END OF CHAPTER EXERCISES

Chapter 23 : VaR : Mapping Cash Flows

Financial Engineering : Derivatives And Risk Management

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1. What is "mapping" and why is it useful in calculating VaR?

2. Briefly list 6 key potential problem areas when applying the VaR approach to market risk

3. Robert Citron the Treasurer of Orange County lost about $7bn in 1994. In no more than ½ page explain how this happened. (Use *The Economist* or other sources from the financial press)

You can easily set up most of the answers to the questions below in the form $(ZCZ')^{1/2}$ using Excel (or many other software packages (e.g. Gauss, RATS, Mathematica etc.)

4. A financial asset (e.g. Bond) has the following payments profile

Year	1	2	3
Payment (£)	400	450	500
Spot rate (%p.a.)	7.84	7.96	7.98
S.D. of bond returns (=**price changes**) % per day	0.23	0.20	0.25

(a.) Calculate the market value of each cash flow
(b.) Calculate the (one day) VaR for each cash flow at t = 1, 2 and 3 years
(c.) If $\rho_{12} = 0.8$, $\rho_{13} = 0.7$ and $\rho_{23} = 0.6$ calculate the VaR of all 3 cash flows.

5. You have a portfolio consisting of 3 UK industry-based equity portfolios : consumer goods, capital goods and financial services. The local market index is the FT All-Share Index. The market values of your portfolio and the portfolio betas are as follows

	Market Value (£)	$\beta_{i, FTA}$
Consumer Goods	1,000,000	1.0789
Capital Goods	900,000	0.9937
Financial Services	450,000	1.0382

The return on the FT All-Share index has a standard deviation of 1.896%p.d.

Assuming that these three asset returns are generated by a single index model and that these 3-assets constitute a well diversified portfolio, calculate the VaR for this portfolio.

6. It is currently March 1st 1996. You are holding a portfolio of bonds that will pay £5,000 on June 1st each year (i.e. in 0.25 years, 1.25 years, 2.25 years etc.). However, you only have information on yields and price volatilities for the standard maturities. Using the RiskMetrics methodology and the information in the table below, answer the following questions, for a payment due on June 1st 2002 (i.e. in 6 years 3 months' time).

Maturity (Years)	**Yield (%p.a.)**	**Price Vol. σ(dP/P) (%p.d.)**
5	6.93	1.261
7	7.01	1.109

(a.) What is the market value of cash payment at t = 6.25 years (using $y_{6.25}$)
(b.) What is the standard deviation of price volatility at t = 6.25 years (using $\sigma_{6.25}$)
(c.) Assume RM has calculated the optimal proportions of the £5,000 cash flow at t = 6.25, to allocate to the standard vertices with weights $\gamma_5 = 0.40$, $\gamma_7 = 0.60$. What is the VaR of these two cash flows if the correlation between bond returns at t = 5 and t = 7 is $\rho = 0.8$.

7. You sell a 6x12m FRA with principal of $100,000. (Assume 180 days = 6 months and 1-year = 360 days).
(a.) If $y_6 = 6.5\%$ and $y_{12} = 7.0\%$ (simple interest), what is the forward rate (between t = 6 and t = 12 months)?
(b.) Show that the FRA gives cash flows that are equivalent to borrowing for 6 months (at t = 0) and using these borrowed funds to invest (lend) for 12 months.
(c.) If the *daily* price volatilities at 6 and 12 months are $\sigma_6 = 1\%$ and $\sigma_{12} = 0.5\%$ with correlation coefficient $\rho = 0.7$ then what is the "worse case" VaR and the actual VaR ? (use a 5% lower tail).