Ulysses’ Pact or Ulysses’ Raft: Using Pre-Analysis Plans in Experimental and Non-Experimental Research

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Ulysses’ Pact

They bound me hand and foot in the tight ship erect at the mast-block, lashed by ropes to the mast.

— Homer, The Odyssey, Book XII
Ulysses’ Raft

And now the master mariner steered his craft, sleep never closing his eyes, forever scanning the stars.

— Homer, The Odyssey, Book V
The Pact or the Raft?

- Ulysses Pact - pre-commitment to a specific analysis plan
  - Common in law and medicine
  - Minimize the probability of false discoveries
  - Mirrors the way “proper” science is done

- Ulysses Raft - explore the data for discoveries only possible through searching
  - Way economics has always been done
  - Specification search may be the best way for new discoveries
  - Anything else is “impossible” for non-experimental data
Introduction

Outline

- A brief history of pre-analysis plans
- Components of a pre-analysis plan
- Using a pre-analysis plan
- A third way?
Pre-Analysis Plans in Medicine

- Plans have been required by law in the United States for all drug trials since 1997
  - Stated goal was to counter strong incentives of drug companies to find positive results
- In 2004 the twelve journals of International Committee of Medical Journal Editors announced public trial registration would be pre-requisite for publication
  - Stated goal was to counter the “file drawer problem,” where only significant results get published
- ClinicalTrials.gov is where most are registered
  - Pre-2004, registry averaged 1,879 a year
  - Post-2004, registry averaged 22,088 a year
Pre-Analysis Plans in Social Science

- Pre-analysis plans predate registry
- Most commonly sited first studies:
- In 2012 AEA established the AEA RCT Registry
  - Allows for registration of lab and field experiments
- Additional social science registries founded since
  - 3ie’s Registry for International Development Impact Evaluations (RIDIE) - impact evaluations in low income countries
  - Open Science Foundation (OSF) registry - any study
In medical science, there has been a clear distinction between:
- What pre-analysis plans prevent - *p*-hacking/HARKing/Specification Search
- What public registration solve - file drawer problem

In economics, these two have been muddled
- See Olken (2015); Coffman and Niederle (2015); Burlig (2018); Duflo et al. (2020)

Making pre-analysis plans work means understanding the difference between what a plan accomplishes and what a public registry accomplishes
Basic Pre-Analysis Plan

- **Data description**: Describe the process by which data was generated or collected
- **Hypotheses**: Clearly state the research questions and hypotheses to be tested
- **Outcome variables**: List the primary outcome variables as well as any secondary outcomes to be tested.
- **Variable construction**: Precisely define how each outcome and control variable is to be constructed
- **Model specification**: Describe the statistical method of analysis, including covariates and the approach to inference
Comprehensive Pre-Analysis Plans

- **Motivation**: Provide motivation and context for the study. A review of the literature can be helpful.

- **Theoretical model or theory of change**: The model to be tested or causal diagram that justifies the selected hypotheses.

- **Multiple inference adjustments**: Address how multiple inference will be dealt with. Either Familyweise Error Rate (FWER) or False Discovery Rate (FDR).

- **Data cleaning**: Outline basic operating principles for how data cleaning will be conducted, such as windsorizing outliers, correcting for attrition, and adjusting for contamination.
Components of a Pre-Analysis Plan

Comprehensive Pre-Analysis Plans

- **Subgroup analysis**: Describe any subgroup or heterogeneity analysis.
- **Power calculations**: If data allows, include information on sample size and power calculations.
- **Exploratory analysis**: What questions/methods/techniques are you unsure about but might want to explore.
Prevent $p$-Hacking

- Forming a Ulysses Pact is a good way to prevent $p$-hacking
- It binds the researcher to limit “research degree of freedoms”
- Important when there are strong incentives to cheat (drug trials)
- Or, when there is leeway for what researchers can “discover”
  - Coffman and Niederle (2015) - economic theory limits what a research might “find”
  - Brodeur et al (2016) - little evidence of $p$-hacking in experiments
Solve the File Drawer Problem

- Ulysses Pacts don’t solve the file drawer problem but public registries do
- Regardless of the empirical methods a “hypotheses registry” creates a database on the universe of research questions asked
- Pre-analysis plans and public registries work together but are not the same thing
  - Registered reports at *Journal of Development Economics*, the *Journal of Accounting Research*, *The Review of Financial Studies*, and *PLOS One*
Pre-Analysis Plans for Observational Studies

- Typical history of pre-analysis plans in econ start with two RCTs (Casey et al. and Finkelstein et al.) both in *QJE*
- First published paper with a pre-analysis plan in econ was Neumark (2001) in *Industrial Relations*
  - Neumark tests impact of increase of minimum wage on employment
  - Developed pre-analysis plan prior to use of new data
  - Submitted plan to editors ahead of data release
  - Neumark (2020) uses same process to test effects of CA minimum wage law
- Econ has muddled the point, it has focused on pre-analysis plans for experiments only
- No reason why pre-analysis plans & registries can’t be used in observational studies - especially to solve the file drawer problem
Pre-Analysis Plans for Replication

- There has been recent growth in pre-analysis plans for replications
- Restrict incentives to find positive results ($p$-hacking)
- Replications have limited scope for “exploration” (no loss of freedom from Ulysses raft)
- Protects against accusation of bias in undermining a famous study
- Andrew Chang (US Fed) has 6 replications studies in which he filed pre-analysis plans
Pre-Analysis Plans for Teaching

- Grad students frequently struggle to articulate their research question or method
- Pre-analysis plans (registered or not) can help focus grad student ideas
- Easy to make part of a prospectus or an assignment for a research methods course
- Extremely helpful in giving guidance to students that are part of a large project
Pre-analysis plans are an Ulysses’ pact
- They bind the researcher to a plan
- They prevent p-hacking but also the ability to explore
- Registering them helps solve the file drawer problem
- In econ, focus has been on RCTs

Typical econ uses an Ulysses’ raft
- Allows researchers to explore messy social science data
- Does not limit the questions we can ask to what we think we might have know ahead of time
- Could register exploratory work to solve the file drawer problem
- In econ, been excluded from pre-analysis and registry discussion
Of immense value in a country where the want of wood renders it impossible to form any sort of raft.

— French explorer Joseph Renè Bellot
Value of the Packraft

- A packraft is a portable inflatable boat first designed in the 1840s for use in exploring the Canadian arctic
- The researcher develops a basic pre-analysis plan and files it with a public registry
- Unlike a binding pact, researchers are allowed to update the plan as new information arises as in ArXiv
- Transparency about deviations from the original plan allows for flexibility, while also addressing issues of \( p \)-hacking
- Encourages a disciplinary practice of telling readers at what point in the research process (and for what reason) a particular model emerged
Promoting the Packraft

- AEA registry should allow for studies beyond RCTs
- Other association journals should mandate pre-registration for:
  - Studies that collect new data
  - Studies that claim to establish causal relationships
- Basic pre-analysis plans should be the norm for conducting good economic science
- Public registration of a study’s objectives should be the norm in economics
- Registered plans should be allowed to deviate as long as deviations are documented
Ulysses’ Journey Continues

Then go, taking with you a well-shaped oar,
until you come to people who know nothing of the sea.

— Homer, The Odyssey, Book XI