Anne MacKay

Département de mathématiques
Université de Sherbrooke
2500, boul. de l'Université
Sherbrooke, QC J1K 2R1
+1-819-821-8000 x62075
anne.mackay@usherbrooke.ca

RESEARCH INTERESTS

Actuarial and financial mathematics
Optimal stopping and optimal control applied to long-term financial and insurance guarantees
Numerical methods and quantum computing 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 ($21,000 per year for 5 years)   2024 Start up fund, Université de
Sherbrooke ($30,000)   2021 – 2023
Discovery Grant, NSERC ($18,000 per year, extended until 2023)   2016 – 2023
Établissement de nouveaux chercheurs universitaires, FRQNT (40,000$ 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

Awards

Doob Best Paper Award for "Portfolio optimization with a guaranteed minimum   2022
maturity benefit and risk-adjusted fees" (with A. Ocejo)

PUBLICATIONS

Publications in peer-reviewed journals

1. Vachon, M.-C. and MacKay, A. (2024): "A Unifying Approach for the Pricing of Debt Securities", *Quantitative Finance*, to appear.

2. MacKay, A., M.-C. Vachon and Z. Cui (2023): "Analysis of VIX-linked fee incentives in variable annuities via continuous-time Markov chain approximation", *Quantitative Finance*, 23(7-8): 1055 – 1078.

3. MacKay, A. and A. Ocejo (2022): "Portfolio optimization with a guaranteed minimum maturity benefit and risk-adjusted fees", *Methodology and Computing in Applied Probability*, 24: 1021 – 1049.

4. 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.

5. Kouritzin, M. A. and A. MacKay (2020): "Branching Particle Pricers with Heston Examples", *International Journal of Theoretical and Applied Finance*, 23(1), 29 pages.

6. MacKay, A., A. Melnikov and Y. Mishura (2018): "Optimization of small deviation for mixed fractional Brownian motion with trend", *Stochastics*, 90(7): 1-24.

7. Kourtizin, M. and A. MacKay (2018): "VIX-linked fees for GMWBs via Explicit Solution Simulation Methods", *Insurance: Mathematics and Economics*, 81: 1-17.

8. MacKay, A. (2017): "Quantile hedging pension payoffs: an analysis of investment incentives", *European Actuarial Journal*, 7(2): 481-514.

9. 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.

10. 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.

11. MacKay, A., M. V. Wüthrich (2015): "Best-Estimates in Bond Markets with Reinvestment Risk", *Risks*, 3(3): 250-276.

12. Bernard, C., A. MacKay and M. Muehlbeyer (2014): "Optimal Surrender Policy for Variable Annuity Guarantees", *Insurance: Mathematics and Economics*, 55, 116-128.

13. Bernard, C., M. Hardy and A. MacKay (2014): "State-Dependent Fees for Variable Annuity Guarantees", *ASTIN Bulletin*, 44, 559-585.

14. 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 and A. MacKay (2021): "Explicit solution simulation method for the 3/2 model", In *Advances in Probability and Mathematical Statistics*, Birkhäuser, Cham, 123 – 145.

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 Vachon, M.-C. (2024): "On an Optimal Stopping Problem with a Discontinuous Reward".

2. Kouritzin, M. and A. MacKay (2024): "On stochastic approximation and option pricing".

SEMINARS AND INVITED TALKS

1. "Continuous-time Markov chain approximations for an optimal stopping problem with discontinuous reward function", Modeling, Learning and Understanding: Modern Challenges between Financial Mathematics, Financial Technology and Financial Economics, Banff International Research Station, Banff, November 2024.

2. "On an Optimal Stopping Problem with a Discontinuous Payoff", Fields-CFI Conference on Recent Advances in Mathematical Finance and Insurance, Fields Institute, Toronto, September 2023.

3. "On stochastic approximation and American option pricing", ISI World Statistics Congress 2023, Ottawa, July 2023.

4. "Optimal stopping with a discontinuous and time-dependent reward function", 2023 Canadian Mathematical Society Summer Meeting, Ottawa, June 2023.

5. "Optimal stopping with discontinuous and time-dependent reward", 2022 Actuarial Research Conference, University of Illinois at Urbana-Champaign, Champaign, USA, August 2022.

6. "Optimal stopping with discontinuous and time-dependent reward", AARMS CRG Conference on Computational Aspects in Finance and Actuarial Sciences, University of Prince Edward Island, July 2022 (virtual conference).

7. "On stochastic approximation and option pricing", 2022 CORS/INFORMS International Conference, Vancouver, June 2022.

8. "On stochastic approximation and option pricing", 2022 Annual Meeting of the Statistical Society of Canada, June 2022 (virtual conference).

9. "VIX-linked fee analysis via continuous-time Markov chain methods", One World Actuarial Research Seminar, November 2021 (virtual seminar).

10. "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).

11. "Les mathématiques financières, de Bachelier à la finance quantique", Club Math, Université de Sherbrooke, Sherbrooke, Canada, November 2020 (virtual seminar).

12. "Fee structure and optimal investment mix in variable annuities", Quantact Seminar, Montreal, Canada, November 2020 (virtual seminar).

13. "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).

14. "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).

15. "Optimisation de portefeuille appliquée aux fonds distincts", Statistics seminar, Université de Sherbrooke, January 2020.

16. "Fee structure and optimal investment mix in variable annuities", Mathematical Finance and Applied Probability Seminar, University of Connecticut, January 2020.

17. "Constrained portfolio optimization in variable annuities", Winter Meeting of the Canadian Mathematical Society, Toronto, Canada, December 2019.

18. "Branching pricers with Heston examples", XV Latin American Congress of Probability and Mathematical Statistics, Mérida, Mexico, December 2019.

19. "Simuler le modèle de Heston à l'aide de solutions explicites faibles", Statistics Seminar , Université de Sherbrooke, June 2019.

20. "Simulating Heston via explicit weak solutions", Fields Institute Quantitative Finance Seminar, Toronto, Canada, February 2019.

21. "Risk management via product design in variable annuities", Georgia State University, Atlanta, USA, December 2016.

22. "VIX-linked Fee Structure for Variable Annuities", Sixth International IMS-FIPS Workshop, Edmonton, Canada, July 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", 19th 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.

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. "Reducing Surrender Incentives through Fee Structure in Variable Annuities", 2014 Annual Meeting of the Statistical Society of Canada, Toronto, Canada, May 2014.

34. "Optimal Surrender Policy for Variable Annuity Guarantees", 3rd Workshop on Insurance Mathematics, Quebec City, Canada, January 2014.

35. "State-Dependent Fees and the Surrender Option in Variable Annuities", IFA Ulm, Ulm, Germany, July 2013.

36. "Stochastic Volatility Models: Calibrating, Pricing and Hedging", Annual Meeting of the Canadian Institute of Actuaries, Toronto, Canada, June 2012.

37. "Hedging Equity-Indexed Annuities under Stochastic Volatility Models", Mathematical Finance Days, Montréal, Canada, April 2012 (Finalist for best master's thesis).

TEACHING

Supervision

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

PhD students
Université de Sherbrooke, Sherbrooke, Canada:
- Iro René Kouarfate (co-supervised with M. Pigeon, 2023 – *2027*)
- Julie Bélanger (2022 – *2026*)

UQAM, Montreal, Canada:
- Marie-Claude Vachon (2018 – 2024)

Master students
Université de Sherbrooke, Sherbrooke, Canada:
- Lova Ramaroson (2023 – *2025*)
- 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
Université de Sherbrooke, Sherbrooke, Canada:
- Mathis Rainville (Winter 2022)

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
Université de Sherbrooke, Sherbrooke, Canada:
- Mohammed Amallah
- Hamza Ben Amara
- Audrey Bérubé
- Yassine Lassaoui (étudiant à U. Laval)
- Simon Lévesque
- Jean-François Sherazi

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

Université de Sherbrooke
- FEC453 – Marchés obligataires   Winter and Fall 2022, Fall 2023
- STT390 – Statistique mathématique et inférentielle   Fall 2022 and Fall 2023
- STT708 – Stochastic Calculus   Winter 2023
- STT489 – Processus stochastiques   Summer 2022
- FEC453 – Marchés obligataires   Winter and Fall 2022

UQAM, Montreal, Canada
- ACT2100: Compléments de probabilités   Winter 2018 to Fall 2020
- MAT7070: Mesure et probabilités (with J.F. Renaud)   Winter 2018 and Fall 2020
- MAT998G: Sujets spéciaux en finance actuarielle: Fonds distincts   Winter 2019
- 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

Université de Sherbrooke
- Regional representative (Quebec), Statistical Society of Canada   2024 – 2026
- Managing committee of the Algolab, Institut Quantique   2023 – present
- EDI committee of the Quantact research lab   2022 – 2024

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
- Fields-CFI Conference on Optimal Stopping and Its Applications   2025 in Finance and Insurance
- Co-chair of the scientific committee, 24$^{\text{th}}$ International Congress on   2019-2020 Insurance: Mathematics and Economics (cancelled due to COVID-19)
- 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 – present

- Annals of Actuarial Science
- ASTIN Bulletin
- European Actuarial Journal
- Insurance: Mathematics and Economics
- International Journal of Theoretical and Applied Finance
- Journal of Risk
- Methodology and Computing in Applied Probability
- North American Actuarial Journal
- North American Journal of Economics and Finance
- Quantitative Finance
- Risks
- Scandinavian Actuarial Journal

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

Professional

Actuarial Associate 2007 – 2009
Towers Perrin, Toronto, Canada