The Cycle Survival Kit

An investigation into the reserving cycle and other issues

Working Party

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Summary

In this paper we investigate and confirm the existence of a reserving cycle in the UK. We ask what causes it and demonstrate that standard actuarial techniques may contribute to it. In particular, we show that the underwriting cycle may distort development patterns and that premium rate indices may understate its magnitude. In order to address the reserving cycle an understanding of the underwriting cycle is essential. This paper raises a number of questions and challenges regarding current reserving practice. Further work may be required by the profession to address these questions.

Keywords

reserving cycle, underwriting cycle, soft market, rate indices, development patterns

The views expressed in this paper are those of the working party and do not necessarily represent the views of every member or of any organisation with which any member of the group is, or has been, associated.

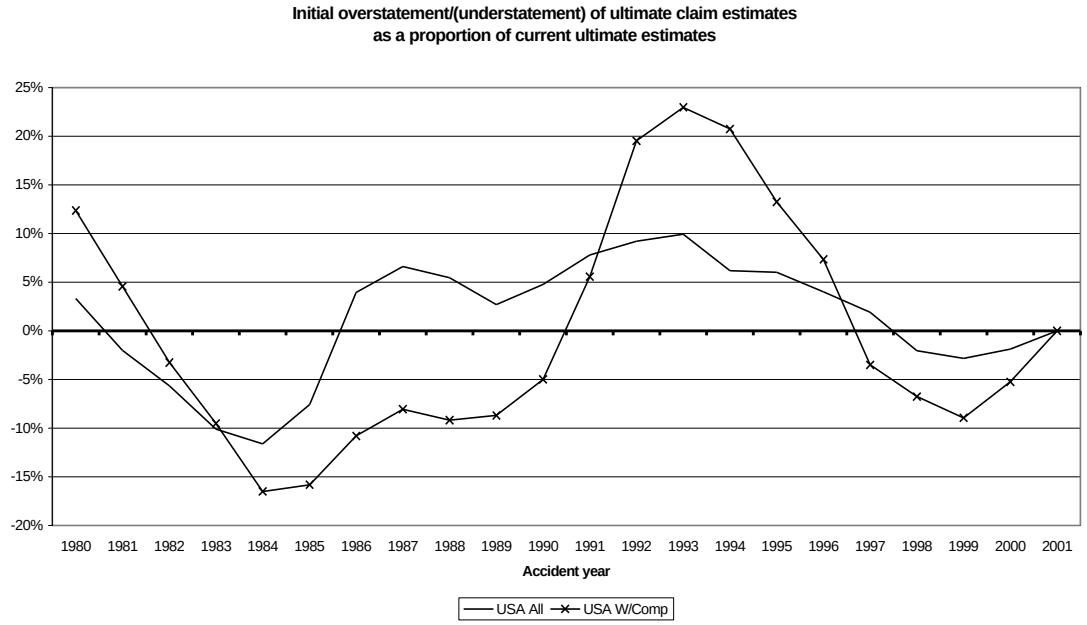
Contents

Introduction

At GIRO 2002, Bob Conger, CAS President, gave the keynote presentation.
This presentation included a graph, which we have reconstructed below.

The graph indicates the relationship between initial and current ultimate loss selections for each accident year for the last 20 years for the US industry.

The graph demonstrates a strikingly clear cycle of over- and under-reserving. The phasing of this cycle appears to match the underwriting cycle. In particular, there seems to be a tendency for insurers to over-reserve when underlying loss ratios are low and to under-reserve when underlying loss ratios are high. We have called this cycle the "Reserving Cycle". The Reserving Cycle should not be confused with the underwriting cycle.



The suggestion of a reserving cycle clearly posed a number of questions and challenges for the UK insurance industry, and for the actuarial profession. This working party was established in an attempt to address some of these issues. To deal with these in an orderly manner, the working party established the following terms of reference:

1) Is there a reserving cycle in the UK?
2) What causes it?
3) How does it affect the various actuarial methods? How can we fix them?
4) How do we prepare for a soft market?
5) Can we suggest management strategies for handling the cycle?

This paper addresses the first four points. The fifth has been dealt with in a separate, but related, paper prepared by one of the members of the working party, “Cynic and Idealist: Two views of the Insurance Cycle (and of the general insurance business).”

SECTION 1: Is there a Reserving Cycle in the UK?

1.1 Introduction

The most immediate question faced by the working party was to establish whether a reserving cycle did, in fact, exist in the UK.

To carry out this work we have used data from the FSA Returns (and prior incarnations) from 1985 to 2001 inclusive. This data has been sourced from Standard & Poor's Synthesys who kindly gave permission for us to use their data in this investigation.

We have combined gross of reinsurance data across all direct writers in the UK market (excluding Lloyd's of London). For each accident/underwriting year we compared the market's initial estimate of ultimate cost at the end of development year one with the current or most recently available estimate of ultimate cost.

Due to the nature of the FSA Return data, we have segmented the UK market into two components – business accounted on an accident year basis, and business accounted on an underwriting year (funded) basis.

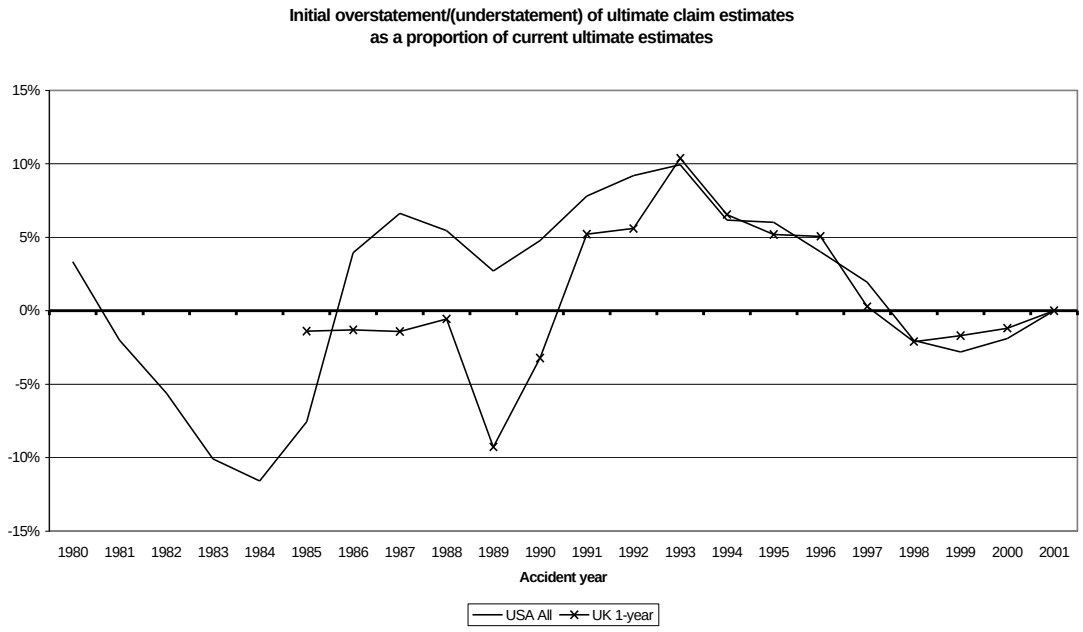
In preparing the graphs below, and, in particular, in determining the overstatement/understatement of initial ultimate claim estimates, we have assumed that the "correct" estimate is represented by the most recently available value. In practice, this assumption is unlikely to hold true, especially in respect of the most recent years of account. As a result of this approximation, the graphs appear to indicate an improving accuracy of initial ultimate claim estimates as we move towards 2001. We caution that such a conclusion is likely to be unduly optimistic. A description of how we have used the FSA Return data is included in Appendix A.

At this point a caveat is required. We have not spent as much time analysing this data as we would have liked. In particular we wanted to analyse specific companies and groups of companies. Our work was done at a reasonably high level in order to understand general trends. If the Working Party continues, a more detailed analysis of the FSA data could be undertaken.

1.2 Results for the UK Market

(a) Accident year basis

The first graph below compares the reserving cycle in the US, as identified by Bob Conger, with the UK reserving cycle (for business accounted for on an accident year basis only) implied by our own analysis.

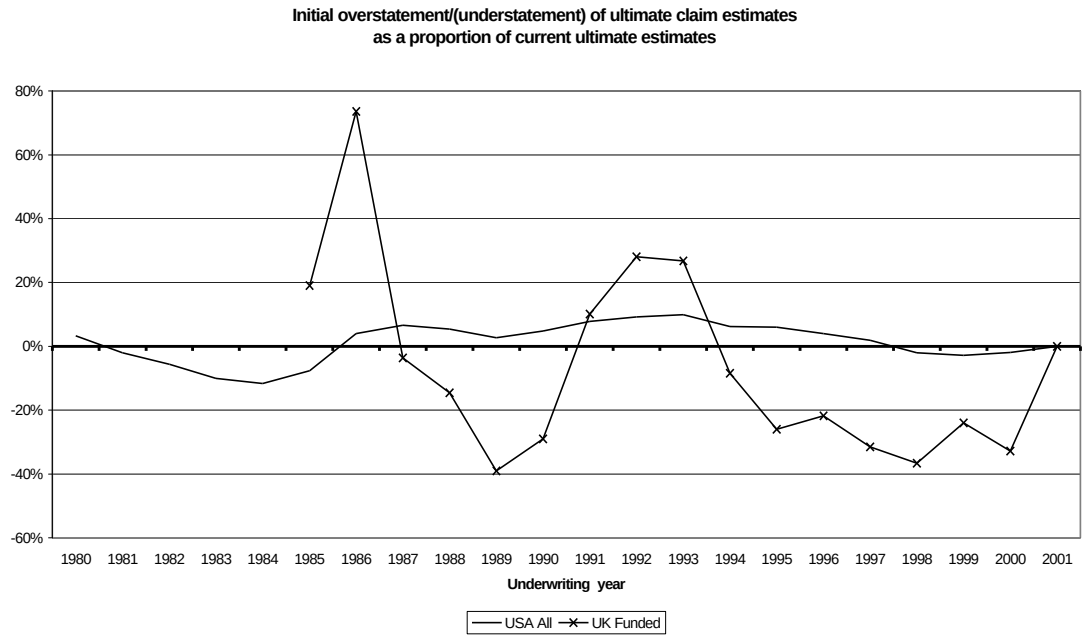


The graph indicates a remarkably close match between the US and UK experience, especially from 1993 onwards. Both graphs show a clear cyclical pattern with a peak at the 1993 accident year and troughs around 1989 and 1999.

The graph provides clear evidence of a pronounced reserving cycle in the UK.

(b) Underwriting year basis

The next graph compares the US reserving cycle with the UK reserving cycle for underwriting year business (excluding inwards reinsurance). This segment of the UK market predominantly relates to the London Market.



Again, the graph indicates a clear cycle in the UK, with peaks and troughs at broadly the same times. However, there are two profound differences from the previous graph that are immediately apparent.

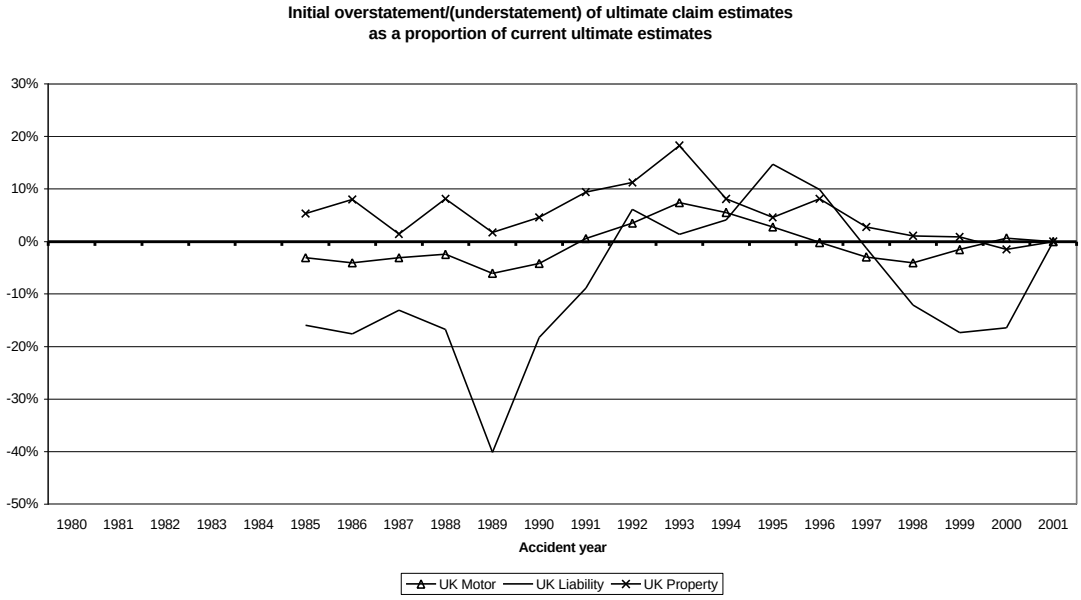
- The amplitude of the reserving cycle is far greater for funded business, with the initial error exceeding +/-30% at each peak and trough.

- The latest period of initial understatement of reserves appears to be much longer than the previous period of overstatement. This suggests a tendency towards under-reserving of funded business. This may be related to the poor loss experience over this period.

We highlight that the above analysis should not be distorted by asbestos, pollution and similar latent claims, which are concentrated in underwriting years 1985 and prior.

1.3 Results by line of business

A review of certain selected lines of business is instructive, as can be seen from the graph below, which compares the reserving cycles for Liability, Motor and Property business (all on an accident year basis).



All three curves show broadly the same shape. This supports the view that the reserving cycle operates across classes, rather than being driven by a single "rogue" line of business or by short-term volatility.

Note our earlier caveat about recent years; the analysis assumes that the latest company ultimate is correct. This may overstate reserve accuracy on recent years.

In addition, we can observe the following differences between the three classes.

- There is a much greater amplitude of variation in respect of Liability, compared to the other two classes, probably reflecting the greater uncertainty (and hence scope for error) of longer tailed business

- There appears to be a tendency towards under-reserving in respect of Liability and towards over-reserving in respect of Property. For Motor alone do we observe a true cycle around an otherwise reasonable market estimate.

Equivalent graphs for other FSA accounting classes are shown in Appendix A.

1.4 Conclusion

We have established that the UK insurance industry does indeed exhibit a strong reserving cycle. This cycle tends to be more pronounced for longer tailed lines of business, and is more extreme for funded business.

Note that we have found a cycle in companies' booked numbers. We now look at how these may relate to actuarial recommendations.

SECTION 2: What causes the reserving cycle?

2.1 Introduction

Having established that there does appear to be a reserving cycle in the UK, we must consider what might give rise to the cycle. There are various possibilities:

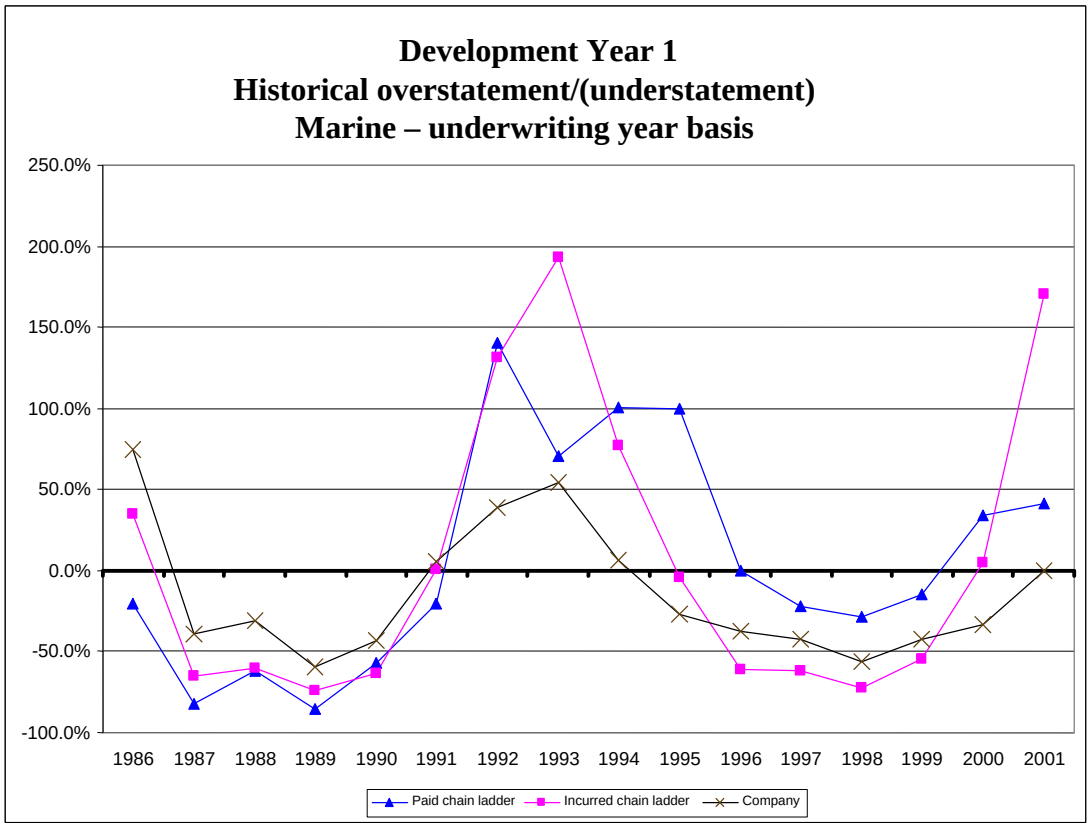
- "Actuarial" methods go wrong (ie are skewed) because they are driven by the rating cycle, economic cycle or other influences
- Judgements applied to the methods may be skewed. For example by overriding figures that appear to be too extreme but turn out to be realistic
- It may be that reserves are not set using actuarial methods – the methods actually used may be distorted by the rating cycle
- Actuaries or management may deliberately choose to move away from best estimate figures at different stages in the cycle

The Working Party concentrated its investigations on whether standard actuarial methods could give rise to the observed cycles, either because of the "mechanics" of the methods themselves, or because of the judgments made when they are applied. Further investigation into the other areas that could give rise to the reserving cycle may be beneficial if the Working Party continues.

2.2 Analysis of actuarial methods

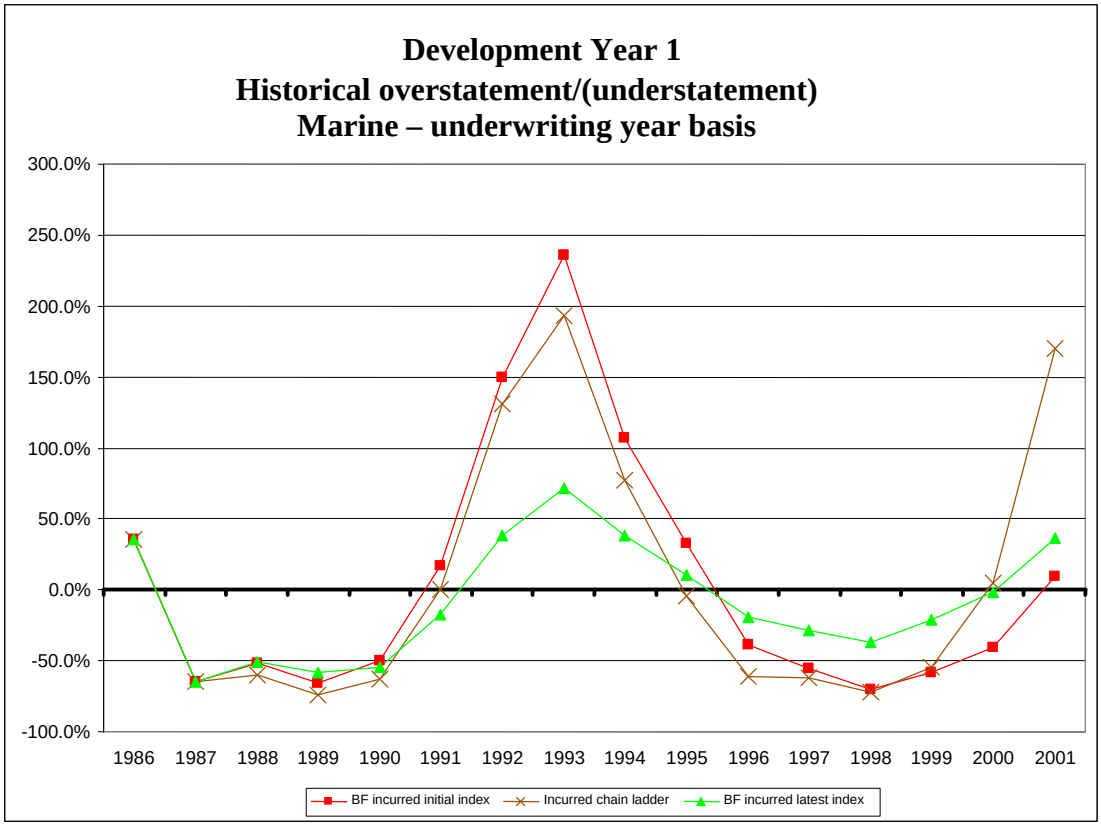
The Working Party applied a mechanical approach to estimate reserves using standard actuarial methods. To limit the potential for human bias to distort our conclusions, the only judgement applied was at the initial set-up of the mechanical approach. No further intervention was made. Details of the methods we have used can be found in Appendix B.

In this section we comment on a sample of the classes of business we analysed. The graphs below show the historical overstatement or understatement of the initial reserve estimate at the end of development year one compared to the latest company estimate for each accident/underwriting year.



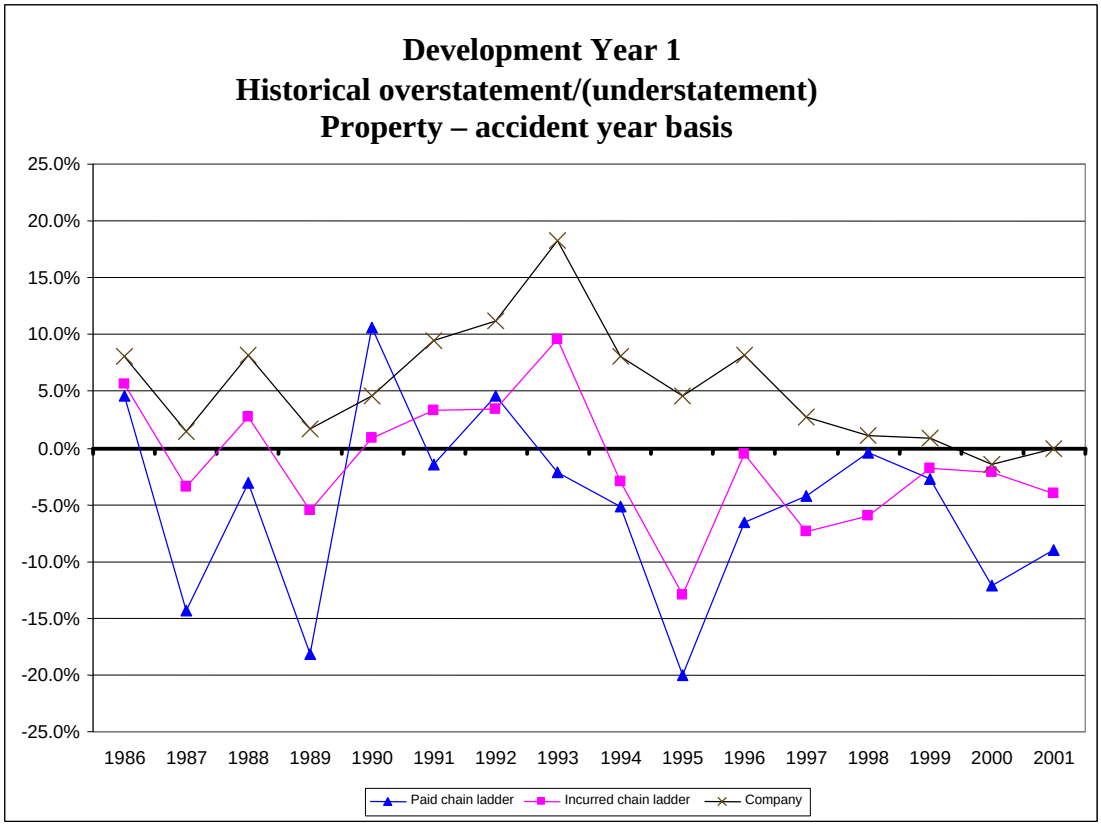
Both the paid and incurred chain-ladder methods show a reserving cycle. There is also a cycle in the company estimates, as discussed in Section One. The company and method cycles are clearly correlated. Interestingly, the company cycle exhibits a smaller amplitude.

The following graph shows the same marine business reserves using the Incurred Bornhuetter-Ferguson (IBF) method. Two rating indices were used to derive Initial Expected Ultimate Loss Ratios (IEULRs) from previous years' ULRs. The 'initial' index was an *a priori* index an actuary may have used at the time. The 'latest' index was based on actual results. It could be described as a perfect hindsight index.



The IBF methods also produce a reserving cycle. Although the IBF with a perfect hindsight index gives a cycle of smaller amplitude, there is a still a cycle. There are two possible reasons for this. Firstly, despite using the hindsight index, the IEULR will be wrong if the prior years' ULRs are wrong. Secondly, the cycle may influence the appropriateness of the chain ladder factors used in the method.

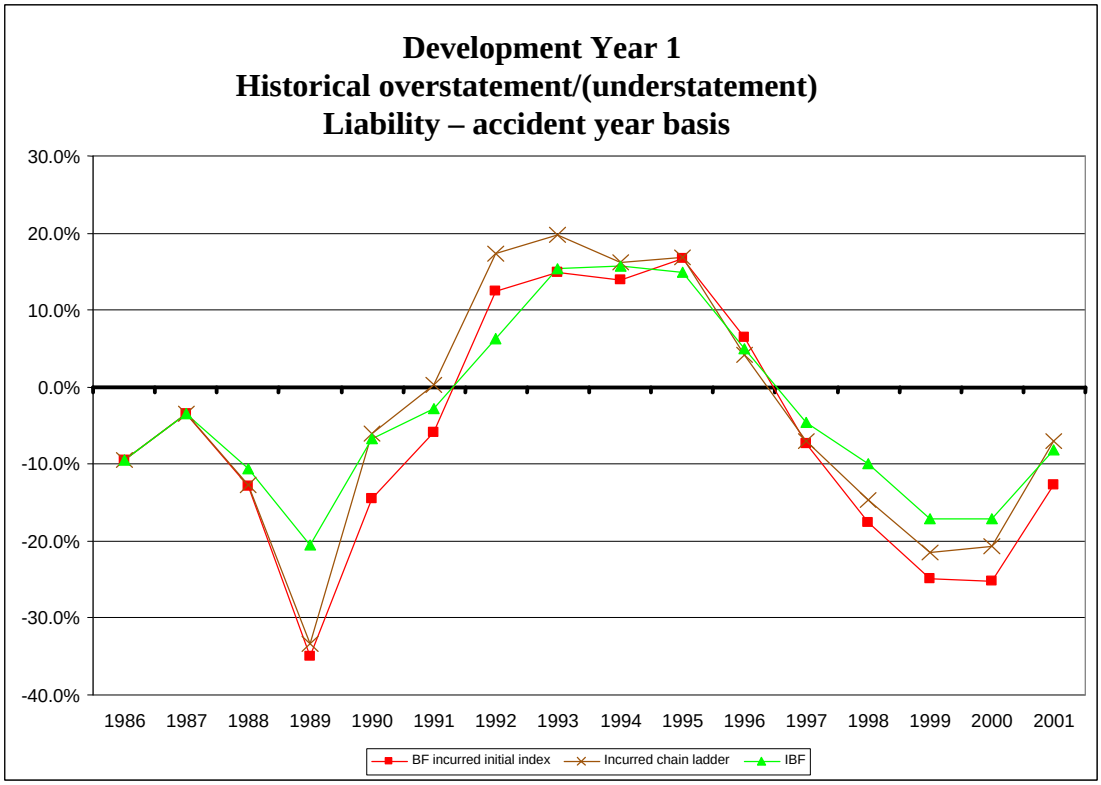
The following graph shows property business for the chain-ladder methods.



The company reserves show an initial overstatement of reserves. This is possibly due to redundancies in case reserves being released over time. The degree of company reserve overstatement appears to be cyclical.

The incurred chain ladder shows weak evidence of cycle. If the level of case reserve redundancy is cyclical then the incurred chain ladder will be affected. The paid chain ladder is too volatile to produce conclusions.

The following graph shows Liability business for the incurred chain-ladder and BF methods.



Each of the above methods shows a cyclical pattern. Interestingly, the chain-ladder and the BF methods are closely correlated. This raises some interesting questions. How independent is the choice of the initial expected loss ratio for the BF method from the chain-ladder method? Can the cycle be dampened or avoided after judgemental intervention?

Analysis of other classes of business shows similar results. Further details are provided in Appendix B.

2.3 Conclusion

It does appear that a "mechanical" approach to reserving using traditional actuarial methods may result in a reserving cycle. Any judgemental intervention to a mechanical approach may dampen the effects of a reserving cycle. It does not follow that actuarial methods are unhelpful; in fact it underlines the importance of using actuarial judgement in conjunction with the methods.

Of course there is no doubt that actuaries do already apply considerable judgement in the application of traditional methods. However, we must ensure that such judgement is sufficient to overcome the reserving cycle, which we suggest is not fully understood by the insurance industry.

Further investigations into the underlying reasons for the influence of actuarial methods on the reserving cycle would be beneficial if the Working Party continues.

In the first section of the paper we showed that UK companies' reserves tend to show a cycle of initial over- and under-statement in line with the underwriting cycle.

In the second section we applied standard actuarial reserving methods to UK company data and suggested that these methods also exhibit such a cycle.

In the final three sections of the paper we investigate possible improvements both to the application of these methods and to the methods themselves.

SECTION 3: Development patterns and the underwriting cycle

3.1 Introduction

The core foundation of many actuarial reserving methods is the assumption regarding claim development patterns. We usually assume that, despite fluctuating premium levels and fluctuating loss ratios, the shape of a claim development curve is, subject to random influences, the same from year to year.

We asked ourselves if the underwriting cycle was likely to affect development patterns in some way, so as to invalidate this assumption. Our hypothesis was that there would be some effect and the results of the previous section provide prima facie evidence to support it. Certain soft market features that we thought could impact patterns include:

Looser term and conditions
These could lead to types of coverage with different reporting and/or settlement delays. Looser conditions could also lead to more, or more protracted, litigation.

Lower deductibles
These could lead to a shorter development pattern

Multi-year deals
If not spotted and allowed for these could lead to an underestimate of the tail. Accident year analysis would deal with this problem, as would annual re-signing. Reinsurance could cover cedants writing multi-year policies.

The difficulty with identifying a relationship between reporting patterns and the market cycle is that other trends affect development patterns. The change from losses occurring to claims made is one example.

3.2 Data

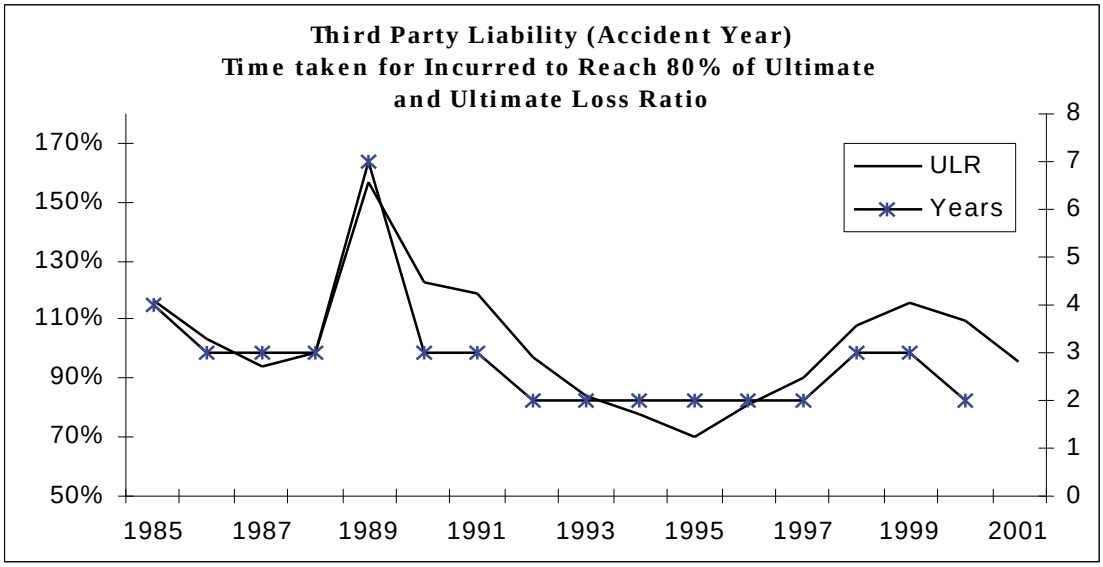
The challenge when trying to investigate the effect of the underwriting cycle on development patterns is to obtain a credible set of data over a significant period of time. Only fully mature years can be used for this research. We considered using Lloyd's data. However, this does not cover

a full cycle since it is only available from 1993 and recent years are not fully mature for most classes.

We used the FSA data from Section 1 and looked at the time taken to reach a certain percentage of the ultimate. We covered both accident and funded bases and looked at both paid and incurred data.

3.3 Results

The clearest relationship between Loss Ratio and Tail Length was for the Liability class on an accident year basis. The chart below compares the two.



Marine also showed a strong correlation on the funded basis. However, the LMX spiral in the 1980's distorts this class giving a clear relationship between tail and results. Other classes also showed a positive correlation between tail length and loss ratio (higher loss ratio, longer tail).

3.4 Conclusions

The results were not significant enough to confirm or refute our hypothesis beyond doubt. However, when investigating own company data and discussing the issue of development patterns we came up with the following points that are food for thought.

- Paid and incurred chain ladder projections assume future development patterns will match the past.

- Incurred patterns are reliant on consistent case reserve setting. In a hard market companies may encourage conservative case setting because they can afford to, and to create cushions for the future. Soft years may produce the opposite effect. Paid patterns may be unaffected.

- Certain factors may distort paid projections during the cycle. In a soft market cashflow may become tight. This may lead to slower payments, more protracted arguments over claim validity and a different level of commutation activity.

- Both paid and incurred patterns may be affected by changes in terms and conditions. Completely new terms and conditions mean that there are no prior years whose development may reflect the current experience. If current terms and conditions were last used ten years ago the data from that time may be considered. However, many other influences may have changed making even that data useless.

- Classes may show a negative correlation between Loss Ratio and Tail Length. For example, a property class that has a very large loss early on will reach a given percentage of ultimate sooner. However, an actuary would be expected to take account of such features.

- If a mechanical chain ladder cannot handle the underwriting cycle, and if other trends prevent older years' patterns being used, then something else is needed. Clearly a degree of judgement must be applied to modify past development patterns. Discussions with underwriters, claims staff and others may invaluable input into making such modifications.

- We have focussed here on the limitations of the standard chain ladder technique. However it would be wrong to suggest that adopting a Bornhuetter-Ferguson approach will eliminate these limitations. Firstly, this method is influenced in part by the chain ladder assumptions, which we have shown to be affected by the cycle. Secondly, this method requires and reliable and up-to-date rate index. These can be hard to come by, as we discuss in Section 5.

- It may be beneficial to create an expected development pattern from first principles to suit the current terms and conditions exactly. Historical data could be used to understand the claims development process. A model could then be built to cover each step in the process: policy incepts, loss occurs, loss is reported, case reserve is established, case reserve is re-evaluated, loss is paid (possibly after a legal process). Thus a Markov chain could be used to create a bespoke benchmark development pattern. This could be constantly updated throughout the life of a policy year as claims come in and policies go off risk. This approach presents a number of challenges particularly in respect of parameterisation. However, this could be an interesting direction for future research.

SECTION 4: Understanding the underwriting cycle

4.1 Introduction

Whether or not we are going to use our judgement to dampen the Reserving Cycle it is certainly beneficial to know where we are in the underwriting cycle. Are we in a soft market?

4.2 Definition of a Soft Market

Softness is clearly a relative term but, at some point, it becomes absolute: a class of business is losing money. The trouble is that this subjective. Underwriters will have different views on the adequacy of rates. One may allow for investment income in assessing profitability. Another may have a different expense allocation. Another may have a cheaper reinsurance programme to pay for. Defining profitability is hard, even before you try to measure it.

4.3 Factors driving the underwriting cycle

In order to understand the underwriting cycle we need to know what factors drive it. Looking out for these will help us enormously:

In-flows and out-flows of capital
Capital essentially determines the supply of insurance. Supply and demand determines price.

Industry loss experience
Heavy losses take capital out of the industry

Profitability and 'payback'
In commercial insurance, insureds seem content to pay higher premiums for cover after big events. This is the concept of payback. Insureds are also very aware of when the industry has become profitable and expect to pay lower premiums after a year or two of good experience. These lower premiums may be lower than the technical rate.

Reserve deterioration
This has two effects. Firstly, it takes free capital out of the market. Secondly, it may cause insurers to re-evaluate their rates for current business.

Investment performance
Good investment performance can make up for poor underwriting performance and can raise capital levels in the industry. High expectations of investment performance may encourage softer rating levels.

Self-fulfilling gossip
Like many things in life, the press seems to have an influence over the events on which they report. Brokers, too, are well placed to "talk the market up" – or down.

Do different classes of business have different cycles? Are they out of phase? Do they have different amplitudes? Many of the factors driving the cycle are common to all classes (capacity, investment conditions, economic conditions). Even loss activity in one class can affect other classes via capacity reductions (World Trade Centre, for example).

4.4 Is the Market Different Now?

Yes!
One could argue that today capital is much more sophisticated and can move around more freely than historically. The free flow of capital is vital to allow the market to remain close to the optimum level of capital at any one time.

Current investment conditions mean that underwriting results are far more exposed than historically. The lifespan of the hard market may depend on how long investment conditions prevail.

At Lloyd's, the Franchise Performance Directorate aims to encourage higher underwriting standards. The FSA has, perhaps, greater influence now than any previous regulator.

Finally, many believe that a post WTC world makes the rating sins of the past far less likely to be repeated.

No!
The above arguments may be optimistic. The worldwide insurance market has a poor record of learning from its mistakes. The key influences of 'supply and demand' and 'fear and greed' are universal constants.

The need for large amounts of capital can make starting up a new company onerous – but this never seems to have been a problem. The problem has been leaving the market as there are high barriers to exit. Going into run-off leaves capital tied up for years, and run-off expenses (which may not be properly priced or reserved for) will erode it.

The Working Party discussed these conflicting attitudes at length and they are explored in greater depth in the separate but related paper entitled "Cynic and Idealist: Two views of the insurance cycle (and of the general insurance business)."

4.5 Measuring Premium Rates

Once we have understood the factors driving levels of pricing in the market we need to look closer to home. We need to measure the levels of pricing in our own markets.

Can we determine, in real time, the absolute level of premium rates? If everyone knows when it's a soft market, how come we still get it wrong? Perhaps we don't realise how soft the market is. One answer is to monitor premium rates and this is dealt with in the Section 5.

4.6 Other Soft Market Indicators

Are there other metrics for spotting the beginning of a soft market? We asked a number of underwriters and insurance practitioners to complete the following sentence:

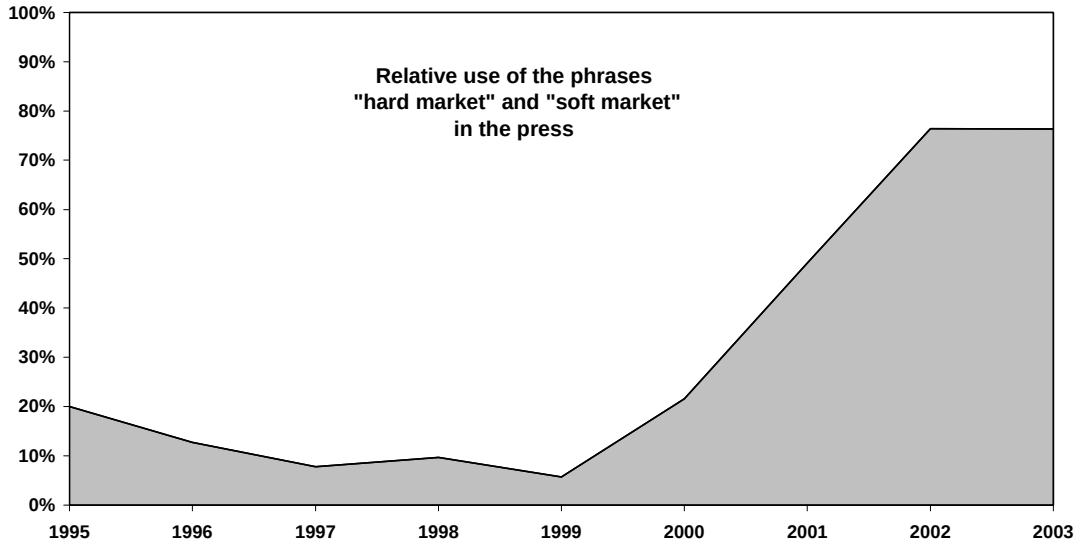
"You know you're in a softening market when…."

Not all of the answers were entirely serious:

- ….prices are falling
- ….terms are getting looser
- ….you get signed down more
- ….underwriters are afraid of losing income
- ….commissions increase
- ….premium payment terms get longer
- ….underwriters are not prepared to let business go
- ….the new market leader in a class is someone you have never heard of
- ….Wall Street buzzes with the sound of insurance CEOs confidently promising top line growth
- ….the underwriter pays for the lunch, not the broker
- ….actuaries ask you questions about being in a soft market
- ….it's too late!

Finally, we mentioned above the impact of gossip on the insurance market. As a more light-hearted piece of work we searched the internet site of a well-known insurance publication for the phrase “hard market” and “soft market” for each year since the site began. The graph below shows the relative usage of these words. Clearly headlines like “No sign yet of the soft market” can distort the analysis. However, as the following graph illustrates, we may have stumbled on a useful metric. We will keep this graph going in the future and see if the trend continues!

The lower (shaded) area relates to “hard market”, the upper area relates to “soft market.”



SECTION 5: Premium Rate Indices

5.1 Introduction

One of the key inputs to the reserving process of the more immature years will normally be an assessment of the likely profitability of the business written.

For example, in the case of the Bornheutter-Ferguson method this is expressed in the form of an initial expected loss ratio. This is normally derived from ULRs projected on older, more mature, years of account, adjusted for changes in premium rates. In this context, changes in "premium rate" will need to include not only pure rate movements, but also other changes to the contract that will have an impact on expected profitability, for example deductibles and limits, and more general terms and conditions.

There is therefore significant reliance placed upon the assessment of "rate movement". This is commonly expressed in terms of a rate index. There are various ways in which these indices are constructed, and it is not the purpose of this paper to discuss these, except to say that in many cases, particularly in the London Market, the prime source of the index will often be the underwriters of the business. These indices will therefore be susceptible to bias – both intentional and unintentional – and will, in any case, include a substantial element of subjectivity. Bill McConnell et al presented a paper covering the construction of premium indices at GIRO 2001.

The cynical actuary will normally expect the underwriters to understate the extent of a downturn in the market. After all, there are a large number of influences on underwriters in a softening market that will push them towards taking a more optimistic view than they might have otherwise taken. However, the difficulties of quantifying the effect of terms and condition changes should not be underestimated.

In a hardening market, the influences on underwriters are different, and can operate so as to engender a degree of pessimism, or conservatism, in the underwriters' assessment of the business they have written. It is normally preferable to deliver an acceptable result up front, and have it improve, than to promise a stellar result that does not deliver.

If the underwriter (and hence rate index) is influenced by these factors, then, whilst the rate index may well show the direction in which the cycle is moving, it is likely to understate the extent of that movement. Unless corrected for this would lead to a reserving cycle, since the reliance placed upon rate indices for immature years would cause them to be reserved closer to an "average" year than the true position in the cycle would require.

5.2 Analysis

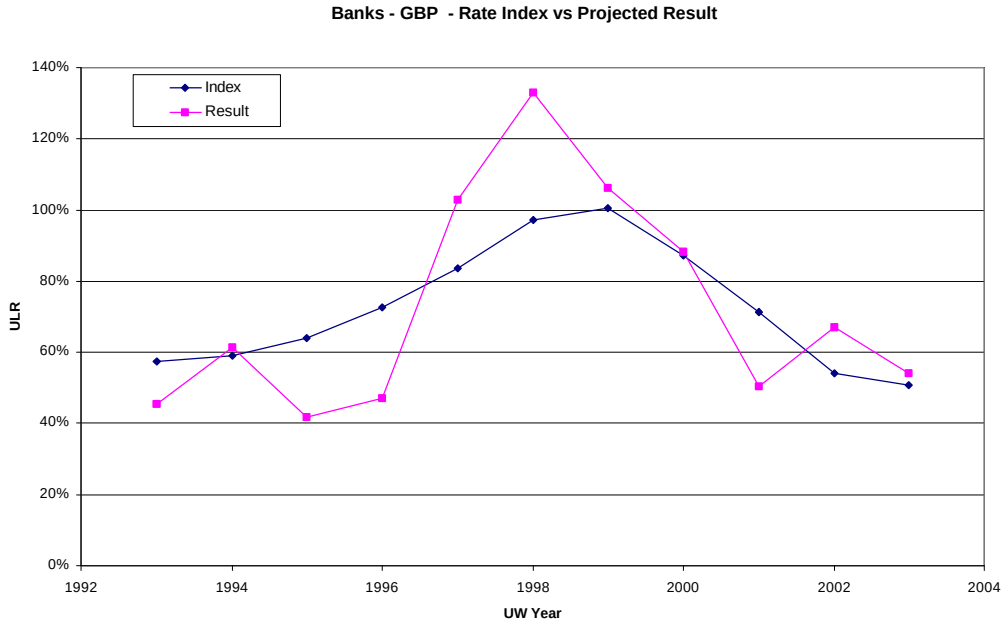
We decided to test whether a rating index does understate the amplitude of the cycle. We took selected market level risk code data from Lloyd's and projected ULRs using Chain Ladder and Bornheutter-Ferguson models. These projections were carried out fairly mechanically, so do not necessarily allow for all the features of the business in the years in question. The results should nevertheless be representative of the general trends. The underwriting cycle is clearly present in the results, although for some of the classes the results are also significantly claims driven.

We then took the market average premium rate indices collated centrally by Lloyd's. We chose a loss ratio for the first year (1993) and used the Lloyd's indices to derive loss ratios for each later year of account. To provide a comparison with the ULRs projected as described above we set the 1993 loss ratio such that the average loss ratio over the years 1993-2003 was equal to the average projected ULR.

This was done for a variety of risk codes and currencies as shown in the table that follows. We did not analyse Property XL or Aviation business as the results in these markets are significantly influenced by random large loss experience, which would make it more difficult to draw any conclusions from the analysis.

5.3 Results

The following graph shows the projected ULRs resulting from the claims projections, and those ULRs implied by the rate index, for the Banks class in USD. As can be seen, the range between the best and worst years is considerably greater in the actual results than according to the index. However, the general shape of the graph is similar for the two sets of loss ratios.



This example supports the hypothesis that the index gives an indication of the cycle, but appears to understate the amplitude. In order to quantify this understatement, we have used two alternative measures of the amplitude of the cycle. The first quantifies the amplitude as being the range between the high and the low point, expressed as a proportion of the mean value. The second is simply the standard deviation.

In the table below we show the maximum and minimum ULRs both as projected (using loss data) and derived from the rate index for each of the risk codes considered. For each of these we then calculate the amplitude on the two bases, and compare these by dividing one by the other to give a measure of relative amplitude.

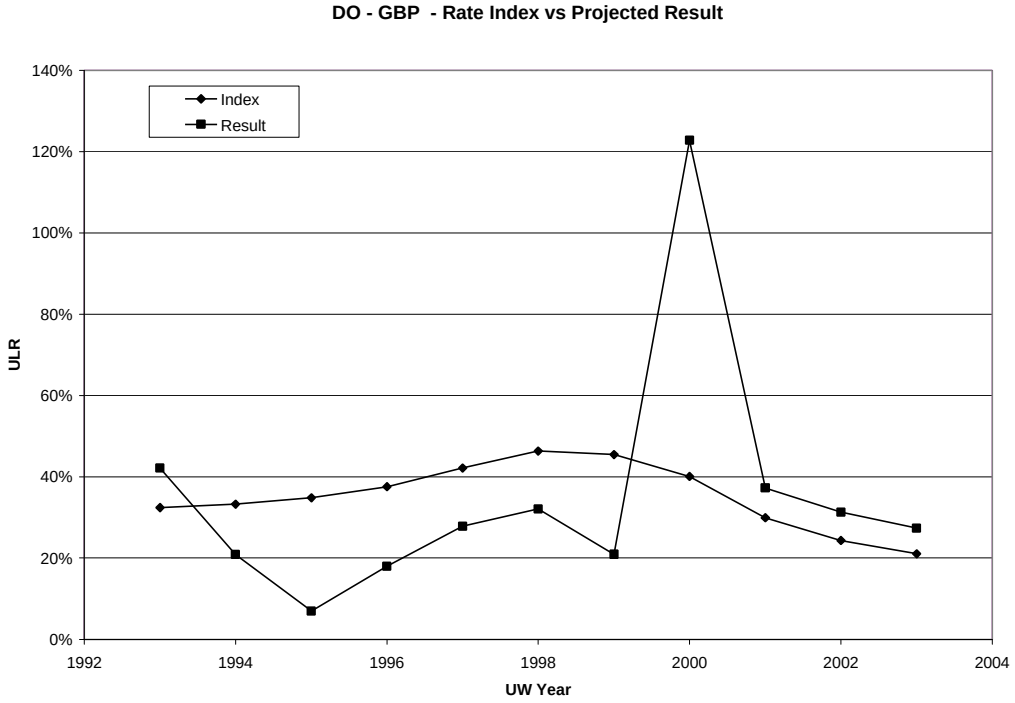
Class	Projected ULRs %					Index-implied ULR%				**Rel Amp**	**Rel Std Dev**
	Mean	Max	Min	Amp	Std Dev	Max	Min	Amp	Std Dev		
Banks USD	102	204	40	1.61	50	141	72	0.69	23	**2.35**	**2.19**
Banks GBP	73	133	42	1.26	30	100	51	0.69	17	**1.84**	**1.75**
D&O USD	140	53	273	1.57	74	184	84	0.72	32	**2.18**	**2.27**
D&O GBP	35	123	7	3.29	31	46	21	0.72	8	**4.58**	**3.75**
Hull USD	90	150	48	1.12	35	126	65	0.67	22	**1.68**	**1.57**
Hull GBP	98	149	54	0.97	34	137	71	0.67	24	**1.45**	**1.42**
PI USD	112	185	73	1.00	46	143	78	0.58	21	**1.73**	**2.14**
PI GBP	93	166	60	1.14	32	119	65	0.58	18	**1.97**	**1.79**
M Liab USD	55	112	23	1.62	28	73	41	0.57	12	**2.83**	**2.26**
M Liab GBP	55	105	12	1.68	30	73	41	0.57	12	**2.93**	**2.51**
Cargo USD	91	140	65	0.82	23	113	72	0.45	14	**1.82**	**1.68**
Cargo GBP	84	106	61	0.53	16	104	66	0.45	13	**1.18**	**1.26**
D Pty GBP	82	161	45	1.42	38	124	59	0.78	23	**1.81**	**1.67**
D Pty USD	98	148	41	1.10	38	129	62	0.68	22	**1.61**	**1.75**

5.4 Commentary

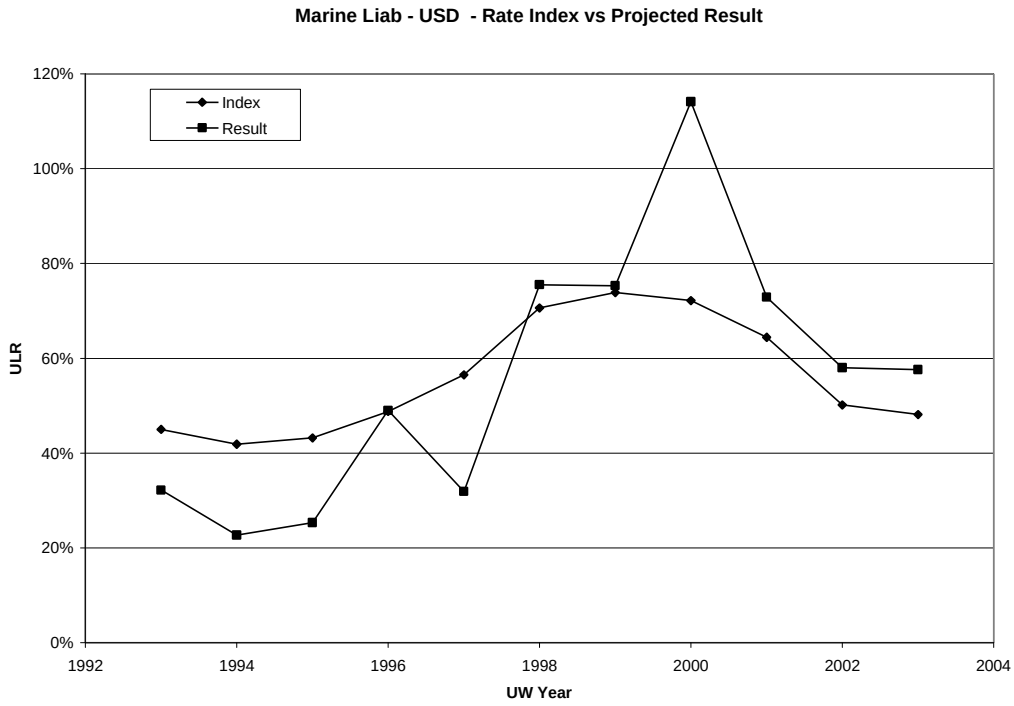
The last two columns are greater than one for every class. Thus the amplitude and standard deviation of the actual underwriting cycle are, in all cases, greater than those of the underwriting cycle implied by the index.

The two measures showed themselves to be relatively consistent, with some exceptions. An example is the PI class, where the differences can be explained by the "spike" in the experience (see graph later).

The values of the relative amplitude and standard deviation varied quite significantly between classes, ranging from around 1.2 (Cargo GBP) to 2.5-3.0 (Marine Liability), to GBP D&O at around 4.0. The GBP D&O is entirely driven by very heavy claims experience on the 2000 year. If this is excluded, the relative amplitude reduces to less than 2.0, which is probably a better reflection of the quality of the index. This can clearly be seen in the graph below:



The Marine Liability results may be attributable to anomalous poor claims experience, although this is not as clear cut as in the case of GBP D&O. The graph for the USD business appears below:



The extent of the understatement of the amplitude varies considerably across the classes considered as can be seen from the numbers in the final two columns of the table. However, it is unclear whether this difference is due to sampling error – there are, after all, only 11 data points – or whether there is something intrinsic to the classes of business that will produce different levels of understatement.

On the second point, one might expect the understatement to be greater for classes of business where there is greater variation in terms and conditions over the course of the cycle. Profitability would thus be driven by factors that are harder to quantify than simply rate. It is possible to find examples in the above to support this. Cargo and Hull generally have relativities at the lower end of the range. The relative amplitude for Cargo USD is high as a result of a single year's experience (1998).

The results of the property analysis do not support this assertion however, as both the GBP and the USD relative amplitudes are comparatively high.

This may be partly claims driven – the USD 2001 result is very poor (WTC) and 2002 is particularly good.

Sampling error is potentially significant, as inspection of the graphs shows that there are many "outliers". In many cases these could be argued as being attributable to unusual claims experience and so not something that a rate index should be expected to anticipate. If this is the case, then the rate index may not in fact be understating the quality of the business being written. This would suggest that modifying the index to reflect experience would be beneficial for reserving. However, this "unusual" claims experience does seem to occur more often than not in the worst years of the soft market, as was the case with USD Marine Liability. An alternative explanation therefore could be that these poor results come from claims that would not arise under stronger, hard-market, terms and conditions. If this is the case, then the rate index should make provision for such losses.

The uncertainty relating to this issue makes it difficult to form any strong conclusions as to the level of understatement, or even whether this genuinely varies between different classes of business.

5.5 Conclusions

This discussion clearly raises more questions than it answers, and so could be a fruitful area for more work.

For the time being, the one conclusion that can be drawn is that there does consistently appear to be an understatement in the amplitude of the cycle when measured by rate indices. The extent of the understatement is variable, and the uncertainties in the data significant, but an adjustment factor of 1.5 to 2.0 could well be appropriate.

Section 6: Conclusions

6.1 The Reserving Cycle in the UK

Our analysis of FSA data has shown that there is a Reserving Cycle in the UK. This cycle is correlated to the underwriting cycle.

6.2 Merits of the Reserving Cycle

Having established that a reserving cycle exists, it would be premature to state that it is necessarily "a bad thing". We would struggle, though, to justify any conclusion that a long-term tendency to under-reserve is a good thing. Arguably, if the cycle is well understood by insurers then, within the bounds of regulation, it can be used to manage the emergence of profit over time and the image of the company.

This Working Party would suggest, however, that the above proposition is a complacent one. The last soft market led to significant levels of under-reserving across the globe. Rather than increasing stability, the effects of this under-reserving are still being addressed, and are continuing to cause a drag on profit levels in the industry.

There are two principal motivations for flattening the reserving cycle.

Firstly, by improving the accuracy of reserve selections early on we can reduce the level of prior year deteriorations that are so damaging to the industry.

Secondly, by giving management a more accurate assessment of the profitability of product lines we can facilitate appropriate decisions being taken. In a hard market this may mean expansion for a product line. In a softening market this may mean reducing volume targets, encouraging rate increases or exiting lines of business completely.

6.3 Causes of the Reserving Cycle

Standard actuarial reserving methods could well contribute to the Reserving Cycle. Further investigation of this conclusion is needed. Obviously, actuaries do not set reserves; this is the responsibility of management. We wanted to spend some time examining the relationship between the actuaries (internal and external) and the management of

insurance companies. The way this relationship changes during the underwriting cycle could be an area for future work.

6.4 Actuarial Methods

We have shown the importance of not using standard methods mechanically. Both chain-ladder and Bornhuetter-Ferguson methods can be distorted by the vagaries of the underwriting cycle. An appreciation for the current state of the underwriting cycle and what drives it is vital. A greater understanding of the claims development process could be sought. This may be a topic for future study.

Users of actuarial methods should be mindful of the assumptions being made within each method, and consider whether there are reasons why these assumptions may be invalid. If this is the case, then modifications may be possible, perhaps after discussions with others in the company.

Rating indices are a fundamental reserving tool. Their usefulness is as great as the difficulty in constructing them. For classes where the underwriting cycle affects only price they will be useful. Where there are major changes to terms and conditions they will need to be carefully produced and, even then, treated with caution. For all classes, they are likely to understate the amplitude of the underwriting cycle.

Perhaps the best way to stay close to the likely profitability of current business is to be close to its pricing. By increasing the degree of technical input to the pricing process both the management and the actuary would increase their understanding of the adequacy of rates.

Appendix A: Use of FSA Returns

A.1 Data used

The FSA returns contain claims information on a company by company basis. They are split into 8 accounting classes and within each are shown on either a one-year or funded accounting basis as determined by the company concerned.

Each return contains claims paid, outstanding estimates of reported claims and IBNR; the sum of these 3 components being the estimated ultimate cost.

Each set of returns contains claims data with up to 10 years of historical information by accident year and subsequent development. Therefore the 1985 returns allow us to see the 1976 development year 10 figures, 1977 development year 9 etc... Combing all the data from the 1985 to 2001 returns gives:

- only the year 10 development for the 1976 accident year;
- years 9 and 10 for the 1977 accident year etc;
- a full 10 years of development data for accident years 1985 to 1992;
- 9 years of development for the 1993 accident year, 8 for the 1994 etc;
- only the year 1 development for the 2001 accident year.

Development year 1 is taken to mean the value as at the end of the first year; so for example the 2001 claims paid figure as at the end of 2001 is here referred to as the development year 1 figure.

This data can be "triangulated" to give a parallelogram shaped data set for subsequent analysis.

To overcome inconsistencies in the data from brought forward and carried forward figures from one year to the next, we have:

- started with the latest available cumulative data for each accident year
- calculated the proportionate movement in that year's return between the brought forward and carried forward figures
- applied this proportionate movement to the latest data to work back to the previous year's figure

This is repeated for each year of data.

A.2 Method

To assess whether a reserving cycle exists we have examined the movement in ultimate claims estimates for each accident year by development year. We have initially aggregated data across all companies and lines of business and we have then looked at each line of business separately.

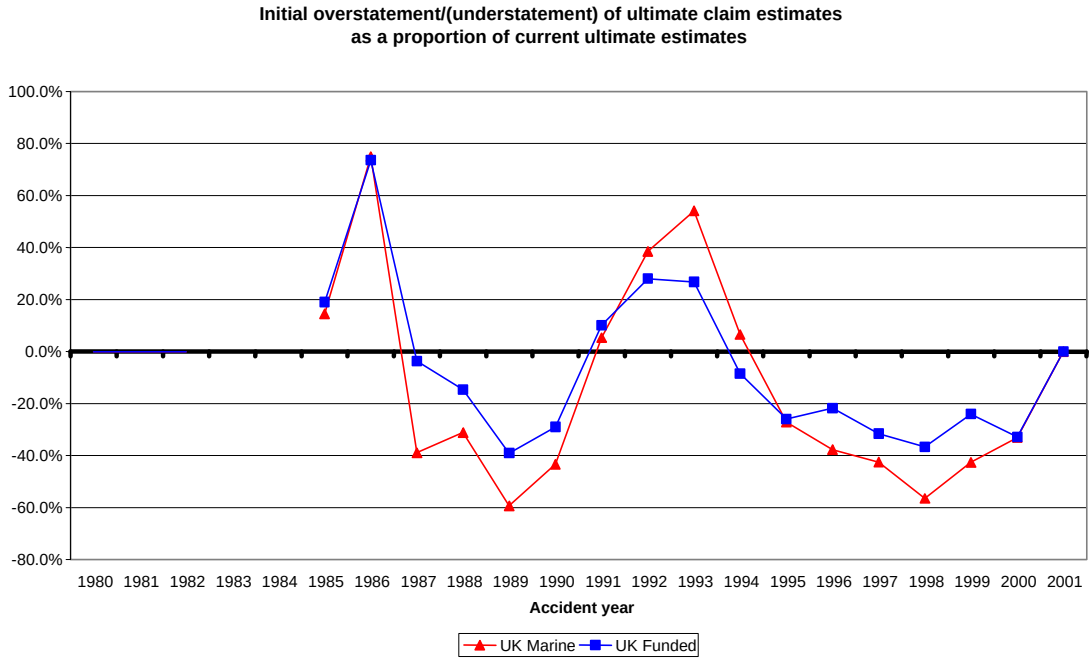
To view the results graphically we have plotted for each accident year the difference between the ultimate claims (including estimated IBNR) as at development year one less the ultimate claims for the latest development year as a percentage of this latest development estimate. Thus accident year forms the x-axis of the graph, and the lines show the extent of any initial under or over estimation at each development period compared to the latest estimate.

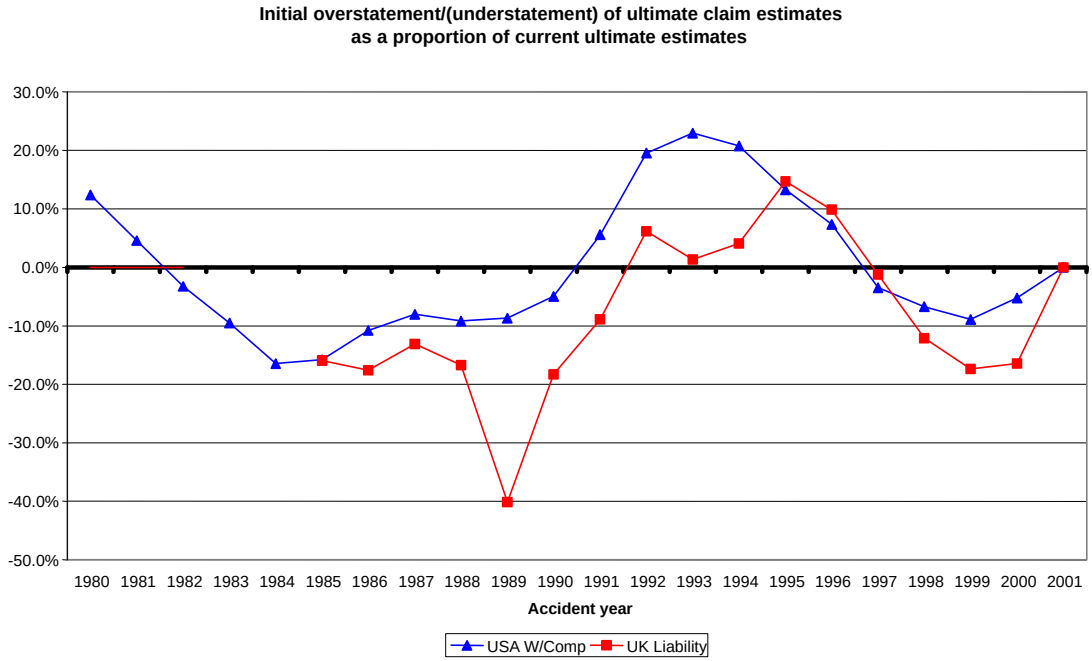
Given the data available we are unable to see any development periods after year 10 so the graphs implicitly assume that by the 10^{th} development year the estimate of the incurred will not change any further. For certain longer tailed classes of business this assumption is unlikely to be true.

Furthermore for the more recent accident years it is likely that the latest incurred figures will continue to move in future years, as more data becomes available. Therefore the graphs only show the extent of any under or over estimates compared to the latest position, not the ultimate position. This means that the graphs appear to show an improving degree of accuracy as we move towards 2001. This is a consequence of the methodology rather than an indication of improving accuracy of estimation.

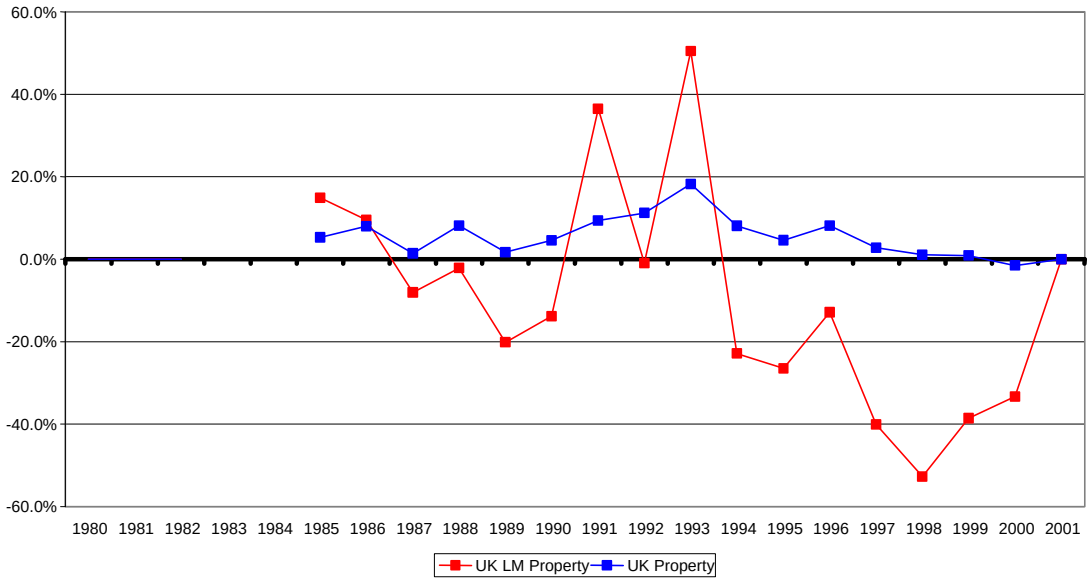
A.3 Results

The main body of the paper contains the results for certain lines of business. Others are shown below.





Initial overstatement/(understatement) of ultimate claim estimates as a proportion of current ultimate estimates



Appendix B: Testing standard reserving models

B.1 The models

We have considered 4 different models commonly used by actuaries in setting reserves:

- a basic chain ladder on incurred claims development (ICL)
- a basic chain ladder on paid claims development (PCL)
- a Bornhuetter-Ferguson projection on incurred claims (IBF)
- a Bornhuetter-Ferguson projection on paid claims (PBF)

We have used the data from the FSA returns that was described in Appendix A and applied each of these models to this data. We have started with the earliest data available: that of the 1985 FSA returns, and then worked progressively through each year's return applying the model to the latest data. The models project the ultimate losses for each accident or underwriting year. We then recorded how the estimates of the ultimate losses moved each year as more data became available.

We have analysed each line of business separately across the data for all companies combined.

The models are applied mechanistically without any intervention for judgment, large losses (or an absence thereof) etc. As such this is not intended to simulate what reserves would have been set in practice, but to attempt to see whether these methods will tend to give rise to a reserving cycle.

The basic chain ladder calculations use the weighted average development factors for the last 5 years. A tail factor is fitted for development years after the 10^{th} assuming an exponential decay.

For the BF models the initial expected loss ratio (IEULR) is taken each year to be the value derived from the BF model on the previous years' data, adjusted by a rating index movement. To estimate the rating index we have considered two approaches:

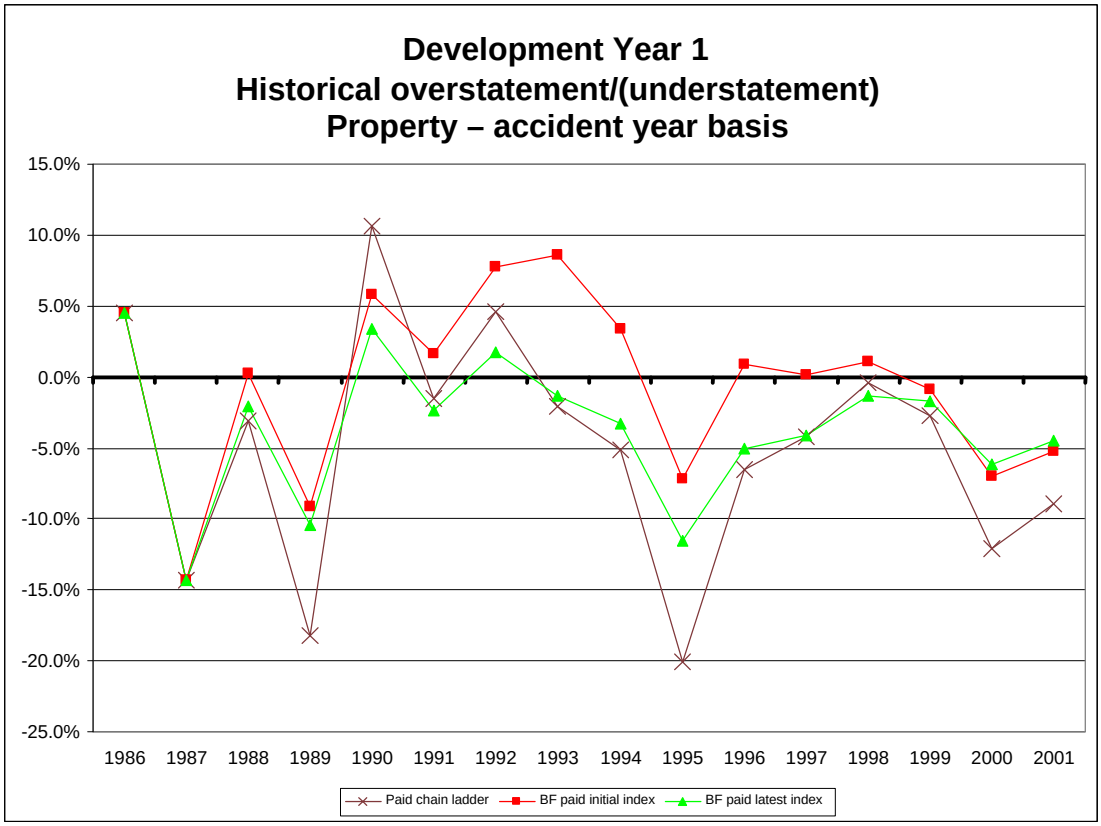
- "Initial index". This index is intended to represent a proxy for the rating index that was assumed, either explicitly or implicitly, by the combined market at each year-end. We have built up the index

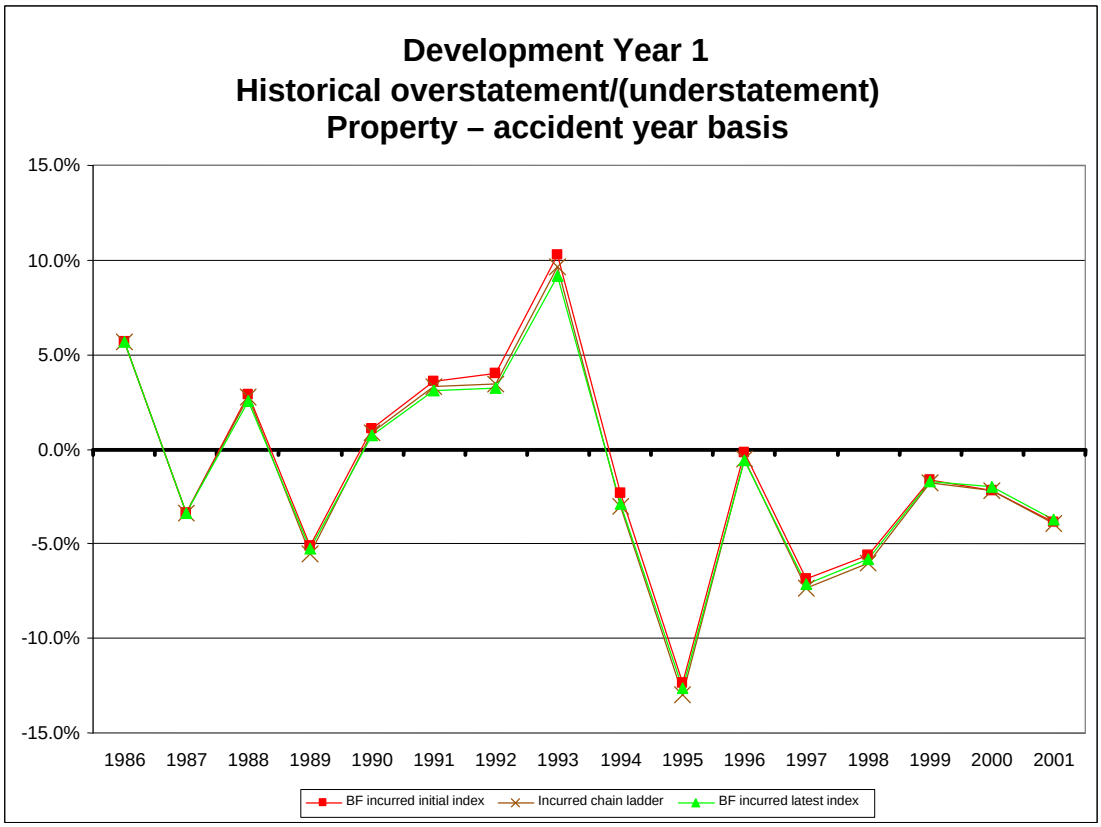
progressively from the historical FSA data by looking at the ratio of the ULRs for the two most recent accident/underwriting years at each year-end.

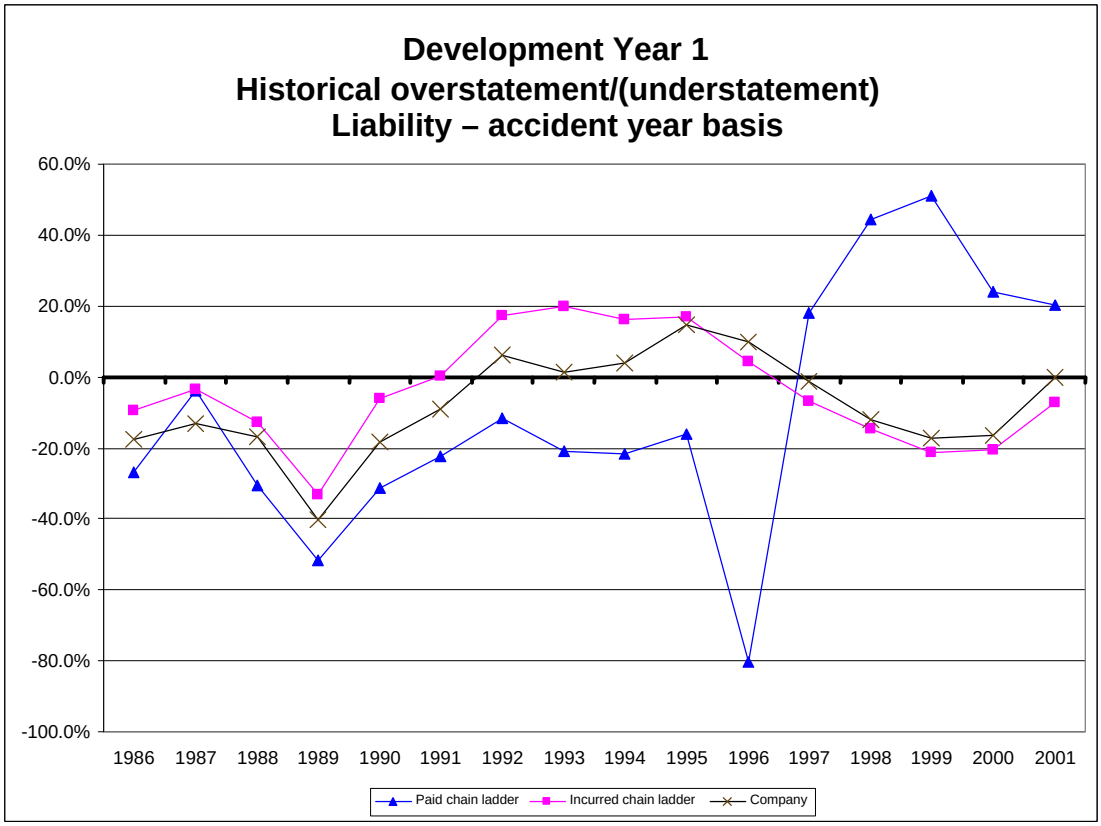
- "Latest index". This index has been constructed with the full benefit of hindsight. We have looked at the most up-to-date ULRs available in the FSA data for each accident/underwriting year and have built the rating index based on the movements in these loss ratios. In using hindsight, we have generated a rating index that would not in practice be available to insurers. However, this index is of interest in providing an indication of the additional value that could be provided if it were possible to incorporate perfect knowledge into a rating index.

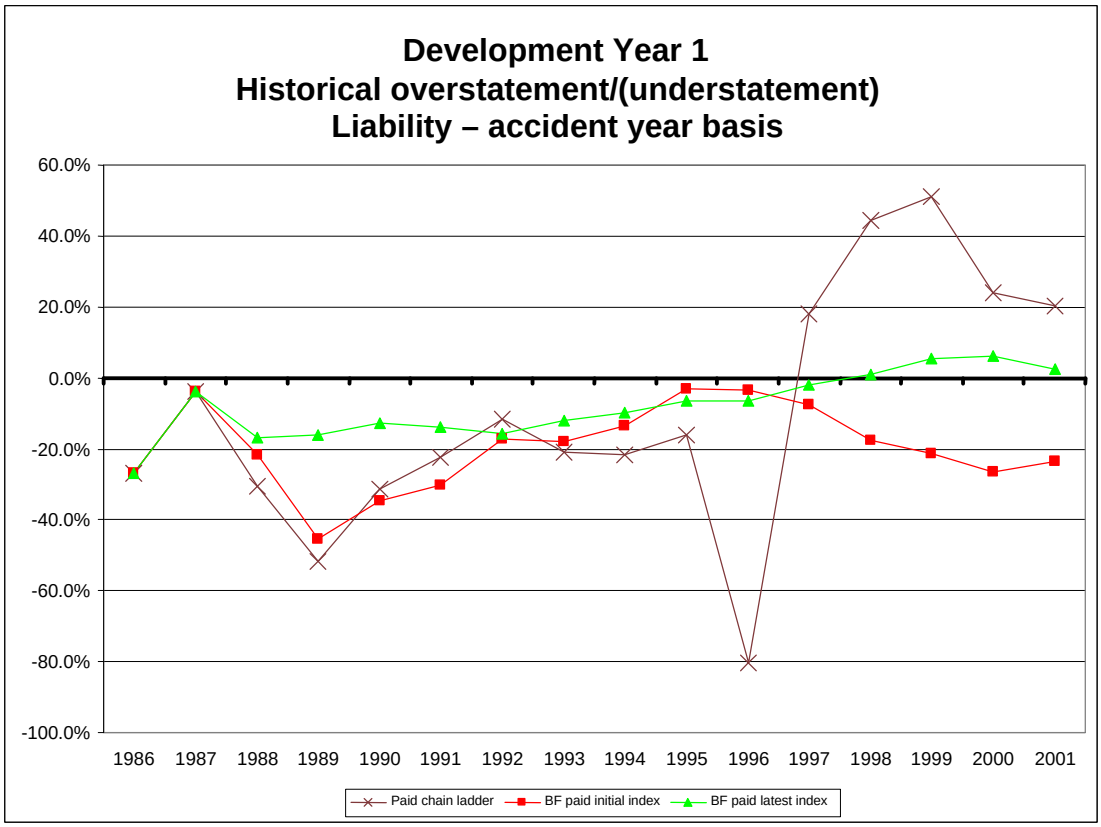
B.2 Results

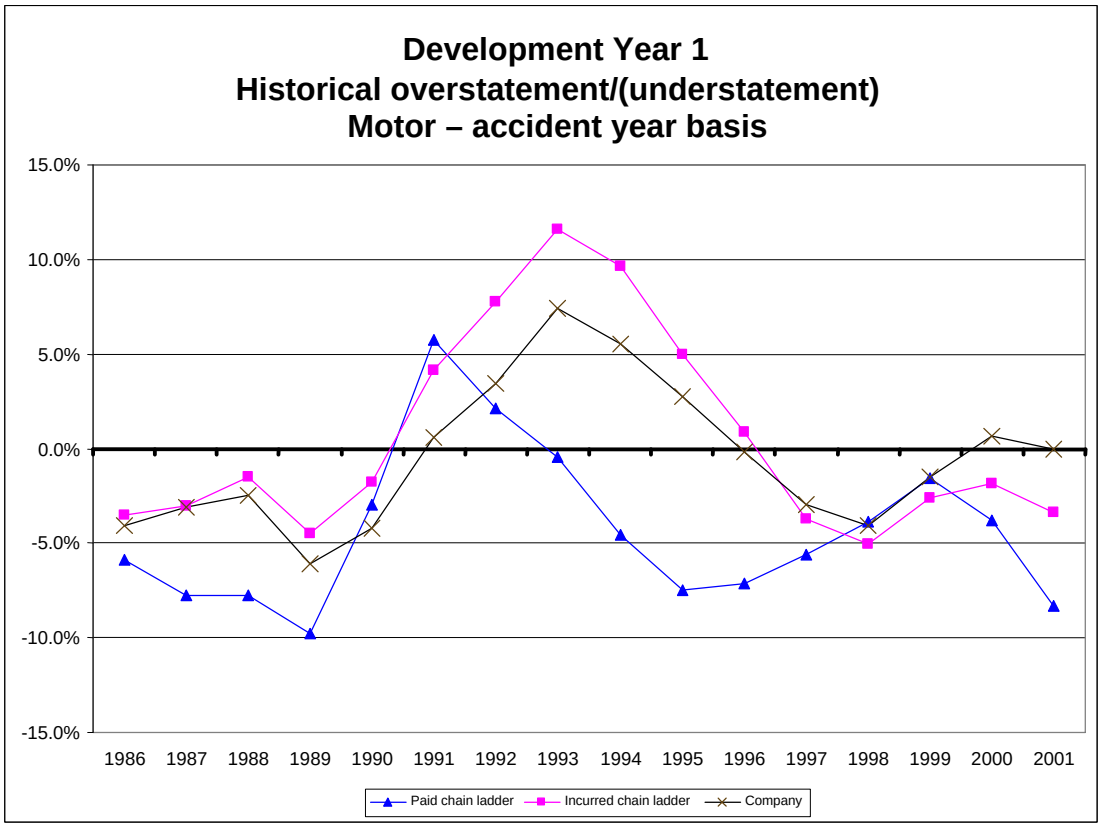
The main body of the paper contains a selection of graphs of the results from this modelling, further results are shown below. We have kept to the same format as that used previously: for each accident or underwriting year we show the difference between the projected ultimate loss produced by the model for the first development period, less the latest development period estimate, as a percentage of this latest estimate. The latest estimate is the most recent of the ones that we have available which the company actually set.

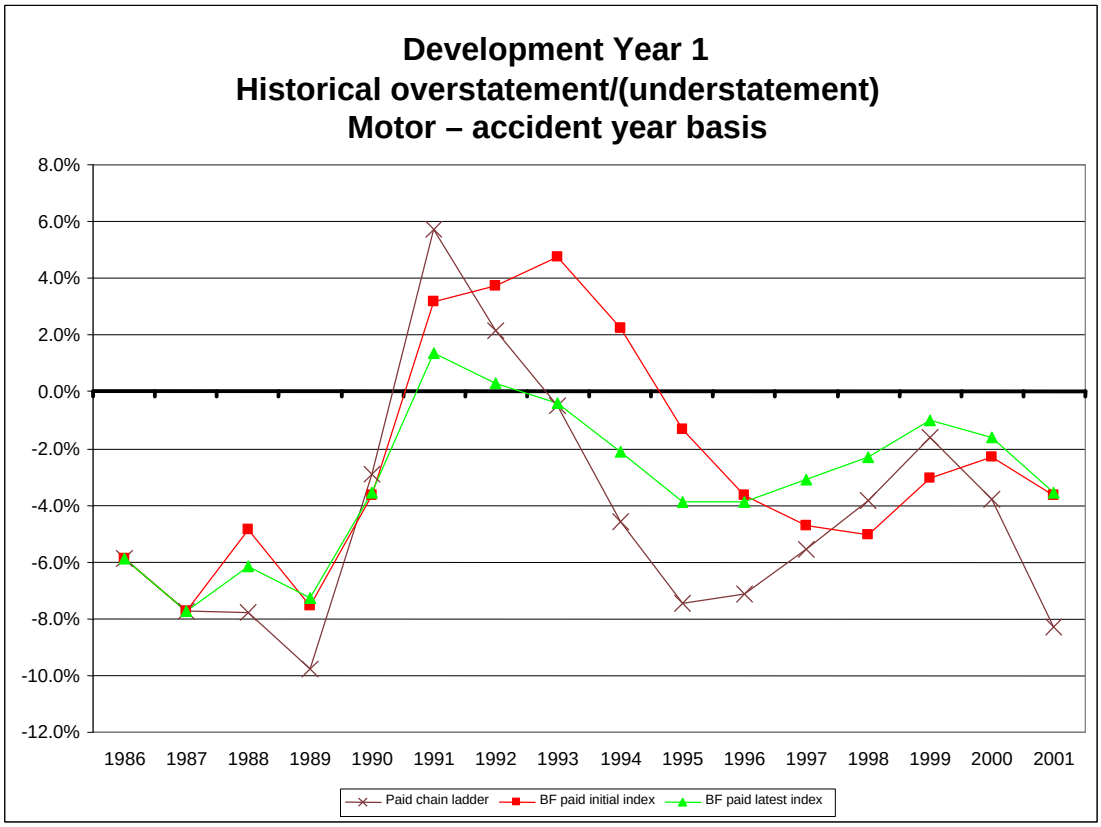

Development Year 1
Historical overstatement/(understatement)
Property – accident year basis
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
-20.0%
-25.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Paid chain ladder
BF paid initial index
BF paid latest index

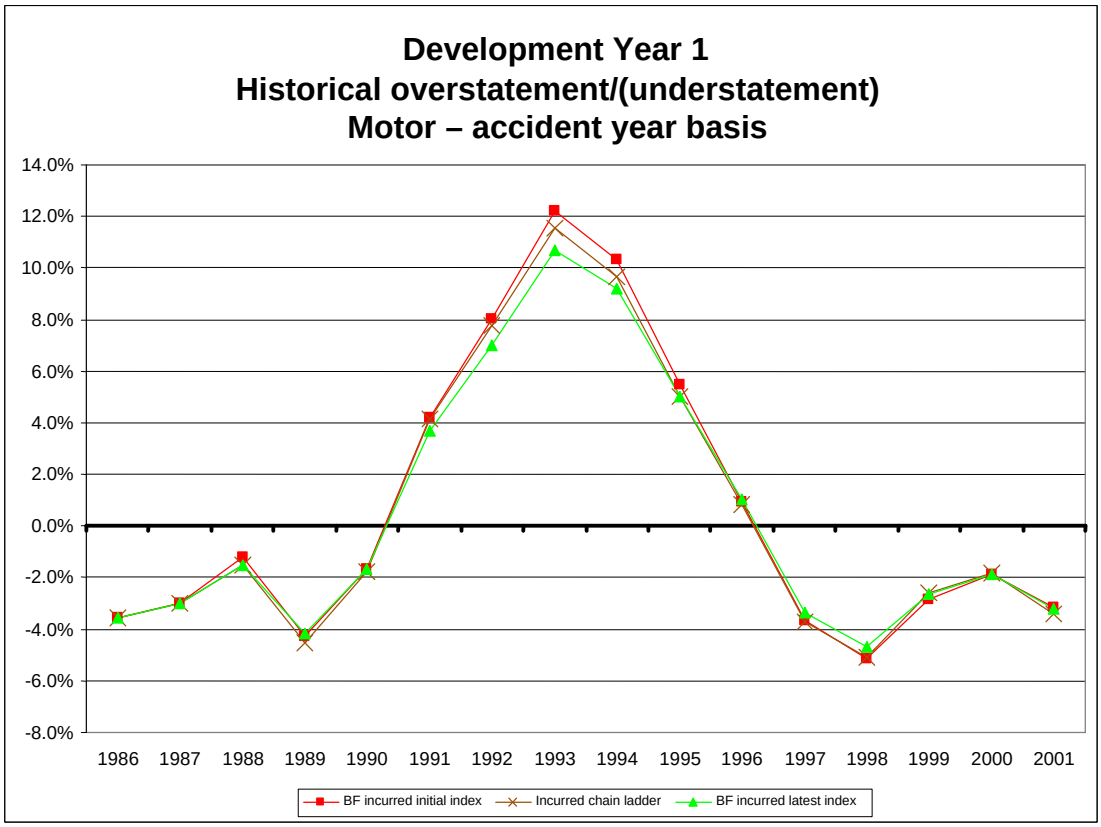

Development Year 1
Historical overstatement/(understatement)
Property – accident year basis
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
BF incurred initial index
Incurred chain ladder
BF incurred latest index


Development Year 1
Historical overstatement/(understatement)
Liability – accident year basis
60.0%
40.0%
20.0%
0.0%
-20.0%
-40.0%
-60.0%
-80.0%
-100.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Paid chain ladder
Incurred chain ladder
Company


Development Year 1
Historical overstatement/(understatement)
Liability – accident year basis
60.0%
40.0%
20.0%
0.0%
-20.0%
-40.0%
-60.0%
-80.0%
-100.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Paid chain ladder
BF paid initial index
BF paid latest index


Development Year 1
Historical overstatement/(understatement)
Motor – accident year basis
15.0%
10.0%
5.0%
0.0%
-5.0%
-10.0%
-15.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Paid chain ladder
Incurred chain ladder
Company


Development Year 1
Historical overstatement/(understatement)
Motor – accident year basis
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
-6.0%
-8.0%
-10.0%
-12.0%
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
Paid chain ladder
BF paid initial index
BF paid latest index


Development Year 1
Historical overstatement/(understatement)
Motor – accident year basis
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
-6.0%
-8.0%
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
BF incurred initial index
Incurred chain ladder
BF incurred latest index