

# FACUNDO ARGAÑARAZ

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## Education

### Universidad Carlos III de Madrid

Ph.D. in Economics, 2021-2025 (Expected).

### The University of Chicago Booth School of Business

Academic visit, Spring 2024.

### Universidad Carlos III de Madrid

Master's Degree in Economic Analysis (Top GPA in cohort), 2019-2021.

### Universidad Nacional de Tucumán

Bachelor's Degree in Economics (Top GPA in cohort), 2013-2018.

## Fields

Econometrics; Causal Inference; Semiparametrics; Machine Learning

## References

Professor Juan Carlos Escanciano (Ph.D. supervisor)

**Universidad Carlos III de Madrid**

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Professor Jesús Gonzalo

**Universidad Carlos III de Madrid**

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Professor Christian Hansen

**The University of Chicago**

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## Job Market Paper

### [Automatic Debiased Machine Learning of Structural Parameters with General Conditional Moments \(2024\)](#)

**Abstract:** This paper proposes a method for conducting inference on finite-dimensional parameters in models defined by a finite number of conditional moment restrictions (CMRs), with possibly different conditioning variables and endogenous regressors. CMRs are allowed to depend on non-parametric components, which might be flexibly modeled using Machine Learning tools, and non-linearly on finite-dimensional parameters. Inference is based on constructing locally robust/orthogonal/debiased moments, in a data-driven or automatic way, extending these to accommodate CMRs. Those moments are less affected by regularization bias, which is relevant to machine learning first steps and typically invalidates standard inference. The key step in this construction is the estimation of Orthogonal Instrumental Variables (OR-IVs)—“residualized” functions of the conditioning variables, which are then combined to obtain a debiased moment. Our strategy exploits the CMRs implied by the model in a general way and can thus be applied to a wide range of settings, where the construction of orthogonal moments has remained unexplored, including highly non-linear and complex settings with CMRs, prominent in economics. We argue that computing OR-IVs necessarily requires solving potentially complicated functional equations, which depend on unknown terms. However, by imposing an approximate sparsity condition, our method automatically finds the solutions to those equations using a Lasso-type program and can then be implemented straightforwardly. Based on this, we introduce a GMM estimator of finite-dimensional parameters in a two-step framework. We derive theoretical guarantees for our construction of orthogonal moments and show  $\sqrt{n}$ -consistency and asymptotic normality of the introduced estimator. Our Monte Carlo experiments and an empirical application on estimating firm-level production functions and productivity measures highlight the importance of relying on inference methods like the one proposed.

## Teaching

Teaching Assistant - Applied Economics (Master in Economic Analysis), 2021-. Teaching Excellent Acknowledgement.

Teaching Assistant - Principles of Economics, 2023.

Teaching Assistant - Econometric Techniques, 2021-2022. Teaching Excellent Acknowledgement.

Teaching Assistant - Econometrics, 2021.

Teaching Assistant - Economics I (Microeconomics), 2020.

## Working Papers

[Machine Learning Debiasing with Conditional Moment Restrictions: An Application to LATE \(2024\)](#), joint with Juan Carlos Escanciano.

**Abstract:** Models with Conditional Moment Restrictions (CMRs) are popular in economics. These models involve finite and infinite dimensional parameters. The infinite dimensional components include conditional expectations, conditional choice probabilities, or policy functions, which might be flexibly estimated using Machine Learning tools. This paper presents a characterization of locally debiased moments for regular models defined by general semiparametric CMRs with possibly different conditioning variables. These moments are appealing as they are known to be less affected by first-step bias. Additionally, we study their existence and relevance. Such results apply to a broad class of smooth functionals of finite and infinite dimensional parameters that do not necessarily appear in the CMRs. As a leading application of our theory, we characterize debiased machine learning for settings of treatment effects with endogeneity, giving necessary and sufficient conditions. We present a large class of relevant debiased moments in this context. We then propose the Compliance Machine Learning Estimator (CML), based on a practically convenient orthogonal relevant moment. We show that the resulting estimand can be written as a convex combination of conditional local average treatment effects (LATE). Altogether, CML enjoys three appealing properties in the LATE framework: (1) local robustness to first-stage estimation, (2) an estimand that can be identified under a minimal relevance condition, and (3) a meaningful causal interpretation. Our numerical experimentation shows satisfactory relative performance of such an estimator. Finally, we revisit the Oregon Health Insurance Experiment, analyzed by Finkelstein et al. (2012). We find that the use of machine learning and CML suggest larger positive effects on health care utilization than previously determined.

[On the Existence and Information of Orthogonal Moments \(2023\)](#), joint with Juan Carlos Escanciano.

**Abstract:** Locally Robust (LR)/Orthogonal/Debiased moments have proven useful with machine learning first steps, but their existence has not been investigated for general parameters. In this paper, we provide a necessary and sufficient condition, referred to as Restricted Local Non-surjectivity (RLN), for the existence of such orthogonal moments to conduct robust inference on general parameters of interest in regular semiparametric models. Importantly, RLN does not require either identification of the parameters of interest or the nuisance parameters. However, for orthogonal moments to be informative, the efficient Fisher Information matrix for the parameter must be non-zero (though possibly singular). Thus, orthogonal moments exist and are informative under more general conditions than previously recognized. We demonstrate the utility of our general results by characterizing orthogonal moments in a class of models with Unobserved Heterogeneity (UH). For this class of models our method delivers functional differencing as a special case. Orthogonality for general smooth functionals of the distribution of UH is also characterized. As a second major application, we investigate the existence of orthogonal moments and their relevance for models defined by moment restrictions with possibly different conditioning variables. We find orthogonal moments for the fully saturated two stage least squares, for heterogeneous parameters in treatment effects, for sample selection models, and for popular models of demand for differentiated products. We apply our results to the Oregon Health Experiment to study heterogeneous treatment effects of Medicaid on different health outcomes.

## Awards & Scholarships

*Special Prize for being the student with the highest GPA of the Master in Economic Analysis in the academic year 2020-2021.* Universidad Carlos III de Madrid, November 2021.

*ANCE Award 2018 to the best undergraduate student of the School of Economics at the National University of Tucuman.* Academia Nacional de Ciencias Económicas Argentina, December 2019.

*First Place - Prize to the Best Student Researcher in Economics Sciences - Argentina 2018.* Universidad Nacional del Litoral - Banco Credicoop Argentina, October 2018.

*Flag bearer*, a distinction granted to outstanding students for their excellent academic performance. Universidad Nacional de Tucumán, May 2017.

*Scholarship "Friends of Fulbright".* I took courses on English, U.S. Culture, and Economics at the University of Central Arkansas. Fulbright Commission - U.S. Embassy - Ministerio de Educación de Argentina, January 2017 - February 2017.

*Stimulus Fellowship for Scientific Vocations.* This is a highly prestigious research scholarship in Argentina, which was obtained for my paper "Productivity vs. Management: What Matters in the Export Process?" Consejo Interuniversitario Nacional Argentina, December 2016.

## Other Academic Activities

Reviewer. *Journal of Business & Economic Statistics*, 2023-.

Participation in the "Econometric Games" representing Universidad Carlos III de Madrid, 2021-2022.

## Languages

Spanish (Native)  
English (Fluent)

## Software

RStudio  
Stata  
Python