Charles Thraves

Assistant Professor of Operations Research

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I am an Assistant Professor at the Department of Industrial Engineering (DII) at the Universidad de Chile, where I have been a faculty member since July 2017. I hold a B.S. and M.Sc. in Industrial Engineering from Universidad de Chile and a Ph.D. in Operations Research from MIT (2017). My research sits at the intersection of operations research, machine learning, and applications in revenue management, public policy, political science, motorsport, and healthcare. I have published exclusively in Q1 international journals (Operations Research, Production & Operations Management, M&SOM, EJOR, INFORMS Journal on Applied Analytics, The Lancet Infectious Diseases, and JAMA, among others), and have been recognized with the Franz Edelman Award 2022, FONDECYT Initiation grant as principal investigator, the best undergraduate teaching award at the department of industrial engineering and the Faculty of Physics and Mathematics of the University of Chile 2023, and the best teaching award in 2024 in the Master in Business Analytics program of the same university.

EDUCATION

Ph.D. in Operations Research · Massachusetts Institute of Technology (MIT), 2012–2017
M.Sc. in Operations Management · Universidad de Chile, 2010–2011
B.S. in Industrial Engineering · Universidad de Chile, 2005–2011

1. RESEARCH

My research agenda spans five interconnected areas, each with a distinct set of contributions:

Revenue Management and Pricing

My research on revenue management and pricing spans both my graduate studies and my time as faculty. During my Master's at Universidad de Chile, I studied pricing under strategic consumer behavior — specifically, settings where customers postpone purchases in anticipation of future price drops. The key contribution was characterizing the structure of the optimal pricing policy and showing that, under certain conditions, the seller can extract full surplus even from strategic consumers by committing to a contingent preannounced price schedule (Operations Research, 2016). At MIT, supervised by Georgia Perakis, I extended this agenda in two directions. First, I developed a data-driven two-part tariff pricing model for service industries, where the seller observes only aggregate demand signals rather than individual valuations; the contribution was a tractable optimization framework that recovers near-optimal prices from limited data (M&SOM, 2021). Second, I established a unifying framework for consumer surplus under demand uncertainty, showing that standard surplus measures systematically overestimate or underestimate true consumer welfare when demand is stochastic, and providing corrected closed-form expressions applicable across a broad class of demand models (POM, 2021). More recently, I have been extending this agenda to the problem of demand model estimation from partial data. In ongoing work (with G. Vulcano, Universidad Torcuato Di Tella, and I. Vidal), I study how to estimate a Markov Chain Choice Model when the seller observes only initial and final inventory levels — without any transaction-level records. Because the incomplete likelihood involves an exponential number of purchase-path combinations, a standard EM approach is intractable; the contribution is a methodology that combines EM with MCMC sampling to generate purchase-path realizations consistent with the observed inventory data, enabling parameter recovery and out-of-sample prediction of stock-outs and final inventory levels. This line of work has been presented at multiple top venues including INFORMS, MSOM, and POMS.

Operations Research Applied to Political Science

Since joining DII in 2017, I have developed an independent research program at the intersection of operations research and political science — an area rarely explored in the OR literature. My contributions span four specific directions: (i) electoral campaign resource allocation modeled as a strategic game, establishing equilibrium characterizations under majority rule and electoral college systems (POM, 2021); (ii) parametric and non-parametric Ecological Inference models for estimating vote transitions across demographic groups when only aggregate data are available — a hard statistical inverse problem — developing algorithms more accurate, faster, and scalable than state-of-the-art techniques whose implementation is released as the R package “fastei” on CRAN (paper in second round of revision); (iii) outlier and fraud detection applied to electoral data, with a report shared directly with SERVEL (Chilean Electoral Service); and (iv) adaptive questionnaire design with partial information to maximize inferential efficiency about political opinions. This line has been funded by a FONDECYT Initiation grant (PI, 2024–2027) and has generated 5 graduate theses, 3 international seminar invitations, and 1 Q1 publication and another under review.

Motorsport Strategy Optimization (Formula 1)

I have developed a line of research on race strategy optimization in Formula 1, combining dynamic programming, game theory, and machine learning. The problem is inherently complex: drivers must make real-time pit stop decisions under tire degradation that varies across compounds, stochastic on-track events such as safety cars and mechanical failures, and direct competitive interaction with other drivers. My contributions include: (i) the first dynamic programming formulation of the pit stop timing problem in a single-agent setting, incorporating stochastic events and establishing structural properties of the value function that yield managerial insights into when and how often to pit (CEJOR, 2023); (ii) an extension to a two-driver competitive setting modeled as a zero-sum Stackelberg game, characterizing the equilibrium pit stop strategy and showing how the presence of a competitor

systematically shifts the optimal timing (EJOR, 2024); and (iii) ongoing work comparing exact optimization methods with deep reinforcement learning for pit stop strategy, examining the trade-off between solution quality and computational tractability in a real-time decision environment (working paper, 2026). These papers have appeared in Q1 international journals and have received coverage in Chilean media.

Public Health Analytics

A significant part of my applied research has been conducted in collaboration with the ISCI (Institute for Complex Engineering Systems) and directly with the Chilean Ministry of Health. Contributions include: (i) co-developing pool testing strategies that account for correlation and false negatives during the COVID-19 pandemic (Health Care Management Science, 2021); (ii) being part of the team behind the analytics work that earned the Franz Edelman Award 2022 (INFORMS), the most prestigious global recognition in applied OR, for the COVID-19 response effort in Chile (INFORMS Journal on Applied Analytics, 2023); (iii) cost-benefit analysis of nirsevimab for Respiratory Syncytial Virus (RSV) prevention that directly informed Chile's 2024 national immunization policy decision, contributing to a reduction from 13 infant deaths in 2023 to zero in 2024 and 2025 (Journal of Infection and Public Health, 2025); (iv) retrospective effectiveness study of nirsevimab published in The Lancet Infectious Diseases (2025); and (v) analysis of nirsevimab in high-risk infants published in JAMA (2026).

Machine Learning and Applied Analytics

Across several projects, I have applied machine learning methods to generate knowledge and decision support tools in diverse industries. Specific contributions include: (i) a comparative study of ML methods for real estate price estimation, combining regression, ensemble, and neural approaches (Journal of Forecasting, 2025); (ii) a queue statistics inference system that estimates average queue length and waiting time from transaction data alone, without requiring direct observation of queues (in collaboration with a major Chilean retailer, CORFO Semilla grant); (iii) outlier detection for standardized test results (DEMRE), supporting fraud and correction-error identification; (iv) predictive models for open-air TV channel ratings; and (v) financial scoring of residential buildings based on common-expense payment data, using unsupervised machine learning. I also teach machine learning at undergraduate and graduate levels and have supervised multiple theses in this area.

1.1 Peer-Reviewed Journal Publications

All published papers are in Q1 international journals except one (Q2). Listed in reverse chronological order.

An Accurate, Fast, and Scalable Ecological Inference Algorithm for the R×C case

Accepted in Statistics and Computing (2026)

Ubilla-Pavez P., Hermosilla D., and Thraves C.

Torres J.P., Sauré D., Goic M., Thraves C., et al. **"Health care utilization and cost implications of Chile's 2024 nirsevimab strategy for RSV prevention: a counterfactual analysis"** *The Lancet Regional Health - Americas (2026)*, Q1.

Torres J.P., Sauré D., Goic M., Thraves C., et al. **"Nirsevimab in High-Risk Infants in a Respiratory Syncytial Virus Prevention Strategy"** *JAMA Network Open (2026)*, Q1.

Torres J.P., Sauré D., Goic M., Thraves C., et al. **"Effectiveness and impact of nirsevimab in Chile during the first season of a national immunisation strategy against RSV (NIRSE-CL): a retrospective observational study"** *The Lancet Infectious Diseases (2025)*, Q1.

Sauré D., O'Ryan M., Torres J.P., Thraves C., et al. **"Cost-savings and health impact of strategies for prevention of Respiratory Syncytial Virus with nirsevimab in Chile based on the integrated analysis of 2019–2023 national databases"** *Journal of Infection and Public Health (2025)*, Q1.

Bozanic M., Goic M., Thraves C. **"Affinities and Complementarities of Methods and Information Sets in the Estimation of Prices in Real Estate Markets"** *Journal of Forecasting (2025)*, Q2.

Aguad F., Thraves C. **"Optimizing Pit Stop Strategies in Formula 1 with Dynamic Programming and Game Theory"** *European Journal of Operational Research (2024)*, Q1.

Basso L., Goic M., Olivares M., Sauré D., Thraves C., et al. **"Analytics Saves Lives During the COVID-19 Crisis in Chile"** *INFORMS Journal on Applied Analytics (2023)*, Q1.

Carrasco F., Thraves C. **"On the Optimization of Pit Stop Strategies via Dynamic Programming"** *Central European Journal of Operations Research (2023)*, Q1.

Morales S., Thraves C. **"On the Resource Allocation for Political Campaigns"** *Production and Operations Management (2021)*, Q1.

Perakis G., Thraves C. **"On a Variation of Two-part Tariff Pricing of Services: A Data-Driven Approach"** *Manufacturing & Service Operations Management (2021)*, Q1.

Cohen M., Perakis G., Thraves C. **"Consumer Surplus Under Demand Uncertainty"** *Production and Operations Management (2021)*, Q1.

Basso J.L., Salinas V., Sauré D., Thraves C., Yankovic N. **"The effect of correlation and false negatives in pool testing strategies for COVID-19"** *Health Care Management Science (2021)*, Q1.

Correa J.R., Montoya R., Thraves C. **"Contingent Preannounced Pricing Policies with Strategic Consumers"** *Operations Research (2016)*, Q1.

1.2 Working Papers and Ongoing Research

On the Estimation of a Markov Choice Model from Partial Inventory Data
Working paper
Vidal I., Vulcano G., and Thraves C.

Efficient Computation of Exact p-values for Multinomial Tests
Working paper
Subiabre F., and Thraves C.

Estimating Checkout Lines with Transaction Data
Working paper
Carrasco-Heine F., Guerra R., Olivares M., and Thraves C.

Deep Reinforcement Learning for Pit Stops Strategy Optimization in Formula 1
Working paper
Méndez F., and Thraves C.

Own Brand: Who benefits from it?
Working paper
Thraves C.

1.3 Research Grants

Principal Investigator — FONDECYT Initiation N° 11241531 (March 2024 – March 2027)
"On the Estimation of a Non-Parametric Ecological Inference Model with Optimal Group Aggregation using Integer Programming." Budget: CLP ~45 M. Outputs to date include three M.Sc. theses (Operations Management), two M.Sc. theses (Data Science), three invited talks at international seminars, one Q1 journal publication, and the fastei package released on CRAN.

Co-Investigator — FONDECYT Regular N° ID1240492 (May 2024 – present, PI: Denis Sauré)
"Information Traps for Consumer Learning in Assortment Planning."

Researcher — FONDEF ID18I10250 (December 2018 – November 2020, PI: José Soto San Martín)
"Robust management for dispatching products from multiple warehouses with variable time windows." Contributed optimization modeling for vehicle routing problems.

Researcher — FONDEF ID19I10303 (November 2019 – October 2021, PI: Marcelo Olivares)
"Integrated transplant management system based on Machine Learning and Market Design." Developed predictive models for kidney transplant life span estimation.

Researcher — FONDEF IT16I10010 (December 2017 – May 2019, PI: José Rafael Correa)
"Technology development for fare evasion control in public transportation." Applied network optimization and game theory to maximize inspector coverage.

1.4 Conference Presentations (Selected)

International conferences:

2025 – INFORMS Annual Meeting, Atlanta, USA: *A Fast Ecological Inference Algorithm for the R×C Case*

2025 – INFORMS Annual Meeting, Atlanta, USA: *On the Estimation of a Markov Choice Model from Partial Inventory Data*

2025 – Workshop Universidad Torcuato Di Tella, Buenos Aires, Argentina: *A Fast Ecological Inference Algorithm for the R×C Case*

2024 – INFORMS Annual Meeting, Seattle, USA: *Ecological Inference with a Markov Discrete Choice Model*

2023 – INFORMS Annual Meeting, Phoenix, USA: *On the Detection of Outlier Ballot Boxes Using Ecological Inference*

2022 – INFORMS Annual Meeting, Indianapolis, USA: *Pooling Polls and Parametric Estimation under Diffuse Observations*

2022 – CLAIO, Buenos Aires, Argentina: *Pooling Polls and Parametric Estimation under Diffuse Observations*

2022 – POM Annual Meeting, Orlando, USA: *Pooling Polls and Parametric Estimation under Diffuse Observations*

2022 – COER, Cambridge, USA: *Predicting Checkout Lines from Transaction Data*

2022 – INFORMS Business Analytics Conference, Houston, USA: *Applied Analytics Saves Thousands of Lives During the COVID Crisis in Chile*

2019 – INFORMS Annual Meeting, Seattle, USA: *On the Equilibrium of Elections Game Under Majority Rule and Electoral College*

2018 – MSOM, Dallas, USA: *Unifying Framework for Consumer Surplus under Demand Uncertainty*

2016 – INFORMS Annual Meeting, Nashville, USA: *A Two-part Tariff Pricing for Services: A data-driven approach*

2016 – MSOM, Auckland, New Zealand: *A Two-part Tariff Pricing for Services: A data-driven approach*

2016 – Revenue Management Conference, New York, USA: *A Two-part Tariff Pricing for Services: A data-driven approach*

2015 – INFORMS Annual Meeting, Philadelphia, USA: *A Unifying Framework for Consumer Surplus / Pricing for a Satellite Service Provider*

2015 – Cornell Workshop in Operations Research, Ithaca, USA: *Pricing for a Satellite Service Provider*

2014 – MSOM, Seattle, USA: *Competition and Externalities in Green Technology Adoption*

2014 – INFORMS Annual Meeting, San Francisco, USA: *Competition and Externalities in Green Technology Adoption*

2013 – INFORMS Annual Meeting, Minneapolis, USA: *Competition and Externalities in Green Technology Adoption*

2012 – MSOM, New York, USA: *Contingent Preannounced Pricing Policies with Strategic Consumers*

National conferences (Chile):

2026 – Workshop in Management Science, Santa Cruz: *On the Estimation of a Markov Choice Model from Partial Inventory Data*

2023 – IFORS, Santiago: *Optimizing Pit Stop Strategies with Competition in a Zero-Sum Feedback Stackelberg Game*

2023 – Workshop in Management Science, Puerto Varas: *Pooling Polls and Parametric Estimation under Diffuse Observations*

2022 – OPTIMA, Talca: *On the Outlier Detection for Standardized Tests*

2011 – OPTIMA, Pucón: *Preannounced Prices with Strategic Consumers*

1.5 Session Organization at International Conferences

I have been invited to organize sessions on Public Sector Operations Research at INFORMS Annual Meetings 2022, 2023, and 2024, and at POM Annual Conference 2022. In these sessions I invited international speakers and presented my own research on ecological inference applied to electoral data.

1.6 Research Software

fastei — R package for fast ecological inference (R×C case). Released on CRAN as output of FONDECYT N°11241531.

1.7 Research Awards and Distinctions

- IFORS Prize for OR in Development 2026, First Prize — awarded by the International Federation of Operational Research Societies for a high-impact application of operations research addressing development challenges in emerging economies.
- Franz Edelman Award (INFORMS, 2022) — one of the most prestigious global recognitions in applied operations research; awarded for the COVID-19 analytics work developed with the ISCI team and the Chilean Ministry of Health.
- POMS Best Student Paper Award — College of Supply Chain Management (INFORMS).
- Premio Incidencia Pública, Universidad de Chile, 2025 — awarded at the 3rd Innovation with Territorial Impact Meeting.
- Gold Medal, National Mathematics Olympiad (SOMACHI, 2002).

2. TEACHING

I teach at both undergraduate and graduate levels, with a consistent emphasis on connecting rigorous theory to real applications. My teaching contributions can be organized around three main areas:

- New course creation: I have designed and launched several new courses that did not previously exist in the department of industrial engineering curriculum, at both the undergraduate and graduate levels. These include Probability for undergraduates — a course that was previously taught by a different department — as well as graduate courses in Applied Data Analysis, Optimization, Data-Driven Decision Making, and a Workshop in R and Python, among others.
- Application-driven pedagogy in courses where this is not the norm: I have introduced case-based learning and real-world problem sets into courses that are traditionally taught in a purely theoretical manner, most notably Probability. Each case ends with an individual in-class quiz, ensuring active engagement and graded accountability beyond standard exams.
- Assessment innovations to promote continuous study and deter free-riding: I use surprise exercises with a randomized mechanism to incentivize class-by-class preparation and attendance, and weekly proposed homework submitted via U-Cursos (the university's online learning platform) to track sustained effort throughout the semester. For students who miss a scheduled exam, I administer individual oral evaluations rather than deferring to the final exam. This approach serves a dual purpose: it ensures that all course topics are fully assessed and eliminates the incentive to skip exams strategically — a practice that has been problematic in other courses — while also allowing prompt identification of suspected academic dishonesty.

2.1 Teaching Awards

- Best Full-Time Professor, DII, and Best Undergraduate Professor, FCFM, Universidad de Chile (2023 academic year, awarded 2024) — recognized both at the departmental and faculty-wide level.
- Best Professor, Master of Business Analytics (DII-FEN joint program), Universidad de Chile (2024 academic year, awarded 2025).
- Best Teaching Assistant Award, DII, Universidad de Chile (2010 and 2011).

2.2 Graduate Courses Taught

Course	Credits	Students	Role	Year	Semester
Operations Management (Diploma)	0	16	100%	2025	Spring
Business Analytics (MBA-FEN)	3	16	50%	2025	Spring
Workshop in R and Python (M.Analytics)	3	26	100%	2025	Fall
Operations Management I (MGO)	3	16	100%	2025	Spring
Optimization (M.Analytics)	3	26	100%	2024	Spring
Operations Management (Diploma)	0	18	100%	2024	Spring
Operations Management (MGO)	3	6	100%	2024	Spring
Operations Management I (MGO)	3	17	100%	2024	Spring
Workshop in R and Python (M.Analytics)	3	36	100%	2024	Fall
Operations Management (Diploma)	0	5	100%	2023	Spring
Operations Management (MGO)	3	2	100%	2023	Spring
Operations Management I (MGO)	3	21	100%	2023	Spring
Data Analytics Applied to Management	3	42	100%	2023	Spring
Operations Management (Diploma)	0	9	100%	2022	Spring
Operations Management I (MGO)	3	41	100%	2022	Spring

Course	Credits	Students	Role	Year	Semester
Data Driven Decision Making (M.Analytics)	3	23	25%	2021	Spring
Operations Management (Diploma)	0	23	100%	2021	Spring
Operations Management (MGO)	3	1	100%	2021	Spring
Operations Management I (MGO)	3	39	100%	2021	Spring
Data Driven Decision Making (M.Analytics)	3	23	50%	2020	Spring
Operations Management (Diploma)	0	18	100%	2020	Spring
Operations Management I (MGO)	3	20	100%	2020	Spring
Operations Management I (MGO)	3	14	100%	2019	Spring
Operations Strategy (MBA – WashU Olin)	–	40	100%	2022	Spring

DG = Diploma in Business Management (DII); MGO = M.Sc. in Operations Management; M.Analytics = Joint M.Sc. in Business Analytics (DII + FEN); MBA-FEN = MBA at Facultad de Economía y Negocios; MBA-WashU = Olin Business School, Washington University in St. Louis (taught in Chile). Instructor is sole responsible when participation = 100%.

2.3 Undergraduate Courses Taught

Course	Credits	Students	Role	Year	Semester
Probability (IN3141)	6	100	100%	2026	Fall
Probability (IN3141)	6	94	100%	2025	Fall
Probability (IN3141)	6	104	100%	2025	Spring
Probability (IN3141)	6	69	100%	2024	Fall
Probability (IN3141)	6	94	100%	2024	Spring
Probability (IN3141)	6	90	100%	2023	Fall
Probability (IN3141)	6	51	100%	2023	Spring
Probability (IN3141)	6	72	100%	2022	Fall
Probability (IN3141)	6	77	100%	2022	Spring
Probability (IN3141)	6	89	100%	2021	Fall
Probability (IN3141)	6	66	100%	2021	Spring
Operations Management I (IN4703)	6	66	100%	2020	Spring
Operations Management I (IN4703)	6	61	100%	2020	Fall
Operations Management I (IN4703)	6	88	100%	2019	Fall
Operations Management I (IN4703)	6	83	100%	2019	Spring
Applied Methods for Data Analysis (IN5724)	6	21	50%	2019	Fall
Operations Management I (IN4703)	6	79	100%	2018	Fall
Operations Management I (IN4703)	6	71	100%	2018	Spring

2.4 New Courses Created

Undergraduate:

- Probability (IN3141) — Designed a new undergraduate probability course for the Department of Industrial Engineering (DII), replacing a shared Probability & Statistics course previously taught by the math department, with exclusive focus on Probability and applications. Includes real-world case studies, simulation in R/Python, and in-class mini-exams. This is the first dedicated probability course in the DII curriculum.

- Applied Methods for Data Analysis (IN5724) — An applied machine learning course bridging theory and practice: each method is developed from its optimization foundations and implemented in R. The course covers both supervised and unsupervised techniques, with particular attention to the mathematical structure underlying each method. A distinguishing feature is the inclusion of rigorous but underrepresented topics in standard ML curricula, such as the Expectation-Maximization algorithm and its applications. Also offered as an elective in the M.Sc. Operations Management and Ph.D. Engineering Systems programs.

Graduate:

- Workshop in R and Python (M.Sc. Business Analytics, DII-FEN) — Covers programming fundamentals in both languages: data types, functions, control flow, classes, and visualization libraries.
- Data Driven Decision Making (M.Sc. Business Analytics, DII-FEN) — Supervised and unsupervised machine learning methods with emphasis on managerial decision making.
- Data Analytics Applied to Management (MBA, DII) — MBA elective applying machine learning methods through real case studies.
- Optimization (M.Sc. Business Analytics, DII-FEN) — Optimization modeling and programming for industry problems.
- Business Analytics (MBA, FEN) — Supervised and unsupervised machine learning with real case studies for MBA students.

2.5 Thesis and Dissertation Supervision

M.Sc. Theses (as principal supervisor):

- Agustín Hilcker — Estimation of a Markov Choice Model via Ecological Inference using the EM Algorithm in the Context of Political Elections. M.Sc. Operations Management, UCh, 2025.
- Leonardo Meneses — Parametric Estimation of Voting Probabilities via Ecological Inference. M.Sc. Operations Management, UCh, 2025.
- Felipe Méndez — Deep Reinforcement Learning for the Optimization of Pit Stop Strategies in Formula 1. M.Sc. Data Science, UCh, 2025.
- Branco Paineman — Applications of Reinforcement Learning and Game Theory in Electoral Strategy Models. M.Sc. Data Science, UCh, 2024.
- Mariana Quiroga — On the tires compound performance estimation with on-line data. M.Sc. Operations Management, UCh, 2023.
- Felipe Aguad — Optimizing Pit Stop Strategies with Dynamic Programming under Competition using Game Theory. M.Sc. Operations Management, UCh, 2023.
- Ignacio Cantillano — On the prediction of success of students in college special admission processes by using machine learning. M.Sc. Operations Management, UCh, 2023.
- Pablo Ubilla — On fraud detection in elections with multiple candidates and demographic groups. M.Sc. Operations Management, UCh, 2023.
- Germán Silva — Price estimation of second-hand garments using Machine Learning. M.Sc. Operations Management, UCh, 2023.
- Sebastián Morales — Electoral Campaigns Under the Lens of Game Theory, Behavioral Models and Equilibrium. M.Sc. Operations Management, UCh (year ongoing).

Undergraduate Theses / Memorias (as principal supervisor):

- Lucas Bordeu — Exploration of Optimal Betting Strategies for Blackjack. B.Sc. Industrial Engineering, UCh, 2024.
- Maximiliano Barra — Planning the Stages of a Modernization of the Control and Monitoring System for Metropolis Trains. B.Sc. Mechanical Engineering, UCh, 2021.
- Mirko Bozanic — A Price Prediction System for Residential Real Estate in the Metropolitan Region. B.Sc. Industrial Engineering, UCh, 2019.

2.6 Pedagogical Innovations

- Case-based learning integrated into theory courses: real-world problem cases are used in Probability (historically a purely theoretical course) where each case concludes with an individual 15-minute in-class quiz graded as part of the course.
- Oral recovery exams: individual oral evaluations (15–20 min) administered to students who either missed written exams or are suspicious of fraudulent activity. This method verifiably detects knowledge gaps, reduces unjustified absences, and ensures comprehensive topic coverage. (In most other courses, students who missed an exam use the final exam to replace the grade.) During the pandemic, oral exams were used for all ~70 students as a complement to written online assessments.
- Surprise exercises with a randomization mechanism: a box with colored balls (blue → surprise exercise; white → class break) drawn without replacement guarantees exactly 5 surprise exercises per semester, incentivizing class-by-class study and attendance.
- Weekly proposed exercises: mandatory short homework submitted via U-Cursos (the university's online learning platform) every week, providing a continuous measure of student effort used in borderline grading decisions.
- Teaching assistant office hours (US-model): weekly individual consultation hours for students, separate from the auxiliary class, imported from US undergraduate practice. This practice is not used in other courses at the University of Chile.
- Course notes: co-authored the Probability course notes used by all DII students (main author: Iván Vidal).

2.7 External and Executive Teaching

- Operations Strategy — Olin Business School (WashU St. Louis) MBA, Spring 2022. Taught on-site in Santiago, Chile. 40 students, 48 contact hours over 6 days, plus company visits. Sole instructor of one section, coordinated course with Patrick Moreton.
- Diploma in Data Analytics, FEN, Universidad de Chile — guest lecturer.
- ISCI research internship supervision — supervised undergraduate and graduate students in applied research projects (optimization, ML, simulation).

3. SERVICE

My service contributions reflect a sustained commitment to the health and development of the academic community, to the translation of research into real-world impact, and to the professional formation of the next generation of engineers. At the departmental level, I currently serve simultaneously as Head of the Operations Research Group (coordinating course assignments and acting as liaison between faculty and academic leadership), as a member of the DII Teaching Commission (COMDOC), and as a member of the DII Board of Directors — the body that advises the Department's Director on strategic and tactical decisions. I also serve on the committees of two graduate programs (M.Sc. Operations Management and M.Sc. Data Science), where I contribute to fellowship allocation, admissions criteria, and program development. Beyond the university, I have been part of the team in applied projects with direct societal impact, most notably in public health (collaborating with Chile's Ministry of Health on immunization policy for RSV) and in public institutions such as DEMRE and SERVEL. Finally, as co-director of the mentorship program “Madrinas y Padrinos ICI” since its inception in 2022, I have helped structure and run an annual cohort-based mentorship initiative that pairs senior DII alumni (with 10+ years of professional experience) with final-year students, supporting their career development through a structured 3-month program with 6–7 individual sessions per pair. A methodological contribution to this program has been the design of the mentor-mentee matching process, formulated and solved as an integer programming problem.

3.1 Departmental and University Service

- Head of the Operations Research Group, DII (April 2023 – present): coordinates teaching assignments, schedules, and exam load for all operations-related courses; acts as liaison between instructors and the departmental academic directorate.
- Member, DII Teaching Commission (COMDOC, April 2023 – present): participates in bi-weekly (later monthly) meetings addressing curricular and pedagogical issues for all DII courses.
- Member, M.Sc. Operations Management Committee (April 2023 – present): monthly meetings for strategic and tactical decisions including fellowship allocation, admission criteria, and program outreach.
- Member, M.Sc. Data Science Committee (June 2023 – November 2025): same functions as above for the Data Science master's program.
- Member, DII Board of Directors (September 2023 – present): bi-weekly meetings; provides advisory input on strategic and operational decisions of the department.

3.2 Professional Societies and Conference Organization

- ICHIO (Instituto Chileno de Investigación Operativa) — member.
- INFORMS (Institute for Operations Research and the Management Sciences) — member.
- POMS (Production and Operations Management Society) — member.
- Invited to organize Public Sector OR sessions at INFORMS Annual Meetings 2022, 2023, and 2024, and at POM Annual Conference 2022.

3.3 Public Engagement and Science Communication

Talks and outreach:

- "Equilibrio en juego de campañas electorales" — UAI Research Seminar, November 2019.
- "On the Resource Allocation for Political Campaigns" — PUC Research Seminar, August 2020.
- "Identificación de Anomalías en los resultados electorales" — High school talk, Ingenio Community (ISCI), August 2024.
- "Detección de outliers en resultados electorales" — Winter School in Engineering Systems, FCFM, July 2025.
- "Detección de outliers en resultados electorales" — Summer School, Ingenio Community (ISCI), January 2024.

- "Detección de outliers en resultados electorales" — High school talk, Ingenio Community (ISCI), August 2023.
- "Investigación de Operaciones: una aplicación en Apple" — High school talks, Ingenio Community (ISCI), May 2019 and October 2018.

Media coverage and opinion columns:

- Columna La Tercera: "Hacia dónde se fueron los votos" (October 30, 2025).
- El Mercurio: "El camino de regreso también es clave en la cadena de suministros" (June 12, 2024).
- La Segunda: "Los números de Maduro, más fraude que casualidad" (August 13, 2024).
- La Tercera: "Minsal fija el 1 de abril para el vamos de Nirsevimab" (April 1, 2024).
- Diario Estrategia: "¿Cuál es la mejor estrategia de carrera en la Fórmula 1?" (December 2023).
- La Tercera: "Proyección de la U. de Chile da como probable ganador de las elecciones en EE.UU. a Joe Biden" (November 3, 2020).
- El Mostrador: "La Ingeniería detrás del Premio Franz Edelman 2022" (May 4, 2022).
- El Mercurio: "El despegue del e-commerce en Chile" (October 2018).

Broadcast media:

- CNN Chile (recorded) and Canal 13 (live) — group testing techniques for COVID-19, May 2020.
- Radio Cooperativa Ciencia — Formula 1 pit stop optimization, December 2023.
- Radio Infinita — US Presidential Election 2020 modeling, November 4, 2020.
- Radio Universidad de Chile — Vote distribution analysis, Chilean presidential runoff, November 24, 2025.

3.4 Applied and Policy Contributions

- Ministry of Health (Chile): collaborated on (i) cost-benefit analysis of nirsevimab monoclonal antibody for RSV prevention, informing the 2024 national immunization decision (13 infant deaths in 2023, 0 in 2024); (ii) national RSV monitoring dashboard (weekly incidence by age group and ICU bed type); (iii) effectiveness study of nirsevimab controlling for geographic area, sex, prematurity, and week of birth; (iv) high-risk subgroup analysis (congenital heart disease, extreme prematurity).
- ISCI: developed the Active Case Search (BAC) index used by all regional health authorities (SEREMIS) to deploy mobile PCR units to test for COVID-19.
- DEMRE (entity in charge of Chilean standardized college admission exam): developed an outlier-scoring tool to detect anomalous score combinations in national standardized tests, supporting fraud and correction-error detection.
- Retail: developed queue statistics inference from transaction data (queue length, waiting time) using ML, in collaboration with a major Chilean retailer. CORFO Semilla grant co-investigator.
- AltaLey: simulation of carbon emission reduction scenarios and cybersecurity risk in the mining industry.
- Apple (PhD internship, Cupertino, CA, 2015): built a supply chain optimization tool generating ~$10M quarterly savings; model extended to other product lines.

3.5 External Non-University Service

- Board member, Corporación ICI (DII alumni network) — June 2018 to December 2023. Organized activities promoting networking, employment, and entrepreneurship for DII graduates.

- Board member, Madrinas y Padrinos ICI mentorship program — since 2022. An annual 3-month cohort-based mentorship initiative pairing senior DII alumni (10+ years of professional experience) with final-year students, matching them by career area and professional interests. The program has consistently received high satisfaction ratings from both students and alumni, and participation is entirely voluntary — both for mentors and mentees, and for the five-member directing board of which I am part. A methodological contribution has been the design of the mentor-mentee matching

process, formulated and solved as an integer programming problem using NLP-based distance metrics; this work also motivated a related M.Sc. Data Science thesis on the same topic.