**Principles of Financial Engineering. By Salih N. Neftci. Elsevier Academic Press, 525 B Street, Suite 1900, San Diego, California 92101-4495, USA. 556 pages, $99.95.**

*Reviewed by Emanuel Derman.*

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As physics students at the liberal University of Cape Town in apartheid-era South Africa, we looked down on engineering students. They had a reputation for being raucous and reactionary; worse, they took the easier physics courses in which you learned more about rules rather than explanations.

Therefore, when I first heard the words "financial engineering" in connection with the founding of the International Association of Financial Engineers in 1992, I disliked the moniker. I had been on Wall Street since 1985, and the few available textbooks – Cox & Rubinstein's *Options Markets* and Jarrow & Rudd's *Option Pricing* – didn't resemble engineering books at all. I much preferred to think of what we practitioners did each day as science. But inappropriate though I thought it was, the term stuck.

Science is about finding new principles that describe the world, and is often reductive. Engineering is about constructively using those principles to make practical devices. Salah Neftci's *Principles of Financial Engineering* is a very readable, wide-ranging, practical and wise book that introduces the entire field and covers it in a compulsively consistent fashion. I'm glad to say it convinced me of the appropriateness of the word "engineering" for the field.

Neftci's is not a book about financial mathematics, stochastic calculus, options pricing or even martingale theory, though most of this is covered in an enlightening but informal style. It's genuinely about financial engineering, in the best sense of the word; it's about how to create financial devices that behave in desired ways in the real world. In spirit it reminds me a little of Cochrane's more difficult *Asset Pricing* in that it seeks, ambitiously, to explain everything from one overarching viewpoint. In Cochrane's case that's the notion of expected discounted payoff; in Neftci's it's the replication of cash flows and their properties. If I had one caveat about the book, it would be that because it sensibly avoids the shorthand of very advanced mathematics, it is sometimes a bit verbose.

Students and practitioners fresh to our field have a hard time understanding what's truly useful in practice: not so much advanced mathematics, often too misleadingly precise for an imprecise world, but rather the behavior of assets and how to replicate them. But we know so little about how assets behave, and most books conceal this from students, sometimes by temptingly pretending you can axiomatize markets. (Sentence first, verdict afterwards, said the Red Queen.)

In contrast, Neftci tries to demystify the field rather than complexify it. He focuses on how to use the little we know about the behavior of stocks, bonds and other assets to create the payoffs we want, makings heavy use of traditional cash-flow diagrams as decomposition tools. But he's always aiming to solve an actual problem, so along the way he sets the stage, explaining Euromarkets, quoting conventions, funding, repos, security lending, the contrasting aims of retail clients and broker-dealers, and the effects of legal, tax and regulatory constraints – the sorts of things that MBAs or salespeople somehow seem to know but that traditional quantitative finance books never cover at all. In addition he makes liberal use of case studies based on excerpts from International Financing Review and Derivatives Week. As Darrell Duffie writes on the back cover, Neftci finds a natural balance between theory and practice.

Neftci is appealingly honest about the limitations of financial theory. Like Paul Wilmott, though less wittily, he tells you what's important and what's not, what to believe and what to be skeptical of. He stresses the advantage of acquired experience with a simple model over no track record with a sophisticated one. He points out the much greater fragility of dynamic replication over the static case: suddenly you face transactions costs, liquidity constraints, the need for choosing evolution models and the uncertainties that ensue, the confounding effect of jumps, the necessity for position and risk management software. All valid points, often glossed over.

Convexity – the holy grail of derivatives traders – gets an entire chapter, which begins by using the natural and familiar convexity of a bond's price-yield relationship to obtain the partial differential equation for bond pricing. Volatility trading leads to exotic options and, eventually, variance swaps and the smile. Different smile models are introduced and quickly weighed against the real world.

In summary, this is a very good book to use at the start of a financial engineering or mathematics

program, to connect students to content and practice while they learn technique. Though one will want to cover its topics in more detail in specialized courses, the book has a breadth and consistency that make it an excellent introduction to the concepts of engineering and pricing securities.

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