Institute of Actuaries of Australia

A Survey of Personal Lines Pricing Practices in Australia and the United Kingdom

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1. Introduction

In 2000, Murphy, Brockman and Lee presented a paper to the Casualty Actuarial Society on the use of Generalised Linear Models to optimise insurance prices[1]. The paper, which is now part of the IAAust General Insurance specialist course, discusses a number of elements of best practice insurance pricing including:

- The use of Generalised Linear Models as opposed to traditional rating techniques (one-way and multi-way tables) in modelling both risk premiums and price elasticity;
- Various recommendations on risk premium modelling including:
  - Recommending separate models for claim frequency and severity by claim type;
  - Recommending separate treatment of large claims and events;
- Various recommendations on demand side modelling including:
  - new business (or conversion) demand; and
  - renewal demand;
- The use of external data in the pricing process; and
- The development and implementation of optimal pricing structures.

Based on our experiences working in Australia and the UK many of these concepts would appear to be much more common practice in the UK than in Australia.

The purpose of this paper is to document current industry practice in relation to short-tail personal lines pricing in both Australia and the UK, with the pricing process outlined in the paper by Murphy, Brockman and Lee used as a benchmark.

Industry Survey

We surveyed general insurance companies in both Australia and the UK to determine current practices in relation to short-tail personal lines (specifically Domestic Motor and Householders) pricing.

Fourteen insurers from Australia responded (including one from New Zealand), representing the majority of insurers writing short-tail personal lines classes in the region.

Nine insurers from the UK responded, representing a reasonable cross section of insurers in terms of both pricing sophistication and distribution channel. The responders include a mix of purely broker-based and direct companies together with insurers who write business through both channels.

[1] *"Using Generalised Linear Models to Build Dynamic Pricing Systems" by Karl Murphy, Mike Brockman and Peter Lee*

Note that for a number of survey questions the total percentage of responses may add to over 100% since some insurers answered yes to more than one response category.

The results of the survey are set out as follows:

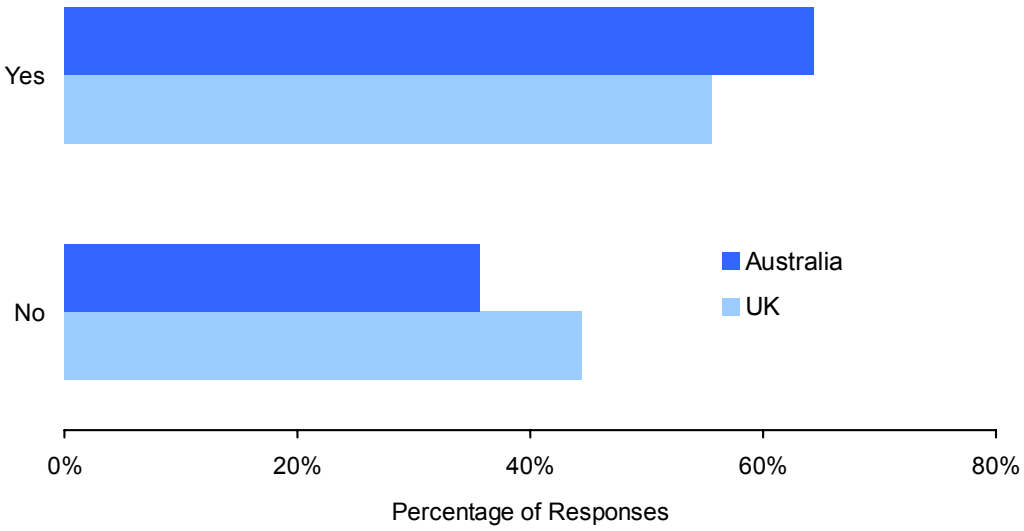
- Section 2 discusses industry practice in relation to the involvement of actuaries in the pricing process.
- Section 3 discusses the high level approaches to pricing used in each country.
- Section 4 discusses approaches to modelling the risk premium in more detail.
- Section 5 discusses approaches to expense allocation including the allowance made for expenses in each class in the pricing process.
- Section 6 discusses demand modelling in more detail including modelling both new business conversion and renewal demand;
- Section 7 discusses access to data and systems for pricing; and
- Section 8 draws conclusions.

2. Involvement of Actuaries in Pricing

The last ten years has seen a significant increase in the number of actuaries working within general insurance companies. Increasingly actuaries are responsible for a range of functions including pricing in both short tail and long tail classes.

We surveyed insurers to determine who is typically responsible for technical pricing within insurance companies.

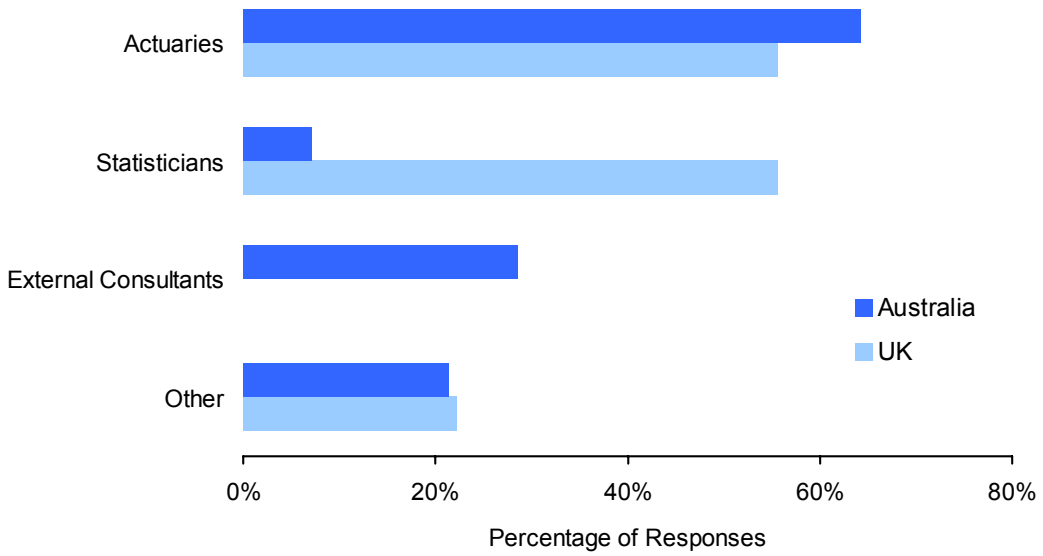
Do you have an internal actuary responsible for pricing in your company?



The survey shows similar results in both Australia and the UK. In both cases, approximately 60% of insurers have an internal actuary responsible for technical pricing.

Nine of the fourteen insurers from Australia and five of the nine insurers from the UK have an actuary responsible for pricing.

Who is responsible for technical pricing within your company?



The survey shows that whilst approximately 60% of insurers in each market have an internal actuary responsible for technical pricing, in many cases there is also someone else with responsibility.

In the UK, a number of insurers also have statisticians involved in the pricing process, perhaps reflecting the more statistically based pricing techniques used in that market (see later sections). Many of these statisticians are fulfilling an actuarial pricing role, often aided by external pricing software and supported by consultants.

In Australia, just under a third of insurers surveyed rely on external consultants for technical pricing support. This reflects the smaller size of these insurers and (in some cases) the difficulty in recruiting the appropriate expertise in-house.

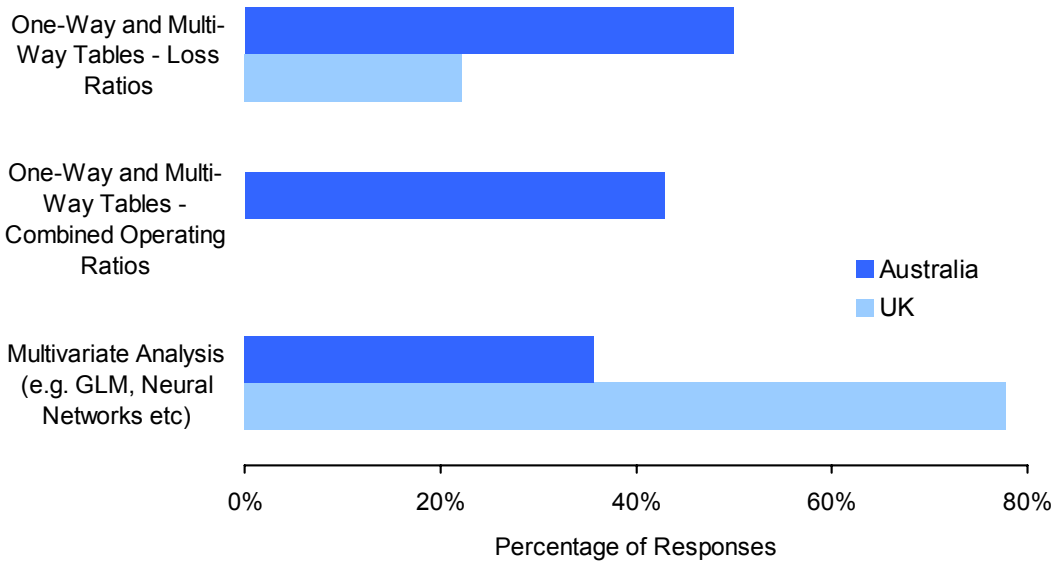
Others recorded as being responsible in some cases included underwriters, portfolio managers and business analysts.

3. Overview of Pricing Approaches

The traditional way to determine relativities by rating factor is to examine a series of one-way tables, either focusing on relative risk premiums, loss ratios or combined operating ratios. Numerous authors have documented the limitations of such approaches and increasingly insurers are utilising some form of multiple regression approach designed to remove any distortions caused by different mixes of business.

The most commonly adopted multiple regression approach utilised by insurers is Generalised Linear Modelling. We surveyed insurers on the approach they use to determine technical prices.

How would you best describe your current approach to determining technical prices?

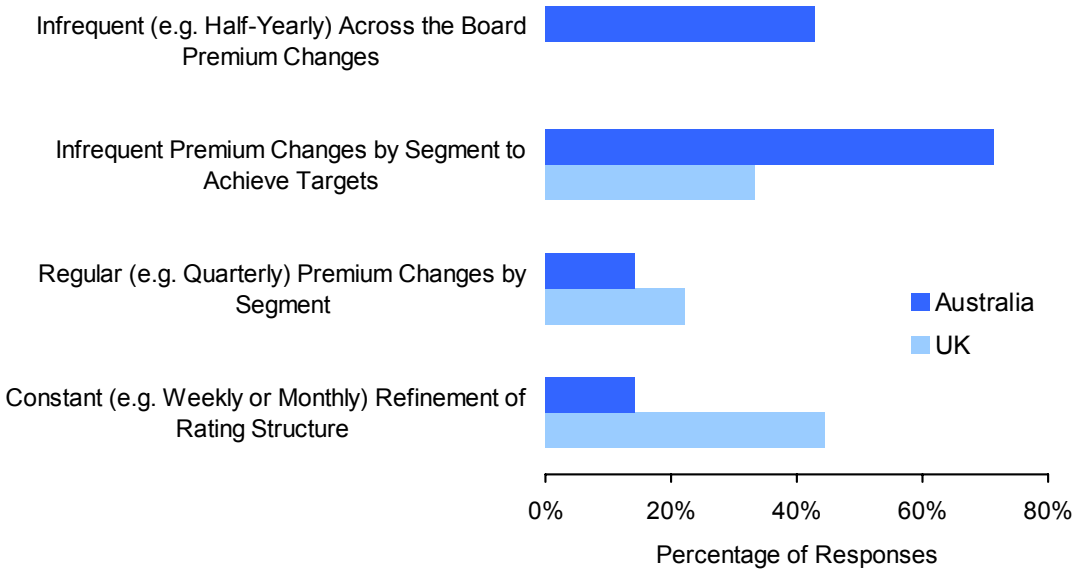


The survey results demonstrate a significant difference in the pricing approaches used in each market. Just under 80% of insurers surveyed in the UK utilise multiple regression approaches such as Generalised Linear Modelling.

By comparison, just over a third of Australian insurers (five of fourteen surveyed) use multi-variate approaches. A number of other insurers commented that they were currently in the process of investigating using such approaches.

Two Australian insurers use a combination of all three approaches.

Which of the following best describes your current approach to updating premium rates?



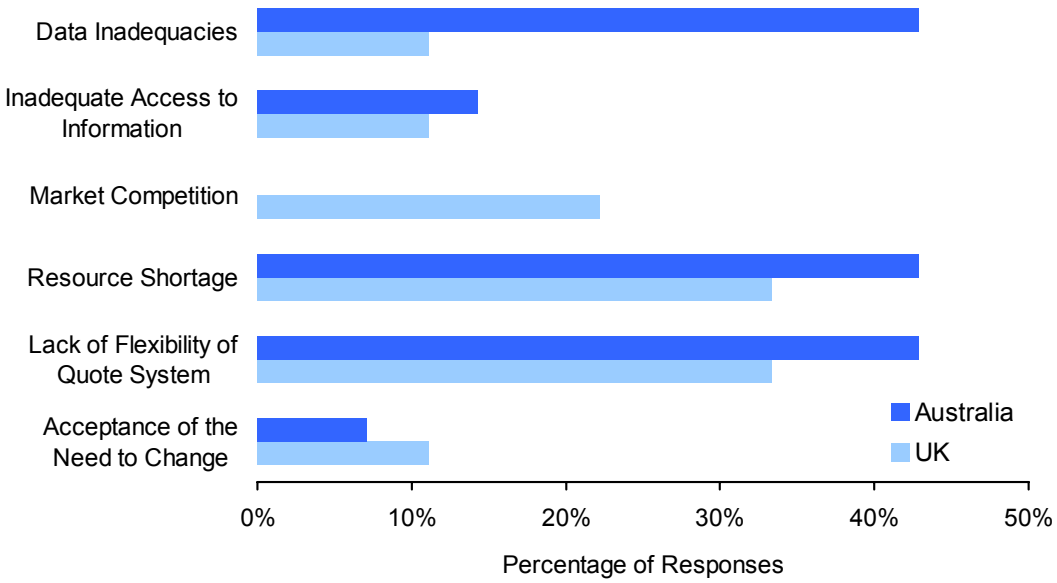
One would expect the more sophisticated insurers to make constant refinements to particular sub-segments of their rating structure, responding to changes in the competitive market and associated demand levels. At the other end of the scale insurers might be expected to make less frequent price changes, perhaps even across the board changes to the rating structure.

Based on the survey responses there is a significant difference in the practices of insurers in each market in terms of frequency of changes to the rating structure. Just over 40% of Australian insurers make infrequent across the board changes to the rating structure compared with just 14% who make constant refinements to the rating structure.

By comparison, over 40% of insurers in the UK make constant refinements to the rating structure, perhaps reflecting the fact that insurers in the UK would appear to have a more detailed understanding of the factors impacting on demand (see section 6).

A number of Australian insurers use a combination of approaches to updating their rating structures – for example combining infrequent across the board premium changes with regular changes by segment.

What would you describe as the biggest challenges facing you in technical pricing?



Some common themes emerged on the biggest challenges facing insurers in pricing today. A number of insurers in both Australia and the UK cited resource shortages and the lack of flexibility in their quote system as the biggest challenges they face in determining technical prices.

Over 50% of Australian insurers cited data and information related issues as the biggest hurdles to overcome in determining technical rates. This compares with just over 20% of insurers in the UK. Many UK insurers invested in improved data warehousing capabilities five to ten years ago and that investment is now bearing dividends in terms of the ability to perform analyses relatively pain free.

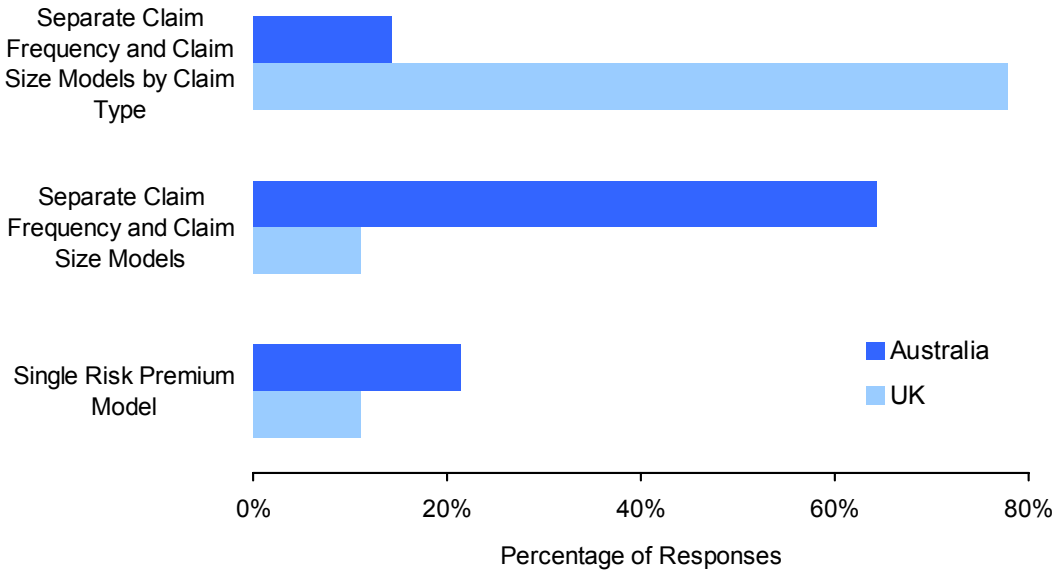
A number of insurers from the UK also cited the competitive state of the market as their biggest challenge in determining technical rates. Interestingly, no Australian insurers cited market competition as a significant barrier to technical pricing at present.

4. Modelling the Risk Premium

Brockman and Wright[2] recommend that separate models of claim frequency and claim size (average cost) be constructed for each type of claim covered under the policy in modelling the risk premium.

The other end of the modelling spectrum would be to simply construct a single model of the risk premium. By modelling the total risk premium rather than splitting it into its constituent parts, insurers are unable to identify whether an apparently anomalous trend is the result of a random fluctuation in average cost for a certain claim type (e.g. liability claims) or a genuine trend in claim frequency.

Which of the following best describes the level to which the risk premium is modelled?

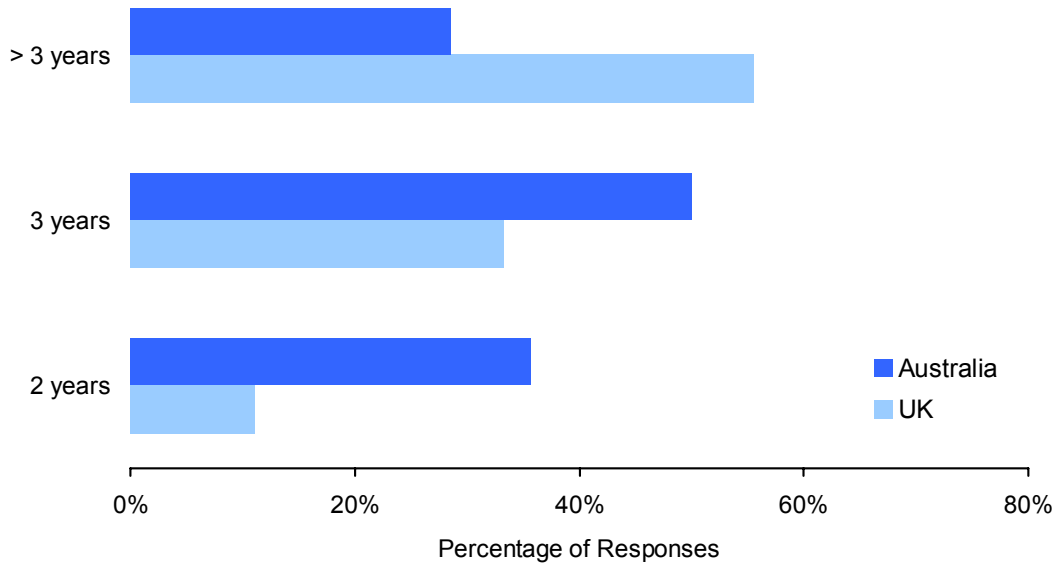


Not surprisingly given the level of statistical modelling sophistication, there is a stark difference between the two markets in terms of the detail to which the risk premium is currently modelled. Almost 80% of insurers in the UK develop separate claim frequency and claim size models by claim type compared with just 14% of Australian insurers. Note that to some extent this may be driven by the differences in the risks covered in each market (as an example, third party bodily injury risks are covered within Comprehensive Motor policies in the UK).

Most Australian insurers develop separate models of claim frequency and claim size, but do not separately construct these models by claim type. Three of the fourteen Australia insurers model the risk premium in total.

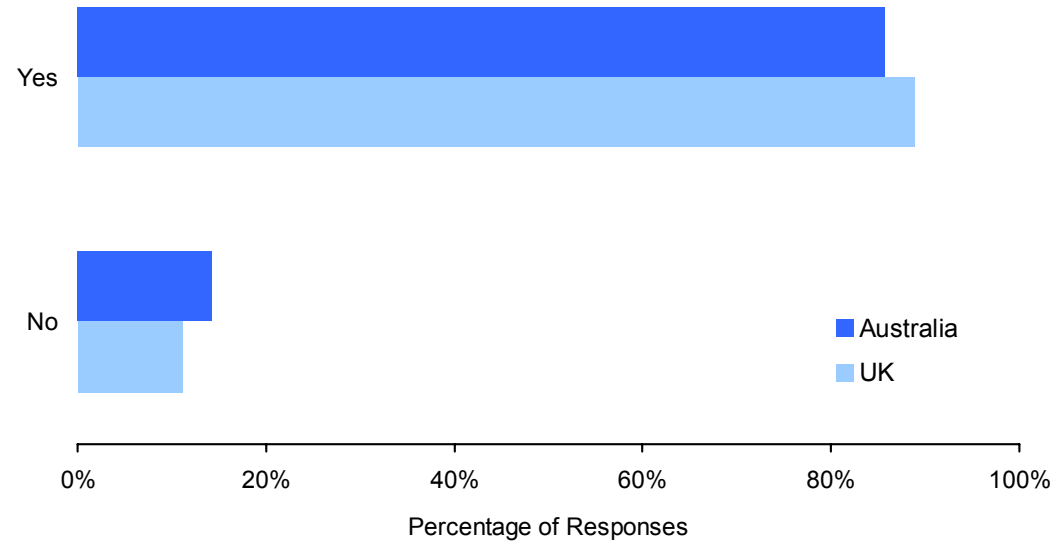
[2] See MJ Brockman and TS Wright, *Statistical Motor Rating: Making Effective Use of Your Data*, (JIA 119III)

How much claims history would you typically include in the modelling process (for attritional claims)?



All insurers surveyed typically include a minimum of two years historical data when modelling attritional claims. The majority of insurers use a minimum of three years data with over 50% of insurers from the UK using greater than three years claims history, again perhaps reflecting the work done getting data systems into place several years ago.

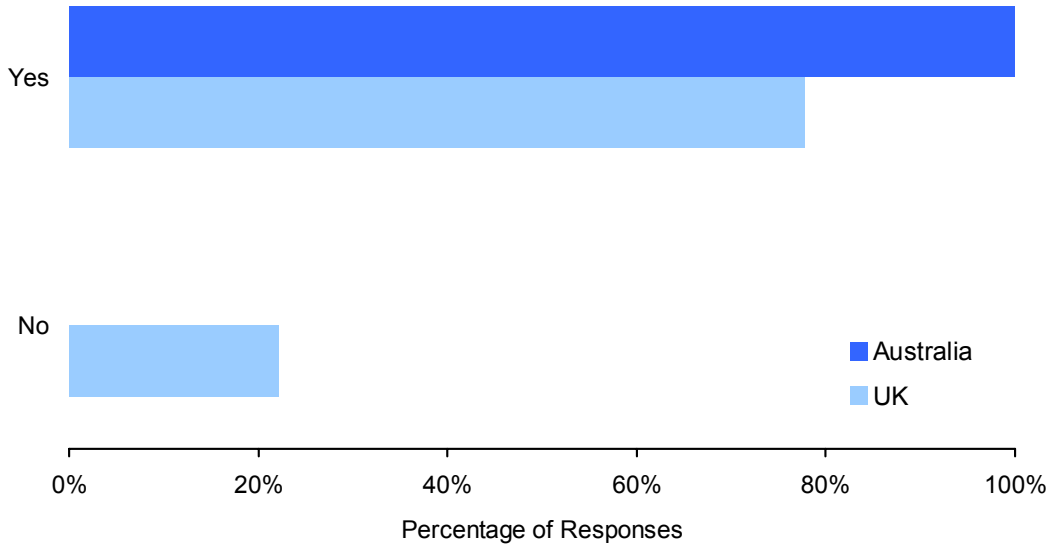
Are large claims treated separately as part of the modelling process?



Almost all insurers surveyed treat large claims separately in the modelling process. Fitting a model to the small claim average cost obviously gives more stable results than modelling total average cost.

Interestingly, the two Australian insurers who do not treat large claims separately in the modelling process were two of the more sophisticated insurers in terms of other areas covered in the survey.

Are events treated separately as part of the modelling process?



All Australian insurers surveyed treat event claims separately in the modelling process.

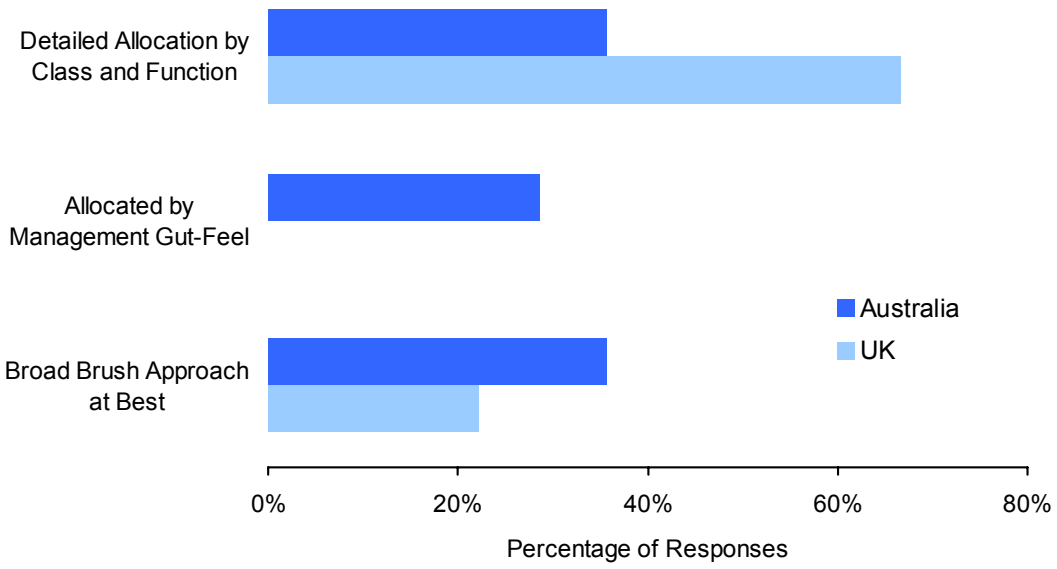
Two of the nine insurers from the UK do not treat event claims separately, although it should be noted that insurers in the UK are less at risk of event claims than their counterparts in Australia.

5. Expenses

Depending on the class, expenses generally represent between 20% and 40% of gross premiums for short tail classes of business. Despite representing such a large proportion of the total premium however, many insurers apply very little science to the allocation of expenses when determining required premiums for different segments of customers.

Whilst many expenses might be expected to be roughly proportional to premium, some expenses might also be expected to be related to claim frequency and/or claim size.

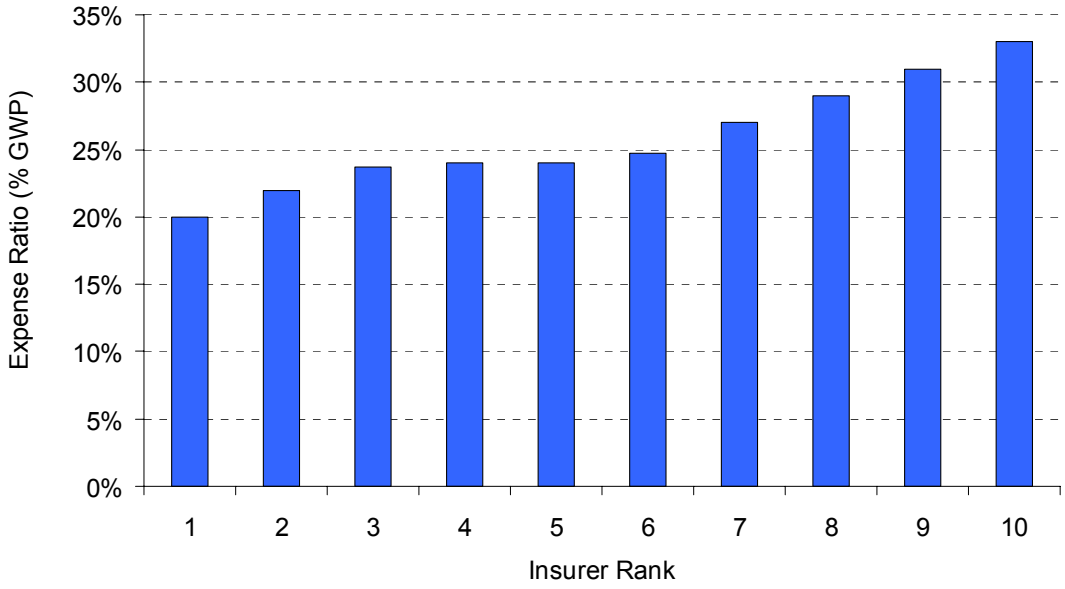
How accurately do you currently allocate expenses in the pricing process?



Insurers in the UK tend to take a more detailed approach to the allocation of expenses for pricing purposes. Two thirds of insurers in the UK allocate expenses by class and function compared with just 36% of Australian insurers. 36% of Australian insurers responding to the survey described their approach to expense allocation as “broad brushed at best”.

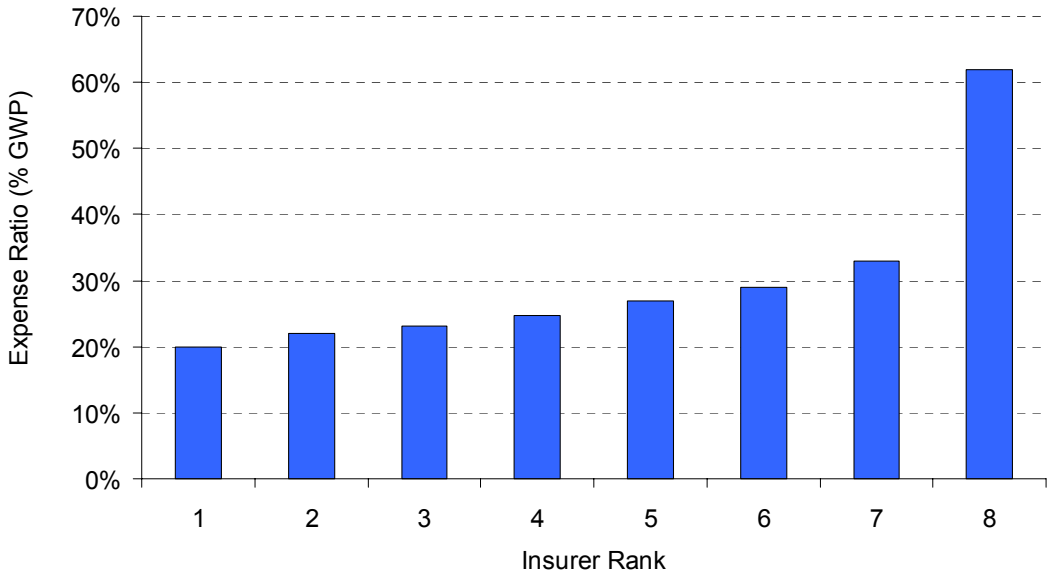
In addition to surveying insurers on their approach to allocating expenses, we surveyed insurers on the allowance they make for expenses in the pricing process (as a percentage of gross premium). The results are set out below, noting that a number of insurers did not complete this question. Results are shown for the combined Australian and UK markets. Based on the survey responses received there did not appear to be any obvious difference in the allowances made in each market.

What allowance do you make for expenses for Comprehensive Motor?



Expenses for Comprehensive Motor ranged from 20% of gross premium to 33% of gross premium. The majority of insurers had an expense allowance of around 25% of gross premium.

What allowance do you make for expenses for Third Party Motor?

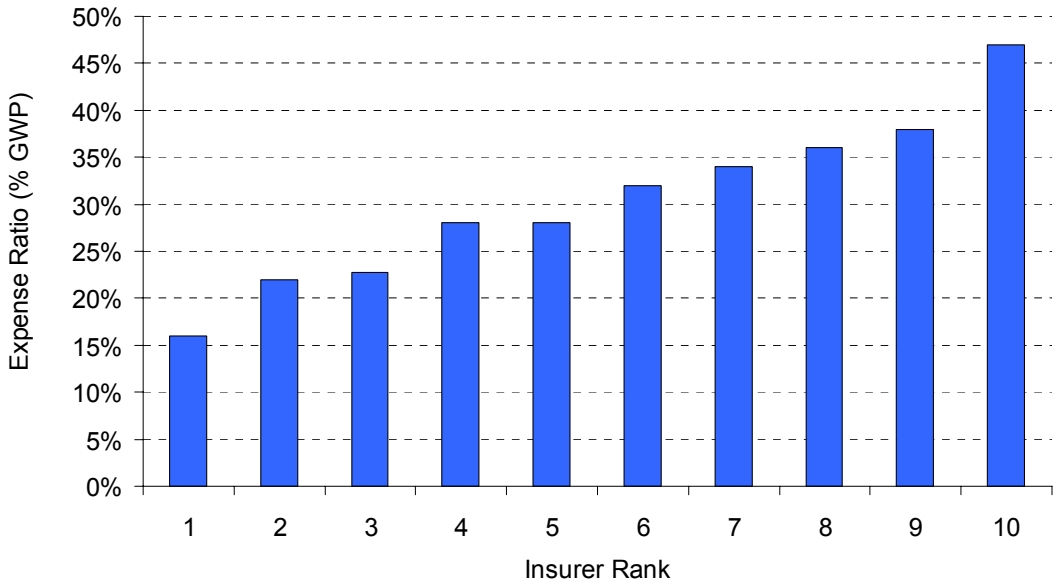


With the clear exception of one insurer, the majority of insurers who responded had very similar expense allowances (as a percentage of gross premium) for each of Third Party Motor and Comprehensive Motor.

With many expense items unrelated to premium size (for example policy administration expenses) and the average premium for Third Party Motor being around a third of that for Comprehensive Motor, one would expect the expense loading as a percentage of gross premium to be higher for Third Party Motor.

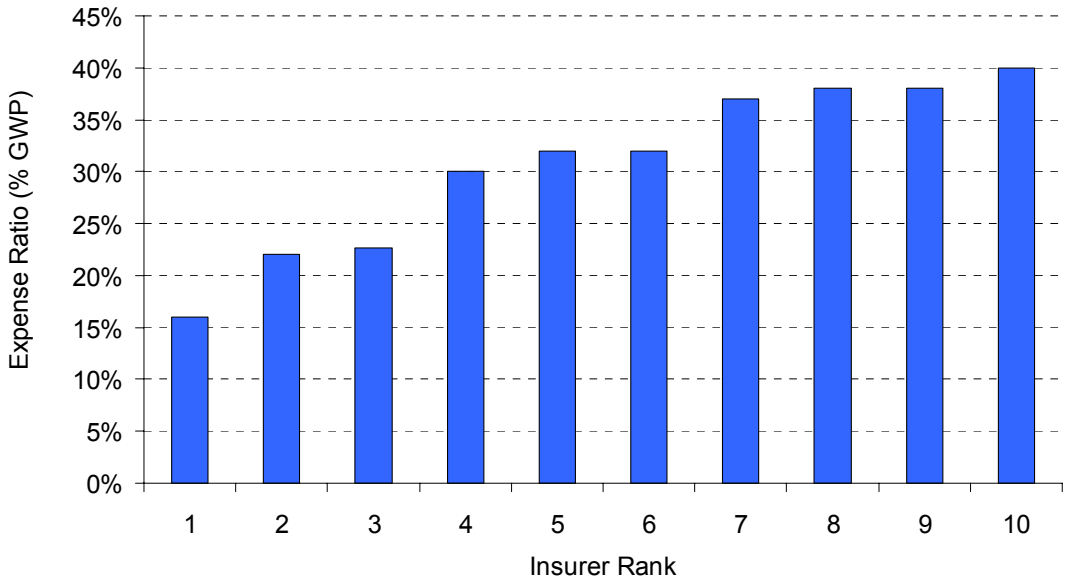
This suggests that insurers are either under-estimating the level of expenses for Third Party Motor or knowingly cross-subsidising expenses for this product with expenses for other products.

What allowance do you make for expenses for Buildings?



Ignoring the outliers at either end of the range, expense ratios for Buildings ranged from 22% to 38% of gross premium. There would appear to be a reasonably even spread of expense allowances within this range.

What allowance do you make for expenses for Contents?



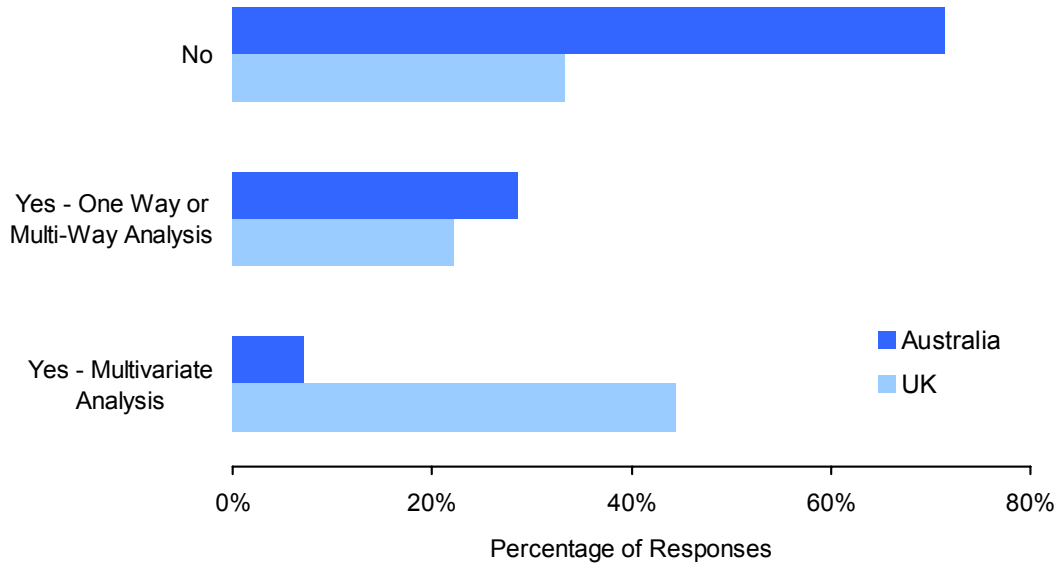
Similar to Buildings, ignoring outliers, the expense ratio for Contents ranged from 22% to 40% of gross premium with the majority of insurers assuming very similar expense ratios for each of Buildings and Contents.

6. Demand Modelling

Actuaries have traditionally been involved in modelling the claims cost side of the pricing equation. Just as important to the whole business process however, is the ability to understand how customers respond to price and price change (i.e. the demand side of the pricing equation). Similar techniques to those used for estimating risk premiums can also be used to estimate price elasticity functions for individual customers, and to identify areas of the portfolio with good or bad conversion/renewal experience.

There are two aspects to demand-side modelling, namely new business (or quote conversion) demand and renewal demand. There are some differences in the types of analyses performed on each, but the fundamental framework is the same for each. Examples of some of the differences in the approach for each are set out in the paper by Murphy, Brockman and Lee.

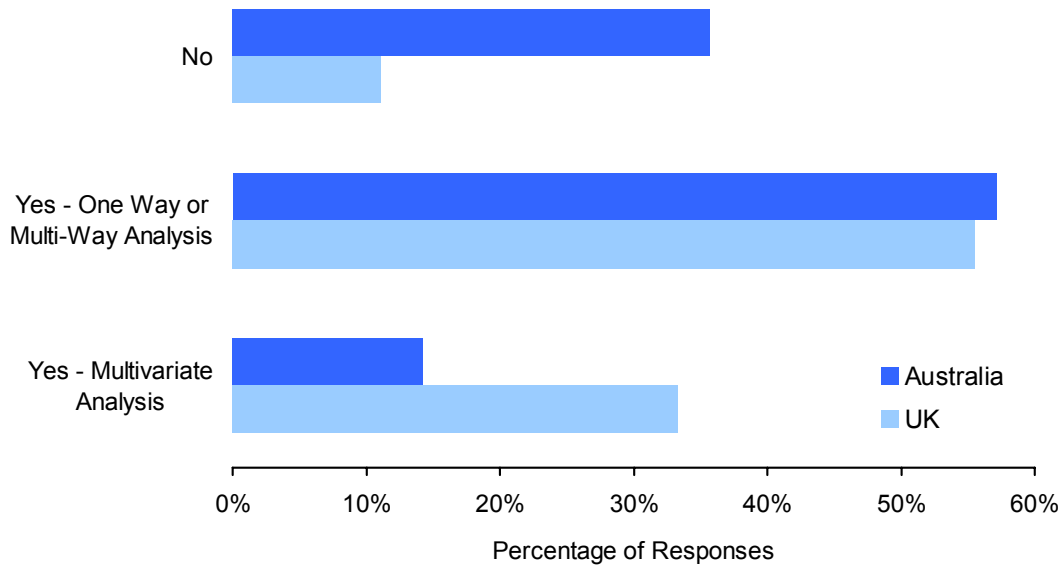
Do you explicitly analyse quote conversion rates by segment?



The majority of Australian insurers do not currently model quote conversion rates (i.e. the percentage of quotes issued that eventually become paid up policies) by segment. Just 29% of Australian insurers analyse quote conversion rates by segment, with one of these insurers analysing conversion rates using both traditional techniques and multi-variate modelling techniques.

By comparison, 67% of insurers from the UK explicitly analyse quote conversion rates, the majority of which use multi-variate techniques. In addition, a number of the insurers from the UK who do not analyse conversion rates operate through intermediaries or agents and hence only find out about the quotations that are converted into policies (and hence are unable to analyse quote conversion in any case).

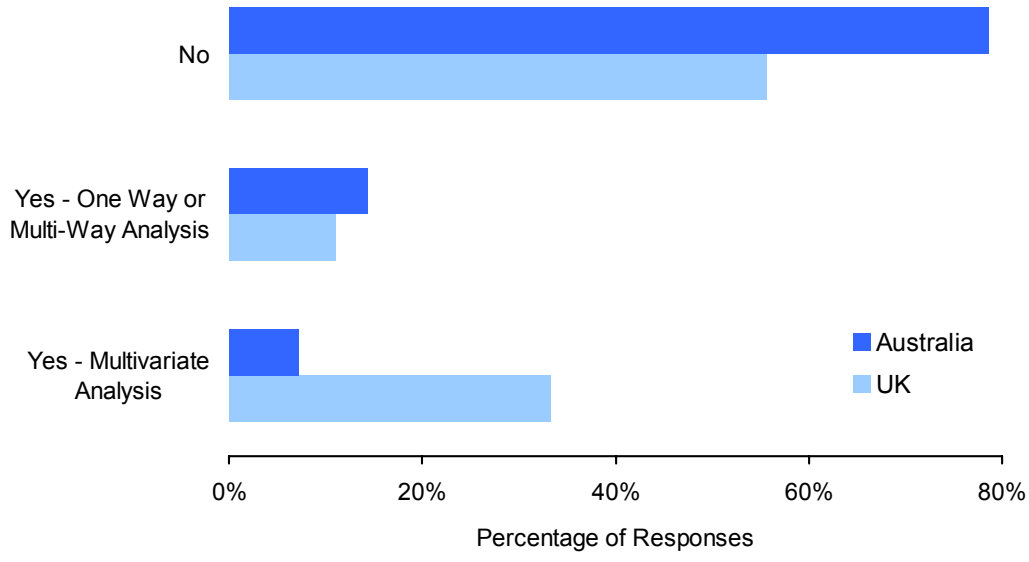
Do you explicitly analyse renewal rates by segment?



A surprising number of Australian insurers do not currently model renewal rates by segment. Just 64% of Australian insurers analyse renewal rates by segment, with the majority of those using traditional one-way or multi-way analysis as opposed to multi-variate analysis.

By comparison, 89% of insurers in the UK explicitly analyse renewal rates by segment with a third of those insurers using multi-variate analysis as opposed to more traditional one-way analysis.

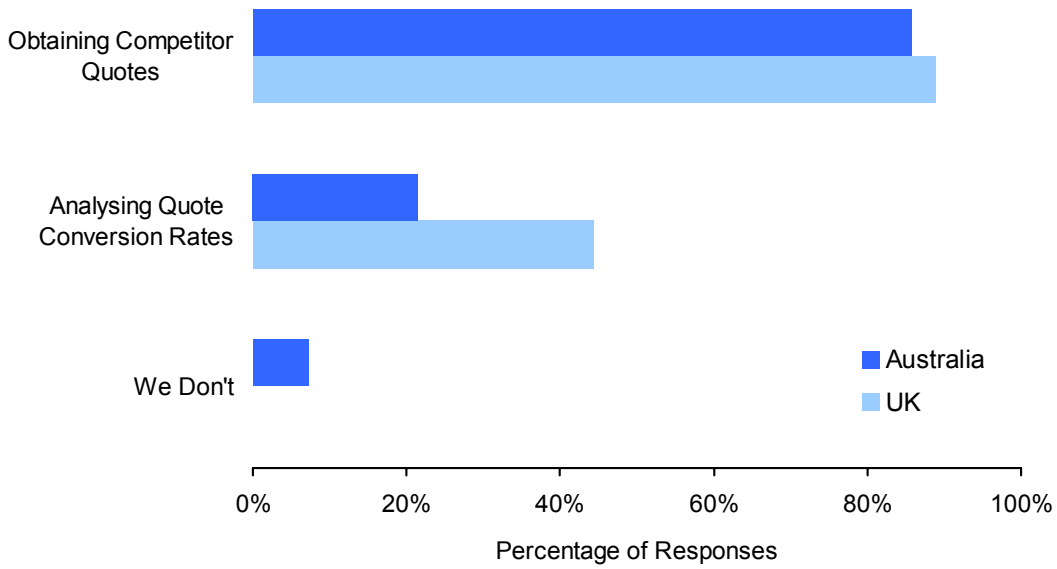
Do you explicitly analyse price elasticity?



The majority of insurers surveyed in both Australia and the UK do not explicitly analyse price elasticity. Just 20% of Australian insurers explicitly analyse price elasticity whilst 44% of insurers from the UK analyse price elasticity.

As with other modelling components, insurers from the UK are significantly more likely to use multi-variate analysis as opposed to traditional approaches to analyse price elasticity.

How do you measure market competitiveness by segment?



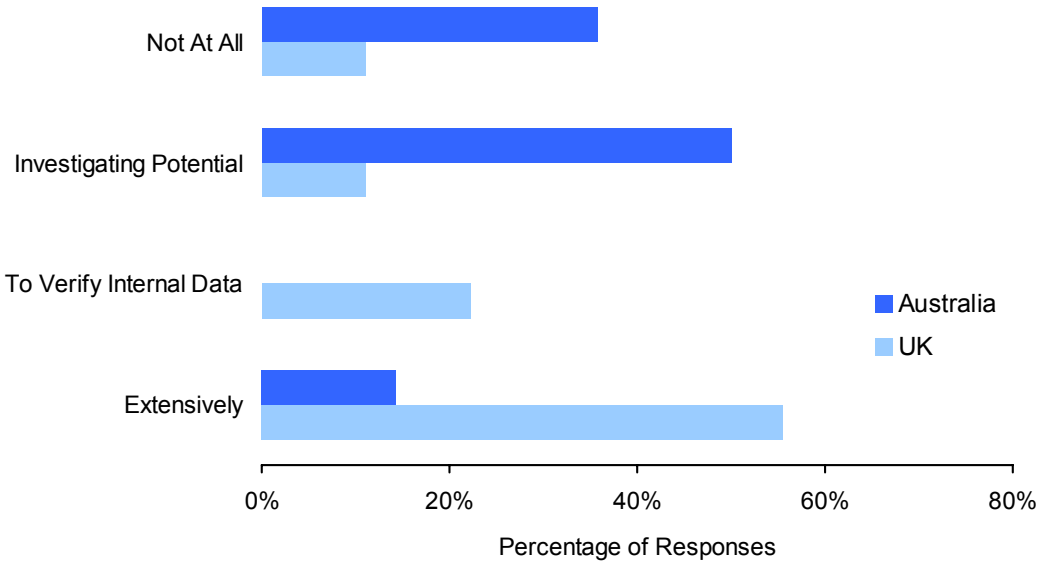
Almost 90% of insurers from both Australia and the UK use competitor quotes to help measure market competitiveness. A further 21% of Australian insurers and 44% of insurers from the UK also analyse quote conversion to measure market competitiveness by segment. Whilst the majority of these insurers use both competitor quotes and quote conversion analyses to measure competitiveness, one insurer in each market relies purely on analyses of quote conversion by segment to measure market competitiveness.

7. Data and Systems

In section 3 we found that data inadequacies (both data quality and data volume) represent one of the key barriers to insurers developing technical prices in both Australia and the UK.

We surveyed insurers to determine the quality of their data and their use of external data and insurance pricing systems to assist in the pricing process.

To what extent do you currently use external data in the modelling process?



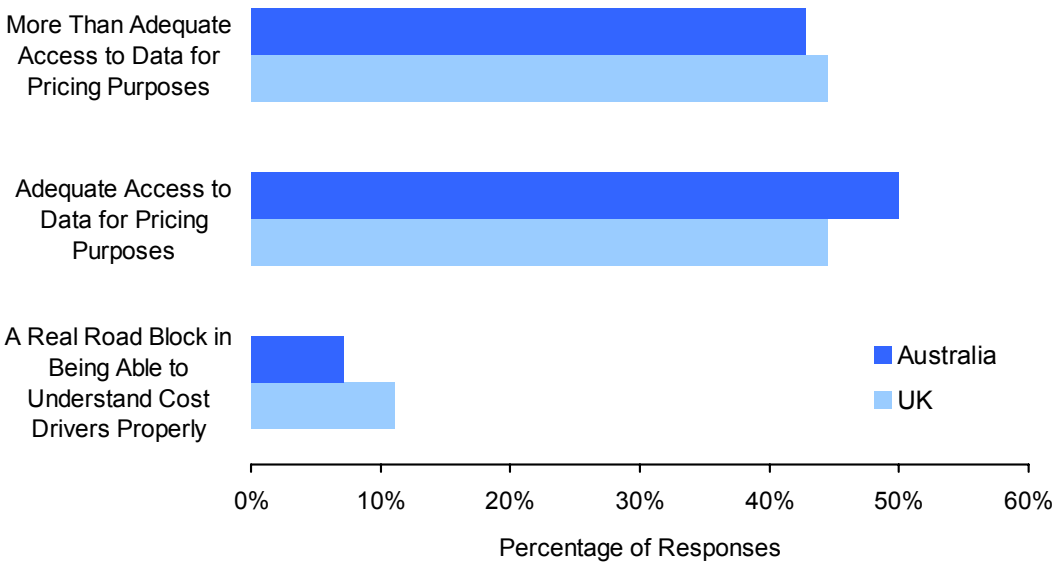
A variety of external data sources exist which can be used to supplement the insurer's existing information held on each policyholder. External data sources may include variables such as socio-economic information (e.g. household income, education levels etc), crime statistics, weather related variables and other factors such as distances to main roads, distances to railway stations etc. Usually this information would be appended based on the insured's postcode or census collection district.

Australian insurers are clearly behind the market in the UK in terms of the use of external data sources. Whilst 50% of Australian insurers surveyed responded to suggest they are currently investigating the potential of external data, only two of the fourteen insurers surveyed make extensive use of external data. In the UK, on the other hand, 78% of insurers surveyed use external data in the modelling process, with just under 60% using external data extensively.

It is important to note that the majority of external variables are highly correlated with existing rating factors. When assessing the additional value of such information, therefore, it is essential to do so within a multi-variate framework in order to ensure that correlation issues are properly addressed and understood. Simply looking at a one-way table will give very misleading results if the external information is correlated with other factors.

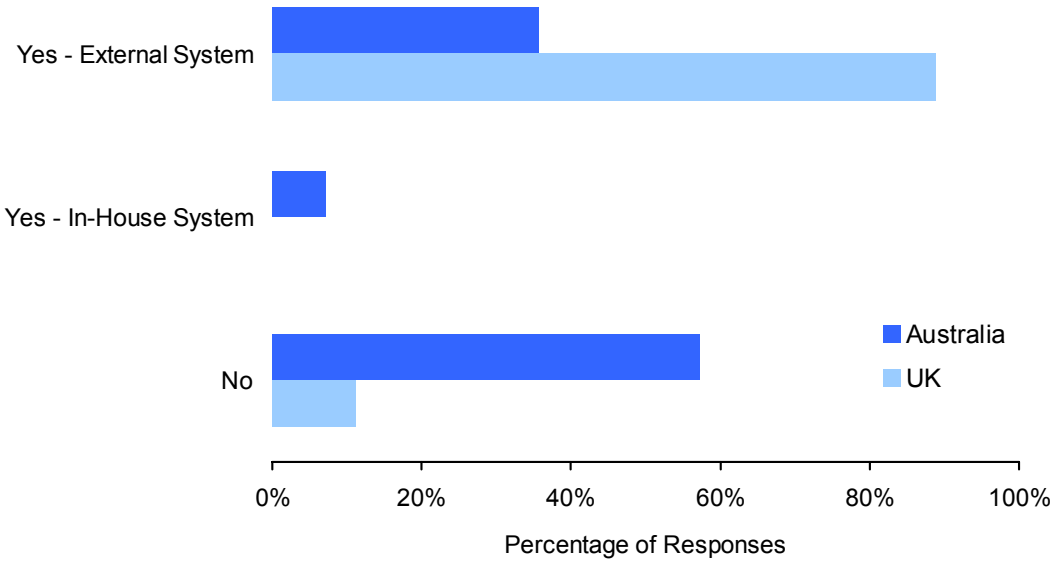
The majority (but not all) of the insurers who responded to say they use external data extensively in the pricing process also tended to use multi-variate techniques in developing models of the risk premium and demand.

Which best describes your current access to internal data sources for pricing purposes?



Surprisingly, insurers in Australia and the UK had very similar responses in relation to access to internal data for pricing purposes. Over 90% of insurers had at least adequate access to data for pricing purposes with half of these insurers in each market stating they had more than adequate access to data.

Do you currently use specialist insurance pricing software in the pricing process?



Eight on the nine insurers surveyed in the UK use specialist insurance pricing software to assist in the pricing process. This is consistent with the majority of these insurers employing multi-variate approaches to modelling.

Six of the fourteen insurers in Australia use specialist insurance pricing software systems, one of which developed their own in-house system to help 'automate' many components of the pricing process.

8. Conclusions

The purpose of this paper was to document current industry practice in relation to short-tail personal lines pricing in both Australia and the UK, with the pricing process outlined in the paper by Murphy, Brockman and Lee used as a benchmark.

The results of the survey clearly demonstrate that Australian insurers are 'behind' their UK counterparts in respects of various components of the pricing process. Specifically, relative to Australian insurers, insurers in the UK:

- use more statistically based modelling approaches in understanding the drivers of both the risk premium and demand;
- model the risk premium in more detail (e.g. by claim type);
- model the demand side of the pricing equation in more detail (including new business conversion, renewal rates and price elasticity);
- make more regular adjustments to the rating structure;
- allocate expenses in more detail;
- make more extensive use of external data sources; and
- utilise specialist insurance pricing software systems more extensively.

Many Australian insurers cite data inadequacies as the reason for employing less sophisticated approaches to pricing. Based on the survey responses, however, insurers in the UK would appear to have similar limitations in terms of data, yet still employ more detailed approaches to pricing. More likely, Australian insurers simply have lower budgets than their UK counterparts to invest in pricing capabilities.

It should be noted that a number of Australian insurers responded that they were currently in the process of assessing the value of a more detailed approach to pricing. Each of these insurers has just embarked on a multi-variate modelling approach for the first time and has begun either modelling demand in more detail or investigating the value of external data.

This would suggest that whilst the majority of Australian insurers have been able to retain profitable portfolios without necessarily adopting sophisticated approaches to pricing in the past, they may well be at risk of falling behind the rest of the market as the Australian marketplace gradually catches up to its UK counterpart.