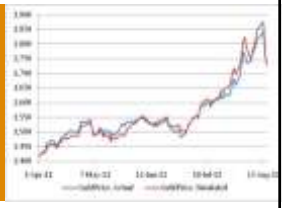
June 2012

Risk Management

Ideas, Products, Risks, Limits



Jawwad Intro

Fellow Society of Actuaries, Investments

MBA, Columbia Business School

19 years consulting: US, UK, ME & Pakistan

Risk Management, Product Development, Regulatory Reporting, Actuarial Practice

Prefers - Jawwad

http://FinanceTrainingCourse.com
http://www.alchemya.com
jawwad@alchemya.com

Alchemy Intro

Actuarial & Risk Advisory firm

8 years, 4 Markets

Derivative & Risk Management models, ALM, ICAAP, Stress Testing, Financial Product Development, Training workshops

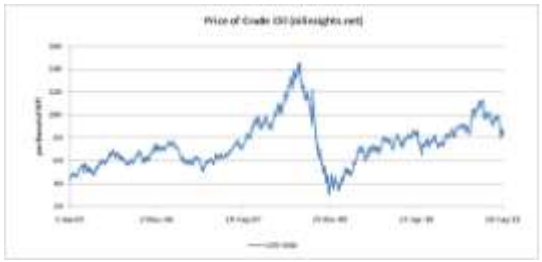
120th workshop - 1600 trained professionals

What is this course about

Price | Risk | Value

Products | Limits

Price

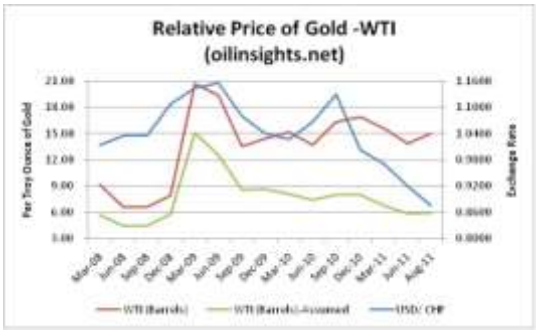


Volatility

Models

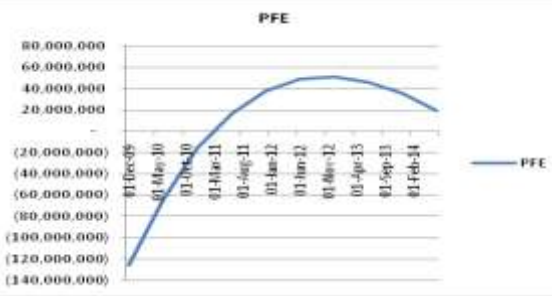
Relative Value

Relative Value - II



Products & Payoffs

Limits



Action Plan – Day One

Volatility	• Trailing volatility
Data & Trends	• Review of trends
Value at Risk	• Understanding & Calculating Value at Risk.
Calculating VaR	• Hands on practice

Action Plan – Day Two

Working with Oil & Gold	• Fundamental models
Air Canada	• Oil
GM	• FX
Measuring Exposure	• What would you recommend?

Distribution & Volatility

Sigma

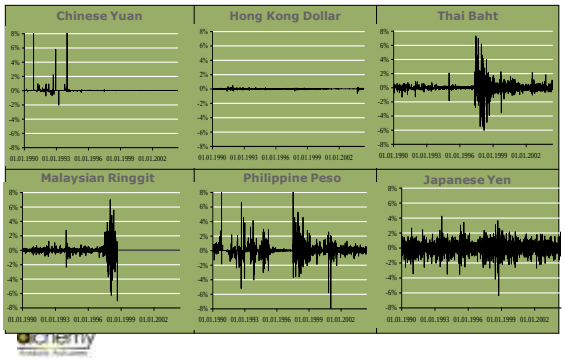
Volatility

Variance ==> expectations not met

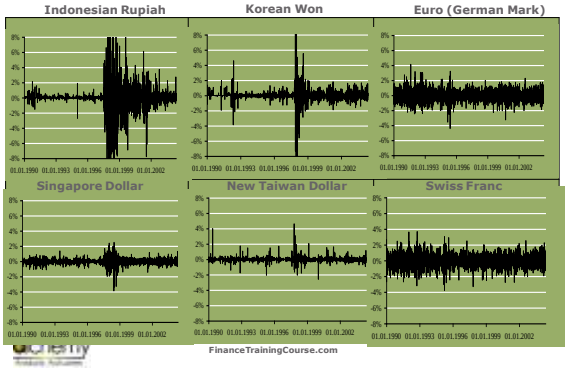
>Std-deviation ==> square root (Variance)
>Dispersion, Diffusion
>Volatility
>Vol
>Trading Vol
>Implied Vol

Optionality - Volatility - Convexity

Exchange Rate Volatility against the US Dollar of Selected Crisis and Non-Crisis Currencies, 1990:01-2004:05 (Daily) - Source Ronald Mckinnon, Stanford University



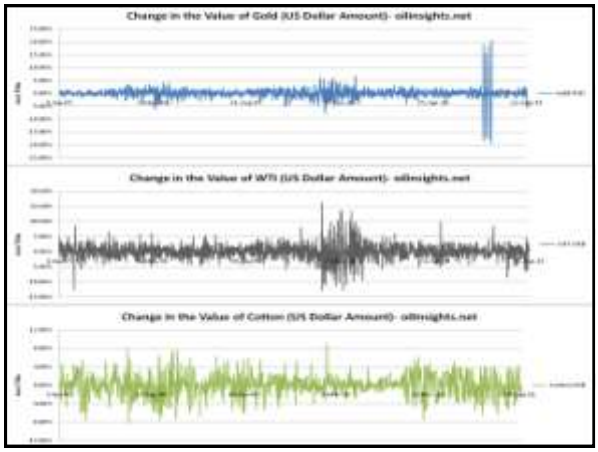
(Continued), Exchange Rate Volatility against the US Dollar, 1990:01-2004:05 (Daily)



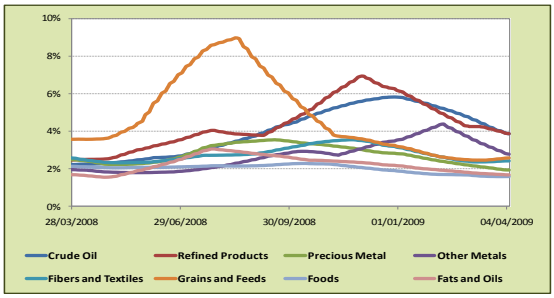
Standard Deviations of Monthly Exchange Rate Fluctuations against the Dollar

	Pre-crisis	Crisis	Post-crisis
Chinese Yuan	0.25	0.03	0.00
Hong Kong Dollar	0.08	0.07	0.11
Indonesian Rupiah	0.26	26.54	5.16
Korean Won	1.01	11.53	1.92
Malaysian Ringgit	1.06	6.69	0.00
Philippine Peso	1.19	5.25	1.67
Singapore Dollar	0.76	2.88	1.18
New Taiwan Dollar	1.01	2.63	1.35
Thai Baht	0.43	8.88	1.60
Japanese Yen	3.66	3.64	2.39
Euro (Deutsche Mark)	2.20	2.33	2.58
Swiss Franc	2.62	2.60	2.54

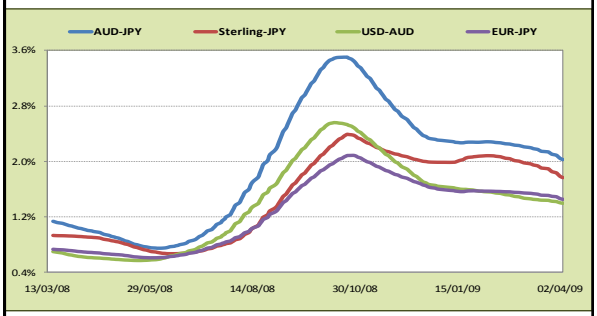
Data source: IMF: IFS, Ronald Mckinnon, Stanford University



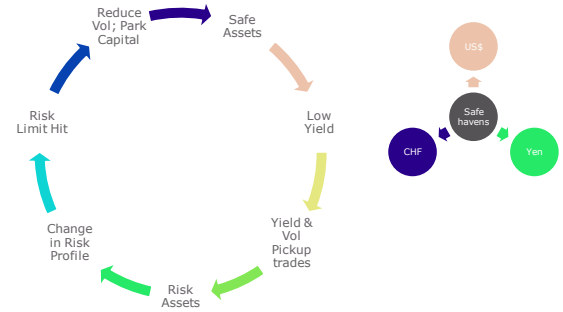
Vol Trend



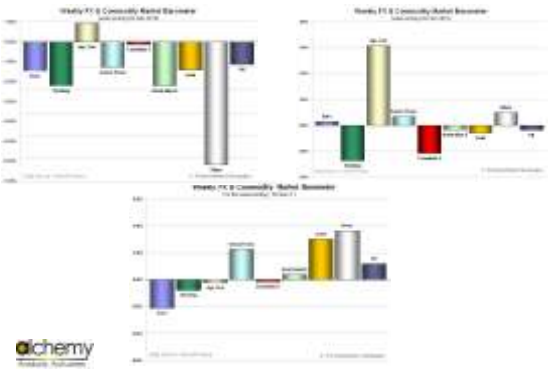
Lagged effects



Flight to Safety cycle

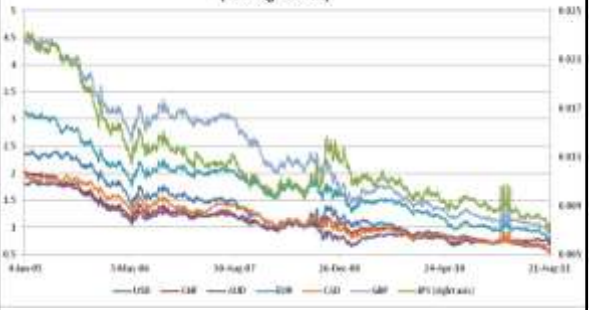


Flight to Safety - II



Thought Experiments?

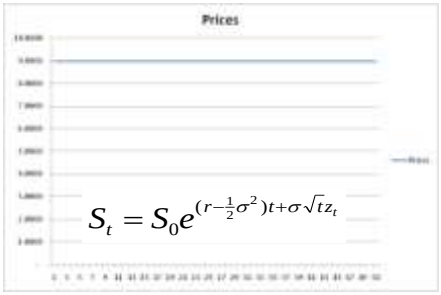
How many troy ounces of Gold can 1000 units of currency buy (oilinsights.net)



Volatility Drag?

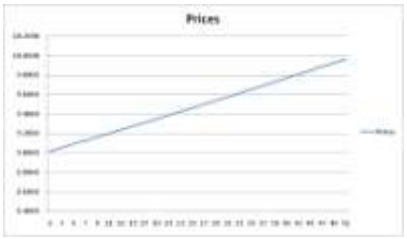
Vol =?, r = ?

Vol = 0, r = 0



$$S_t = S_0 e^{(r-\frac{1}{2}\sigma^2)t+\sigma\sqrt{t}z_t}$$

Vol = 0, r = 1



$$S_t = S_0 e^{(r-\frac{1}{2}\sigma^2)t+\sigma\sqrt{t}z_t}$$

Vol = 0, r = ?

$$S_t = S_0 e^{(r-\frac{1}{2}\sigma^2)t+\sigma\sqrt{t}z_t}$$

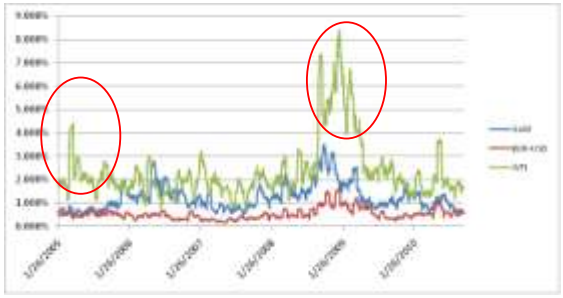
Vol = ?, r =1

$$S_t = S_0 e^{(r-\frac{1}{2}\sigma^2)t+\sigma\sqrt{t}z_t}$$

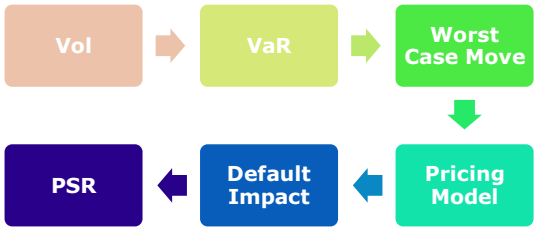
Vol = ?, r =0

$$S_t = S_0 e^{(r-\frac{1}{2}\sigma^2)t+\sigma\sqrt{t}z_t}$$

Trailing Volatilites

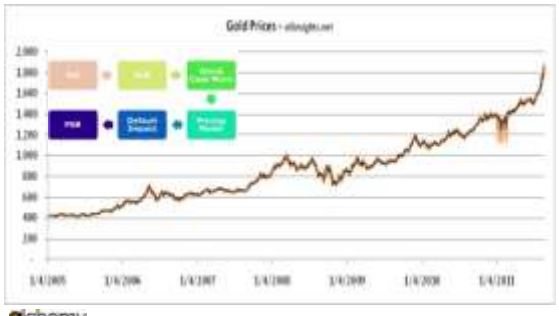


Thought experiment - PSR Process

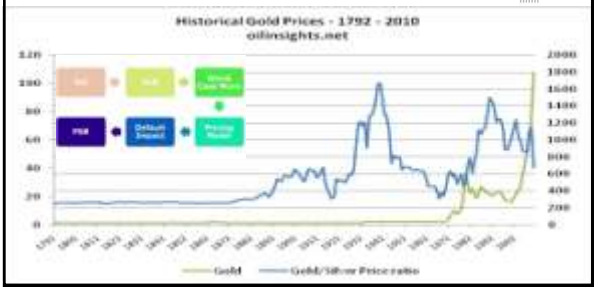


FinanceTrainingCourse.com

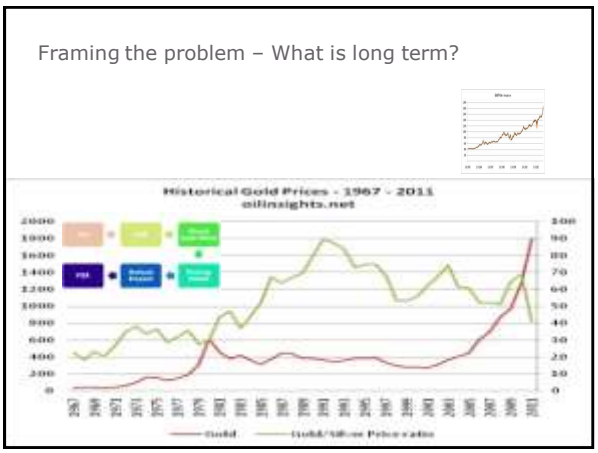
Framing the problem – What is long term?



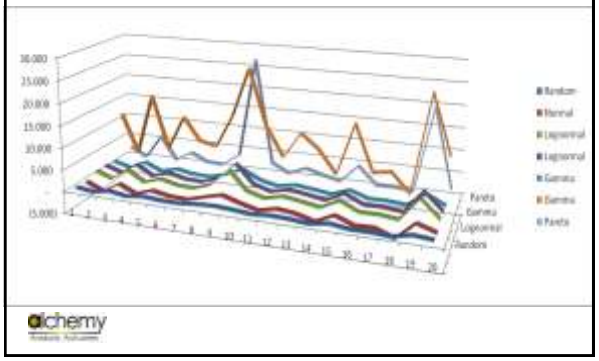
Framing the problem – What is long term?



Framing the problem – What is long term?



Distributions - Simulations



Mindset – Distributions - Models

ALL MODELS ARE WRONG

SOME MODELS ARE MORE USEFUL THAN OTHERS

Sigma $_{a,b}$

Questions

What is the probability that margins will decrease in any month over the next quarter, the next half year, or the next full year?

What is the range of these projected reductions?

What is the worst case reduction in any month over the next 12 months?

What is the likely reduction in any month over the next 12 months?

Value @ Risk

Monthly Crude Oil Change –
The Oil Refinery Case

alchemy

VaR and Margins

Application Questions

alchemy

Questions

What is the probability that margins will decrease in any month over the next quarter, the next half year, or the next full year?

What is the range of these projected reductions?

alchemy

alchemy

Questions

What is the worst case reduction in any month over the next 12 months?

What is the likely reduction in any month over the next 12 months?

More questions?

What is the probability that gross margins will shrink below the minimum profitability threshold?

What is the probability that gross margins will turn negative?

More questions?

What is the likely expected gross margin number at current price volatility levels?

How will this number change if volatility moves by a percentage point?

By how much does a dollar change in prices change the expected margin number?

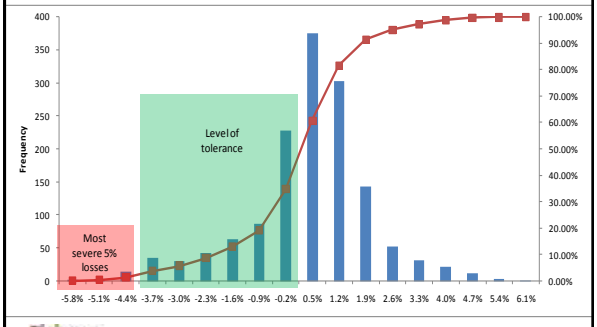
Monthly Crude Oil Change

Integration - Example

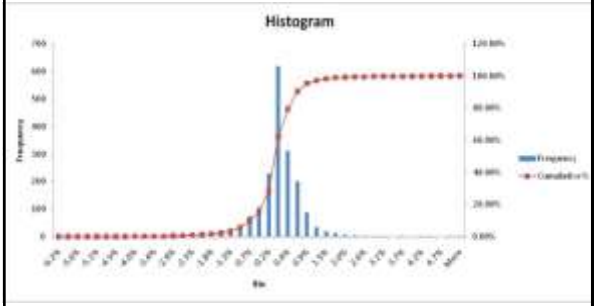
Odds	Percentile	Input Price Shock-low	Input Price Shock-high	Inventory Losses Low	Inventory Losses High
	99%	145	364	12,310,771	30,885,105
1%	99%	145	364	12,310,771	30,885,105
11%	90%	80	200	6,781,826	17,014,160
18%	85%	65	162	5,484,689	13,759,917
25%	80%	52	132	4,453,765	11,173,548
33%	75%	42	105	3,569,324	8,954,674
43%	70%	33	82	2,775,068	6,962,056
52%	66%	26	64	2,182,708	5,475,951
67%	60%	16	40	1,340,684	3,363,492
82%	55%	8	20	664,986	1,668,308
96%	51%	2	4	132,662	332,820

Crude Volatility

VaR

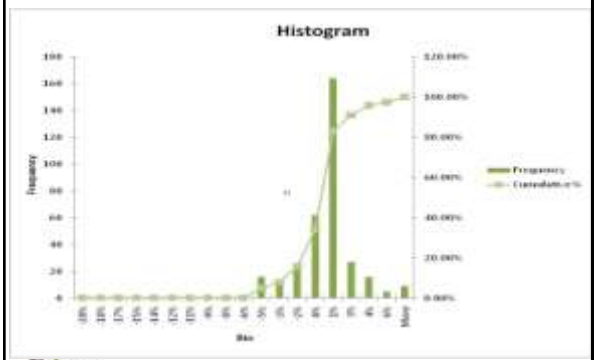


AUD/USD Exchange Rate

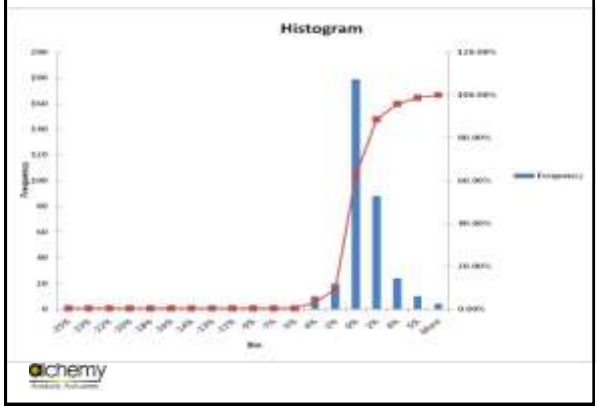


VaR Case

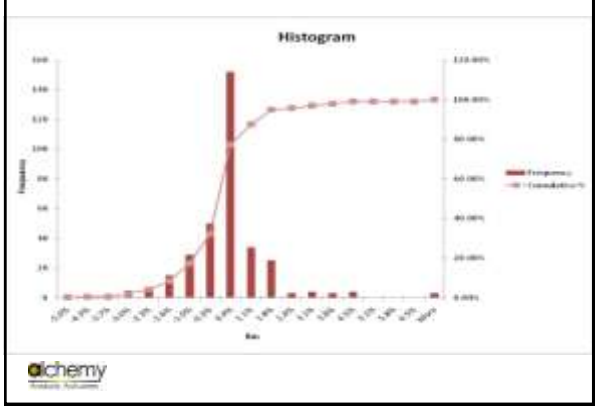
Portfolio A



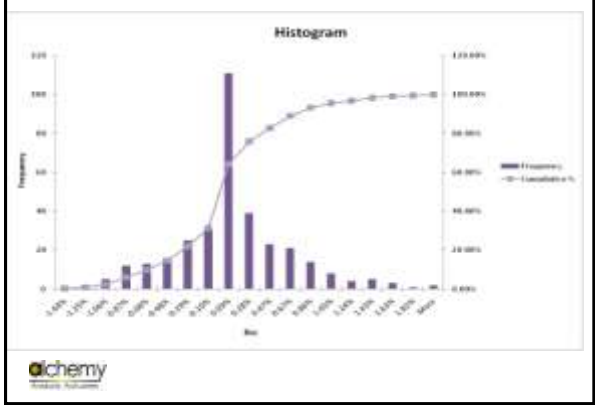
Portfolio B



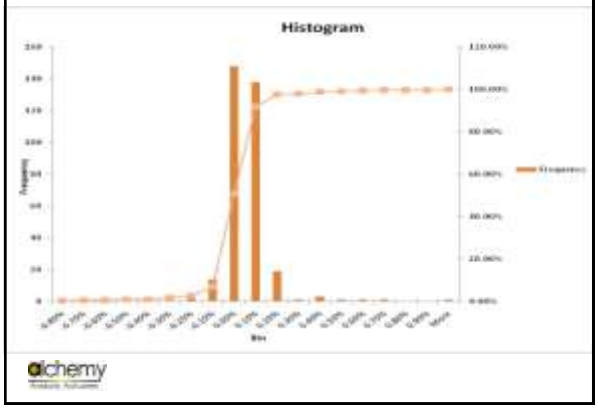
Portfolio D



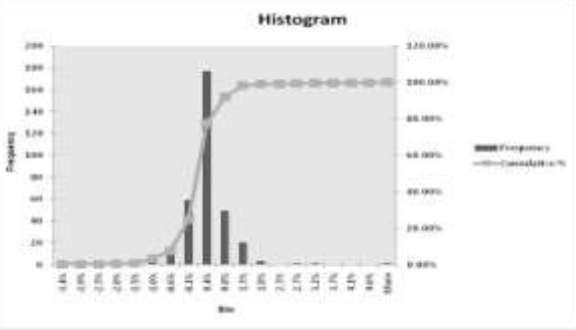
Portfolio J



Portfolio N



Portfolio P



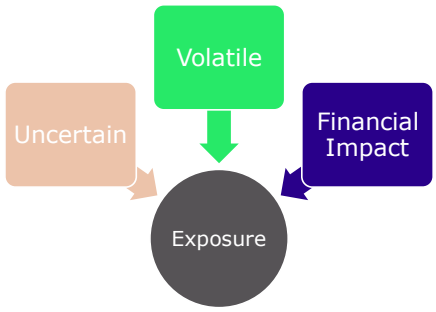
Histogram Source

A			B			D		
Bin	Freq	Cumulative %	Bin	Freq	Cumulative %	Bin	Freq	Cumulative %
-20%	1	0.30%	-25%	1	0.30%	-5.0%	1	0.30%
-18%	0	0.30%	-23%	0	0.30%	-4.3%	1	0.60%
-17%	0	0.30%	-22%	0	0.30%	-3.7%	0	0.60%
-15%	0	0.30%	-20%	0	0.30%	-3.0%	5	2.08%
-14%	0	0.30%	-18%	0	0.30%	-2.3%	7	4.17%
-12%	0	0.30%	-16%	0	0.30%	-1.6%	15	8.63%
-11%	0	0.30%	-14%	0	0.30%	-1.0%	29	17.26%
-9%	0	0.30%	-13%	0	0.30%	-0.3%	50	32.14%
-8%	0	0.30%	-11%	0	0.30%	0.4%	152	77.38%
-6%	0	0.30%	-9%	0	0.30%	1.1%	34	87.50%
-5%	16	5.06%	-7%	0	0.30%	1.8%	25	94.94%
-3%	10	8.04%	-5%	0	0.30%	2.4%	3	95.83%
-2%	26	15.77%	-4%	10	3.27%	3.1%	4	97.02%
0%	62	34.23%	-2%	20	9.23%	3.8%	3	97.92%
1%	164	83.04%	0%	179	62.50%	4.5%	4	99.11%
3%	27	91.07%	2%	88	88.69%	5.1%	0	99.11%
4%	16	95.83%	4%	24	95.83%	5.8%	0	99.11%
6%	5	97.32%	5%	10	98.81%	6.5%	0	99.11%
More	9	100.00%	More	4	100.00%	More	3	100.00%

Histogram Source

J			N			P		
Bin	Freq	Cumulative %	Bin	Freq	Cumulative %	Bin	Freq	Cumulative %
-1.44%	1	0.30%	-0.80%	1	0.30%	-3.4%	1	0.30%
-1.25%	2	0.89%	-0.70%	1	0.60%	-2.9%	0	0.30%
-1.06%	5	2.38%	-0.60%	0	0.60%	-2.5%	0	0.30%
-0.87%	12	5.95%	-0.50%	1	0.89%	-2.0%	1	0.60%
-0.68%	13	9.82%	-0.40%	0	0.89%	-1.5%	1	0.89%
-0.48%	16	14.58%	-0.30%	3	1.79%	-1.0%	9	3.57%
-0.29%	25	22.02%	-0.20%	3	2.68%	-0.6%	13	7.44%
-0.10%	31	31.25%	-0.10%	14	6.85%	-0.1%	59	25.00%
0.09%	111	64.29%	0.00%	148	50.89%	0.4%	177	77.68%
0.28%	39	75.89%	0.10%	138	91.96%	0.8%	49	92.26%
0.47%	23	82.74%	0.20%	19	97.62%	1.3%	20	98.21%
0.67%	21	88.99%	0.30%	1	97.92%	1.8%	3	99.11%
0.86%	14	93.15%	0.40%	3	98.81%	2.3%	0	99.11%
1.05%	8	95.54%	0.50%	1	99.11%	2.7%	1	99.40%
1.24%	4	96.73%	0.60%	1	99.40%	3.2%	1	99.70%
1.43%	5	98.21%	0.70%	1	99.70%	3.7%	0	99.70%
1.63%	3	99.11%	0.80%	0	99.70%	4.1%	0	99.70%
1.82%	1	99.40%	0.90%	0	99.70%	4.6%	0	99.70%
More	2	100.00%	More	1	100.00%	More	1	100.00%

What is exposure?



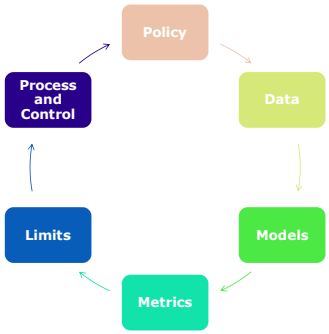
FinanceTrainingCourse.com

What is exposure?

Air Canada	• Rising Jet Fuel Prices
GM	• Rising Canadian Dollar
Banc One	• Interest Rates
LTCM	• Volatility

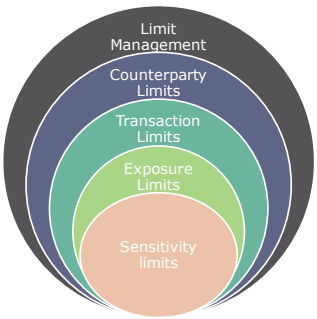
FinanceTrainingCourse.com

Issues



FinanceTrainingCourse.com

Limit Management



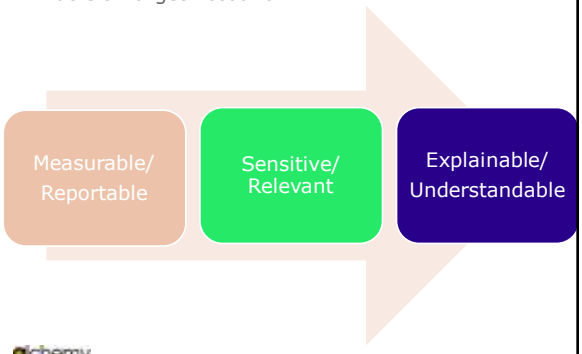
FinanceTrainingCourse.com

Stop Loss Limit Process

Risk appetite	• Loss Capital Amount – depends on Expected and Minimum Rates of Return, Capital Amount
Target Stop loss limit	• applicable for given period
Book Size	• Allocation of book size to individual business/ investment lines
Actual stop loss limits	• individual lines for given period

FinanceTrainingCourse.com

What is a Target Account?



Target Accounts

- Air Canada • P&L Shortfall
- GM • FX Factor Sensitivity
- Banc One • Interest Rate Impact on Earnings
- LTCM • Volatility, Value at Risk

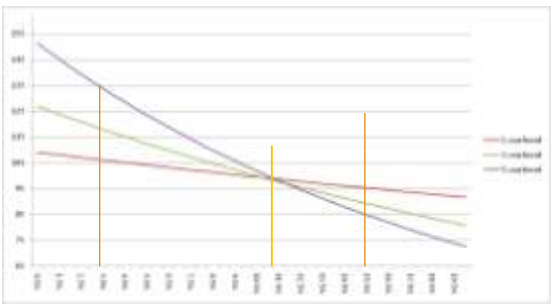
Exposure, Risk, Target Accounts

Exposures
- Gross Numbers
- Book Size
- Driven by Internal choices

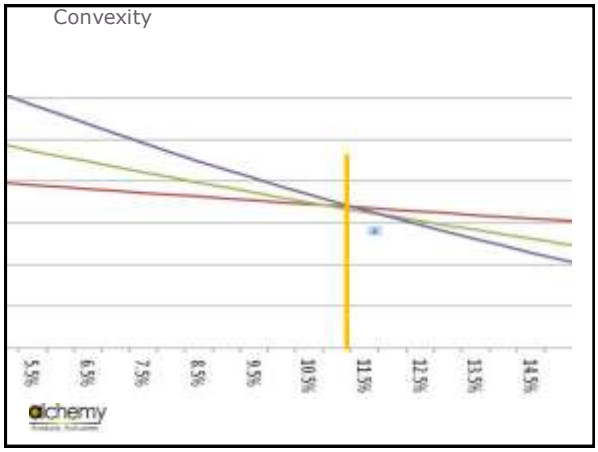
Risk
- Probability that we may lose something
- Driven by external factors

Target Accounts
- Sit somewhere in the middle at the intersection of exposure and risk

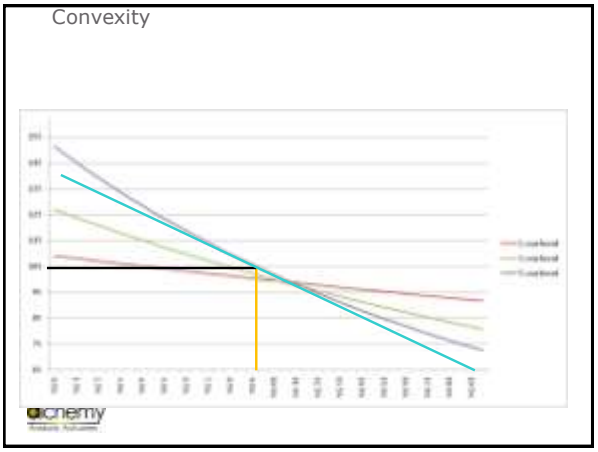
Duration / Convexity



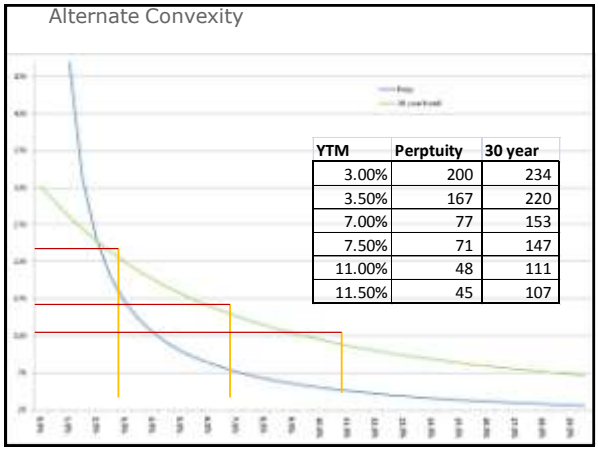
Convexity



Convexity

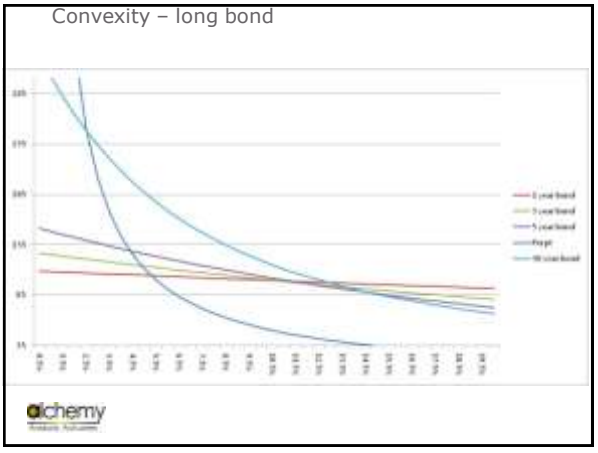


Alternate Convexity



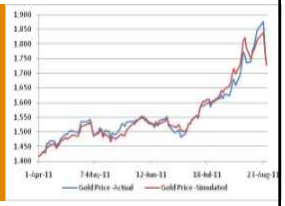
YTM	Perptuity	30 year
3.00%	200	234
3.50%	167	220
7.00%	77	153
7.50%	71	147
11.00%	48	111
11.50%	45	107

Convexity – long bond



Measuring Exposure

Oil Refinery Case Study



Case Study One

Crude Oil Refinery

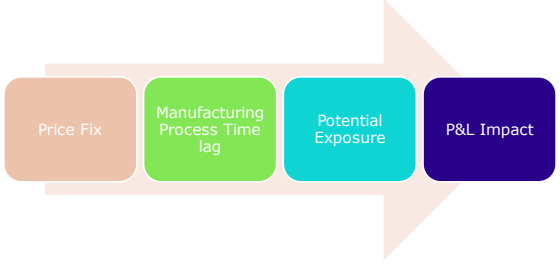
Lag between crude oil purchase and product arrival for distribution

Retail price sensitive to pricing set by market price regulator

Market regulator link pricing to international crude prices

There is a 30 day lag in every price reset

Crude Oil Oil Refiner

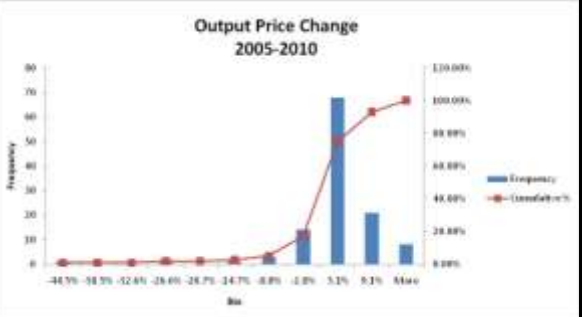


Assumption

HSFO	NAPHTHA	MOGAS	HOBC	KERO	Aviat Fuels	HSD	LDO
6.6	8.22	8.53	8.51	7.73	8.08	7.52	7.24
32.50%	0.00%	19.03%	0.29%	2.67%	10.50%	33.84%	0.39%

Crude Oil - input

Refined products



Margin Impact

Crude Oil Refiner

Exposure Assessment

>Understand Manufacturing Process

>Estimate time lag between input price fix and retail product delivery

>Breakdown between fixed and variable pricing

>Estimate dollar sensitivity to unit change in input price

>Estimate projected impact on P&L

Questions & Answers

Odds	Percentile	Input Price Shock-low	Input Price Shock-high	Margin shortfall Low	Margin shortfall High
	99%	145	364	25%	63.4%
1%	99%	145.0	363.8	25.0%	63.4%
11%	90%	79.9	200.4	13.6%	34.7%
18%	85%	64.6	162.1	11.0%	28.0%
25%	80%	52.5	131.6	8.8%	22.7%
33%	75%	42.0	105.5	7.0%	18.1%
43%	70%	32.7	82.0	5.4%	14.0%
52%	66%	25.7	64.5	4.2%	10.9%
67%	60%	15.8	39.6	2.4%	6.6%
82%	55%	7.8	19.7	1.0%	3.1%
96%	51%	1.6	3.9	-0.1%	0.3%

Questions & Answers

Odds	Percentile	Input Price Shock-low	Input Price Shock-high	Inventory Losses Low	Inventory Losses High
	99%	145	364	12,310,771	30,885,105
1%	99%	145	364	12,310,771	30,885,105
11%	90%	80	200	6,781,826	17,014,160
18%	85%	65	162	5,484,689	13,759,917
25%	80%	52	132	4,453,765	11,173,548
33%	75%	42	105	3,569,324	8,954,674
43%	70%	33	82	2,775,068	6,962,056
52%	66%	26	64	2,182,708	5,475,951
67%	60%	16	40	1,340,684	3,363,492
82%	55%	8	20	664,986	1,668,308
96%	51%	2	4	132,662	332,820

Questions

What is the probability that margins will decrease in any month over the next quarter, the next half year, or the next full year?

What is the range of these projected reductions?

What is the worst case reduction in any month over the next 12 months?

What is the likely reduction in any month over the next 12 months?

More questions?

What is the probability that gross margins will shrink below the minimum profitability threshold?

What is the probability that gross margins will turn negative?

More questions?

What is the likely expected gross margin number at current price volatility levels?

How will this number change if volatility moves by a percentage point?

By how much does a dollar change in crude prices change the expected margin number?

Questions for Air Canada & GM

What is the probability that margins will decrease in any month over the next quarter, the next half year, or the next full year?

What is the range of these projected reductions?

What is the worst case reduction in any month over the next 12 months?

What is the likely reduction in any month over the next 12 months?

As a board member what % of hedging do you recommend and why?

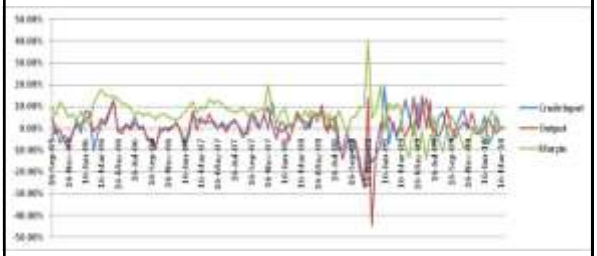
Crude Oil

Price Volatility

alchemy

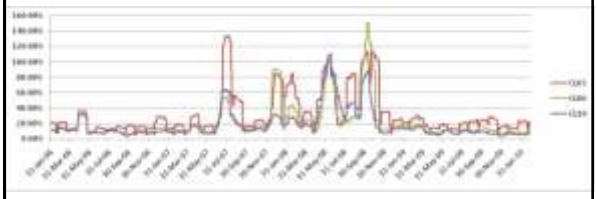
FinanceTrainingCourse.com

Integrated



alchemy

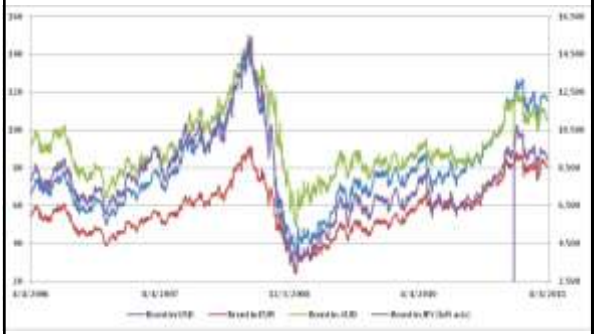
Future spreads



alchemy

FinanceTrainingCourse.com

Brent Relative Price in USD, EUR, AUD, JPY



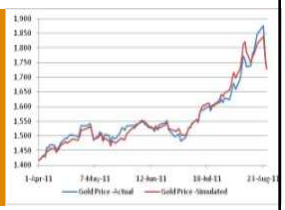
alchemy

Brent, WTI Correlation

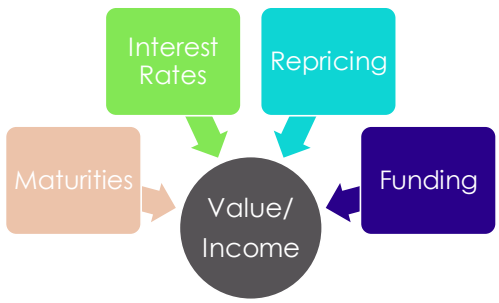
Correlation with EUR-USD

ALM

Banc One Case



ALM at a glance



FinanceTrainingCourse.com

A tale of two banks

Bank A

A → 100 M

L → 90 M

E → 10 M

Bank B

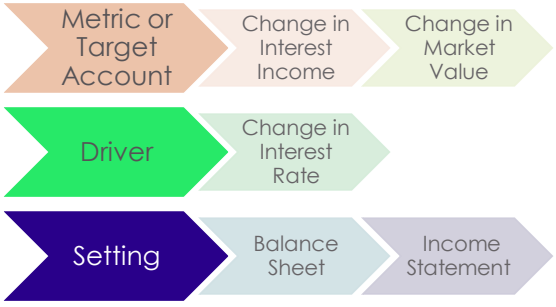
- A → 100 M
- L → 90 M
- E → 10 M

Assets?
Maturity?

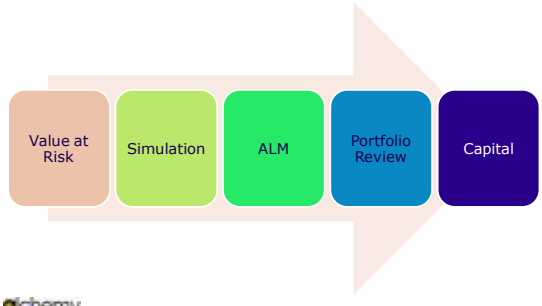
Liquidity?
Funding?

Risk → Return → Sensitivity

Risk - Return



ALM – Framework - II



Concepts

- Sigma
- Duration
- Convexity
- Asset Sensitive
- Liability Sensitive
- Value at Risk
- Hedging Tools

Concepts

Liquidity – Funding

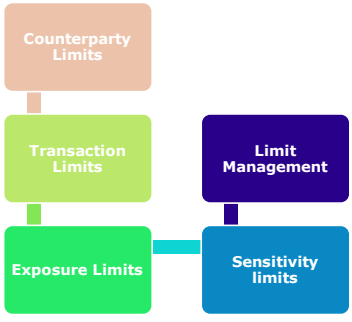
Liquidity – Market (Tbills)

Liquidity – Assumptions

Earnings at Risk

FinanceTrainingCourse.com

Limit Management



FinanceTrainingCourse.com

Banc one Questions?

How does Banc One measure its interest rate exposure? Given Banc One's exposure should they worry about rising rates or declining rates environment?

Can you optimize Earning at risk and NPV at risk at the same time? How would you go about it? Take Banc One's example and show through numbers.

How do derivatives and other non-funded instrument help with capital optimization. Show through numbers.

Review the annexure on pages 26-29. If you look at these numbers as an analyst, what are your conclusions? Your recommendations to Banc One?

FinanceTrainingCourse.com