CURRICULUM VITAE

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CITIZENSHIP: Canadian (U.S. resident)

EDUCATION: Ph.D. in Economics, University of British Columbia, June 1977 M.A. in Mathematics, Hebrew University, Jerusalem, April, 1970 B.Sc. (Honours) in Mathematics, University of Manitoba, 1968

ACADEMIC AND PROFESSIONAL EXPERIENCE:

Research Economist, Strategic Planning and Research, Department of Manpower and Immigration, Ottawa, November 1971-May 1974.
Assistant Professor, U. Toronto, July 1977; Associate Professor, from March 1980.
Professor, Department of Economics, U. Toronto, from July 1983.
University Professor of Economics, U. Toronto, July 1994 – June 1998.
Elmer B. Milliman Professor of Economics, U. Rochester, July 1998 – June 2007.
Current Position: Professor of Economics, Boston University (since July 2007)

HONOURS: Fellow of the Econometric Society (since 1989)
1994 Frisch Medal (awarded by Econometric Society)
Fellow of the Royal Society of Canada 1994-1999
John Rae Award (CEA) for Outstanding Research (1994)
Listed in Who's Who in Economics, 3rd ed., M. Blaug ed., Edward Elgar, 1999.
ISI Highly Cited Researcher
SAET Economic Theory Fellow (since 2011)
Member of American Academy of Arts and Sciences (since 2013)
Fellow of the Canadian Economic Association (since 2019)

PAPERS IN REFEREED JOURNALS

- "Some Economic Effects of Immigration: A General Equilibrium Analysis," <u>Canadian Journal of</u> <u>Economics</u> 7, (1974), 174-90.
- "A Disaggregate Analysis of Consumer Choice Under Uncertainty," <u>Econometrica</u> 43 (1975), 877-92.
- "Production Flexibility and the Behaviour of the Competitive Firm Under Price Uncertainty," <u>Review of Economic Studies</u> (1978), 251-261.
- "The Le Chatelier Principle in Optimal Control Problems," Journal of Economic Theory (1978), 103-22.
- "Decision Making and the Temporal Resolution of Uncertainty," <u>International Economic Review</u> (1980), 267-281.
- "Generalized Increasing Correlation: A Definition and Some Economic Consequences," <u>Canadian Journal of Economics</u> 13 (1980), 16-34, with S. M. Tanny.
- "Endogenous Capital Utilization in a Short Run Production Model: Theory and an Empirical Application," Journal of Econometrics 12 (1980), 189-207, with M. Denny.
- "Multivariate Risk Independence and Functional Forms for Preferences and Technologies," <u>Econometrica</u> (1980), 973-85.
- "Capital Asset Prices and the Temporal Resolution of Uncertainty," <u>Journal of Finance</u> (1980), 627-643, with S. Turnbull.
- "Generalized Duality and Integrability," Econometrica (1981), 655-678.
- "Duality Theory and Functional Forms and Dynamic Factor Demand Functions," <u>Review of</u> <u>Economic Studies</u> (1981), 81-95.
- "Comparative Dynamics in the Adjustment-Cost Model of the Firm," <u>Journal of Economic</u> <u>Theory</u> (1982), 77-100.
- "On Decreasing Absolute Risk Aversion and Utility Indices Derived from Cake-Eating Problems," Journal of Economic Theory (1983), 245-264.
- "Integrability of Incomplete Systems of Demand Functions," <u>Review of Economic Studies</u> (1982), 411-425.
- "The Multivariate Flexible Accelerator Model: Its Empirical Restrictions and an Application to U.S. Manufacturing," <u>Econometrica</u> (1983), 647-673, with M. Denny.
- "Stationary Cardinal Utility and Optimal Growth Under Uncertainty," Journal of Economic

<u>Theory</u> (1983), 133-152. Reprinted in <u>Growth Theory II</u>, R. Becker and E. Burmeister eds., Edward Elgar Ltd., 1990.

- "Intertemporal Price Indices for the Firm," <u>Journal of Economic Dynamics and Control</u> 6 (1983), 109-126.
- "The Rate of Time Preference and Dynamic Economic Analysis," <u>Journal of Political Economy</u> (1983), 611-635, with A. Hynes. Reprinted in <u>Growth Theory III</u>, R. Becker and E. Burmeister eds., Edward Elgar Ltd., 1990.
- Aggregating Quasi-Fixed Factors," Scandinavian Journal of Economics 85 (1983), 191-205.
- "The Empirical Determination of Technology and Expectations: A Simplified Procedure," Journal of Econometrics 27 (1985), 235-258, with A. Yatchew.
- "Decreasing Risk Aversion and Mean-Variance Analysis," Econometrica 53 (1985), 945-961.
- "Nonparametric Hypothesis Testing Procedures and Applications to Demand Analysis," <u>Journal</u> of Econometrics 30 (1985), 149-169, with A. Yatchew. Reprinted in <u>New Approaches to</u> <u>Modelling, Specification Selection and Econometric Inference</u>, W. Barnett and R. Gallant eds., Cambridge U. Press, 1989.
- "Intergenerational Preference Orderings," Social Choice and Welfare 3 (1986), 151-160.
- "A Simple Dynamic General Equilibrium Model," <u>Journal of Economic Theory</u> 41 (1987), 68-95.
- "Implicitly Additive Utility and the Nature of Optimal Economic Growth," <u>Journal of</u> <u>Mathematical Economics</u> 15 (1986), 111-128.
- "The Global Stability of Efficient Intertemporal Allocations," Econometrica 55 (1987), 329-355.
- "The Unimportance of the Intransitivity of Separable Preferences," <u>International Economic</u> <u>Review</u> 28 (1987), 315-322.
- "The Law of Large Numbers and the Attractiveness of Compound Gambles," Journal of Risk and Uncertainty 1 (1988), 103-117, with Chew S. H.
- "The Structure of Preferences and Attitudes Towards the Timing of the Resolution of Uncertainty," <u>International Economic Review</u> 30 (1989), 103-117, with Chew S.
- "Risk Aversion and Asset Prices," Journal of Monetary Economics 22 (1988), 179-192.
- "A Unifying Approach to Axiomatic Non-Expected Utility Theories," <u>Journal of Economic</u> <u>Theory</u> 49 (1989), 207-240, with Chew S. H., "Correction and Comment," 59 (1993), 183-188, with Chew S. H. and P. Wakker.

- "Substitution, Risk Aversion and the Temporal Behaviour of Consumption and Asset Returns: A Theoretical Framework," <u>Econometrica</u> 57 (1989), 937-69, with S. Zin. (Awarded the Frisch Medal 1994.)
- "Non-Expected Utility Preferences in a Temporal Framework with an Application to Consumption-Savings Behaviour," Journal of Economic Theory 50 (1990), 54-81, with Chew S. H.
- "First-Order Risk Aversion and the Equity Premium Puzzle," Journal of Monetary Economics 26 (1990), 387-407, with S. Zin.
- "Mixture Symmetry and Quadratic Utility," <u>Econometrica</u> 59 (1991), 165-187, with Chew S. H. and U. Segal.
- "Substitution, Risk Aversion and the Temporal Behaviour of Consumption and Asset Returns: An Empirical Analysis," Journal of Political Economy 99 (1991), 263-286, with S. Zin.
- "Stochastic Differential Utility," Econometrica 60 (1992), 353-394, with D. Duffie.
- "Quadratic Social Welfare Functions," <u>Journal of Political Economy</u> 100 (1992), 691-712, with U. Segal. Reprinted in Amartya Sen: Critical Assessments of Contemporary Economics, J. Wood and R. Wood eds., Routledge, 2007.
- "Asset Pricing with Stochastic Differential Utility," <u>Review of Financial Studies</u> 5 (1992), 411-436, with D. Duffie.
- "Habits and Time Preference," International Economic Review 34 (1993), 61-84, with S. Shi.
- "Dynamically Consistent Beliefs Must Be Bayesian," Journal of Economic Theory 61 (1993), 1-22, with M. Le Breton.
- "The Projective Independence Axiom," <u>Economic Theory</u> 4 (1994), 189-215, with Chew S. H. and U. Segal.
- "Intertemporal Asset Pricing Under Knightian Uncertainty," <u>Econometrica</u> 62 (1994), 283-322, with Tan Wang. Reprinted in *Uncertainty in Economic Theory: Essays in Honor of David Schmeidler's* 65th Birthday, I. Gilboa ed., Routledge, 2004.
- "Uncertainty, Risk-Neutral Measures and Security Price Booms and Crashes," <u>Journal of</u> <u>Economic Theory</u> 67 (1995), 40-82, with Tan Wang.
- "A Revealed Preference Analysis of Asset Pricing Under Recursive Utility," <u>Review of</u> <u>Economic Studies</u> 62 (1995), 597-618, with Angelo Melino.

"Beliefs about Beliefs' without Probabilities," Econometrica 64 (1996), 1343-73, with T. Wang.

"Preference, Rationalizability and Equilibrium," Journal of Economic Theory 73 (1997), 1-29.

"Least Convex Capacities," Economic Theory 13 (1999), 263-286, with J. Zhang.

- "A Definition of Uncertainty Aversion," <u>Review of Economic Studies</u> 66 (1999), 579-608. Reprinted in *Uncertainty in Economic Theory: Essays in Honor of David Schmeidler's* 65th Birthday, I. Gilboa ed., Routledge, 2004.
- "A Revelation Principle for Competing Mechanisms," Journal of Economic Theory 88 (1999), 119-160, with M. Peters.
- ``Are Probabilities Used in Markets?'', Journal of Economic Theory 91 (2000), 86-90.
- "Subjective Probabilities on Subjectively Unambiguous Events," <u>Econometrica</u> 69 (2001), 265-305, with J. Zhang.
- "Sharing Ambiguity," <u>American Economic Review</u> 91 (2001), 45-50.
- "The Core of Large Differentiable TU Games," Journal of Economic Theory 100 (2001), 235-273, with M. Marinacci.
- "The Independence Axiom and Asset Returns," Journal of Empirical Finance 8 (2001), 537-572, with S. Zin.
- "Ambiguity, Risk and Asset Returns in Continuous Time," <u>Econometrica</u> 70 (2002), 1403-1443, with Z. Chen.
- [^]A Two-Person Dynamic Equilibrium under Ambiguity," <u>Journal of Economic Dynamics and</u> <u>Control</u> 27 (2003), 1253-1288, with J. Miao.
- "Recursive Multiple-Priors", <u>Journal of Economic Theory</u> 113 (2003), 1-31, with M. Schneider. Included in the list of 50 influential articles from the journal's first 50 years, (May 2020 virtual issue)
- ^{**}IID: Independently and Indistinguishably Distributed," <u>Journal of Economic Theory</u> 113 (2003), 32-50, with M. Schneider
- ^{**}An Axiomatic Model of Non-Bayesian Updating, <u>Review of Economic Studies</u> 73 (2006), 413-436.
- ``Cold Feet," Theoretical Economics 2 (2007), 231-259, with I. Kopylov
- ``Learning under Ambiguity," <u>Review of Economic Studies</u> 74 (2007), 1275-1303, with M. Schneider.

- "Coarse Contingencies and Ambiguity," <u>Theoretical Economics</u> 2 (2007), 355-394, with M. Marinacci and K. Seo.
- ``Ambiguity, Information Quality and Asset Pricing," <u>Journal of Finance</u> 63 (2008), 197-228, with M. Schneider.
- "Non-Bayesian Updating: a Theoretical Framework," <u>Theoretical Economics</u> 3 (2008), 193-229, with J. Noor and A. Sandroni.
- "Living with Risk," <u>Review of Economic Studies</u> 75 (2008), 1121-1141.
- "Subjective States: A More Robust Model," <u>Games and Economic Behavior</u> 67 (2009), 399-407, with K. Seo.
- "Non-Bayesian Learning," <u>B.E. Journal of Theoretical Economics (Advances)</u>, Vol. 10 : Iss. 1, with J. Noor and A. Sandroni.
- "Symmetry of Evidence without Evidence of Symmetry," <u>Theoretical Economics</u> 5 (2010), 313-368, with K. Seo.

``A Paradox for the `Smooth Ambiguity' Model of Preference,'' <u>Econometrica</u> 78 (2010), 2085-2099.

"Symmetry or Dynamic Consistency?", <u>B.E. Journal of Theoretical Economics (</u>Advances), Vol. 11 : Iss. 1, with K. Seo.

"Ambiguous Volatility and Asset Pricing in Continuous Time," <u>Review of Financial Studies</u> 26 (2013), 1740-1786, with Shaolin Ji.

``Ambiguous Volatility, Utility and Possibility in Continuous Time," Journal of Mathematical Economics 50 (2014), 269-282, with Shaolin Ji.

"De Finetti Meets Ellsberg," <u>Research in Economics</u> 68 (2014), 11-26, with Kyoungwon Seo.

"How Much Would You Pay to Resolve Long-Run Risk?" <u>American Economic Review</u> 104 (2014), 2680-97, with Emmanuel Farhi and Tomasz Strzalecki.

"Exchangeable Capacities, Parameters and Incomplete Theories," <u>Journal of Economic Theory</u> 157 (2015), 879-917, with Kyoungwon Seo.

"Robust Confidence Regions for Incomplete Models," <u>Econometrica</u> 84 (2016), 1799-1838, with Hiroaki Kaido and Kyoungwon Seo.

"Ambiguous Correlation," <u>Review of Economic Studies</u> 86 (2019), 668-693, with Y. Halevy.

"Optimal Learning under Robustness and Time-Consistency," <u>Operations Research</u>, forthcoming, with Shaolin Ji.

SHORT ARTICLES IN REFEREED JOURNALS

"On the Recoverability of Intertemporal Preferences," Econ. Letters 5 (1980), 11-14.

- "A Correspondence Theorem Between Expected Utility and Smooth Utility," <u>Journal of</u> <u>Economic Theory</u> 46 (1988), 186-193, with Chew Soo Hong and I. Zilcha.
- "Axiomatic Rank Dependent Mean Values," <u>Annals of Operations Research</u> 19 (1989), 299-309, with Chew S. H.
- "Mutual Absolute Continuity of Multiple-Priors," <u>Journal of Economic Theory</u> 137 (2007), 716-720, with M. Marinacci.

OTHER PUBLICATIONS

- Impatience," three thousand word entry in <u>The New Palgrave: A Dictionary of Economic Theory</u> <u>and Doctrine</u>, J. Eatwell, M. Millgate and P. Neuman (eds.) Macmillan Press, 1987.
- "Discussion of 'Substitution Over Time in Consumption and Work," in <u>Value and Capital, Fifty</u> <u>Years Later</u>, L. McKenzie and S. Zamagni eds., Macmillan, (1991), 268-278.
- "Recursive Utility Under Uncertainty," in <u>Equilibrium Theory in Infinite Dimensional Spaces</u>, A. Khan and N. Yannelis (eds.), Springer Verlag, (1991), 352-369; with S. H. Chew.
- "Behaviour Under Risk: Recent Developments in Theory and Application," in <u>Advances in</u> <u>Economic Theory – Sixth World Congress of the Econometric Society</u>, Vol II, J. J. Laffont ed., Cambridge U. Press, (1992), 1-63.

``Ambiguity and Asset Markets,'' <u>Annual Review of Financial Economics</u> 2 (2010), 315-346, with Martin Schneider.

EDITORIAL POSITIONS

Associate Editor, <u>Econometrica</u>, 1991-2009 Associate Editor, <u>Journal of Economic Theory</u>, 1991-2013 Associate Editor, <u>Economic Theory</u>, 1993-2005; member of Advisory Board, 2010-Associate Editor, <u>Journal of Risk and Uncertainty</u>, 1988-Associate Editor, <u>Macroeconomic Dynamics</u>, 1997- 2001 Member of the Editorial Board of the <u>Can. J. Economics</u>, 1982-85. Advising Editor 2013-2017

REFEREEING

Econometrica, American Economic Review, International Economic Review, Journal of Political Economy, Review of Economic Studies. Quarterly Journal of Economics, Journal of Economic Theory, Theoretical Economics, Mathematical Social Sciences, Journal of Finance, Scandinavian Journal of Economics, Journal of Money, Credit and Banking, Canadian Journal of Economics, Social Sciences & Humanities, Research Council of Canada, National Science Foundation, Management Science

OTHER PROFESSIONAL SERVICE

Member of Executive Council of Canadian Economics Association, 1987-1990. Member of Fellows Nominating Committee of Econometric Society, 1995 and 1999.

PH.D. THESIS SUPERVISION

Shouyong Shi, 1991, now at Penn State Susheng Wang, 1991, Hong Kong U. Science and Technology Chenghu Ma, 1992, Fudan University Tan Wang, 1992, U.B.C. (Finance) Kin Chung Lo, 1995, York University Jiankang Zhang, 1998, Carleton University Jianjun Miao, 2003, Boston University Igor Kopylov, 2003, UC Irvine Takashi Hayashi, 2004, U. Glasgow Jawwad Noor, 2005, Boston University Norio Takeoka, 2006, Hitotsubashi University Kazuya Hyogo, 2007, Ryukoku University Spyros Galanis, (co-supervisor) 2007, City Univ. London Kyoungwon Seo, 2008, Seoul National University Youichiro Higashi, 2008, Okayama University Asen Kochov, 2010, University of Rochester John Stovall, (co-supervisor), 2010, Brigham Young Univ. Andrew Ellis, 2013, LSE Guihai Zhao, (co-supervisor), 2016, Bank of Canada Yi-Hsuan Lin, 2019, Academia Sinica Taiwan Fernando Payro Chew, 2021, Universitat Autònoma de Barcelona

RESEARCH GRANTS AWARDED

- Connaught Fund (\$11,816), November 1979, Dynamic Factor Demand Functions: Theory and Estimation.
- Social Sciences and Humanities Research Council (SSHRC) Sabbatical Leave Fellowship, 1984-5.
- SSHRC research grant (\$19,640), Feb. 1985, Nonparametric Testing of Economic Hypotheses; joint with A. Yatchew.
- NSF research grant (\$45,000 U. S.), August 1986, Nonlinear Preference Theory and Temporal Decision Making Under Uncertainty, joint with Chew Soo Hong.
- SSHRC research grant (23,250), 1987-1989, Choice and Behaviour Under Uncertainty.
- SSHRC research grant (\$81,000), 1989-1992, Recursive Utility, Risk Aversion and Issues in Stochastic Capital Theory.
- SSHRC research grant (\$74,000), 1993-1996, Choice Under Knightian Uncertainty: Theory and Applications.
- Connaught Research Fellowship, University of Toronto, 1994-5.
- National Science Foundation award SES-9972442 (\$186,500), 1999-2002: Ambiguity: Meaning and Applications.
- National Science Foundation award SES-0611456 (\$147,513), 2006-2009: Coarse Contingencies.
- National Science Foundation award SES-0917740 (\$186,859), 2009-2012: Symmetry, Ambiguity and Frequencies, Collaborative Research with Kyoungwon Seo.
- National Science Foundation award SES-1216339 (\$190,636), 2012-2015: Volatility, Possibility and Utility.