Anne MacKay

Département de mathématiques
Université de Sherbrooke
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RESEARCH INTERESTS

Actuarial and financial mathematics
Pricing and hedging long-term financial and insurance guarantees
Numerical methods in financial mathematics

ACADEMIC EXPERIENCE

Associate professor 2021 – present
Department of Mathematics and Department of Finance
Université de Sherbrooke, Sherbrooke, Canada

Associate professor 2020 – 2021
Department of Mathematics, UQAM, Montreal, Canada

Assistant professor 2016 – 2020
Department of Mathematics, UQAM, Montreal, Canada

Postdoctoral researcher 2014 – 2016
RiskLab, ETH Zurich, Zurich, Switzerland

EDUCATION

Doctor of Philosophy, Actuarial Science 2011 – 2014
University of Waterloo, Waterloo, Canada
Under the supervision of Dr. Carole Bernard and Dr. Mary Hardy
Thesis: Fee Structure and Surrender Incentives in Variable Annuities

Master of Science, Mathematics 2009 – 2011
Concordia University, Montréal, Canada
Under the supervision of Dr. Patrice Gaillardetz
Thesis: Pricing and Hedging Equity-Linked Products under Stochastic Volatility Models

Bachelor of Science, Actuarial Science 2004 – 2007
Université Laval, Québec, Canada

Certificate in Economics 2003 – 2005
Université Laval, Québec, Canada

PROFESSIONAL DESIGNATIONS

Fellow of the Society of Actuaries (FSA) 2012
Associate of the Canadian Institute of Actuaries (ACIA) 2019

GRANTS AND AWARDS

Research Grants

Discovery Grant, NSERC ($90,000 over 5 years, one year extension) 2016 – 2022
Établissement de nouveaux chercheurs universitaires, FRQNT (40 000$ over 2 years) 2018 – 2020
Research Grant, IFSID ($35,000 shared with A. Melnikov) 2016 – 2017
Individual Research Grant, Society of Actuaries ($24,000 shared with Z. Cui, R. Feng) 2015 – 2016

PUBLICATIONS

Publications in peer-reviewed journals

1. Kouritzin, M. A., A. MacKay and N. Vellone-Scott (2020): "New Branching Filters With Explicit Negative Dependence", *IEEE Access*, 8, 157306-157321, doi: 10.1109/ACCESS.2020.3019226.
2. Kouritzin, M. A. and A. MacKay (2020): "Branching Particle Pricers with Heston Examples", *International Journal of Theoretical and Applied Finance*, 23(1), 29 pages.
3. MacKay, A., A. Melnikov et Y. Mishura (2018): "Optimization of small deviation for mixed fractional Brownian motion with trend", *Stochastics*, 90(7): 1-24.
4. Kourtizin, M. et A. MacKay (2018): "VIX-linked fees for GMWBs via Explicit Solution Simulation Methods", *Insurance: Mathematics and Economics*, 81: 1-17.
5. MacKay, A. (2017): "Quantile hedging pension payoffs: an analysis of investment incentives", *European Actuarial Journal*, 7(2): 481-514.
6. Cui, Z., R. Feng and A. MacKay (2017): "Variable Annuities with VIX-linked Fee Structure under a Heston-type Stochastic Volatility Model", *North American Actuarial Journal*, 21(3): 458-483.
7. MacKay, A., M. Augustyniak, C. Bernard and M. Hary (2015): "Risk Management of Policyholder Behavior in Equity-Linked Insurance", *Journal of Risk and Insurance*, 84(2): 661-690.
8. MacKay, A., M. V. Wüthrich (2015): "Best-Estimates in Bond Markets with Reinvestment Risk", *Risks*, 3(3): 250-276.
9. Bernard, C., A. MacKay and M. Muehlbeyer (2014): "Optimal Surrender Policy for Variable Annuity Guarantees", *Insurance: Mathematics and Economics*, 55, 116-128.
10. Bernard, C., M. Hardy and A. MacKay (2014): "State-Dependent Fees for Variable Annuity Guarantees", *ASTIN Bulletin*, 44, 559-585.
11. Gaillardetz, Patrice, Huan Yi Li, and Anne MacKay (2012): "Equity-linked products: evaluation of the dynamic hedging errors under stochastic mortality", *European Actuarial Journal*, 2(2): 243-258.

Peer-reviewed book chapters

1. Kouarfate, I. R, M. A. Kouritzin, A. MacKay (2021): "Explicit solution simulation method for the 3/2 model", to appear in *Advances in Probability and Mathematical Statistics*.
2. MacKay, A. and A. Melnikov (2018): "Price bounds in jump-diffusion markets revisited via market completions", in *Recent Advances in Mathematical and Statistical Methods for Scientific and Engineering Applications* edited by D. Marc Kilgour, Herb Kunze, Roman Makarov, Roderick Melnik and Sunny Wang, Springer, 553 - 563.
3. Bernard, C., A. MacKay (2014): "Reducing Surrender Incentives through Fee Structure in Variable Annuities", Chapter in *Innovations in Quantitative Risk Management* edited by K. Glau, M. Scherer and R.Zagst, Springer, 209 - 223.

Working and submitted papers

1. MacKay, A. and A. Ocejo (2021): "Portfolio optimization with a guaranteed minimum maturity benefit and risk-adjusted fees", under revision.
2. Kouritzin, M. and A. MacKay (2021): "On stochastic approximation and option pricing".

SEMINARS AND TALKS

1. "VIX-linked fee analysis via continuous-time Markov chain methods", One World Actuarial Research Seminar, November 2021 (virtual seminar).
2. "Fee structure and optimal investment mix in variable annuities", Waterloo Actuarial Science and Mathematical Finance Seminar, University of Waterloo, Waterloo, Canada, November 2020 (virtual seminar).
3. "Les mathématiques financières, de Bachelier à la finance quantique", Club Math, Université de Sherbrooke, Sherbrooke, Canada, November 2020 (virtual seminar).
4. "Fee structure and optimal investment mix in variable annuities", Quantact Seminar, Montreal, Canada, November 2020 (virtual seminar).
5. "Fee structure and optimal investment mix in variable annuities", Virtual Workshop on New Challenges in the Interplay between Finance and Insurance (event held as replacement for the Workshop on New Challenges in the Interplay between Finance and Insurance, Oberwolfach, Germany), October 2020 (virtual talk).
6. "Equity-linked insurance products: bridging actuarial and financial mathematics", October Math Day Symposium, University of North Carolina at Charlotte, Charlotte, USA, October 2020 (virtual plenary talk).
7. "Optimisation de portefeuille appliquée aux fonds distincts", Statistics seminar, Université de Sherbrooke, January 2020.
8. "Fee structure and optimal investment mix in variable annuities", Mathematical Finance and Applied Probability Seminar, University of Connecticut, January 2020.
9. "Constrained portfolio optimization in variable annuities", Winter Meeting of the Canadian Mathematical Society, Toronto, Canada, December 2019 (invited talk).
10. "Branching pricers with Heston examples", XV Latin American Congress of Probability and Mathematical Statistics, Mérida, Mexico, December 2019 (invited talk).
11. "Fee structure and optimal investment mix in variable annuities", 23$^{\text{rd}}$ International Congress on Insurance: Mathematics and Economics, Munich, Germany, July 2019.

12. "Simulating Heston via explicit weak solutions", Third International Congress on Actuarial Science and Quantitative Finance, Manizales, Colombia, June 2019.
13. "Simuler le modèle de Heston à l'aide de solutions explicites faibles", Statistics Seminar , Université de Sherbrooke, June 2019.
14. "Simulating Heston via explicit weak solutions", Annual meeting of the Statistical Society of Canada, Calgary, Canada, May 2019.
15. "Simulating Heston via explicit weak solutions", Fields Institute Quantitative Finance Seminar, Toronto, Canada, February 2019.
16. "Stochastic approximation algorithms: applications to variable annuities", 53$^{\text{rd}}$ Actuarial Research Conference, London, Canada, August 2018.
17. "VIX-linked Fees for GMWBs via Explicit Solution Simulation Methods", 21$^{\text{st}}$ International Congress on Insurance: Mathematics and Economics, Vienna, Austria, July 2017.
18. "Risk management via product design in variable annuities", Georgia State University, Atlanta, USA, December 2016.
19. "Variable Annuities with VIX-linked Fee Structure under a Heston-type Stochastic Volatility Model", 51$^{\text{st}}$ Actuarial Research Conference, Minneapolis, USA, July 2016.
20. "Quantile Hedging Interest Rate Linked Payoffs Using Equity", 20$^{\text{th}}$ International Congress on Insurance: Mathematics and Economics, Atlanta, USA, July 2016.
21. "VIX-linked Fee Structure for Variable Annuities", Sixth International IMS-FIPS Workshop, Edmonton, Canada, July 2016 (invited talk).
22. "Can quantile hedging explain funding practices for pension plans?", ETH Zurich, Zurich, Switzerland, April 2016.
23. "Risk Management of Policyholder Behavior in Equity-Linked Life Insurance", Université Catholique de Louvain, Louvain-la-Neuve, Belgium, November 2015.
24. "Risk Management of Policyholder Behavior in Equity-Linked Life Insurance", Université de Lausanne, Lausanne, Switzerland, November 2015.
25. "Risk Management of Policyholder Behavior in Equity-Linked Life Insurance", Cass Business School, London, United Kingdom, October 2015.
26. "Best-Estimates in Bond Markets with Reinvestment Risk", University of Copenhagen, Copenhagen, Denmark, October 2015.
27. "Best-Estimates in Bond Markets with Reinvestment Risk", Heriot Watt University, Edinburgh, United Kingdom, July 2015.
28. "Best-Estimate Yield Curves in Incomplete Bond Markets", 19$^{\text{th}}$ International Congress on Insurance: Mathematics and Economics, Liverpool, United Kingdom, June 2015.
29. "Best-Estimates in Bond Markets with Reinvestment Risk", 2015 Annual Meeting of the Statistical Society of Canada, Halifax, Canada, June 2015 (invited talk).
30. "Risk Management of Policyholder Behavior in Equity-Linked Insurance", Actuarial and Financial Mathematics Conference, Brussels, Belgium, January 2015.
31. "Group Self-Annuitization Schemes: How Optimal Are 'Optimal' Strategies?", ETH Zurich, Zurich, Switzerland, November 2014.
32. "Risk Management of Policyholder Behavior in Equity-Linked Life Insurance", Université de Montréal, Montréal, Canada, September 2014.

33. "Fixed and Variable Payout Annuities: How Optimal Are 'Optimal' Strategies?", 49$^{\text{th}}$ Actuarial Research Conference, Santa Barbara, USA, July 2014.
34. "Reducing Surrender Incentives through Fee Structure in Variable Annuities", 2014 Annual Meeting of the Statistical Society of Canada, Toronto, Canada, May 2014 (invited talk).
35. "Optimal Surrender Policy for Variable Annuity Guarantees", 3$^{\text{rd}}$ Workshop on Insurance Mathematics, Quebec City, Canada, January 2014 (invited talk).
36. "State-Dependent Fees and the Surrender Option in Variable Annuities", IFA Ulm, Ulm, Germany, July 2013.
37. "State-Dependent Fees and the Surrender Option in Variable Annuities", 17$^{\text{th}}$ International Congress on Insurance: Mathematics and Economics, Copenhagen, Denmark, July 2013.
38. "State-Dependent Fees and the Surrender Option in Variable Annuities", Annual Meeting of the Canadian Applied and Industrial Mathematics Society, Quebec City, Canada, June 2013.
39. "Market Dependent Fees for GMMB and GMDB Riders", 47$^{\text{th}}$ Actuarial Research Conference, Winnipeg, Canada, August 2012 (Honorable mention for high quality of presentation).
40. "Stochastic Volatility Models: Calibrating, Pricing and Hedging", Annual Meeting of the Canadian Institute of Actuaries, Toronto, Canada, June 2012 (invited talk).
41. "Hedging Equity-Indexed Annuities under Stochastic Volatility Models", Mathematical Finance Days, Montréal, Canada, April 2012 (Finalist for best master's thesis).
42. "Hedging Equity-Linked Products under Stochastic Volatility Models", 46$^{\text{th}}$ Actuarial Research Conference, Storrs, USA, August 2011 (Honorable mention for high quality of presentation)

TEACHING

Supervision

Dates in *italic* are expected dates of thesis submission.

PhD students
UQAM, Montreal, Canada:
- Marie-Claude Vachon (co-supervised with J.F. Renaud, 2018-*2023*)

Master students
Université de Sherbrooke, Sherbrooke, Canada:
- Charles-Antoine Jauron (co-supervised with A. Bélanger, 2021-*2023*)

UQAM, Montreal, Canada:
- Ayoub Bakraoui (2020-*2022*)
- Iro René Kouarfaté (2018-2020)
- Nicolas Vellone-Scott (co-supervised with C. Simard, 2017-2020)
- Julie Bélanger (2017-2020)
- Matthieu Bousquet-Racine (2016-2020)
- Jackson Book (co-supervised with M. Boudreault, 2016-2019)

ETH Zurich, Zurich, Switzerland:

- Valentin Stalder (co-supervised with P. Embrechts, 2015-2016)
- Michelle Kühne (semester paper, 2016)
- Pawel Kalinowski (semester paper, 2015)

Undergraduate students

UQAM, Montreal, Canada:

- David Borel (Summer 2018)
- Nicolas Vellone-Scott (Summer 2016 and Summer 2017)
- Vincent Tousignant (Summer 2016)

Member of master's thesis evaluation committee

UQAM, Montreal, Canada:

- Adel Benlagra
- Andra Crainic
- Jean-François Forest-Desaulniers
- Zahra Ghasemivanani
- Félix Locas
- Patricia Piché
- Dominic Viola
- Juan Sebastian Yanez
- Leila Zerrouk

Courses taught

UQAM, Montreal, Canada

- MAT998G: Sujets spéciaux en finance actuarielle: Fonds distincts — Winter 2019
- ACT2100: Compléments de probabilités — Winter 2018 to Fall 2020
- MAT7070: Mesure et probabilités (with J.F. Renaud) — Winter 2018 and Fall 2020
- ACT5001: Régimes de retraite: évaluation — Fall 2016 to Winter 2018
- ACT650C: Sujets spéciaux en actuariat: Initiation à la recherche — Winter 2017

University of Waterloo, Waterloo, Canada

- ACTSC231: Mathematics of Finance — Winter 2013

Concordia University, Montréal, Canada

- MATH206: Algebra & Functions — Winter 2011

OTHER EXPERIENCE

Service

UQAM

- Director of the Quantact research lab — 2020
- Actuary in charge of the University Accreditation Program of the CIA — 2019–2020
- Seminar committee of the Quantact research lab — 2018 – 2020

Conference organisation

- Co-chair of the scientific committee, 24$^{\text{th}}$ International Congress on Insurance: Mathematics and Economics (cancelled due to COVID-19) 2019-2020
- Ninth Graduate Student Workshop in Insurance and Financial Mathematics 2020
- Quantact workshop in financial mathematics 2019
- Eighth Graduate Student Workshop in Insurance and Financial Mathematics 2019
- Seventh Graduate Student Workshop in Insurance and Financial Mathematics 2018
- Quantact workshop on risk management of variable annuities 2018
- Sixth Graduate Student Workshop in Insurance and Financial Mathematics 2017

Scientific Referee 2013 – 2020

- ASTIN Bulletin
- European Actuarial Journal
- Insurance: Mathematics and Economics
- Journal of Risk
- Methodology and Computing
- North American Actuarial Journal
- North American Journal of Economics and Finance
- Quantitative Finance
- Risks

Question Writer and Grader, Society of Actuaries, Schaumburg, USA 2013 – 2017

Professional

Actuarial Associate 2007 – 2009
Towers Perrin, Toronto, Canada