

Mathematics Careers at ANZ

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ANZ Market Risk
Date May 2, 2006

Presentation Overview

- A Career Profile
- Mathematics in Risk
- Mathematics in the Investment Bank
- The Ideal Graduate
- Miscellaneous

A Profile

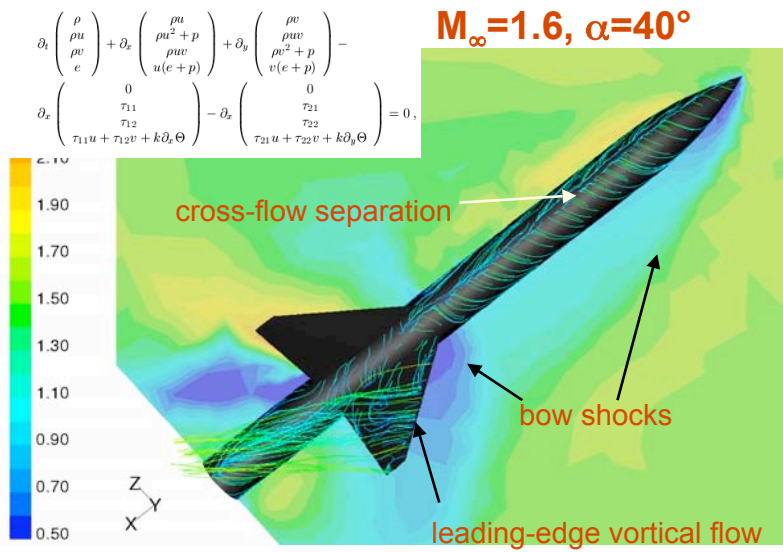
Education

- B.E. (Aero) (Hons) University of Sydney 1987
- PhD. (Mech. Eng.) University of Melbourne 1998
 - Thesis 'An Investigation of the Invariants of the Velocity Gradient Tensor in Transitioning and Turbulent Fluid Flow'
- Grad. Dip. Applied Finance and Investment, Securities Institute of Australia 1990
- Chance and Options Pricing, Mathematics of Options Pricing (3rd/4th year undergrad maths courses, Melbourne, Monash)
- Mathematics Skill Set ->
 - Calculus, PDEs/ODEs, computational methods, programming (C/Fortran), mathematical modelling

A Profile

Experience

- Defence Science and Technology Organisation
 - Engineer 1986-1993
 - Advanced Engineering Laboratories, Aeronautical Research Laboratories, Salisbury S.A. and Fishermen's Bend, VIC
 - Research Scientist 1993-2001
 - Aeronautical and Maritime Research Laboratories
- Performing Applied Aerodynamic Analysis and Computational Fluid Dynamics in support of the Australian Defence Force's Air Operations.



Wilmott Forums -- Search Results - Microsoft Internet Explorer provided by ANZ

Quantitative Finance for Actuaries
Paul Wilmott - 7city
Classroom programme or live distance learning - June 6th 2006

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Senior Equity Derivatives Quantitative Analyst - London - £Excellent	0	227	Jobs Board	Administrator	Wed Apr 26, 06 02:20 PM by Administrator
Senior Java Developer - Fixed Income (Mortgage and Derivatives) - New York - \$180-260,000 - HUX2841	0	307	Jobs Board	Huxley	Tue Apr 25, 06 09:13 PM by Huxley
Senior Sales Structured Credit - Frankfurt, Germany - Negotiable - HUX2831	0	1253	Jobs Board	Huxley	Fri Apr 21, 06 09:50 PM by Huxley
Senior Equity Analyst Leading House - Amsterdam - Negotiable - 65-95k+OTE - HUX2829	0	1367	Jobs Board	Huxley	Thu Apr 20, 06 11:43 PM by Huxley
Fund Derivatives Structurer (VP to Senior VP) - UK - £Competitive Package - HUX2826	0	1385	Jobs Board	Huxley	Thu Apr 20, 06 11:38 PM by Huxley
Senior Developer/Manager(C++/UNIX) - Front Office - New York - From \$200,000+ - HUX2824	0	2583	Jobs Board	Huxley	Wed Apr 19, 06 03:24 PM by Huxley
Senior FX Structurer - US Investment Bank - London - £Market Rate - HUX2824	0	1569	Jobs Board	Huxley	Wed Apr 19, 06 03:20 PM by Huxley
Senior Quant Analyst / Developer - Front Office IR Trading - Global Tr - London/Singapore - £200-300k Pack - MILL322	0	1720	Jobs Board	MillarAssociates	Tue Apr 18, 06 04:28 PM by MillarAssociates
Senior Credit/Fixed Income Quant - Leading JB - London - Total Package £250-400k - MILL321	0	1731	Jobs Board	MillarAssociates	Tue Apr 18, 06 04:26 PM by MillarAssociates
Senior Fixed Income Asset Management Quant - New York/London - £300k	0	1749	Jobs Board	FleetSearch	Tue Apr 18, 06 01:24 PM by FleetSearch
Senior Relationship Manager - Institutional Banking - Brussels - Negotiable - HUX2815	0	1660	Jobs Board	Huxley	Tue Apr 18, 06 12:57 PM by Huxley
Senior Quantitative Analyst - Interest Rate Hybrids - London - £100,000 -	0	2415	Jobs Board	Huxley	Wed Apr 12, 06 01:48 PM

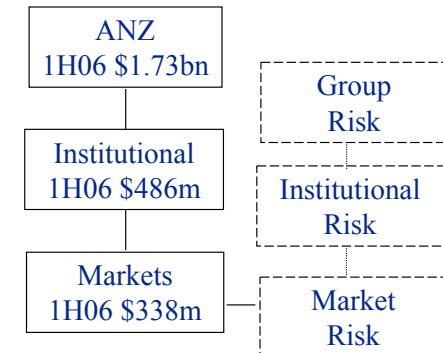
A Profile

Experience

- ANZ Market Risk
- Quantitative Analyst 2001-
- Performing quantitative financial analysis in support of ANZ's Investment Banking operations

ANZ

- Household Name
- Top 5 Australian Company
- Assets ~AUD\$300bn
- Worth ~AUD\$40bn
- ~30 000 employees



Financial Risk Management

Market Risk

Credit Risk

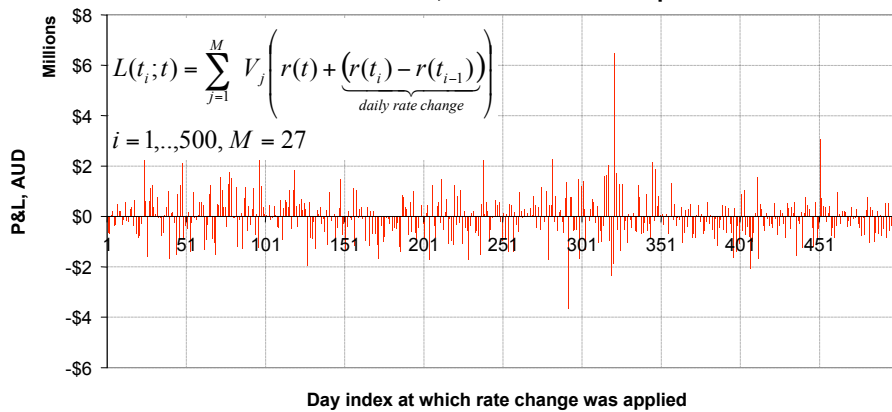
Operational Risk

Financial Risk Management

Market Risk

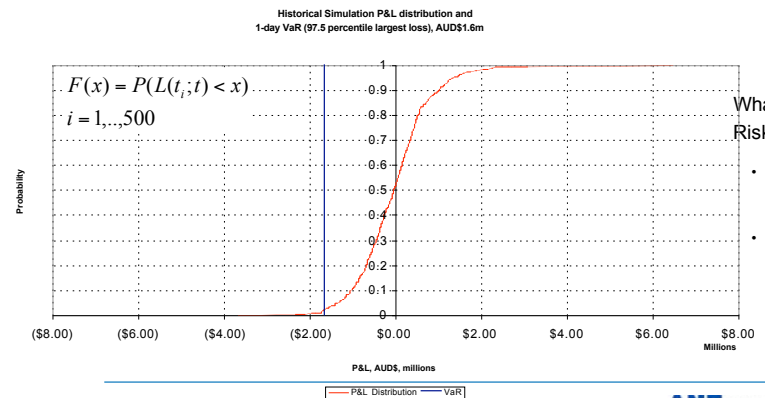
- Losses on holdings of market-valued instruments due to movements in market rates
- 'Trading Book' – Investment Banking
- Foreign Exchange, Interest Rates, Commodities, Credit, Energy, Power etc.
 - Both fundamental and derivative contracts in all markets
- $V(t)$ the value of all our fundamental and derivative contracts at time t

Historical Simulation VaR, 500 Hypothetical P&Ls
Portfolio of 27 USD, JPY and XAU FX Options



Financial Risk Management

Loss Distribution – Market Risk analysis of a portfolio of derivatives



What's the Value-at-Risk (tail measure)?

- Limits management
- Capital

Financial Risk Management

Market Risk

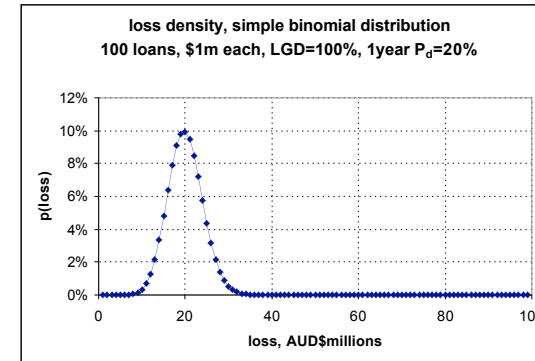
- Losses on holdings of market-valued instruments due to movements in market rates
- 'Trading Book' – Investment Banking
- Foreign Exchange, Interest Rates, Commodities, Credit, Energy, Power etc.

Credit Risk

- Loss due to default of a counterparty to whom money has been lent
- 'Banking Book' – Commercial+Retail Banking
- Home loans, credit cards, loan facilities, line-of-credit etc

Financial Risk Management

Loss Density – Credit Risk analysis of a portfolio of loans



$$p(l) = \binom{n}{l} p^l q^{n-l}$$

$$n = 100$$

$$p = 0.2$$

$$q = 0.8$$

–What's the expected loss?

- Pricing

–What's the unexpected loss?

- Capital

Investment Banking

Derivatives – the Sell Side and the Buy Side

Investment Banking primarily 'Sell-side' – bank will package up products containing derivatives for clients to buy, whether for risk management or investment purposes.

Asset management 'Buy-side' – asset managers will make investments involving derivatives, taking a view on market direction

Investment Banking

Derivatives Pricing and Risk Management

No Arbitrage Pricing Theory (Black/Scholes/Merton)

can construct a self-financing portfolio to replicate the derivative using a predictable trading strategy

Valuation is risk-neutral – the sell-side is agnostic to market direction or 'risk-neutral'. The initial value of the self-financing portfolio is the same regardless of where the market moves

Sell-side will make its money by selling a derivative for more than the value of the replicating portfolio – goal is **RISK-FREE PROFITS**

Heavy Quant work involved in construction of the underlying rate models and derivative pricing models, construction of the replicating portfolios, measurement of residual risks – difficult and lucrative

Investment Banking

Derivatives Pricing and Risk Management

e.g. Black-Scholes underlying SDE (Geometric Brownian Motion) for X_t

$$dX_t = \mu X_t dt + \sigma X_t dB_t$$

Let $g(X_T)$ be the price of a derivative at maturity $t=T$. Application of Pricing Theory and use of the Feynman-Kac formula gives the PDE for the value of the derivative

$$\frac{\partial f(x,t)}{\partial t} + \frac{1}{2}\sigma^2 \frac{\partial^2 f(x,t)}{\partial x^2} + r \frac{\partial f(x,t)}{\partial x} = rf(x,t)$$

with $f(x,T)=g(x)$ and r equal to the risk-free interest rate.

If the derivative is a call option, $g(x)=(x-K)^+$ and the solution to this equation is the classic Black Scholes option pricing formula

$$f(S,0) = \left[SN(d_1) - Ke^{-rt} N(d_1 - \sigma\sqrt{T}) \right] d_1 = - \frac{\ln\left[\frac{S}{K}\right] + \left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}$$

Investment Banking

Derivatives Pricing and Risk Management

Example – Gold-Linked Note

Investment bank may 'manufacture' a fixed income note for an investor linked to the price of Gold:

Note details:

1y maturity, USD\$10m, offered Dec04

Coupon & principal paid at expiry

Coupon 14% if gold stays between USD400-500/oz during '05

otherwise 2%

Suitable for a wholesale investor keen to take a view on the Gold Price during '05.

Replicated using a combination of a zero coupon bond and a double-no touch gold option, priced using Black/Scholes with volatility smile corrections – in effect, the investor has sold the gold option for less than the investment bank can buy the fundamental components

Investment Banking

Proprietary Trading

"Buy-Side" of investment banking

Uses statistical analysis to identify trading opportunities

Quant Groups at ANZ

Markets ~ 8

Market Risk ~ 4

Credit Risk ~ 8

Other Businesses ~ 10

All up – approx 30

The Ideal Quant

Education

- PhD in a numerate discipline
 - Maths, Physics, Engineering, Computational Finance
- Financial Education (not essential)
 - Financial Mathematics subjects – Chance and Options Pricing, Mathematics of Options Pricing – basic for Quants
 - Securities Institute – basic
 - Master of Applied Finance – Macquarie University – advanced
 - Master of Quantitative Finance - UTS
 - MBA – very advanced

The Ideal Quant

Skills

- Maths
 - Stochastic Calculus, Martingales, Theory of Options Pricing, Change of Measure, PDEs, Monte-Carlo simulation etc, Probability theory, Numerical Methods
- Programming Skills
 - C/C++, VBA, Databases (SQL) preferred
- Investment Banking – Hot Topics
 - BGM interest rate model (term structure), Structured Credit (synthetic CDOs, CDO options, CDO²), Electricity
- Risk – Hot Topics
 - Copulas, Fat-tailed dependency structures, EVT, multivariate distributions, convergence of credit & market risk, holistic capital allocation

The Ideal Quant

Traits

- Ability to communicate to technical and non-technical personnel
- Analytical ability
- Front Office
 - Ability to work under pressure
 - Ability to think under pressure
 - Ability not to get too stressed under pressure

Some Resources

Jobs Boards (by no means a complete list)

- Australia
 - Bank sites
 - www.seek.com use keywork “Quant”
 - http://www.austms.org.au/Jobs/Finance_listings.html
- International
 - www.wilmott.com
 - http://www.numa.com/cgi-bin/numa/bb-jobs.pl?F_FULL

Some Resources

Some Books (by no means a complete list)

- Finance Textbooks
 - John Hull, “Options, Futures and Other Derivatives”
 - Baxter and Rennie, “Financial Calculus”
 - Brigo and Mercurio, “Interest Rate Models – Theory and Practice”
- Good Reads about Wall Street Life
 - Michael Lewis, “Liars Poker”
 - Frank Partnoy, “FIASCO Blood in the Water on Wall Street ”

Some Resources

ANZ Contacts

ANZ Careers <http://www.anz.com/aus/careers/default.asp>

Graduate program <http://www.anz.com/aus/careers/Graduate.asp>