INSURANCE AND RISK MANAGEMENT EXAM
SUGGESTED ANSWERS – NOV 2004
PAPER 3 – RISK MANAGEMENT AND REINSRUANCE

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1) Explain the concept of market power. Discuss the ways in which market power arises in an insurance market.

Ans: In a purely competitive market both sellers and buyers are price-takers. If a few sellers or buyers are able to influence the price of a product or service, we call it market power. The resource allocation in such a market is sub-optimal. In insurance market, market power exists almost exclusively on sellers side.

There are four ways in which market power arises:

(i) Barrier to entry or exit: Insurance industry characterized by barriers to entry / exit. Regulator (IRDA) prescribes norms for entry of new insurance firms. Existing firms enjoy market power. Collusion among existing firms can create market power.

Liberalization reduces market power.

(ii) Product differentiation: Products of a firm, say insurance company, differentiated from products of other firms. Product differentiation may be real or imaginary. Differentiation exists if the buyer in his mind believes that there is differentiation in the products. Regulators attempt to prevent misleading the public by insurance firms of spurious differentiation.

(iii)**Price discrimination: Charging different prices to different groups of customers for the same or identical product. Firms try to increase market share through price discrimination. Market segmentation helps price discrimination. Regulator's task is to prevent price discrimination practices**.

(iv)Economies of Scale : The larger the firm, the lower the average unit cost of production because of scale economies. . Economies of Scope – a single

insurer can produce a number of products. Economies of scope exist for joint production of some insurance lines. Economies of joint marketing. Market power not assessed by the absolute size of the insurer but by the insurer's size relative to the insurance market

(b) In Risk Management process, briefly explain the differences between Risk control and Risk financing.

Ans: Risk Control :

Risk control refers to the techniques that reduce the frequency of losses or reduce the severity of loss when it occurs. Avoidance of loss and control of loss are the two major techniques of risk control. Avoidance consists of not entering into an activity which has a potential for loss exposure or giving up or discontinuing an activity where loss exposure is present

Risk Financing:

This relates to employment of techniques providing for the funding of losses subsequent to their occurrence. There are three prime risk financing techniques, viz., retention, non-insurance transfers and insurance.

While retention refers to financing of loss internally, non-insurance transfers are techniques by which a risk exposure and its potential financial loss are transferred to another party. Insurance is a technique of transferring risk from one party to another

2. (a) Describe the process by which decisions are made using expected value rule. To what extent this strategy is useful for risk management decisions.

Ans:

(a) Expected value of a decision alternative is the sum of the weighted payoffs for the alternative. The weight for each payoff is the probability that the payoff occurs multiplied by the value

$EV_j = \Sigma\, p_i\, x_i$

Where EV_j = Expected Value of Prospect j

p_i : Probability of outcome x_i

x_i : Outcome i in money value

The option with highest expected value is chosen.

The EV rule ignores risk. People are averse to risk or hate to lose. This has to be included in the decision-making rule. e.g. Expected Utility Rule.

The computation of expected value requires dependable information which is not always available.

(b) Briefly explain "Bernoulli principle"

Ans: A rational risk-averse individual will choose to insure if the premium is equal to the expected value of loss or insurance is offered at an actuarially fair premium. This is known as "Bernoulli Principle".

(c) Explain the term "Risk transfer". Outline various forms of risk transfer.

Ans: In risk transfer, financial impact is shifted to another party. This process involves a payment by the transferor to the risk bearer. (1)

There are five forms of risk transfer.

- **Hold harmless agreements**
- **Incorporation**
- **Diversification**
- **Hedging**
- **Insurance.**

A brief explanation of each of the above risk transfer techniques is to be given.

3. (a) Briefly explain three probability distributions which are widely used in risk management.

Ans:

3. (a) Three distributions which are widely used are (i) Binomial, (ii) Poisson, and (iii) Normal distribution.

<u>Binomial Distribution</u>

This is a discrete distribution.

Let p be the probability for an event to occur and 1-p or q is the probability that this will not occur. Let the number of trials be n. Then, the probability of x successes in n trials is given by.

$$\frac{\lfloor n}{\lfloor x \; \lfloor n-x} \; p^x \; q^{n-x}$$

Poisson Distribution:

This is also a discrete distribution.

n is the number of events for which probability estimate is required.

m is the mean or expected loss

e is the base for natural logarithms.

$$p = \frac{e^{-m} \; m^n}{\lfloor n}$$

Normal distribution:

- **This is a continuous distribution.**
- **This distribution is completely defined by mean and standard deviation.**
- **This distribution is symmetric.**
- **More values are located near the mean**
- **As we move away from mean, there are fewer and fewer values.**

(b) "Damayanti Life Insurance Company Ltd., had experienced in 2003-04 losses of Rs. 500 with a mean value of Rs. 500 and a standard deviation of Rs. 150." Comment on this statement.

Ans: Then the insurer can assume that 2/3 or 68% of all losses will be within one standard deviation of the mean. 95% of all losses will lie within two standard deviations of the mean. Furthermore, about 99% of all observation of losses should be within 3 standard deviations of the mean.

This relationship will enable the risk manager to predict the probability of losses being within a central range of the mean

4 (a) Distinguish between the following, giving an example of each:

(i) Subjective and Objective risk
(ii) Moral hazard and Morale hazard
(iii) Fundamental and Particular risk.

Ans: (i) Subjective Risk: an individual's perception of risk – uncertainty. It affects the decisions people make. Better information improves subjective risk estimates.

Objective Risk : Actual Risk.

Ideally, individuals should make decisions based on objective risk.

(ii) Moral Hazard: Increase in probability of loss, which results from evil tendencies in the character of the insured. An insured's dishonest tendencies inducing him to defraud the insurer.

Morale Hazard: Results from insured's careless attitude towards the Occurrence of losses as he purchased insurance.

(iii) Fundamental and Particular Risks – based on the difference in consequences of losses.

Fundamental Risks – involve losses that are impersonal in origin and consequence.

They are group risks, caused mostly by economic, social and political phenomena.

Particular risks : involve losses that arise out of individual events and are felt by individuals.
Each of these may be static or dynamic.

Examples of Fundamental Risks: Earthquakes, Floods, Inflation, War, Unemployment.

Examples of Particular Risks: Burning of A's House, Robbery of Bank B

(b) Abhishek is asked to choose between the following two options:

Option A: 80% chance of winning Rs. 4,000 and 20% chance of winning nothing
Option B: 100% chance of receiving Rs. 3,000
Which of the two options Abhishek would you advice to choose? Justify your advice.

Ans: **If Abhishek is risk averse, he would accept Option B (100% chance of receiving Rs. 3,000) even though the risky Option A has a higher mathematical expectation of Rs. 3,200. If he were a risk seeker he would go in for Option A.**

5. (a) Suppose that property losses of ABC Company have the following distribution.
   Rs. 30 lakhs with probability 0.005
   Rs. 15 lakhs with probability 0.010
   Rs. 8 lakhs with probability 0.025
   Rs. 0 with probability 0.96
   What is the expected property loss?

   Ans:
   0.005 (Rs. 30 lakhs) + 0.010 (Rs. 15 lakhs) + 0.025 (Rs. 8 lakhs) + 0.960 (Rs. 0)

   = Rs. 15,000 + Rs. 15,000 + Rs. 20,000 + Rs. 0 = Rs. 50,000

   Expected Property Loss : Rs. 50,000

   (b) Explain how knowing the frequency and severity of loss for a given exposure to loss is helpful in determining what should be done about the exposure

   Ans: One should categorize risks into four classes using high frequency and low frequency and High and Low severity. The appropriate and low cost risk management techniques:

   High Severity, High Frequency – Risk Avoidance
   High Severity, Low Frequency – Commercial Insurance
   Low Severity, High Frequency – Loss control and Retention
   Low Severity, Low Frequency – Retention

   A brief explanation of the terms such as risk avoidance has to be given.

6. Identify whether the following risks are covered by Enterprise Risk Management. Justify your answer.

   (a) Development of new technology that adversely affects the strategic goals of the firm

Ans: Yes.

(b) Lapses in due diligence relating to Mergers and Acquisitions
Ans: Yes

(c) Favourable changes in the price of Wheat used by the firm as input in its production operations

Ans: No

(d) Political upheaval in the country that disrupts the firm's production activities

Ans: Yes

(e) Changes in regulatory regime that do not affect the business environment

Ans: No

Justification for each of the answers has to be provided.

7. (a) In an effort to reduce insurance costs, the risk manager of a medium-sized manufacturing firm cancelled the property insurance on the firm's Rs. 8.5 crore plant and equipment, for which the annual premium was about Rs. 2.65 lakhs. Two years later, when the action was discovered the risk manager was asked to explain his action by the horrified Vice-President of Finance. His explanation: "we did not have a loss. The fact that I saved the firm over Rs. 5 lakhs in the past two years is proof that the decision was the right one". If you agree with the risk manager, help him convince the Vice-President that he is right. If you disagree, help the Vice-President convince the risk manager that he is wrong.

Ans: The choice is between insurance and non-insurance.
The question is whether the company can afford to be without insurance.
As future is uncertain one must assess the consequences of each of the two choices. Past loss record may not be a good basis for prediction of future losses.

With plant and equipment damaged, with no insurance, the firm may become bankrupt. Firm must protect against losses that may lead to bankruptcy. The risk manager's argument is post facto. The decision has to be ex ante, justification is ex post.

(b) For an airline, describe the most important components of the cost of risk that arise from the risk of plane crashes. How might the risk of crashes be eliminated by the airline?

Ans:

The most important components of the cost of risk for an airline:

I. Direct Losses

- **(i) Expected cost of damage to Aircraft**
- **(ii) Liability claims of injured people**
- **(iii) Defence costs**

II. Expected cost of indirect losses

- **(i) Reduction in profits**
- **(ii) Continuing expenses**
- **(iii) Extra expenses, if a major crash harms the airline's reputation**

III. Costs of retention and of premium loadings for aircraft property

It might not be possible to entirely eliminate the risk of crashes.

8. Explain the following clauses with reference to reinsurance treaties:

(a) Attachment of cessions
(b) Exclusions
(c) Accounting
(d) Commissions and Profit commissions
(e) Reserves

Ans: (a) "Attachment of Cessions" Clause:

The liability of the Reinsurer in respect of reinsurance allotted hereunder shall commence simultaneously with that of the Company as soon as the retention of the Company on any one risk as defined by its limits, records, practice or instructions is exceeded.

(b) Exclusions clause:

In no event shall this Agreement protect the Company in respect of War and Civil War. Obligatory Reinsurance.

Any loss or liability accruing to the company, directly or indirectly and whether as insurer or Reinsurer, from any pool of insurers or Reinsures formed for the purpose of covering Atomic or Nuclear Energy risks."

(c) Accounting Clause:

Accounts embodying all transactions under this Agreement shall be rendered quarterly by the Company to the Reinsurer as soon as possible after the close of each quarter which shall be deemed to close on the 31st March, 30th June, 30th September and 31st December respectively.

The insurer shall confirm the accounts within fifteen days of receipt and the balances on either side shall be paid within fifteen days after receipt of such confirmation.

(d) Commission and Profit Commission:

The Reinsurer shall pay to the Company a commission as specified in the schedule upon the net premiums (gross premiums less return and cancellations) together with an additional commission, as specified in the schedule, on the profits derived from this agreement and computed at the 31st December in each year as follows:

Income

1. **Premium reserve for previous year**
2. **Losses outstanding for previous year**
3. **Net premiums for the current year.**

Outgo

Premium reserve of 40% of the net premium for the current year Commission, taxes,f ire brigade charges etc.

Losses paid during the year
Reinsurer's expenses beign 5% of item 3 of "Income"
Losses outstanding at the end of the current year
Deficit, if any, from the previous year's profit commission statement.

The excess, if any, of income over outgo shall be deemed the net profit of the Reinsurer and profit commission shall be calculated thereon.

In the event of termination, profit commission on the net profit in respect of the year in which such termination takes place shall be calculated in like manner. Thereafter, when the whole of the liabilities hereunder have been liquidated, a final profit commission statement shall be rendered to include all transactions

subsequent to the date of termination and the profit commission share on the preceding account shall be adjusted accordingly.

(e) Reserve Clause:

The company shall be entitled to retain Premium Reserve at the percentages specified in the schedule as security for the due performance of the obligations of the Reinsurer under this Agreement. The Premium Reserve shall be retained at the percentage specified in the Schedule in each quarterly account and shall be based upon the net premiums of the relative quarter of the previous three preceding quarters after deduction of the reserve of the corresponding quarter of the previous year.

The company shall pay to the Reinsurer interest on premium reserve at the rate specified in the Schedule less tax, such interest to accrue from the date on which the respective amounts are credited to the premium reserve.

9. (a) You are the financial adviser to "Nalanda Life Insurance Company Ltd.,". The Board has asked you to recommend suitable limits for reinsurance. Explain briefly in a note setting out the factors you would consider.

Ans: (a) Setting Reinsurance Limits:

There should be fairly high limits to cover a good majority of the loss exposures and the limits must be considered along with the retention. Large limits are sought especially in pro-rata and per risk or per policy excess treaties. Setting the reinsurance limits depends on the cost considerations since reinsurance costs increase in direct proportion to reinsurance limits, keeping the retention constant.

However, the treaty reinsurance costs must be weighed against other recurring costs in facultative placements such as the premium, administrative expense and inconvenience and uncertainty associated with facultative reinsurance. However, while setting the reinsurance limits only the volume of the premium is considered and not the premium loading.

Limit Setting for a Catastrophe treaty is even more difficult in practice since one cannot predict a large loss merely based on historical records. Therefore, in reinsuring catastrophes, concentration of loss exposures must be carefully analyzed.

In the case of aggregate excess treaty, the reinsurance limit must be set at an amount adequate to cover the higher loss ratio that the primary insurer may expect to sustain, but the reinsurance premium for such a limit must be acceptable.

To estimate a large loss in future is not easy. However, there will be greater variation in loss ratios for a property insurer than for a liability insurer and it is

clear that the variance in the loss ratios is in part a function of the lines of insurance written.

It is also understood that there will be greater variation in loss ratios for a similar insurance with a lower premium volume. Similarly, a primary insurer who is having a business in major parts of the country will be less vulnerable to loss ratio fluctuation than a regional insurer.

In the exercise of setting the reinsurance limit, the terms of the several treaties must be compared and the limits can be kept flexible. For example, the limit for an aggregate excess treaty can be lowered if adequate catastrophe reinsurance is carried.

Again the limit of a catastrophe can be lower if it applies only to the retention of the primary insurer after recoveries from pro-rata reinsurance, rather than to the direct losses.

(b) Explain the factors to be considered by the primary insurer while taking decision regarding whether to continue or not the existing reinsurer.

Ans: The Primary Insurer should consider the following while reviewing its reinsurance business.

1. **When to change a reinsurer**
2. **Changes in underwriting the policy and its business.**

Whether or not to continue with the existing reinsurer, the following should be given utmost importance:

Technical competence.
Reputation.
Financial strength.

Long-term relationship with the company can be obtained by continuing with one reinsurer.

Adequate reinsurance protection must be given by the company.

10. Briefly explain the following features, which exemplify the reinsurance market

a) Stability factor
b) Availability of knowledge capital
c) The location advantage
d) The Arbitration factor
e) Matured financial markets

Ans:

(a) Stability factor:

Reinsurers have an impact on their performance due to economic stability, social and political factors. If the economy is inconsistent, then there will be an adverse affect on the performance of reinsurance companies. There should also be consistency not only in regulatory environment but also in legal environment so that it would be helpful for the augmentation of the reinsurance market.

As reinsurance is not a daily business, both the parties should be sure that the market remains stable and they are not affected by the changes in the market.

(b) Availability of Knowledge Capital:

For the reinsurance market to be thriving, there should be personnel with widespread knowledge about the industry. Tasks like underwriting which the reinsurer has to perform on depends upon the proficient knowledge the staff possesses.

(c) The Location Advantage:

Location advantage plays a very important role in case of reinsurance business. If the country has well-developed reinsurance market, then reinsurance business can be expanded to the countries that are less developed.

(d) The Arbitration Factor:

In reinsurance, if any dispute arises, it is referred to arbitration. As such if the market provides good arbitration with appropriate legal framework then the disputes between the parties can be settled quickly and easily. So arbitration plays very significant role in the development of the reinsurance industry.

(e) Matured Financial Markets:

The scope for the reinsurers to raise the resources depends upon the maturity of the country's financial markets. If the financial markets are more mature, then the reinsurance market will greatly benefit. The reinsurers can easily access the market and can maintain their business.

11. (a) Discuss the factors which are considered by individuals before making risk financing decisions.

Ans: The following factors are considered by individuals before making risk-financing decisions.

- **Expected cost.**
- **Financial position.**
- **Degree of risk aversion**
- **External constraints.**

Each of these factors has to be discussed briefly.

The expected value and the variability of cost of various risk-financing options are prime considerations.

(b) Discuss the ways in which risk is shared under reinsruacne agreements in the field of property and liability insurance.

Ans: There are essentially two ways in which risk is shared. Reinsurance agreement may provide

(i) Sharing in every loss that occurs to a reinsured risk – proportional reinsurance and includes quota share and surplus line reinsurance.

(ii) For reinsurer to pay only after a loss reaches a certain size – excess loss reinsurance.

Each of these arrangements can be illustrated with an example.

12. (a) The XYZ Insurance Company is having net assets of Rs. 500 crores in the year 2003 – 04. It writes a gross premium income of Rs. 2,500 crores
    (i) Calculate the solvency ratio of the Company
    (ii) XYZ Company cedes the gross premium of Rs. 750 crores. What is its solvency ratio?
    (iii) If the Company considers the solvency ratio is not adequate, what steps are open to it to improve the ratio?

    (b) How does the problem of non-existent information arise in insurance business? Justify.

12. (a) (i) $\frac{\text{Rs. 500 crore}}{\text{Rs. 2,500 crore}}$ **= 20 per cent**

(ii) $\frac{\text{Rs. 500 crore}}{\text{Rs. 750 crore}}$ **= Over 66.67 per cent**

(iii) The solvency ratio can be improved by opting for reinsurance and raising additional capital.

Brief explanation of each of the options to be discussed.

(b) Contracts of insurance involve

i. future delivery

ii. determination of price (premium) before the production costs are fully known

Both insured and insurer face uncertainty, as the future is not known.

Brief explanation is to be given.