

# **Durational Effects in a Health Insurance Portfolio**

By John Feyter

## **1. Introduction**

1.1 This paper examines the relationship that exists between claims costs and duration in-force for a large health insurance portfolio. It is found that claims costs increase with increasing duration in-force and this trend persists over long durations. The observation is consistent with the effect of withdrawal anti-selection.

1.2 A simple model was created to study how morbidity rates might vary under different portfolio conditions and, in particular, differences that may be expected for portfolios that are open or closed to new business.

1.3 There is a motivation for insurance companies to maintain competitiveness for new business premiums which, in the absence of regulation, may have some implications for how the pricing of an existing portfolio is managed. A pure risk-based pricing approach will minimise any cross-subsidy between short-duration and long-duration policyholders. It is argued minimising this cross-subsidy may not be consistent with policyholder expectations because policyholders believe they have a valuable renewal option.

1.4 Alternative structures for health insurance have been established in several other countries, including Australia. Structures that reduce the ability for insurers to select against poorer risks support a greater degree of pooling of risk and are consistent with a valuable renewal option. In theory such structures also have wider economic advantages by encouraging insurers to focus on health funding outcomes rather than on cherry picking the best risks.

## **2. Background**

2.1 New Zealanders incur out of pocket expenses for primary healthcare which is partially government funded and for private specialist consultations or treatment which receives no government funding. There is generally no out of pocket expense for acute care in the public sector which is funded out of general taxation. Elective surgery is delivered in either the public hospital system (where there is no out of pocket expense but treatment is subject to a scoring system and waiting lists) or in private facilities where the individual incurs the full cost of treatment.

2.2 Health insurance plans cover the costs of private treatment. There are two main plan types:

(i) surgical plans – providing cover for private surgery and other significant medical costs like imaging, and

(ii) comprehensive – providing cover as per a surgical plan plus additional cover for day to day events including primary care, alternative medicine, dental, and optical depending on the plan option taken.

2.3 Within each plan type there are products that have differing scopes of cover, or products that provide reimbursements for either a percentage of costs or up to 100% of costs incurred. There are also excess options where cover is for costs incurred in excess of an agreed amount. New business is dominated by surgical plans. Currently these plans make up about 64% of the market by lives insured, and 73% of the new business. [Source: HFANZ data – June 2008].

2.4 Cover is underwritten at the time of policy issue in the individual market. Pre-existing conditions are generally excluded.

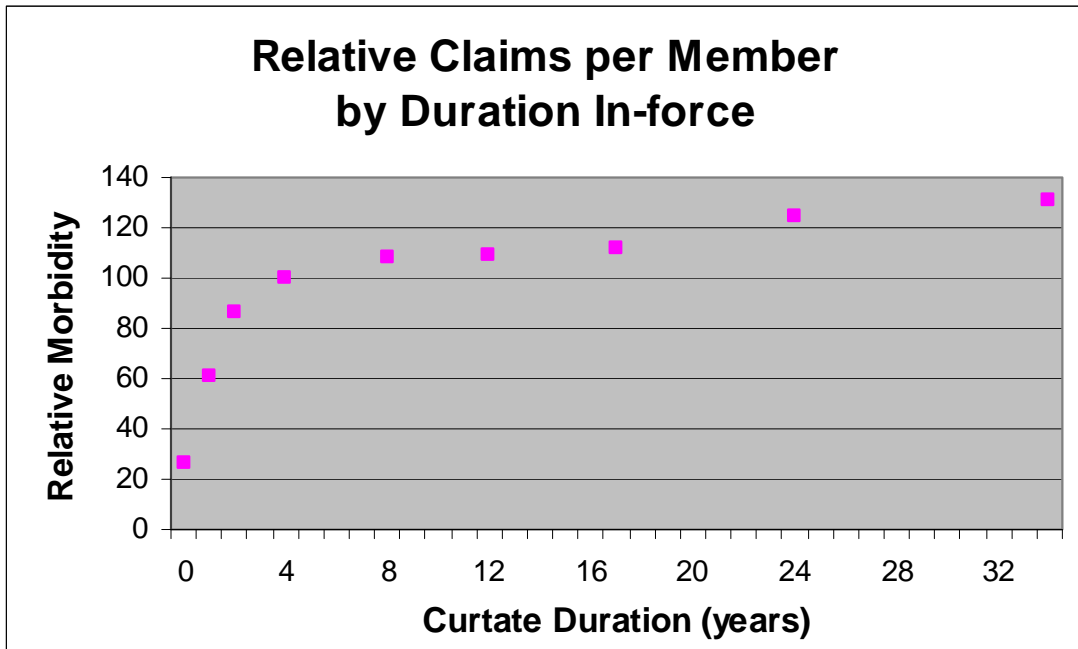
2.5 Health insurance is guaranteed renewable and generally priced on the basis of attained age. Some insurers have introduced separate male and female rates and non-smoker discounts. The renewal guarantee gives the right to maintain insurance without taking into account any change in health status since inception. In this way people can obtain valuable long-term insurance cover against the costs of private treatment for illnesses such as heart disease, cancer and osteoarthritis.

2.6 Although the right to renew is guaranteed, the terms and conditions of cover are generally not guaranteed. Insurance policies specify the range of treatments covered. Changes are made regularly to take into account developments in medical practice like new surgical techniques or treatment options.

2.7 Premium rates are also not guaranteed and change from time to time. A special feature of health insurance is that price inflation, new medical technology, and (in New Zealand) the increasing private provision of healthcare all combine to increase claims costs from year to year. Premium rate scales therefore tend to increase over time at a faster rate than consumer price inflation (CPI).

2.8 There is currently no taxation or other government subsidy associated with the purchase of health insurance in New Zealand. There is also no government regulation on the pricing or operation of health insurance other than Human Rights Act Guidelines regarding health insurance premiums. Health insurance is subject to broad insurance regulation and financial reporting requirements as would apply to any insurer operating in New Zealand.

Figure 1.



### 3. The Durational Curve

3.1 Premium rates vary according to attained age. Insured lives of the same attained age will have varying durations in-force from those who have just joined to those who have been in-force for many years.

3.2 An investigation into the relative claim rates by duration in-force was performed on a large portfolio of individual business underwritten by Southern Cross Medical Care Society. Claims data for the period 1 July 2007 to 30 June 2008 was obtained for 115,000 lives aged between 36 and 55. Data was separated by plan type, age, and duration in-force. Duration in-force data was grouped into nine categories to avoid very small data points. The duration groups constructed were curtate duration 0 years, 1 year, 2 years, 3-5 years, 6-9 years, 10-14 years, 15-19 years, 20-29 years and 30 years+.

3.4 Exposure for each duration group was standardised by plan type and attained age to obtain comparable claim rates for each duration group. The result after standardisation is to produce figures that represent just the duration effect on risk premium levels. Individuals in the portfolio will have different claims levels due to age differences and over time claims levels will vary due to the forces of medical price inflation and increasing utilisation. Figures shown assume all these other factors are held constant. The durational effects shown are, therefore, **in addition** to the other factors affecting claims levels and premium rates.

3.5 The observed result can be considered in two distinct parts:

(i) A period of initial selection where lives experience a low level of claims due to the effect of underwriting. The data suggests this period lasts at least 3 years. Claims levels have, therefore, been shown relative to a value of 100 for curtate duration “3-5 years”.

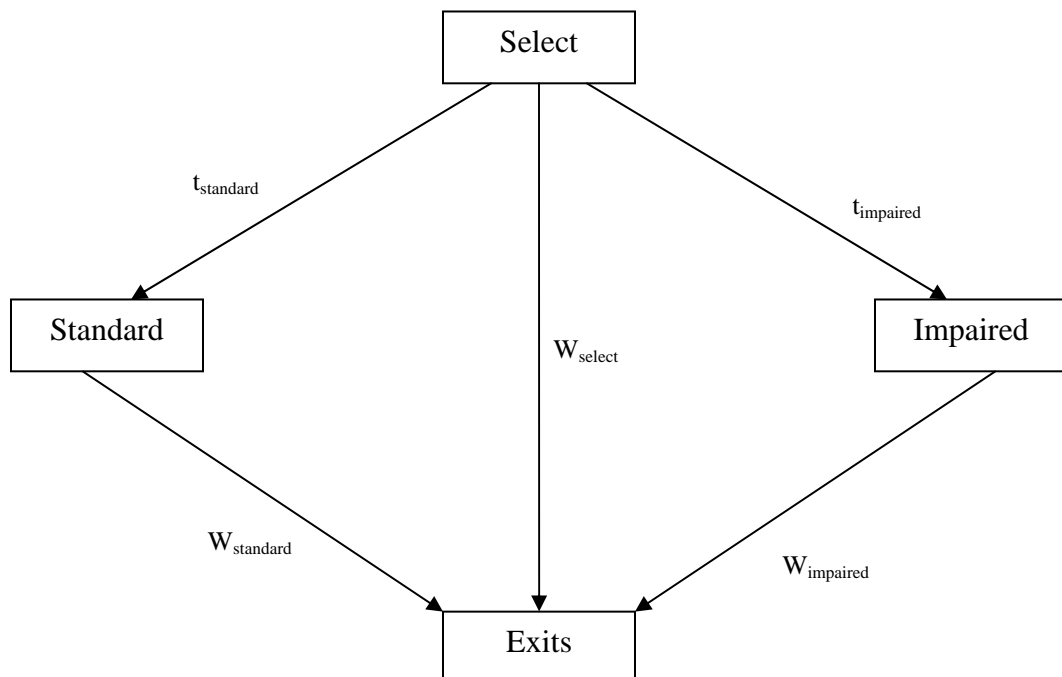
(ii) A subsequent period where claims continue to increase steadily with increasing duration. From curve fitting this period can be reasonably represented as a straight-line relationship with increasing claims costs of about 1% per annum relative to the claims level for curtate duration “3-5 years”.

The main aim of this paper is to consider the implications of the longer term durational effect on the management of a health insurance portfolio.

#### 4. Anti-Selective Withdrawal

Anti-selective withdrawal is a process occurring in insurance portfolios whereby, over time, better risks elect to withdraw from the insurance pool. The outcome is that the average risk covered by the pool increases. This would occur in renewable health insurance with healthier lives perhaps seeing less value in maintaining cover and, therefore, cancelling. The trend outlined in 3(ii) is consistent with what one would expect to see from the process of anti-selective withdrawal.

4.2 A simple model was constructed to reproduce the observed pattern of initial selection and longer-term anti-selection. The structure of the model is:



4.3 New lives insured are assumed to be select. They are assumed to transition to non-select over three years and at that time are deemed to be either “standard” or “impaired”.

4.4 In a real portfolio there is a complete spectrum of risks covered from lives who will never claim to those whose ultimate claims costs will be many times the average claims cost of the portfolio. Grouping into “standard” and “impaired” is, therefore, a gross simplification of the actual position.

4.5 Select, standard and impaired lives are all subject to a force of withdrawal. The rate of withdrawal assumed was 17.5% for select lives, consistent with the cancellation rate observed for new lives in the portfolio. The rates of cancellation for standard and impaired lives were set as a function of the statistic “ $-C / P$ ” where C is the expected claims for the given status and P is the premium payable. Standard lives have lower expected claims than impaired lives and, therefore, have a higher rate of cancellation. The differential in the rates of cancellation acts to increase the proportion of impaired lives by duration.

4.6 The model was constructed to examine the expected claims experience of an insured portfolio relative to the underlying morbidity of the same group if insurance had not been entered into. Therefore possible transitions between the two statuses “standard” and “impaired” were not considered in the model because any such transfer would be just one of the forces influencing the underlying level of morbidity in the general population. The model makes no assumption about the underlying level of morbidity and simply projects claims costs relative to a nominal level of claim by duration in-force.

4.7 The model was used to generate expected claims costs by duration in-force for a single tranche of business. The “Solver” functionality in Microsoft Excel was used to solve for the relationship between “standard” and “impaired” morbidity, the initial proportions of the “standard” and “impaired” lives and the parameters of the withdrawal function so that the expected claims costs from the model matched the pattern measured from the Southern Cross portfolio (figure 1 in section 3).

4.8 Key assumptions used in the model were:

- (i) “Select” lives either withdraw or transfer to “standard” or “impaired” status over the first three years.
- (ii) The expected morbidity of “impaired” lives is equal to three times the expected morbidity of “standard” lives.
- (iii) 50% of the lives transferring from “select” are assumed to be “standard”. The other 50% are assumed to be “impaired”.

(iv) Notional risk premiums were established on the basis of expected claims experience taking into account the durational mix of the model portfolio. A theoretical portfolio based on a steady rate of new business each year has been constructed for this purpose.

(v) The withdrawal rate for “select” lives was set equal to 17.5% p.a. Withdrawal rates for “standard” and “impaired” lives were calculated so as to give an ultimate withdrawal rate of approximately 5% per annum but with the additional constraint of the relationship between “standard” and “impaired” withdrawal rates outlined in 4.5 above.

The formula to satisfy the constraints was found using Microsoft Solver.

***Formula 4.8(v)***

$$\text{Withdrawal rate} = 2.8\% + 4.6\% * (150\% - C / P)$$

The outworking of these parameters is:

withdrawal rate for “standard” lives = 7.6% p.a.

withdrawal rate for “impaired” lives = 3.5% p.a.

4.9. It was found that a reasonable fit to the observed data could be obtained with significantly different input assumptions, especially with respect to the ratio between “impaired” and “standard” mortality, and also the initial proportions of “standard” and “impaired” lives. A number of different assumption sets were tested to ensure the subsequent modelling gave similar results and that conclusions would not be different if an alternative assumption set was chosen. Trends were found to be stable under different assumption sets and, therefore, the model has been described using one representative assumption set.

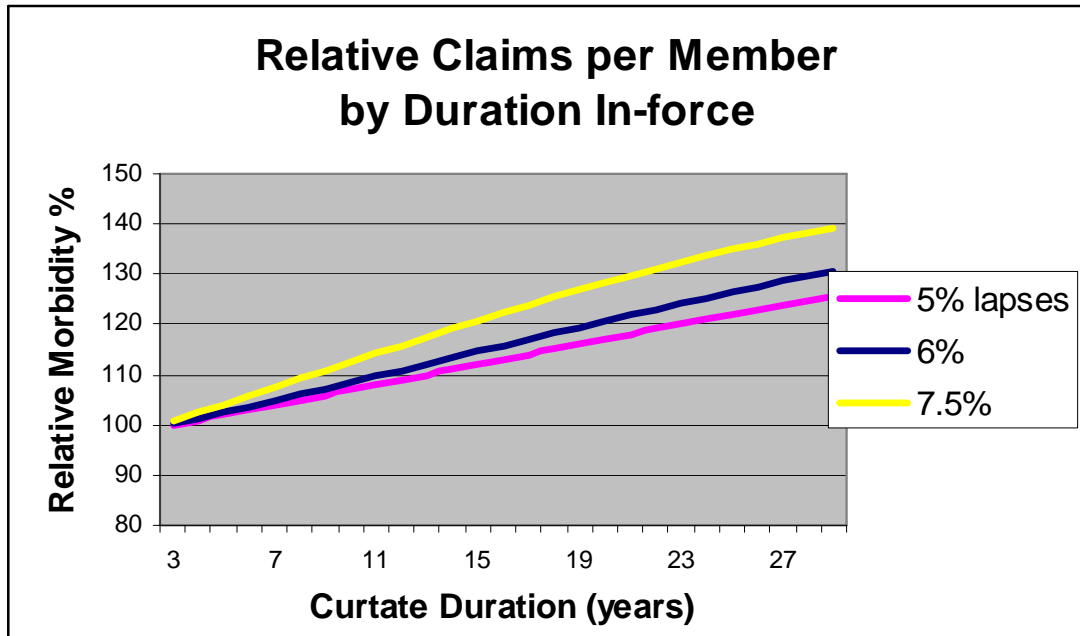
4.10 Having constructed a model it was then used to assess the sensitivity of the durational curve to different levels of cancellation and to consider the effect of different portfolio pricing strategies.

## **5. Withdrawal Rate Sensitivity**

5.1 In recent years the Southern Cross portfolio has experienced a lower rate of withdrawal than the average reported in industry data available from HFANZ. The duration effect measured on the Southern Cross portfolio is itself a function of the withdrawal rate experience of the portfolio.

5.2 The withdrawal rates in the model were, therefore, adjusted to consider two further scenarios – (i) long-term withdrawal rates of 6% p.a. (broadly consistent with the average market rate of withdrawal from HFANZ data), and (ii) long-term withdrawal rates of 7.5% p.a. The method used was to vary the withdrawal forces in Formula 4.8(v) proportionately to achieve the desired long-term withdrawal rate.

Figure 2.



5.3 A higher overall withdrawal rate includes a proportionately higher number of withdrawals of standard lives. Therefore there is a more significant anti-selective effect as shown above.

5.4 The magnitude of the anti-selective effect at different withdrawal rates can be summarised as:

Long-term withdrawal rate	Anti-Selective Effect per annum
5%	1%
6%	1.25%
7.5%	1.5%

A 6% per annum long-term cancellation rate assumption is representative of an average market level of long duration cancellation estimated from HFANZ data. Therefore, for the purposes of generalisation, a durational claim effect of 1.25% p.a. is used to examine expected morbidity trends in a theoretical portfolio.

## 6. Portfolio Projections

6.1 The model was also used to project claims experience and imply a risk premium for a theoretical portfolio. For this purpose a constant level of sales was assumed each year.

6.2 The reference rate of claims in the model is 100 per annum per person assumed from year four. Claims are lower in policy years one to three due to the effect of initial selection for new business. This is not necessarily useful for pricing purposes because there is usually a significant acquisition cost. An “adjusted risk premium” was calculated to take into account acquisition costs. The assumption has been made that acquisition costs are identically equal to the initial selection effect in the first three years in order to remove a temporary distortion from new business. This equates to a total allowance for acquisition costs of 115 or approximately 1.2 times the initial adjusted risk premium.

The expected claims costs per person and the adjusted risk premium for a new portfolio writing a constant level of new business each year are as follows. All figures are shown relative to an index value of 100 equal to the expected value of claims at the end of the initial selection period of three years:

<b>Year</b>	<b>Expected Claims per Life Insured</b>	<b>Adjusted Risk Premium</b>
1	26	100
2	43	100
3	55	100
5	70	100
10	84	102
15	91	105
20	94	107
30	99	110

It can be seen that the positive claims effect from ongoing new business outweighs long-term durational effects in the portfolio even after 30 years has elapsed. However the adjusted risk premium does increase over longer periods and in this example a mature portfolio needs to price at least 10% higher than a new portfolio all else being equal.

6.3 The premium effect leads to some interesting potential market behaviour. The health insurance market is competitive and margins are low. For new business pricing purposes it makes sense to structure new business products and their premium rates so they are ring-fenced from the poorer experience of the existing book. An insurer is continuously able to offer pricing for new business based on the best part of the claims curve if from time to time existing products are closed to new business and

new products opened in their place. An insurer operating in this manner is able to maintain a relative pricing level of 100 for new business. The corollary is that the claims experience of the closed book can be expected to deteriorate rapidly. The table below shows the expected claims and risk premiums for a portfolio closed to new business after five years.

Year	Open Portfolio		Portfolio closed after 5 years	
	Expected Claims per Life Insured	Adjusted Risk Premium	Expected Claims per Life Insured	Adjusted Risk Premium
1	26	100	26	100
2	43	100	43	100
3	55	100	55	100
5	70	100	70	100
10	84	102	106	106
15	91	105	112	112
20	94	107	119	119
30	99	110	131	131
Steady State			150*	150*

6.4 The steady state under the model’s closed portfolio scenario is reached when the portfolio consists entirely of “impaired” lives. In the real world the situation is different because there are different degrees of “impaired”. As the premium rate increases significantly the less impaired may themselves be more likely to cancel. There may be a continuous anti-selective process (sometimes referred to as an “antiselection spiral”) that takes place until the portfolio reaches a level where all the policyholders who are motivated to cancel their coverage have done so.

6.5 In practice a closed portfolio will experience even higher morbidity increases than shown. The model only takes into account withdrawals whereas there will be an additional force arising from healthy lives in the closed book transferring to a new book to take advantage of a lower premium rate. The total rate of anti-selective withdrawal may, therefore, be very high causing the claims experience to deteriorate rapidly.

## 7. Social Insurance vs. Risk Based Pricing.

7.1 In the absence of any current regulation the two pricing options available to a New Zealand health insurer are either:

- (a) to maintain a policy of cross-subsidising longer duration risks with shorter duration ones, or
- (b) to remove all or some of the cross-subsidy by closing existing blocks of business and opening new blocks or using some alternative pricing method to obtain a similar outcome.

As outlined above, the result will be that (all else being equal) those insurers operating under policy (a) have higher premium rates for new business than insurers operating under policy (b). It is difficult, therefore, for insurers (a) to compete in a competitive new business market when there are also insurers (b).

7.2 The phenomenon of the closed health insurance book has been discussed in actuarial forums in the USA. Extensive analysis has been performed, most recently by the Rate Filing Task Force (RFTF) of the American Academy of Actuaries who submitted a report to a Working Group of the National Association of Insurance Commissioners (NAIC) in May 2004 (Academy of Actuaries' Rate Filing Task Force 2004). It's referred to as the "closed book problem" in the United States and was summarised by Bill Bluhm (the chairman of the Academy of Actuaries' RFTF) at an actuarial sessional meeting (Bluhm 2003) as follows:

*"The problem is having carriers who will issue a policy form for a couple of years, close it off, rate the heck out of it as the experience goes up and then open up a new block and rate it at a select level. Once somebody does that, everybody else has to do it, at least to some extent, because you can't afford not to. The only alternative is to subsidize older risk with the newer risks, and you can't afford to do that and be competitive at the same time."*

7.3 It is useful to take a moment to consider whether we would view the closed book phenomenon to be a "problem" in the context of the New Zealand insurance market. Some relevant points are:

- (i) The New Zealand market is relatively unregulated and a risk-based pricing approach has, therefore, evolved. Managing closed blocks of business is effectively a risk rating solution and therefore we should have little objection with it. In New Zealand any approach must comply with The Human Rights Act 1993. Actuaries will also be mindful of the New Zealand Society of Actuaries Guidance Notes. In my opinion closed book pricing is consistent with these constraints.

- (ii) Can policyholders afford what they have bought? The reality is that under closed book management health insurance premiums are significantly higher for those people that need health insurance than the price at the time the insurance was purchased. It should be remembered that all price relativities in this paper are for a fixed age, and ignore inflation. As such, actual premium rates payable will be a function of underlying medical inflation, **plus** ageing, **plus** any durational effects. Is health insurance a worthwhile product offering without some meaningful long-term pooling of risk?
- (iii) Are policyholders getting what they think they are? Is the product consistent with policyholder reasonable expectations? A key feature of health insurance is that it has a renewal option – the policyholder is not disadvantaged or re-underwritten for health conditions that have developed since the policy commenced.

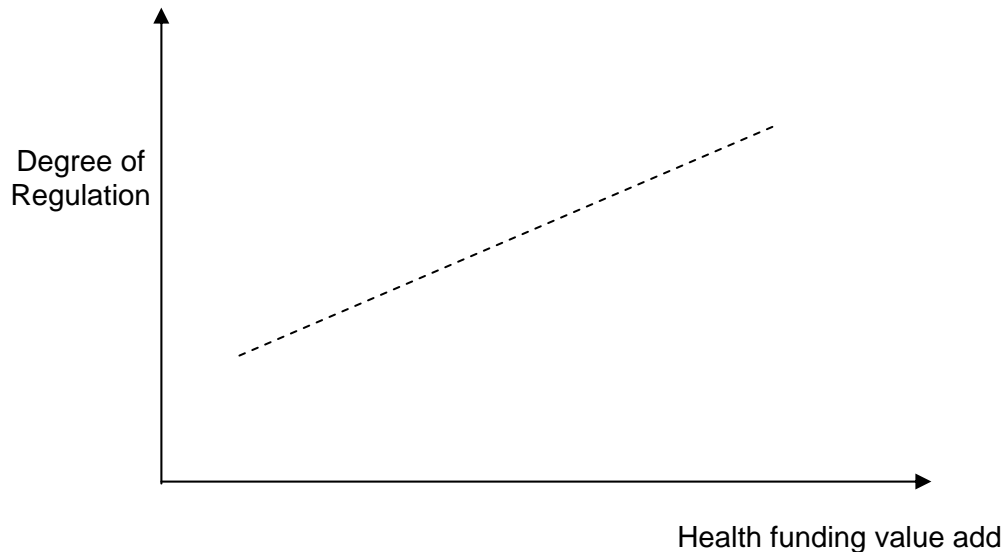
For an open portfolio there is an ongoing cross-subsidy between lives that have recently joined the portfolio and those that have been in force for longer. The renewal option has an overall positive value for lives at longer durations equal in value to the amount of cross-subsidy from shorter duration lives.

For a closed portfolio the aggregate value of renewal options for the longer duration members is nil because the premium payable reflects total expected risk. In my view, this result causes some difficulty because many policyholders believe they have a valuable option. Health insurance is often sold (and bought) and retained on the basis that it is “needed in case I get sick”.

- (iv) There is inequity between policyholders of the closed book if it has been running for a long time before it is closed. Early entrants to the portfolio benefit from the initial favourable experience of the portfolio whereas those who enter just before it is closed do not have any such period of favourable experience.

7.4 An interesting feature of health insurance is that competition does not necessarily promote economic efficiency (Van de Ven et al. 2003). Health insurers can potentially add value for their policyholders through a wide range of possible initiatives including administration efficiency, cost-effective disease management, health promotion, and provider cost control. These sorts of initiatives have the useful economic outcome of trying to maximise the value of healthcare provided and/or obtain the best health outcome for the insured population per unit cost. But these things are hard to do. For example, provider cost initiatives are, unsurprisingly, not popular with medical professionals. Success often cannot be measured easily and any effects may take years to emerge. A health insurer has available to it the alternative strategy of reducing price for new business by better segregation of risk. This strategy is easy to do and has an immediate pricing effect but, arguably, adds nil value in the context of an overall healthcare funding goal.

7.5 A schematic of the impact of possible pricing philosophies is:



7.6 Many developed countries have constructed social insurance models for health insurance. In Australia there is mandatory entry age pricing, a risk equalisation arrangement and guaranteed portability from insurer to insurer. The Netherlands has a comprehensive risk equalisation system and community rating. Most other European countries have community rating (Orros 2007).

7.7 In the absence of any pricing regulation the trend in New Zealand has been towards more risk based pricing. The USA and United Kingdom also have risk based approaches. Closed book pricing occurs in the United States and is well-documented. Insurers in the United Kingdom have introduced large low claims discounts (maximum levels are typically of the order of 50%). Given what we know about the incidence of claims by duration these also have the effect of reducing overall premiums for short duration members and increasing premiums for longer duration members.

## **8. Solutions proposed in the United States.**

8.1 The Rate Filing Task Force of the Academy of Actuaries developed four generic categories of solution which were outlined in its report to the NAIC. The US market is larger and more sophisticated than the market in New Zealand and, therefore, some of the solutions are not directly relevant. The solutions can be summarised as two general ideas:

(i) **Durational Pooling.** The concept proposed was to require the experience of all policy forms beyond a certain duration in-force to be combined for premium rating purposes. The idea in the US was for such experience to be combined within each insurer but with New Zealand's small market it might be more appropriate to require

pooling at market level in order to obtain a more robust solution and deter opportunistic behaviour from a new market entrant. Note that the ultimate pricing outcome of durational pooling is similar to the pricing outcome described in 7.1 (a) above. The difference is that the requirement is for some form of regulation to mandate the pooling so it can occur without insurers facing a loss of competitiveness.

(ii) Prefunding. The proposal was that each issue year's cohort of business would be financed on the basis of premiums and claims from that cohort. This would increase complexity significantly with premium rates presumably being differentiated on the basis of both attained age and issue year. In my view a possible modification to this idea would be to operate a pre-funding method with premium rates determined solely on attained age but reserves managed at portfolio level. The outcome would be that a new portfolio accumulates reserves while policies are at early durations in-force and while claims experience is low relative to the premium calculated on a pre-funded basis. In due course an old portfolio will draw on those reserves to supplement premiums.

8.2 The advantage of alternative pricing models such as those outlined above is that with a greater requirement to pool risk there is a real incentive to manage that risk through added value healthcare activities. For example, sickness funds in Germany are now participating in disability management programmes for four initial health conditions: diabetes, breast cancer, asthma and coronary heart disease (Busse 2004). In this way health insurers become active participants in the efficient delivery of healthcare rather than just price takers.

## **9. Conclusion**

9.1 Current health insurance behaviour in New Zealand is a risk-based pricing approach. Closed block pricing is a natural market outcome in the absence of any controls or regulation. In my opinion this is not an ideal market situation because:

(i) There is a discrepancy between policyholder reasonable expectations and the ultimate pricing outcome. It is difficult to see how the actual pricing mechanics can be communicated effectively to consumers at the time of purchase. Would anyone want to buy health insurance if the actual mechanics were communicated and understood?

(ii) Such an environment gives a significant reward to activities relating to the identification and segregation of risk. It is argued that in the context of the whole health sector these activities have little economic value other than to effect the distribution of wealth. Activities that have significant economic value (e.g. maximising operational efficiency, managing healthcare costs) may still have a payoff for the insurer but are less likely to be promoted while risk segregation activities are rewarded.

9.2 Actuaries are in a unique situation to understand and educate decision makers on long-term issues surrounding the management of insurance business. My hope is that this paper helps to initiate debate within the profession on this issue.

## **10. Acknowledgements**

10.1 I am grateful to the Southern Cross Medical Care Society for making available the claims data to perform the durational experience analysis.

10.2 All opinions expressed in this paper are solely my own and not the views of my employer.

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