

Random Walk from Physics to Finance:

To Yale and Wall Street from Behind the Iron Curtain

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Why Physics?

Eureka Moment

At the age of 15, I read George Gamow's book "Biography of Physics", 1961. I found it on the for-sale shelf, in a scientific book store in Warsaw on Swietokrzyska Street, selling for something like 10 cents.

At around 4 o'clock in the morning, after spending the whole night reading the book, I decided to become a physicist. Reading Gamov's book was a spiritual/religious experience; a point of no return. I was particularly taken by the human drama behind the process of discovery that the book captured.

Like Newton, Maxwell, Einstein, Planck, Pauli, de Broglie, Bohr, and others whose paths to their discoveries were described in the book, I too wanted to be pregnant with revolutionary physics ideas.

My Father's Reaction

My father was at first disappointed since he thought I would follow in his footsteps and go into the family manufacturing business (he had a university degree in mechanical engineering).

“Son, I will not be able to buy you a lab” he said. Little did he know that even the richest parents can't afford physics labs for their children!

In the end, seeing my determination, he supported my decision.

Fascination with Physics

Fascination with the idea that you can discover the ultimate laws of nature by doing table-top experiments and capturing the results through mathematics lead me to studying physics at Warsaw University, followed by doctoral studies at Yale.

My obsession with physics led me to write:

Physics, who are you?

A nightmare

Or a lover

You do not leave me

Day and night

Maybe you are God

Hidden behind formulae

Or perhaps my psychiatrist friend

Was right

Fizyko, kim Ty jesteś?

Snem koszmarnym

Lub kochanka

Nie opuszczasz mnie

Dniem i Nocą

Może jesteś Bogiem

Ukrytym we wzorach

A może jednak miał rację

Mój przyjaciel psychiatra

**Ending Up on Wall
Street**

by Complete Accident

Accidentally Running into a Yale Physics Friend

The last Sunday in May, 1984, the Yale graduation day, I was walking by the Yale Cross-Campus Library and ran into a physics friend, Thomas Cardello, wearing a graduation toga and surrounded by his family. He had finished his PhD doing particle experiments in April 1983 and was working somewhere in New York.

“Tom, could you find me a job in New York?” I asked. “Would you like to trade gold options?” he replied. “I would love to!” I exclaimed, desperate to get a job, any job, knowing what “gold” was and having no idea what the word “option” meant.

Landing my First Finance Job

A week later, at dinner time, Tom called from New York. His boss, Mel Mullen, PhD in applied math from Courant Institute, NYU, and the head of trading at Mocatta Metals the firm he worked at, “is looking to hire somebody like you” said my friend. Mocatta’s owner, Henry Jarecki, was a former professor of psychiatry from Yale.

A few days later I made the 75 mile trip to New York, down to the 4 World Trade Center where Mocatta was located. My interviews went very well and towards the end Mel Mullen said: “Piotr, I’m concerned that you will get bored here because we do only simple things.” “Mel, science is based on simplifying things, and not by making them more complicated than they need to be, and by the way Einstein’s $E = mc^2$ was simple too” I replied. At this moment a big wide smile appeared on Mel’s face and I was hired. I started in September 1984.

Learning Finance On-the-Job

I knew roughly what stocks were and that was the extent end of my finance knowledge.

I learned on-the-job about option pricing, the term "derivatives" did not exist in 1984, through projects and reading every single article and available book on the subject.

Getting a Job at Goldman Sachs

My career accelerated when Fischer Black hired me into the Quantitative Strategies Group at Goldman Sachs in early 1987.

At that time GS employed number of famous finance academics.

One of my new Mocatta friends introduced me to a member of Fischer's group, nephew of a former Mocatta executive committee member. This is how I got the Goldman Sachs interview.

Why Finance?

Reliving Early 20th Century Physics in Finance

In finance I found what I was looking for in physics:

the ability to combine intellectual thought with practical action, all within a short time period.

I was very lucky by getting into the field relatively early, at the right time, at the right place, learning-by-doing while working with the best people in the field.

Model with Fischer Black

As the initial projects at Goldman Sachs I had to first learn and then enhance the Black-Derman-Toy interest rate model.

The outcome of this project was Black-Karasinski model that Fischer and I published in 1991 in Financial Analyst Journal .

Physics vs Finance

Physics versus Finance

Physics:

- We believe in the existence of universal eternal fundamental laws, written in the language of mathematics, that can explain the physical world.

Finance:

- Past performance is not a guarantee of future performance
- Models create markets and shape the way market participants think. Their use influences market behaviour.
- According to George Soros's reflexivity theory people's biases and actions can affect the direction of the underlying economy.

Universal Physics Laws vs Models in Finance

Physics:

- Classical: Electromagnetism, Newtonian gravity and dynamics, Thermodynamics, Einstein's special and general relativity, Thermodynamics
- Quantum: Quantum Mechanics, QED, Electroweak Interactions, QCD, Quantum Thermodynamics

Finance:

- Capital Asset Pricing Model, Black-Scholes-Merton model
- Gaussian Short-Rate model, BDT, BK, Libor Market Model
- Gaussian Copula Model for credit derivatives

Crisis in Finance

2008 Credit Crash and Meltdown in Finance

Finance executives' lack of proper accountability and wrong incentives : "As long as the music is playing, you've got to get up and dance."

Compensation structure.

Credit derivatives as a magnifier and facilitator of crash.

Credit rating agencies were paid to rate credit structures by their issuers.

The decision by the SEC to lift broker/dealer leverage limits in 2004: the result of Wall Street lobbying in which Henry Paulson, Goldman Sachs CEO at that time and a future U.S. Secretary of Treasury, played a major role. Earlier, in 2000, the SEC decided that lifting leverage limits was unsafe.

Making Finance Safer

How can we protect ourselves against ourselves? What role can mathematical finance play?

Can we make finance simpler? What does that mean?

Using complex methods to control complex system works in engineering and may fail in finance.

A Few Words of Wisdom

What You Need for Business Success

Quote from Kenneth D. Brody, co-founder of Taconic Capital Advisors, former Goldman Sachs partner. Ken received a BS in EE from the University of Maryland and a MBA from the Harvard Business School.

“Good judgment regarding human behaviour is more important than intelligence in achieving business success”

Advice from Freeman Dyson

The following piece of wisdom from Freeman Dyson is highly relevant when moving from maths/physics into finance.

“I gazed at the stars as a young boy,” he once wrote. “That’s what science means to me. It’s not theories about stars; it’s the actual stars that count.”

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Good Sense in Seeking Truth in the Sciences

Quote from "Discourse on the Method of Rightly Conducting the Reason, and Seeking Truth in the Sciences" by Rene Descartes

Good sense is, of all things among men, the most equally distributed; for every one thinks himself so abundantly provided with it, that those even who are the most difficult to satisfy in everything else, do not usually desire a larger measure of this quality than they already possess. And in this it is not likely that all are mistaken the conviction is rather to be held as testifying that the power of judging aright and of distinguishing truth from error, which is properly what is called good sense or reason, is by nature equal in all men; and that the diversity of our opinions, consequently, does not arise from some being endowed with a larger share of reason than others, but solely from this, that we conduct our thoughts along different ways, and do not fix our attention on the same objects. **For to be possessed of a vigorous mind is not enough; the prime requisite is rightly to apply it. The greatest minds, as they are capable of the highest excellences, are open likewise to the greatest aberrations; and those who travel very slowly may yet make far greater progress, provided they keep always to the straight road, than those who, while they run, forsake it.**