

Marc RAKOTOMALALA

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Education

- MBA, Financial Engineering, Sloan School of Management, Massachusetts Institute of Technology, 1996
- Master of Science, EE, CS/AI, Ecole Supérieure d'Electricité (CentraleSupélec, Université Paris-Saclay), 1988
- Master of Science, Mechanical Engineering and Control Theory, Ecole Centrale de Nantes, 1985

Research Interests

- Fintech
- Disruptive technologies – AI/ML, big data, IoT, blockchain, quantum computing

My primary research interest is in Financial technology (FinTech), as it has the potential to be a positive, game-changing force for boosting financial inclusion; mobile money and greater access to basic financial services have the capacity to improve the economic well-being of households. I look at financial inclusion and technology, and how cooperative efforts between policymakers, the private sector, and their broader communities can promote financial stability and inclusive growth through the deployment of fintech applications supported by cloud-computing, big data analytics, the Internet-of-Things (IoT), Artificial Intelligence (AI), blockchain technologies, cryptocurrencies, and Central Bank Digital Currencies (CBDC).

Recently, among technologies disrupting the finance industry, quantum computing is emerging from being theoretical to having real world applications; quantum hardware is becoming increasingly larger, of higher quality, and more accessible. This new technology for computation leverages the laws of quantum mechanics, potentially enables completely new territories of computing, and can improve combinatorics calculations. It may be transformative and disruptive in some industries, e.g. Banking & Finance and applications in portfolio optimization, credit scoring, derivatives pricing. I currently am involved in a research project, working with an industry partner, to investigate the potential quantum advantage for assessing loan applications from SMEs.

Experience

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|--------------------------|--|------------|
| Oct. 2020 - Aug. 2021 | Vice-Ministre des Nouvelles Villes et de l'Habitat <i>Chargé de Mission (non-permanent)</i> . Member of the Cabinet of the Minister within its mission of new cities planning, housing projects and other specialized government projects. My role is to support the Minister, promote public-private partnership -- as well as bilateral or multilateral partnership within the framework of housing sector development, provide technological expertise in the development of smart city applications and solutions, assist in financial structuring and international markets access through new financial products and technology. | Madagascar |
| Feb. 2020 - Feb. 2021 | BANKY FOIBEN'I MADAGASIKARA <i>Advisor</i> . Advised in the initial design of the central bank digital currency (CBDC) e-Ariary. | Madagascar |
| Feb. 2019 - Feb. 2021 | MIT SLOAN SCHOOL OF MANAGEMENT / CSAIL <i>Academic Tutor</i> . Artificial Intelligence for Business course. | MOOC |
| Oct. 2018 - Present | MIT Educational Council <i>Appointed</i> . Ambassador-at-large of the Institute in Singapore. | Singapore |
| Jul. 2019 - Present | SINGAPORE MANAGEMENT UNIVERSITY <i>Research Fellow</i> . The Sim Kee Boon Institute for Financial Economics (SKBI) at SMU is a leading international institute for applied financial and economic research. | Singapore |

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In charge of the financial technology research area. Researching the impact of innovative technologies on emerging economies' development. Contributed an article on fintech and inclusion in ASEAN to a forthcoming Cambridge University book. Exploring practical fintech solutions to facilitate financial inclusion, a catalyst for economic development. Part of a multi-disciplinary and multi-university team set up to explore quantum computing capabilities in finance, "*Quantum-Enhanced Modelling of Financial Time-Series Data for Rare Event Forecasting*".

Jul. 2016 - **MENTORICA TECHNOLOGY PTE LTD** Singapore
Aug. 2018 *Co-Founder, Chief Executive Officer.*

Led, in conjunction with the Board, the development of the Company's strategy. Responsible for day-to-day management decisions and for implementation of the Company's long and short term plans. Liaison between the Board and management. Communication on behalf of the Company to shareholders, employees, Government authorities, and other stakeholders.

Sold part of the intellectual property and systems of the company.

Aug. 2013 - **MENTORICA TECHNOLOGY PTE LTD** Singapore
Jul. 2016 *Co-Founder, Chief Technology Officer.*

In charge of technical architecture, development, and new product development of a Big Data analytics platform. Filed an international patent on automated data analysis and customer relationship management.

Jun. 2011 - **EDHEC RISK INSTITUTE - ASIA** Singapore
Oct. 2012 *Senior Quantitative Financial Analyst.*

Head of the Asian quantitative equity team. Portfolio construction, fundamental indexation, and customized index approaches with a focus on Asia ex-Japan equity markets. Initiated the work on Scientific Beta indices that led to a future venture between SGX and EDHEC.

Asian fundamental factors research and formulation of thematic equity investments: Asian internal demand strategy and Asian export success strategy. Coded and developed support tools for stock screening/selection, portfolio construction and strategy backtesting (Matlab). Created in-house database of historical fundamental attributes of Asian stocks, and achieved greater universe coverage and higher data quality than popular vendor databases (Bloomberg, Bureau van Dijk, Capital IQ, Factset, and Thomson Reuters Worldscope).

Aug. 2007 - **Sabbatical**
May 2011

Jan. 2005 - **ATHILON STRUCTURED INVESTMENT ADVISORS** New York, NY
Jul. 2007 *Co-Founder, Executive Vice President.*

Member of the executive team. Defined the company strategy. Participated in Board meetings and Accounting Committee. Issued \$400 MM 40-year A-rated bonds and AAA-rated bonds to institutional investors bringing total capital to \$650 MM. Responsible for relationship with de facto regulators (rating agencies) and markets.

Chief Risk Officer.

Defined trading and risk management strategies. Answered due diligence questions from investors and counterparties. Created the technical architecture and specifications of the company's processes, trading systems, risk management systems, and back-office systems. Reported weekly to rating agencies and market counterparties on \$40 BN portfolio composition and risk. Established relationships and unofficial partnerships with academics/data and system providers ('outsourced' cutting-edge research) for the development of proprietary tools and pricers.

Valued personal interests in Athilon, and sold to the company. Closed 2H07.

Apr. 2004 - **AXIOM (renamed ATHILON upon incorporation)** New York, NY
Dec. 2004 *Co-Founder, Executive Vice President.*

Envisioned the growth potential of a niche segment of the credit default swap (CDS) market, and decided to create a company that would sell credit protection to banks, insurance companies, and portfolio managers. Axiom would be the second Credit Derivatives Product Company (CDPC) to be created, and the first CDPC to sell protection solely on a portfolio basis rather than on an individual debt. From a niche segment in 2004, the CDS market grew to a global business sized at \$24 Trillion two years later according to the Bank for International Settlements. Since Dec '04 Athilon counterparty risk is rated Aaa by Moody's Investors Service

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and AAA by Standard & Poor's, and is also rated AAA by Fitch Ratings since July '05. Only about 30 companies are rated 'AAA' worldwide.

Raised \$100 MM of equity capital and issued \$150 MM of 40-year AA-rated debt capital.

Developed the company's capital model. The capital model is a proprietary software tool coded in JAVA for assessing portfolio risk due to default events. This tool identifies diversification benefits or potential over-concentrations across the portfolio, and consequently helps decide which marginal investment brings the highest marginal return with the lowest marginal capital consumption. The capital model begins with an estimate of obligor cumulative default probabilities, correlation of asset returns, and recovery rates. It then derives the full distribution of realized default rates and losses over multiple horizons, and determines whether current capital is sufficient to support the business activity and the AAA counterparty credit rating of the company.

Feb. 2000 - **MARSH & MCLENNAN SECURITIES** New York, NY
Apr. 2004 *Senior Vice President, Capital Markets Group.*
Synthetic CDO Used CDO technology to model, structure, and hedge an aggregate \$4.6 BN of corporate exposure of the State of California. *Synthetic CLO* Modeled, and structured an equivalent \$1.3 BN dynamic portfolio of middle-market corporate loans for a major European bank. *Arbitrage Synthetic CDO* Modeled, structured, and securitized a \$450 MM 'AAA' basket of credit derivatives for a major European bank. *Arbitrage Synthetic CDO* Modeled, structured, and securitized a \$1 BN portfolio of credit derivatives for a major European bank.

Vice President, Capital Markets Group.

Small Business Administration transaction Modeled and structured the non-government guaranteed portion of a \$500 MM pool of 7 (a) loans through an ABCP program. *Equipment Lease Backed transaction* Using CDO technology, modeled, structured, and synthetically transferred the \$100 MM global exposure of a leading computer equipment manufacturer and solution provider to the dot.com sector. *Project Finance transaction* Modeled and structured the large development costs of an aircraft manufacturer. *Private Equity transaction* Modeled and structured the \$1 BN principal guarantee of a private equity fund. *Credit risk transaction* Feasibility study on reinsuring a portion of the \$3 Trillion credit portfolio of the FDIC for market price discovery purposes. Developed new CDO technology to analyze single sector asset portfolio. *New Asset Class CLO* Modeled, and structured the risk transfer of a \$1.6 BN portfolio of distressed loans for a major bank, in effect applying Good Bank / Bad Bank paradigm with a new technology.

Sept. 1998 - **MBIA INSURANCE CORPORATION** New York, NY
Jan. 2000 *Assistant Vice President, Alternative Structured Finance Investments Group.* Structured and modeled innovative synthetic CBO transactions using a diversified portfolio of credit derivatives as assets and surety bonds as liabilities to achieve equity investor objectives. Developed an off-balance sheet vehicle to fund alternative investment grade ABS assets and take advantage of arbitrage opportunities. Focused on eligible assets: new market issuance, asset spread tracking, engineering of synthetic assets, and accumulation strategies during the warehousing period. Designed the operational set-up of the group by defining the functional architecture (e.g. KMV Credit Monitor, Wall Street Analytics) as well as the technical architecture.

May 1996 - **CREDIT AGRICOLE INDOSUEZ** New York, NY
Sept. 1998 *Assistant Vice President, Structured Products Group.* Traded and hedged a U.S Dollar interest rate options book with over \$1 Billion in notional using over-the-counter and listed options, futures, and swaps. Designed new analytical tools and provided improved information for portfolio management. Initiated and managed a financial engineering effort for the New York office. Developed modeling capabilities to engineer and price long dated transactions such as option-embedded notes issued by agencies such as FNMA and FHLB (implemented a one-factor Hull & White yield curve model in C++ to value Bermudan and barrier swaptions). Structured derivatives products to provide corporates and financial institutions with hedging, funding and yield enhancement strategies; securities include: callable debt, putable debt, convertible floaters, callable step-ups, range floaters. Developed the equity derivatives activity of the desk in pricing and marketing total return swaps (about \$2 BN notional). Analyzed the use and modeling of credit derivatives for yield enhancement of the bank's proprietary bond portfolio.

1995 **INTERNATIONAL FINANCE CORPORATION (The World Bank Group)** Washington DC
Summer intern. Analyzed regional and sectoral profitability of the firm's portfolio of bonds and equities in emerging markets. Evaluated the performance of IFC's growing syndication program in mobilizing additional

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private project finance from financial institutions. Modeled market risks and measured IFC's exposure on interest rate derivatives and currency options.

- 1990-1994 **ANDERSEN CONSULTING** Paris, France
Senior consultant. Led teams of internal and client personnel on consulting assignments. Managed client relationships on proposals and projects. Representative projects: *Institutional Investment Bank* Coordinated and monitored upgrade of the middle office system managing 600 BN French Francs. *International Tourism Company* Devised information strategic plan for company. Performed cost analysis and evaluated organizational impacts. *Department of Defense* Led the installation of budgeting and accounting system for French army, achieving consolidation of 65 centers and simplified procedures.
- 1988-1990 *Staff Consultant.* Designed and installed management information systems. *Securities Central Organization* Assisted brokerage firms and financial intermediaries of the Paris Stock Exchange in their connection to the future clearing system. *National Energy Supplier* Designed and implemented production monitoring system to aid managers identify and solve operational problems. System also allowed performance of short and medium term capacity planning for French nuclear plants.
- 1988 **HOUSTON AREA RESEARCH CENTER** The Woodlands, TX
Visiting scientist. Conceived an innovative approach for solving fuzzy problems by combining neural networks and heuristics and implementing on a parallel and vectorized supercomputer (NASA program). Published an article "*Neural Networks, Supercomputers and Computer Vision*" (Springer-Verlag Editions).
- 1987 **ARMEE DE TERRE** France
Supervised regiment's computing department. Volunteered to teach remedial arithmetic and reading to recruits.

Various

IBM Quantum Machine Learning (2021) – ‘Certificate of Quantum Excellence’.
Université Paris-Saclay Machine Learning and Python (2021) – 95 / 100.
Université Paris-Saclay Physique Quantique (2021) – 90 / 100.
Université Paris-Saclay Statistiques et R (2020) – 99 / 100.
NVIDIA Deep Learning for Multi-GPUs (2019).
MIT Blockchain Technologies (2018).
MIT Machine Learning for Big Data and Text Processing (2018).
MIT Data & Models in Engineering, Science, and Business (2014).
MIT Big Data Technologies (2014).

Developed expertise in Microsoft Excel, VBA, Java, C/C++, Matlab, EViews, Fortran, Lisp, Prolog, Object Oriented Language, SQL. Extensively implemented numerical methods: dynamic programming, Monte Carlo simulation, stochastic differential equation resolution, lattice methodologies, simulated annealing, nonlinear optimization.