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Proving Ground

Why Students Of Prof. El Karoui Are In Demand

**French Math Teacher Covers
Structure Of Derivatives;
Banks Clamor for 'Quants'**

A Lesson on 'Smile Risk'

By **CARRICK MOLLENKAMP** and **CHARLES FLEMING**

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(See *Corrections & Amplifications* item [below](#).)

When Xavier Charvet applies for a job at an investment bank next year, he thinks he'll have an advantage. The 24-year-old French student's resume begins with the phrase: "DEA d'El Karoui."

That stands for the postgraduate degree he is studying for under Nicole El Karoui, a math professor in Paris. She teaches skills required to create and price derivatives, the complex financial instruments based on stocks, bonds or loans. "When I talk about El Karoui's master's, everyone knows" about the degree, says Mr. Charvet.



Nicole El Karoui

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Nicole El Karoui

As derivatives have become one of the hottest areas for the world's biggest banks, Ms. El Karoui, 61 years old, has become an unlikely player in the business. Her courses at the prestigious Ecole Polytechnique and a state university, in such rarefied subjects as stochastic calculus, have become an incubator for experts in the field. A resume with her name on it "is a shortcut because you don't need to train the person on the basics of derivatives," says Rachid Bouzouba, a former student who is now head of European equity trading at the London office of **Lehman Brothers Holdings Inc.**

The derivatives departments at banking giants **J.P. Morgan Chase & Co.**, **Deutsche Bank AG**, Dresdner Kleinwort Wasserstein, and France's **BNP Paribas SA** and Societe Generale SA include many of her protégés.

The high demand for her students reflects big changes in the global banking industry. Investment banks used to make much of their money from underwriting and trading stocks and bonds, or providing mergers-and-acquisitions advice. They hired people with a wide range of academic experience, including liberal-arts and science graduates.

In recent years, profits from trading and selling derivatives have come to rival those from stocks and bonds at many banks. On average, revenue from derivatives based on stocks now accounts for about 30% of an investment bank's total revenue from stock-related businesses, according to a Citigroup Inc. report issued in January.

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Carrick Mollenkamp

Nicole El Karoui in class.

As a result, banks are hiring an increasing number of recruits who understand derivatives. Inside banks, they are known as "quantitative analysts," or "quants" for short. They are able to marry stochastic calculus -- the study of the impact of random variation over time -- with the realities of financial trading.

Derivatives are financial contracts, often exotic, whose values are derived from the performance of an underlying asset to which they are linked. Companies use them to help mitigate risk. For example, a company that stands to lose money on fixed-rate loans if rates rise can mitigate that risk by buying derivatives that increase in value as rates rise. Increasingly, investors are also using derivatives

to make big bets on, say, the direction that interest rates will move. That carries the possibility of large returns, but also the possibility of large losses.

The 75 or so students who take Ms. El Karoui's "Probability and Finance" course each year are avidly sought by recruiters. Three years ago, Joanna Cohen, a specialist in quant recruitment at Huxley Associates in London traveled to Paris to meet Ms. El Karoui to ensure her search firm was in the loop when students hit the job market. Today, Ms. Cohen says she carefully checks résumés with Ms. El Karoui's name to make sure applicants aren't overstating their interaction with the professor.

"French quant candidates know that Nicole El Karoui's name has real clout, so many of them put her name on their [curriculum vitae] even if they've just taken one course with her. They want to give the impression that she has supervised their Ph.D.," Ms. Cohen says. "It'd be impossible for any one person to supervise the number of students who put her name on their CV."

Rama Cont, a former student and now a research fellow at the Ecole Polytechnique, describes a degree with Ms. El Karoui's name on it as "the magic word that opened doors for young people."

Headhunters say Ms. El Karoui's graduates can expect to earn up to about \$140,000 a year in their first job, including a bonus, once they complete an internship that constitutes part of her course. After five years, they could be earning at least three times as much.

'IT'S VERY CHALLENGING'



Reporter Carrick Mollenkamp talked with student Christel Younes about her experience in Ms. El Karoui's class. Listen to the interview: [Windows Media Player²](#) | [Real Audio³](#)

In BNP Paribas's offices in London, the fixed-income interest rates derivatives research team, which totals six, includes three of her former students. On a recent day, Fahd Belfatmi, who took Ms. El Karoui's course in 2003, was working at the bank on a model to predict long-term interest rates. For help, he keeps handy a beat-up, paperback copy of Ms. El Karoui's French-language textbook, "Stochastic Models in Finance."

Ms. El Karoui's only hands-on banking experience in her 38-year career was a six-month stint about two decades ago at a French retail bank. "I'm still a theoretician. My knowledge of markets is patchy and I've never spent a year in a trading room," she says. "On many counts, I probably have a fairly naive vision of things."

Carving Out a Niche

But she was one of the first in the world to carve out an academic niche studying the underpinnings of derivatives transactions, starting courses in the late 1980s. About two dozen universities have moved into that field, setting up their own mathematical-finance departments, including Stanford University, Carnegie Mellon University and the Massachusetts Institute of Technology.

One of eight children in a middle-class family, Ms. El Karoui grew up a Protestant in a predominantly Catholic town in eastern France. Today she attributes her nonconformity to that background. "Protestants are rebels by nature," she says. Though her mother thought France's elite colleges were better suited for boys, her father, an engineer, encouraged her to take the tough entrance exams for Ecole Nationale Supérieure, where she was accepted to study math. In 1968, around the time she was protesting the Vietnam War, she married a Muslim Tunisian economics professor, Faycal El Karoui.

"If you'd told the left-winger that I was then that I was going to end up working in finance, I'd never have believed it," Ms. El Karoui says.

DEA d'El Karoui

Nicole El Karoui's lectures have left a mark upon the derivatives desks of banks that have hired her students. One

mark upon the derivatives desks of banks that have hired her students. One of the clearest indicators is the bankers' reliance on mathematical formulas learned while attending her class. In the equation below, used to price zero-coupon bonds, the industry's customary "P" for "price" is replaced by Ms. El Karoui's "B" for "bond."

$$\frac{dB(t, T)}{B(t, T)} = r_t dt + \Gamma(t, T) dW_t$$

Source: Lecture notes

France, the land of Descartes and Fermat, has a storied tradition in the study of math. Over the years, its engineering schools, including Ecole Polytechnique, a 212-year-old institution transformed by Napoleon into a military academy, have produced a steady stream of math students. Louis Bachelier's work in 1900 at the Sorbonne is considered the earliest effort to grasp how the markets work.

Ms. El Karoui first branched into finance in 1987. The government had just closed down the elite Ecole Normale Supérieure in Paris, where she had been teaching. She took a six-month sabbatical to work in the research department of consumer credit bank Compagnie Bancaire.

At the time, many French mathematicians tended to deem the world of finance beneath them. "Finance meant selling your soul to the devil," she says. Her break with the French math establishment "took a lot of courage," says Marek Musiela, a leading figure in financial mathematics and the global head of fixed-income quant research at BNP Paribas.

At first, Ms. El Karoui felt out of her depth. "I didn't even know what a bond is. I took a dictionary to look up the financial words," she recalls.

But she soon realized that employees on the bank's newly formed derivatives desk were facing problems similar to those of stochastic scholars in trying to build models to predict the impact of interest-rate changes.

After her time at the bank, she took a post teaching at the Paris VI, officially known as the University of Pierre and Marie Curie. She and another academic, Hlyette Geman, launched a postgraduate mathematical-finance course. Demand for know-how in derivatives was growing rapidly among banks at that time, sparked by the development of specialized exchanges that could trade derivative products, such as futures.

"I said 'That's beautiful mathematics and it's teachable as a theoretical course,'" Ms. El Karoui says.

Amine Belhadj, head of BNP Paribas's U.S. equity and derivatives department in New York, says Ms. El Karoui played a crucial role in finding interns when the bank began handling derivatives for clients in 1989. "There was nobody on the options desk with a mathematical-financial background," he says. "Having someone like Nicole who was making a specialty of it was pretty timely."

Today, four of her five children have pursued careers in math and sciences, two as academics and two still

as students. In her spare time, Ms. El Karoui plays classical piano, with a preference for Brahms sonatas.

She earns about 80,000, or about \$95,000, a year as a professor, plus a smaller amount for consulting fees -- a fraction of what her students can make. She drives around Paris in a small Renault.

A Warning

Lately, Ms. El Karoui has been vocal in warning students to use derivatives carefully. She says she is perturbed that an instrument that began primarily as a hedge for banks and financial firms against market risk is increasingly being used as a way to make a profit. Investors can profit, for example, by betting that the prices of stocks or bonds will increase. Ms. El Karoui worries that those looking for quick speculative gains could ramp up their bets on derivatives, but lose sight of the underlying financial instruments on which they're based, actually increasing their risk exposure.

"Some clients aren't mature enough to understand the risks of products that are too complex," she says. "It's better to do business with those people responsibly, either taking the time to teach them or selling them a less complex product."

Managing the Risks
Outstanding over-the-counter derivatives contracts, in trillions of dollars:

CONTRACTS	TOTAL CONTRACTS	FOREIGN EXCHANGE	INTEREST RATE	EQUITY-LINKED
June 2003	\$169.66	\$22.07	\$121.80	\$2.80
Dec. 2003	197.17	24.48	141.99	3.79
June 2004	220.06	27.00	164.63	4.52
Dec. 2004	251.82	29.58	190.50	4.39
June 2005	270.10	31.08	204.39	5.15

Note: Some categories excluded
Source: Bank for International Settlements

Some big banks are being criticized for selling derivatives to institutions that may not understand the risks. Last year, for instance, **Bank of America Corp.** and **Barclays PLC** of the United Kingdom each agreed to settle claims that they had missold or mismanaged derivatives that were purchased by smaller banks in Italy and Germany. The banks said the matters were settled amicably.

One recent afternoon in her classroom, Ms. El Karoui ran through a series of dense formulas designed to price derivatives. In class were about 50 students studying for the DEA, or "Diplome d'Etudes Approfondies," as a French master's degree leading to a doctorate is known.

Ms. El Karoui talked softly toward the blackboard as much as she faced her students. There were few questions. Only near the end of the two-hour class did she raise a faint titter as she gestured to a full page of

equations headed "General Pricing Formula." "There might be some of you brave enough to go through this," she said, then continued on, breezing through arcane jargon such as "smile risk," "volatility of volatility" and "Vega hedging."

To some, Ms. El Karoui has been almost too successful in placing her students in top international banks. Ryan Taylor, a headhunter specializing in quantitative-finance candidates at Napier Scott Executive Search Ltd. in London, says some investment bankers are now starting to question how many French-trained quants are in the field. "France has got what borders on a monopoly of quant candidate production and we'd love to hear from quants in other countries," he says.

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Corrections & Amplifications:

French math professor Nicole El Karoui attended Ecole Normale Supérieure. This article incorrectly said she attended Ecole Nationale Supérieure. Also, the French government in 1987 closed the Ecole Normale Supérieure in Saint Cloud, a Paris suburb, moving it to Lyon. This article incorrectly stated the government closed the Ecole Normale Supérieure in Paris.

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