Bornhuetter-Ferguson Initial Expected Loss Ratio Working Party Paper

This paper is the culmination of effort of the working party over the span of several years. Listed below are the working party members that were part of the group during the survey that was created and conducted, during the initial presentation at the Casualty Loss Reserve Seminar, during the subsequent presentation at the CAS Annual Meeting or during the writing of the this paper. Special thanks to Lynne Bloom, Kelly Moore and Chandu Patel for being instrumental in bringing this paper to completion.

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INTRODUCTION

"The Actuary and IBNR" was published in 1972 by Ronald Bornhuetter and Ronald Ferguson [1]. The methodology from this paper has exploded into a veritably universal methodology used by actuaries and commonly referred to as the "Born Ferg" or "BF" method. The technique and its application are included in the syllabus for the CAS actuarial exams and the use of the technique is pervasive in both the reserving and pricing worlds.

The method involves the selection of an "Initial Expected Loss Ratio" or "IELR" for which the selection criteria varies greatly and a great degree of latitude is permitted to the practitioner for "actuarial judgment." Given the widespread use of this method and its impact on financial reporting, the Bornhuetter Ferguson Initial Expected Loss Ratio Working Party set out to glean an understanding of general industry practices surrounding the selection of the IELR used in this method.

A survey was conducted across the CAS membership and the results of that survey are presented in this paper.

Along with the survey, the paper also explores several alternative methods to selecting the initial expected loss ratios, their relative strengths and weaknesses and their relative predictive value when applied to historical data. Carried reserves versus the outcome of several alternative methods for selecting the IELR are also explored to determine the effectiveness of industry practices.

The Basic BF Method

The Bornhuetter-Ferguson ("BF") expected loss projection method based on reported loss data relies on the assumption that remaining unreported losses are a function of the total expected losses rather than a function of currently reported losses. The expected losses used in this analysis are generally based on a review of previous accident year ultimate loss ratios and the company's business plan. The expected losses are multiplied by the unreported percentage to produce expected unreported losses at a point in time. The unreported percentage is calculated as one minus the reciprocal of the selected cumulative reported loss development factor ("LDF") for the segment under review. Finally, the expected unreported losses are added to the current reported losses to produce the estimated ultimate losses.

The calculations underlying the Bornhuetter-Ferguson expected loss projection method based on paid loss data are similar to the reported Bornhuetter-Ferguson calculations with the exception that paid losses and unpaid percentages replace reported losses and unreported percentages.

Alternative Choices for Initial Expected Loss Ratios

A critical assumption within the framework of the Bornhuetter-Ferguson method is the Initial Expected Loss Ratio ("IELR"). The IELR can be determined using several methods. The most frequently used methods for determining IELR for long-tailed lines are as follows:

- Pricing Loss Ratio
- Prior Analysis Ultimate Loss Ratios
- Industry Aggregates
- Cape Cod
- Prior Accident Years' projected loss ratios
- Prior Accident Years' loss ratios adjusted for rate changes and trends
- Judgment

METHODS

Pricing or Plan Loss Ratio

This method uses a pricing target loss ratio from the pricing actuary or a plan loss ratio from the company's financial plan as the IELR.

A refinement to this method is to adjust the target or plan loss ratio for the difference between

actual and target or planned pricing. Companies often have price monitoring systems that monitor actual price level compared to target price level. Actuaries can also track actual rate changes implemented compared to planned rate changes. For example, if the plan loss ratio is 60% and included a planned earned price change of 5%, but the company actually achieved an earned price change of 3%, then the IELR would be calculated as:

$$60\% \times 1.05 / 1.03 = 61.2\%$$

Other adjustments to the plan assumptions could be reflected as well. For example, if the actuary has an updated estimate of loss trend compared to the loss trend assumptions used in the plan, the IELR could be adjusted accordingly. If an operational or regulatory change is implemented that wasn't anticipated in the plan, then the expected impact of that change could be reflected in the IELR as an adjustment to the plan loss ratio.

Below are some advantages and disadvantages of this method. Similarly, advantages and disadvantages will be listed for each method in subsequent sections.

Advantages

- It is straightforward.
- It will be generally understood and accepted by management and staff in other departments.
- It includes information from multiple departments.

Disadvantages

- Pricing targets and plan loss ratios can be aspirational and therefore may not reflect the true expected loss ratio;
- Plan loss ratios are often derived by subtracting expense and profit provisions from a target combined ratio. The target combined ratio often reflects optimistic estimates for the impact of rate/pricing changes and underwriting actions. If the rate and underwriting effects do not materialize, the plan ratio can be significantly understated.

Rate Indication Adjusted for Rate Changes and Trends

Another way to use a pricing loss ratio as the basis for the IELR is to start with the indicated loss ratio from a rate indication/pricing study and adjust for rate changes and loss trend from the prospective proposed effective period to the appropriate accident year. An example of this method is shown in Exhibit 1 of Appendix A. In this example, in the latest rate indication the pricing actuary has projected the loss ratio for policies effective from 7/1/2017 through 6/30/2018, and we start with that loss ratio to estimate the IELR for accident year 2016. First, we adjust for the net loss and

premium trend from the projection period in the rate indication back to accident year 2016. Next, we adjust for any rate changes reflected in the rate indication that haven't been fully earned in accident year 2016. In the example, there were two such rate changes, one effective on 7/1/2015 and one effective on 7/1/2016.

Other adjustments to the projected loss ratio from the rate indication could be reflected as necessary, for example, the impact of operational, regulatory, and/or underwriting changes.

Advantages

- It leverages the work already done by the pricing actuary.
- It reflects the expected impact of trend and rate changes.
- Indicated loss ratios from rate indications have generally already been smoothed for large losses and catastrophes.

Disadvantages

- Rate indications are often done at a lower level of detail than reserve analyses, for example by state or business unit, so this method may require aggregation before use.

Prior Analysis Ultimate Loss Ratio

Another method that can be used is to select the ultimate loss ratios from the prior reserve analysis as the IELRs in the current reserve analysis. For example, if the company does semiannual reserve reviews, we would use the ultimate loss ratio for accident year 2015 from the 6/30/2016 reserve review as the IELR for accident year 2015 in the 12/31/2016 reserve review.

Advantages

- It is straightforward.
- It leverages work already done to arrive at a best estimate of the ultimate loss ratios.

Disadvantages

- This method will increase the responsiveness of the BF method to the extent that the ultimates from the prior reserve review reflect the actual loss emergence, which may be a disadvantage in some cases, for example when an accident year has experienced unusually high or low large losses.

Industry Aggregates

The IELR may be based on industry aggregate loss ratios. Sources for industry results include the following:

- A.M. Best

- NCCI
- SNL
- ISO
- Internal benchmarks

This approach may be especially appropriate when a company is writing a new type of business and doesn't have the historical data necessary to use many of the other methods, or when a company has a small book of business and doesn't have credible historical data.

Advantages

- It reflects the whole industry, so results are based on a credible volume of data.
- Industry results reflect the aggregate impacts of price changes, loss trend, and the underwriting cycle.

Disadvantages

- There is a lag in receiving industry results and the selected IELR is usually based on dated information;
- It doesn't reflect factors specific to the company's book of business that can impact the loss ratio, such as pricing, underwriting, and mix of business.

Prior Accident Years

Another method is to select an IELR based on the loss ratios for prior accident years for the same book of business. Averages of the loss ratios from several years can be used to smooth out or exclude abnormal variations in the results.

Advantages

- It is straightforward.
- It is easy to explain.

Disadvantages

- It doesn't reflect changes in pricing, loss trend, and underwriting that can impact the loss ratio.

Prior Accident Years Adjusted for Rate Changes and Trends

In this method, the IELR is based on estimates for prior accident years adjusted for rate changes and loss trends. Examples of this method are shown in Appendix A, Exhibit 4, which uses on-level

earned premiums and loss ratios, and Appendix A, Exhibit 5, which uses exposures and pure premiums. In both examples, we start with ultimate losses from the prior reserve review for accident years 2007 through 2015 and use them to estimate the accident year 2016 IELR.

This method is similar to the rate indication adjusted for rate changes and trends method in that both start with an indicated loss ratio and adjust for rate changes and trends to get the IELR for the accident year in question. However, this method starts with the estimated loss ratios for prior accident years and adjusts forward to the appropriate accident year, while the rate indication method starts with an indicated loss ratio for a prospective proposed effective period from a rate indication and adjusts back to the appropriate accident year.

In Exhibit 4, we calculate the ultimate loss ratios from the prior reserve review by dividing the ultimate losses from the prior review by the earned premiums. Then, we adjust each of the loss ratios for accident years 2007 through 2015 to the accident year 2016 level. The on-level premium factors are calculated based on the rate change history and the loss trend factors are calculated based on selected annual loss trends. We apply the on-level and loss trend adjustments to the loss ratios for accident years 2007 through 2015 to arrive at various estimates of the accident year 2016 IELR. Then, we calculate various averages of the indicated IELRs and make a selection.

Exhibit 5 shows a similar calculation except using pure premiums instead of loss ratios. We calculate the ultimate pure premiums from the prior reserve review by dividing the ultimate losses from the prior review by the earned exposures. We then apply the pure premium trend adjustments to the pure premiums for accident years 2007 through 2015 to arrive at various estimates of the accident year 2016 pure premiums. Next, we calculate various averages of the indicated pure premiums and select an expected pure premium for accident year 2016. Finally, we convert the selected accident year 2016 expected pure premium to an expected loss ratio.

Advantages

- It reflects the expected impact of trend and rate changes.
- By using several accident years and taking averages, random variation in loss results should be smoothed.

Disadvantages

- It requires either rate change or exposure information, which in practice is sometimes not available.

Cape Cod

The Cape Cod or Stanard-Buhlmann method (Stanard [2]) calculates the expected loss ratio based

on the reported loss experience for all accident years. First, reported losses are trended and earned premiums are adjusted for rate changes such that they are at an equivalent point of evaluation. Then, the "used-up" or "reported" on-level earned premiums are calculated as the on-level earned premiums times the percent of losses expected to be reported, which is equivalent to the on-level earned premiums divided by the cumulative loss development factor. The IELR for each accident year is calculated by dividing the trended reported loss by the "reported" on-level premium. The overall IELR is calculated as the weighted average of the IELR for each year using the "reported" on-level earned premiums as weights.

Gluck [3] introduced a decay factor to the Cape Cod method in order to give more weight to those accident years that are closer in time to the accident year whose IELR is being estimated. This refinement recognizes that the results for more remote accident years are less relevant to estimating an IELR for a given accident year since trend and on-level estimates are not perfect and there may have been changes in the book of business over time due to mix or underwriting changes. The decay factor is between zero and one, with lower factors being more appropriate for books of business with more stable experience and higher factors being more appropriate for books of business with more volatile experience. A decay factor of one results in the original Cape Cod method.

Examples of this method are shown in Appendix A, Exhibit 2, which uses on-level earned premiums and loss ratios, and Appendix A, Exhibit 3, which uses exposures and pure premiums.

This method can also be done ignoring both rate changes and trend in losses under the assumption that pricing changes are reflective of loss changes. Later in this paper, we used the method both ways to demonstrate the impact with industry data.

Advantages

- It uses all the available reported loss experience to develop the IELR.
- It can reflect the expected impact of trend and rate changes.
- It is very responsive to experience.

Disadvantages

- It may require a complete history of either rate change or exposure information, which in practice is sometimes not available.
- Each accident year is treated as similar experience if decay factors are not used; decay factors are difficult to program in practice.

Judgment

The actuary could use judgment to select the IELR, incorporating knowledge of the book of

business including underwriting and pricing, information on industry and company results in similar types of business and awareness of the underwriting cycle. Similar to industry aggregates, this approach may be especially appropriate for new or small books of business lacking the credible historical data necessary to use many of the other methods.

For books of business with credible experience, judgment is used in the application of the other methods described above, for example, in deciding which methods to use, what adjustments are appropriate and what selections to make when faced with varying indicated IELRs from different methods or various averages.

Advantages

- It doesn't require any specific data.
- It allows the actuary to apply knowledge gained through experience.

Disadvantages

- It may be more difficult to document and support the selection.

THEORETICAL ROBUSTNESS OF THE BF METHOD

The Bornhuetter-Ferguson method is most useful as an alternative to other models for immature accident years. For these immature years, the amounts reported or paid may be small and unstable and therefore not predictive of future development. Therefore, future development is assumed to follow an expected pattern that is supported by more stable historical data or by emerging trends. This method is also useful when changing reporting patterns or payment patterns distort historical development of losses and for lines of business with volatile reporting and payment patterns. For example, it is effective for lines of business such as aviation where a dominant large loss may distort current paid and reported loss experience and render it unusable for the reported and paid loss development methods. It can also be very useful for lines of business with significantly long reporting periods. For example, in high excess casualty occurrence lines of business, paid and reported loss activity may be zero for decades and losses may manifest themselves many years after the policy has been issued. In this instance, the reported and paid loss development methods cannot be applied in any meaningful manner.

SURVEY RESULTS

Major Observations / Conclusions from the BF IELR Survey

A complete list of questions posed and responses received is included in Appendix B. Discussed below are the highlights from the survey.

Extent of Use

Not surprisingly, the BF methodology is used extensively within the industry; over 75% of survey respondents use the BF methodology for all lines of business analyzed. The BF methodology is used to analyze loss as well as ALAE/DCC (often in combination with loss); it is not commonly used to analyze ULAE/AAO. Although the methodology is used extensively, there was a fair amount of negative feedback regarding the misuse of the methodology, particularly in the selection of the IELR:

"In the vein of coming up with a best estimate using all available information, the rationale for using some initial expected loss ratio in the analysis despite information that suggests that initial expected loss ratio was either too high or too low is a flawed approach."

"I do see abuse and unsupported BF selections frequently on the low side as a reviewer."

"Although my decisions are independent, I feel pressure from management, and I can't imagine an actuary working for a client that doesn't."

The testing in the next section of this paper is geared toward addressing possible industry biases.

Choice of Method

For long-tailed lines of business, the most prevalent method for determining the IELR is prior accident year loss ratios adjusted for rate changes and loss trend. Second is the ultimate loss ratio from the prior analysis. Cape Cod is the third most popular, but less than 10% of respondents use it. Within the reinsurance industry, the pricing/plan loss ratio is the most popular, consistent with long-tailed lines of business. For short-tailed lines of business, prior accident year loss ratios adjusted for rate changes and loss trend is most popular.

Other Common Practices

1) It is very common to use the BF method to estimate loss ratios for the most recent accident year; for older accident years, the use of BF drops off rapidly.
2) There is wide degree of variation in beliefs about whether the IELR should be changed, if new data indicates that a change is necessary based on either higher or lower actual loss experience. A few responders believe that once picked, the IELR should not be changed; on the other hand, the majority of responders believe that it is necessary to change the IELR once the new experience indicates that a change is necessary and over 60% of responders change the selection annually.

3) Although most respondents considered their selection of IELR to be independent, for a significant amount of respondents, management plays a role in reviewing/guiding the actuary in the process of selecting the IELR.
4) A majority of the respondents do not place minimum boundaries in the selection of the IELR; for example, they keep the IELR the same even if paid or reported loss ratios exceed the previously selected IELR.
5) A majority of the respondents used an internal peer review process and/or actual versus expected analysis to test the reasonability of the selected IELR.

INDUSTRY TESTING

The survey gave us a snapshot of what respondents were doing in practice, but we also wanted to understand the methods in the context of financial statements and real world data. There is a great degree of cynicism surrounding the use of the BF methods and the partially judgmental selection of IELR. Using actual reported loss data, we sought to glean what the general industry practice was and how well it was working.

Both the efficacy and accuracy of the method itself are important aspects of our study. Therefore, we tested the industry use of the BF method with the following questions:

1. How do actual carried reserves compare to the various forms of BF method?
2. How well do the various BF methods compare to hindsight reserves?

To answer these questions, we used Schedule P Data, an industry rate change index for commercial lines (CIAB) and industry claim cost inflation trends (Towers Watson). With the available data we were able to test three forms of the BF method:

1. Prior evaluation (using past carried)
2. Cape Cod (used with and without inflation and rate change information)
3. Trended rate-adjusted loss ratio (using Schedule P carried)

For commercial lines, we had aggregate rate change information and tested Workers Compensation, General Liability (Claims Made and Occurrence), Medical Malpractice (Claims Made and Occurrence) and Commercial Auto. We also tested personal lines (Private Passenger Auto and Homeowners) and Commercial Multiple Peril, but we did not have aggregate rate change information.

Observations on Carried Reserves

Commercial Lines

Commercial lines that we studied included:

Commercial Auto

Workers Compensation

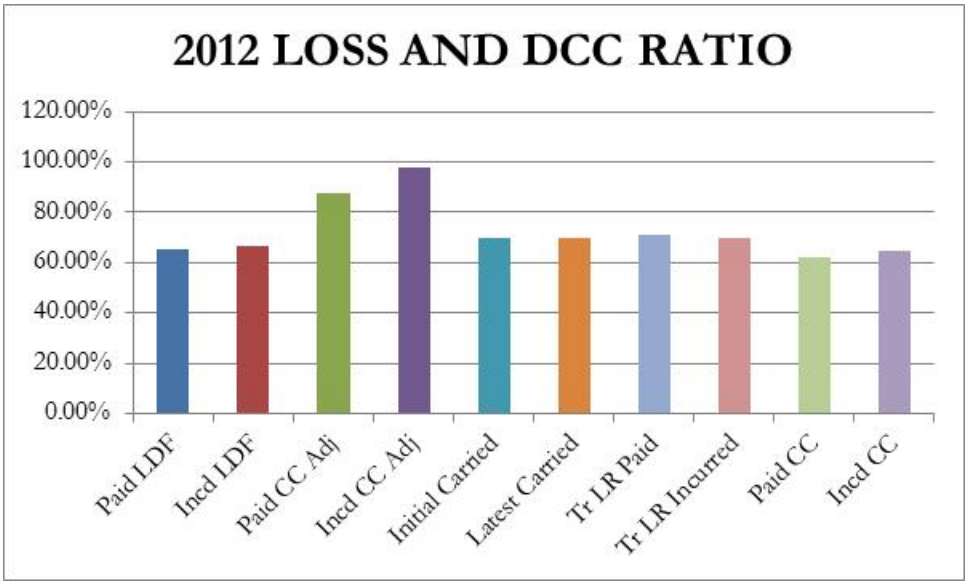
General Liability (Both Occurrence and Claims Made)

Medical Malpractice (Both Occurrence and Claims Made)

Note, we are not including CMP in this aggregation due to the lack of available rate change information.

Findings for All Commercial Lines – Current Accident Year

Actual carried and indicated net loss ratios for the industry for accident year 2012 evaluated as of December 31, 2012 are as follows:

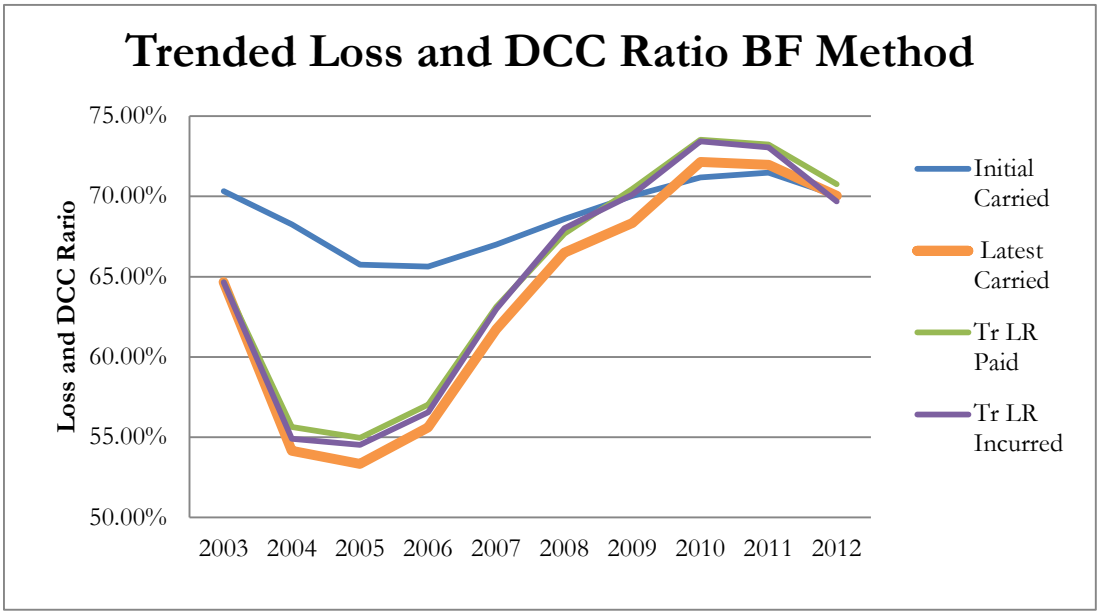


The graph displays the paid and incurred LDF methods, where LDF's are selected based on weighted averages along with an industry tail factor. These LDF's are also used to project the Cape Cod, the trend / rate change adjusted Cape Cod methods and the trended loss ratio BF method on a paid and incurred basis. For accident year 2012, for Commercial business in aggregate, the industry

booked loss ratio is at a level commensurate with trended paid and incurred loss ratio BF methods, higher than the LDF or Cape Cod methods but lower than the trend adjusted Cape Cod methods. In this case, the prior ultimate method would not be applicable since we are evaluating the current accident year.

Conclusion: For accident year (2012), the industry aggregate commercial lines booked net loss ratio most closely matches indications from the trended loss ratio BF method.

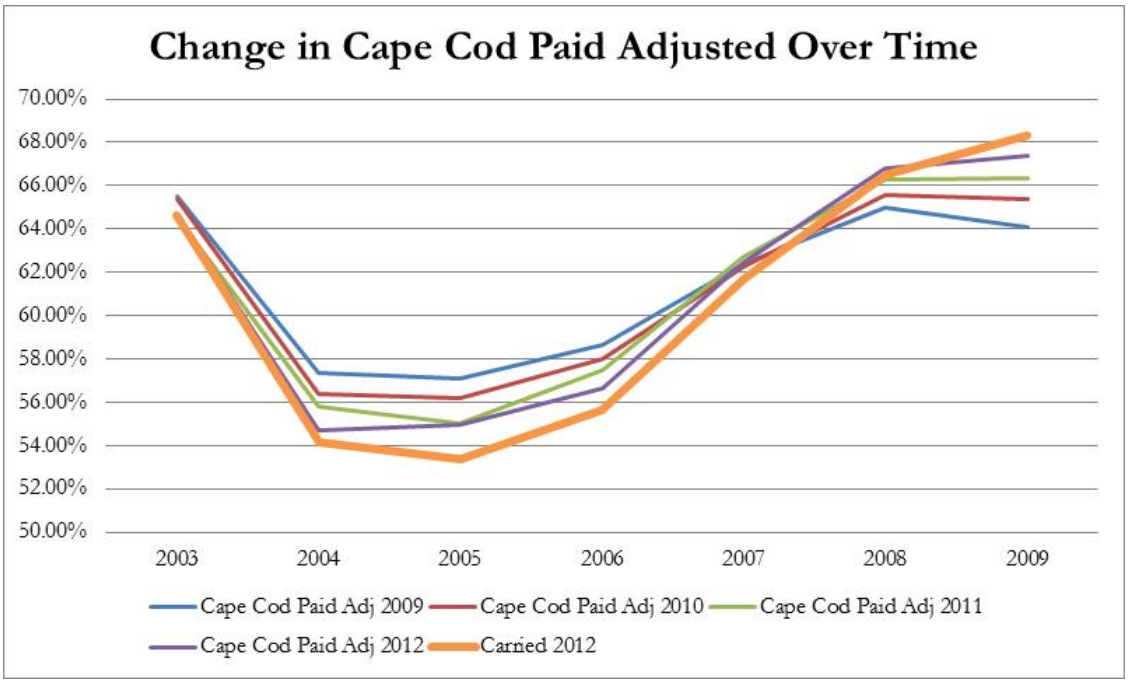
Findings for Trended Loss Ratio BF Method – All Accident Years



The graph allows us to focus on the trended loss and DCC ratio BF method for all accident years as of December 31, 2012. Although current carried reserves are close to these methods for the latest accident year and are slightly lower than this method for prior accident years, we can see that initial carried reserves in the 2003 through 2006 period are much higher than this method. It is clear that initial carried amounts reflected more pessimism about loss ratios at the time and may be indicative of the market cycle change and the higher loss ratio experience around the year 2000.

Conclusion: Initial carried reserves in hindsight appear to reflect the market cycle more than the BF indications.

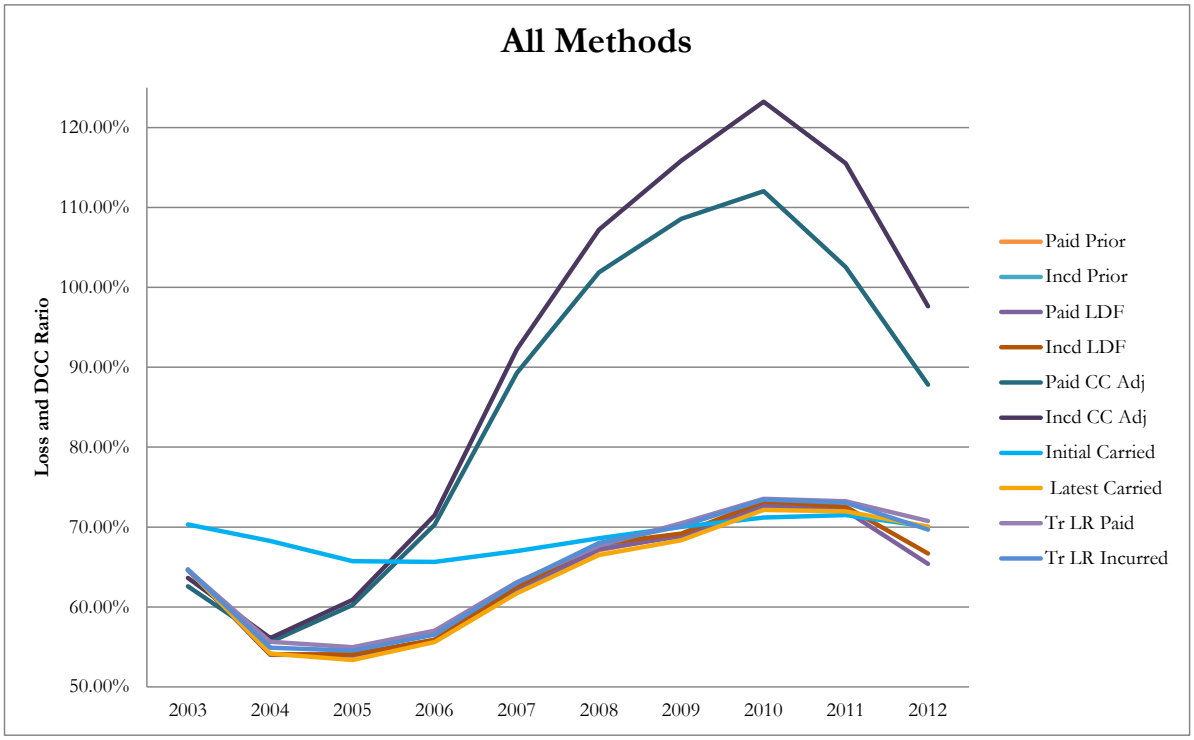
Findings for Cape Cod Paid Adjusted Method – All Accident Years (Loss Plus DCC Ratio)



If we look at just the Paid Cape Cod method adjusted for rate changes and trend across accident years, we can see that the current carried is more optimistic for older accident years and more pessimistic for more recent accident years. This demonstrates that carried reserves lean more toward methods that view accident years separately rather than gravitating toward a long-term average, which is what the Cape Cod method does.

Conclusion: The industry may look at accident year results in more isolation than Cape Cod methods would imply.

Findings for All Methods - All Accident Years

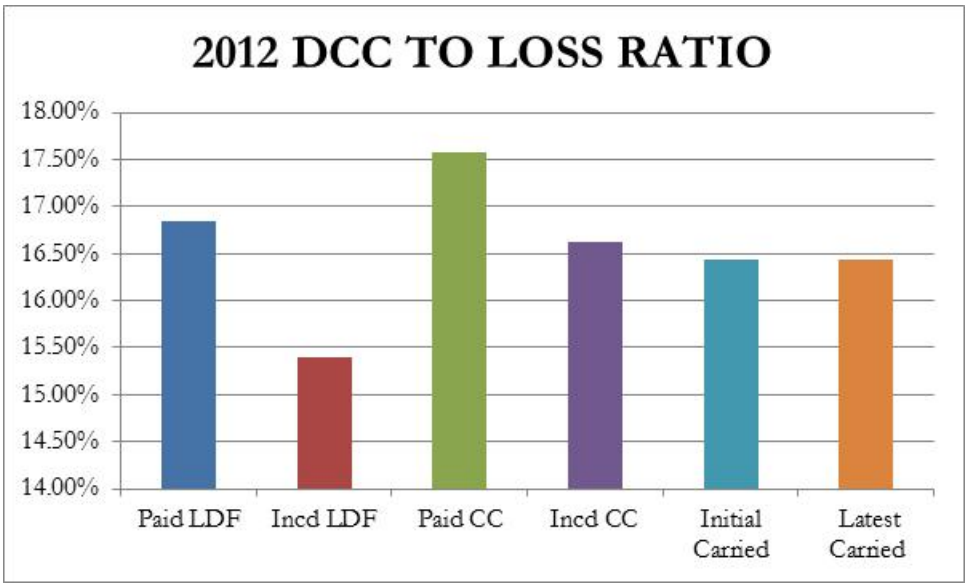


Based on the graph above (methods are done using most recent data), one can see that other than the trended adjusted Cape Cod Methods, the methods and carried reserves are very close until the latest accident year. It is also clear that the initial carried amounts do not move with the methods, implying a tendency not to deviate from a set level of reserves or a tendency not to react to market conditions.

Conclusions: In selecting the initial carried amounts, reactions to market cycles appear to play a more prominent role than actuarial indications.

Findings for DCC to Loss Ratio – Current Accident Year

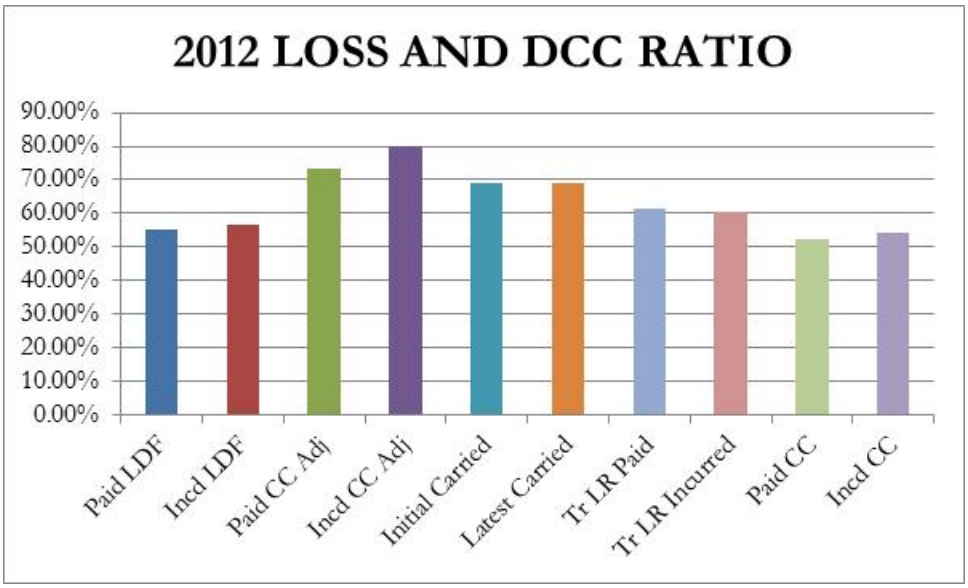
The previous graphs all consider the projection of losses and DCC together. We also examined the BF method in the context of separate loss and DCC analyses and using the projection of ultimate losses as an exposure base for DCC.



DCC Method results are slightly more erratic than loss plus DCC methods. For the 2012 accident year, actual carried reserves fell close to an incurred Cape Cod method. This makes sense since the ratio of DCC to loss might be expected to be more stable than losses during market changes.

Conclusion: DCC ratio may not be as greatly impacted by the market cycle.

Findings for Gross Loss and DCC Ratio – Current Accident Year

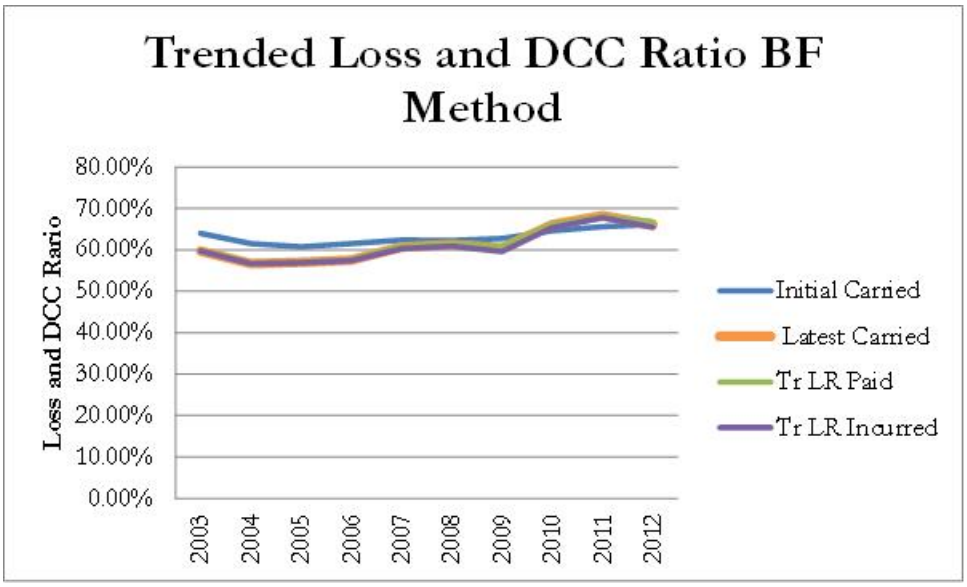


In general, the pattern of methods is very similar to what we observed on a net basis. One difference is that carried reserves are closer to the higher end of the methods on a gross basis, perhaps suggesting that carried reserves are swayed more by balance sheet considerations than exact methodology.

Conclusion: Ceded reserves may not be as impacted by preconceived reserve level expectations.

Findings for Individual Lines of Business - Commercial Lines

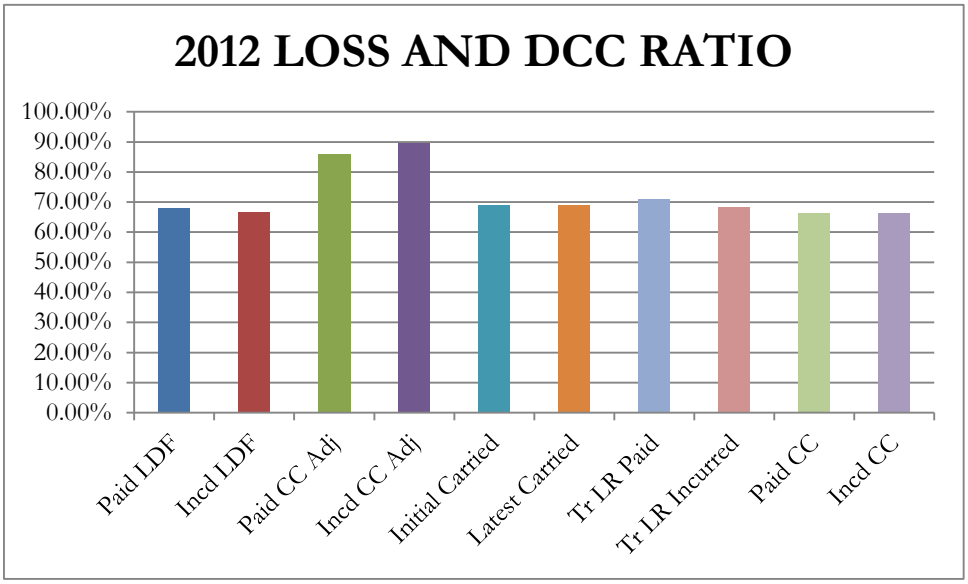
The findings for individual lines of business were very similar to the all lines indications. A notable exception is the medium-tailed Commercial Auto line of business, where the market cycle effects are less pronounced. Shown below are the results for Commercial Auto.



Personal Lines

For Personal Lines, we did not have the benefit of a rate change index, but we did have trend information for the two personal lines studied, Personal Auto and Homeowners, as well as CMP.

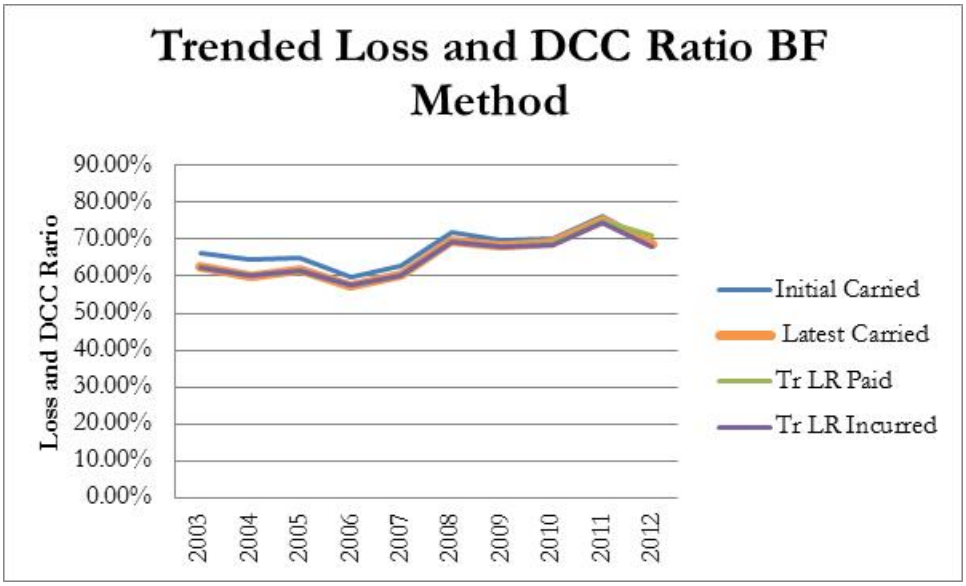
Findings for All Lines (Personal Auto, Homeowners and CMP) – Current Accident Year



The graph is very similar to the graph above for commercial lines, with carried reserves falling in line with most methods but below Cape Cod adjusted methods. It is interesting that using trend in losses but not rate change for these lines would seem to overstate indications versus that of other methods in the same manner it does for commercial lines, where rate change was incorporated. This would suggest that the available rate change information does not account for all the changes in loss ratio due to market cycle effects.

Conclusion: Rate changes do not necessarily compensate for loss trends during a market cycle; this would suggest that changes in terms and conditions play a significant role in the final outcome of the results.

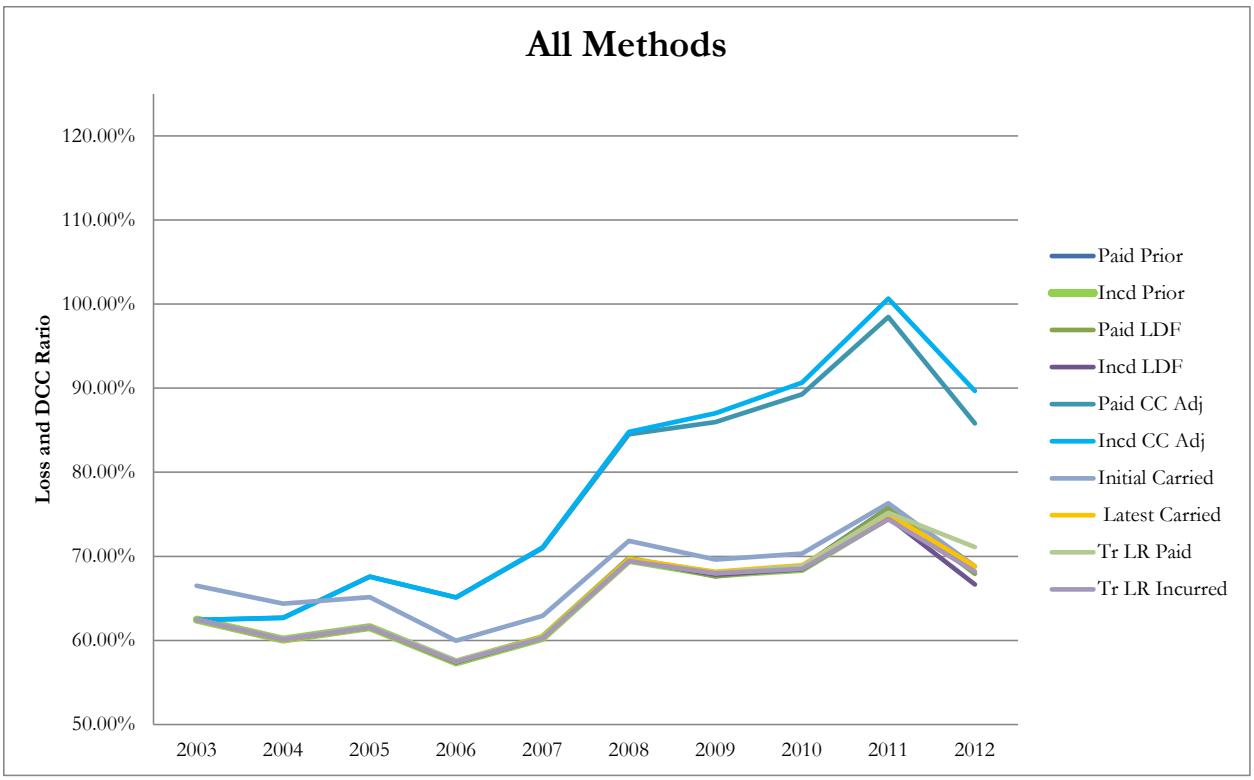
Findings for Trended Loss Ratio BF Method – All Accident Years



This graph allows us to focus on the trended loss and DCC ratio BF method for all accident years as of December 31, 2012. Similar to findings for shorter-tailed lines in the Commercial segment, there is much less variation in carried reserves over time and less deviation of carried reserves from a specific method. However, the cycle effect on initial carried reserves is still present, even though to a lesser degree.

Conclusion: The choice of IELR even in the latest accident has very little significance on shorter-tailed lines.

Findings for All Methods - All Accident Years

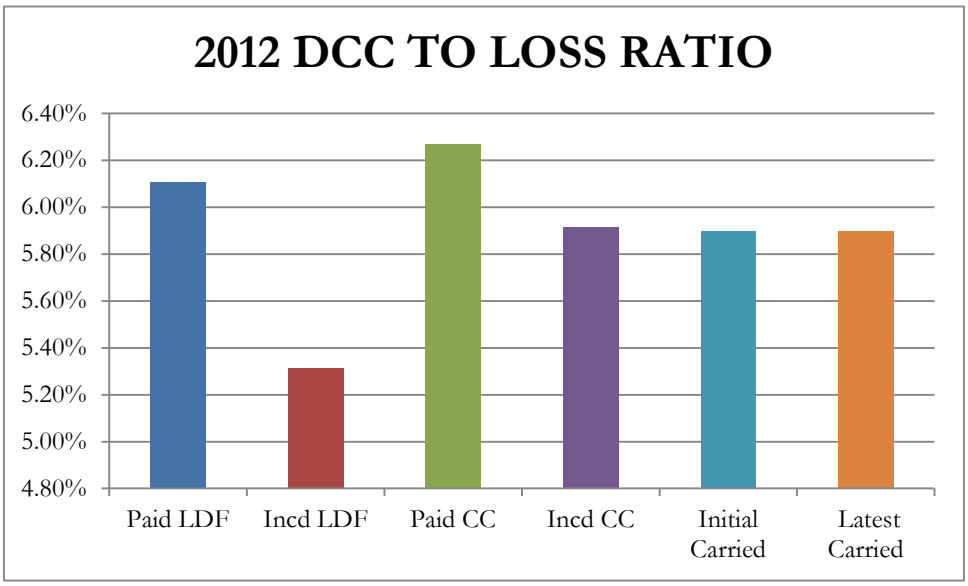


Based on the graph above, one can see that other than the trended adjusted Cape Cod Methods, the methods and carried reserves are very close until the latest accident year. It is also clear that the initial carried amounts do not move with the methods, implying a tendency not to deviate from a set level of reserves or a delay in reacting to market swings. This effect is minimized in these shorter-tailed lines.

Conclusions: The impact of market cycles is present in Personal Lines as well; however the impact is less pronounced than commercial lines.

Findings for DCC to Loss Ratio – Current Accident Year

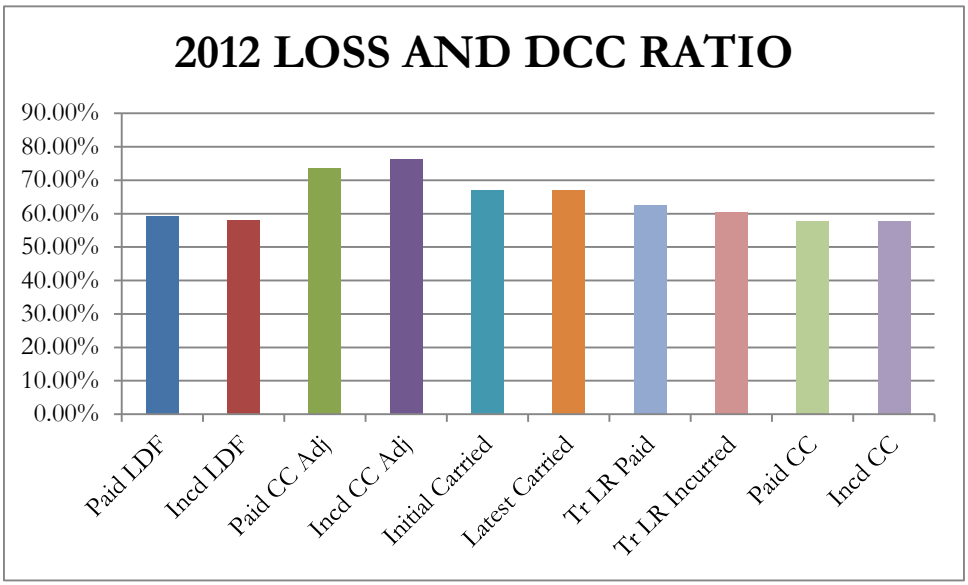
The previous graphs all consider the projection of losses and DCC together. We also examined the BF method in the context of separate loss and DCC analyses and using the projection of ultimate losses as an exposure base for DCC.



DCC Method results are slightly more erratic than loss plus DCC methods. For the 2012 accident year, actual carried reserves fell close to an incurred Cape Cod method. This makes sense since the ratio of DCC to loss might be expected to be more stable than losses during market changes. These findings are very similar to the findings for Commercial lines.

Conclusion: Consistent with Commercial Lines, DCC ratio is not as impacted by the market cycle.

Findings for Gross Loss and DCC Ratio – Current Accident Year



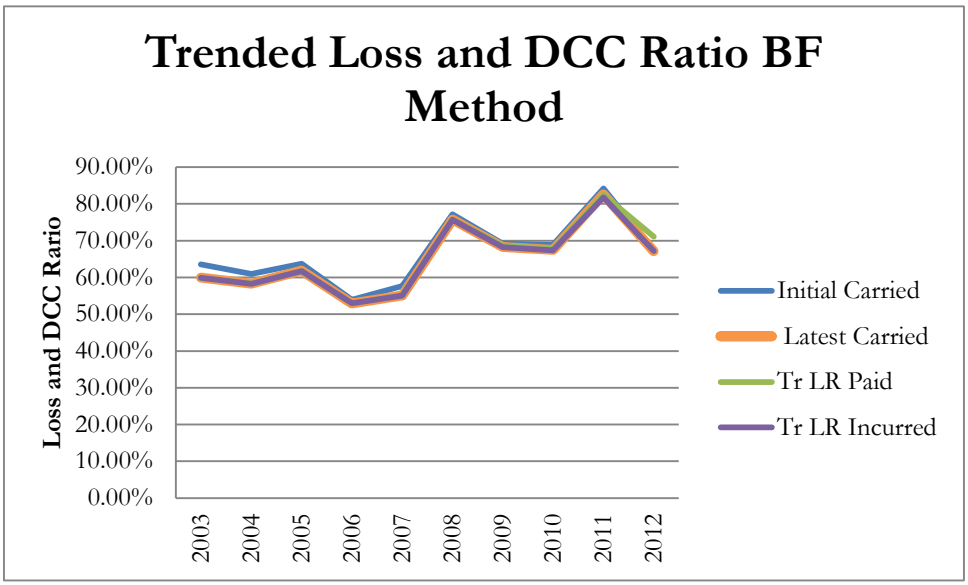
In general, the pattern of methods is very similar to what we observed on a net basis. One difference is that carried reserves are closer to the higher end of the methods on a gross basis, perhaps suggesting that carried reserves are swayed more by balance sheet considerations than exact methodology. Once again, we see personal lines results are similar to Commercial lines results.

Conclusion: Ceded reserves may not be as impacted by preconceived reserve level expectations.

Findings for Individual Lines of Business - Personal Lines

The findings for individual lines of business were very similar to the all lines indications. The findings for Commercial Lines with regards to shorter-tailed lines have a more profound effect. The Homeowners line demonstrates convergence of carried reserves to methods very quickly.

Shown below are the results for Homeowners.



Conclusion: As expected, choice of initial expected loss ratio has very little effect on the Homeowners line of business.

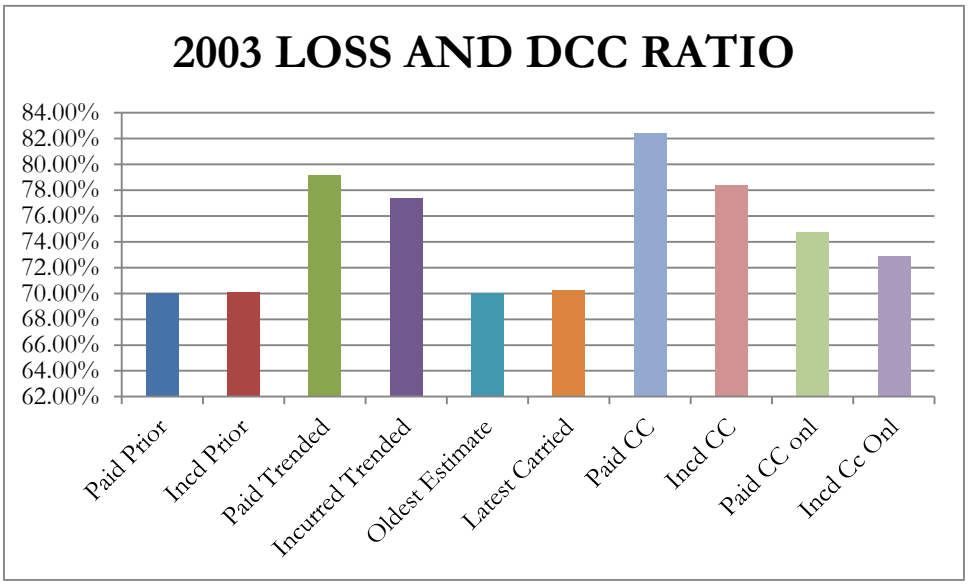
A full set of graphs is available in Appendix C.

Hindsight Testing

Commercial Lines

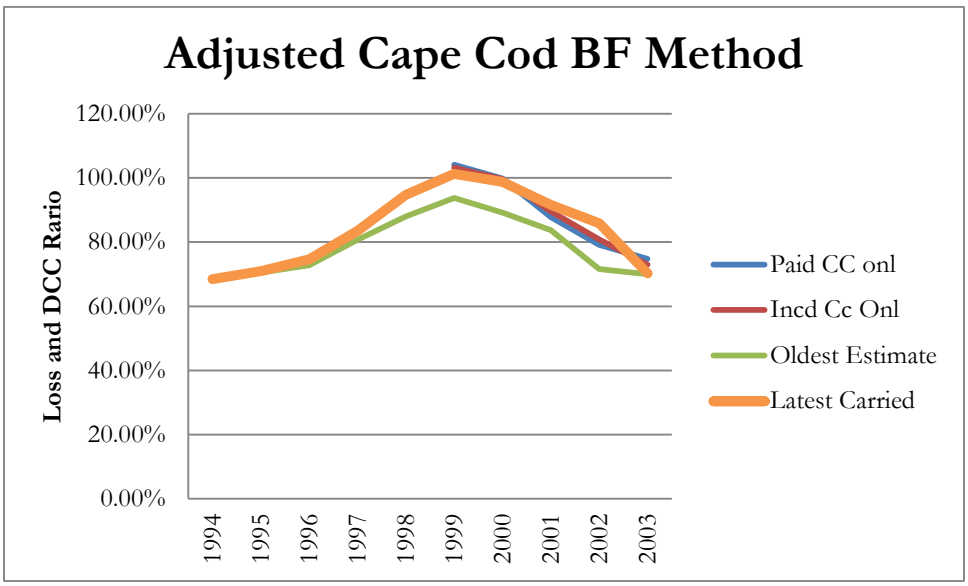
Findings for Commercial Lines – 2003 Accident Year

The following graph represents results of methods as they would appear at the end of 2003. 2003 was coming off of a very severe soft market, where overall loss ratios peaked in 1999 at over 100%. In 2003, the industry picked the carried loss ratio ignoring Cape Cod information from the prior years. Although Cape Cod methods, adjusted for large rate increases, came closer to the hindsight 2003 ratio (as carried in 2012), they still overstated the loss ratio. Even trending from 2002 overstated the actual loss ratio achieved during 2003. Here "Oldest Estimate" is the earliest carried amount we have data for.



Conclusion: During a year not affected by the soft market cycle but following the soft market, adjusted (on-leveled) methods for Cape Cod tend to overstate ultimate losses.

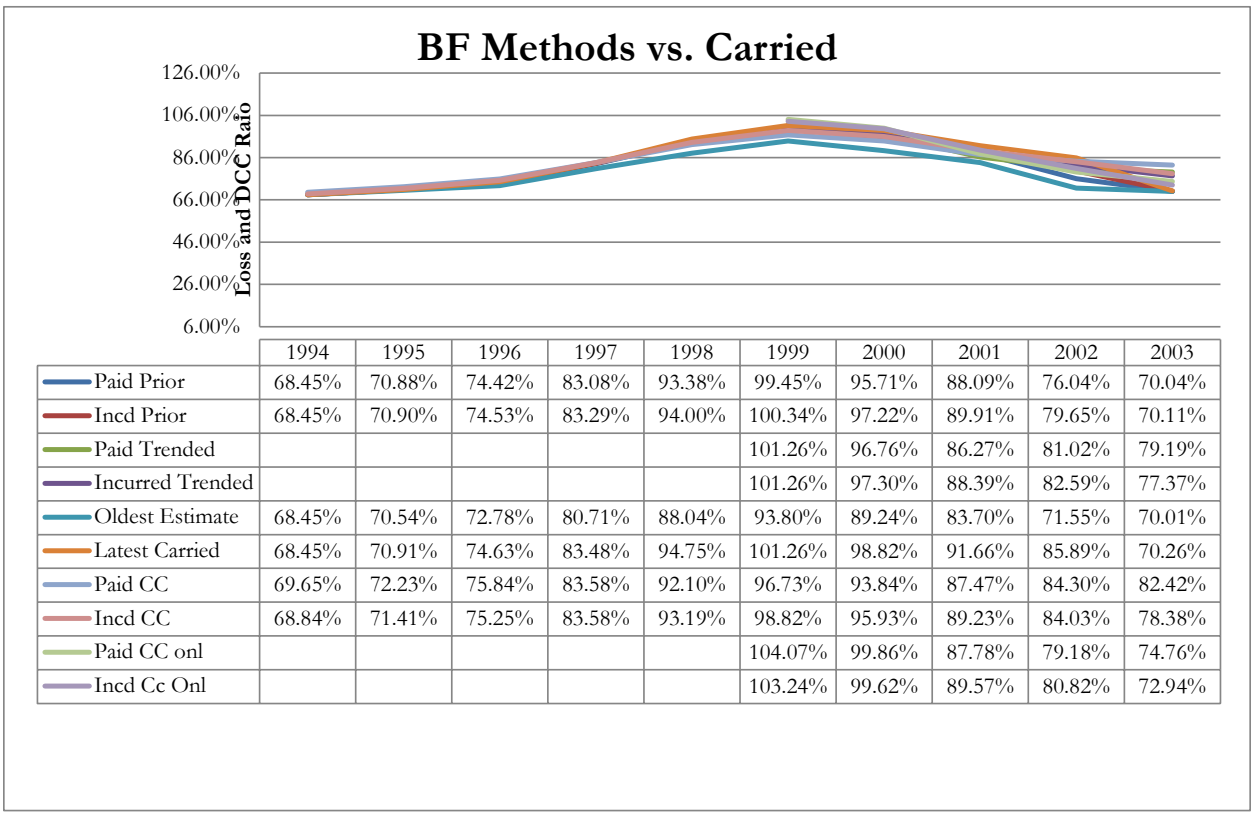
Findings for Commercial Lines – All Accident Years Adjusted Cape Cod



The effects of the market cycle and reserving practices appear clearly on this graph. We can see that initial carried amounts were furthest from method indications and 2012 carried levels during the high point of the cycle. The adjusted Paid and Incurred Cape Cods (performed with information as of year-end 2003) did a good job of matching the losses coming off the soft market.

Conclusion: During accident years in a soft market cycle, adjusted (on-leveled) Cape Cod methods do a good job of predicting ultimate losses.

Findings for Commercial Lines – All Accident Years All Methods

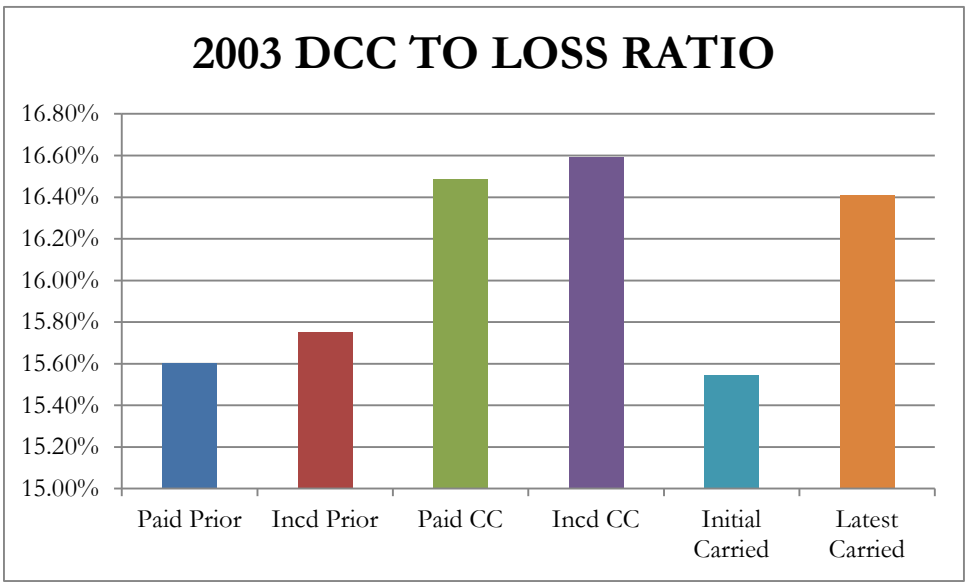


	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Paid Prior	68.45%	70.88%	74.42%	83.08%	93.38%	99.45%	95.71%	88.09%	76.04%	70.04%
Incd Prior	68.45%	70.90%	74.53%	83.29%	94.00%	100.34%	97.22%	89.91%	79.65%	70.11%
Paid Trended						101.26%	96.76%	86.27%	81.02%	79.19%
Incurred Trended						101.26%	97.30%	88.39%	82.59%	77.37%
Oldest Estimate	68.45%	70.54%	72.78%	80.71%	88.04%	93.80%	89.24%	83.70%	71.55%	70.01%
Latest Carried	68.45%	70.91%	74.63%	83.48%	94.75%	101.26%	98.82%	91.66%	85.89%	70.26%
Paid CC	69.65%	72.23%	75.84%	83.58%	92.10%	96.73%	93.84%	87.47%	84.30%	82.42%
Incd CC	68.84%	71.41%	75.25%	83.58%	93.19%	98.82%	95.93%	89.23%	84.03%	78.38%
Paid CC onl						104.07%	99.86%	87.78%	79.18%	74.76%
Incd Cc Onl						103.24%	99.62%	89.57%	80.82%	72.94%

As mentioned above it becomes apparent that the soft market renders the trended and adjusted methods most useful whereas in years following the soft market, these methods will overstate losses.

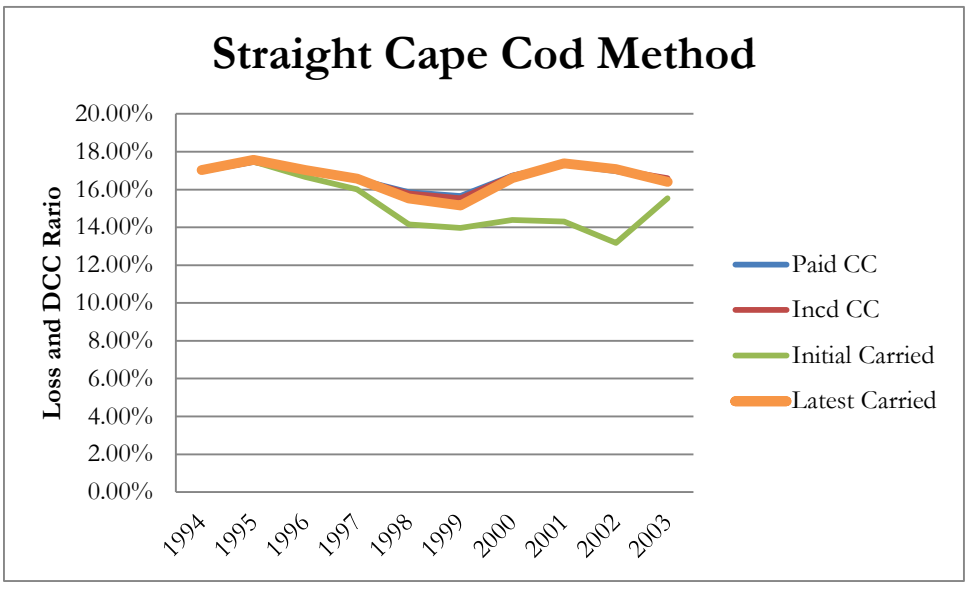
Conclusion: Knowledge of the market cycle is critical to establishing an appropriate IELR; in many instances, knowledge of the market cycle is more important than the variety of methods used.

Findings for Commercial Lines – DCC to Loss Ratio 2003



Final DCC to loss ratio was higher than initially carried. Either Paid or Incurred Cape Cod methods would have provided a better estimate than actual booked reserves. The source of the low carried amounts is unclear, but it is possible that the uncertainty in loss amounts makes the DCC prediction less predictable.

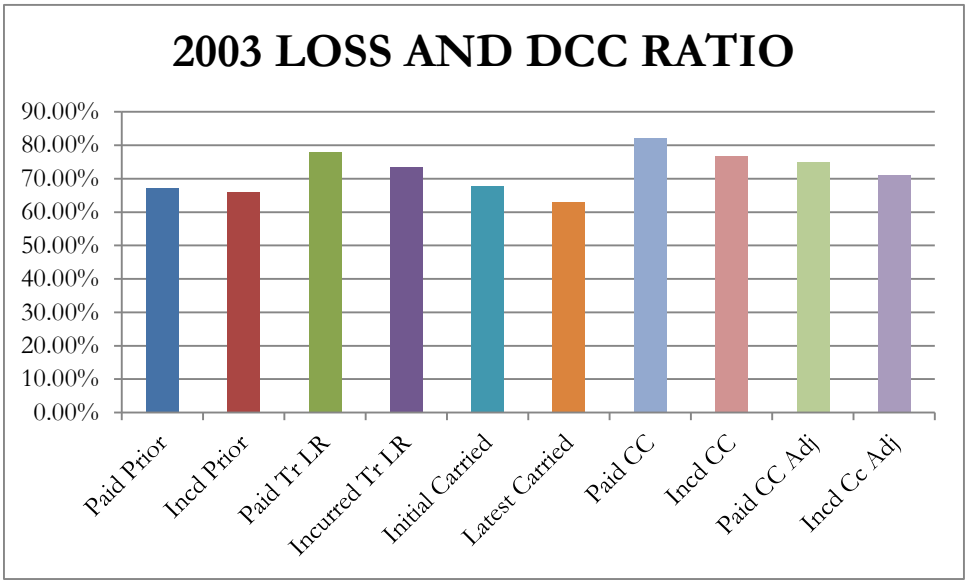
Findings for Commercial Lines – DCC to Loss Ratio All Accident Years



Looking at all accident years for commercial lines, DCC booked ratios were deficient in the years following the soft cycle. Cape Cod methods were more accurate. DCC booked ratios seemed to go down when booked loss ratios went up.

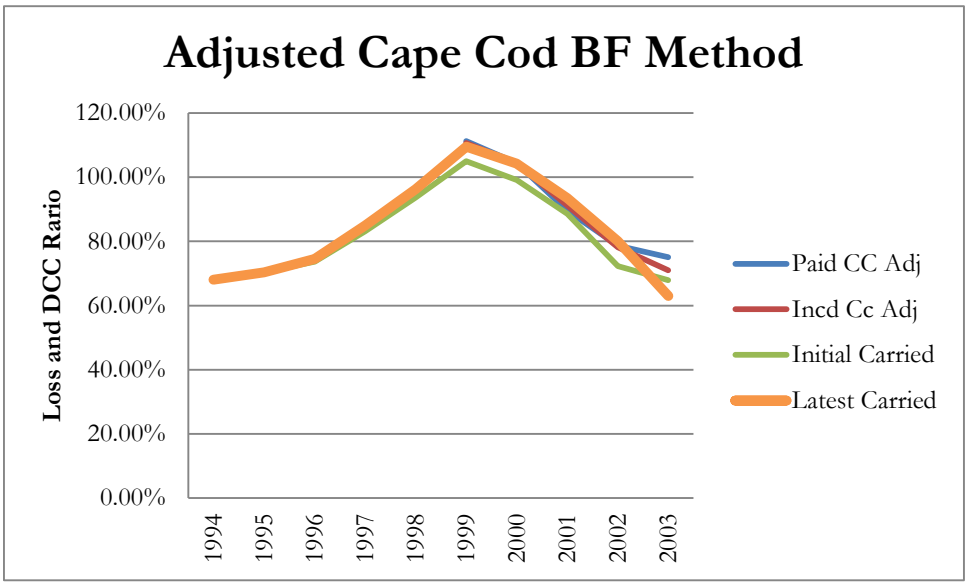
Conclusion: Carriers held lower DCC reserves than necessary following a soft market cycle, but Cape Cod methods would have predicted DCC more accurately.

Findings for Commercial Lines – Gross Loss and DCC Ratio 2003 Accident Year



In the case of Gross losses, the carried loss ratios were overstated. Similar to the more recent loss ratios above, gross carried loss ratios are less affected by market considerations and are more commensurate with the results of Cape Cod methods.

Findings for Commercial Lines – Gross Loss and DCC Ratio All Accident Years

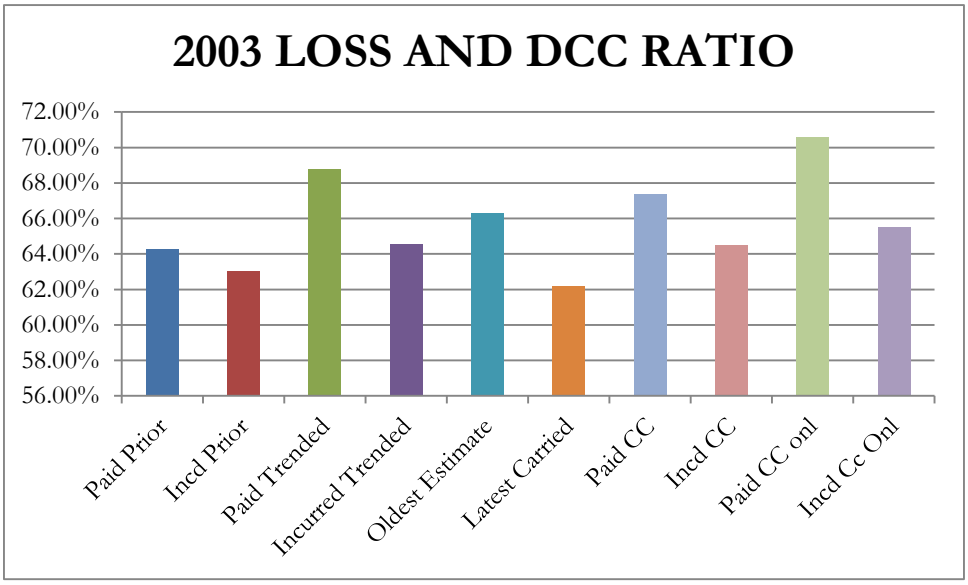


Similarly to above, booked gross losses were closer to final estimates and adjusted Cape Cod methods. This has a serious implication, in that the methodology is adequate but insurers chose to book lower net reserves in a soft market cycle.

Personal Lines

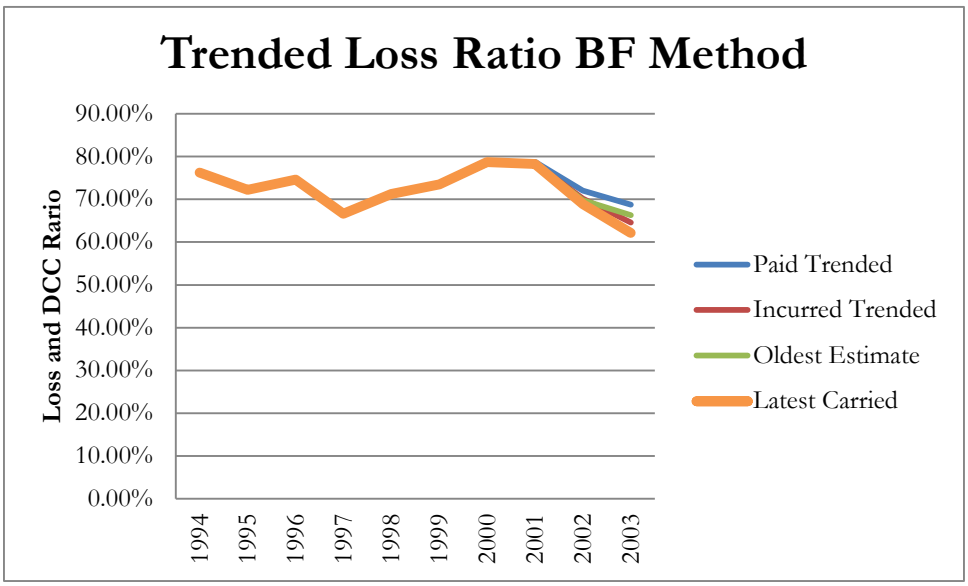
For Personal Lines, we did not have the benefit of a rate change index, but we did have trend information for the two personal lines studied, Personal Auto and Homeowners, as well as CMP.

Findings for All Lines – Current Accident Year



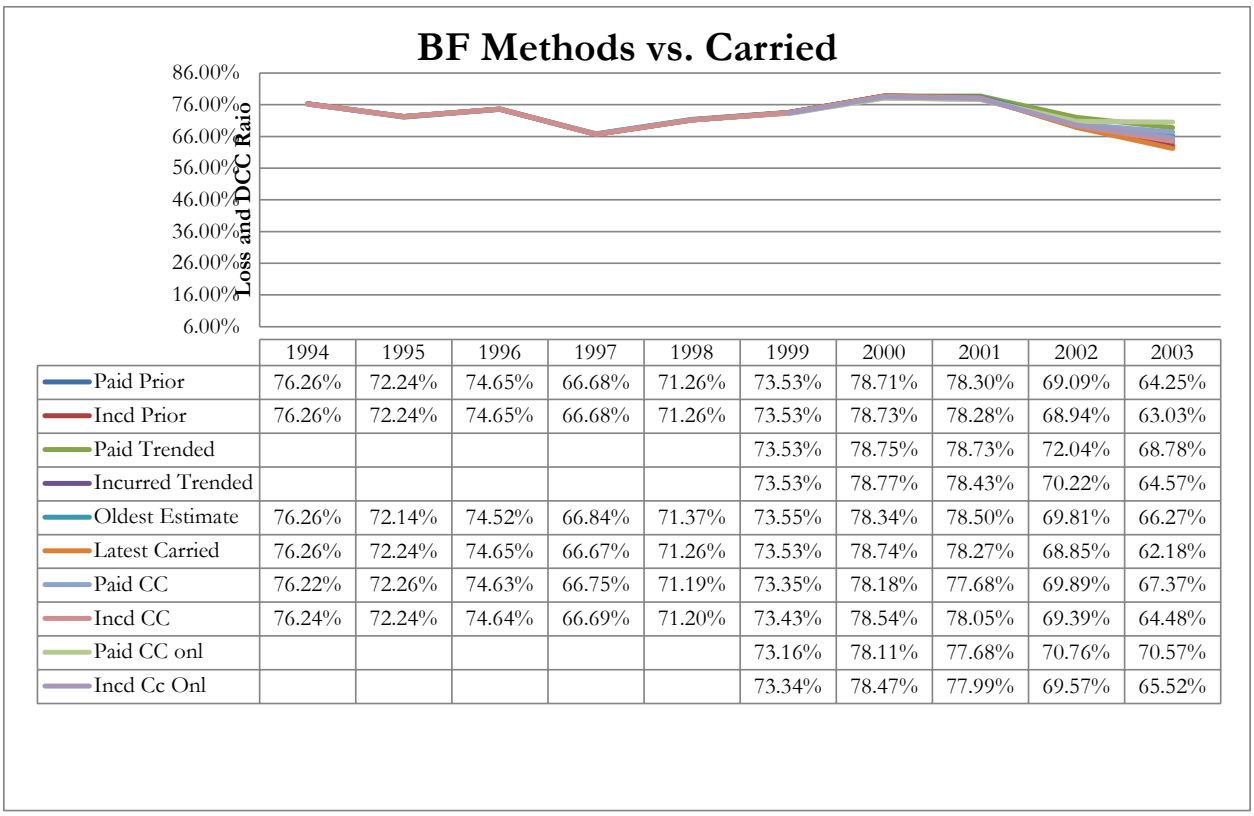
For personal lines, all methods and carried reserves overstated losses. This is more similar to gross reserves on commercial lines.

Findings for Trended Loss Ratio BF Method – All Accident Years



As seen above, the shorter-tail personal lines demonstrate a convergence of methods as well as carried reserves.

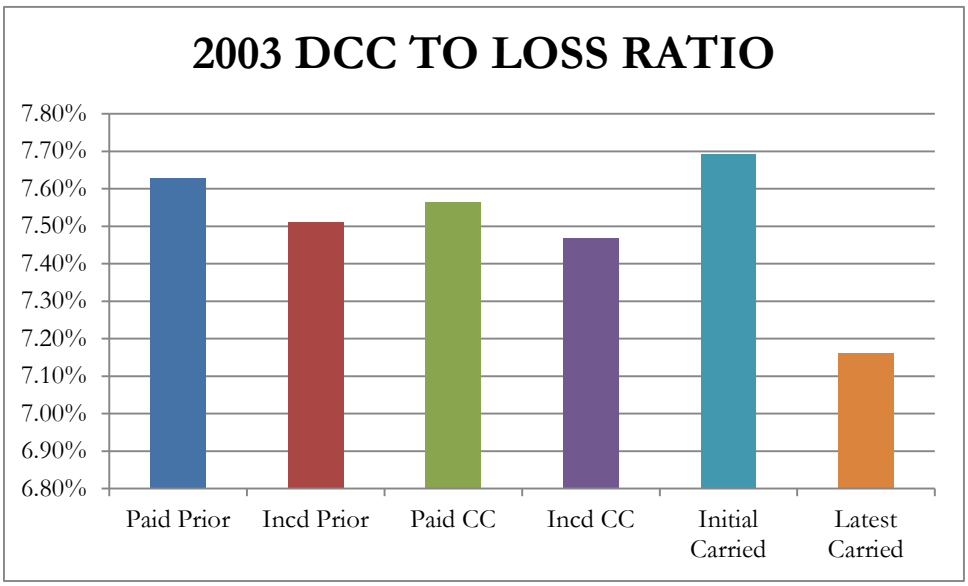
Findings for All Methods – All Accident Years



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Paid Prior	76.26%	72.24%	74.65%	66.68%	71.26%	73.53%	78.71%	78.30%	69.09%	64.25%
Incd Prior	76.26%	72.24%	74.65%	66.68%	71.26%	73.53%	78.73%	78.28%	68.94%	63.03%
Paid Trended						73.53%	78.75%	78.73%	72.04%	68.78%
Incurred Trended						73.53%	78.77%	78.43%	70.22%	64.57%
Oldest Estimate	76.26%	72.14%	74.52%	66.84%	71.37%	73.55%	78.34%	78.50%	69.81%	66.27%
Latest Carried	76.26%	72.24%	74.65%	66.67%	71.26%	73.53%	78.74%	78.27%	68.85%	62.18%
Paid CC	76.22%	72.26%	74.63%	66.75%	71.19%	73.35%	78.18%	77.68%	69.89%	67.37%
Incd CC	76.24%	72.24%	74.64%	66.69%	71.20%	73.43%	78.54%	78.05%	69.39%	64.48%
Paid CC onl						73.16%	78.11%	77.68%	70.76%	70.57%
Incd Cc Onl						73.34%	78.47%	77.99%	69.57%	65.52%

For short-tailed personal lines, only the most recent two years show any material variation in methods. In hindsight, the Incurred Cape Cod methods seemed to be the closest for both years.

Findings for Personal Lines – DCC to Loss Ratio 2003



In this case the initial carried for DCC overstated the latest carried. This is the opposite effect observed on the commercial lines. If anything, this underscores the unpredictability of DCC after a soft market cycle. Unlike the commercial lines, none of the methods would have predicted the right level of DCC.

SUMMARY OF OBSERVATIONS AND CONCLUSIONS

In selecting the initial carried amounts, reactions to market cycles appear to play a more prominent role than actuarial indications. During accident years in a soft market cycle, adjusted (on-leveled) Cape Cod methods often do a more accurate job of predicting ultimate losses, but could easily overestimate losses during the period following a soft market. In this case, accurate rate changes (and changes in terms and conditions) may not be available to properly adjust the method. Overall it appears the industry selects accident year loss ratios more uniquely than the Cape Cod results, which would weight in a more long-term average.

The influence of market cycle in deflating net reserves during a soft market is not seen on the gross side, which suggests carriers approach net and gross reserves differently during the market cycle. In addition, DCC reserves tend to be deflated during a soft cycle, despite the fact that actuarial indications such as Cape Cod are not distorted by the cycle.

Most of the observations above impact long-tailed commercial lines and not surprisingly, have a lesser effect on short-tailed or personal lines.

Knowledge of the market cycle is critical to establishing an appropriate IELR; in many instances, knowledge of the market cycle is as important as the appropriateness of the methods used to select the IELR. Based on hindsight testing, it is apparent that methods that reflect rate changes, loss trends and give appropriate weights to the on-level loss ratios (the best example being Cape Cod) tend to perform better than methods that do not. However, it is evident from the survey results that the use of the Cape Cod is not prevalent within the industry. Although the use of appropriate models can play a role in improving the accuracy of the booked reserves, changing business conditions and business considerations are also factors that have an important impact.

REFERENCES

[1] Bornhuetter, Ronald L. and Ronald E. Ferguson, "The Actuary and IBNR," *PCAS*, 1972, Vol. LIX, 181-195.
[2] Stanard, James N., "A Simulation Test of Prediction Errors of Loss Reserve Estimation Techniques," *PCAS*, 1985, Vol. LXXII, 124-148.
[3] Gluck, Spencer M., "Balancing Development and Trend in Loss Reserve Analysis," *PCAS*, 1997, Vol. LXXXIV, 482-532.

Appendix A – Method Examples

Adjusted Rate Indication Method Exhibit 1
Estimating Accident Year 2016 Initial Expected Loss Ratio at 12/31/2016

(1)	Projection Period	Policies Effective from 7/1/2017 to 6/30/2018
(2)	Indicated Ultimate Loss Ratio for Projection Period	65.3%
(3)	Net Annual Loss/Premium Trend	3.0%
(4)	Average Earned Date for Projection Period	6/30/2018
(5)	Midpoint of Accident Year 2016	6/30/2016
(6)	Number of Years of Trend	2.0
(7)	Detrend Factor	0.943
(8)	2015 Rate Change	2.0%
(9)	Effective Date of 2015 Rate Change	7/1/2015
(10)	Portion of 2015 Rate Change Not Earned in 2016	12.4%
(11)	Unearned 2015 Rate Change Adjustment	1.002
(12)	2016 Rate Change	2.0%
(13)	Effective Date of 2016 Rate Change	7/1/2016
(14)	Portion of 2016 Rate Change Not Earned in 2016	87.4%
(15)	Unearned 2016 Rate Change Adjustment	1.017
(16)	Selected IELR	62.8%

Notes:
(1), (2), (3), (8), (9), (12) and (13) from rate indication
(6) = ((4) - (5)) / 365
(7) = (1 / (1 + (3)))^(6)
(10) = (((9) + 365 - 12/31/2015)/365)^2/2
(11) = 1 + (8) x (10)
(14) = 1 - ((12/31/2016 - (13))/365)^2/2
(15) = 1 + (12) x (14)
(16) = (2) x (7) x (11) x (15)

Cape Cod Method Using On-Level Earned Premiums ($000's) Exhibit 2
Estimating Accident Year 2016 Initial Expected Loss Ratio at 12/31/2016

Accident Year	Reported Losses	Earned Premium	Cumulative Rate Index	On-Level Premium Factor	On-Level Earned Premium	Annual Loss Trend	Cumulative Loss Trend Index	Loss Trend Factor	Trended Reported Losses	Percent Reported	"Reported" On-Level Premium	Trended Developed Loss Ratio	Decay Weight	Weight
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
2007	68,000	120,000	1.004	1.275	152,981		1.000	1.409	95,819	98.0%	149,982	63.9%	0.075	11,261
2008	69,476	123,152	1.030	1.242	152,981	5.0%	1.050	1.342	93,236	97.1%	148,497	62.8%	0.100	14,866
2009	71,765	126,846	1.061	1.206	152,981	5.0%	1.103	1.278	91,723	95.2%	145,585	63.0%	0.133	19,433
2010	75,217	130,652	1.093	1.171	152,981	5.0%	1.158	1.217	91,557	93.3%	142,730	64.1%	0.178	25,403
2011	73,397	134,571	1.126	1.137	152,981	5.0%	1.216	1.159	85,088	88.9%	135,934	62.6%	0.237	32,258
2012	70,124	139,994	1.159	1.104	154,511	3.0%	1.252	1.126	78,925	82.3%	127,123	62.1%	0.316	40,223
2013	65,882	145,636	1.194	1.072	156,056	3.0%	1.290	1.093	71,991	73.5%	114,638	62.8%	0.422	48,363
2014	56,643	152,814	1.228	1.042	159,177	3.0%	1.328	1.061	60,092	60.2%	95,845	62.7%	0.563	53,913
2015	41,603	156,056	1.255	1.020	159,177	3.0%	1.368	1.030	42,851	42.3%	67,259	63.7%	0.750	50,445
2016	27,981	159,177	1.280	1.000	159,177	3.0%	1.409	1.000	27,981	28.2%	44,840	62.4%	1.000	44,840
Total	620,087	1,388,899			1,553,004				739,263		1,172,431			341,004

(16) Selected Decay Factor 0.75

(17) Selected IELR 62.9%

Notes:
(2), (3), (4), (7) and (11) from company data
(5) = ((4) for Accident Year 2016) / (4)
(6) = (3) x (5)
(8) cumulative index based on (7)
(9) = ((8) for Accident Year 2016) / (8)
(10) = (2) x (9)
(12) = (6) x (11)
(13) = (10) / (12)
(14) = (16)^(2016 - (1))
(15) = (12) x (14)
(16) judgmentally selected
(17) weighted average of (13) using (15) as weights

Cape Cod Method Using Earned Exposures ($000's) Exhibit 3
Estimating Accident Year 2016 Initial Expected Loss Ratio at 12/31/2016

Accident Year	Reported Losses	Earned Exposures	Annual Loss Trend	Cumulative Loss Trend Index	Loss Trend Factor	Trended Reported Losses	Percent Reported	"Reported" Earned Exposures	Trended Developed Pure Prem.	Decay Weight	Weight
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2007	68,000	100,000		1.000	1.409	95,819	98.0%	98,039	977	0.075	7,361
2008	69,476	100,000	5.0%	1.050	1.342	93,236	97.1%	97,069	961	0.100	9,718
2009	71,765	100,000	5.0%	1.103	1.278	91,723	95.2%	95,165	964	0.133	12,703
2010	75,217	100,000	5.0%	1.158	1.217	91,557	93.3%	93,299	981	0.178	16,605
2011	73,397	100,000	5.0%	1.216	1.159	85,088	88.9%	88,856	958	0.237	21,086
2012	70,124	101,000	3.0%	1.252	1.126	78,925	82.3%	83,097	950	0.316	26,292
2013	65,882	102,010	3.0%	1.290	1.093	71,991	73.5%	74,936	961	0.422	31,614
2014	56,643	104,050	3.0%	1.328	1.061	60,092	60.2%	62,651	959	0.563	35,241
2015	41,603	104,050	3.0%	1.368	1.030	42,851	42.3%	43,966	975	0.750	32,974
2016	27,981	104,050	3.0%	1.409	1.000	27,981	28.2%	29,311	955	1.000	29,311
Total	620,087	1,015,161				739,263		766,389			222,906

(13) Selected Decay Factor	0.75
(14) Selected Expected Pure Premium	962
(15) Accident Year 2016 Earned Premium	159,177
(16) Selected IELR	62.9%

Notes:
(2), (3), (4), (8) and (15) from company data
(5) cumulative index based on (4)
(6) = ((5) for Accident Year 2016) / (5)
(7) = (2) x (6)
(9) = (3) x (8)
(10) = (7) / (9)
(11) = (13)^(2016 - (1))
(12) = (9) x (11)
(13) judgmentally selected
(14) weighted average of (10) using (12) as weights
(16) = (14) x ((3) for 2016) / (15)

Prior Accident Year Loss Ratios Trended and Rate Adjusted ($000's) Exhibit 4
Estimating Accident Year 2016 Initial Expected Loss Ratio at 12/31/2016

Accident Year	Earned Exposures	Earned Premium	Estimated Ultimate Loss	Estimated Ultimate Loss Ratio	Cumulative Rate Index	On-Level Premium Factor	Annual Loss Trend	Cumulative Loss Trend Index	Loss Trend Factor	Estimated Expected Loss Ratio
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
2007	100,000	120,000	69,360	57.8%	1.004	1.275		1.000	1.409	63.9%
2008	100,000	123,152	71,574	58.1%	1.030	1.242	5.0%	1.050	1.342	62.8%
2009	100,000	126,846	75,411	59.5%	1.061	1.206	5.0%	1.103	1.278	63.0%
2010	100,000	130,652	80,619	61.7%	1.093	1.171	5.0%	1.158	1.217	64.1%
2011	100,000	134,571	82,602	61.4%	1.126	1.137	5.0%	1.216	1.159	62.6%
2012	101,000	139,994	85,231	60.9%	1.159	1.104	3.0%	1.252	1.126	62.1%
2013	102,010	145,636	89,686	61.6%	1.194	1.072	3.0%	1.290	1.093	62.8%
2014	104,050	152,814	94,071	61.6%	1.228	1.042	3.0%	1.328	1.061	62.7%
2015	104,050	156,056	98,458	63.1%	1.255	1.020	3.0%	1.368	1.030	63.7%
2016	104,050	159,177	99,331	62.4%	1.280	1.000	3.0%	1.409	1.000	
Total	1,015,161	1,388,899	846,343							

(12) Average Estimated Expected Loss Ratios

Average All Years	63.1%
Average Latest 7 Years	63.0%
Average Latest 5 Years	62.8%
Average Latest 3 Years	63.1%

(13) Selected IELR 63.1%

Notes:
(2), (3), (6) and (8) from company data
(4) from prior reserve review valued at 6/30/2016
(5) = (4) / (3)
(7) = ((6) for Accident Year 2016) / (6)
(9) cumulative index based on (8)
(10) = ((9) for Accident Year 2016) / (9)
(11) = (5) x (10) / (7)
(12) simple averages of (11)
(13) selected based on (11) and (12)

Prior Accident Year Pure Premiums Trended and Rate Adjusted ($000's) Exhibit 5
Estimating Accident Year 2016 Initial Expected Loss Ratio at 12/31/2016

Accident Year	Earned Exposures	Earned Premium	Estimated Ultimate Loss	Estimated Ultimate ure Premiur	Annual Loss Trend	Cumulative Loss Trend Index	Loss Trend Factor	Estimated Expected ure Premiur
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
2007	100,000	120,000	69,360	694		1.000	1.409	977
2008	100,000	123,152	71,574	716	5.0%	1.050	1.342	961
2009	100,000	126,846	75,411	754	5.0%	1.103	1.278	964
2010	100,000	130,652	80,619	806	5.0%	1.158	1.217	981
2011	100,000	134,571	82,602	826	5.0%	1.216	1.159	958
2012	101,000	139,994	85,231	844	3.0%	1.252	1.126	950
2013	102,010	145,636	89,686	879	3.0%	1.290	1.093	961
2014	104,050	152,814	94,071	904	3.0%	1.328	1.061	959
2015	104,050	156,056	98,458	946	3.0%	1.368	1.030	975
2016	104,050	159,177	99,331	955	3.0%	1.409	1.000	
Total	1,015,161	1,388,899	846,343					

(10) Average Estimated Expected Pure Premiums

Average All Years	965
Average Latest 7 Years	964
Average Latest 5 Years	960
Average Latest 3 Years	965

(11) Selected Expected Pure Premium 965

(12) Selected IELR 63.1%

Notes:
(2), (3) and (6) from company data
(4) from prior reserve review valued at 6/30/2016
(5) = (4) / (2)
(7) cumulative index based on (6)
(8) = ((7) for Accident Year 2016) / (7)
(9) = (5) x (8)
(10) simple averages of (9)
(11) selected based on (9) and (10)
(12) = (11) x ((2) for Accident Year 2016) / ((3) for Accident Year 2016)

Appendix B – Survey Results

Choice of Method – Long-Tailed Lines

Prior Accident Years Adjusted for Rate Changes and Trends	43.6%
Prior Analysis Ultimate Loss Ratios	27.6%
Cape Cod	9.6%
Pricing Loss Ratio	9.3%
Prior Accident Years	6.1%
Judgment	2.3%
Industry Aggregates	1.5%

Choice of Method – Short-Tailed Lines

Prior Accident Years Adjusted for Rate Changes and Trends	34.3%
Prior Analysis Ultimate Loss Ratios	31.8%
Pricing Loss Ratio	11.4%
Cape Cod	8.6%
Prior Accident Years	8.0%
Judgment	3.4%
Industry Aggregates	2.5%

Choice of Method – Additional Considerations

In addition to the above, the actuary may also consider the following in selecting the IELR: (select all that apply)

Maturity of accident year	78.0%
Homogeneity of portfolio	48.3%
Credibility of development factors	46.6%
Size of Book	45.9%
Size of development factors	33.8%

BF Used to Develop (select all that apply)

ALAE/DCC	81.0%
Claim Counts	51.4%
Salvage and Subrogation	31.2%
ULAE/AAO	6.5%

How is DCC Treated

Analyze Loss and Expense combined	30.7%
Assume an Expense/Ultimate Loss Ratio that varies by year	23.2%
Don't use BF on expenses	22.2%
Assume a fixed percent to losses/premium for all years as IE	15.0%
Assume an Expense/Premium IE that varies by year	8.2%
Use a claim count method to determine ultimate expenses	0.7%

For Current AY, BF is	
Always used	49.6%
Sometimes used	40.5%
Rarely used	7.1%
Not used	2.8%

For Other than Current AY, BF is	
Sometimes used	76.1%
Always used	14.1%
Rarely used	9.3%
Not used	0.6%

How Often is IELR Reselected?	
Annually	61.1%
Quarterly	31.4%
Every 2 - 3 years	2.9%
Every 3 -5 years	2.3%
Never	2.3%

Restrictions on IELR?	
No boundaries put in place	62.1%
Higher than reported losses	26.8%
Higher than paid losses (excluding high salvage situations)	11.1%

Use of Cape Cod with	
Don't use Cape Cod	65.0%
Loss trend	29.3%
Rate changes	25.9%
A decay factor	18.2%

Rate Changes considered with	
A price monitor	63.6%
Not considered	20.2%
Planned changes	16.2%

Sources of Industry LR Benchmarks	
Not considered	50.6%
AM Best	13.5%
Internal benchmarks	13.1%
NCCI	9.3%
SNL	9.0%
ISO	4.5%

Management Influence	
My decisions are completely independent	50.7%
Management points out factors that I consider in my analysis	42.2%
Management guides my final decisions	5.7%
I feel pressure from management	1.4%

Reasonability Checks of IELR? (select all that apply)

Internal Peer Review	82.6%
Comparison of expected losses to actual emerged losses to date	65.9%
Hindsight Tests of accuracy of methodology	36.8%
External Peer Review	32.1%
Audit controls under SOX	14.7%
Audit controls under Model Audit Rule	6.8%