info

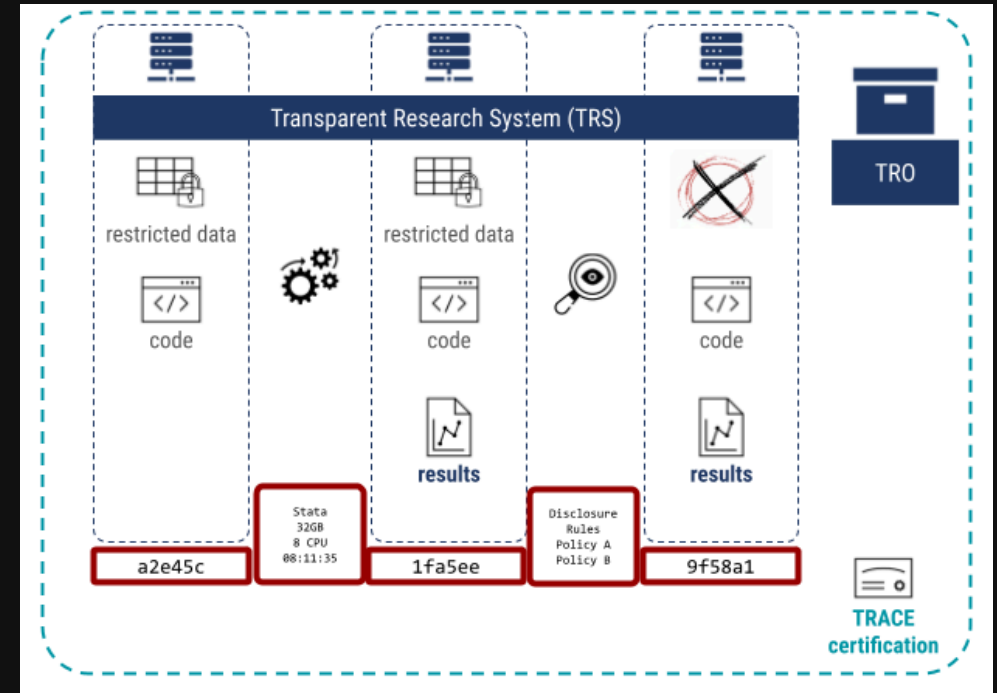


Example Trusted Research System

Making a Workflow TRACE-Compliant

Add a few computationally easy steps:

3. Express in a **controlled vocabulary** (TROV)
4. Wrap everything into a package with a **cryptographic signature** → creates a **TRO**



Example Trusted Research System

Scenarios TRACE Addresses



SCN3 — Restricted access data environments

RADCs have no vested interest in any particular paper — they satisfy the arms-length requirement.

Partners at **central banks** (and World Bank!) are already implementing TRACE-compliant capabilities.

Thank you



Additional info

- Credibly conducting surveys
- Reproducibility when data are confidential
- Sharing not-for-publication data with AEA Data Editor
- More about TRACE and SIVACOR

Further reading

Schmidt, Klaus M., Levent Neyse, Marianne Saam, Doreen Siegfried, Lars Vilhuber, and Joachim Winter. 2026. "**Open Science in Den Wirtschaftswissenschaften: Transparenz, Reproduzierbarkeit Und Zugang.**" Perspektiven Der Wirtschaftspolitik. <https://doi.org/10.1515/pwp-2026-0019>.

Vilhuber, Lars. 2025. "**Reproducibility and Open Science in Economics.**" Revue Économique 76 (5). <https://doi.org/10.3917/reco.765.0697>.





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Appendix

