

Careers in Financial Engineering

Jim Gatheral and Dan Stefanica

It seems all areas of human activity are becoming increasingly mathematized, and the financial industry is no exception. In fact, finance has been very mathematical ever since investment banks started hiring so-called rocket scientists in the early 1980s.

According to the New York saying, “If they say it’s not about the money, it’s the money!” Whilst a career in the financial industry has many rewards, it is universally understood that the money is good, with starting salaries in the range of \$85–125K. As far as other benefits are concerned, you will find yourself in a fast-paced environment where your ideas are valued and have immediate impact, and your colleagues are very smart. Moreover, the finance industry is so closely linked with academia that some academics seem more like industry practitioners and some practitioners more like academics. Mathematical and technological innovation are often motivated by financial applications.

An incomplete list of potential employers would include investment and commercial banks on the so-called sell side and hedge funds and asset managers on the so-called buy side. PhDs in quantitative subjects are also increasingly being sought after for fintech (financial technology) and consulting roles.

There are a number of roles for quantitative PhD candidates. A quantitative researcher might work on topics ranging from option pricing to risk assessment to the identification of profitable trading opportunities. A desk

quant (short for “quantitative analyst” in finance industry jargon) helps the trading desk analyze trading problems, performing a function that is typically more tactical than that of the quantitative researcher. Traders trade (obviously), but the distinction between trader and desk quant is increasingly blurred. Indeed, nowadays most traders are quantitative and can code. In the case of algorithmic trading, all traders are programmers. A risk manager analyzes the risk of trading desk and/or firm positions, advising both traders and senior management. A model validator assesses the validity and correctness of models and strategies developed by quantitative researchers, desk quants, and traders. A data scientist specializes in extracting useful information from data, particularly large datasets using machine learning techniques. Finally, a consultant can be hired to provide external advice on any of the above aspects of the operations of a financial firm.

How does one get started? As a PhD in a mathematical subject from a school where Wall Street firms do regular recruiting, you may be attractive to a number of employers in the finance industry, notably hedge funds. If your PhD is from a non-target school, you may wish to consider obtaining a professional masters degree from a financial engineering program with an established pipeline for placing graduates in the financial industry.

Whereas the areas of technical expertise required obviously depend on the precise role, a well-rounded candidate will know stochastic calculus, time series analysis, and numerical methods. Programming skills are essential. Strong C++ is a prerequisite for many employers. On the other hand, Python appears to be the current language of choice for daily research, and thus strong Python skills can also be regarded as very important.

The ability to communicate well with others who do not necessarily share your technical background is of

Jim Gatheral is Presidential Professor of Mathematics at Baruch College. His email address is jim.gatheral@baruch.cuny.edu.

Dan Stefanica is co-director of the Baruch MFE program and author of three books on financial engineering. His email address is Dan.Stefanica@baruch.cuny.edu.

For permission to reprint this article, please contact: reprint-permission@ams.org.

DOI: <https://dx.doi.org/10.1090/noti1841>

paramount importance. This includes the ability to read cues of all sorts—including nonverbal ones. If you have the ability to handle ambiguity, you will bring something valuable to the table, as assignments will typically not be as well defined as a typical mathematical problem. That is of course in the nature of the real world, and there is real pleasure to be had from formulating a vague observation or desire in such a way that the resulting problem may be solved mathematically.

For banks and large hedge funds, the time-honored route to obtaining permanent employment is to do a summer internship one or two years before completing your degree. This represents a “try before you buy” opportunity for both the employer and you. You can apply for such opportunities directly on company websites, typically in August or September. For smaller firms, personal referrals are often the preferred route.

While an in-depth knowledge of finance would be ideal, it is by no means a requirement for starting out in the financial industry. The kind of quantitative skills one obtains while working towards a PhD in mathematics, and innate personal talents, mean a great deal in this a career. As in any other field, an interest and passion for the work itself carries a lot of value for employers. It also makes it possible to thrive in an environment where the hours can be long and pressure can be high.



Jim Gatheral



Dan Stefanica

Credits

Photos of Jim Gatheral and Dan Stefanica are courtesy of the authors.