



M-Phimac: Master's in Financial Mathematics at McMaster





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About M-Phimac

Banking and Investment are two fields that offer a wide range of exciting career opportunities to ambitious, quantitatively minded people. M-Phimac, the M.Sc. program offered by the Mathematics and Statistics Department at McMaster University, is for the student who wants a fast track to a finance industry career in the areas of risk management, derivative securities analysis and portfolio design. With seven specialized grad courses in the first eight months, followed by an industrial project through the summer, you will be well prepared to go after one of many opportunities available in banking, insurance and the investment business.

What is it?

M-Phimac is an intensive M.Sc. program in Financial Mathematics that is completed within one year. Eight months of coursework emphasize the development of strong mathematical foundations, with the goal to understand the applications of mathematics to finance and investments. The summer industrial project will explore a topic of current interest with guidance from an industry professional and can be completed while working full time or as an intern.

Who is this for?

This program targets ambitious new and recent graduates in mathematics, or related subjects such as statistics, physics, computer science, and engineering, who are interested in a career in finance. Successful applicants will have a minimum B+ average across their level 3 and 4 undergraduate courses, or the equivalent standard from another university. Beyond academic achievement, other key indicators of potential success in the program are analytical expertise, excellent communication skills and computer programming capability.

What will you gain?

You will have a competitive advantage in exciting careers in the expanding quantitative finance industry. Having mastered sophisticated mathematical techniques, and having gained a deep understanding of valuing financial securities, you will have the confidence to face the challenging interview process that marks the entrance into the finance profession. You will be prepared to start a career as a quant working on financial modeling, risk management, or as a trading analyst. Quantitative career paths accessible to our graduates are also expanding in the insurance and investment management industries.

Phimac, the Department, and McMaster University

Established in 1999, Phimac – the Financial Mathematics laboratory at McMaster – is a group of faculty, postdoctoral fellows and graduate students working on the theory and practice of financial mathematics, including derivative pricing models in complete and incomplete markets, credit risk modeling, statistical properties of financial time series, interest rate models, and portfolio risk management.

The Department:

Mathematics & Statistics at McMaster University has 39 regular faculty, 14 post-doctoral fellows and 97 graduate students. We are well-known throughout the world mathematical community for the high quality of our research: A 2000 survey by OST ranks McMaster third among Canadian mathematics departments based on research impact. Research seminars in Algebra, Analysis, Applied Math, Finance, Geometry and Topology, and Statistics, plus the weekly Colloquium, attract some of the world's most prominent mathematicians.

The James Stewart Centre for Mathematics, located in McMaster's historic Hamilton Hall, provides agreeable space for the faculty and graduate students, with panoramic views of the forested area bordering the scenic campus. The "Math Café" on the main floor provides a natural setting for informal meetings.

McMaster University:

Founded in 1887, McMaster University is a mid-sized, research intensive university with approximately 3,000 graduate students and 21,000 undergraduate students. One of the Top 100 universities in the world according to both the Shanghai Jiao Tong University and Times Higher Education rankings, McMaster University ranks first in the country in research intensity--a measure of research income per full-time faculty member.

Hamilton:

Located in Hamilton, the fourth largest city in Ontario and ninth largest in Canada, McMaster University is 68 kms from Toronto and served by frequent bus and train connections. The City of Waterfalls, Hamilton boasts 126 named cataracts, many along the Bruce Trail that follows the Niagara Escarpment, the World Biosphere Reserve flanking the city. With a thriving arts scene, the third most diverse population in Canada, and a vibrant local economy, Hamilton city life complements and enhances the educational experience provided by the program.





The core financial math courses of our program are taught by the following faculty members:



Tom Hurd is Professor of Mathematics at McMaster, and in 1999, the founder of Phimac. After a research career in mathematical physics he turned to the mathematical study of financial markets in the late 1990s. Since then he has built an international research reputation, with many publications in portfolio theory, interest rate modeling, and credit risk. In 2010, Dr. Hurd was the chief organizer of the 6th World Congress of the Bachelier Finance Society, attended by over 500 participants from around the world. In addition to teaching in the M-Phimac program, he has supervised numerous M.Sc. and Ph.D. research students working in financial mathematics, many of whom have moved on to careers in banking



$$\left(\pi - \frac{1}{2} \sigma^2 \right) T + \sigma W_T$$

$$V_T = x e^{\left(\pi - \frac{1}{2} \sigma^2 \right) T + \sigma W_T}$$

ϕ is C^1 with ϕ' bounded

$$\mathbb{E} \left[e^{-\int_0^T r_t dt} \frac{\partial \phi(X_T)}{\partial x} \right] = \int_{-\infty}^{\infty} \frac{e^{-\pi T}}{\sqrt{2\pi}} \frac{\partial \phi}{\partial x} \left(x e^{\left(\pi - \frac{1}{2} \sigma^2 \right) T + \sigma \sqrt{T} y} \right) e^{-\frac{1}{2} y^2} dy$$



David Lozinski is the director of the M-PhiMac program, having returned to teach at McMaster University after having worked over 10 years in the banking industry in a variety of quantitative roles. In industry, he established a team responsible for mathematical models for global credit risk, and has worked with fellow banking leaders to produce Canada's responses to new model-based international banking regulations. He has extensive experience in the mathematical modeling and analysis of credit risk, including work in economic capital, structured product analysis, and the validation of pricing and hedging models for exotic derivatives.



Traian Pirvu, our most recent faculty member, joined the department after three years of teaching and research in mathematical finance at The University of British Columbia. Prior to that, Dr Pirvu obtained his doctorate in mathematical finance from Carnegie Mellon University under the supervision of the well known author and researcher Steven Shreve. Dr Pirvu has done extensive research on the foundations of mathematical finance, in areas such as the theory of risk measures, optimal consumption and investment with risk limits, time-consistency of decision makers and equilibrium pricing in illiquid markets.



Application Procedure

Every M-Phimac applicant is asked to complete an Online Application found at www.math.mcmaster.ca/graduate/application.php and to supply the following required documentation:

1. One official/notarized transcript of academic work done to date, sent directly from the issuing institution. If the final transcript does not show that a completed degree has been conferred, an official/notarized copy of your diploma is also required..
2. Two confidential letters of recommendation from instructors most familiar with your academic work. Recommendations must be provided directly from the instructors.
3. If English is not your native language, an official copy of your TOEFL or IELTS score. For TOEFL a minimum score of 92 (iBT) 580 (paper), or 237 (computer test) is required. For IELTS a minimum overall score of 6.5 and a minimum of 5.5 in each section of the Academic test.
4. Payment of the non-refundable application fee. The amount is \$90 Canadian dollars if paid by credit card, and \$105 if paid by cheque or by money order. Please make cheques payable to "McMaster University".

Please arrange to have all required documentation sent to:

Graduate Admissions

Department of Mathematics & Statistics
McMaster University
1280 Main Street West
Hamilton, Ontario
L8S 4K1 Canada

The deadline for September admission is February 1.

If you have any questions, please contact the Math Grad Advisor.

Fees

In September 2011, the total fees for this program, including tuition, miscellaneous and incidental fees, were:

Canadian Citizen or Permanent Resident Students: \$ 7,307.77

Visa Students: \$15,737.77



M-Phimac Courses

Course work forms the core of the program, and occupies the majority of students' efforts. Each course involves 13 weeks of lectures, with associated written assignments, projects, tests and a final exam. Some courses include intensive use of scientific computation and financial databases. M-Phimac students will take the following 8 master's level courses, providing a range of expertise from highly mathematical foundations to topical business applications.

Math 771: Mathematics of Finance

Stochastic calculus, martingales and arbitrage, Black-Scholes equation and pricing derivative securities, fundamental theorems of asset pricing, models of equity and fixed income markets, exotic options.

Math 772: Topics in Financial Mathematics

Credit risk capital, counterparty risk, Credit Value Adjustment; risk in retail portfolios; financial time series; GARCH models; additional topical issues of capital and risk management.

Math 774: The Mathematics of Credit Risk

Default events and stopping times; bonds and rates; credit spreads and corporate bond prices; intensity based models; credit rating models, firm value models; default correlation; credit derivatives; calibration; basket credit products; collateralized debt obligations.

Math 775: Optimal Investment and Risk Management

The continuous time portfolio problem; portfolio problems with constraints, portfolio optimization in the presence of transaction costs; risk measures; optimal cash management in equity index tracking with transaction costs.

Math 776: Financial Markets

Overview of equity, fixed income and FX markets; summary of discrete and continuous time financial modelling; pricing

of vanilla and exotic derivatives; discussion of volatility; market risk, VaR, CAPM models; introduction to credit risk; capital models.

Math 778: Applied Computational Finance I

Module course (6 weeks). Introduction to scientific computing: floating-point arithmetic, error analysis. Lattice methods: binomial trees; numerical methods of parabolic PDEs; applications to option pricing.

Math 779: Applied Computational Finance II

Module course (6 weeks). Monte Carlo methods, simulation of stochastic processes, variance reduction techniques; applications to option pricing and portfolio risk management.

Stats 721: Statistical Modelling in Practice

Sampling distributions, point estimation, interval estimation, linear regression, time series, model fitting and validity, multivariate models and dependence structures.

Math 790: Major Project

Completion of a project of industrial interest. Students will work together with a mentor from a financial institution, or alternatively, may complete the project while working as an intern or while beginning work full time in the financial industry. Students deliver a paper and an oral presentation at the end of August to complete their degree requirements.



Other M-Phimac Activities

While course work forms the foundation of the program, additional activities provide essential components in professional development. A key emphasis is placed on paving the way to a successful entry into the finance industry.

Sessions on résumé preparation and interviewing techniques are begun at the outset of the program. The job application and interview process starts as early as October. To facilitate this, the faculty provide a great deal of support in connecting students with professionals in our extensive network of industrial contacts. This support includes circulating student résumés, communicating industry opportunities, and developing personal contacts between students and hiring managers in information sessions off-campus.

Additional opportunities for networking also arise from our regular “Fields Trips” to Toronto to attend the Fields Institute Seminars on Quantitative Finance. This long running series is popular amongst both the university and industry communities.

Student projects, presentations, and seminars provide the opportunity to not only learn of leading edge topics in finance, but develop students’ interpersonal and communications skills.

McMaster also boasts the Allen J. Gould Trading Floor, where M-Phimac students have a chance to become familiar with a real trading floor environment, and the computer facilities that make modern financial markets function.

Employment Data

At the time of writing, the fourth cohort of students has recently finished the program. From the four cohorts, 90% have gone on to work in financial mathematics. Three quarters of graduates work in one of the 5 large Canadian banks. Those that have not taken a career with the banks are working in pension funds, insurance companies, and supporting areas such as the banking regulator, financial software firms, and academia.



“The M-PhiMac program was a rewarding and enriching experience. The skill set developed by the program was a tremendous asset for retaining employment since it set me apart from other applicants who had strong quantitative backgrounds but lacked a well-rounded exposure to finance.”

Robert Axente
Associate
BMO Financial Group

“Applying for M-phimac was perhaps the best professional decision I have made in my life.”

Pejman Salem
Senior Analyst
TD Securities

“The M-Phimac program not only gave me a strong foundation to meet the demands of my workplace, but also connected me with my current employer. My success in the interview process was largely due to the preparation I received from M-Phimac.”

Sasha Tailor
Market Risk Analyst
RBC Capital Markets



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