



# Improving transparency in observational social science research: A pre-analysis plan approach

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## HIGHLIGHTS

- Existing transparency efforts in economics have focused on randomized trials.
- Improving economics broadly requires transparency in quasi-experiments.
- Pre-analysis plans can be used in certain observational data contexts.
- Prospective analysis, new data, and confidential data enable preregistration.

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## ABSTRACT

Social science research has undergone a credibility revolution, but these gains are at risk due to problematic research practices. Existing research on transparency has centered around randomized controlled trials, which constitute only a small fraction of research in economics. In this paper, I highlight three scenarios in which study preregistration can be credibly applied in non-experimental settings: cases where researchers collect their own data; prospective studies; and research using restricted-access data.

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## 1. Introduction

In the wake of serious criticism of applied research (Hendry, 1980; Leamer, 1983), economics has undergone a credibility revolution (Angrist and Pischke, 2010). New data and an emphasis on research designs for causal inference has improved the rigor and believability of modern empirical research in economics. At the same time, there is a growing concern that existing research practices stand to undermine these gains (Miguel et al., 2014; Christensen and Miguel, forthcoming). Several studies from across the social sciences have documented a variety of issues in existing research, including publication bias (Rosenthal, 1979; Franco et al., 2014); specification search (Humphreys et al., 2013; Brodeur et al., 2016); bias and failures to replicate (Open Science Collaboration, 2015; Camerer et al., 2016; Ioannidis et al., 2017); and outright

fraud (Simonsohn, 2013 and Brockman et al., 2014).<sup>1</sup> This research raises concerns about the validity of empirical work in economics and in social science more generally.

In light of this evidence, new research advancing transparency practices in the social sciences has begun to emerge (Miguel et al., 2014; Nosek et al., 2015; Christensen and Miguel, forthcoming). One of the most popular tools for reducing publication bias and specification search in economics is study pre-registration using pre-analysis plans, wherein researchers submit a document describing the analysis they plan to carry out to a registry prior to accessing the data they will use. By creating a public record of proposed hypotheses, pre-analysis plans guard against the so-called “file drawer problem”, and reduce *ex post* researcher degrees

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<sup>1</sup> See Christensen and Miguel (forthcoming) for a broad overview of problematic research practices in multiple social science fields, including economics.

of freedom (Casey et al., 0000; Finkelstein et al., 2012). Study pre-registration is increasingly common in economics — since its inception in 2013, the American Economic Association’s randomized controlled trial (RCT) registry has grown to include 1453 studies across 115 countries.<sup>2</sup> The nature of the registry itself is representative of the current state of pre-registration in economics: it only accepts pre-analysis plans for randomized controlled trials (RCTs). Up to this point, the vast majority of pre-registered research in economics has been for experimental designs. In general, registration-based methods for improving transparency in the social sciences have been targeted at experimental research alone, in large part because it is difficult to credibly pre-register observational work (Miguel et al., 2014; Christensen and Miguel, forthcoming).

The challenges with pre-registering observational research are particularly problematic because only a small fraction of published papers in economics are experiments: in 2010, only 3% of papers in top journals were field RCTs (Card et al., 2011). Fig. 1 presents the fraction of non-experimental empirical papers published in the *American Economic Review*, the *Journal of Political Economy*, and *The Quarterly Journal of Economics* between 2005 and 2011, using data from Brodeur et al. (2016). Over this time period, non-experimental work — across journals and fields — made up approximately 80 percent of published empirical research in these journals. As a result, addressing the credibility issues in empirical economics must involve advances for observational research.<sup>3</sup>

The only known example of a published observational economics paper that was credibly pre-registered is Neumark (2001), who prospectively specified an analysis to estimate the impacts of a federal minimum wage increase in the United States (Neumark, 1999). There is an active debate in the sciences about pre-registration of observational work (see *Epidemiology* (2010), *BMJ* (2010), *The Lancet* (2010), *PLOS Medicine* (2014) and Dal-Ré et al. (2014)). However, Christensen and Miguel (forthcoming) note that “there is often no credible way to verify that pre-registration took place before analysis was completed...in our view, proponents of the pre-registration of observational work have not formulated a convincing response to this obvious concern”.

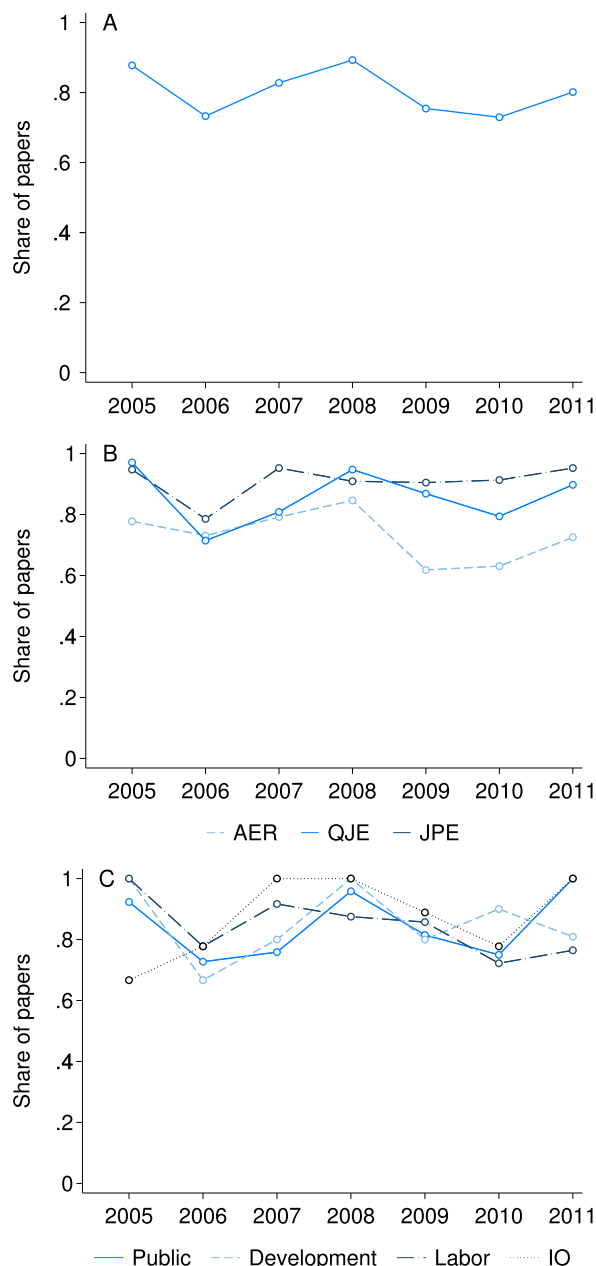
In this paper, I contribute to the growing literature on research transparency in the social sciences by outlining three scenarios in which observational research can be credibly pre-registered. Researchers can use pre-analysis plans for observational research when they collect their own data — as in RCTs; when the study design involves events that have not yet occurred or the future public release of datasets; and when research involves restricted-access data. In these cases where researchers can credibly register analysis plans prior to accessing, pre-analysis plans can improve transparency in observational research.

## 2. What is a pre-analysis plan?

Broadly speaking, a pre-analysis plan is a document wherein a researcher outlines her planned empirical analysis before having an opportunity to access her data. In order for the pre-analysis plan to be credible, the researcher needs to submit the pre-analysis plan to a (public) registry, which archives and timestamps the pre-analysis plan, preventing it from being altered after the researcher

<sup>2</sup> The registry can be found online at <https://www.socialscisearch.org/>; these numbers are current as of October 26, 2017.

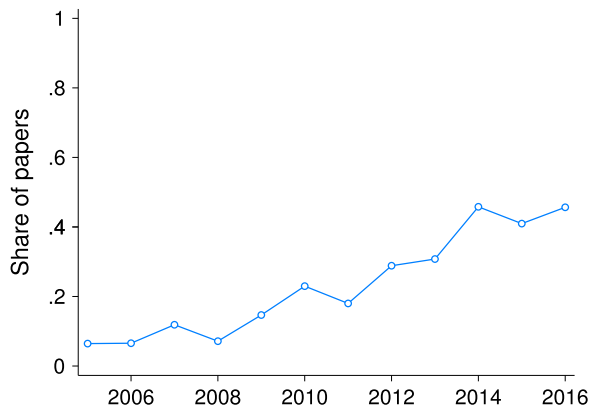
<sup>3</sup> Furthermore, researchers have suggested that pre-registration of experiments is not extremely valuable (Coffman and Niederle, 2015; Olken, 2015), in part because there are strong norms around the presentation of results from papers using randomized controlled trials. The GoBifo experiment detailed in Casey et al. (0000) is an important empirical counterpoint to this argument.



**Fig. 1.** Non-experimental papers represent the bulk of economics research. *Notes:* This figure presents the fraction of empirical papers that appeared in the *American Economic Review*, *The Quarterly Journal of Economics*, and the *Journal of Political Economy* that used non-experimental research designs (i.e., were not lab experiments or RCTs). The data are taken from Brodeur et al. (2016). Panel A presents data for the full sample; Panel B shows the data by journal, and panel C shows the data across four large microeconomics fields. In all cases, the majority of papers are non-experimental.

gains access to her data.<sup>4</sup> Pre-analysis plans are valuable tools for research transparency in two main ways. First, they contain a record of planned analyses, which guards against publication bias. Second, pre-analysis plans “tie a researcher’s hands” against (intentional or unintentional) specification search, data mining,

<sup>4</sup> Prominent registries in the social sciences include the American Economic Association’s RCT registry: <http://www.socialscisearch.org/>, the Experiments in Governance and Politics registry: <http://egap.org/design-registration/>, the Registry for International Development Impact Evaluations: <http://ridie.3ieimpact.org/>, and the Open Science Framework: <https://osf.io/>.



**Fig. 2.** Data policy exemptions are increasing over time. *Notes:* This figure presents the fraction of papers in the *American Economic Review* that had an exemption from the journal's data policy as a share of all empirical papers in the journal. I collected the data from the May (Papers and Proceedings) issues of the 2006–2017 *American Economic Review*. The fraction of papers with an exemption from the data policy is steadily rising over time, with more than 45 percent of empirical papers exempted from the policy in 2016.

“p-hacking”, or selective presentation of hypotheses. Finally, pre-analysis plans allow for credible adjustments for multiple hypothesis testing by laying the set of hypotheses that will be tested *ex ante*.<sup>5</sup> While pre-analysis plans remain relatively uncommon in the social sciences, study preregistration has a successful history in the medical sciences, where registration of clinical drug trials is both mandatory for publication in top medical journals and required under U.S. law.

### 3. Credible pre-registration for observational research

In order for a pre-analysis plan to improve transparency, researchers must be able to credibly demonstrate that it was registered prior to accessing the data. This has been a major barrier to pre-registration of observational research, because much observational research is performed on data that are already publicly available. There are, however, three key scenarios in which observational research can be credibly pre-specified: cases in which researchers collect their own data; prospective research studying future events or designed around future releases of public data; and research using restricted-access data. In all three cases, there are substantial barriers to accessing the data, which researchers can leverage to register a credible pre-analysis plan.

#### 3.1. Researcher-generated data

A non-trivial amount of observational research involves researchers generating their own survey data. In these cases, as in RCTs, researchers can simply pre-register their analysis plan before data collection occurs. This is perhaps the easiest scenario in which to pre-register observational research, as researchers are intimately familiar with the structure of the dataset – and may even have conducted some pilot surveys – before getting access to the final version. When researchers collect their own data, worries about being “locked in” to an analysis plan only to find that a key variable is defined differently than expected ought to be assuaged. Despite the obvious overlap between cases where researchers collect their own data in RCTs and those where researchers collect their own data for quasi-experimental analysis, to the best of my knowledge, pre-specification of this type of observational research has not been discussed in the existing literature.

<sup>5</sup> See Anderson (2008), Fink et al. (2014), List et al. (2016), and Casey et al. (0000) for further detail on multiple testing corrections.

#### 3.2. Prospective analysis

Neumark (1999, 2001) pre-registered an analysis plan for studying the impact of the October 1996 U.S. federal minimum wage increase. Neumark included estimating equations, variable definitions, and groups for heterogeneity analysis in his pre-analysis plan, which he submitted to *Industrial Relations* prior to the May 1997 release of the Current Population Survey data that he planned to use. Neumark was therefore able to credibly register an observational research design by *prospectively* submitting his analysis plan before the release of the necessary data.

In a recent example from political science, the Election Research Preacceptance Competition encouraged researchers to pre-register observational research on the 2016 general election prior to the March 2017 release of the ANES dataset.<sup>6</sup> Many datasets lend themselves to prospective pre-specification: both the American Census Bureau and IPUMS publish data release dates well in advance; and other research organizations such as the World Bank often announce when particular surveys are in the field. Better yet, many of the survey instruments used to generate these and other large administrative datasets are published in advance of the data being made available, which makes detailed pre-specification possible.

In addition to pre-specifying observational research prior to data being made publicly available, researchers can also credibly pre-specify observational research about future events. Researchers often know about policy changes or other economically meaningful events before they actually occur, and could therefore pre-specify an observational research design prior to the event.<sup>7</sup>

By pre-specifying a research design before the necessary data are released, or prior to a shock itself, researchers can credibly claim that they could not have explored the relevant data prior to registering the pre-analysis plan.

#### 3.3. Restricted access data

Finally, research in economics is increasingly reliant upon proprietary, confidential, or restricted-access data. In the *American Economic Review*, for example, the fraction of papers requesting exemptions from the journal's open data policy rose from 6.5 percent in 2005 to over 45% by 2016 (the most recent year of data). Fig. 2 displays the fraction of papers with exemptions over time. While this poses some challenges to transparency in general, it also represents an opportunity for pre-registered observational research. In general, researchers request access to these restricted data, which generates a time-stamped “paper trail”. So long as the researcher registers her pre-analysis plan prior to being granted access to a confidential or otherwise restricted dataset, she can credibly pre-specify her empirical approach. Sharing confidential data usually comes with severe penalties, so in most cases, it is unlikely for researchers to be able to engage with the data prior to being granted official access.

Furthermore, researchers are usually required to submit a document detailing what they wish to do with the data in order to gain access. In many cases, expanding this into a formal pre-analysis plan will involve relatively little work. It is easy to imagine employing this method when using confidential census microdata; when using data from a healthcare provider, utility, or other corporation; or any other type of data controlled by a non-disclosure agreement.

In some cases, it may also be possible to credibly pre-specify observational research using data that are available for purchase.

<sup>6</sup> More details can be found here: <https://www.ercp2016.com/>.

<sup>7</sup> This would allow a researcher to pre-specify a design that leverages data that are made available in real time, such as information on social media platforms.

In principle, any time where there is a significant barrier to accessing the necessary data, researchers can pre-specify observational research, but the burden remains on the researcher to prove that she has not had access to the data prior to writing her pre-analysis plan.<sup>8</sup> In the case of data that are for sale, researchers should pre-specify their analysis prior to buying the data, and should append the pre-analysis plan with a copy of the data purchase receipt, dated after the original plan was filed. The more expensive the data are, and the more severe are the penalties for sharing the data, the more credible this approach becomes.

#### 4. Discussion

It is important to recognize that not every observational study can be credibly pre-specified. Pre-registration should not, therefore, be broadly required for observational research. There are many examples of excellent observational research that leverages publicly available existing data where a pre-analysis plan would have provided little-to-no benefit. The goal of encouraging more pre-registration in observational research is to improve transparency in situations where this is feasible, rather than to cast dispersions on work where this is not possible.

Similarly, *ex post* deviations from pre-analysis plans should be permitted. From a practical standpoint, pre-analysis plans can include mistakes or omit estimation that is clearly in keeping with the remainder of the analysis in the plan. When this happens, researchers should simply present all of the pre-specified research, and should also include corrected or forgotten analyses as well. In addition, researchers stand to learn from exploratory work. Having a pre-analysis plan for a paper's main hypotheses should not preclude researchers from conducting additional analysis — or from including this additional work in a paper alongside pre-specified research. In these cases, researchers simply need to clearly indicate which results were not pre-specified.<sup>9</sup>

#### 5. Conclusion

Ensuring that the credibility revolution in empirical economics is not undermined by questionable research practices requires new work on research transparency methods for the social sciences. The majority of existing research in this area has focused on randomized controlled trials which, while an important component of modern economics research for their causal identification benefits, still represent only a small fraction of empirical research in economics. Improving transparency in economics more broadly will require new approaches to transparency that can be used in observational research.

In this paper, I suggest three settings in which pre-analysis plans, tools which guard against publication bias and limit researcher degrees of freedom, can credibly be used in observational research: cases where researchers collect their own data; prospective studies; and research using restricted-access data. The use of restricted-access data in particular is rapidly gaining in popularity, so pairing transparency methods with these types of data has the potential to generate significant progress towards improved transparency in non-experimental empirical research in economics. Future research should seek to develop new techniques — such as split-sample methods — that can be used to perform exploratory analysis on part of a dataset prior to pre-registration, and to further develop “data-adaptive” approaches to pre-specification, allowing pre-analysis plans to be both detailed and flexible enough to accommodate researcher learning.

<sup>8</sup> Simply having to fill out an online form prior to downloading data, as is required to access various World Bank datasets, would likely not constitute a sufficient barrier to entry, because the costs of data access are so low, because these data are easy to access.

<sup>9</sup> Finkelstein et al. (2011) do this by assigning a special character (“”) to non-pre-specified results, allowing readers to search for these symbols.

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#### Appendix A. Data Appendix

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.econlet.2018.03.036>.

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