

A photograph of a computer monitor displaying financial market data. The screen shows a table with columns for 'SS SEK', 'Vol', 'Op', 'Hi', and 'Lo'. The current price is 53.70, down 4.70. Volume is 44,737,003. The opening price is 58.90. High is 59.10 and low is 53.70. A line chart is visible at the bottom of the screen. A dark blue semi-transparent box is overlaid on the left side of the image, containing the title text.

Secondment with Danske Bank

Stefan Kretzer

Outline

- Introducing myself
- Introducing Danske Bank
- What do quants (Quantitative Analysts) do?
- What do quants do at Danske Bank?
- What can you do during your secondment with us? (And beyond ...)
- Q & A



Stefan Kretzer

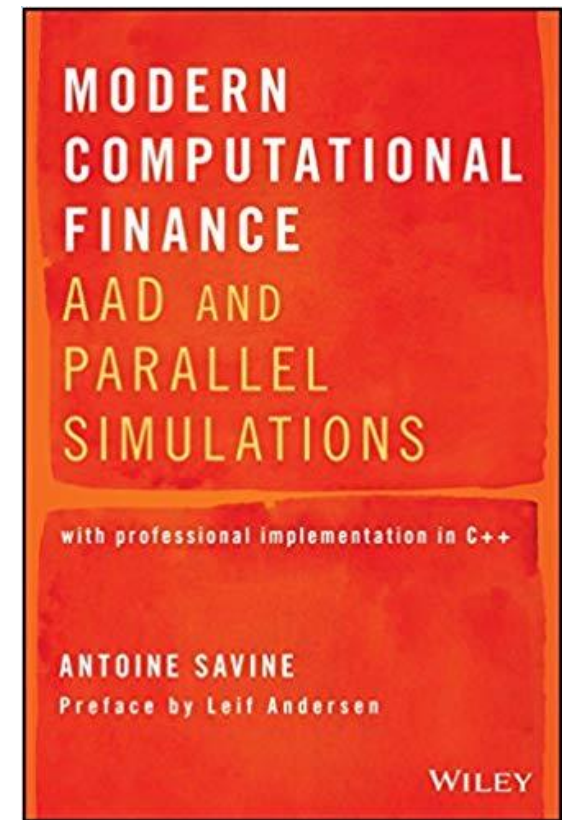
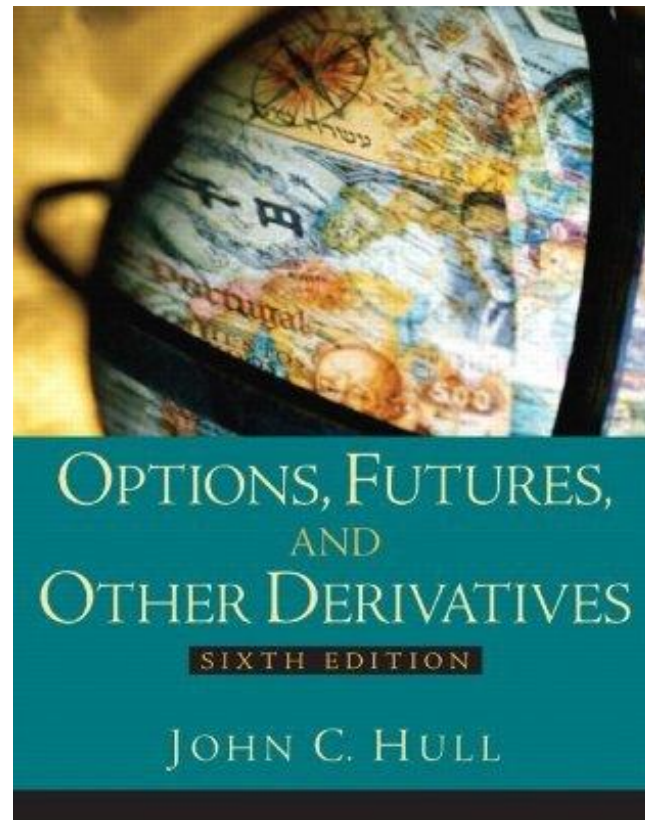
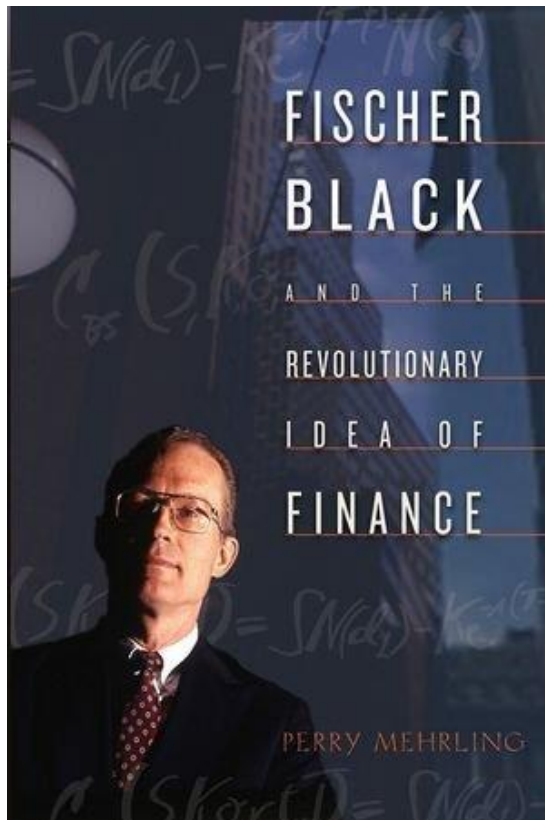
skre@danskebank.dk

- Ph.D. in theoretical physics (particle phenomenology) in Germany
- Postdoctoral research in the US (Brookhaven National Laboratory)
- Perturbative QCD phenomenology
- "Strategist" at Goldman Sachs, London
- With Danske Bank Markets since February 2009
- Head of Quantitative Risk Analytics within SuperFly Analytics
- Reporting to the head of the department: Ove Scavenius

Danske Bank

- Integrated (Retail & Investment) Nordic Bank with headquarters in Copenhagen
- About 20K employees in total
- About 10% thereof in Investment Banking (aka "C&I").
- Of those, about 50 (monotonically increasing since 2007) are "Quants" with mathematical and technological focus (mainly) in the areas
 - Trading in the Financial Markets (classical)
 - Digital Financial Services (fashionable)
- More than 50% of our quants are physicists
- Strong focus on corporate values and (scandinavian) working culture
- Is there an elephant in this room?





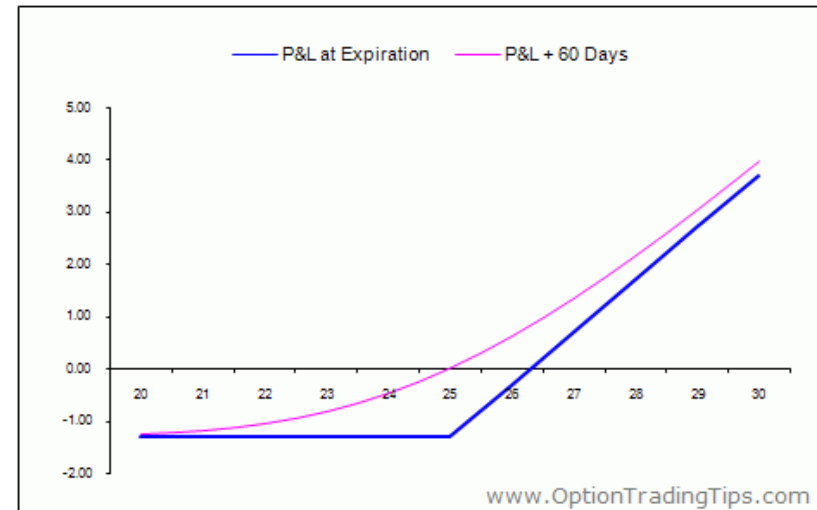
What do Quants do?

Origins: Black Sholes

Contract: $V_T = \max(S_T - K, 0)$

Martingale: $\frac{V_0}{B_0} = E\left(\frac{V_T}{B_T}\right)$

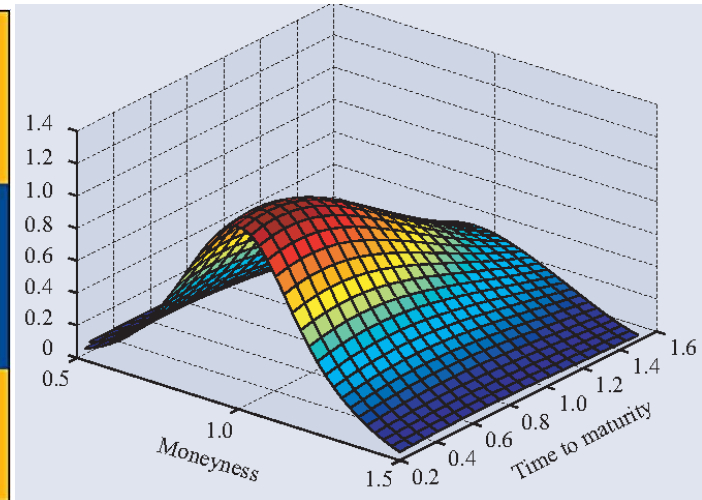
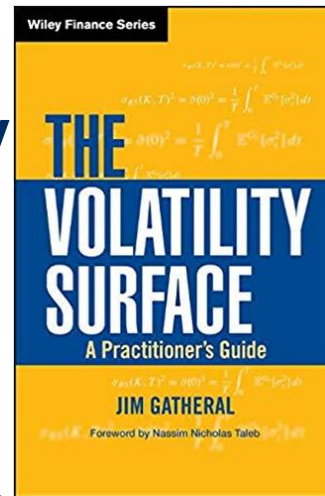
Distribution: $dS = rSdt + \sigma SdW$



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What do quants do today

- Classical (since 1980s):
 - Derivatives
 - Statistical (Stochastic Calculus) modeling and model implementation
- Inevitable
 - Regulation
- Fashionable
 - Machine learning
 - Big data
 - Digital services
- I will judiciously select example cases from the next slides



Sell Side Quants

- Derivatives trading
 - Hedging and positioning (flow and proprietary trading)
 - Trade opportunities (e.g. convertible arbitrage ~2000)
- Sales Quants :
 - Quoting tools
- Automated Market Making
- Collateral optimization
- 3rd party services
- Most of these areas require high numeric precision

Buy Side Quants

- Algorithmic Trading / Statistical Arbitrage:
 - Pairs trading
 - Algorithms for dynamic capital allocation to multiple strategies
- Investment analytics:
 - Distressed investments (e.g. 2009 crisis aftermath)
 - Rich / cheap analysis
- Investment Management:
 - Typically of more qualitative nature than market neutral strategies

Quants in controlling functions

- Risk management (as a back office function)
- Global risk controls of risk taking profit centers
- Model validation

Jobs are a mixture of:

- Modeling and concepts
- Development (models, libraries, ...)
- Business intelligence
- Business support
- Alphabet soup of role names:
Model quant, quant developer, desk quant, front office quant, quant trader, strategist, ...
- There are almost no jobs where coding in a serious language (C++) is not a sine qua non requirement

Quant Backgrounds

- Physics
- Math
- Physics
- Statistics
- Physics
- Computer Science
- Physics
- Financial Engineering
- Did I already say "Physics"?

$V(x) = \begin{cases} 0, & x < 0 \\ V_0, & x \geq 0 \end{cases}$
 $\sigma_x \sigma_p \geq \frac{\hbar}{2}$
 $E = \hbar \nu$
 $E = \frac{\hbar^2 k^2}{2m}$

$\Psi_1(x) = \frac{1}{\sqrt{k_1}} (A_+ e^{ik_1 x} + A_- e^{-ik_1 x})$
 $x < 0$

$\Psi_2(x) = \frac{1}{\sqrt{k_2}} (B_+ e^{ik_2 x} + B_- e^{-ik_2 x})$
 $x > 0$

$T(j, m) \equiv |T(j, m)| = (-1)^{j-m} |j, -m\rangle$

$i\hbar \frac{\partial}{\partial t} \Psi(r, t) = \hat{H} \Psi(r, t)$
 $|\Psi\rangle_{AB} = \sum_{i, j} c_{ij} |i\rangle_A \otimes |j\rangle_B$

$P[a \leq X \leq b] = \int_a^b \int_{-\infty}^{\infty} W(x, p) dp dx$
 $H_n(x) = (-1)^n e^{x^2} \frac{d}{dx^n} (e^{-x^2})$

$\frac{\hbar^2}{2m} \frac{d^2 \Psi}{dx^2} = E \Psi$
 $\Psi(x) = A e^{ikx} + B e^{-ikx}$
 $U(t) = \exp\left(\frac{-iHt}{\hbar}\right)$
 $i\hbar \frac{d}{dt} |\Psi(t)\rangle = H |\Psi(t)\rangle$
 $A(x) = \exp\left(\frac{i}{\hbar} \int X(t) dt\right)$

$P(a, b) = \int d\lambda \cdot \rho(\lambda) \cdot p_A(a, \lambda) \cdot p_B(b, \lambda)$

$W \rightarrow \frac{1}{(\pi \hbar)^3} \exp\left[-\alpha^2 \left(x - \frac{pt}{m}\right)^2\right]$

Why do we love physicists?

Why are physicists so successful as quants

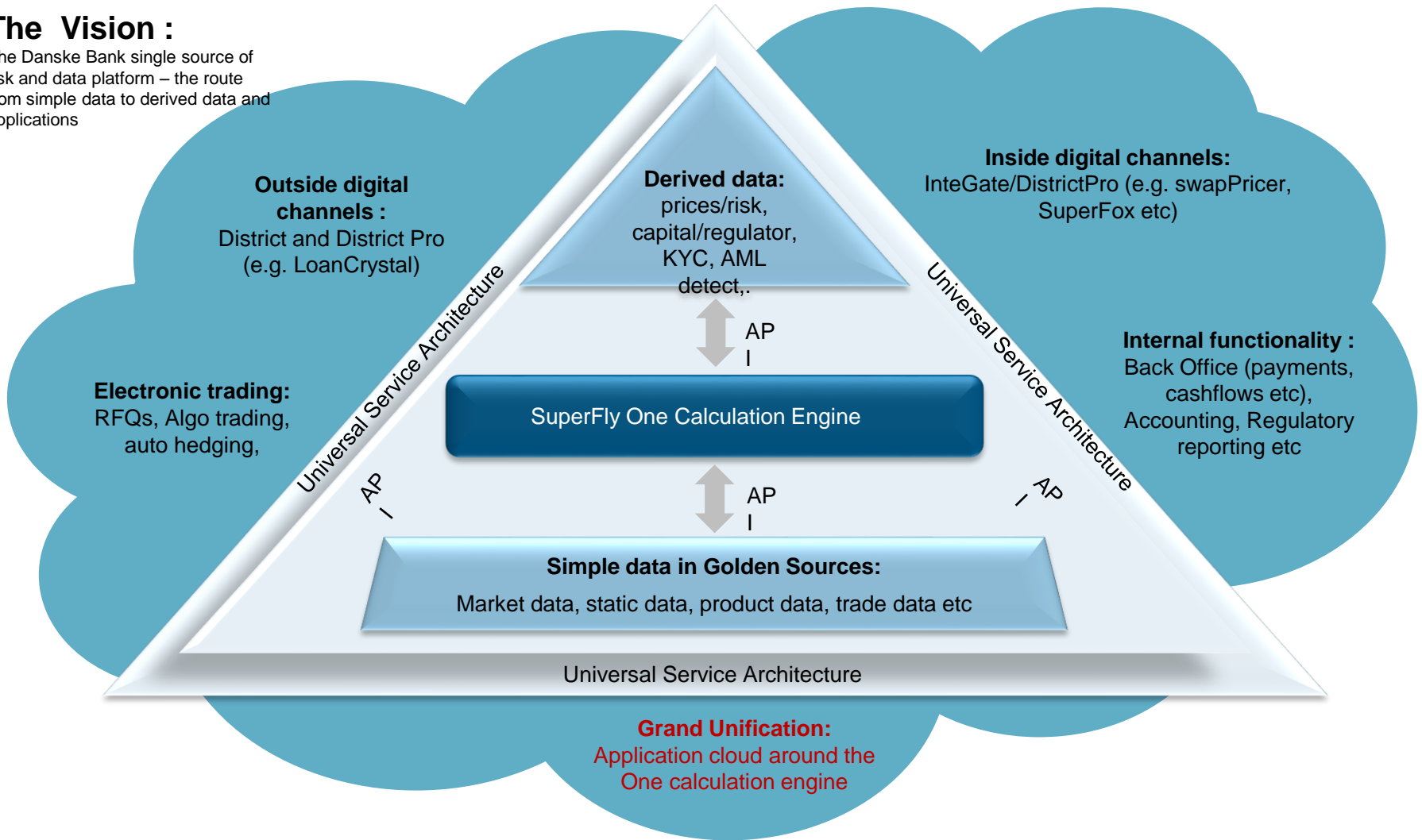
- Mathematical quantitative background including
 - Analysis
 - Statistics
 - Numerics
- Pragmatism: The fine art of "misusing math" and applying the KISS ("Keep it simple, stupid") paradigm
- "Creativity in a straightjacket"
- Quants are modelers. Physicists distinguish models from theories. They have a good understanding of model scope restrictions.
- Structured, synoptical thinking and problem solving.
- A rare breed of "red blooded nerds"



What do Quants do at Danske Bank?

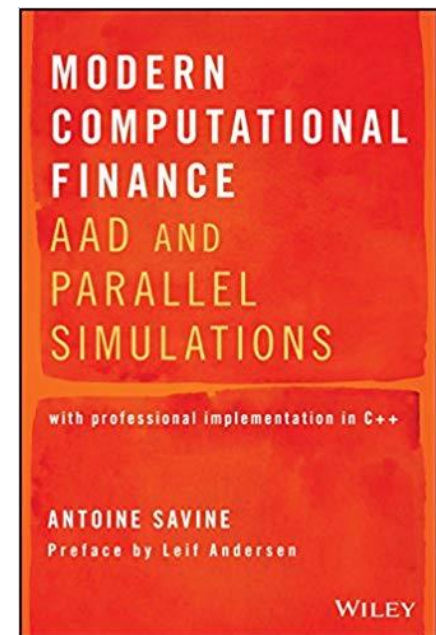
The Vision :

The Danske Bank single source of risk and data platform – the route from simple data to derived data and applications



Credentials

- Risk magazine's "in house system of the year 2015"
 - AAD fired xVA system
- Risk magazine's "Quant(s) of the year 2012"
- Text book by Antoine Savine
- Many of us came from prestigious academic positions and / or jobs with London tier 1 banks
- We are a very diverse department of about 50 Quants from a dozen or so nations and both sexes (alas, more men than women).



What can you do at Danske Bank?

Possibilities for your secondment

- Quant projects don't sit on the shelf for long, so these are typical present day examples only
- Theoretical (by practical standards)
 - Equity proxy hedges
 - Spread option modeling
- Industry Standard Code Development
 - Work with us on the platform vision
 - Implement metric templates to a C++ API (exposed to .NET)
- Hands-on practical
 - Working with traders day to day to understand their market risk exposure
 - Talking to senior management and risk managers to understand the controlling aspect
- We are open to all those possibilities, also in combination.

Summary

- Despite crises driven changes to the financial industry, opportunities to make a good life as a Quant remain
- Physicists make for excellent Quants
- A secondment with Danske Bank offers you
 - A close up experience of the financial industry. ("Is it for me?")
 - A broad bandwidth of interesting work lines during your secondment
 - With a world class team
 - Within a working culture that is not as cut throat as the industry is infamous for (and in a city top ranked for quality of life).
 - A significant edge in landing a permanent job after your Ph.D. (with us or elsewhere)
- Stay in touch (also on possible topics for your secondment):
 - OVS@danskebank.dk (my boss Ove Scavenius) and SKRE@danskebank.dk (me)



Non-quantitative quant books

