Actuarial Society of India

Examinations

November 2005

ST1 – Health Insurance

Indicative Solutions

Q.1)

RDR

It is the interest rate used to discount cashflows to calculate their present value
Its level is a function of the risk free rate ……
…… plus a margin to reflect the uncertainty in the future cashflows
A fundamental parameter for profit testing and EV work

[2]

Different RDR for health business

To reflect differences in the risk characteristics of health business cf. life
Likely to use a higher RDR for health
Greater pricing uncertainty and volatility in claims costs
Future lapses and (claim management) expenses may be quite uncertain (esp. if relatively new lines of business)
May just use higher RDR for particular cashflows (e.g. claims costs)
Alternative is to use a higher profit criterion (e.g. PV profit as % of PV premiums

[2]

Q.2)

i) Deferred period

Period of incapacity (according to injsurance definition) before income benefit commences
Typically, ranges from 4 – 104 weeks.

ii) Linked claims

Two claims for the same cause of disability, the second occurring within a prescribed period after termination of the first
No deferred period on second claim if within the link period

iii) Net replacement ratio

Ratio of post-disability income to pre-disability income, after tax, social security deductions

Important that < 1 to maintain incentive to return to work

iv) Proportionate benefit

Reduced IP benefit payable if claimant takes up alternative paid work …
… while remaining disabled from original occupation

v) ADWs

Alternative to occupational incapacity definition, ……
…… requiring functional assessment of ability to perform particular tasks relevant to the workplace

[5]

Q.3)

Approach

Identify factors likely to have a bearing on lapse experience ……

…… e.g. policy duration, calendar year, age, policy size, premium mode, distribution channel, gender

Allocate exposure and withdrawals into the risk cells defined by the factors chosen

Calculate withdrawal rates for each cell

Consider the analysis be policies and amounts

Limitations

LTCI is relatively new product line => may have little prior experience of lapses on this product

Unlikely to have experience of lapses at long policy durations

Difficult to assess the extent to which withdrawals are selective with regard to propensity to claim ……

Particularly at older ages when a claim becomes more likely in those who already have disabling disease

[5]

Q.4)

LTC triggers	Activities of daily living (ADL) Typically, failure of 3 or 4 of 6 ADL May additionally require to be in formal care Benchmark ADL are Washing; Dressing; Feeding; Toileting; Mobility; Transferring Additional claim trigger of cognitive impairment is usual The latter usually overrides ADL failure to qualify for benefits Assessment of ADL failure generally involves determination of (i) persistent failure of the ADL; …… …… (ii) inability for perform the ADL without the assistance of another person Testing for cognitive failure involves standardised tests of mental functions Claims triggers are designed to assess the ability of the insured to function independently …… …… with regard for personal safety and that of others
Different triggers for IP	The degree of incapacity at which LTC is required is much more severe than that at which it is not possible to perform physical the tasks necessary to hold down regular employment …… …… so LTC claim triggers are too tough for IP Many genuinely disabled IP claimants would not qualify for benefits using ADL triggers Most IP contracts employ an occupational definition (inability to perform the main tasks of usual occupation etc) ….. …… so a claimant may be unable to work but still able to function independently at home

[4]

IP claim triggers may be ADWs ……
…… ADWs are similar to ADL but are geared to physical functions necessary for an individual to manage in the workplace

[5]

Q.5)

Why reinsure

Desire to limit exposure to insurance risks ……
…… likely small in-force portfolio ……
…… and possibly limited capital to withstand volatility in claims
To smooth the underwriting results
Pricing uncertainty
Limit exposure to peak risks
And risk concentrations
To assist with financing of new business strain
To increase the insurer's capacity to accept risks (e.g. by reduction in solvency margin reqt.)
To gain access to reinsurer's expertise and knowledge of the market ……
…… advice on premium rates to cha rge ……
…… and benefit definitions and other product design features ……
…… and specialised risk management expertise for healthcare products (e.g. facultative underwriting and claims management serives) ……
Reinsurer's terms and conditions may be attractive

[5]

Appropriate types of reinsurance

IP

Proportional reinsurance: quota share or surplus basis ……
…… both can be effective at reducing exposure to insurance risk ……
…… but surplus is better to limit max. loss on any one claim
Reciprocal QS could be used to build a more diversified portfolio / reduce claim volatility
Risk premium or original terms ……
…… OT is generally more effective to relieve NB strain
Non-proportional: Aggregate XoL can be used to protect against excess claims across the portfolio from e.g. a single peril or major claim event (catastrophe cover)

CI

Usually individual surplus or QS arrangement ……
…… because benefit amount is a fixed sum
Typically risk premium reinsurance (CI is often a rider benefit)

PMI

Individual QS could be sought, particularly by a company without its own experience ……

…… e.g. to reduce exposure to mispricing risk

Risk Excess of Loss is effective to contain the insurers claim outgo in relation to single large claims

Portfolio stop loss reinsurance limits the insurer's losses across the whole portfolio……

…… whis is effective at reducing the risk of insolvency ……

…… but may be difficult to obtain from the reinsurer because interests maybe poorly aligned between the parties.

[6]

Q.6)

Rationale for State scheme

Main motivation is clearly to contain costs of the scheme

Deductible limits exposure of the scheme to small claims ……

…… which are typically frequent and relatively costly to administer ……

…… and affordable for the individual

Co-pay maintains an alignment of financial interests ….

… intended to reduce non-essential use of health services

Cap on room rates will influence pricing behaviour of providers if they wish to receive admissions under the scheme ……

…… and means that resources are directed to essential elements of care rather than luxurious accommodation etc

Similar limits may well apply to professional fees and other elements of treatment costs

Exclusions ensure that the scheme covers essential care only

Restricting the scheme to those in formal employment and their families may well make the scheme easier to manage ……

…… e.g. the employer may participate in aspects of administration for the scheme ……

…… employers +/- 'ees may be required to make contributions to fund the scheme

[4]

Types of PMI

Private insurers could offer products to fill the gaps in the State scheme – i.e. costs not reimbursed by the scheme

e.g. to insure a proportion of the deductible and copay under the state scheme

Costs that exceed the limits under the State scheme can be insured in various ways

Daily hospital cash cover provides a fixed cash amount for each day hospitalised ……

…… which would enable a claimant to upgrade the quality of hospital room while an inpatient

Major medical cover, with benefits set at an appropriate level, could be offered to meet the costs of expensive procedures that exceed the limits of the State scheme

Supplementary reimbursement cover could be offered to provide higher effective limits for some or all elements of the costs of care ……
….. including cover for certain procedures excluded under the State scheme ……
…… or paramedical services (e.g.optical, dental, physio., nursing care)

[4]

Impact on State scheme costs

Insuring part of the copay and deductible would have the effect of reducing the effectiveness of the risk control mechanisms of the State scheme ……
….. with the result that claims costs may increase
If privately insured benefits exceed the personal out-of-pocket costs under the State scheme, individuals may incentivised to utilise the health services to a greater extent
The existence of PMI cover in the market may tend to drive up the charges made by providers
Availability of top-up private cover may divert patients from approved facilities to private hospitals ……
… … which could reduce costs for the State scheme

[3]

Q.7)

Differences

Accelerated CI (ACI) is a pre-payment of the death benefit. The benefit is paid on the first to occur of death or CI
Stand alone CI (SACI) provides no benefit on death
If SACI is provided as rider to a life contract, the policy and death benefit remain in force following a SACI claim
SACI cover needs to feature a minimum survival period to allow time to determine whether death followed a CI event or not (difficult to assess in sudden death)
Factors include: Purpose of cover (e.g. ACI more suited for loan repayment) ……
…… target market (e.g. if selling to policyholders with existing life cover, SACI may be complementary) ……
…… affordability (ACI is cheaper) ……
…… competitors products

[3]

Comprehensive cover

Condition is capable of clear, objective definition

…… which will be durable for the duration of the contract (definition wording usually gteed)
Suitable data exist to price the benefit
Anti-selection risk can be minimised (e.g. by underwriting)
(perceived as) a serious medical condition by potential policyholders
Insured event has significant financial implications for the insured ……
…… e.g treatment costs, loss of income

Event is life threatening or life altering
Potential for adverse trend in future incidence rates ……
…… due to change in underlying incidence or impact of medical advances
Conditions covered by competitors
Recommendation of professional advisers (e.g. CMO, reinsurer)

[4]

Formulae

ACI: $CC = SA * (\sum [i_x] - \sum [k_x] * q_x)$
Where:
CC = expected claims cost (to add CI acceleration benefit)
SA = sum assured
i_x = incidence rate of CI condition at age x
k_x = proportion of deaths caused by the CI condition
q_x = mortality rate at age x
the summation is over all CI conditions covered and rating groups
SACI: $CC = SA * \sum [i_x * (1 - {}_iq_x)]$
Where:
${}_iq_x$ = probability of death within the survival rate following the CI event
the summation is over all CI conditions covered an rating groups

[3]

Practical difficulties with formulae

In practice, it is difficult to obtain suitable statistics in the level of detail indicated by the formulae ……

…… incidence rates by age and gender may only be available for the most common conditions – e.g. cancer – from registry data ……
Unlikely to have sufficient insured data ……
……for less common conditions, an average incidence rate for whole populations may be all that is available
Marginal cost of adding such minor conditions can be approximated with an appropriate, average addition to the risk rate
Estimation of k_x factors depends on good cause of death reporting
${}_iq_x$ factors are difficult to estimate accurately – few data ……
…… solution is often to ignore ${}_iq_x$ factor for all but most significant events (e.g. heart attack, stroke)
Formulae give a bottom-up approach to pricing – can reconcile with top-down estimate of claims costs by reference to own / industry experience ……
Care is required with ACI experience data – claims data are generally of i_x form – ideally compare basis with experience of CI and death claims

[5]

Q.8)

Why Gtee.

May be regulatory requirement
May be established mkt. practice – need to be competitive
To provide security/certainty of product cost to policyholders
As product alternative to reviewable business (i.e. higher premium option)
Reviewable business may be difficult to review in practice ……
…… so additional risk to insurer (cf. marketing benefit) may be considered low
To avoid selective laspation risk on rate increase for reviewable product
May be rider to gteed. life cover => expectation of fully gteed. product (e.g. accelerated CI on term business)
Market may bear a high premium margin for gteed. cover (i.e. > insurer's assessment of premium for XS risk)
Single premium business (e.g. immediate needs annuity)
May be gteed for less that full term of contract (e.g. first 5-10 years) – within insurer's risk appetite **[4]**

Risks to insurer

Mis-pricing or adverse claims trends lead to losses
Additional reserving requirement to cover future losses reduces solvency margin cover
Volatility of health business is not a problem per se but potential for adverse trend development in claim incidence rates ……
…… or e.g. medical inflation, is much greater than for life business
Potential for claims incidence shocks to increase the cost of claims is real ……
…… e.g. medical advancement, legal precedent, tax effect
Data to derive incidence rates may be inappropriate => XS mispricing risk cf. life business
Insurer's assessment of the cost of the gtee. provided (incl. the cost of holding additional reserves) may make the product unattractive / uncompetitive
More exposed to a change in reserving standards than reviewable business

<u>Management</u>

Allowance for continuation of trends in pricing (incidence, inflation etc)
Establish higher reserves for gteed business – i.e. higher provision for adverse deviation (may well be prescribed)
Undertake sensitivity testing – both deterministic……
..... and stochastic to model potential consequences of parameter uncertainty
Level of charge for gtee. will depend, amongst other things, on level of uncertainty in base pricing assumptions
Price for higher profit target to reflect additional risk / apply additional contingency margin
Can cap the risks assumed by including e.g. monetary limits in the product design

Can limit the amount of business accepted (in absolute terms and as % of portfolio)
Buy appropriate reinsurance (e.g. large QS) with matching rate gtee. ……
…… but this may be difficult to obtain (at an attractive price) for some lines

[8]

Impact of medical advances

Screening test:
CI: May reduce or increase claim rates
If early diagnosis and subsequent treatment prevent profression of the disease process to the stage that it is 'critical' => reduction in incidence
If screening accelerates CI diagnosis/procedure, claim incidence rates may increase
LTC: may reduce incidence(possibly years later) if test is related to the risk of future, severe disability.
Early diagnosis will not increase the risk of future disability
PMI: May increase or decrease PMI claim costs
Increase could result from costs of further investigations and treatment (including investigation of false positives)
May be savings (possibly in longer term) if early diagnosis reduces requirement for treatment later on at a more advanced state of illness
New Drug
CI: No impact for diagnosis-based covers
May reduce incidence if survival is prolonged in a pre-'critical' stage of disease in the case of CI covers triggerred by a particular level of disability
LTC: May reduce or increase care costs
Depends on whether the impact on survival has most impact at levels of disability before / after degeneration progresses to the level at which LTC is required
PMI: Overall impact would depend on whether underlying condition (currently and in future), including the costs of the new drug, are covered by the PMI plan

[6]

Q.9)

Demographic assumptions

Claim inception rates

Mortality and morbidity rates for healthy lives - Together these are required to determine the probability of a new IP claim arising

Claim termination rates

Mortality rates for disabled lives – Together these are required to determine the expected capitalised cost of a the claim annuity

Consider at least all risk factors used as rating factors

Age / gender / smoker status

Occupation class / distribution method

Policy duration / policy size / (underwriting)

[3]

Data sources

Insurer's own experience ……

Of same or similar contracts

Need to consider relevance of statistics ……

… particularly with regard to target market / distribution method / risk assessment / claims management / product design features

Usefulness may be limited by quantity of data and immaturity of inforce policies

Insurance industry statistics may address some of these limitations ……

…… but inevitably less directly relevant then own experience because of (significant) experience differences between companies / product designs

Population statistics for disability may be available ……

……but definition of disability is likely to differ from that used by insurers ……

…… and risk characteristics of population are usually quite different from insured groups

Reinsurance data may reflect a broad section of the industry ……

…… and be available to insurers before formal, industry studies become available

…… but may not reflect expected experience of direct insurers (e.g. not ground-up claims data)

Published returns to the insurance supervisor

Overseas data (any of the above) ……

…… of limited use because of wide variations in morbidity experience between different regions

[5]

Control over risks accepted

<u>Individual</u>

Policies individually underwritten ……

…… using some or all of proposal form / medical attendant's report / medical examination / additional investigations 1

May apply policy exclusions for particular risks

Or charge an appropriate higher premium for any excess risk

identified

Group
Targeting of particular types of group for insurance (e.g. by level of occupational risk)
Compulsory participation / minimum take-up rate if voluntary
Active at work requirement
Initial wait for new members
Medical underwriting of large covers (e.g senior management) in excess of free cover limit
General policy exclusions (Gp. And Indl.)

[5]

Method

Vs. Formula Method
Advantages: Enables explicit allowance to be made for amount and timing of all cashflows ……
…… including the impact of holding reserves / solvency margin ……
Allows more complex product features to be modelled explicitly
Facilitates sensitivity testing of profitability
Can allow easily for change in the values of parameters at different points in the life of the policy
Can integrate profit testing model with a full model of new business or model office to investigate impact on the financial position of the whole office (e.g. solvency position, capital requirements)
Disadvantage: complexity of model

Vs. MSM
Advantages: Potentially much simpler then MSM ……
…… MSM requires transition probabilities from all relevant states to all other possible states
Disadvantages: MSM can provide greater insights into dynamics of insured population ……
…… and robustness / sensitivities of premium rating basis

[5]

Large group pricing

Large IP experience variations are found between insured groups ……
…… in the case of a large group, the past claims data may provide a good indication of the likely future claims cost ……
…… because it reflects employer specific factors that have a bearing on expected claims costs (e.g. occupational risks / employer behaviour with regard to healthcare and disability)
Past experience is weighted with the insurer's relevant book rate for group IP ……
…… according to the level of credibility assigned to the groups' own experience
A minimum expected number of claims to assign full credibility can be determined, depending on the confidence level that the insurer specifies for the best estimate

For lesser levels of claims a credibility factor in the range 0 to 1 is determined as e.g [expected claims / no. of claims for full credibility]$^{0.5}$. = Z

Formula: adjusted rate = Z * Actual + (1-Z) * Expected
Low claim frequency for IP implies a large volume of experience data is required for full credibility
Poor guide to future
IP experience is influenced by many factors that my change over time, including: ……
…… product features / policy conditions / benefit levels ……
…… risk characteristics of the group (age / gender / occ. Class mix)……
…… external, macroeconomic environment / unemployment risk / employee morale etc

[6]

****