

The Metamorphosis of Finance Education

Master's degree programs in general finance and quantitative finance have grown dramatically over the past 15 years, and graduates of these programs are now competing for some of the most prestigious managerial and technical finance jobs. **Pablo Triana** details the rise of quant finance and general finance master's programs and analyzes how graduates of these programs match up with MBA and PhD graduates.

When an academic institution such as Princeton University suddenly decides to launch a new master's in finance (one of only 10 terminal master's degrees offered by the university), you know that something important is happening in the financial education landscape.

Historically, Princeton had shied away from offering "professional" graduate degrees and instead had concentrated almost exclusively on "academic" undergraduate and doctoral programs. So when the university's specialized finance degree made its debut in 2001, it marked a significant development. The Princeton, New Jersey-based Ivy League school became the first truly elite university in the world to offer a master's in finance.

Prior to 2001, existing graduate finance programs had been, with a few exceptions, housed in second-tier institutions. In fact, at the turn of the century, the two top programs in general finance (not to be confused with "quantitative finance" education, which, as we shall discuss shortly, has also grown dramatically) in the US and the UK were housed, respectively, at Boston College and London Business School. While the latter is a top international business school that is a part of the highly regarded University of London and the former is a popular, selective and distinguished university that is usually portrayed as the über symbol of academic tradition in America's northeast, they are not among the globe's truly elite educational institutions.

There are no doubts, however, about Princeton's standing in the academic community. In a sense, then, the fact that an elite university with a traditional distaste for professional

degrees chose to launch a focused, specialized program in the field symbolized the coming-of-age of finance education. It delivered a very clear message that there was a market gap that needed to be filled and that tailor-made, sophisticated graduate training in finance was (and remains) essential, given ever more complex products and markets.

Other leading universities have heeded the message and followed Princeton's lead. Oxford University's Saïd Business School (2005) and, more recently, Toronto's Rotman School (under the leadership of derivatives megaguru John Hull) have started innovative master programs that resemble Princeton's in spirit and objectives — if not (entirely) in terms of curriculum. The University of Cambridge and Madrid's Instituto de Empresa (both of which will offer a pair of graduate finance degrees) plan to join the "master's in finance" party next year.

What's more, NYU Stern — consistently ranked as one of the world's very best finance schools — has, in an unprecedented move, just partnered with a Hong Kong-based counterpart to offer a master's in global finance for working professionals.

The Quant Finance Eruption

Though the master's in finance revolution has had an undeniable impact, it's really just the tip of the iceberg. A more profound transformation has been taking place in quantitative finance education. Since 1995 or so, dozens of financial engineering-type programs have emerged at universities the world over, in what has to be one of the most impressive developments to have affected the educational landscape in a very long time.

Encouraged by the increasing dominance of derivatives in the financial markets and by the (accompanying) enhanced use of quantitative methods in those markets, scientific departments at universities (and also at a few business schools) have smelled a unique opportunity and have designed new programs that teach extremely advanced



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mathematical, statistical and computational techniques.

In contrast to the situation in the general finance field, the number of elite universities that have joined the quant bandwagon is truly staggering. Legendary names such as Stanford, Chicago, Columbia, NYU, Cornell and Carnegie Mellon have been present since the early days. Moreover, the quant finance academic world is also filled with second-tier programs; however, given the limited size of the quant industry, many of these programs will probably struggle to survive (in fact, some have already been canceled).

top institutions jump into this market. As opposed to quant finance, the career opportunities afforded to graduates of general programs should be (barring a recession) plentiful. Simply put, employers require many more plain finance folks than they do quant folks.

What about the MBA? Should it feel threatened by these new developments? The answer is no ... and yes. Quant finance programs are not real competitors to MBA programs, given their widely differing curriculum and goals. It is extremely doubtful that an MBA student

Quant Finance: A Quick History Lesson

The origins of the quantitative finance graduate programs date back to the mid-1990s, when the derivatives revolution was in full swing. At the time, the now ubiquitous credit derivatives market was beginning to flourish. Derivatives were not niche anymore, and this created the need for quants on a much larger scale than before.

Several leading universities stepped up to the plate and became true innovators. In fact, some of the very best-known programs (which remain global leaders today) emerged back then. The three original pioneers were Carnegie Mellon, Cornell and the University of Chicago.

The now mythical master's in computational finance launched by Carnegie Mellon in 1994 took the education world by storm. Never before had finance seemed more impossibly sophisticated, more irresistibly sexy (in a geeky kind of way, if you like). The program seemed designed exclusively for

geniuses, and a PhD in physics or computer science seemed like an unavoidable requirement.

At one point, a course called "Machine Learning in Finance" was introduced by the Pittsburgh, Pennsylvania-based university — a clear reminder that financial markets were not just about discounted cash flows analysis anymore. Suddenly, every math whiz kid with Wall Street aspirations began to yearn for the pilgrimage to the mecca of quantitative finance.

In 1995, it was Cornell's turn. Given the presence of Robert Jarrow and David Heath, two of the indisputable theoretical leaders in the field, this was a natural step for Cornell. Unlike Carnegie Mellon (which chose to offer just one degree housed at the business school), Cornell offered two tracks for its financial engineering certificate: one for MBAs and another for engineering students.

A year later, the University of

Chicago's math department launched its master's in financial mathematics, in close collaboration with leading practitioners. Taking into account the University of Chicago's legendary strengths in mathematics and financial economics — as well as the "Windy City's" historical derivatives preeminence — this program seemed like a natural fit.

Columbia, NYU, Toronto, Michigan and Purdue were among the other universities that offered quant finance education programs in the early days. With the start of the new millennium, dozens of new players jumped onto the quant finance bandwagon — both in the US and, increasingly, overseas. These late entrants, with some notable exceptions, don't own the stellar reputations and success stories that the pioneers continue to enjoy to this day, more than a decade after they decided to use stochastic calculus and numerical analysis to turn the world of finance education upside down.

Distinguishing Features

While both the quant finance and the master's in finance metamorphoses have been dramatic, there are some key differences. The quant finance transformation could logically be seen as an irrational bubble — a fad taken too far. There are simply too many programs chasing too few quant jobs. In a field where barriers to entry are naturally very high, overcrowding has become a problem, and many schools won't be able to compete, even if they offer a quality product.

The general finance revolution, on the other hand, has barely started in earnest (with the recent arrival of top-notch schools). In the near future, we should see even more

would be able to land a quant job (even if he or she had any desire to acquire such a post). Similarly, it seems highly unlikely that a financial engineer could successfully compete for those positions traditionally sought by MBA graduates.

When it comes to master's in general finance, though, things are much more worrisome for MBA administrators. Programs offered by the likes of Princeton, Oxford and Toronto have made aggressive inroads deep inside MBA territory. The goal of those programs is to place students as traders, analysts, portfolio managers, venture capitalists, marketers, corporate financiers, mergers and acquisitions

advisers, private equity professionals and financial consultants — i.e., the types of jobs that until a very few years ago seemed the exclusive playground of MBAs.

Indeed, for the first time ever, MBA students now face stiff and real competition when it comes to well-paid, glamorous high-finance jobs. Given the undeniable attractiveness of such jobs for bright young minds all over the world, how MBA administrators respond to this threat could very well determine the future of the degree itself.

make reasonable guesses. If we assume the existence of around 75 quant finance programs worldwide and that the average number of students in each program is 25 (with some schools taking in almost 100 students and others accepting fewer than 15), we can conclude that slightly fewer than 2,000 quant finance students graduate annually.

What about general finance? In a testament to the breathtaking growth experienced by quant education, the number of master's in finance programs offered by quality

Table 1: Institutions Offering Master's Degrees in Quantitative Finance-Related Fields*

UNITED STATES	REST OF WORLD
Baruch College	Birbeck College (UK)
UC Berkeley	Bocconi University (Italy)
Boston University	University of Cape Town (South Africa)
Claremont University	City University London (UK)
Carnegie Mellon University	City University (Hong Kong)
Columbia University (I)	University of Edinburgh (UK)
Columbia University (II)	Erasmus University (Holland)
Cornell University	HEC Montreal (Canada)
University of Chicago	Imperial College (UK)
DePaul University	Kings College London (UK)
Florida State University	University of Manchester (UK)
Fordham University	University of New South Wales (Australia)
Georgia State University	University of Oxford (UK)
Georgia Tech	Nanyang Tech (Singapore)
Hofstra University	University of Toronto (Canada)
Kent State University	University of Warwick (UK)
University of Michigan	University of Waterloo (Canada)
University of Minnesota	York University (Canada)
New York University Courant	
Oklahoma State University	
University of Pittsburgh	
Polytechnic University	
Purdue University	
Rutgers University (I)	
Rutgers University (II)	
Stanford University	
University of Southern California	

*This is only a partial list. Mathematical finance, financial engineering, financial mathematics and computational finance are among the types of degrees being offered.

Numbers Crunching

Tables I and II (above) list many of the best-known quant finance and general finance programs in the world. The depth of the finance education revolution should be obvious: both the number of institutions offering degrees and the geographical diversity of these entities clearly illuminate a wide-ranging, dynamic and expanding industry. But how expansive, exactly?

While exact numbers are difficult to come by, we can

Table 2: Institutions Offering Master's Degrees in General Finance*

UNITED STATES	REST OF WORLD
University of Alabama	University of Cambridge (UK)
University of Arizona	City University London (UK)
Boston College	ETH Zurich (Switzerland)
Bentley College	HEC Paris (France)
Brandeis University	HKUST (Hong Kong)
Clark University	Instituto de Empresa (Spain)
DePaul University	Imperial College (UK)
University of Denver	London Business School (UK)
George Washington University	London School of Economics (UK)
University of Houston	University of Manchester (UK)
Illinois IT	University of Melbourne (Australia)
Johns Hopkins University	University of Oxford (UK)
New School University (New York)	University of Reading (UK)
NYU Stern	University of Toronto (Canada)
Princeton University	University of Warwick (UK)
SUNY Buffalo	
Syracuse University	
Texas A&M	
Tulane University	
Vanderbilt University	

*This is only a partial list.

international institutions may now lag behind the quantitative alternatives. If we assume 50 general master's in finance offerings at 25 students each, we have around 1,250 graduates per year.

We can therefore estimate (roughly) a total number of 3,000 graduate finance students (i.e., the combination of master's in general finance and master's in quant finance students) worldwide. This figure would be similar to the number of MBAs churned out by just the top 10 US business schools. So while specialist finance graduates are becoming more and more abundant, the numbers need to be kept in perspective.

The Paradox of Quantitative Finance Education

If there is one unmistakable trend in the global graduate education landscape in the past 10 years or so, it surely has



to be the unending proliferation of programs dealing with what is indistinguishably known as financial engineering, quantitative finance or computational finance. Ever since the first pioneering efforts bore fruit around 1995, not a year seems to go by without yet another university launching its own master's degree in one of these areas.

There is no denying that these are boom times for those involved in quant finance academics — but this state of affairs is somewhat paradoxical. While no one can question that these programs have had a positive impact and have filled previously unfilled market need, the growth of quant finance education may have gotten out of hand. The types of jobs that require the high-level mathematical and computational skills regularly taught in these programs are not that plentiful.

“If you want to find a good quant job, you need a strong quant job market nearby and you really have to graduate from an elite program.”

While the demand for “normal” jobs such as banker, consultant or salesperson should remain (barring a recession) predictably large, the demand for quantitative finance-type positions is far inferior. Though it is very difficult to find hard data on the total number of quant jobs worldwide, it's safe to say that hard-core financial engineers remain very much a minority within the global financial community, despite the significant boost they have received in the recent past.

It's also important to remember that before the evolution of master's degrees in financial engineering, financial institutions tended to recruit from physics, mathematics and computer science PhD programs to meet their demands for heavily quantitative people. Even today, most quant jobs require a PhD, and only graduates of the truly elite quant education programs can compete with the “PhDs” for these jobs. Prospective employers may simply believe that quant finance master's graduates who do not also boast a PhD cannot match the skills of their PhD counterparts.

Of course, if you are one of the lucky graduates from the most prestigious quant finance programs, you might be laughing at such a suggestion while counting the sizeable signing bonus that you (unlike your classmates with MBAs or master's in general finance) just received from a top

hedge fund or investment bank.

For VIPs Only

The inescapable truth is that quant finance education is a very tough field and that only a few institutions can truly offer top-notch programs. Quant finance, simply put, is not for everyone. It's only for VIPs — for those rare individuals who not only possess the necessary mathematical and computational muscle but can also boast the expertise necessary to explain how things are done in the real world. Moreover, if you want to find a good quant job, you need a strong quant job market nearby and you really have to graduate from an elite program.

In the MBA world, a top-50 school can still do very well. It can deliver a satisfactory education and can place its graduates well. Though being in the top-10 is always nice, a “top 50” MBA program can survive and even thrive. When it comes to quant finance, in contrast, not being at the top is almost akin to not being.

If you are interviewing for a managerial or sales job and the interviewer happens to like you, you may be able to secure a position independent of your brainpower or school pedigree. When it comes to quant finance, however, there can be no bull: either you are really proficient at C++ and stochastic calculus or you aren't.

Indeed, knowing your stuff and having studied under star professors carries decisive weight in quant finance. That is why it could be reputational suicide to offer a quant finance degree unless an institution really aspires to be considered an elite program. The last thing you want is to see your students being systematically slaughtered at job interviews, as your name consequently gets dragged through the mud.

Universities need to understand that the barriers to entry when it comes to quant finance are very high and that you just cannot become a leader in C++, stochastic calculus or numerical methods (and their financial applications) overnight.

Everyone wants to be invited to the Playboy mansion, but very few have what it takes to get in and enjoy the untold pleasures. Quant finance education is similar. It is a highly tempting, very exciting, rewards-filled world that is strictly reserved to those VIPs who possess the required very-hard-to-get credentials.

Will the MBA Strike Back?

An MBA has historically been conceived as a passport to the glamour and untold riches of a high-finance career. Get into a top MBA program, the conventional wisdom has traditionally been, and the keys to the financial kingdom will be yours.

However, such traditional beliefs may be a bit outdated these days. Simply put, the MBA is now facing, for the first time ever, a serious competitor when it comes to accessing the promised land of finance. For the past few years, a significant number of new specialized programs have sprung up at universities across the globe that provide focused, to-the-point, cutting-edge financial training. Such new programs could potentially derail MBAs as the preferred fishing pond for talent-hungry recruiters worldwide. (To acquire a sense of the types of jobs awaiting graduates of master's in finance programs, please see Table 3 below.)

These newcomers present several key comparative advantages over the MBA programs. Students in the master's in finance programs get an education that is exclusively tailored to finance-related issues, as opposed to having to attend unrelated marketing, organizational behavior or general

management courses. Moreover, the level of the finance courses themselves tends to be higher than those taught at the MBA level — where many schools seem very eager to preserve the “generalist” feeling of the program and actually see excessive depth in a single area as a threat to the mission.

Master's in finance programs tend to be considerably shorter than MBA programs, requiring less school time and costing much less in tuition. A specialized degree allows graduates to market themselves as brave individuals who took the road less traveled, inspired by their unmitigated passion for finance.

Given this long list of advantages, soon bright young minds looking for an exciting financial career may begin seriously to wonder why they should spend two years and \$80,000 for the privilege of receiving “soft” financial training, when across town some other school is offering “hard-core” training for half the price and half the time commitment.

One of the reasons that MBA programs are not yet endangered is because of the fact that the majority of graduate finance programs (outside of quant finance) are offered by universities that could be safely categorized as second tier. Clearly, this gives the MBA one tangible advantage: not many students would give up a top-10 MBA program in exchange for a top-50 finance master's — even if their hearts would guide them toward a focused financial degree.

However, this doesn't mean that MBA administrators should be complacent. While the “peer threat” may not (yet) be really there, a much more menacing danger lurks in the shadows. Namely, the potential for investment banks, hedge funds and private equity folks — encouraged in large part by the proliferation of new specialist programs — to change their recruitment tactics and to start to show a bias against, not for, general business graduates.

In this era of super-complex derivatives and hedge funds, it may become more and more difficult to place graduates whose knowledge of finance is, to put it mildly, primitive. For those schools that have enough finance weaponry and that have not taken themselves out of the race, the recipe should be clear: escape from an über-generalist approach and strengthen your MBA finance curriculum — via new advanced courses and new “real life-focused” professors.

An MBA that offers neither up-to-date, relevant financial training nor competitive advantages to its students when it comes to finance-related job searching can't survive at the top, particularly in these days of highly innovative markets and emerging specialist educational programs. ■

Table 3: Job Destinations for Graduates of Princeton's Masters in Finance Program (2001-2006)

Asset Management (Princeton)	Fixed Income Trading (London)
Asset-Backed Securities (New York)	Global Capital Markets (New York)
Bank Supervision (Milan)	Hedge Fund (Chicago)
Bank Supervision (New York)	Hedge Fund Trading (Greenwich, CT., 2)
Business Consulting (Paris)	Mergers and Acquisitions (New York)
Capital Markets (New York)	Mortgage-Backed Securities (New York)
Commodities Trading (New York)	Options Trading (Chicago)
Corporate Finance (New York)	PhD (London Business School)
Currency Trading (New York)	PhD (Northwestern University)
Derivatives Pricing Software (New York)	PhD (University of Oxford)
Derivatives Trading (London, 2)	PhD (Princeton University)
Emerging Markets Trading (New York, 2)	PhD (Wharton School, University of Pennsylvania, 2)
Equity Derivatives Trading (New York)	Principal Strategies (London)
Equity Research (Hong Kong)	Private Client Strategy (New York)
Finance (Singapore)	Private Equity (Munich)
Financial Consulting Analyst (Washington)	Private Equity (Singapore)
Financial Research (New York)	Proprietary Trading (New York, 2)
Fixed Income Analysis (New York)	Quantitative Asset Management (Boston)
Fixed Income Research and Analytics (New York, 2)	Quantitative Asset Management Strategy (New York)
Fixed Income Research (New York, 2)	Quantitative Equity Modelling (New York)

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