

Financial Risk Management 25849

Assignment

Spring 2015

- i. Determine the Value-at-Risk (VaR), denominated in Australian dollars, for the portfolios provided below using
 1. Variance/covariance (Delta-Normal/Delta Gamma for non-linear positions)
 2. Historical Simulation
 3. Monte Carlo Simulation

- ii. Determine the Expected Tail Loss (ETL), denominated in Australian dollars, for the portfolios provided below using the results from
 1. Historical Simulation
 2. Monte Carlo Simulation

For each of the methods above, calculate the VaR and ETL (where applicable) for the following parameter sets:

Confidence Level (%)	95	99	95	99
Holding Period (days)	1	1	10	10

Individual Portfolios	Portfolio 1
	Portfolio 2
	Portfolio 3
	Portfolio 4
	Portfolio 5
Combinations (Compute <i>diversified and undiversified</i> VaR for these combinations)	Portfolio 2 and Portfolio 3
	Portfolio 1 and Portfolio 4 (Physical Shares Only)

Assumptions:

Valuation Date: August 07, 2015

Variance/Covariance method: use delta-normal/delta-gamma approximation method for non-linear positions.

Monte Carlo simulation: Geometric Brownian motion acceptable (but you may choose to use another process if you wish). Zero drift may also be assumed. For the option positions, consider only risk due to the change in the value of the underlying asset.

Mark-to-Market of positions: standard valuation methods assumed. All options are assumed to be of European style. All data required for mark-to-market valuation can be found in the data files (Valuation date: 07/08/2015). For the option positions assume that the standard deviations provided are ***constant over the holding period*** for the purpose of VaR.

Outline of Steps:

1. Determine the risk factors affecting each portfolio. (*Note: the set of interest rate data provided consists of many more zero-coupon rates than needed for the portfolios.*)
2. Determine the valuation formulae to be used for the positions. Some positions may need to be decomposed into simpler instruments (e.g bonds can be decomposed into equivalent zero coupon bonds).
3. Determine the ***mark-to-market*** value of the portfolios on the ***valuation date***.
4. Determine a method for estimating the change in the underlying risk factor (e.g. $\log(\text{change})$, discrete change (%))
5. Determine the variance/covariance and correlation matrices for the various portfolios.
6. Proceed with VaR estimation.

See **UTSOnline** for

- Cholesky Factorisation Spreadsheet.
- Notes on VaR for bond portfolios
- Data for assignment

Task 1: Due on October 07, 2015

You are required to submit the results for the following:

1. **Mark-to-market value of the all portfolios.**
2. **Value-at-Risk for the following portfolios:**

Portfolio 1
Portfolio 2
Portfolio 4

Using:

- a. Variance/covariance methodology
- b. Historical simulation.

with the parameter values below:

Confidence Level (%)	95	99	95	99
Holding Period (days)	1	1	10	10

(You will need to submit the actual results and the code for producing the results.)

Task 2: Due on November 10, 2015

Final Submission of Assignment:

The final results of the assignment should be submitted should be in the form of

1. **Written report** consisting of :
 - A brief description of the methods used in calculating VaR.
 - Any additional assumptions made for each VaR method including the method used to measure the changes in risk factors, the technique used to determine the 10-day VaR for each method.
 - Full documentation of the VaR results for **all individual portfolios and the specified combinations** using the various methods as required for the assignment. (See table on page 1 of Assignment)

- A brief analysis and explanation of the **variability in the VaR estimates** determined using the different methods.
- A brief analysis of the **diversified vs. undiversified risk for the combined portfolios.**

2. **Computer programs/spreadsheets** developed and used for the assignment.

References:

Jorion, P., Value-at-Risk, McGraw-Hill, 3rd Edn., 2006

RiskMetrics Technical Document, 4th Edn. (1996)

Smithson, C.W., Managing Financial Risk, 3rd Edn, McGraw-Hill, 1998.

Lecture Notes from Financial Markets Instruments. (May be useful for valuation formulae)

Hull, J., Futures, Options and Other Derivative Securities, 7th Edn., McGraw-Hill, 2009.

Portfolios for Financial Risk Management Assignment

Portfolio 1

Physical Bonds

Issuer	Coupon rate p.a	Maturity	Next Coupon Date	Face Value (Millions)
Com G	4.75%	15-Jun-2016	15-Dec-2015	10
Com G	4.25%	21-Jul-2017	21-Jan-2016	5
Com G	5.50%	21-Jan-2018	21-Jan-2016	8
Com G	5.25%	15-Mar-2019	15-Sep-2015	10
Com G	4.50%	15-Apr-2020	15-Oct-2015	5

Assume: *coupon paid semi-annually.*

Portfolio 2

Spot Foreign Exchange

Currency	Currency Description	AUD Million Equivalents
USD	US \$	-40
EUR	Euro	60
GBP	UK £	55
NZD	New Zealand \$	30
INR	Indian Rupee	-50
JPY	Yen	-30

Negative amount implies short position.

Portfolio 3

Foreign Exchange Options

Expiration Date	Put/Call	Bought/Sold	Underlying Asset	Amount	AUD Amount (Millions)	Strike
09-Oct-2015	Call	Bought	USD	150.00	205.68	0.7293
11-Dec-2015	Put	Bough	USD	210.00	280.15	0.7496
13-Dec-2015	Call	Bought	CHF	100.00	138.12	0.7240
08-Feb-2016	Call	sold	Euro	180.00	265.53	0.6779
05-Apr-2016	Put	Bought	Euro	220.00	337.99	0.6509

Strike rate expressed as 1AUD = xx CCY. Option exercise style is European.

You may use historical data to estimate σ to use in the pricing the options (unless you have access to implied volatilities). Assume that the computed σ is constant over the holding period for the purpose of VaR calculations.

Forward Foreign Exchange Contracts

Expiry	Buy Currency	Buy Amount (Millions)	Sell Currency	Sell Amount (Millions)	Contracted Forward Rate (K)
07-Nov-2015	JPY	1500	AUD	16.38	91.57
08-Dec-2015	USD	50	AUD	66.83	0.7482
15-Jan-2016	EUR	30	AUD	44.67	0.6715

Forward rate expressed as 1AUD = xx CCY.

Portfolio 4
Physical Shares

Issuer	Number of Shares	Bought/Sold
CBA	60,000	Sold
ANZ	80,000	Bought
RIO	100,000	Bought
NCM	200,000	Sold
WPL	150,000	Bought
TLS	250,000	Sold

Share Options (Exchange Traded)

Maturity	Underlying	Put/Call	Bought/Sold	Number of Shares	Strike	σ (% p.a)
09-Oct-2015	BHP	Call	Bought	250,000	\$28.00	29.53%
08-Jan-2016	RIO	Put	Bought	200,000	\$54.00	26.06%
12-Mar-2016	RIO	Call	Bought	200,000	\$53.00	26.48%
04-Mar-2016	NCM	Put	Sold	200,000	\$12.00	44.18%
07-Apr-2016	NCM	Call	Sold	250,000	\$10.00	44.00%
09-Jun-2016	WPL	Put	Bought	200,000	\$33.00	25.22%

Assume: Options are European style

Portfolio 5

Interest Rate Swaps

Maturity	Notional Amount (AUD Million)	Payer/Receiver	Swap Rate (p.a.)	Settlement
07-Nov-2015	\$20	Receiver	2.20%	Quarterly
07-Aug-2016	\$80	Payer	2.30%	Semi-annual
06-Nov-2016	\$70	Receiver	2.45%	Quarterly

Payer = fixed rate payer, floating rate receiver

Reference Rate = BBSW