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Current Employment

Principal Economist, Canadian Economic Analysis, Bank of Canada, February 2022–present

Education

Post-Doctoral Fellow, Western University, London, Ontario. 1998-2000.

Ph.D. in Economics, Jawaharlal Nehru University, New Delhi, 1999. Dissertation Title: *The Revival of Regional Trade Arrangements: Implications for Indian Trade Policy*, Advisor: Manmohan Agarwal. A major part of the thesis work was done at the *Western University* under Professor John Whalley while visiting the University as an exchange student under the Shastri-Indo Canadian doctoral fellowship.

M. Phil in Economics, Jawaharlal Nehru University, New Delhi, May 1993, Dissertation Title: *Non-Tariff Barriers to Trade: Case Study of India vis-vis EC, Japan, and the USA*, Advisor: Manmohan Agarwal.

M.Sc. in Economics, Calcutta University, Calcutta, India, May 1989, Specialization: International Trade and Economic Planning.

Other professional courses

Summer School on Foundations of DSGE Macro-Modelling, University of Surrey, September 2025.

Sustainable Development Leadership Program, Richard Ivey School of Business, Western University – 2012.

Language

English Fluent
 French: BBB

Previous Positions

Senior Advisor and Chief of the CGE Modeling Section: Model Development and Quantitative Analysis Division, Economic Analysis Directorate (EAD), Environment and Climate Change Canada, Government of Canada, Gatineau, January 2011-Feb 2022.

Senior Policy Advisor: Economic Studies and Policy Analysis Division (ESPAD), Economic and Fiscal Policy Branch, Department of Finance, Government of Canada, Ottawa, March 2007-December 2010.

Senior Research Economist: Micro-Economic Policy Analysis (MEPA) Branch, Industry Canada, Ottawa, June 2004-March 2007.

Research Economist: Micro-Economic Policy Analysis (MEPA) Branch, Industry Canada, Ottawa, October 2000-June 2004.

Contract Instructor: Carleton University, Ottawa, Canada, 2008-2009. Taught Introduction to Economic Development 3rd year students.

Research and Teaching Fellow: University of Western Ontario, Fall 1998-September 2000. Taught Econ 152: Intermediate Macroeconomics; Econ 589/689: Applied General Equilibrium. Worked on Economies of Vietnam, South Korea, and Thailand. Actively involved in Vietnamese trade and tax policy modeling using applied general equilibrium framework.

Teaching and Research Assistant: University of Western Ontario, Fall 1996 - Fall 1998.

Visiting Scholar: University of Western Ontario, Jan 1996 - Fall 1996.

Research Scholar: Jawaharlal Nehru University, India, 1991- 1996.

Research Associate: National Institute of Public Finance and Policy, India, Nov. 1992- Jan. 1996.

Junior Research Associate: Indian Statistical Institute, India, Sept. 1992- Nov. 1992.

Junior Research Associate: National Institute of Public Finance and Policy, India, Sept. 1991- October 1992.

Current areas of research

CGE/IAM/DSGE model-based analyses of Climate Change Policies, Energy and Environmental policies, Trade and public finance.

Publications

Transitions in energy mix and the economic costs under a carbon constrained world: the role of zero and net-negative emission technologies, with Elisabeth A. Gilmore , Peter Johnston, Muhammad-Shahid Siddiqui and Nick Macaluso (2023). *Energy and Climate Change* 4 (2023) 100106, DOI:

<https://doi.org/10.1016/j.egycc.2023.100106>. [Link to Paper](#).

Income and investment, not energy policy, are driving GHG emission intensities, co-authored with Joel Bruneau, Deming Luo, Yunfa Zhu (2022) *Economic Systems Research*. DOI: [10.1080/09535314.2022.2133598](https://doi.org/10.1080/09535314.2022.2133598). [Link to Paper](#).

A model intercomparison of the welfare effects of regional coalitions for ambitious climate mitigation targets with Gökçe Akın-Olcum, Elisabeth Gilmore, Peter Johnston, Mohammad M. Khabbazan, Ruben Lubowski, Margaret McCallister, Nick Macaluso, Sonja Peterson, Malte Winkler, Maosheng Duan, Mengyu Li, Ramiro Parrado, Sebastian Rausch, *Climate Change Economics* (2022), doi: 10.1142/S2010007823500094.

Capturing key energy and emission trends in CGE models: Assessment of status and remaining challenges, with Taran Fæhn, Gabriel Bachner, Shinichiro Fujimori, Meriem Hamdi-Cherif, Elisa Lanzi, Sergey Paltsev, Toon Vandyck, Robert Beach, Bruno Cunha, Rafael Garaffa, Karl Steininger, *Journal of Global Economic Analysis*, Volume 5 (2020), No. 1, pp. 196-272 (2020). [Link to Paper](#)

The Drivers of GHG Emissions Intensity Improvements in Major Economies Analysis of Trends 1995-2009, with Deming Luo, Muhammad Shahid Siddiqui, Thomas Rutherford, Yunfa Zhu - *Foreign Trade Review*, Volume 55(3) 277–297 (2020). [Link to Paper](#)

Revenue recycling and cost effective GHG abatement: An exploratory analysis using a global multi-sector multi-region CGE model, Yunfa Zhu, Madanmohan Ghosh, Deming Luo, Nick Macaluso and Jacob Rattray, *Climate Change Economics*, Vol. 9, No. 1 (2018) 1840009. [Link to Paper](#)

Impacts of Technology uncertainty on Energy Use, Emission and Abatement Cost in USA: Simulation results from Environment Canada's Integrated Assessment Model for EMF 24 US Scenarios (with Yunfa Zhu). *The Energy Journal* (2014) Vol. 35, No. SI1. [Link to Paper](#)

Production versus Consumption-Based Emission Targeting: Implications for Developing and Developed Economies (with Manmohan Agarwal). *Environment and Development Economics* (2013), available

doi:10.1017/S1355770X13000582. [Link to Paper](#)

Temperature control, emission abatements and costs: Key EMF 27 results from the Environment Canada integrated assessment model (with Yunfa Zhu). *Climatic Change* (2014) 123:571–582. [Link to Paper](#)

Analysis of the Marginal Abatement Cost of GHG Emissions across Regions: Insights from a CGE Model (with Deming Luo, Muhammad Shahid Siddiqui and Yunfa Zhu), in Jingwen Li and Liao Mei (eds), “Proceedings of 2nd Annual Conference of Asian-European Energy Policy Research Network: *Transition Towards Low Carbon Transport: Asian and European Perspectives*”. Beijing University of Technology. 2013. [Link to Paper](#)

Impact of Foreign Ownership Restrictions on FDI Stock in OECD Countries (with Panagiotis Syntetos and Weimin Wang). *Global Economy Journal*, Vol. (12:3, Article 1) 2012. [Link to paper](#)

Border tax adjustments in the climate policy context: CO2 versus broad-based GHG emission targeting (with Deming Luo, Muhammad Shahid Siddiqui and Yunfa Zhu). *Energy Economics* (2012), Vol 34. (sp 2). [Link to Paper](#)

An India-China FTA: Potential Economic Implications for the Asian and the North American Economies (with Manmohan Agarwal). *South Asia Economic Journal*, Vol. 12(2): 185-220, October 2011. [Link to Paper](#)

Canada and US Outward FDI and Exports: Are China and India Special? (with Weimin Wang). *International Trade Journal*, 25(4):465-512, August 2011. [Link to Paper](#)

Chinese Accession to the WTO: Economic Implications for the Asian and North American Economies (with Someshwar Rao). *Journal of Policy Modeling*, Volume 32(3):389-398, May-June 2010. [Link to Paper](#)

Does FDI Accelerate Economic Growth? The OECD Experience Based on Panel Data Estimates for the Period 1980-2004 (with Weimin Wang), *Global Economy Journal*, 9 (4), Article 1, 2009. [Link to paper](#)

State-Owned Enterprises, Shirking and Trade Liberalization (with John Whalley), *Economic Modelling*, 25: 1206-1215, October 2008. [Link to Paper](#)

Endogenous Effort and Intersectoral Labour Transfers under Industrialization (with John Whalley), *Journal of Economic Integration*, 22(3):461-481, September 2007. [Link to Paper](#)

R&D Policies and Endogenous Growth: A Dynamic General Equilibrium Analysis of the Case for Canada, *Review of Development Economics*, 11(1): 187-203, February 2007. [Link to Paper](#)

Is Canada Underperforming in Foreign Direct Investment and Exports to China? (with Weimin Wang), *HORIZONS*, 9(2): 55-58, August 2006. [Link to paper](#) – [Link to paper version French](#).

Effects of A Free Trade Area of The Americas (FTAA): Evaluation Based on A Dynamic Global General Equilibrium Model (with Carolyn Mac Leod), *Integration and Trade*, 24: 27-61, June 2006. [Link to paper](#) [Link to Spanish version](#)

Adjustment Costs in Labour Markets and the Distributional Effects of Trade Liberalization: Analytics and Calculations for Vietnam (with Nguyen Chan, Tran Kim Dung, and John Whalley), *Journal of Policy Modeling*, 27(9): 1009-1024, December 2005. [Link to Paper](#)

Economic Impacts of a Possible Canada-U.S. Customs Union: Simulation Results from a Dynamic CGE Model (with Someshwar Rao), *Journal of Policy Modeling*, 27(7): 805-827, October 2005. [Link to Paper](#)

Possible Economic Impacts in Canada of a Canada-US Customs Union (with Someshwar Rao, *HORIZONS*, 7(1): 32-34, June 2004. [Link to paper](#) – [Link to paper version French](#).

Are Price Controls Necessarily Bad? The Case of Rice in Vietnam, (with John Whalley), *Journal of Development Economics*, 73(1): 215-232, January 2004. [Link to paper](#)

Developing Country Benefits from MFN Relative to Regional/Bilateral Trade Arrangements, (with John

Whalley and Carlo Perroni), *Review of International Economics*, 11(4): 712-728, September 2003. [Link to Paper](#)

The Revival of Regional Trade Arrangements: A General Equilibrium Evaluation of the Impacts on Small and Medium Size Countries, *Journal of Policy Modeling*, 24(2): 83-101, May 2002. [Link to Paper](#)

The Revival of Regional Trade Arrangements: Implications for Indian Trade Policy, in Parthasarathi Banerjee and Frank-Jürgen Richter (eds.), *Economic Institutions in India: Sustainability Under Liberalization and Globalization*, pp 237-262, Hounds Mills, U.K. and New York: Palgrave Macmillan, 2002.

Multiple Constraint Relaxation and The Shadow Price of Foreign Exchange (with Eric Hutton and John Whalley). *Journal of Development Economics*, 60(2): 577-588, November 1999. [Link to Paper](#)

On Some Properties of a Trade Closure Structure Widely Used in Numerical Modelling (with Keshab Bhattacharai and John Whalley), *Economics Letters*, 63(1): 13-21, January 1999. [Link to Paper](#)

More on Trade Closure (with Keshab Bhattacharai and John Whalley), in Gustav Ranis and Lakshmi K. Raut (Eds.), *Trade, Growth and Development: Essays in Honor of Professor T.N. Srinivasan*, pp. 125-36, Contributions to Economic Analysis, vol. 242. Amsterdam; New York and Oxford: Elsevier Science, North-Holland, 1999. [Link to paper](#)

Uneven Growth of Government Expenditure in India: An Analysis of Trends Between 1974-75 to 1990-91 (with M. Govinda Rao and Tapas Sen). *Journal of Indian School of Political Economy*, .7(2):256-276, April-June 1995. [Link to Paper](#)

The Implications of 1994-95 Budget for Growth and Stability (with Tapas Sen and M. Govinda Rao), *Economic and Political Weekly*, pp 969-977, April 16-23, 1994. [Link to Paper](#)

Papers under consideration with Journals

Macroeconomic Impacts of the Transition to Net Zero in Small Open Economies, with colleagues at Bank of Canada with Tatjana Dahlhaus et al. With *Journal of Financial Stability*.

Monographs/Working Papers

Implications of cap-and-trade in oil and gas sector emissions and ZEV sales mandate for Canada's macroeconomy (2024).

Beyond the numbers: Examining economic modeling tools for climate change policy analysis (2024). [Link to paper](#).

Navigating Decarbonization Challenges in Hard-to-abate Industrial Sectors in the United States: The Role of Transformative Technologies (2024), with Eric Stewart, Peter Johnston and Nick Macaluso.

On the issues of closures in CGE models: An exploration using a small open-economy multi-provincial CGE model (2017), with Deming Luo, Nick Macaluso, Jacob Rattray, Yunfa Zhu.

Effects of the rise in oil price on emissions and the economy: A computable general equilibrium analysis for Canada (2011). Was accepted in *Energy Policy*.

Marginal abatement cost of GHG emissions: Why they differ across Models? (2016), with Deming Luo, Jacob, Rattray and Yunfa Zhu.

Climate Finance: A multi-sector, multi-regional CGE analysis (2014), with Deming Luo and Yunfa Zhu.

Embodied Emissions in International Trade: Regional Dimensions with a focus on Canada (2011), with Muhammad Shahid Siddiqui.

Why Do the Costs of GHG Emission Abatements Differ Across Countries? An Illustration for Canada and the United States (2011) with Deming Luo.

The Determinants of Business Sector R&D in Canada: The Role of Government (2004), with Mohammed Rafiquzzaman1 and Someshwar Rao.

State-Owned Enterprises, Shirking and Trade Liberalization (2000), with John Whalley, NBER Working paper No. 7696, May 2000.

Evaluating Tax Reform in Vietnam Using General Equilibrium Methods (1999), with Nguyen Chan and John Whalley, Working paper, University of Western Ontario.

The Value of MFN Treatment (1998), with John Whalley and Carlo Perroni, NBER Working Paper No. 6461, March 1998.

Inter-State Economic Inequality in India: Some Implications for Development Strategy, *Monograph, Trade and Development Division, School of International Studies, Jawaharlal Nehru University*, June 1995, with Sandip K. Das and Alokes Barua.

Non-Tariff Barriers to Trade: Case Study of India vis-a-vis EC, Japan and the USA (1994), *Working Paper No. 3/94, National Institute of Public Finance and Policy, New Delhi*, 1994.

Upcoming conference presentation

ASSA Annual Meeting (AEA), Philadelphia, Jan 3–5, 2026 — “Do Carbon Prices Influence Inflation? The Canadian Experience,” session: *Inflation and Expectations*.

Honours and Fellowships

Shastri Indo-Canadian Institute Doctoral Award 1994-95, tenured at the University of Western Ontario, Canada, 1996.

Indian Council of Social Science Research Doctoral Fellow 1995.

Research Grants

Co-applicant of University of Ottawa Research Grants: “*Designing Carbon Pricing Policy to Drive Innovation in Low Carbon Technologies and Practices*” – Awarded 400K by Carbon Management Canada (CMC).

Journal Referees

B.E. Journal of Economic Analysis & Policy, Canadian Journal of Economics, Canadian Public Policy, Canadian Journal Forestry Research, Economic Modeling, Economics of Energy and Environmental Policy, Energy Economics, Energy Policy, Environment and Development Economics, Global Citizenship and Equity Education, Global economy Journal, International Journal of Public Policy, Journal of Globalization and Development, World Economy,

Membership of Professional Organizations and Committees

American Economic Association (AEA), Association des économistes québécois (l'ASDEQ), Canadian Economic Association (CEA), Canadian Resource and Environmental Economics (CREE), The International Association for Energy Economics (IAEE).