Léo Zabrocki

CONTACT

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CURRENT POSITION

PhD Student, Paris School of Economics & EHESS
Advisor: Hélène Ollivier (CNRS, PSE)
Title: Improving the Design of Air Pollution & Human Health Studies
Primary Fields: Environmental & Health Economics
Secondary Fields: Causal Inference & Metascience

REFERENCES

Professor Hélène Ollivier
Paris School of Economics
CNRS
48 Boulevard Jourdan
75014 Paris, France
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Professor Tarik Benmarhnia
University of California, San Diego
Scripps Institute and School of Medicine
8880 Biological Grad
La Jolla, CA 92037
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Dr. Marie-Abèle Bind
Massachusetts General Hospital
Biostatistics Center
50 Staniford Street
Boston, MA 02114
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EDUCATION

PhD Candidate at the Paris School of Economics & EHESS	2018-2022
Graduate studies at the Ecole Normale Supérieure	2014 - 2018
Master in Public Policy and Development, Paris School of Economics	2016 - 2018
Visiting student, Middleburry College (Vermont, US)	2015 - 2016
Intensive Program in Liberal Arts, Janson de Sailly	2012 - 2014

RESEARCH PAPERS

"**Why Acute Health Effects of Air Pollution Could Be Inflated**", with Vincent Bagilet (PhD student, Columbia University), *Job Market Paper*.

Accurate and precise measurements of the short-term effects of air pollution on health play a key role in setting air quality standards. Yet, statistical power calculations are rarely—if ever—carried out. We first collect estimates and standard errors of all available articles found in the standard epidemiology and causal inference literatures. We find that nearly half of them may suffer from a low statistical power and could thereby produce statistically significant estimates that are

actually inflated. We then run simulations based on real data to identify which parameters of research designs affect statistical power. Despite their large sample sizes, we show that studies exploiting rare exogenous shocks such as transport strikes or thermal inversions could have a very low statistical power, even for plausibly large effect sizes. Our simulation results indicate that the observed discrepancy in the literature between instrumental variable estimates and non-causal ones could be partly explained by the inherent imprecision of the two-stage least-squares estimator. We also provide evidence that subgroup analysis on the elderly or children should be implemented with caution since the average number of events for an health outcome is a major driver of power. Based on these findings, we build a series of recommendations for researchers to evaluate the design of their study with respect to statistical power issues.

"**Air Pollution Impacts of Cruise Traffic: A Causal Inference Approach**, with Marion Leroutier (Missum-SSE) & Marie-Abèle Bind (MGH), *Submitted*.

The air pollution and health effects of cruise vessel traffic is a growing concern in the Mediterranean area. We propose a novel methodology based on high-frequency observational data to estimate the causal effects of maritime traffic on pollution, which we apply to cruise traffic in Marseille, a large Mediterranean port city. Using a new pair-matching algorithm designed for time series data, we create hypothetical randomized experiments and estimate the change in air pollution caused by a short-term increase in cruise traffic. We carry out a randomization-based approach to quantify uncertainty and compute 95% Fisherian intervals (FI) consistent with the matched data. Cruise vessels' arrivals increase city-level hourly concentrations of nitrogen dioxide (NO_2) by 4.7 $\mu g/m^3$ (95% FI: [1.4, 8.0]) and of particulate matter (PM_{10}) by 4.6 $\mu g/m^3$ (95% FI: [0.9, 8.3]). At the daily level, one cruise vessel entering the port increases daily NO_2 concentrations by 2.3 $\mu g/m^3$ (95% FI: [0.1, 4.6]). Our results suggest that well-designed hypothetical randomized experiments provide a principled approach to better understand the negative externalities of maritime traffic.

"**Measuring the Influence of Wind on Air Pollution Using a Causal Inference Pipeline**", with Tarik Benmarhnia (UCSD) & Anna Alari (INSERM-UPMC), *Submitted*.

Changes in wind patterns can substantially alter the air pollution level of a city. It is however not straightforward to statistically estimate this relationship. Since wind variations are not randomly distributed over time and are related to other weather parameters influencing air pollution, researchers must adjust for these confounding factors. As an alternative to current practices, we implement a causal inference pipeline to embed an observational study within an hypothetical randomized experiment. We illustrate this new approach for air pollution studies using 4018 daily observations from Paris, France, over the 2008-2018 period. Following the Neyman-Rubin potential outcomes framework, we first define our treatment of interest as the effects on several air pollutant concentrations of North-East winds (824 units) compared to other wind directions (3194

units). We then use a matching algorithm to approximate a pair randomized experiment resulting only in 119 matched pairs. By pruning many units, matching allows us to adjust nonparametrically for observed confounders while avoiding model extrapolation to treated days without similar control days. Once the balance of treated and control groups was deemed satisfactory, we estimate the average differences in air pollutant concentrations and their sampling variability using Neymanian inference. We find that North-East winds increase PM_{10} concentrations by 4.8 $\mu g/m^3$ (95% CI: 2.6, 6.9). As in any observational studies, an unobserved confounder could bias our results. We therefore carry out a sensitivity analysis which reveals that an unobserved variable 2 times more common among treated units could make our data compatible with small negative effects up to very large effects (95% CI: -0.5, 10.6). Our causal inference approach should make researchers aware that finding the subset of similar observations to estimate more credibly the effects of wind patterns on air pollution may be more difficult than previously thought.

RESEARCH IN PROGRESS

"**The Trade-Off Between Omitted Variable Bias and Type M Error**", Vincent Bagilet (PhD student, Columbia University).
"**The Effects of Air Pollution Exposure during Pregnancy on Children's Health and Cognitive Outcomes**", with Marion Davin & Emmanuelle Lavaine (University of Montpellier).
"**The importance of implementing a design stage in environmental epidemiology: an overview of matching techniques to balance pre-exposure covariates**", with Tarik Benmarhnia and Marie-Abèle Bind.
"**Improving Instrumental Variables Design to Better Estimate the Acute Health Effects of Air Pollution**", with Tarik Benmarhnia.

OTHER WORKS

"**Individual and Environmental Risk Factors for COVID- 19 Mortality in Elderly**", with Thomas Bourdel *et al.*, Submitted.
"**The effects of an air quality alert program on premature mortality: A difference-in-differences evaluation in the region of Paris**, with Anna Alari, Lara Schwarz, Géraldine Le Nir, Basile Chaix and Tarik Benmarhnia, *Environment International* (2021).

RESEARCH EXPERIENCES

RA in Cognitive science & Digital Humanities (ENS Ulm)	2014 - 2020
RA in Development economics (IRD-DIAL)	2017
RA in Public economics (Middlebury College)	2016

GRANTS

Teaching Fellowship at the Ecole Normale Supérieure	2021 - 2022
Doctoral Fellowship from the French Ministry of Higher Education	2018 - 2021

CONFERENCES & SEMINARS

Columbia SusDev Colloquium, IPWSD, M&A's Lab, FAERE annual conference, PSE Regulation and Environment Seminar, PSE Lunch Seminar, TEPP conference, AASLE conference	2021
EAERE annual conference, FAERE annual conference, PSE Regulation and Environment Seminar, PSE Applied Economics Seminar	2020
PSE PhD Students Seminar, NORTFACE Workshop	2019

TEACHING

Introduction to Microeconomics (TA)	Ecole Normale Supérieure	2021 - 2022
Economics for Scientific Students (PI)	Ecole Normale Supérieure	2021 - 2022
Introduction to Economics Research (PI)	Ecole Normale Supérieure	2021 - 2022
Economics Lunch Seminar (PI)	Ecole Normale Supérieure	2021 - 2022
Design and Analysis of Experiments (PI)	PSL University	2020 - 2021
Introduction to Linear Regression (TA)	PSL University	2020
Introduction to Empirical Research (TA)	PSL University	2018 - 2019

LANGUAGES & SKILLS

Programming: R, QGIS, LaTeX
Languages: French (native) and English (fluent)