The Winner’s Curse in Group Risk

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The Winner’s Curse in Group Risk

Abstract

The Winner’s Curse is a theory that in an auction there is a tendency for the winner to have overpaid for the item purchased. This is especially the case where it is difficult to determine the intrinsic value of an item and the item has a similar value to each bidder. The Group Risk market in Australia appears to meet many of the requirements for the Winner’s Curse to exist. Through the use of a simple model, this paper explores the possible implications of the Winner’s Curse and discusses some associated issues.

Keywords: Winner’s Curse, Group Risk,

1 Introduction

“There are a lot of ways to lose money in insurance, and the industry never ceases searching for new ones.” Warren Buffett

The aim of this paper is to use a particular subject, the Winner’s Curse, to bring together a number of topics that have a strong bearing on both how Group Risk pricing is performed and the way that it is gone about. The many ideas in this paper are far from original and have been covered in much greater depth elsewhere; however, I believe that there is significant value in bringing all of these ideas together; particularly, for those involved in Group Risk pricing who may not have come across some of them before.

Partway through writing this paper, I realised that I had taken on a very challenging topic and could not do it justice. I made the decision at the time that there would be more value in bringing together as many ideas as possible rather than concentrating on one area in particular; hence, much of this paper is still a work in progress.

The concepts discussed in this paper are focused more heavily toward large group risk schemes that are generally priced with a heavy reliance on self-experience rating rather than smaller group risk schemes that are mostly priced using book rates.

Finally, I would like to acknowledge the contributions of Darren Wickham and Saul Field who have provided invaluable assistance along the way. Their advice has been greatly appreciated and improved this paper immeasurably.

2 Summary

The insurance industry as a whole is extremely complex and it is generally actuaries with our specialist skills who are heavily relied upon to ensure that insurance companies are soundly run. In Group Risk, it is often the actuary who determines or recommends the premium rates or price to be offered whenever a group risk scheme is up for renewal. Often, the price will be determined through a tender process that involves a number of competing insurers. Vital to this, is that the actuary needs to be aware of how the Group Risk insurance market operates and the implications of this in determining the price.
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The selection of an insurer for a Group Risk scheme is usually determined through a tender process, which for larger schemes is conducted through a formal tender process often via an advisor along with the issue of a Request For Proposal (RFP). In any tender, a large weighting is usually given to the price offered by the competing insurers with the winning insurer often having the lowest or close to the lowest price.

In a tender, each insurer will determine a price that has been determined from their best estimate of the future claims cost based upon the historical claims information provided by the tendering scheme or their advisor. The determination of a best estimate for future claims can use a variety of methods and each insurer will use their own internal models, taking into account a wide range of information and involving application of their own judgement.

As pricing is carried out independently, no two best estimates determined by the participating insurers will be the same; hence, the best estimates determined will comprise a range of reasonable estimates. Assuming that each insurer’s best estimate of the future claim costs is an unbiased estimate of the expected claim costs, then some of those estimates would be below the expected claims cost and some would be above. If the winning insurer has the lowest price, then we would expect that the winning insurer’s best estimate would be below the expected claim costs all other things being equal.

Section 4 of this paper shows that with a few basic assumptions, a simple model can demonstrate that the outcome of the situation where each insurer bases its price on its own best estimate will result in the lowest best estimate being materially below the expected mean claim costs; hence, the winning insurer pricing at too low a price.

The implication of this is that unless competing insurers take the Winner’s Curse into consideration then, all other things being equal, the winning insurer is likely to have under-priced.

The potential magnitude of the Winner’s Curse is partly determined by the likely range of the best estimates from insurers. The range of best estimates depends on how accurately insurers can estimate the expected claim costs. Section 5 discusses some of the causes for possibly having a wide range of estimates. Section 6 raises some other issues that are strongly related to the Winner’s Curse and will have a bearing on the extent of it.

Finally this paper examines why the Winner’s Curse may not have been evident in the past and discusses how we should potentially respond to the implications of the Winner’s Curse to ensure that we do not become “cursed” in the future.

3 Background and Reading

The Winner’s Curse as a concept was first described in a 1971 paper by Capen, Clapp and Campbell (1971) in their paper “Competitive Bidding in High-Risk Situations” in the context of the sale or auction of oil drilling rights. The background to the original idea is
simple: suppose that a number of parties are bidding for the drilling rights to a particular parcel of land. If the rights are worth the same to each party, then the auction is a common value auction and each party is trying to estimate the common value of the land. Given the difficulty of valuing a parcel of land, some estimates are likely to be too high and some estimates too low. The winner of the auction will be the party whose estimate was too high and can be described as “cursed”.

Since that original paper, the Winner’s Curse has been studied in relation to auctions for radio spectrums, book rights, market for free agents in baseball, takeovers and many other areas. More recently, there have been papers specific to insurance.

A good starting point for anyone interested in this topic is Richard Thaler’s paper “The Winner's Curse: Paradoxes and Anomalies of Economic Life”.

Other important papers which are specific to insurance and recommended further reading are GIRO Working Party (2009), GRIT (2006) and Lewis et.al. (2005).

It should be noted that Lewis et.al. (2006) was the only paper that I found that related to group risk business.

4 A simple model

One of the simplest ways to demonstrate the Winner’s Curse and explore its implications is through the use of a simple model. We can assume that best estimates are unbiased estimates of the true statistical mean, then model the outcomes from simulations of a hypothetical tender to see the impact.

We first start with a model where all insurers can price the risks equally well, have the same margins and where the lowest price wins.

4.1 Identical insurers

Consider a situation where we have a number of insurers all competing in a series of tenders for identical Group Risk schemes. Assume that:

- The current price of the scheme prior to each tender is 100
- the true mean loss ratio for each scheme is 85% i.e. expected claim costs are 85
- all insurers produce unbiased estimates of the true mean that are normally distributed with a standard error of 10%
- all insurers require a margin of 15% of the premium to meet profit margins and expenses
- the winner of each tender is the insurer with the lowest price

Running 1,000,000 simulations of the above scenario we get the following results:
The Winner’s Curse in Group Risk

Table 4.1 – Simple model of Winner’s Curse

<table>
<thead>
<tr>
<th>Number of Companies</th>
<th>Average Winning Price</th>
<th>Expected Loss Ratio on winning price</th>
<th>Average Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100.03</td>
<td>84.97%</td>
<td>15.03%</td>
</tr>
<tr>
<td>2</td>
<td>94.38</td>
<td>90.07%</td>
<td>9.93%</td>
</tr>
<tr>
<td>3</td>
<td>91.56</td>
<td>92.84%</td>
<td>7.16%</td>
</tr>
<tr>
<td>4</td>
<td>89.72</td>
<td>94.73%</td>
<td>5.27%</td>
</tr>
<tr>
<td>5</td>
<td>88.38</td>
<td>96.17%</td>
<td>3.83%</td>
</tr>
<tr>
<td>6</td>
<td>87.32</td>
<td>97.34%</td>
<td>2.66%</td>
</tr>
<tr>
<td>7</td>
<td>86.49</td>
<td>98.28%</td>
<td>1.72%</td>
</tr>
<tr>
<td>8</td>
<td>85.77</td>
<td>99.10%</td>
<td>0.90%</td>
</tr>
</tbody>
</table>

The expected loss ratio above is based upon the new price so that if the price is below 100 then the loss ratio will be higher than 85% i.e. the winning price divided by 85.

The above table clearly demonstrates the main premise of the Winner’s Curse. That is, in a market where participants price using best estimate loss ratios, then the expected long term outcome will be worse than the best estimate.

It can also be clearly seen that as the number of participants increase, the expected loss ratio increases and the average margin falls well below the 15% used by each company for pricing.

The figure below shows the actual distribution of both best estimate loss ratios and prices for a tender involving five insurers.

Figure 4.1 – Distribution of expected loss ratio

The graphs in the left-hand panel of figure 4.1 are based upon the price of 100 prior to each tender and show the distribution of best estimate loss ratio of each individual insurer (dashed line) and the resulting distribution of the lowest best estimate loss ratio (red line).
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The right-hand panel of figure 4.1 shows a graph of the expected winning price, which is likely to be significantly below the required price of 100 to achieve a target margin of 15%.

4.2 Varying standard error of pricing

To see the impact on the average price and expected loss ratio of varying standard errors, the above simple model has been re-run with five companies, with the standard error varying between 1% and 15%.

Table 4.2 – Winner’s Curse with varying standard errors

<table>
<thead>
<tr>
<th>Standard Error</th>
<th>Average Price</th>
<th>Expected Loss Ratio</th>
<th>Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1%</td>
<td>98.84</td>
<td>86.0%</td>
<td>14.0%</td>
</tr>
<tr>
<td>2%</td>
<td>97.67</td>
<td>87.0%</td>
<td>13.0%</td>
</tr>
<tr>
<td>3%</td>
<td>96.51</td>
<td>88.1%</td>
<td>11.9%</td>
</tr>
<tr>
<td>4%</td>
<td>95.34</td>
<td>89.2%</td>
<td>10.8%</td>
</tr>
<tr>
<td>5%</td>
<td>94.18</td>
<td>90.3%</td>
<td>9.7%</td>
</tr>
<tr>
<td>6%</td>
<td>93.02</td>
<td>91.4%</td>
<td>8.6%</td>
</tr>
<tr>
<td>7%</td>
<td>91.85</td>
<td>92.5%</td>
<td>7.5%</td>
</tr>
<tr>
<td>8%</td>
<td>90.69</td>
<td>93.7%</td>
<td>6.3%</td>
</tr>
<tr>
<td>9%</td>
<td>89.52</td>
<td>94.9%</td>
<td>5.1%</td>
</tr>
<tr>
<td>10%</td>
<td>88.36</td>
<td>96.2%</td>
<td>3.8%</td>
</tr>
<tr>
<td>11%</td>
<td>87.20</td>
<td>97.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>12%</td>
<td>86.03</td>
<td>98.8%</td>
<td>1.2%</td>
</tr>
<tr>
<td>13%</td>
<td>84.87</td>
<td>100.2%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>14%</td>
<td>83.70</td>
<td>101.5%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>15%</td>
<td>82.54</td>
<td>103.0%</td>
<td>-3.0%</td>
</tr>
</tbody>
</table>

The table above shows that, as the standard error of best estimates increases, the expected future loss ratio also increases. This is because an increase in the standard error reduces the low range of best estimates from insurers. Similarly, as the standard error reduces, the expected loss ratio reduces and is closer to 85%.

In reality, it is hard to determine what the standard error of best estimates is. There are some situations, due to the quality of data or the introduction of new benefits, where the standard error will be high.

4.3 One insurer has a pricing advantage

We now move from the scenario where all the insurers are identical to a scenario where a single insurer is differentiated from the other insurers. A pricing advantage can be characterised as a situation where an insurer can more accurately price a risk. As it is assumed that all insurers have unbiased estimates, an insurer has pricing advantage if it can determine best estimates with a smaller standard error.

The simple model has been re-run with the assumption that the first company’s best estimate has a standard error of 5% rather than 10%.
Table 4.3 – One company has a pricing advantage

<table>
<thead>
<tr>
<th>Number of Companies</th>
<th>Average Price</th>
<th>Company 1</th>
<th>Other Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market Share</td>
<td>Average Price</td>
<td>Average Margin</td>
</tr>
<tr>
<td>2</td>
<td>95.54</td>
<td>50.0%</td>
<td>98.21</td>
</tr>
<tr>
<td>3</td>
<td>92.71</td>
<td>28.2%</td>
<td>96.85</td>
</tr>
<tr>
<td>4</td>
<td>90.75</td>
<td>17.3%</td>
<td>95.72</td>
</tr>
<tr>
<td>5</td>
<td>89.26</td>
<td>11.3%</td>
<td>94.80</td>
</tr>
<tr>
<td>6</td>
<td>88.10</td>
<td>7.7%</td>
<td>94.00</td>
</tr>
<tr>
<td>7</td>
<td>87.15</td>
<td>5.5%</td>
<td>93.31</td>
</tr>
<tr>
<td>8</td>
<td>86.36</td>
<td>4.0%</td>
<td>92.66</td>
</tr>
<tr>
<td>9</td>
<td>85.68</td>
<td>3.0%</td>
<td>92.16</td>
</tr>
<tr>
<td>10</td>
<td>85.09</td>
<td>2.3%</td>
<td>91.72</td>
</tr>
</tbody>
</table>

It can be seen from the table above that:

- Company 1 has a lower market share than each of the other companies, apart from when there are two companies.
- Company 1 has significantly higher average prices and margins than the other companies.

Although the first insurer has a lower market share its margins are much higher than the other companies. This clearly shows that having better quality pricing confers a significant advantage to that company.

4.4 One participant has a pricing disadvantage

Rather than consider one company with a pricing advantage, we can consider the opposite: one company with a pricing disadvantage. To do this, we re-use the above model; however, we assume that Company 1’s pricing has a standard error of 15% rather than 10%.

The results from this are as follows:

Table 4.4 – One company has a pricing disadvantage

<table>
<thead>
<tr>
<th>Number of Companies</th>
<th>Average Price</th>
<th>Company 1</th>
<th>Other Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market Share</td>
<td>Average Price</td>
<td>Average Margin</td>
</tr>
<tr>
<td>2</td>
<td>92.81</td>
<td>50.0%</td>
<td>90.02</td>
</tr>
<tr>
<td>3</td>
<td>89.97</td>
<td>37.1%</td>
<td>86.59</td>
</tr>
<tr>
<td>4</td>
<td>88.24</td>
<td>30.8%</td>
<td>84.55</td>
</tr>
<tr>
<td>5</td>
<td>87.01</td>
<td>26.8%</td>
<td>83.20</td>
</tr>
<tr>
<td>6</td>
<td>86.05</td>
<td>24.0%</td>
<td>82.14</td>
</tr>
<tr>
<td>7</td>
<td>85.28</td>
<td>21.9%</td>
<td>81.29</td>
</tr>
<tr>
<td>8</td>
<td>84.63</td>
<td>20.3%</td>
<td>80.59</td>
</tr>
<tr>
<td>9</td>
<td>84.07</td>
<td>19.0%</td>
<td>80.00</td>
</tr>
<tr>
<td>10</td>
<td>83.59</td>
<td>17.9%</td>
<td>79.51</td>
</tr>
</tbody>
</table>

We can see from the table above that:
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- Company 1 has an average loss ratio of above 100% with as few as 3 companies
- Company 1 maintains a higher market share than its competitors

This clearly demonstrates the disadvantages to a company of having pricing that is poorer than its competitors.

4.5 One participant discounts

We now look at a scenario where all companies have the same standard error but one company decides to price on lower margins. This may be due to having lower expense margins or cost of capital or due to wanting to increase market share. This scenario has been modelled by setting the margin for Company 1 to 10% rather than 15%.

The outcome of this is shown in the table below.

Table 4.5 – One company uses a lower pricing margin

<table>
<thead>
<tr>
<th>Number of Companies</th>
<th>Average Price</th>
<th>Company 1</th>
<th>Other Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market Share</td>
<td>Average Price</td>
<td>Average Margin</td>
</tr>
<tr>
<td>2</td>
<td>91.30</td>
<td>65.7%</td>
<td>90.82</td>
</tr>
<tr>
<td>3</td>
<td>89.39</td>
<td>50.0%</td>
<td>88.76</td>
</tr>
<tr>
<td>4</td>
<td>88.04</td>
<td>40.8%</td>
<td>87.33</td>
</tr>
<tr>
<td>5</td>
<td>87.01</td>
<td>34.6%</td>
<td>86.28</td>
</tr>
<tr>
<td>6</td>
<td>86.17</td>
<td>30.2%</td>
<td>85.42</td>
</tr>
<tr>
<td>7</td>
<td>85.48</td>
<td>26.8%</td>
<td>84.71</td>
</tr>
<tr>
<td>8</td>
<td>84.88</td>
<td>24.2%</td>
<td>84.12</td>
</tr>
<tr>
<td>9</td>
<td>84.36</td>
<td>22.0%</td>
<td>83.59</td>
</tr>
<tr>
<td>10</td>
<td>83.90</td>
<td>20.3%</td>
<td>83.14</td>
</tr>
</tbody>
</table>

From the above it can be seen that:
- Company 1 maintains a much higher market share than the other companies
- Although overall margins are low, the margin for Company 1 is not significantly below the other companies

4.6 Combining a lower margin with a pricing advantage

Now let’s consider what happens if one company combines both a pricing advantage (i.e. a standard error of 5%) with a lower margin (i.e. a margin of 10%).

The results of this are shown in the table below.
From the table above, we can see that Company 1 manages to maintain a higher market share whilst at the same time having much better margins. This demonstrates that Company 1 has a clear advantage from being able to more accurately price.

### 4.7 One company tries to maintain higher margins

The next scenario I will consider is where one company tries to maintain higher margins (i.e. a margin of 20%) This may be due to having a higher cost of capital, taking a conservative approach to pricing or making a specific allowance for the Winner’s Curse.

From the table above, it can be seen that:

- The market share for Company 1 is much lower
- Company 1 maintains higher margins but the differential is much smaller than the difference between the 15% the market is using and the 20% Company 1 is using

### 4.8 One company has better pricing and tries to maintain higher margins

The final scenario I will consider is where a company with a pricing advantage (i.e. a standard error of 5%) tries to maintain higher margins (i.e. a margin of 20%).
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Table 4.8 – One company has a standard error of 5% and uses a 20% pricing margin

<table>
<thead>
<tr>
<th>Number of Companies</th>
<th>Average Price</th>
<th>Company 1</th>
<th>Other Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Market Share</td>
<td>Average Price</td>
<td>Average Margin</td>
</tr>
<tr>
<td>2</td>
<td>97.95</td>
<td>29.0%</td>
<td>103.30</td>
</tr>
<tr>
<td>3</td>
<td>93.84</td>
<td>11.1%</td>
<td>101.19</td>
</tr>
<tr>
<td>4</td>
<td>91.35</td>
<td>5.1%</td>
<td>99.52</td>
</tr>
<tr>
<td>5</td>
<td>89.61</td>
<td>2.6%</td>
<td>98.23</td>
</tr>
<tr>
<td>6</td>
<td>88.32</td>
<td>1.5%</td>
<td>97.10</td>
</tr>
<tr>
<td>7</td>
<td>87.29</td>
<td>0.9%</td>
<td>96.17</td>
</tr>
<tr>
<td>8</td>
<td>86.45</td>
<td>0.6%</td>
<td>95.35</td>
</tr>
<tr>
<td>9</td>
<td>85.74</td>
<td>0.4%</td>
<td>94.62</td>
</tr>
<tr>
<td>10</td>
<td>85.13</td>
<td>0.3%</td>
<td>94.05</td>
</tr>
</tbody>
</table>

As can be seen from the table above, a company with a pricing advantage can maintain higher margins; however, this is at the expense of market share. For example, with as few as four companies, its market share falls to 5%.

4.9 Summary

In summary, in an environment where the above assumptions hold:
- The quality of an insurer’s pricing has a significant impact on both its margins and its market share.
- To consistently perform better than its peers, a company must either:
  - have better quality pricing; or
  - must be able to differentiate on other than price.
- The scenarios where there are more insurers competing produce much poorer outcomes for all insurers.

5 Parameter or Model Risk versus Process Risk

To fully understand the Winner’s Curse, we need to understand and appreciate the uncertainty around the pricing of Group Risk business. In Group Risk, as in many fields of actuarial work, there are two main types of uncertainty that we come across and need to understand. In this paper, they are referred to as parameter risk and process risk.

To price Group Risk requires a best estimate which is an estimate of the expected future claim costs. Parameter risk is then the risk that the true mean is not estimated accurately. Parameter risk includes mis-estimation arising from the choice of model or models, the calculation of parameters used in the model, assumptions relied upon and the required use of judgement. A list of some sources of parameter risk for Group Risk pricing is shown in 5.1 below.

Process risk is the risk that the actual outcome will be different from the underlying risk. The main sources of this are typically: stochastic variability, systemic risks that lead to larger variations (e.g. flu epidemics) and changes to the actual underlying risks themselves from other external factors (e.g. increased unemployment).
GRIT [2006] provides an excellent description of the parameter risk and process risk in the context of actuarial work.

A situation where many of us will have recently encountered both parameter risk and process risk is with regards to LAGIC. In LPS115, the future stress margin in a large part covers the parameter risk of the estimated liabilities whereas the random stress margin is required to cover the process risk.

As parameter risk is the risk that the best estimate does not accurately estimate the true mean, it is parameter risk that is relevant when considering the extent of the Winner’s Curse.

5.1 Pricing Methodology

To fully understand the parameter risk associated with Group Risk pricing requires an understanding of how group insurance business is priced. Although there will be variations between insurers, the methodology will largely follow the same main steps. These steps are:

1. Estimate what the past claims experience has been  
2. Adjust the past claims experience to how we believe it will perform in the future  
3. Determine how much weight or credibility to give this estimate and blend it with the insurers own internal basis  
4. Add loadings for expenses, reinsurance, cost of profit shares, profit and/or cost of capital

Some insurers may perform steps 2 and 3 in reverse order.

All of the above steps are subject to parameter risk with some of the specific sources being:

- interpretation of data  
- choice of the experience period  
- segmentation of data  
- credibility formula to blend with an insurers book or risk rates  
- the book or risk rates themselves  
- IBNR methodology e.g. to use amounts v claim counts, choice of time interval  
- tail factors  
- use of subjective information  
- allowance for product changes  
- costing of profit shares

The list of all items that contribute to parameter risk is long; hence, the above list is not exhaustive.
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5.2 Can we quantify parameter risk?

Within the actuarial profession, we use the term “best estimate” to refer to the estimate of the mean of possible outcomes. Although the best estimate is a point estimate the best estimate is often only one estimate from a range of reasonable estimates.

To measure the parameter uncertainty in the best estimate is difficult and a number of possible methods could be adopted to provide some guide as to what a reasonable range of this variable could be. Some possible methods are:

- Carry out a study of how pricing estimates have varied from eventual outcomes. This could be achieved by either comparing the estimates of past claim costs or the estimates of future claim costs
- Perform a comparison of price estimates across multiple insurers
- Build a bottom-up view of parameter risk by quantifying the potential error from various elements of the price

To give some insight into the possible ranges, 5.3 below summarises the surprising results of Blumsohn (2009) which describes a survey on IBNR estimates that tabulated a very wide range of estimates. Section 5.4 considers a bottom-up approach by looking at few of the model choices that would need to be made in pricing.

In addition, many insurers will have recently determined their margins for LAGIC and pricing actuaries could look to build on this to arrive at a view of their own parameter risk.

5.3 Empirical evidence

Most pricing actuaries work within individual companies and so will only have a limited view of the range of prices produced for individual tenders; hence, they are unable to build a full view of prices in the market. Each individual’s experience is generally limited to the feedback that is provided during tenders and the range of prices provided by reinsurers.

One paper available that provides some evidence as to how independent views can vary is Blumsohn and Laufer (2009). In this paper, the authors surveyed 52 General Insurance actuaries, requesting them each to provide an estimate of the IBNR from a sample set of data covering 10 years of observed experience. The results of this paper showed that the IBNR estimates provided by the surveyed actuaries for the 10-year period had a standard error of 30%. The figure below shows a histogram of the IBNR estimates in their paper.
The 30% standard error in this paper is of more relevance to valuation rather than pricing as it includes the IBNR for all 10 years (including the most recent incurred year). We can, however, make use of the data provided in the paper, to carry out an analysis for a period more relevant to pricing i.e. by looking at the standard error of the IBNR for a select number of more recent years compared to the overall cost of claims over the entire 10-year period.

In the chart below, I have shown the range of estimates of the IBNR for the second to sixth most recent years.
The result of this exercise is that the standard error of the IBNR for a period that would be relevant to pricing is 32% of the IBNR or 5.1% of the total claims cost.

5.4 Bottom-Up Approach

Another possible approach to estimate possible parameter risk is to consider the individual source of variations within pricing and to try and quantify these.

This paper has only considered a few of the factors that go into determining the best estimate loss ratios. One vital component of past claims experience is the IBNR reserve and some choices that contribute to parameter risk are investigated below. Also contemplated is the impact of credibility model and choice of tail factors. Further work could be undertaken to expand this analysis.

5.4.1 Simple IBNR Model

When determining the IBNR, there are many options available and parameters to set. For the purposes of this paper, I have considered only the following:

- Choice of Experience Period
- Choice of interval
- Claim Counts v Claim Amounts

To look at each of the above, I have utilised a simple model based upon a hypothetical Group Risk scheme.

Assume that we have a Group Risk scheme with the following profile in the table below.
The Winner’s Curse in Group Risk

Table 5.1

<table>
<thead>
<tr>
<th>Age Band</th>
<th>Number of Lives</th>
<th>Sum Insured</th>
<th>Annual Claim Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>20,000</td>
<td>100,000</td>
<td>0.0005</td>
</tr>
<tr>
<td>30-39</td>
<td>25,000</td>
<td>70,000</td>
<td>0.0007</td>
</tr>
<tr>
<td>40-49</td>
<td>30,000</td>
<td>40,000</td>
<td>0.0014</td>
</tr>
<tr>
<td>50-59</td>
<td>20,000</td>
<td>20,000</td>
<td>0.0040</td>
</tr>
<tr>
<td>60-69</td>
<td>5,000</td>
<td>10,000</td>
<td>0.0060</td>
</tr>
</tbody>
</table>

For this scheme we assume that:
- Claims are incurred evenly throughout each annual period
- Claim delays are distributed according to a gamma distribution

Using the above scheme profile, we can run a number of simulations to produce incurred claims and notified claims. Using the notified claims, we can then calculate the IBNR using the basic chain-ladder method. By slightly varying the application of the basic chain-ladder method to the notified claims, we can then compare the results to each other and to the total incurred claims. This then provides a simple demonstration of how the result changes to variations in the model or the parameters.

5.4.2 Choice of period

In Group Risk pricing, one of the most important and difficult decisions is choosing the past exposure period upon which to base the rest of the pricing on. This is often an exercise in trying to find a balance between:
- including more recent periods where the final cost of claims is still very uncertain; and
- including older periods from which the underlying experience may have changed and is less relevant to the future; and
- including a sufficiently long period of time to maximise the amount of credibility from the schemes own experience.

Using the above example scheme, 10,000 simulations were run to generate the number of notified claims for a 10-year exposure period. From the notified claims, the total number of reported claims and IBNR claims were calculated for each of the 10 exposure years. This IBNR was calculated using the basic chain-ladder method without any adjustments. The results of this model are shown in the table below with year 10 being the most recent year of exposure.
The tables above show that the claim costs estimated from either of the 4-year exposure periods are unbiased. The loss ratio for the period using exposure years 5-8 has a standard deviation of 3.3% from the true mean, whereas the loss ratio using exposure years 6-9 has a standard deviation of 5.4%. Which exposure period to use requires careful judgement in each particular situation and there is often no right answer, with valid arguments for choosing either. However, the main point to note is that each period produces different results. For this example, the standard deviation of the difference between the two periods is 6.7% of the total claims cost and is a clear source of parameter risk.

### 5.4.3 Choice of Interval

Something as simple as choosing the interval used in the basic chain-ladder method for determining the IBNR, will have an impact on the best estimate loss ratio. Depending on the amount of claims we may use quarterly, half-yearly or annual periods in the basic chain-ladder method. A model where two different intervals are used can demonstrate the impact of this choice.

Using the same hypothetical scheme in table 5.1 and the same 10,000 simulations as in Section 5.4.2, I have calculated the IBNR for claim counts using an annual interval and a half-yearly interval using the basic chain-ladder method.

The results of these simulations show that:

- both calculations produce unbiased estimates of the mean; and
- the standard error of each estimate is similar; and
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- the standard deviation as a percent of the total claims is 1.3%.

Figure 5.3

As expected, the basic chain-ladder method produces unbiased estimates of the number of unreported claims for both the yearly and half-yearly intervals. We also see that, for a particular set of claim data, the IBNR estimates are not the same and the standard deviation of these differences is 1.3% of total claims.

It should be noted that the above is a simplified model and that as other factors come into play (e.g. changing delays, changing experience, SI, etc.), the true standard error between using different intervals for the chain-ladder method will, in fact, be greater.

5.4.4 Claims amounts v claim counts

Two different approaches to determining the IBNR are to calculate:

- the IBNR using claim counts and then apply an average sum insured; or
- to calculate the IBNR directly using claim amounts.
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To model these two approaches, I used the same model as above applying the basic chain-ladder method firstly to the claim counts multiplied by the average SI and compared this to the IBNR from the basic chain-ladder method using only claim amounts.

The results from this are shown in the figures below. In summary:
- both calculations produce unbiased estimates of the mean; and
- the standard error of each estimate is similar; and
- the standard deviation as a percentage of the total claims is 5.2%.

Figure 5.4

5.4.5 Credibility

Credibility is an entire body of theory in itself and I do not intend to explore it in any detail. Current market practice is generally to use relatively basic or straightforward methods such as the:
- Limited Fluctuation method; or
- Buhlmann-Stroub method
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Each method will give a different weighting to experience and a company’s own book rates. The choice of the method used will have a significant bearing on the final best estimate determined.

5.4.6 Tail Factors

Determining tail factors is an area that requires a considerable amount of judgement by the pricing actuary and there are many ways of dealing with this. Common methods (which may be combined) are:

- use the development pattern from other funds where more experience is available; or
- fit a distribution to the delay pattern that has been observed; or
- assume a standard run-off pattern; or
- assume that the data is fully developed (i.e. ignore it)

For TPD benefits, this is particularly important as claims can be reported with delays as long as 10 years or more after the date of disability, furthermore, it is not often that 10 years of claims data is available. Other complicating factors are:

- the increasing prevalence of lawyers; and/or
- experience is often not credible in the tail; and/or
- changes in claim reporting patterns over time: claim delays vary over time and the delays from claims incurred a number of years ago will be different from the claims incurred today for example due to streamlining of company or fund reporting processes.

The calculated tail factors can have a material contribution to the final best estimate and a significant impact on overall parameter risk.

5.4.7 Summary

The above sections cover only a few of different aspects of determining the best estimate and as discussed there are many options and choices to make in getting there. These choices range from a simple choice of methodology to the more subjective application of judgement and each choice has an impact on the final best estimate.

A useful way to consider these choices is as a number of random movements away from the true mean. If, for example, we have 10 independent pricing factors that each have a possible ±2% impact on the loss ratio then our parameter uncertainty would have a standard error of approximately 6.2% (i.e. \( \approx 4 \times \sqrt{10 \times 0.5 \times 0.5} \)). As each of the identified issues above are greater than 1%, it is very easy to see how the standard error could be as great as 10% as was used throughout Section 4.

As a price is built up from a large number of choices that are made in pricing, a reasonable assumption to make is that an individual best estimate is distributed normally about the true mean.
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For further reading that also looks into the issues surrounding parameter risk, I would suggest the excellent paper by Lewis et.al. (2005); this paper provides a very good discussion of many of the issues relating to Group Risk pricing.

6 Other factors to consider

So far we have assumed that both best estimates and prices are unbiased i.e. they are neither systematically too high or too low. This is not necessarily the case and we should consider what factors may lead to loss ratios and prices being biased.

In this paper, I have considered the following four factors that may lead to biased prices. These are:
- cognitive biases
- third party pressures
- market dynamics
- operational risk

6.1 Cognitive biases

A cognitive bias is any of a wide range of errors in decision-making arising from the way that people handle and process information. Cognitive biases are mostly sub-conscious; hence, everybody is subject to cognitive biases to some degree. This paper will only mention a few of the many cognitive biases that are particularly relevant to this topic.

6.1.1 Overconfidence

Much research has been carried out on tasks that involve judgement and decision-making and there is much evidence to show that people tend to overestimate their own abilities and skills. This conclusion holds whether or not it involves an area where people have no particular skill in or professionals operating in their own field. Taylor (2000) states:

"The conclusion from all the research is that overconfidence is greatest for difficult tasks, for forecasts with low predictability and for undertakings lacking fast, clear feedback. Unfortunately, much actuarial work satisfies all three conditions!"

Unfortunately, this means that pricing actuaries are likely to trust in their abilities much more than they should. If pricing actuaries were to be surveyed on how close they think their best estimates were to the true mean, then as a group, they would likely overestimate how close they were.

Much research has been carried out on the performance of experts in various fields and the conclusions are that there have been many cases found where experts perform worse than simple deterministic models.

6.1.2 Anchoring
Anchoring is where the availability of initial information subsequently influences future decisions, even if little or no credibility is later placed on that information. Experiments have shown that the effects of anchoring are extremely hard to ignore and that even the introduction of absurd anchors have an influencing effect (Kahneman (2011)).

Within Group Risk pricing we can be influenced by many anchors of which the most important is the current price. The pricing actuary needs to be conscious of the effect that an anchor can have.

6.1.3 Confirmation Bias

Confirmation bias is the tendency for people to favour information that supports their own position or desired outcome. This comes into play in a few different ways in pricing:

- A tendency to only search for evidence that supports the position we prefer to take. For example, if we are trying to justify a reduction in price, then we are more likely to look for information to support a price reduction and less likely to search for information that would lead to an upward revision;
- A tendency to place more weight on information and evidence that supports the position that we prefer to take. For example, if the recent experience of a scheme has been good we may try and justify placing more weight on that experience.

The danger of the above should be clear to all. If we are looking for evidence that supports a particular position, then we are more likely to find it and may not find information that supports the opposite position irrespective of how valid it may be.

6.2 Third Party Pressure

Whilst third party influences can be wide ranging, most of them are quite subtle. We are all familiar with the usual pressures that may be applied by parts of our business to provide the best price possible and hence maximise the likelihood of winning e.g. to be more aggressive and cut margins. Most of us are prepared for this and are more than capable of dealing with these pressures.

However, some of the dangers that are less obvious that need to be considered are:

- Are we only looking for evidence that will reduce the price? Are we increasing the likelihood that we will find evidence that reduces the price over evidence that increases the price?
- How do we react to information that will increase the price - do we give it equal or less weight?
- Is any evidence that will increase the price being withheld by third parties?
- Do we ultimately end up being more optimistic and end up being unconsciously influenced anyway?
- Where judgement is required, who do we discuss this with? Are these people sufficiently independent and unbiased?
The Winner’s Curse in Group Risk

- In pricing, there are a lot of choices to be made around assumptions. How can we be sure that we are not subconsciously introducing some bias – either through resisting the urging of being conservative or being influenced and being too aggressive?

6.3 Market Dynamics

There are features of the Group Risk market that are different from a straightforward common value auction that should be considered. Some of these are:
- the information asymmetry between the various parties i.e. the incumbent insurer, advisors, the fund itself and other participants in the market; and
- the tiered nature of the market with the existence of reinsurers; and
- the in-built options of many contracts have with the ability of the fund to retender when it wants; and
- the fact that some tenders have more than one round which can be either formal or informal.

Most of the above factors will likely have a downward influence on price. The main exception to this is: that it is generally in the interests of the incumbent insurer to release information that will result in a higher price.

6.4 Operational Risk

If an insurer makes an error in their pricing that results in too low a price, then this may result in them winning the scheme and incurring losses. Many tenders are complex and not all the same.

Most companies will rely upon the use of spreadsheets to perform much of their pricing. Spreadsheets are notoriously difficult to audit and check, so how confident are you that your spreadsheets are error free? Research performed by specialists in this field (Panko (2013)) has found that the majority of complex spreadsheets contain some sort of error. This is another area where there is a danger of being overconfident and we need to ensure that we have sufficiently robust processes in place.

7 Is there any evidence and if not why not?

Without any true evidence of the Winner’s Curse, the above discussions could be viewed as being little more than theoretical. If the Winner’s Curse does exist then we may expect to have seen losses by writers of Group Risk business. This section takes a brief look at the results for Group Risk business as reported by APRA and then goes on to discuss reasons that may counter the Winner’s Curse and why we may not be seeing losses.

7.1 APRA stats

The profitability of Group Risk business has been available from APRA since 2008. A summary of the quarterly results since then are shown below.
During this period, insurers have made reasonable profits with the average profit margin before tax of 6.8% for the period shown. While APRA did not report results prior to this period, my understanding is that most Group Risk insurers will have made reasonable profits for at least the past 10 years.

If this is the case, and the Winner’s Curse is material as the modelling above indicates, then we need to ask ourselves why has Group Risk business been profitable.

### 7.2 Economic

For the past 20 years, Australia has experienced uninterrupted economic growth and has experienced a Goldilocks economy. This has seen steadily improving standards of living. At the same time there have been major shifts in the mix of the economy itself. The relevant features of this are:

- Shifts from Blue Collar jobs and industries to more White and Grey Collar-based occupations and industries. For example, over many years there has been a reduction of jobs in the manufacturing sector and an increase in jobs in the professional services sector (see Table 7.1 below). Due to the nature of these industries, this should lead to lower IP and TPD incidence overall.
- Lower unemployment making it easier to find work
- Increasing urbanisation making alternative employment easier and nearer to find
Table 7.1 – Shifts in industry sector employment

<table>
<thead>
<tr>
<th>Industry Classification</th>
<th>Nov-84</th>
<th>Feb-93</th>
<th>Feb-03</th>
<th>Feb-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry and Fishing</td>
<td>6.1%</td>
<td>5.3%</td>
<td>3.9%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Mining</td>
<td>1.4%</td>
<td>1.1%</td>
<td>0.9%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>16.8%</td>
<td>13.7%</td>
<td>11.4%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Electricity, Gas, Water and Waste Services</td>
<td>2.1%</td>
<td>1.4%</td>
<td>1.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Construction</td>
<td>7.2%</td>
<td>7.1%</td>
<td>7.7%</td>
<td>8.8%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>5.3%</td>
<td>5.3%</td>
<td>4.0%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>10.4%</td>
<td>11.2%</td>
<td>11.9%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Accommodation and Food Services</td>
<td>5.0%</td>
<td>6.2%</td>
<td>6.8%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Transport, Postal and Warehousing</td>
<td>6.0%</td>
<td>5.1%</td>
<td>4.8%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Information Media and Telecommunications</td>
<td>2.4%</td>
<td>2.1%</td>
<td>2.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Financial and Insurance Services</td>
<td>4.0%</td>
<td>4.1%</td>
<td>3.7%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Rental, Hiring and Real Estate Services</td>
<td>1.2%</td>
<td>1.6%</td>
<td>1.7%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Professional, Scientific and Technical Services</td>
<td>4.0%</td>
<td>4.8%</td>
<td>6.5%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Administrative and Support Services</td>
<td>1.9%</td>
<td>2.4%</td>
<td>3.6%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Public Administration and Safety</td>
<td>5.8%</td>
<td>6.1%</td>
<td>6.2%</td>
<td>6.1%</td>
</tr>
<tr>
<td>Education and Training</td>
<td>6.9%</td>
<td>7.4%</td>
<td>7.4%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Health Care and Social Assistance</td>
<td>8.2%</td>
<td>8.9%</td>
<td>9.8%</td>
<td>12.0%</td>
</tr>
<tr>
<td>Arts and Recreation Services</td>
<td>1.1%</td>
<td>1.2%</td>
<td>1.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Other Services</td>
<td>4.2%</td>
<td>4.8%</td>
<td>4.6%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>

Source: ABS

7.3 Mortality Improvements

Pricing does not always fully allow for future mortality improvements and, to the extent that this is the case, will have created additional margins. The improvement in the Australian population (based upon ABS data) has been around 2.3% per annum for the
The Winner's Curse in Group Risk

period 2001 to 2011 when based upon a typical Group Risk portfolio. The figure below shows the standardised mortality rate for each of the year 2001 to 2011.

Figure 7.3 – Standardised Mortality Rate 2001-2011

Source: ABS

7.4 Occupational health and safety

Apart from an overall improvement in mortality, there have been other related improvements that will have contributed to an ongoing reduction in claim costs and improved experience. A study of worker’s compensation claim rates shows that there has been a consistent reduction in the number of worker’s compensation claims over the past decade. Although difficult to quantify, some of this will have inevitably reduced TPD and income protection claims.

Figure 8.4 below, shows that the reductions in worker’s compensation claims have been significant across most industry sectors.
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Figure 8.4 – Lost Time Injury Frequency Rate for Major Industries

Source: Safe Work Australia

7.5 Business or Insurance Cycle

“The Insurance Cycle affects all areas of insurance except life insurance, where there is enough data and a large base of similar risks (i.e. people) to accurately predict claims, and therefore minimise the risk that the cycle poses to business.” Wikipedia

Despite the above quote, the insurance cycle is undoubtedly a feature of the Group Risk market in Australia. In a hard market, there are fewer bidders, prices are high and insurers can maintain margins. In soft markets, there are many bidders, prices are low and similarly insurers’ margins are low.

Due to the above and other possible reasons loss ratios have been trending downwards for a number of years. Although some of this downward trend may have been anticipated it enabled insurers to maintain profits on Group Risk.

Recent years (which I’ll put down as 2008-2010) saw a softening of the market with significant price reductions or benefit increases. The industry is now already seeing a hardening of the market with some significant price increases on some funds over the past year.

The insurance cycle has had the effect of concealing the vulnerability of insurers to the Winner’s Curse. A danger for the future is either that the downward trend ends or eases or that a number of insurers decide they can fully allow for downward trends in their pricing. Under this scenario insurers will be much more likely to be exposed to the Winner’s Curse and accentuate the insurance cycle.
7.6 Conservatism

As a profession, we are generally very careful when providing opinions and may err on the conservative side. I’m sure that there are numerous cases where additional margins have been included in our pricing, especially when faced with significant uncertainty. This could be seen in part as a response to the Winner’s Curse without explicitly being the case.

8 So What?

As can be seen in Section 4, the implications of the Winner’s Curse can be very material. A company that is unable to accurately price a risk runs the danger of having reduced margins and possibly making significant losses. Some lessons or possible responses that should then be considered are described in the sections below.

8.1 Bid Shading

Considered in isolation, the rational response to the Winner’s Curse is to employ bid shading i.e. include an extra margin in pricing to allow for the risk that you have under-priced. Although there are many other considerations, the use of bid shading should be seriously considered; particularly, for keenly contested tenders. One extreme form of bid shading, is to not tender when there are a large number of participants.

8.2 Pricing Expertise

As can be seen from the modelling in this paper, a significant benefit is conferred upon a company that has a pricing advantage over other competing companies. The opposite can also be seen; in that it is a significant disadvantage not to be able to price as well as your competitors. To ensure that a company is best placed, it needs to ensure that it has a skilled and fully resourced pricing team.

8.3 Communication and Transparency

Education of decision makers is essential for them to make fully informed decisions. This needs to be followed up with clear communication and full disclosure of key pricing assumptions and a quantification of the uncertainty in pricing estimates.

8.4 Reinsurance

Use of reinsurance provides a useful reference point for your own pricing and can give a sense of whether you are at the high or low end of the range of best estimates.

8.5 Third Party Influence
Pricing actuaries should be aware of the influence that third parties can have. This should be taken into consideration when forming prices.

8.6 Control Cycle

As stated above, pricing is a difficult task because feedback is slow; however, this does not mean that we shouldn’t try. An excellent discipline is to go back and have a look at how the actual experience compares with the assumptions made. A review of this nature provides important feedback into the pricing process and is thus an important aspect of managing overconfidence.

8.7 Don’t Ignore It!

One of the reasons that I have written this paper is that the market responds best to the challenges of the Winner’s Curse if as many of the participants in the market are aware of it.

9 References


Capen, Clapp and Campbell (1971). Competitive Bidding in High-Risk Situations


Kahneman (2011). Thinking Fast and Slow, Allen Lane 2011


