Actuarial Society of India

EXAMINATIONS

22nd May 2006

Subject CT8 – Financial Economics

Time allowed: Three Hours (02.30 – 05.30 pm)

Total Marks : 100

INSTRUCTIONS TO THE CANDIDATES

1) ***Do not write your name anywhere on the answer scripts. You have only to write your Candidate's Number on each answer script.***

2) ***Mark allocations are shown in brackets.***

3) ***Attempt all questions, beginning your answer to each question on a separate sheet. However, answers to objective type questions could be written on the same sheet.***

4) ***Fasten your answer sheets together in numerical order of questions. This, you may complete immediately after expiry of the examination time.***

5) ***In addition to this paper you should have available graph paper, Actuarial Tables and an electronic calculator.***

Professional Conduct:

"It is brought to your notice that in accordance with provisions contained in the Professional Conduct Standards, If any candidate is found copying or involved in any other form of malpractice, during or in connection with the examination, Disciplinary action will be taken against the candidate which may include expulsion or suspension from the membership of ASI."

Candidates are advised that a reasonable standard of handwriting legibility is expected by the examiners and that candidates may be penalized if undue effort is required by the examiners to interpret scripts.

AT THE END OF THE EXAMINATION

Hand in both your answer scripts and this question paper to the supervisor.

Q1)

(i) Explain what is meant by:

a) risk-neutral models (4)

b) equilibrium models (4)

(ii) Outline the advantages and disadvantages of the two different approaches for modelling asset prices and returns. (4)

[12]

Q2) The price $_tS$ of a particular share follows a geometric random walk:

$$S_t = S_{t-1}Z_t$$

where $\{Z_t\}$ is a sequence of independent, identically distributed random variables with value :

1.1 with probability 0.6
0.95 with probability 0.4
and *t* denotes the time in months.

A 1-month European call option is available on the share with a strike price of Rs 10.50.
The current market price of the share is Rs 10. No dividends are to be paid over the next 6 months. An annualised risk-free force of interest of 4% is available.

(i) Find the expected payoff of the call option. (2)

(ii) Construct a replicating portfolio for the derivative out of shares and cash, and hence find the fair price of the derivative. (4)

(iii) Hence state how many options need to be bought (or sold) per share, in order to construct a risk-free portfolio out of shares and these options. (2)

(iv) Describe quantitatively the arbitrage opportunity that would arise if the price of the option in the market was equal to the discounted value of the expected payoff. (5)

(v) Another derivative is available on this share. It gives the purchaser the right (but not the obligation) to buy two shares at a price of Rs 12.00 each, or sell one share at a price of Rs 9.00, both in 4 months' time. Determine the possible payoffs for this derivative, and hence find the fair price of this derivative using risk-neutral valuation. (5)

[18]

Q3) Describe in detail the following for the term structure of interest rates:

(a) Single Factor Vasicek, (4)

(b) Cox-Ingersoll-Ross (4)

(c) Hull & White (2)

(d) Explain the key differences and similarities in these models (6)

[16]

Q4) An investor is using the Wilkie stochastic investment model to analyze inflation. The updating equation for the force of inflation is:

$$I(t) = QMU + QA\left[I(t-1) - QMU\right] + QSD.QZ(t)$$

where $QZ(t) \sim N(0,1)$

Based on observations of the economy over the previous twenty years, the investor decides on the following parameter values:

$QMU = 0.035$
$QA = 0.7$
$QSD = 0.02$

(i) Given that the current force of inflation is 2% *pa*, calculate the 95% confidence interval for the force of inflation in one year's time. (4)

(ii) Comment on the result in (i). (3)

[7]

Q5) Discuss the three forms of the Efficient Markets Hypothesis and their consequences for investment management. **[10]**

Q6) Discuss the assumptions underlying the Black-Scholes model and their validity in real world. **[12]**

Q7) The table below shows the monthly returns yielded by Securities W and Z during 2005,
together with those for the market as a whole.

Security returns (%)

Month	*W*	*Z*	*Market*
January	3	6	5
February	5	3	9
March	3	5	2
April	-12	-10	-12
May	4	-5	0
June	0	8	11
July	-5	0	–8
August	5	–4	3
September	0	–7	2
October	3	0	–5
November	–1	12	2
December	0	7	1

Assume that in this particular investment market security returns can be modelled by a single-index model based upon the market return. On this basis:

(i) Calculate variance and covariance of returns the two securities (7)

(ii) Calculate the mean and variance of a portfolio equally weighted between the two Securities and compare these values with those based purely upon historical data. (6)

[13]

Q8)

(a) Discuss the salient features of the Wilkie Model (6)

(b) Discuss how the Wilkie Model differs from the continuous-time log normal model of security prices. (6)

[12]

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