JORGE A. GARCIA

ja4garci@uwaterloo.ca ⋄ jorge-antares.github.io ⋄ GitHub
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Water Institute
University of Waterloo
200 University Avenue West
Waterloo, ON, Canada N2L 3G1

Office: PHY3013
E: ja4garci@uwaterloo.ca
P: +1(226) 988 4035

RESEARCH INTERESTS

Applied Optimization (linear/nonlinear)
Agent-Based Modelling
Applied Machine Learning
Computable General Equilibrium Models
Complex Systems
Bayesian Decision-Making

EDUCATION

PhD, Systems Design Engineering 2014-2018
University of Waterloo
Thesis: Rule Derivation for Agent-Based Models of Complex Systems: Nuclear Waste Management and Road Networks Case Studies.

MSc with honours, Operations Research - Systems Engineering 2011-2013
National Autonomous University of Mexico (UNAM)
Thesis: Methodology for production planning using simulation and integer programming.

BSc, Industrial Management 2004-2009
National Polytechnic Institute (IPN)
Thesis: Development and Implementation of a ISO 9001:2008 Quality Management System on a civil engineering company.

RESEARCH EXPERIENCE

Research Associate - Core Modeller for Global Water Futures Aug 2022 - Currently
Water Institute/Department of Economics, University of Waterloo *Waterloo ON, Canada*

- Development of multi-regional computable general equilibrium model for hydro-economic analyses.
- Development of nonlinear optimization models for environmental analyses.
- Implementation of machine learning models to discrete choice experiment.

Post-Doctoral Fellow - Core Modeller for Global Water Futures Jun 2018 - Jul 2022
Water Institute/Department of Economics, University of Waterloo *Waterloo ON, Canada*

- Developed a computable general equilibrium (CGE) model for Canada.
- Carried out hydro-economic analyses using quadratic programming and input-output models.
- Implemented data-driven methods for discrete choice models.
- Implemented intensive simulations using distributed computation (Compute Canada).
- Performed GIS analyses using python (geopandas) and R (sf).

Doctoral Research 2014 - Jun 2018
Department of Systems Design Engineering, University of Waterloo *Waterloo ON, Canada*

- Estimated lifetimes of nuclear waste used fuel containers under microbiologically-induced corrosion.
- Derived rules of behaviour for agent-based models describing the reaction-diffusion equation.
- Formulated and solved optimal travel time models for road networks.
- Conceived and implemented equivalent representations using agents and bayesian decision-making.

Masters Research 2011 - 2013
Department of Systems Engineering, UNAM *Mexico City, Mexico*

- Formulated integer programs for production planning in a small manufacturing company.
- Performed discrete-event simulations of a metro station in Mexico City and a manufacturing process.
- Collected data on sales and passenger arrivals and performed time series analyses.

TEACHING EXPERIENCE

Teacher Assistant Aug 2014 - Dec 2017
University of Waterloo *Waterloo ON, Canada*

- Matrices and linear systems (SYDE 113).
- Numerical and applied calculus (SYDE 114).
- Probability and statistics (SYDE 212).
- Fundamental engineering math 1 (SYDE 111).
- Fundamental engineering math 2 (SYDE 112).
- Digital systems (SYDE 192).

My activities included: *tutorials, office hours, marking, lab.*

PEER-REVIEWED PUBLICATIONS

1. Brouwer, Roy, Pinto, Rute, **Garcia-Hernandez, J. A.** et al., (2023). Spatial optimization of nutrient reduction measures on agricultural land to improve water quality: A coupled modeling approach. *Canadian Journal of Agricultural Economics*. https://doi.org/10.1111/cjag.12342
2. **Garcia-Hernandez, Jorge A.** and Brouwer, Roy and Pinto, Rute, (2022). Estimating the Total Economic Costs of Nutrient Emission Reduction Policies to Halt Eutrophication in the Great Lakes. *Water Resources Research*. https://doi.org/10.1029/2021WR030772
3. Martin-Hernandez, Edgar, **Garcia-Hernandez, Jorge A.** et al., (2023). Multi-sectorial assessment of phosphorus in Ontario, Canada: mapping flows and analysis of the potential for recovery and reuse. *Resources, Conservation and Recyling*. https://doi.org/10.1016/j.resconrec.2023.107108
4. **Garcia-Hernandez, J. A.** Alamanos, Angelos (2023). Optimization in Water Resources Management. Book chapter in *Elgar Encyclopedia of Water Policy, Economics and Management*. Edward Elgar Publishing. Accepted, In the Press. https://www.e-elgar.com/shop/usd/elgar-encyclopedia-of-water-policy-economics-and-management-9781802202939.html
5. **Garcia-Hernandez, Jorge A.** and Alamanos, Angelos. (2023). A multi-objective optimization framework for water resources allocation considering stakeholder input. *Environmental Sciences Proceedings*. https://doi.org/10.3390/ECWS-7-14227
6. **Garcia-Hernandez, J. A.**, Alamanos, A. (2022). Integrated Modelling Approaches for Sustainable Agri-Economic Growth and Environmental Improvement: Examples from Canada, Greece, and Ireland. *Land*, 11, 1548. https://doi.org/10.3390/land11091548

7. Alamanos, Angelos; **Garcia, Jorge A.**; Linnane, Suzanne; and McGrath, Triona. (2022). Integrated modelling for the optimal resource use, production-economic outputs, and emissions control: A Goal Programming model for Irish agriculture. *Proceedings of the 39th IAHR World Congress.* https://doi.org/10.3850/IAHR-39WC2521716X2022890

8. **Garcia-Hernandez, J. A.**; Ponnambalam, K.; Sivaraman, M. (2021). Lifetimes of Used Nuclear Fuel Containers Affected by Sulphate-Reducing Bacteria Reactions inside the Canadian Deep Geological Repository. *Applied Sciences*,11(17),7806 https://doi.org/10.3390/app11177806

9. **Garcia-Hernandez, Jorge A.** and Brouwer, Roy, (2020). A multiregional input–output optimization model to assess impacts of water supply disruptions under climate change on the Great Lakes economy. *Economic Systems Research.* https://doi.org/10.1080/09535314.2020.1805414

10. Sivaraman M., **Garcia-Hernandez, J. A.**, Ponnambalam K., (2019). Microbial Corrosion of Used Fuel Containers. *Proceedings of the 4th Nuclear Waste Management, Decommissioning and Environmental Restoration, Canadian Nuclear Society.*

11. **Garcia, J. A.**, Ponnambalam, K., and Sivaraman, M. (2018). Lifetimes of Used Fuel Containers Assuming Sulphate-Reducing Bacterial Activity. *Proceedings of the 8th International Conference on Simulation Methods in Nuclear Science and Engineering, Canadian Nuclear Society.*

12. **Garcia-Hernandez, Jorge A,** (2018). Rule Derivation for Agent-Based Models of Complex Systems: Nuclear Waste Management and Road Networks Case Studies. *PhD thesis, Systems Design Engineering, UWSpace* http://hdl.handle.net/10012/13325.

13. **Garcia-Hernandez, J.A.**, Ponnambalam K. (2015). Stochastic programming for train distribution in a metro transportation system. *Proceedings of the 27th European Modeling and Simulation Symposium.*

14. **Garcia, J.A.** (2013). Production capacity and investment policy for a manufacturing company using simulation and integer programming. *Proceedings of the 25th European Modelling and Simulation Symposium.*

15. **Garcia-Hernandez, Jorge Andres,** (2013). Methodology for production planning using simulation and integer programming. *MSc thesis, Operations Research, UNAM.* http://132.248.9.195/ptd2013/febrero/0689556/Index.html.

16. **Garcia, J.A.** and Flores, Idalia (2012). Simulation of the operation of a metro station. *Proceedings of the 24th European Modelling and Simulation Symposium.*

17. **Garcia-Hernandez, Jorge Andres**, et al., (2011). Development and Implementation of a ISO 9001:2008 Quality Management System on a civil engineering company. *BSc thesis, Industrial Management, IPN.* https://tesis.ipn.mx/handle/123456789/8396.

SUBMITTED OR WORK-IN-PROGRESS PAPERS

- **Garcia-Hernandez, Jorge A.** and Brouwer, Roy, (2023). Water Markets as a Coping Mechanism for Climate-induced Water Changes on the Canadian Economy: A Computable General Equilibrium Approach. *To be submitted soon.* See preprint here: https://arxiv.org/abs/2309.16678.
- **Garcia-Hernandez, J. A.**, Brouwer, R., Pinto, R., and Cheng, T., (2023). A System of Environmental-Economic Accounting for the Canadian Great Lakes Economy. *In preparation to be submitted.*

PEER-REVIEWED CONFERENCES

1. **Garcia-Hernandez, Jorge A.** and Brouwer, Roy. (2023). A Computable General Equilibrium Model to Study Water Markets as a Coping Mechanism for Climate-Induced Water Changes on the Canadian Economy. *57th Annual Conference of the Canadian Economics Association*, Winnipeg, Manitoba.

2. **Garcia-Hernandez, Jorge A.** and Brouwer, Roy. (2023). Pan-Canadian Hydro-Economic Model to Study the Economy-Wide Impacts of Climate Change and Water Markets as a Coping Mechanism. *Global Water Futures Annual Conference*, Saskatoon, Saskatchewan.

3. **Garcia-Hernandez, Jorge A.** and Alamanos, Angelos. (2022). A multi-objective optimization framework for water resources allocation considering stakeholder input. *7th International Electronic Conference on Water Sciences.*

4. Alamanos, Angelos; **Garcia, Jorge A.**; Linnane, Suzanne; and McGrath, Triona. (2022). Integrated modelling for the optimal resource use, production-economic outputs, and emissions control: A Goal Programming model for Irish agriculture. *39th IAHR World Congress.*

5. **Garcia-Hernandez, J. A.**, Brouwer, R., & Pinto, R. (2021). Estimating the total economic costs of nutrient emission reduction policies to halt eutrophication in the Great Lakes. *64th International Association for the Great Lakes Research (IAGLR)*; *2021 European Association of Environmental and Resource Economists.*

6. **Garcia-Hernandez, J. A.**, Alamanos, A. (2021). Balancing Phosphorus Runoff Reduction and Farmers' utility: An Optimization for Lake Erie Area. *64th International Association for the Great Lakes Research (IAGLR).*

7. **Garcia-Hernandez, J. A.**, Brouwer, R., & Pinto, R. (2019). Assessing the Economic Impacts of Water Scarcity on the Great Lakes Basin using a Supply Side Input-Output Model. *2019 European Association of Environmental and Resource Economists.*

8. **Garcia-Hernandez, J.A.**, Ponnambalam K. (2018). Bayesian Algorithm to Estimate Travel Times in Road Networks. *Conference on Modelling Complex Urban Environments.*

9. **Garcia-Hernandez, J.A.**, Ponnambalam K. (2015). Stochastic programming for train distribution in a metro transportation system. *27th European Modeling and Simulation Symposium.*

10. **Garcia, J.A.** (2013). Production capacity and investment policy for a manufacturing company using simulation and integer programming. *25th European Modelling and Simulation Symposium.*

11. **Garcia, J.A.** and Flores, Idalia (2012). Simulation of the operation of a metro station. *24th European Modelling and Simulation Symposium.*

DATA PUBLICATIONS & OTHER

- **Garcia-Hernandez, J.**, Brouwer, R. , Pinto, R. (2022) Data for: Estimating the Total Economic Costs of Nutrient Emission Reduction Policies to Halt Eutrophication in the Great Lakes. *Federated Research Data Repository.* https://doi.org/10.20383/103.0576

- **Garcia-Hernandez, J.**, Brouwer, R (2023) (Poster) Pan-Canadian Hydro-Economic Model to Study the Economy-Wide Impacts of Climate Change and Water Markets as a Coping Mechanism. *UWSpace.* http://hdl.handle.net/10012/19552

PROJECTS

Phosphorus flow emissions in Ontario. (2022) Collected, quantified, and estimated emissions, releases, and disposals of phosphorus by the manufacturing and wastewater treatment sector located in Ontario, using different sources for 2003-2019. This piece was part of a collaborative project about mapping phosphorus flows in Ontario. https://www.pollutionprobe.org/mapping-phosphorus-flows-in-the-ontario-economy/

Flickr data retriever. (2022) Created and used a python class to retrieve photos from the Flickr API to build a regression model on valuation of ecosystem services in Ontario Canada.
https://github.com/jorge-antares/flickr_data_retriever

Discrete Choice and Latent Variable for ANA. (2020) Formulated and estimated a choice model for Attribute Non-Attendance using latent variables on Biogeme Python module.

System of Environmental Economic Accounts for Ontario. (2019) Created a database on economic (GDP by industry, population, jobs) and environmental data (water use, emissions) aggregated by the sub-basin drainage regions composing the Great Lakes, covering the 2001-2016 period.

PROGRAMMING SKILLS

Python	■■■■■
MATLAB	■■■■■
R	■■■■■
GAMS/Lingo	■■■■■
NetLogo	■■■■■
SQL	■■■□□
C++	■■■□□
bash/zsh	■■■□□
Java	■■□□□
php/html/css	■■□□□

AWARDS / SCHOLARSHIPS

2018	Graduate Research Studenship.
2014 - 2017	CONACYT Scholarship for PhD studies.
2016	SEP Complementary scholarship for graduate studies.
2013	UNAM - PAPIIT Research bursary.
2011 - 2013	CONACYT Scholarship for MSc studies.

LANGUAGES

- English: Professional working proficiency
- Spanish: Native proficiency

OTHER ACTIVITIES

- Global Representative Program volunteer 2015-2018
  University of Waterloo

NEWS/MEDIA

- New report released mapping the flow of phosphorus in Ontario's economy. July 2022
  https://uwaterloo.ca/water-institute/news/new-report-released-mapping-flow-phosphorus-ontarios-economy
- Halting eutrophication in the Great Lakes: How much will it cost? 2021
  https://uwaterloo.ca/water-institute-research/issue-13/faculty-arts/halting-eutrophication-great-lakes-how-much-will-it-cost
- Measuring the economic impact of declining water levels in the Great Lakes Basin Sep. 29th, 2020
  By Leah Gerber, *The Record*, https://www.therecord.com/news/waterloo-region/2020/09/29/measuring-the-economic-impact-of-declining-water-levels-in-the-great-lakes-basin.html
- Two UW scientists developed a model to assess the economic impact of climate change on the Canadian Great Lakes Sep. 23th, 2020
  By Felicia Daryonoputri, *im print*, https://uwimprint.ca/article/two-uw-scientists-developed-a-model-to-assess-the-economic-impact-of-climate-change-on-the-canadian-great-lakes/

- Water supply and climate change: How will the Great Lakes economy be impacted? 2020
  https://uwaterloo.ca/water-institute-research/issue-10/blue-economy/water-supply-and-climate-change-how-will-great-lakes-economy

REFERENCES

Roy Brouwer Professor, Department of Economics
Executive Director of the Water Institute, University of Waterloo
Ontario, Canada
E: rbrouwer@uwaterloo.ca P: +1 226 972 4798

Angelos Alamanos Associate Editor
Nature Sustainability
Berlin, Germany
E1: angelos.alamanos@springernature.com E2: angalamanos@gmail.com

Haiyan Liu Senior Data Analyst, Former Post-Doctoral Fellow, Department of Economics
University of Waterloo
Ontario, Canada
E: haiyan.e.liu@gmail.com