

Santiago Torres Paz

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Education

Universidad de los Andes **Bogotá, Colombia**
Cum Laude Master's degree in Economics (M.A.): GPA 4.98/5.0, Rank: 1/23. *2021-2023*
Thesis: Addressing Bias in Politician Characteristic Regression Discontinuity Designs.
Supervised by: Leopoldo Fergusson and Manuel Fernández.
Selected Coursework (graduate level): Advanced econometrics, Advanced game theory, Advanced microeconomics - General Equilibrium Theory, Advanced short-term macroeconomics - DSGE modeling, Advanced long-term macroeconomics - Growth models, Contract theory, Machine learning.

Universidad de los Andes **Bogotá, Colombia**
Summa Cum Laude in Mathematics (B.S.). GPA: 4.83/5.0, Rank: 1/12 *2017-2021*
Thesis: Unraveling crowd dynamics: An introduction to mean field games.
Supervised by: Mauricio Junca.
Selected Coursework: Non-parametric statistics, Functional analysis (graduate level), Measure theory (graduate level), Differential geometry (graduate level), Topology, Partial differential equations, Mathematical statistics, Probability theory, Real Analysis.

Universidad de los Andes **Bogotá, Colombia**
Summa Cum Laude in Economics (B.A.). GPA: 4.83/5.0, Rank: 1/123 *2016-2021*
Selected Coursework: Industrial organization, Political economics, Fiscal theory, Mathematical economics, Intermediate microeconomics, Intermediate macroeconomics, Intermediate econometrics, Intermediate game theory.

Research Assistants

Pre-Doctoral Scholar, Harris School, the University of Chicago. **Chicago, USA**
Supervised by Dr. James A. Robinson and Dr. Leander Heldring. *March 2023-*

Graduate Research Assistant, CEDE, Universidad de los Andes. **Bogotá, Colombia**
Supervised Dr. Leopoldo Fergusson *June 2021-March 2023*

Undergraduate Research Assistant, CEDE, Universidad de los Andes. **Bogotá, Colombia**
Supervised Dr. Leopoldo Fergusson *June 2019-June 2021*

Undergraduate Research Assistant, CEDE, Universidad de los Andes **Bogotá, Colombia**
Supervised by Dr. Daniel Wills *December 2018-May 2019*

★ **Constitutions and Order: A theory and comparative evidence from Colombia and the United States.**

NBER Working Paper

With Leopoldo Fergusson, James A. Robinson and Javier Mejía.

Abstract: We propose a framework to explain why some societies may end up with different constitutional solutions to the problem of maintaining order in the face of self-interested behavior. Though the salient intellectual tradition since Hobbes has focused on how institutional design is used to eradicate violence, our framework illustrates that equilibrium constitutions may in fact have to deliberately allow for violence. This arises because some societies are unable to use institutions to influence income distribution. In this case, a constitutional tolerance of violence emerges as a credible way for an incumbent to meet the participation constraint of a challenger. We illustrate the results with the comparative constitutional history of the US and Colombia.

★ **The Interaction of Economic and Political Inequality in Latin America**

LACIR Working Paper

With Leopoldo Fergusson and James A. Robinson.

Abstract: We investigate how economic inequality can persist in Latin America in the context of visible falls in political inequality in the last decades. Using data from Colombia, we focus on a critical facet of democratization - the entry of new politicians. We show that initial levels of inequality play a significant role in local policy outcomes, such as in education, which can impact future inequality. A vicious circle emerges whereby policies that reduce inequality are less likely to be adopted and implemented in places with relatively high inequality. We present evidence consistent with the capture of new politicians and barriers to institution and state capacity building in relatively unequal places driving the results. Our results, therefore, help to reconcile the persistence of economic inequality with the new political context.

★ **The Oracle Local Polynomial Estimator.**

CEDE Working Paper

Abstract: This paper introduces a new estimator for continuity-based Regression Discontinuity (RD) designs named the estimated Oracle Local Polynomial Estimator (OLPE). The OLPE is a weighted average of a collection of local polynomial estimators, each of which is characterized by a unique bandwidth sequence, polynomial order, and kernel weighting schemes, and whose weights are chosen to minimize the Mean-Squared Error (MSE) of the combination. This procedure yields a new consistent estimator of the target causal effect exhibiting lower bias and/or variance than its components. The precision gains stem from two factors. First, the method allocates more weight to estimators with lower asymptotic mean squared error, allowing it to select the specifications that are best suited to the specific estimation problem. Second, even if the individual estimators are not optimal, averaging mechanically leads to bias reduction and variance shrinkage. Although the OLPE weights are unknown, an “estimated” OLPE can be constructed by replacing unobserved MSE-optimal weights with those derived from a consistent estimator. Monte Carlo simulations indicate that the estimated OLPE can significantly enhance precision compared to conventional local polynomial methods, even in small sample sizes. The estimated OLPE remains consistent and asymptotically normal without imposing additional assumptions beyond those required for local polynomial estimators. Moreover, this approach applies to sharp, fuzzy, and kink RD designs, with or without covariates.

Abstract: This article presents a general framework for using continuity-based regression discontinuity designs as an identification strategy in multi-seat electoral contests. First, I extend single winner-close-race designs by developing precise definitions of electoral tightness in elections where multiple winners are possible. These narrowness measures can be used to formulate forcing variables for conducting regression discontinuity designs. Moreover, I show that it is possible to construct different running variables to identify different (local) causal effects. I further specialize my method to proportional election systems, the most prominent family of multi-seat assignment methods, covering its most common variations: the highest average methods and largest remainder algorithms. The proposed approach improves existing methodologies for causal inference on multi-seat systems in four dimensions: it relies on weaker identifying assumptions, estimated quantities have a clear interpretation as causal effects, it does not hinge on discretionary choices, and it is easier to scale into problems with many political entities and seats.

★ Addressing Bias in Politician Characteristic Regression Discontinuity Designs.

CEDE Working Paper

Abstract: Politician characteristic regression discontinuity (PCRD) designs are a popular strategy when attempting to casually link a specific trait of an elected politician with a given outcome. However, recent research has revealed that this methodology often fails to retrieve the target causal effect—a problem also known as the PCRD estimation bias. In this paper, I provide a new econometric framework to address this limitation in applied research. First, I propose a covariate-adjusted local polynomial estimator that corrects for the PCRD estimation bias provided all relevant confounders are observed. I then leverage the statistical properties of this estimator to propose several decompositions of the bias term and discuss their potential applications. Next, I devise a strategy to assess the robustness of the new estimator to omitted confounders that could potentially invalidate results. Finally, I illustrate these methods through an application: a PCRD aimed at evaluating the impact of female leadership during the COVID-19 pandemic.

★ A Pharmacokinetic Model for Multiple-Dose Dynamics and Long-Term Treatment Effectiveness.

ArXiv

With Jose R. Arteaga

Abstract: This paper presents a novel pharmacokinetic model that utilizes Time Scale Calculus to analyze the dynamics of blood concentration resulting from multi-dose treatments. The proposed model offers a closed-form solution, termed the Generalized Bateman function, which characterizes the blood concentration dynamics of orally administered multiple dosage regimens. We also investigate the asymptotic properties of this function to describe the long-term dynamics associated with specific dosage plans. Notably, we establish the ubiquitous existence of effective dosage schedules, meaning that a medical practitioner can always formulate a prescription ensuring that a patient's long-term blood concentration levels remain within a desired range. Furthermore, our framework highlights how different metabolisms can significantly influence long-term blood concentration dynamics in response to the same dosage. Lastly, we employ anecdotal treatment responses to Efavirenz as an illustrative example, demonstrating how individuals with distinct biological characteristics may require different dosage regimens to maintain effective drug blood concentrations over an extended period.

Public data sets

★ Colombia's Electoral Results

CEDE working paper + CEDE data repository

With Andrés Barinas-Forero, Wilson Forero-Mesa, Juan Ernesto Sánchez and Mercedes Tibavisco.

Abstract: This document describes the structure, content, and construction process of the datasets constituting the "Colombia's Electoral Results" repository as of 10/27/2023 (Version 1.1). The repository comprises 124 datasets containing the results of the vast majority of elections for mayors, municipal councilors, assembly deputies, governors, lower house representatives, senators, and presidents between 1958 and 2022. In addition, we present a new database containing information on all of the political parties, movements, coalitions, and significant citizen groups that were involved in these elections. Finally, this document provides guidance on how to use the databases and a summary of the major changes to the electoral system that occurred between 1958 and 2022.

★ A historical characterization of Colombian political parties: 1958-2022

CEDE working paper + CEDE data repository

With Nicolás Cabra-Ruíz, Laura Wills-Otero and Valentina Castilla-Gutiérrez.

Abstract: This document describes the structure, content, and construction process of the data repository entitled "A historical characterization of political parties in Colombia: 1958-2022". In it, all political parties, movements, and coalitions have competed in elections for mayors, municipal councilors, assembly deputies, governors, lower house representatives, senators, and presidents in Colombia for which there are records are classified into five dimensions: their ideology, the identity groups they represent, their traditionality, their degree of nationalization, and longevity. We also provide a collection of primary and secondary sources that contain additional information on the political groupings studied.

Thesis

★ Unraveling crowd dynamics: An introduction to mean field games (Bachelor Thesis.)

Abstract: This document is a self-contained introduction to mean-field games. As the number of players grows, finding equilibria becomes more complex and often impossible, even with computational tools. Mean-field games seek to find an approximation to these equilibria inspired by mean-field theory, a tool widely used in physics to approximate the dynamics of large particle systems. This theory postulates that it is possible to predict a particle's dynamics by focusing only on the statistical properties of the system instead of accounting for the individual interaction of each particle with another. By substituting particles with rational agents, the mean-field theory allows for a good approximation of Nash Equilibria in stochastic differential games. More precisely, the mean-field game theory reduces the problem of finding Nash Equilibria to solving a system of coupled partial differential equations: the Hamilton-Jacobi-Bellman equation representing player rationality and the Fokker-Plank equation condensing the system's statistical properties. Several ideas from other mathematical branches such as stochastic optimal control, stochastic analysis, stochastic processes, and partial differential equations are used in building this theory.

Awards

Cum Laude - Master's degree in Economics.

Bogotá, Colombia

October 2023

This distinction is given to students whose GPA ranks them in the top 3% of the historical average of their program's graduates over the past five years.

Honorific mention: Colombia's best college student, 2021.

Bogotá, Colombia

November 2021

This award is given each year to a graduate student in economics, business administration, or a related field, taking into account not only his or her academic record, but also his or her commitment to social responsibility. Portafolio-El Tiempo.

Summa Cum Laude in Mathematics**Bogotá, Colombia***September 2021*

This honor is reserved for students whose cumulative average is in the top 1% of the historical average of their program's graduates over the past four years. Recipients must also demonstrate comprehensive merits in an interview before a commission appointed by the academic council.

Summa Cum Laude in Economics**Bogotá, Colombia***September 2021*

This honor is reserved for students whose cumulative average is in the top 1% of the historical average of their program's graduates over the past four years. Recipients must also demonstrate comprehensive merits in an interview before a commission appointed by the academic council.

Academic Excellence Distinction in Economics**Bogotá, Colombia***June 2021*

This award is given by the Universidad de los Andes to students who have completed and passed at least 15 credits in their program and have the highest grade average among all economics undergraduates during the semester preceding the award.

Academic Excellence Distinction in Mathematics**Bogotá, Colombia***June 2021*

This award is given by the Universidad de los Andes to students who have completed and passed at least 15 credits in their program and have the highest grade average among all mathematics undergraduates during the semester preceding the award.

Fabio Sánchez Torres Award**Bogotá, Colombia***December 2019*

Best research paper in Colombian economic history. Awarded by Universidad de los Andes

Ramon de Zubiría Distinction in Mathematics**Bogotá, Colombia***October 2019*

Best overall GPA in the Mathematics Department.

Academic Excellence Distinction in Mathematics**Bogotá, Colombia***October 2019*

This award is given by the Universidad de los Andes to students who have completed and passed at least 15 credits in their program and have the highest grade average among all mathematics undergraduates during the semester preceding the award.

First Place: XI National Academic Contest in Economics**Bogotá, Colombia***October 2019*

Awarded by Colombia's Central Bank and Universidad del Rosario

First Place: XVI National Forum of Students of Economics and Finance**Bogotá, Colombia***October 2019*

Senior Category - Best undergraduate research paper. Awarded by Colombia's Central Bank and Universidad del Rosario.

First Place: XV National Forum of Students of Economics and Finance**Bogotá, Colombia***October 2018*

Senior Category-Best undergraduate research paper. Awarded by Colombia's Central Bank and Universidad del Rosario.

First Place: IX National Academic Contest in Economics**Bogotá, Colombia***October 2017*

Awarded by Colombia's Central Bank and Universidad del Rosario

Academic presentations and poster sessions (PS)

Latin America and the Caribbean Inequality Review (LACIR) Conference- Speaker *March 2023*

Organized by Latin America and the Caribbean Inequality Review (LACIR) of the London School of Economics and the Inter-American Development Bank (IADB). The event took place at Universidad de los Andes, Caribe, in Cartagena Colombia. Presented: A Conditional Iron Law of Oligarchy: Evidence from Colombia.

Quantil- Applied Mathematics Seminar-Speaker *December 2022*

Organized by Quantil. The seminar focuses on the presentation and discussion of methods of applied mathematics for industry and research. Virtual conference. Presented: Close elections regression discontinuity designs in multi-seat systems.

Latin America and the Caribbean Inequality Review (LACIR) Workshop- Speaker *August 2022*

Organized by Latin America and the Caribbean Inequality Review (LACIR) of the London School of Economics and the Inter-American Development Bank (IADB). The event took place at the IADB's headquarters in Washington D.C. Presented: A Conditional Iron Law of Oligarchy: Evidence from Colombia.

XXII Colombian Mathematics Congress - Speaker *June 2019*

Organized by the Colombian Mathematics Society. Presented: Optimal drug dosage on heterogeneous populations.

70 years of Research and Creation in Universidad de los Andes - PS *November 2018*

Commemorative event promoting undergoing graduate research projects. Presented: Optimal drug dosage on heterogeneous populations.

First Latin American Encounter of Students in Engineering and Sciences -PS *October 2018*

International Ph.D students meeting in mathematical modeling. The event was organized and sponsored by the University of Chile. The event took place in Santiago de Chile, Chile.

First Colombian Conference in Applied and Industrial Mathematics - Speaker *August 2018*

Organized by Universidad de los Andes, Universidad Nacional and the Colombian Mathematics Society.

5th International and Interdisciplinary Workshop on Mathematical Modelling of Environment and Evolution on Social and Life Processes - Speaker *June 2018*

Organized by Universidad de los Andes. Held in Villa de Leyva, Colombia.

Teaching Experience

Teacher Assistant - Advanced Econometrics (Graduate) *August 2021 - December 2022*

Lecturer: Manuel Fernández.

Teacher Assistant - Political economy (Graduate) *January 2022 - June 2022*

Lecturer: Leopoldo Fergusson.

Teacher Assistant - Integral calculus with differential equations *January 2021 - June 2021*

Lecturer: Maricarmen Martínez.

Teacher Assistant - Mathematical statistics *August 2020 - December 2020*

Lecturer: José Ricardo Arteaga.

Teacher Assistant - Fiscal Policy *January 2020 - June 2020*

Lecturer: Leopoldo Fergusson.

Teacher Assistant - Linear Algebra *August 2019 - December 2019*

Lecturer: *Monika Winklmeier.*

Other academic experience and mentorship work

Consultant to Quantil and the Inter-American Development Bank.

December 2021

Consulting project for estimating the cost-effectiveness threshold for the Dominican Republic.

Mentor - PRE (Pre-doctoral Research in Economics) Workshop

June 2022

Mentor for the PRE (Pre-doctoral Research in Economics) Workshop, organized by PREDOC (Pathways to Research and Doctoral Careers) and the University of Chicago. This workshop aims to prepare students worldwide who want to apply for a Ph.D. to become effective research assistants.

Co-Director: Colombia's historical electoral results database project.

December 2021

Contract with the National Registry Office and the Universidad de los Andes to digitize all electoral results in Colombia from 1958 to 2022.

Other Skills and Exams

○ Programming Languages:

- *Stata* (Very Advanced).
- *Latex* (Very Advanced).
- *Python* (Advanced).
- *R* (Comfortable).
- *MATLAB* (Comfortable).
- *SageMath* (Comfortable).
- *ArcGIS* (Basic).
- *Dynare* (Basic).
- *Java* (Basic).

○ Languages:

- *English* (C2 Level-Fluent).
- *Spanish* (Native).
- *French* (B2 Level-Advanced).
- *German* (A2 Level- Basic)

○ International standardized exams:

- *GRE*: Quantitative: 170/170, Verbal: 162/170, Analytical Writing: 5.0/6.0.
- *TOEFL*: Reading: 30/30, Listening: 29/30, Speaking: 27/30, Writing: 30/30.

Academic references

Professor
James A. Robinson

Reverend Dr. Richard L. Pearson Professor of Global Conflict Studies.
Institute Director, The Pearson Institute for the Study and Resolution of Global Conflicts.
Harris School of Public Policy and Department of Political Science,
The University of Chicago.
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