HOUSEHOLD BUSINESS WORKING PARTY 1997

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0. Introduction

This paper describes various aspects of the UK household insurance market during 1997 and some of the actuarial considerations arising therefrom. Its purpose is mainly documentary and as such it should not contain too much material that is unfamiliar to an experienced practitioner. For part-qualified actuaries, however, or for actuaries working in areas other than household insurance, the paper may provide an easily-digestible introduction to current issues.

The working party make no apology for having concentrated on those aspects of UK household business that interest them most. In particular, the paper's emphasis is on pricing rather than reserving issues. Particular consideration is given to the increasing use in pricing of external datasets, and the related trend towards classifying risks to a finer level of detail. The views expressed in this paper are subjective - they are those of the working party, and do not necessarily represent the views of any organisation with which any member of the group is, or has been, associated.

1. Overview

The UK household insurance market has, over recent years, provided some excellent returns for participating companies. Since 1993, trends in theft claims have been extremely favourable, there have been no catastrophic weather-related losses, and premiums have contained reasonable margins. This recent claims experience has been significantly better than a reasonable long-term expectation but, as the number of years since 90A increases, this message is becoming harder to sell to boards and chief executives.

The current UK market for household insurance products is undoubtedly subject to greater competitive pressures than in the past. The trend of increasing competition is likely to continue for some time as new and recent entrants, particularly from amongst the direct writers and mortgage lenders, battle for market share. There seems little scope, however, for companies to compete through product differentiation, so most of this competition will focus on price.

Pricing actuaries have the opportunity to provide their company with a competitive edge through efficient use of the available data resources. A particular challenge is the careful selection, and appropriate use, of relevant external datasets.

The actuary must ensure that he or she understands the quality of data and limitations of all the data used in pricing. Internally held data must be used to the maximum, with every piece of data held being used to augment rating factor information. The actuary must also keep abreast of advances in computer technology and in statistical analysis techniques, and of developments in pricing models which may assist in setting premium rates so as to maximise portfolio profitability.

There was a time when actuaries had little or no input into the pricing of household business, when premium rates were uniform across the country, or varied broadly according to an underwriter's prejudices. Between 1987 and 1990, the random occurrence of the largest household catastrophe losses in a generation coincided with the breaching of a threshold in terms of affordable desktop computing power. Throughout the UK insurance industry, actuaries began to apply their statistical analysis skills to crude household claims data and seized control of pricing, introducing unprecedented complexity into household rating structures. The party is, however, now over. The actuary has run out of data, computers are no longer simple, and modern statistical methods bear no resemblance to those taught at university or in the Institute exams. The right to price household business is slowly passing to the statisticians and to the owners of external datasets. The actuary should recognise this trend, and consider whether it is a desirable one.

2. An Overview of the UK Household Insurance Market

2.1 Recent History

In recent years, the UK household insurance market has exhibited some characteristics similar to those of the private motor insurance market, albeit often with some time lag. The market penetration of the direct-writing companies has increased, as these companies have been able to benefit from brand-awareness built in the personal motor market. For many such direct-writing companies, however, progress has been slower and harder-won than might have been expected. In part, this has been a consequence of the relatively high proportion of customers who are tied, or who think they are tied, to their mortgage lender, particularly for buildings insurance. Whilst the Courts and Legal Services Act 1990, and a subsequent voluntary code of practice, have prevented lenders from requiring their mortgage customers to purchase own-brand insurance, this has had little practical impact because most of the new mortgages arranged today are "special deals" involving fixed initial interest rates and/or "cashback" arrangements, and such deals can include insurance as a compulsory part of the package.

At the same time, there has been a trend amongst the major mortgage lenders away from "panel" arrangements, whereby a risk would be placed with one of a number of insurers according to agreed criteria, and towards "sole supplier" arrangements with a single insurer. This trend has enabled the mortgage lenders to exert increased influence over product design, rating structures and commission levels. Legislation laid before Parliament late in 1995 has enabled building societies to establish their own general insurance subsidiaries, and there is a move amongst mortgage lenders generally towards more own underwriting, perhaps using a joint-venture

arrangement with an established household insurer as a transitional step towards this end.

Amongst the traditional household insurers, the volume of business being sold through the broker channel has been reducing. To combat the direct-writing operations, traditional insurers have been required to improve administrative efficiency through increased use of technology, and to control their commission rates. Some have established their own direct-writing subsidiaries, often adding household insurance as a second business line after having commenced operations writing only private motor business. There has been increased use of arrangements with affinity groups to gain market share by targeting niches - examples of this would be the arrangements with Age Concern, Help the Aged and SAGA to target the more mature policyholders who are generally perceived to represent better household risks.

Amongst the home service insurers, some smaller companies have lost market share or have pulled out of the market altogether, although those larger companies able to take advantage of economies of scale in their distribution and servicing of business and so compete with direct-writers on expense margins have been reasonably successful at maintaining market share. Another factor assisting in business retention has been that the particular socio-economic groups from which the home service insurers have traditionally drawn their customers have been more resistant to, or less able to take advantage of, purchasing insurance over the telephone.

2.2 *Premium Rates and Profitability*

2.2.1 Premium Rates

Premium rates for household insurance rose significantly during the early-1990s. Contents accounts were hit by recession-related theft claims, leading to double-figure premium increases in each of 1991, 1992 and 1993. Buildings accounts had also been hit by the high number of subsidence claims originating in the hot and dry summers of 1989 and 1990, and the 87J, 90A and 90G events had changed underwriters' perceptions of the probable maximum UK windstorm loss, prompting rises in rates for property catastrophe reinsurance cover. Both of these factors, and the lesser factor of worsening theft, contributed to increases in buildings premium rates between 1990 and 1993.

Coinciding with the increases in household premium rates was an increase in the sophistication of premium rating structures, as geographical rating by postcode district, and then postcode sector, became the norm. Other rating factors, such as policyholder age for contents, and property age for buildings were added, or if already used, were divided into finer rating categories. The move to postcode-rating led to increased geographical variation in rates, driven by the theft, subsidence and flood perils and facilitated by newly-available external datasets, increased desktop computer power and improved statistical analysis techniques. A combination of rising overall premium rates, and greater geographical variation, meant that a policyholder in one of the newly-identified high-risk areas could experience a significant year-on-year premium increase - some exceptional cases seeing premiums double at a single renewal.

Household insurance premium rates peaked in 1994, and fell thereafter, although they seem to have stabilised during 1997. Increasing competition in the market, largely the result of the direct-writers seeking to emulate their successes in the private motor market, has driven down average commission rates, and improvements in technology have assisted companies in reducing other expenses. Contents rates have benefited from a reversal in the earlier trend in theft costs, and buildings rates from an absence of windstorm or flood catastrophe losses. During the period from 1994 to the time of writing this paper, the only major weather-related losses have been the summer-1995 subsidence event and the year-end 1995 freeze. The household market has also benefited from reducing rates for catastrophe reinsurance cover, reflecting increased capacity in the reinsurance market, particularly in Bermuda. A period of exceptional capital growth on UK equities has assisted the solvency position of many companies - particularly important for those composites hit by mortgage indemnity losses in the early-1990s. This excess solvency has enabled companies to cede less premium and profit to reinsurers by increasing catastrophe retentions, and this has benefited premium rates, particularly for buildings cover.

Throughout the period of the 1990s, one underlying factor affecting premium rates has been a continuation of the long-term trend towards wider policy coverage, although its effect has been offset somewhat by increases in the size of compulsory and voluntary excesses.

At the time of writing (mid-July), household premium rates appear to have stabilised, with indexation of sums-insured providing many companies with the premium increases necessary to match inflation of claims and expense costs. Some companies, however, are trying to talk rates up, but the market is so competitive that significant increases are not possible without exposing business to lapsing.

2.2.2 Profitability

When commenting on the profitability of a household insurance account, one should always be aware of the difference between the reported profitability, which may merely reflect an absence of major weather-related losses during the accounting period, and the underlying profitability, which corrects for the random occurrence of infrequent catastrophe events. The introduction in 1996 of statutory claims equalisation reserves for property insurance has reduced the scope for difference between these two quantities.

Many companies reported record household underwriting losses in 1990, owing to an unprecedented combination of large weather-related losses, in particular 90A/90G and the summer subsidence event. With the assistance of dramatic premium rate rises, and an absence of catastrophes, most companies struggled back to apparent profitability in 1992, but only achieved profitability against long-term loss expectations in the following year. 1994 was the peak of the profit cycle, after which time profits have been driven down by intense competition. In 1996, many companies were again able to report profits only in the absence of major catastrophes, and there is some concern in 1997 that much household business is being written at rates that are insufficient to meet profit targets based on an average long-term expectation of claims costs.

2.3 Market Size and Composition

Assessing the size of the UK household insurance market as a whole, or the market shares of individual companies, is not an easy task. A significant problem is the aggregation within DTI returns of domestic property business with commercial business, as part of the Property accounting class. A very few companies provide

household business volume figures in their published accounts, but these may not be broken down between buildings and contents covers, and may typically appear only when business volumes or premium incomes are increasing. Other difficulties arise from differing definitions of household business - for example some companies may include domestic all risks business within the household account whilst others do not.

The working party has compiled estimates of total market size obtained from various more or less informed sources, including statistics compiled by the ABI. Unfortunately, the most recent year for which estimates were available from all sources is 1994. For this year, the estimates of total UK household insurance premium income fall in a range between £4.9bn and £6.3bn. Because premium rates have fallen significantly since this time, a corresponding estimate for 1997 might be centred on £5bn.

Some estimates were also obtained of the split of UK household insurance business between buildings and contents covers. Buildings covers are estimated to comprise around 45% by number of covers, but 55-60% by premium owing to their higher average premium per cover. A typical premium for buildings cover during 1997 might be around £130, whilst for contents cover might be around £100.

The working party also attempted to compile, from published sources and "informed guesses", a table of market shares (by premium income) for various individual companies. Again, a high degree of variation was encountered, as indicated by the ranges of estimates provided for the largest companies. It may be the case that the only individuals with access to accurate market composition data are the property catastrophe reinsurance underwriters, who enjoy access to exposure figures provided by those companies seeking quotations.

Estimates of Market Share for the Largest 10 Players

(from a range of published and company sources)

	Minimum	Maximum
Royal & Sun Alliance	19%	27%
Commercial Union	7%	12%
General Accident	7%	10%
Guardian Royal Exchange	7%	9%
Eagle Star	7%	8%
Prudential	4%	6%
Norwich Union	4%	5%
C I S	4%	5%
Legal and General	1%	4%
Zurich	1%	2%

This group of 10 companies is variously estimated as having between 60% and 85% of the total market.

3. Product Issues

3.1 Rating Structures and Product Design

The premium rating structures used for household policies are still relatively unsophisticated in comparison with those for private motor. One reason for this has been the absence, at least until recent times, of strong competitive pressures in the household market. Some significant trends in rating structures are summarised in the following paragraphs.

Largely in response to a perceived increase in subsidence risk, property age has increasingly been used as a factor for buildings cover. The construction standards to which a property was built, and particularly the depth of its foundations, depend upon the year of construction of the property and can determine the susceptibility of the property to damage from subsidence. Following the particularly poor subsidence claims experience of 1990/91, many companies have increased their compulsory excess for this peril, and the market now seems to have settled upon a standard subsidence excess amount of £1,000.

The property type (detached, semi-detached, flat, maisonette etc.) and construction type (brick, stone, concrete etc.) have also increasingly been adopted as rating factors for buildings cover. Such characteristics are particularly important in determining the potential losses from windstorm and flood. With windstorm, for example, properties having lighter construction may suffer more extensive damage. Northern Scotland, despite suffering much worse storms than the South of England, experiences much better storm claims experience owing to the sturdy construction of properties. In the case of flood, physical damage to top-floor flats is unlikely.

As the perception of geographic risk differentials has increased, particularly for flood and subsidence perils, many companies have increased the number of geographic rating areas used to categorise buildings risks. Multi-dimensional area-rating systems, where a risk may be categorised into different rating areas for different perils, are becoming more common. At the same time, the size of the geographic areas within which all risks are rated similarly has reduced. Published rate guides and broker systems now generally categorise risks into rating areas according to the postcode sector. Increasing use is being made, however, particularly by the telephone-sellers, of on-line premium generation systems which use the full postcode. Such detailed geographic rating classifications require the use of external datasets, which are discussed in detail in sections 3.3 and 3.4.

The premium rating structures for contents covers are generally more sophisticated than those used for buildings covers. Rating by policyholder age is now almost universal, with older policyholders generally attracting lower premium rates. Many arguments have been forwarded to explain the associated patterns in claim experience. These include supposed generational differences in morality and in the care taken of personal possessions, and the suggestion that age may be used as a proxy for occupancy in that retired policyholders are more likely to be at home throughout the day.

No claims discount systems are becoming increasingly prevalent for contents covers although they remain rare for buildings covers unless only a combined cover is offered. The discounts granted are considerably smaller than those available under private motor policies - a typical maximum discount would be 25%, and scales are much shorter - typically 2-4 years in length. These characteristics reflect the lesser degree of control that a household policyholder may exert over claims experience particularly that in relation to natural perils. As with private motor business, companies are concerned not to become uncompetitive for new business as a result

of a generous NCD scale. As a consequence, new customers are typically allowed entry to the scale with credit for past years' experience, and only first time policyholders are charged gross premium rates.

During the early 1990s, when contents premiums increased rapidly owing to sharply deteriorating theft claims experience, many companies increased the amounts of compulsory excesses as a means of avoiding imposing premium increases which would otherwise be unacceptable to policyholders. As premium rates have fallen back, and competition has intensified, some companies have increased excesses further in order to reduce the number of small claims and enable more competitive premiums to be quoted. The availability of large voluntary excesses has also increased, enabling high net worth individuals to partially self-insure.

Following the poor theft claims experience of the early 1990s, policyholders have increasingly been rewarded by premium discounts for taking preventative measures against burglary. Discounts are now generally offered for security measures such as window locks, deadlocks, door bolts and alarms, and for membership of a neighbourhood watch scheme. Additionally, some companies have arranged discounts for their policyholders with alarm suppliers or locksmiths.

Contents insurance products display greater diversity of design than do buildings products. Customers may choose between sum-insured and bedroom-rated products; policies with or without accidental damage cover; policies with or without domestic all risks cover; and between claims settlement on an indemnity or a replacement basis. However, there is now a greater awareness in the industry of the potential for adverse selection that companies offering both sum-insured and bedroom-rated products are exposed to. This has reduced the number of companies offering both products.

There have been many recent additions to the "standard" household product, with added value elements such as domestic helplines, legal helplines and legal expense cover increasingly being included at no apparent extra cost to the customer. Some other features increasingly being made available as policy extensions include annual travel insurance and white goods extended warranty cover. A particular feature of many of the recent additions to the scope of policy cover is that the service being promised to customers is provided by a third-party, so that its immediate quality and long term price may be outside of the control of the insurer.

3.2 Rating by Unit Postcode or Full Postal Address

A full description of the system of Royal Mail postcodes, and of the practical implications of using postcodes as a geographical rating factor for household business, is given in Appendix A.

Increasingly, companies are seeking to gain competitive advantage by rating at the full (unit) postcode level, and there is some talk of rates being set for individual properties. It is only in recent years that the computing power necessary to enable these options to be considered has become readily available. There remain problems for some companies, however, with this level of rating detail. Many broker quotation systems cannot cope with postcode segmentation below the sector level, and some companies may still require to commit their rates to paper, which is difficult enough at the sector level and wholly impractical at lower levels.

The first companies able to successfully introduce rating at sub-postcode sector level will be in a position to "cherry pick" those risks that they favour. When working at this level of detail, however, it is particularly difficult to ensure that the rating methodology is sufficiently robust, since historic claims experience will be sparsely

distributed between rating cells - any company's own experience is unlikely to support the differential pricing of adjacent unit postcodes. As a consequence, there has to be a far greater dependence on other sources of data, whether customer data held on the company's own systems or external data thought to be relevant to the underlying risk. Since external data will almost certainly be necessary to support sub-postcode sector rating, then pricing actuaries will increasingly become "data shoppers", rather than data collectors and extractors. In such an environment, a key element to being able to price successfully will be to identify and purchase external datasets of sufficiently high quality, and to recognise any limitations of that data, so that only genuine, credible differences in underlying risk are reflected in the premiums charged. One possible consequence might be a resurgence of interest in the ABI Household Risk Statistics Scheme (HRSS), or the establishment of additional data-sharing arrangements.

Some issues related to premium-rating using external datasets are considered in more detail in Sections 3.3. and 3.4.

Although each individual company has an understandable interest in developing a premium-rating system more refined than those of its competitors, the move towards extremely low-level geographical rating has potentially adverse consequences for the household insurance industry as a whole. As properties (and individuals) are rated in increasingly small groups then the degree of risk-pooling will be reduced and the range of premium variation will increase. Already, articles in the national press have remarked upon the increasing sophistication in flood-rating, and on the possibility that some properties may become uninsurable at a price affordable to their occupants. This issue is explored in detail in section 3.5. Although the process of sophistication may now be unstoppable both for flood- and subsidence-rating, it is questionable how much further the principle of risk-segmentation should be taken.

There seems to be a natural tendency amongst actuaries to make their work more and more refined. However, it may be that any increased accuracy in matching premiums to the underlying risks will not justify the increased overheads necessitated by such detailed pricing, particularly given the prices charged for some external datasets. Unless detailed pricing is matched by a similarly detailed marketing campaign, it is also questionable whether potential or existing customers are sufficiently price-sensitive to make such work worthwhile.

For the foreseeable future, it is unlikely that there are many situations where the premiums charged for adjacent groups of 15 identical houses would need to differ. This is particularly so in the case of contents business for which the major component of the risk premium - theft - may vary between locations in a more "smooth" manner than, for example, the subsidence risk under a buildings policy. There is, however, a recognised need to rate houses at a finer level of detail than postcode sectors, and the only practical means of achieving this may be by aggregating groups of adjacent unit postcodes.

When considering working at such a low level of detail as the unit postcode, the actuary must recognise the distinction between rating and so-called "red-lining". Whilst it is undoubtedly the case that some geographical areas as small as unit postcodes or individual properties may be identified as unusually high-risk in relation to a particular peril, it is not clear that the precise level of risk for every unit postcode to every household peril can be established.

3.3 Using External Geophysical Data in Rating Buildings Insurance

3.3.1 The conventional approach, and its limitations

The conventional statistical modelling approach to premium rating attempts to explain the claims experience in terms of selected risk and rating factors. This

approach reveals its limitations where claims data are sparse, either because of low numbers of claims or because risk factor values are not easily determined. The approach is also of limited value where the claims experience exhibits extreme volatility between investigation periods, or where the peril being modelled is such that loss events are extremely rare, such as in the case of catastrophic coastal flood. The approach may also become complex to apply when very many factors are used explain the claims experience, particularly where some of these factors are correlated.

A specific difficulty in the case of household business arises when classifying postcodes to obtain a categorical geographical variable. Typically, the analyses for each peril will make use of the same geographical classification of postcodes - that based on the company's current rating areas, although there is no reason to believe that the same classification of postcodes should best explain the geographical risk variation for every single household peril.

3.3.2 What geophysical systems can offer

Geophysical risk assessment systems offer an alternative approach to premium rating. Rather than estimating the level of risk based solely on historic claims experience, they construct a risk premium for each peril based on an understanding of the physical processes that result in loss events. The systems develop models that simulate the underlying physical processes, and these models provide an estimate of the level of risk associated with each location, or postcode.

The risk premium for each location is generally taken as the sum of the risk premiums estimated for each of the perils covered, although there may be some allowance made for correlations between perils. A particular feature of such systems, however, is that a given location may be high-risk with respect to one peril whilst being low-risk with respect to other perils. Another is that the set of factors used to

explain risk variation differ between perils, and are selected so as to be especially relevant to the peril in question. It is a key feature of geophysical risk assessment systems that they do not assume the same relationships and classifications for each peril.

In assessing the level of risk posed by a peril at a specified location, a geophysical system typically assesses two separate quantities. The first is assessed separately for each location, or group of locations, and represents the likelihood of a event of given magnitude occurring at that location. This quantity may be referred to as the "hazard", and is often expressed in the form of a probability distribution of events of differing magnitudes. The second quantity is location-independent, and represents the susceptibility of an insured property to an event of given magnitude. This quantity may be referred to as the "vulnerability" and may additionally depend on factors such as the age and construction of the insured property. The vulnerability is generally expressed in the form of a curve of expected insured loss amounts by event magnitude. The hazard and vulnerability curves may be then convoluted to derive a geophysical risk premium for the peril at each distinct location and for each distinct property type. This two-quantity approach is analogous to the separate modelling of claim frequency and severity in the conventional multifactorial analysis method.

Access to a geophysically-derived risk premium is especially useful where the conventional statistical approach meets its limitations. The geophysical approach has the advantages of using prior knowledge of the physical causes of losses, and each location's susceptibility to those causes. It draws on the expertise of professionals other than actuaries, statisticians and underwriters, including architects, engineers, geologists and meteorologists. It is also possible that the geophysical estimate of the risk may emulate the effects of several risk or rating factors, and so simplify what would otherwise be a more complex model specification. A geophysical system may also provide a means to model scenarios so as to estimate single event exposures.

3.3.3 How the geophysical rate is incorporated into the conventional rating approach

If a conventional rating analysis using generalised linear modelling is being undertaken separately by peril then the geophysical rates by location can be incorporated into the models as an additional explanatory factor. Each different geophysical system may provide several possible additional factors. If those factors based on the insurer's own data and any additional geophysical factors are included in the models then tests may be carried out to see if all of the geographical variation in claims experience is explained by the geophysical factors, or whether there is further information within the insurer's own data. The explanatory power of the external data will largely depend on which other rating factors are held in the insurer's data, and the extent to which these other factors already account for geographical variation. If there are correlations between any of the factors (internal or external) used in the models, then the inclusion of all factors will reduce the significance in the model of each correlated factor. Such correlation is likely if the insurer's existing rating area classification already explains some of the geographical variation in risk. Alternatively, it may be that the external data is correlated with data items that cannot be obtained or are not held by the insurer, in which case, the geophysical factor will act as a proxy in the model to this unavailable information.

Another approach to integrating internal data with external geophysical data, and one understandably advocated by suppliers of geophysical systems, is the provision of the insurer's data for use within the modelling carried out by the supplier to assess hazard and vulnerability. The intention here is to calibrate the results of the model using the insurer's own claims experience, thereby benefiting from the large volume of relevant data that the insurer holds and allowing results to be tailored to the individual insurer's contract and policyholders. A further approach to integration, and one most commonly followed by large household insurers, is to use geophysical rates only for those perils where internal claims data are inadequate, perhaps

additionally applying a credibility formula to make use of any internal claims data that are available.

3.3.4 Issues to be addressed in relation to geophysical systems

The household pricing actuary needs to consider the following issues in relation to geophysical data and risk assessment systems:

- Do you really require the entire geophysical system, or just the underlying data? The integration of the full system may result in operational and IT difficulties and costs, whilst the data in isolation may be difficult to obtain or interpret.

- Can you be confident of the validity of the underlying data and of the models built upon it? It is essential to understand how, when and to what level of detail the data has been collected. In particular, applying the data to a spurious level of accuracy should be avoided. An example of this is in the use of postcodes, by some geographical systems, in models for subsidence risk. Geological phenomena do not generally conform to postal geography and, within any unit postcode, there may be wide variation in subsidence risk owing to differences in geological characteristics.

- Are you making the most efficient use of internal data? When using geophysical systems it is important not to lose any additional information in the insurer's own data. However, you may not feel inclined to allow suppliers of geophysical systems to calibrate their models using your data for the benefit of your competitors.

- Can risk premiums derived at an individual peril level be integrated into the rating structure? The rating structure and product design may need to be peril based, and specifically to allow for the integration of the external geophysical data. Quotations may need to be built up as the sum of the rates for each peril.

3.3.5 Conclusions

The integration of geophysical data and risk assessment systems into the rating methodology for buildings insurance is becoming widespread. If these systems are being used appropriately, and some certainly are not, then any insurer not making use of them risks adverse selection. Conversely, the effective implementation of such a system(s) ahead of the market may offer a competitive advantage. Geophysical rating systems will not go away, for even the largest UK household insurers lack sufficient claims experience to rate all natural perils reliably. Concerns for the pricing actuary, however, include the potential loss of control over premium rating, and the additional expense which must be incurred in acquiring external data, much of which was built-up by government agencies funded in part by insurers' Corporation Taxes. One possibility for the UK household insurance industry to consider is the pooling of resources to acquire rights to the most relevant external datasets.

3.4 Using External Geodemographic Data in Rating Contents Insurance

External geodemographic data is used by some insurers, in particular to rate the theft risk, although it could arguably be used also as an indicator of the propensity to make small claims or to make fraudulent or exaggerated claims.

Proposal forms for household insurance have traditionally been limited in the range of questions concerned with the people residing in the household, rather than the structure and contents. Externally-obtained personal and socio-economic data presents an option to fill in these gaps which have arisen and remain through the insurer's reluctance to deter potential proposers with too many questions. In any event, proposers cannot reasonably be expected to provide information about their near neighbours or immediate surrounding areas, which may be relevant to the

contents risk. External datasets may, however, enable allowance to be made for the increased theft risk for a wealthy area in close proximity to a deprived area.

The considerations regarding the use of geodemographic data are largely the same as those for geophysical data:

- the accuracy of the data may be questionable. This may particularly be the case with data based on decennial census returns which may be out-of-date or inappropriately translated from a census enumeration district classification to one based on postcodes.

- the external data may be used to augment internal data by treating as an additional factor within a generalised linear rating models. Again the usefulness of the external data depends on the extent to which internal data explains variation in the claims experience. Within geodemographic data, factors such as age, marital status, and ownership status will be correlated with internal data.

3.5 Non-insurable properties

3.5.1 Introduction

The objective of this section is to highlight the problems of uninsurability that the industry is likely to face as a result of more refined, unit postcode based rating structures.

A property is deemed uninsurable when the insurance market refuses to quote a premium for its cover or when the price quoted is unbearable for the insured, as the cost is too high a proportion of their income. Moving towards unit postcode rating, along with the other advances in assessing individual risks, will almost certainly create a sub population of properties for which it is hard to obtain affordable insurance. This will reflect their high vulnerability to natural events such as flood, subsidence or man-made perils such as theft or vandalism.

In economic terms, this is a situation where there is a shortage of supply from the private sector, and this can not be balanced via the price mechanism. There are two alternative approaches to the problem:

- a "laissez-faire" policy, i.e. leaving the market to regulate itself.
- an interventionist policy, which would consist in some sort of regulation by the Government aiming at providing cover to those risks.

3.5.2 Laissez-Faire Policy

Insurance companies could respond in several ways to avoid the situation described without government intervention.

The product could be altered in some way, to reduce the cost of the perils that are of concern. For subsidence prone properties, this could mean a much higher excess than is the market norm. In areas prone to very high theft, then extra security measures, such as compulsory alarm systems may be required. There have also been policies issued that exclude the peril of theft.

The absence of regulation might be balanced by market agreements seeking to protect the image of the insurance business. This is currently the case for subsidence claims: there is an agreement between ABI members whereby an insurer incurring a subsidence claim will not refuse to renew the policy. The rate for that insurance can be increased, however. For this to work effectively, all insurers would need to be parties to the agreements. While the ABI is the nearest to such a self regulatory body, not all insurers are members.

Non-standard insurers may also emerge, who would use more sophisticated underwriting to write many of the "uninsurable" risks. This is already evident in that there is an insurer specialising in providing insurance to properties that have suffered from a subsidence claim. Such insurers will only prosper by successfully selecting

the good risks among the cases rejected by the standard market. They are also very vulnerable to the risk of accumulation, (particularly for such hazards as flood) as the non-standard market will often be in relatively small geographical areas. The higher risks undertaken should be rewarded by larger premiums, due to the less competitive market, resulting in larger contributions to fixed expenses and more investment income. Several non-standard insurers are operating in the motor market, the majority being subsidiaries of insurers of standard risks, and they seem to respond adequately to the demand.

3.5.3 Interventionist Policy

There is a danger that the laissez-faire approach would still leave some properties uninsurable, if only because the prospective policyholders do not have enough knowledge as to where they can obtain cover. This may result in situations where some homeowners suffer large losses as a result of catastrophic events, or see the market value of their property fall. There is therefore, on social grounds, a case for state intervention in order to provide insurance for those persons who cannot purchase insurance through the normal market. This contrasts with the motor market, where it could be argued that in refusing to provide affordable cover to young, inexperienced drivers wishing with high performance cars the insurers are in fact benefiting the community.

There are disadvantages with any form of intervention. If a company is required to write too much business that it deems undesirable at unattractive rates, they may decide to pull out of that market leaving less choice for the consumer. There is also a potential moral hazard. The ready availability of insurance may encourage building at low cost in areas exposed to flood or subsidence.

Some countries have already chosen to impose a form of regulation in order to prevent the unavailability of insurance. Though it affects primarily compulsory

Motor insurance, some countries have also set up some facilities in Medical Malpractice or Property. The forms such regulation has taken are described in the following paragraphs.

3.5.3(a) Insurance Plan

Each insurer doing business in the country is assigned a proportionate share of applicants who cannot otherwise get insurance, according to the ratio of the insurers premium volume to the market premium volume.

A very similar approach is to compel an insurer who refuses a risk to underwrite it at an imposed rate. This is the case in the French motor market; for compulsory insurance only, a driver rejected by an insurance company has the right to appeal to a Central Bureau - Bureau Central de Tarification - who imposes insurance conditions on the insurer.

3.5.3(b) Joint Underwriting Associations

Under a joint underwriting association, agents submit the rejected applications to a few insurers who have agreed to service them. All insurers, however, share the expenses and resultant profit or losses. The rates exceed those charged by insurers in the voluntary market (i.e. the majority of the market where insurers will, without intervention, readily provide insurance at an affordable price).

A Medical Malpractice insurance crisis during the 1970's in the USA caused many state legislatures to establish Medical Malpractice liability joint underwriting associations composed of all insurers writing liability insurance in the state.

3.5.3(c) State fund

A fund is set up to provide insurance to those unable to obtain insurance in the voluntary market. The fund could be supported by premiums, a tax on insurers or

some other related levy, (for motor, road tax or a charge on drivers' licence fees). The state of Maryland USA established such a fund in 1972.

3.5.3(d) Reinsurance facilities

The first three approaches have been criticised for

[1] the higher than normal rates they charge and

[2] the stigma attached to the special attention paid to insured under the plan.

Consequently some countries have established reinsurance facilities to which insurers can transfer risks they prefer not to insure. The insured pays the same premium as other policyholders in the same rating class and is unaware of the transfer to the facility. All insurers share the resultant experience of the underwriting pool.

Under this approach some special arrangements must be made to prevent insurers from making excessive use of the reinsurance facility. In France, the Caisse Centrale de Réassurance, an insurer backed by the state reinsures the perils usually rejected by insurers such as terrorism and natural catastrophes.

3.5.4 Conclusion

The issue of non-insurable properties is far from being simple, as it involves both economical and social aspects. Moreover, the increasingly sophisticated rating techniques and the move towards full postcode rating will inevitably aggravate the situation. The choice will then be between a self regulation policy or one of the various forms of intervention.

4. Other issues for company actuaries

4.1 Competitive Pricing

In an increasingly competitive market, it is becoming more and more important to understand how your company's premium rates compare with those of other insurers in each main segment of the market.

Historically, monitoring your competitive position was required in order to achieve a certain sales volume, in the hopes that this would generate sufficient profits for the future. Financial analysis is now getting far more sophisticated. To predict the effect on future profitability of changes in price, it is essential to understand what effect these changes will have on the mix of business. Customer sensitivity to price by population segment has to be modelled, for both new and renewal business. Price-elasticity has therefore become an essential element in profit testing. Developing an effective method of measuring customers' price elasticity which reacts quickly enough to a fast changing market will be a key factor for those companies aiming to be successful in the future.

Building such a price elasticity model requires a market premium for each segment. However, there is no readily available source of price information that is comprehensive, accurate and cost effective. There are various ways that limited information can be obtained, and the remainder of this section sets out the possible options, with their advantages and disadvantages.

Broker quotation systems are flexible and have the facility to calculate a market premium for each quote. There are also sufficient details to enable a comparison of the product features on offer. However, from a practical point of view, it is

extremely cumbersome to process when large sets of data are involved. Also in real life some insurers give their brokers more flexibility than the systems allow so the systems do not reflect the true price presented to customers by the brokers.

The major disadvantage of these systems is that they only contain Broker information, thus excluding direct writers[1]. Composite insurers can use Broker quotation systems to simulate market premiums as the influence of direct writers is still not very significant in terms of size. For direct writers however the problem is different as their competitors are a mixture of Brokers and other direct writers. In practice, it is often assumed that the correlation between Broker and direct writer premiums is high and that the relative position between them stays stable over time. If this is the case, the broker market can be used as a benchmark.

Mystery shopping and surveys are partly an answer to this problem as they can provide premium information for the main telesales operators and also give an idea of the correlation between broker market and direct market premiums. The biggest disadvantage is that mystery shopping is expensive. An agency charges around £5 per quote, and to run the exercise internally is time consuming (a telephone quote can easily take 10-15 minutes), and therefore costly. This means that the information gathered is usually limited, probably to one hundred quotes at the best. The products being compared are unlikely to be directly comparable, and the method is prone to errors. It is quite easy to end up with marginally different product features, or even a different product, from the same company in consecutive surveys and hence get an apparent price change. Mystery shopping is also expensive for the telesales companies, in that they are continually giving quotes for "dummy" business, and the extent to which it adversely affects the conversion rate is not really known.

[1] Direct writers refers to telesales and branch office operations

'Best quote' information - with this method, telesales operators gather competitor information by using their call centre to capture 'best quote' information. A proxy for this for any company is to look at conversion rates (or retention rates) for different segments - the areas where most business is going on the books is probably the one where the price is most keen, and conversely, where lapse rates are high the rate is probably uncompetitive. In theory this approach is very interesting because it should fully reflect the fact that telesales operators' competitors are a mixture of composite insurers and other telesales operators. This is also a cheap and quick way to collect information and it does not require a lot of processing time to produce results.

The problems with this method are rather more subtle. What the best quote is depends on the order in which customers call you. If this is randomly distributed then this not a problem but a company's position in the yellow pages and advertising campaigns probably have an impact. As for the mystery shopping, the best quote might correspond to a different cover. Further errors will creep in as you are reliant on the customer giving the right quote. This may not be remembered accurately, and there is an incentive for the customer to state a lower quote than that they have really obtained, in the hope the telesales company will try to beat this price. The final problem is that of getting the call operator to ask for, and record, this information. In practice, it may be possible to capture this information in about 1 in 10 quotes.

Banks and Buildings Societies

The main competitors for both composite and telesales insurers are building societies and banks and there is no competitor information about the rates charged by banks and building societies available on the market.

Traditionally this has not been a problem. The Domestic market has been different from the Motor market. Customers are less price sensitive and they are even more price inelastic if they hold a policy with a building society or a bank, and hence they are less likely to shop around. Banks and building societies have also been overpriced relative to the market, so that a price known to be competitive in the broker market would almost certainly be competitive against that being paid by the building society customer. This means there has been little interaction between banks and building societies on one side and telesales and composite insurers on the other side.

However as competition intensifies, and particularly as the telesales companies start advertising their lower prices, customers will become more price sensitive. This means that banks and building societies will be forced either to improve their pricing sophistication level and therefore their competitive position or to be prepared to lose market share. If they decide to develop their household insurance activity, they will have a major advantage, by effective use of their comprehensive customer databases. In this case they will also have to act more like traditional insurers and work with call centres, or have other simple means for potential customers to find out their prices. Their price information will thus become available to the market. On the other hand, they have made easy, large and relatively risk free profits out of their household insurance portfolio in the past allowing them to finance other activities (for example discounted mortgage rates). They might well not be willing to invest more money in household insurance business, as they would risk losing money. For example, the occurrence of a big catastrophe or an increase in flood or subsidence claims could have devastating effects on profitability, and which city analysts would be unhappy with.

If banks and building societies decide to develop their household insurance activity beyond an "inertia sell" with a mortgage, their price information will become more readily available to the market place. If they follow a more passive strategy, the information will be less readily available, but the lack of this information will be less of an issue.

4.2 Computer Systems and Data Resources

It has become almost impossible for any company actuary to function effectively without knowledge of computer systems, both in terms of their capabilities and their method of operation. At the same time, there has been an increasing recognition of a company's customer, policy and claims data as a significant asset.

As computers, particularly PCs, become continually more powerful, the actuary is required to use these tools to capture, store, manipulate and analyse the company's data in order to extract maximum information to assist in financial management of household business. This requirement is particularly pressing in premium-rating, where the most powerful computers and software enabling the application of the most advanced techniques of statistical analysis, are essential to maintain competitive position.

In earlier years, the pricing actuary's problem was often one of insufficient computer resource to analyse the available data. Nowadays, the converse is increasingly the case, with even the largest company's internal data resources becoming inadequate for risk assessment purposes. As a consequence, in addition to the increased use of external datasets in risk assessment, actuaries are increasingly involved with their marketing colleagues in strategies to increase the scope of customer data.

Whilst in 1996 it would have been possible to overlook the "year 2000 problem", in 1997 it is difficult for an actuary to avoid it. Whilst there may be minor problems in respect of proprietary software, the more significant task is to ensure that management information and statistical data-provision systems are amended so that financial management is not compromised. In practice, the greatest "year 2000" problem facing actuaries might be that IT resource is tied-up in amending administration systems, so that business-development system changes, such as adding rating factors to your premium calculation subroutine, cannot be implemented. In addition, actuarial resources may be required in specifying and managing any "year 2000" changes to actuarial computer systems.

Furthermore, if European Monetary Union commences as planned on 1st January 1999, and dual-pricing in Sterling and ECU's is required, then IT meltdown becomes a real possibility, potentially seriously compromising the actuary's work.

4.3 Taxation

Insurance Premium Tax ("IPT"), was introduced with effect from 1st October 1994 at a rate of 2.5% of written premiums. A number of initial problems, such as the need to amend accounting systems to calculate and record this new tax, were common to all affected classes. Despite a background of falling premium rates, many companies decided initially to increase their prices by the full amount of the tax, if only to demonstrate their dissatisfaction with its imposition.

The rate of IPT was increased to 4% from 1st April 1997. At this time the market was very soft, with profitability achievable only by virtue of an absence of major weather-related losses and an ongoing improvement in theft claims experience. Publicly-quoted companies in particular were trying to talk premium rates up whilst

some of the newer direct-writers were still competing intensely for volumes. Against this background, companies were generally not willing to absorb the tax increase.

Prior to the July 1997 budget there was intense speculation that the new Chancellor would raise the rate of IPT to 12.5%. Whilst this, and other increases in personal taxation were shied-away from, an increase in the Spring 1998 budget, effective from April 1998, remains a possibility. There are fears of a series of increases in the rate of IPT during the lifetime of the current government, and ultimately to the current VAT rate of 17.5%. However, VAT is reclaimable, and IPT is not, so such a move could encourage insurance companies to challenge the Customs and Excise. The average rate of IPT in Europe is currently around 9%, and this lends weight to the fears of possible future increases in the UK.

With current premium rates so soft, the market could not now readily absorb large increases in the rate of IPT. Since the next movement in household premium rates is likely to be upward, then any IPT increases would compound on premium rate increases, business retention would become a problem and many homeowners might opt to reduce their insurance cover. No responsible government would wish to see increasing numbers of citizens no longer insuring their homes at the peak of the underwriting cycle, especially if this were to correspond with a period of high subsidence or flood claims.

4.4 Reinsurance

For an established company, the most important reinsurance protection purchased for the household account is catastrophe excess-of-loss cover, although a surplus treaty, or facultative excess-of loss cover, may additionally apply in respect of high-value individual residences. The catastrophe reinsurance programme protecting the

household account is likely to be shared with any commercial property business, there again typically sitting on top of surplus treaty arrangements.

The market for property catastrophe reinsurance has become increasingly soft in recent years. Reasons for this include increased capacity, particularly from offshore centres such as Bermuda, and also the completion of "payback" for the losses incurred by reinsurers in respect of the 87J and 90A/90G events. Despite increased affordability, companies are buying less cover, and taking higher retentions, than they did 3 or 4 years ago. For many companies, a significant reason for buying less cover is an improved solvency position following high operating profits and capital growth on UK equities in 1995 and 1996. Furthermore, many of the larger companies have seen business volumes, and thus catastrophe exposures, reducing. The introduction in 1996 of statutory claims equalisation reserves for property business will in time reduce the requirement for catastrophe cover. One hope for the reinsurers is that primary companies' excess capital may soon reduce, through operating losses, acquisitions or share-buybacks, thereby increasing the need for catastrophe reinsurance purchases.

Amongst the larger companies, the typical retention on a 1997 catastrophe reinsurance programme is between 10% and 15% of projected premium income. A typical upper limit to the programme may be between 65% and 90% of projected premium income. As would be expected, the largest and most financially strong companies have both higher retentions and lower cover limits, and may be purchasing cover equivalent to only around 25% of projected premium income.

It is worth noting that much of the development of the geographical rating datasets and models discussed elsewhere in this paper has been sponsored by reinsurers. Whilst reinsurers clearly have a legitimate interest in improving techniques for rating catastrophe covers and for estimating portfolio PMLs, there has been some

cynicism amongst reinsurance purchasers that models may be prone to generating large estimates, thereby lending support to higher catastrophe rates-on-line.

Following 87J and 90A, primary insurers' and reinsurance underwriters' estimates of the frequencies of major events, and of worst-case scenario costs, increased. In the early-1990s the market used a "twice 90A" rule-of-thumb for a portfolio PML (assumed to be a windstorm) and tended to ignore flood. Reinsurers and external data-providers have since talked-up the risk of flood, and have provided various means of estimating flood PMLs. Companies now often find that their flood PML is significantly higher than that for windstorm. The reinsurance market has responded to this development by offering flood-only catastrophe covers for programme layers above the windstorm PML. It is not thought that the uptake of such covers has been particularly high, not least because of perceived poor value and in some instances an "if there's a flood that big then everyone else will be insolvent too" mentality. Evidence suggests that many companies are buying catastrophe cover up to around their estimated windstorm PML, which more detailed analysis often suggests is around twice the cost of 90A!

A relatively new development in the UK reinsurance market is a subsidence-specific catastrophe excess-of-loss cover. Indications are that the uptake of such covers has not been high. Those covers of which the working party is aware have been written at high levels, so that recoveries were not triggered by the 1996 claims experience. An interesting feature is that, despite a dry winter and spring 1996/7, and higher-than-expected first quarter claims, at the time of writing (mid-July) it was still possible to purchase subsidence catastrophe cover for 1997 calendar year incurred claims.

5. Recent Claims Experience

This section describes recent trends in the claims experience under each of the major perils covered under a household insurance policy. In addition, it describes how actuaries are constantly developing their approach to ratemaking in order to accurately reflect these trends.

5.1 Subsidence

Subsidence claims experience is driven by the weather. Broadly speaking, the experience is poor following extended periods of hot and dry weather, and better at other times. Because, during the 1990s, the UK has experienced some of its warmest and driest weather on record, the subsidence claims experience for this period has been particularly poor.

The UK household insurers' first major subsidence catastrophe event resulted from the successive dry summers of 1989 and 1990, and was concentrated in South-East England. Owing to the natural delay in establishing and reporting subsidence damage, most of the resulting claims were reported during 1990 and 1991. With difficulties involved in establishing the precise origin date of a subsidence loss, many UK insurers reported poor claims experience for the 1991 accounting period despite cooler and wetter weather during that year. The effects of the second catastrophe event, following the hot, dry summer of 1995, were spread more extensively throughout the UK, with the North-West in particular being badly-hit. When lower-than-average rainfall was again experienced in 1996, more claims were reported.

The winter and spring of 1996/7 were again unusually warm and dry. December 1996 had less than half the usual rainfall for that month, and January 1997 was the driest January for 200 years. The spring of 1997 saw much media discussion about water shortages, leaking pipes and record low ground water levels. A further adverse development was the long-awaited upturn in the housing market and the consequent increase in the number of properties subject to survey. The highest levels of housing market activity were in the South-East which had been hit by both of the major subsidence events. Quite unsurprisingly, many UK insurers' Q1 1997 results identified subsidence claims experience as an adverse feature. When June 1997 became the wettest since the 19th Century, insurers were cheered, despite the water companies' declaration that it had been "the wrong type of rain". Those household underwriters willing to venture a guess now (mid-July) perceive that the 1997 claims experience will be on a par with, or possibly slightly better than, that for 1996.

Any perception of the likely future subsidence claims experience must depend upon whether "global warming" and its associated climatic changes are accepted as fact. Some experts are predicting that a climatic event like 1989/90, or 1995, will become a 1-in-5 year occurrence by the year 2020. Other predictions regarding climatic change include higher average temperatures throughout the UK, reduced rainfall in the South and increased rainfall in Scotland. In addition, the pattern of rainfall is predicted to change, with heavier downpours separated by extended dry periods, so that the proportion of rainwater absorbed into the ground will be lower. Increasing demand for water, particularly if the new government initiates a large housebuilding programme, may mean that ground water levels in the South remain permanently low.

As a consequence of the poor claims experience during the 1990s, and the possibility of adverse climate change in the future, most companies' buildings insurance

premium rates now contain a higher loading for the subsidence peril than they did 5 years ago. The 1989/90 subsidence event was a major contributing factor to the introduction of postcode-rating for household business, and most companies continue to believe that higher-than-average business penetrations in high subsidence risk areas can be avoided through underwriting controls and differential-pricing. This approach assumes, however, that companies are able to identify the high-risk areas!

Whilst some large companies have recorded tens of thousands of claims from the 1989/90 and 1995 events, even this volume of data is inadequate for risk-assessment at the postcode sector level, since there are over 9,000 postcode sectors. Furthermore, those losses that have occurred will reflect the individual characteristics of the two major events from which they arise, rather than the long-term average subsidence risk. In recent years, therefore, actuaries have made increasing use of external datasets in conjunction with claims experience when assessing the subsidence risk under household policies. The typical external dataset contains information on ground geology, i.e. what types of rock and/or soil are situated where in the UK, and may also provide some estimate of the subsidence risk associated with particular combinations of ground and climatic conditions. The actuary may be able to calibrate these risk estimates using the limited claims data that is available, to the extent that it is considered indicative of long-term experience norms.

A considerable outstanding problem for household insurers and their actuaries is that there is very little agreement between the various external datasets as to which are the high subsidence risk areas. One reason for this is that the owners of the various datasets take understandably different views as to which are the most significant factors determining the level of subsidence risk in any location. When estimating

risk intensity, the actuary is left to choose the relative weight placed on factors such as rock type, soil type, average rainfall, historic soil moisture deficits, tree proximity and property construction, with little claims data to support any sophisticated statistical technique which may check the appropriateness of the chosen weightings. A further problem is that, for each new additional factor reported as being critical to the subsidence risk, an additional dataset must be sought-out and purchased.

5.2 Flood

In recent years, there have been no catastrophic flood events in the UK. Significant flood events have occurred, however, in Towyn (coastal) and Perth (riverine), and most recently in Moray and Banffshire (riverine). The worst year this decade for industry losses has been 1995, with an estimated total claims cost of £350m.

The low frequency of significant flood events and the consequent lack of relevant historic claims data means that the flood risk is difficult to rate. Accurate flood risk assessment requires external data, although many external datasets are more suited to the estimation of flood PMLs for reinsurance purposes than the estimation of annual flood risk premiums. This reflects the relative ease with which it is possible to estimate the geographic extents of particular catastrophic flood events, as compared with the extents and return periods of sub-worst-case events.

Within external datasets, there is also particular emphasis placed on East Anglia and the Thames Estuary. This reflects a view that the most expensive UK flood events could arise on the East coast of England from a combination of seasonal high-tides and storm winds perpendicular to the coast. Perhaps the best known flood dataset is that based on the 1994 ABI/Halcrow study. This dataset is not generally considered useful for rating purposes owing to its low level of detail, and its restriction to the problem of coastal flooding. In general, there is far less external data available

concerning riverine and other inland flooding, and so such events are particularly difficult to rate for.

Another difficulty in flood risk assessment concerns the estimation of likely claim severities given a particular flood event. Some work published by the Buildings Research Establishment provides estimates of claims severities for buildings insurance given different depths and durations of flooding. Such estimates can be compared with an insurer's own claims data for a flood having known characteristics e.g. Towyn, in order to assess their validity.

Many insurers compound the problems posed by inadequate historic claims data through poor claims coding. Typical weaknesses include the failure to differentiate between coastal and riverine flooding, and the miscoding as flood of "escape of water" claims resulting from burst pipes.

As with the subsidence peril, many companies seek to avoid over-exposure in any areas identified as high-risk by their favoured external dataset. This may be attempted through underwriting, including the imposition of flood exclusions, and through differential rating. The high degree of uncertainty surrounding the "correct" flood risk premium for a particular location may cause companies to seek to avoid exposure at any location where there is a hint of potential high risk, despite the potentially adverse impact on business volumes and premium income. The particular dataset relied upon by a company's catastrophe reinsurer is also particularly relevant if excessive catastrophe reinsurance costs are to be avoided. Some companies take the view that reinsurers may be talking up the flood risk in order to support rates in a soft reinsurance market. If this is so, then writing household business in areas deemed a high flood risk by one's reinsurer may prove uneconomic owing to reinsurance costs.

One advantage to insurers of the flood peril, as compared with other insured perils, is that the policyholder may have advance warning of a potential flood event and, with suitable education, can be encouraged to take practical steps to minimise the insured loss. Such steps would include moving valuables and electrical equipment upstairs following a flood warning. A potential downside to the direct writers of this period of advance warning is that those households at risk may be able to effect insurance with them at short notice!

5.3 Windstorm

Although not comparable in size with the 87J , 90A or 90G events (approximately £1.2bn, £2.1bn and £0.8bn respectively) the UK has experienced some medium-sized windstorms during the last seven years.

Date	Estimated Loss
Jan./Feb. 1993	£185m (including flooding)
Oct. 1996	£100 m

The seasonal pattern of UK windstorm events is well-established, and is allowed-for in monitoring the actual incidence of losses against long-term expectations. One rule of thumb adopted for the seasonality of windstorm losses is that 6/14 of total losses (by amount) are expected in each of the 1st and 4th quarters of the year, and 1/14 in each of the 2nd and 3rd quarters.

There remains great uncertainty concerning the frequency of the largest windstorms and how these should be allowed for when pricing household business. As with flood losses, the historic claims experience is scarce and may not represent long-term average expectations. Overlaid on this is the view that, of all UK weather

phenomena, the pattern of large windstorms is likely to change most should global warming prove a reality. Once again, actuaries are placing increased reliance in their pricing on external datasets and models. Such models typically use the experience of UK windstorms, as measured by weather stations over an extended period, to estimate a probability distribution of windspeeds for any particular location. Standard engineering formulae may then be applied to estimate insurance losses given a particular property's construction type and a selected windspeed. Such estimates may then be calibrated using actual claims data from the 87J or 90A events. Allowing for property construction type in this way takes account of the tendency for older properties in particular to be built to withstand local weather conditions.

It is not possible for a company to side-step the problem of rating for large windstorms by purchasing extensive catastrophe reinsurance cover, since the value of the cover purchased must be assessed, and the cost of reinsurance must be equitably apportioned between individual policies.

5.4 Earthquake

This peril is mentioned increasingly by reinsurers and by suppliers of geophysical data. There is no doubt that the UK, particularly Wales and the West Of England, is prone to small earthquakes, and there is much historical documentary evidence of this. However, there is no evidence of any large UK earthquake in the last 1000 years. Compared with windstorm or flood, therefore, the risk to domestic property would seem to be minimal and, presented with a likely risk differential across the UK of a few pence per £1,000 sum insured, the pricing actuary tends to take a pragmatic approach.

If a major earthquake did hit the UK then there may be a disproportionate amount of damage owing to construction standards being consistent with a low earthquake risk.

This might equally be true, however, in the case of meteor strikes or giant tidal waves, which tend to rank equally with earthquake in the list of perils demanding the pricing actuary's consideration. The whole issue of earthquake risk may be of more concern in other areas of commercial activity where structural damage could have severe consequences (e.g. nuclear power stations).

Some recent UK earthquakes of note include North Wales (1984) - 5.5 on the Richter scale - and Wrexham (1990) - 5.2 on the Richter scale. Both these events involved very few (possibly opportunistic) household insurance claims.

5.5 Theft

The trends in theft claims experience are considerably more important for contents business, where theft costs may comprise the majority of the risk premium, than for buildings insurance, where they typically amount to only 10-15% of the risk premium.

Theft claims frequencies for contents business have declined steadily since a peak in 1992/3, at which time frequencies were around 75% higher than at their previous low point during the economic "boom" years of 1988/9. This drop in claims frequency has coincided with a general improvement in the UK economy, and falling unemployment in particular. A consequence of the poor claims experience of the early-1990s has been an increase in the level of security of the typical insured property. The trend towards improved security has been assisted by insurers offering premium discounts, on contents business in particular, where properties are fitted with specified security features, or where policyholders become members of local neighbourhood watch organisations. Increases in the amounts of compulsory and voluntary theft excesses have also acted to reduce recorded claim frequency, which

for 1996 was around 30% below its 1992/3 level - only 25% above the level for 1988/9.

Throughout the 1990s, theft claim severity has been broadly constant in real terms (against RPI), with the effect that theft claims experience has been driven by frequency trends. There is a general expectation that the theft claim frequency for 1997 will be lower than that for 1996, and this is one factor contributing to the lack of premium increases for household business evident in the market at the current time.

The advent of postcode-rating in the early-1990s meant that, despite the high claim frequency, even the largest UK insurers were struggling to find sufficient volumes of historic theft claims experience to enable fully-credible premium rates to be determined. The ABI Household Risk Statistics Scheme (HRSS) issued its first summary of theft claims experience by postcode district late in 1993, by which time rating by postcode sector was becoming standard. Actuaries have increasingly turned to external datasets to assist in their rating of the theft risk. The most commonly-used datasets include socio-economic classification systems such as Mosaic, crude OPCS census data, or financial data such as counts of County Court Judgements or loan defaults. Increasingly sophisticated statistical techniques have been developed to make use of such data, including aspects of credibility theory, generalised linear modelling and contour modelling.

5.6 Liability

Until recently, the provision of homeowners' public liability cover under the household policy has been treated by many insurers as a "freebie", with very little concern as to what its cost might be, as claims have been few and small. There is increasing anecdotal evidence, however, that the incidence of large liability claims

under household business is growing. We would recommend that pricing actuaries monitor this area very carefully in our increasingly litigious society. Particular matters that may require consideration include; the possibility of claims from neighbouring households to recover subsidence excesses or losses where the subsidence is deemed to be caused by trees within the insured's property, and the increased cost to insurers of recovery by the DSS of state benefits paid to recipients of personal injury awards.

5.7 Escape of Water

The largest weather-related household insurance losses since the 90G windstorm resulted from domestic water pipes bursting on New Years Eve 1995 or New Years Day 1996, as they thawed following a week of extremely cold temperatures. These losses were exacerbated by the timing of the thaw because many homes were empty when pipes burst and no immediate remedial action was taken. Amongst those companies reporting on a calendar year basis this event gave great scope for managing the 1995 results, according to which side of midnight the thaw was deemed to have occurred.

Pricing actuaries typically have access to large volumes of data relating to escape of water claims although, again, this may not be adequate for determining the long-term average loss expectation at all UK locations. External datasets relating to this peril are available, but tend to comprise temperature distributions which are not simply incorporated into the risk assessment process. Because insured properties may be constructed and occupied in a manner which reflects the extremes of local climate (i.e. pipes are more likely to be lagged, and heating left on on winter nights, in cold regions), there is generally less geographical variation in the risk premium for this peril than for, say, flood or subsidence. As a consequence, actuaries may

adopt a more pragmatic approach to pricing for escape of water claims than for some other natural perils.

5.8 Fire

Fire claims costs per policy-year are lower now in absolute terms than they were at the beginning of the decade. As with theft, domestic fire is a peril for which claims frequencies vary according to the state of the economy, and recently improving economic conditions have contributed to the improvement in claims experience. It is widely believed, however, that the most significant beneficial factor in recent years has been the widespread installation in homes of smoke detectors, although little further improvement from this source is anticipated.

The domestic fire risk has been demonstrated to be correlated with socio-economic grouping, so that inner city areas often attract the heaviest risk loading. In addition, those areas of the UK such as the Western Isles of Scotland, where peat burning fireplaces are prevalent, show particularly high risk. External datasets containing information on the distance of properties from the closest fire station, and the likely response time to an emergency call, are available. Reservations about their accuracy and relevance have so far prevented their widespread use.

6. Concluding Remarks

Apparently irreversibly so, the UK household insurance market is following the private motor market down the road of increasing competition. The market is well supplied, if not over supplied, and yet there seems to be a constant stream of willing new-entrants. The number of residential properties and householders requiring insurance cover is growing, but at no significant rate. Companies will prosper in the new competitive market only if they price smarter than their competitors, exert tighter control over acquisition and operating costs, underwrite better, handle claims more efficiently and retain business better than do their competitors.

It is in the area of smarter pricing that the actuary can offer most assistance. The pace of change in this area is frantic, however, and the actuary must continually improve his or her skills in order to continue to contribute. The actuary will require ingenuity and tenacity to obtain adequate volumes of data for rating analyses, and sound judgement to ensure that this data is appropriate. Particular skills will also be required in identifying the true degree of validity of any external datasets at the desired level of rating detail. The actuary will need to consistently apply the most powerful statistical analysis techniques, taking advantage of the best available computer hardware and software.

The household insurance pricing actuary has a limited period in which to prove his or her further value above that already added during the last decade. If this challenge is not met, then the actuary's role may be usurped by statisticians or providers of external data who understand the leading edge techniques in their areas of expertise.

References:

Raper J.F., Rhind D.W., Shepherd J.W.; Postcodes: The New Geography. Longman (1992)

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Appendix A: Royal Mail Postcodes

Introduction

The vast majority of UK household business is premium-rated by reference to the Royal Mail postcode. The decision to adopt the postcode as the location descriptor for insured risks has a number of consequences, many of which are little understood by actuaries.

Why do we require a location descriptor?

For the majority of perils insured under a household insurance policy, the risk intensity of the peril varies geographically (all other things being equal). In order to quantify risk during pricing, therefore, the actuary needs to know where an insured risk is situated, and the level of risk associated with that geographical location for each relevant peril. The method most commonly used for categorising the geographical position of insured risks is by reference to the Royal Mail postcode, both during the risk assessment process and in the basis for calculating individual policy premiums.

What alternatives are there to postcodes?

Other methods of describing the geographical position of insured risks are available. For any individual property, the Ordnance Survey grid reference is an ideal measure of position, as it is extremely precise. It also has the merit that it is used as a reference for many of the sources of data on geology, geography and topography that may be used in assessing the risk from natural perils at any given location. However, it is highly unlikely that a customer will know the grid reference of their own property.

Those location descriptors used in everyday life, such as local government areas, or elements of the full postal address such as counties or towns, are more likely to be

known by policyholders, and to be stored in an insurer's policy administration systems. However, local government areas and counties can contain large numbers of insurable household risks which may be heterogeneous in nature with respect to the key household perils. Towns may have imprecisely defined boundaries, and place name duplicates may occur. Furthermore, the full postal address may be complex in form, or lengthy, and customers may disagree that it represents their "true" address (for example, if their postal address includes them in an estate or area that they consider undesirable).

Because the alternatives suffer many practical disadvantages, Royal Mail postcodes have become the most practical compromise as a location descriptor for household insurance risks. Most customers will know the postcode which has been assigned to their property through past exhortations from the Royal Mail to "please use the postcode", and through the increasing use of postcodes in systems of personal identification. Postcodes are relatively permanent, and they contain some geographic positional information. One of their greatest advantages is that they are hierarchical in structure - different groups of characters within the postcode may be used to partition the UK at different levels of detail. Almost all insurers' policy administration systems will store postcodes because the need to correspond with customers by mail required the collection and storage of address information including a full postcode even when premium rates were based on larger geographical areas. Postcoded historic exposure and claims information can therefore readily be extracted from most insurers' computer systems.

What is a postcode?

When using postcodes as a geographical location descriptor for household insurance risks, it is important to remember that this was not the purpose for which they were designed! Postcodes were introduced to help the Royal Mail deliver letters more efficiently, primarily by enabling the automated sorting of mail items.

The first, single character, UK postcodes were introduced in 1857/8 to divide a growing London into 8 postal districts. By 1974, the whole of the UK had been allocated postcodes. A modern UK postcode comprises between 5 and 7 letters and digits arranged in one of a number of standard hierarchical patterns. The hierarchical structure contains four distinct levels. The hypothetical *unit postcode* AB12 3YZ falls within *postcode sector* AB12 3, *postcode district* AB12 and *postcode area* AB. The postcode area AB covers a large area of north-east Scotland, closely corresponding with the Grampian administrative region, so that any household risk having an AB postcode will be situated within this part of Scotland. Similarly, any residential property having postcode district AB12 will be situated within an area of approximately 15 square kilometres south and east of the centre of the city of Aberdeen.

The Royal Mail Postal Address File (PAF) is the central database of UK addresses to which mail is delivered ("delivery points"), and their associated postcodes. A 1996 version of the PAF contained 124 postcode areas, 2,761 postcode districts, 9,153 postcode sectors, 1,431,099 unit postcodes and 24,871,104 delivery points.

Postcode areas are denoted by a string of 1 or 2 letters - single letter codes are used for major cities (e.g. Birmingham = "B") and for the historic division of London (e.g. East London = "E"). Where 2 letters are used then they are selected, where possible, to provide a mnemonic for the dominating conurbation (e.g. Coventry = "CV").

Postcode districts are normally denoted by a string of 1 or 2 digits, commonly interpreted as a number lying between 1 and 99. However, for a limited number of London postcode districts, the second character of the district is a letter, rather than a digit (e.g. "EC4Y"). Those postcode districts situated closest to the centre of the dominating conurbation of the postcode area are generally assigned the lowest numbers. The postcode area and district taken together are often referred to as the "*outward postcode*", or "outcode", and this identifies the office to which mail having that outcode is sent for sorting. The remainder of the postcode is often referred to as the "*inward postcode*" or "incode", and determines the property, or group of properties, to which the mail is to be delivered. The incode is always a string of 3 characters, 1 digit (the *postcode sector*) followed by 2 letters (sometimes referred to as the "*postcode unit*"). Certain letters are prohibited in certain positions in the postcode area, district and unit in order to avoid confusion with other letters or digits which may appear similar in hand-written form. There are no such prohibitions on the use of digits - the postcode sector, in particular, may take any value from 0 to 9.

The problem of non-geographic postcodes

The postcodes allocated to residential properties - those important in the context of household business - are "geographic" in nature, in that the postcodes contain information about the geographic location of the property. However, some postcodes, such as "large-user" postcodes, may be non-geographic in nature. The Royal Mail issues large-user postcodes to commercial organisations receiving large numbers of mail items each day, and to users of PO Boxes. These postcodes are generally consistent with other postcodes in the immediate surrounding area (they may share district or even sector classification), but some "non-geographic" large-user postcodes are allocated to organisations receiving extremely high mail volumes. An example of a non-geographic large-user postcode is the postcode district SA99 which has been allocated to the DVLA. Whilst the "SA" postcode area reflects this

organisation's being situated in Swansea, the "SA99" district differs from those of surrounding postcodes. The pricing actuary must take particular care not to waste any effort calculating premium rates for non-geographic large-user postcodes, since there is no possibility of any valid household risk sharing such a postcode. Indeed, during the early days of postcode-rating for household business (1992/3), UK insurers published rating guides providing household premium rates for, inter alia, the DVLA, Littlewoods Pools, the TV Licensing Authority, various tax offices and even the Blue Peter appeal!

How many delivery points are there in a unit postcode?

A unit postcode does not generally permit the unique identification of a residential property - the vast majority of postcodes contain more than one delivery point. The number of delivery points included in a unit postcode varies considerably between postcodes, although a "rule of thumb" often heard is that there are "around 15". The distribution of numbers of delivery points in a unit postcode is, in fact, extremely skewed (to the right). Whilst the mean of this distribution (based on the 1996 PAF) is 17.4, the median is 13 and the mode is 1. In the past, some unit postcodes (typically relating to large blocks of flats) contained as many as 500 delivery points. However, it is now the case that no unit postcode has more than 100 delivery points, and only 3.4% have more than 50. One reason for this change is to enable individual properties to be uniquely identified by means of the unit postcode followed by a 2 digit suffix.

Do postcodes ever change?

The Royal Mail PAF is updated approximately four times a year. At the time of writing the most recent PAF update, number 24, had been effective from April 1997. One reason why the PAF is updated is that additional postcodes are required when new properties are built, and this may result in the exhaustion of valid postcodes in a

locality. Alternatively, the Royal Mail may wish to reflect any changes in sorting or delivery operations by re-postcoding selected addresses.

How do we cope with changing postcodes?

The frequent updates to the Royal Mail PAF can be problematic for household insurance pricing actuaries. If the business is rated by postcode then the actuary will wish to analyse the historic claims experience by postcode (amongst other factors). Because the PAF can change the actuary must:

a) decide for which set of postcodes (or on which version of the PAF) premium rates will be calculated and quoted, and

b) re-postcode each element of historic policy exposure and claims experience onto the selected PAF.

These tasks can prove particularly difficult and time-consuming.

The set of postcodes for which rates should be provided depends on how long the rating series will apply. Any new postcodes created during the currency of the rating series can cause chaos for the insurer whose quotation or new business premium calculation systems don't recognise them as valid. The actuary should attempt to anticipate any such new postcodes, or rates may need to be made at short notice following a PAF update. The Royal Mail do give some advance notice of planned changes to postcodes, but the proof is often in the PAF!

A further problem for the actuary arises from Royal Mail continuing to recognise old postcodes for purposes of delivering mail for 12 months after they are replaced. If customers choose to use the replaced postcode, and if policy administration systems have not yet been migrated onto the current PAF, then the actuary may need to calculate rates for postcodes that he or she knows are no longer valid.

The task of re-postcoding historic policy and claims data onto the PAF selected for rating is considerably eased if a valid postal address and postcode are obtained for each risk at inception, and thereafter the postcode is updated to reflect any PAF changes as and when they occur. Generating a valid postcode at inception can itself be difficult since customers may provide incorrect (i.e. non-postal) or incomplete addresses, or incorrect postcodes. Although address-checking software can help, this software must be based on the current PAF at all times, and software houses cannot generally achieve this. Once captured, it is not possible to update postcodes to a later PAF in the absence of a valid risk address, since PAF updates may not be restricted to 1-to-1 mappings of unit postcodes (i.e. some unit postcodes are split between two or more new codes, conditioned on the address). The actuary requires, therefore, that full risk addresses are stored in addition to postcodes. Address-postcoding software (and a powerful computer) are also required to perform batch re-postcodings of statistical policy and claims databases. Again, this software may not be available for the latest version of the PAF.

In practice, the customer and risk address information held in most insurers' administration systems lags the current PAF, so that the actuary's policy and claims data is on a different PAF from the one on which rates are required to be set.

A further problem which may arise from PAF updates concerns the re-allocation of unit postcodes (and therefore the associated insured properties) between postcode sectors or districts. If the "old" and "new" sectors or districts attract very different premium rates then the resulting premium changes on renewal can be particularly difficult to explain or justify to customers. The actuary may therefore wish to limit the magnitude of any premium changes which result entirely from changes to postal geography - a good test is to imagine yourself attempting to justify the change on the BBC's Watchdog programme! Customers can take the view that the postcode allocated to their property is fairly arbitrary, and that the premium rate allocated to

that postcode is equally so. Increasing numbers of cases are being reported of homeowners lobbying local councillors or MPs to get postcodes changed if these are deemed to unfairly influence household insurance premiums.

A final feature of PAF updates to make the pricing actuary despair is that the Royal Mail can and does re-use postcodes, so that the postcode for which a rate is required to be calculated, and that same postcode attached to an item of historic claims data, may relate to totally different addresses!

Postcode-rating and the use of external datasets

For some of the perils covered under the typical household insurance policy, and particularly for natural perils such as subsidence, flood and windstorm, no single insurance company has sufficient historic claims experience to adequately rate for the perils based on that experience alone. As a consequence, increasing use is being made in rating of external datasets relating to geology, geography, topography etc.

In order that such external data can be assimilated into the rating process then it must be geographically referenced by postcode. However, many types of physical data, such as geological data, don't lend themselves naturally to this as they have been compiled using a different reference system (e.g. OS grid references), and they describe "area" rather than "point" effects. In order to decide which unit postcodes fall within areas having different risk as measured using an external dataset, much effort has been expended in deciding exactly "where" postcodes are in terms of other geographical reference systems. The actuary must be aware of the consequences of any assumptions implicit in this process of "placing" postcodes, for these assumptions are often glossed-over for convenience. A convention for placing unit postcodes is to draw them at the unit "centroids" (i.e. the centre-of-gravity). However, unit postcodes are typically long and thin, since they may relate to properties lining one side of a road, so that properties at the ends of a row may be

distant from the unit centroid. Similarly, if the geographical extent of a postcode sector is defined by the area containing all its unit postcodes ("placed" by centroid), with a boundary equidistant between its outermost unit postcodes and those adjacent unit postcodes belonging to adjoining sectors, then it is possible for the sector "shape" to contain properties belonging to a different postcode sector! Whilst Geographic Information Systems (GISs) allow the actuary to overlay external natural perils datasets on postcoded claims experience and policy exposures, in the hands of the unwary they can contribute to the setting of nonsense premium rates.

It is possible to purchase datasets which contain an OS grid reference for each UK unit postcode. Notwithstanding the problems arising from the use of unit centroids, such datasets may "place" postcodes only to the nearest hectare (i.e. 100m square). Care should also be taken when using socio-economic classification systems based on OPCS decennial census data. Many such systems classify individual unit postcodes by socio-economic grouping, yet the base census data is collected at "enumeration district" level. These enumeration districts have no direct correspondence with postal geography (since they each broadly represent an individual census collector's "round"), and they may typically contain, or intersect with, between 10 and 20 unit postcodes. Again, datasets are available which purport to accurately map each unit postcode to an individual enumeration district.

One last tip for the hard-pressed household insurance actuary - when using datasets of postcoded information, whether internal or external, and sorting on the postcode, the order that the data records sort into depends on how the postcode field or fields have been formatted. Imposing a 2-character length for each of the area and district, and then left-justifying the area and right-justifying the district, will sort into the natural order (i.e. with district "B2" falling between "B1" and "B3", rather than between "B19" and "B20"!

Conclusion

If household business is to be rated by reference to the Royal Mail postcode then the pricing actuary must recognise the adverse consequences of this choice. In particular, it requires that the pricing actuary become more expert regarding the postcode system and postal geography than his marketing or administration colleagues, who may only need to identify customers and to mail documents to them. The pricing actuary must ensure that his or her historic exposure and claims statistics are fully postcoded with current PAF postcodes, that external rating datasets may be referenced by postcode, and that the list of postcodes that will be valid during the currency of any rating series is known. All these must be accomplished before any thought can be given to how the household insurance risk varies geographically.