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Practical Considerations for Building a D&O Pricing Model

ADVISEN Insurance Intelligence

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Purpose

The intent of this paper is to provide some practical considerations when building a public company Directors' and Officers' Liability (D&O) pricing model. While some of the suggestions can be applied to pricing other lines of business, the scope of this discussion is limited to public company D&O. This is not intended to be an exhaustive discussion of how to build a model nor of all the variables that could be considered in a D&O pricing model.

Acknowledgement

Thank you to Advisen Ltd. for providing the underlying data for this paper.

Collaboration

Building a D&O pricing model is not just an actuarial exercise. A key element to success is strong collaboration between underwriting, claims and actuarial. This collaboration is critical for at least a couple of reasons:

1) To leverage knowledge and expertise of each of these disciplines
2) For end-user adoption

Leverage Knowledge and Expertise of these Disciplines:

Diverse and complementary perspectives will lead to a better end result. Underwriters, claim professionals and actuaries each have different sets of skills, expertise and perspectives that they bring to the table. Leveraging the wealth of knowledge amongst these groups will result in a much better end result than any single discipline would produce.

End-user adoption:

If a company invests the time and money to acquire data, do the analyses and build the model, they want to get the most value out of it. They will want a tool that will help the underwriters make better informed pricing decisions leading to increased profitability; not just a compliance tool to document the underwriting file. If the underwriters (i.e. end-users) are not engaged in the build-out of the pricing model from the beginning, end-user adoption will be much more difficult. In addition to the benefits of the valuable knowledge, insight and perspective they have to offer, including the underwriters from the

beginning in the specifications and build out will increase their sense of ownership and engagement with the pricing model and its underlying assumptions. This will lead to more successful adoption and usage. If the model is built in a vacuum by an actuary, then an underwriter is more likely to view this as something that is being imposed on them as opposed to another useful tool (that they helped create) in their tool box.

In addition to the internal collaboration amongst disciplines, a strong relationship with your data provider can prove to be very useful in making sure you are aware of what data is available and understand its applicability and limitations.

Identify your Universe (Scope)

When building a D&O pricing model, you must first define the applicable universe of companies for which the model will be built. Some considerations in defining the universe are the underwriter's target market, the exchange the companies' stocks are traded on, market capitalization, assets, revenue, sector, industry, etc. In regard to sector/industry, another consideration is what classification system will be used, such as: North American Industry Classification System (NAICS), Standard Industrial Classification (SIC) or Global Industry Classification System (GICS).

Case Types

Exposure to Security Class Action Lawsuits (SCAs) has always been a key consideration in D&O underwriting and pricing, but there are a number of other case types that should be considered, as well. According to Advisen Ltd., "prior to the financial crisis, securities class action suits represented about a quarter of the D&O related events tracked by Advisen. Since 2007, growth in the number of other types of suits has caused securities class actions to steadily decline as a percentage of all events, from 23 percent in 2007 to a low of 10 percent in 2011" and "in Advisen's Quarterly D&O litigation webinar our panelists regularly focus on the increase in the frequency of filings of non-SCAS cases. From these cases, we increasingly see large settlements emerging." Given the significant number (and percentage) of non-SCA cases, it is important to include other case types in the modeling of expected D&O claims. Below is a list of the case types that Advisen uses to track cases that could impact a D&O policy along with the reported case counts.

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CASE_CATEGORY	CASE_TYPE	Total
Business Practices Risks	ADA Non-compliance: Public	1,048
Business Practices Risks	Anti-trust	2,103
Business Practices Risks	Arms Export Control Act (AECA)	93
Business Practices Risks	Bid Rigging	360
Business Practices Risks	Billing Fraud	3,567
Business Practices Risks	Breach of Contract	6,665
Business Practices Risks	Breach of Covenant of Good Faith	66
Business Practices Risks	Bribery	796
Business Practices Risks	Foreign Corrupt Practices Act (DoJ)	384
Business Practices Risks	Foreign Corrupt Practices Act (SEC)	279
Business Practices Risks	Fraudulent Conveyance	136
Business Practices Risks	Malicious Prosecution	66
Business Practices Risks	Market Manipulation	218
Business Practices Risks	Money Laundering - domestic	241
Business Practices Risks	Non-employment Discrimination	1,503
Business Practices Risks	Tax Evasion	146
Business Practices Risks	Tortious Interference	246
Business Practices Risks	Undetermined/Other	271
Corporate Capital Risks	Bankruptcy	669
Corporate Capital Risks	Books & Records Violations	56
Corporate Capital Risks	Capital Regulatory Actions	8,388
Corporate Capital Risks	Control Persons Violations	51
Corporate Capital Risks	Creditor Derivative	16
Corporate Capital Risks	Derivative Action	129
Corporate Capital Risks	Proxies and Solicitation Violations	108
Corporate Capital Risks	Sarbanes Oxley Act	12
Corporate Capital Risks	Wells Notice	65
Shareholder Risks	Breach of Fiduciary Duties: Securities	665
Shareholder Risks	Collective Action	96
Shareholder Risks	Derivative Shareholder Action	2,844
Shareholder Risks	Merger Objection	3,359
Shareholder Risks	Securities Class Action	5,253
Shareholder Risks	Securities Individual Actions	901
Total	Total	40,800

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Given the large number of case types, it is recommended to group some of the case types into larger categories to gain greater credibility for analysis. One could categorize them by how the D&O policy would likely respond for each of them. Input from D&O claim professionals is key here. Three potential categories are: 1) Excluded, 2) Defense only, 3) Full coverage (settlement & defense). Some additional considerations for subgroupings are the frequency, severity and dismissal rate characteristics and the nature of the allegations.

Below are reported case counts by major case types according to Advisen.

	Reported Counts as of July 2015						
Case Type	2010	2011	2012	2013	2014	2015	Total
Securities Class Action	179	223	187	227	260	121	1,197
Capital Regulatory Actions	529	917	859	720	830	507	4,362
Securities Individual Actions	135	176	79	58	33	30	511
Breach of Fiduciary Duties: Securities	57	75	58	56	40	24	310
Derivative Shareholder Action	202	289	255	200	194	69	1,209
Merger Objection	377	438	353	333	302	144	1,947
Total	1,479	2,118	1,791	1,594	1,659	895	9,536

Below are settlement counts by Advisen's major case types.

	Settlement Counts as of July 2015						
Case Type	2010	2011	2012	2013	2014	2015	Total
Securities Class Action	117	91	68	97	77	80	530
Capital Regulatory Actions	344	508	377	291	435	290	2,245
Securities Individual Actions	18	28	20	6	7	2	81
Breach of Fiduciary Duties: Securities	13	16	14	11	2	2	58
Derivative Shareholder Action	63	66	40	44	38	25	276
Merger Objection	73	84	62	30	29	15	293
Total	628	793	581	479	588	414	3,483

The following table provides the average settlement amounts (in 000's) by Advisen's major case types.

	Average Severity (in 000's) as of July 2015						
Case Type	2010	2011	2012	2013	2014	2015	Total
Securities Class Action	23,724	21,351	32,156	84,269	26,679	42,322	38,716
Capital Regulatory Actions	18,648	7,577	7,387	30,836	27,618	72,836	24,569
Securities Individual Actions	2,713	32,820	7,102	4,635	1,746	58,055	15,630
Breach of Fiduciary Duties: Securities	22,631	15,954	44,723	18,295	18,700	10,150	24,733
Derivative Shareholder Action	4,765	24,985	4,512	11,970	3,653	34,975	13,296
Merger Objection	6,141	31,411	15,152	4,912	10,014	25,101	16,521
Total	16,373	14,191	11,807	37,684	24,740	62,549	24,946

As can be seen above, both frequency and severity are significant for a number of the case types beyond traditional securities class actions. For example, in 2015 alone, there were two derivative shareholder action settlements > $200M (Google Inc. and Activision Blizzard, Inc.). Also, Capital Regulatory Action cases make up the largest number of settlements. Again, one should consider how the D&O policy would respond to these various case types. Regulatory fines & penalties are often excluded, but the defense costs are covered.

Predictive Variables

After identifying the universe and case types, one should identify the predictive variables that may be considered to model the frequency, severity and dismissal rates associated with these case types. There are numerous predictive variables and interactions between variables that can be considered. To be able to build the pricing model within a reasonable time and cost budget, potential variables for consideration should be prioritized.

Build your Universes

Many D&O analyses focus solely on the counts and amounts (e.g. SCA reported counts, settlement counts and/or settlement amounts). These are necessary, but not sufficient, because it is also critical to understand how these counts relate to the universe of publicly traded companies (e.g. frequency expressed as SCA reported counts per publicly traded company in a particular size group and/or sector). The frequency is often omitted because defining the universe and matching the cases to the companies in the universe can be a challenging task.

After you have identified 1) your universe (i.e. scope of companies), 2) the grouping of case types to be modeled and 3) the predictive variables to be analyzed, you will need to assemble the required data to perform the analyses.

The first thing needed is to construct the company universe. This is a database containing historical data for all of the companies in your universe including historical values for the predictive variables. This universe contains all in-scope companies whether or not they've had any cases against them. Many of the data elements are likely coming from different tables and/or data sources. Hence, it is critical to have a key that is consistent throughout all of the tables (e.g., company code). Otherwise, pulling all of the data together will be a very manual and challenging process.

Next, a case universe will need to be built. This will include all reported cases for relevant case types, and relevant case details such as status (settled, dismissed or pending), defendants, settlement amount, court, etc for the in-scope universe of companies. There are multiple options for assembling the data. The data could be assembled into one case universe or split into separate tables for purposes of analyzing frequency, dismissal rates and severity.

A key is also required for the case universe. The key (e.g., company code) will be the means for matching the cases in the case universe to the companies in the company universe. Again, without such a key, matching these will be a very manual and challenging process. You will also need date logic to match reported cases to the proper time period for the company data. Basically, the date logic will define the "as of date" for the market cap and other variables which will be associated with each case.

Selecting a data provider/aggregator

Unless you are using a data provider that has already aggregated and matched all of this data for you, you will need to find and assemble this data, which would be quite challenging. In addition to the challenges with finding the data are the challenges with assembling and matching the data (i.e. defining

and assigning the key). Company matching is the biggest challenge. Different sources have different ways of identifying companies. For company name, there are many different naming conventions that are used, so matching based on name can get tricky and require some sophisticated name matching algorithms (e.g. XYZ, X.Y.Z., XYZ Insurance, XYZ Insurance Company, XYZ Ins Co). And, that won't take care of companies whose names changed over time. Matching based on some key like company code is best, but that is not necessarily consistently available in all public data sources.

Trying to manually find and assemble all of the required data for a D&O analysis would be a daunting task. Going down this path may save money required to purchase data, however much more time will need to be invested to obtain, scrub and assemble the data. Further, there may be data that is simply not available unless it is purchased. Using a data provider/aggregator can save a lot of time and likely provide you with better data than you'd be able to assemble on your own. Below are some considerations in selecting a data provider:

1) What data is available (i.e. do they have all or most of the variables of interest)?
2) How much data do they have?
    a. How many years of history do they have for the various data elements?
    b. How complete is the data during that historical period (i.e. is it comprehensive or a manual sampling or some subset like the top X%)?
3) Is there a common key in all data tables to link the data? As mentioned above, this is quite challenging to do on your own. Having a common key to link data on cases and predictive variables from various sources is critical.
4) How recent is the data?
5) How often is the data updated?
6) Do they have data dictionaries to define all the data elements?
7) Service - how responsive will they be to requests and what other value-added services can they offer?
8) Price

Coverages

Another important item is to identify which coverages will be modeled and how (e.g. traditional A/B/C, A-side only). Will A-Side be modeled independently or as a function of the traditional A/B/C?

Analysis

Frequency:

In my opinion, frequency (reported cases per company/year) is the most important variable and also the one for which there is the most data available. After assembling the company universe, with the proper company key and date logic, one can match reported cases to company/time period combinations in the company universe. With this, you can estimate the overall frequency by case type as well as the impact of various predictive variables (e.g. market cap, sector, S&P Rating).

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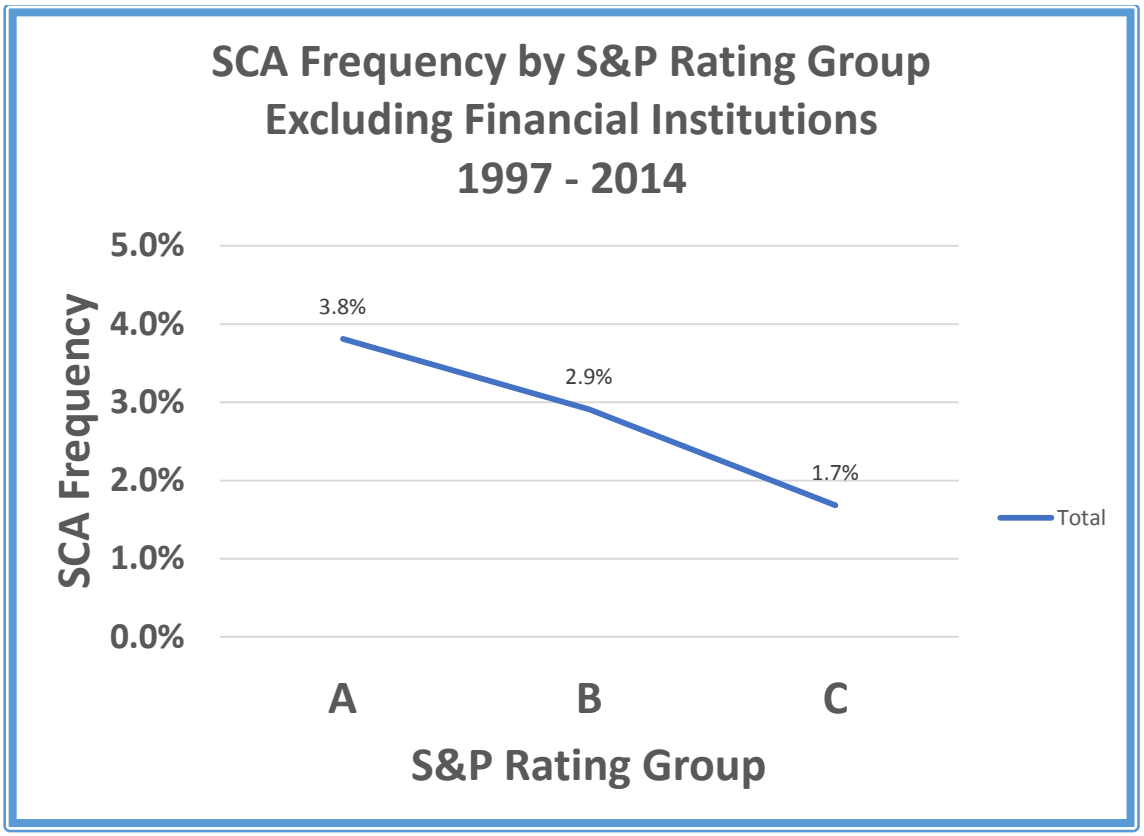
I recommend analyzing financial institutions experience separately from non-financial for several reasons. They are often co-defendants in securities class action lawsuits against other companies, their frequencies tend to be much higher than non-financial companies, they are more susceptible to systemic events and they are the 2nd largest sector (in the NYSE & NASDAQ combined) by company count. This will also, generally, better match the practices and organization of D&O underwriters.

Market cap is the single most predictive variable for both frequency and severity (no surprise here). Hence, I recommend starting by estimating the impact of market cap on frequency by case type group. When modeling the impact of certain predictive variables, you will need to control for market cap and other variables first to make sure you are not double counting the impact of correlated variables. Below is an example looking at SCA frequency by S&P rating group for companies whose stock is traded on the NYSE or NASDAQ. For simplicity, I have grouped together S&P ratings (e.g. A, AA, AAA +/- are all grouped as A). For analytical purposes, you may consider delving deeper. In the first chart, you will see that the better the S&P rating, the worse the SCA frequency. This is counter-intuitive and indicative of the need to probe further into the data. As we know, generally speaking, larger companies tend to have a higher SCA frequency. Also, larger companies tend to have a higher S&P rating. Hence, in the first chart, the higher frequency observed for A-rated companies is due to a greater mix of large and mega cap companies which typically have a higher SCA frequency than small and mid-cap companies.



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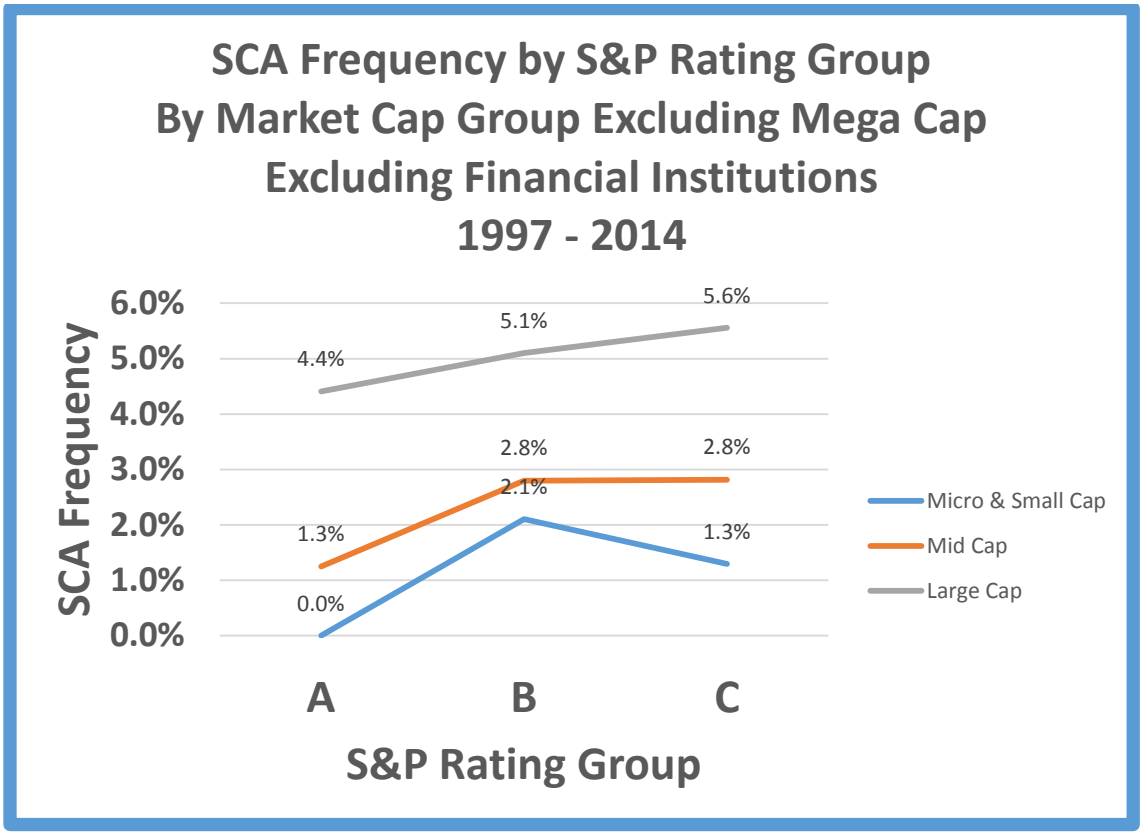
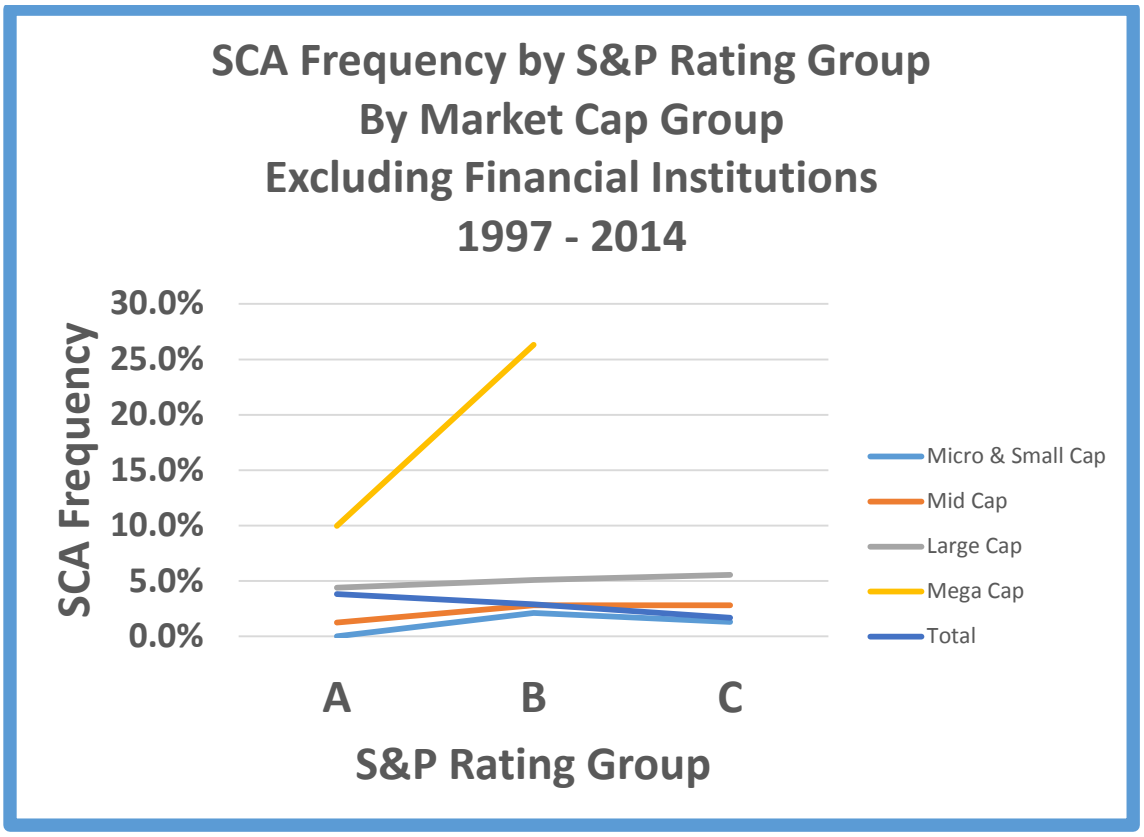
In the next chart, the SCA Frequency has been displayed by market cap group. There is a more intuitive pattern where the better the S&P rating, the better the SCA frequency. Market cap groups have been defined as follows:

Mcap Groups	Mcap Range
Micro or Small	< $2B
Mid	$2B - 10B
Large	$10B - 200B
Mega	> $200B

For display purposes, the mega cap has been omitted from the next chart.



The last chart shows all market cap groups.



Another consideration for estimating frequency is evaluating the impact of systemic events. One possibility is to estimate the non-systemic and systemic frequencies separately. Having some sort of identifier linking related cases would be necessary to separate the cases into systemic and non-systemic. The Advisen data contains related case codes and descriptions which can be useful for this purpose.

Dismissal Rates:

After estimating frequency of reported claims, it is necessary to estimate how many of those cases will ultimately be dismissed vs. settled. Hence, case status is an important field to include in your claim universe. Traditional triangle analysis of settlement counts/reported counts is one way of handling this. Like frequency, one should identify and estimate the impact of the predictive variables that are likely to impact this (e.g. market cap, sector, etc).

The dismissal rates lead into the severity analysis, specifically as it relates to defense-only versus defense plus indemnity cases.

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Severity:

For severity, there is a smaller body of data to work with given that many of the reported cases are dismissed or pending so that settled cases are a much smaller subset. I recommend first estimating severity curves as a function of market cap. Using severity curves gives you the ability of factoring in the impact of limits and retentions without the need to estimate separate increased limit factor (ILF) and retention/deductible credit tables. Hence, you can integrate over a single curve to estimate the expected severity given the limit, attachment point and underlying retention for a given policy (i.e. the probability that a settled claim will exceed the underlying retention and attachment point and the expected severity if it does).

Next, one should identify and estimate the impact of the other predictive variables that are likely to impact severity. The purpose is to derive prospective severity curves to estimate claim severity for pricing. This is different than estimating severity on known claims (i.e. not prospective). For estimating potential settlement amounts on known claims (e.g. loss reserving models), you will have a variety of additional factors that you can take into consideration like the type of allegations and damages, whether or not there is an institutional investor lead plaintiff, if there are co-defendants and who they are. There are flags for these items in the Advisen data for such analyses, but for pricing purposes, you will need to focus on the information that would be available at the time the policy is being quoted.

Another thing to consider is defense costs. While plaintiffs' attorneys' fees are often included in the settlement amount, defense costs are not. Defense cost information is not typically publicly available. So, when modeling severity, some provision needs to be added to the settlement severity for defense costs. Also, for dismissed cases, it will still be necessary to estimate defense costs. This is another area where input from D&O claim professionals is critical.

Related Cases (e.g. SCA with tag-along derivative; SCA with parallel regulatory action)

When modeling expected losses for a D&O policy, it is important to also recognize that losses from various case types are often related. When multiple cases are related, typically only one limit and retention would apply. Hence, adjustments need to be made to the frequency and severity estimates discussed above to account for this. There are various approaches that could be used to accomplish this. Below are a couple that could be considered.

- Approach 1:
    - Model frequency and severity separately by case type
    - Make adjustments to reflect that only one limit and one retention would be exposed for related cases
        - Estimate percentage of cases by case type that would be related
        - Estimate joint severity distribution for related cases
- Approach 2:
    - Explicitly model frequency and severity by each potential case type interaction

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Functionality

After the analysis has been completed and the model parameters and algorithms have been selected and built, the user interface needs to be created. User requirements should be defined in advance. Ideally, the model should be user friendly (this will also increase end-user acceptance and usage). Below are some items to consider when defining requirements:

1) Will company information (e.g. market cap, sector, industry, etc) be manually entered by user or pre-populated when a company is selected?
    a. If using pre-populated data, how often will this data be updated?
2) Will the pricing model be used to calculate rate change for renewals?
3) Will the pricing model include schedule and/or experiencing rating components?
4) Will there be illustrative exhibits included in the model?
5) Will the model be integrated with a production system or data warehouse?
6) How will the model be secured and distributed (e.g. email, shared drive, integrated application)?

User Acceptance Testing (UAT)

In the project plan, plenty of time should be allotted for testing (both actuarial testing and UAT) and necessary refinements to the model in response to that testing. Prior to UAT, the model should be extensively tested by the actuary. If using pre-populated data, one could write a macro to price every single company in the pre-populated universe with various limit, attachment point and coverage options and save the output. The output can be reviewed to see if any rating errors are produced and to check for consistency and reasonability in pricing indications. Also, the actuary can manually rate several policies to test functionality, accuracy of calculations and reasonability of indications. After performing actuarial testing, the model should be released to end-users that have been identified to participate in the UAT. Sufficient time should be allowed for the testers to use the pricing model on a significant sample of accounts. It is helpful to define the expectations upfront on who will be involved in testing, how many policies will be priced for testing and in what time frame. Testing should focus on at least the following areas:

1) Functionality – does everything work as intended?
2) Usability – is it user friendly? Are there other suggested enhancements?
3) Appearance – are there any recommended changes to formatting or arrangement of content?
4) Reasonability of pricing
    a. How do the indicated prices align with underwriter expectations?
    b. How do the indicated prices align with the market?
    c. Is pricing internally consistent (e.g. prices decrease as retentions increase)?
    d. Are pricing changes smooth (e.g. does premium increase smoothly as a function of market cap or are there big jumps based on discrete rating bands)?

One may want to consider building some sort of template to capture the test accounts and allow for underwriter feedback. The more specific the feedback, the easier it will be to identify and fix problem areas.

Documentation

It is recommended to document along the way, however after the analysis is completed, the model is built, tested, refined and deployed, it will be necessary to compile and complete all the documentation.

Conclusion

This paper focused on some practical considerations when building a D&O pricing model. Some of those areas of discussed were:

- Collaboration between disciplines (underwriting, claim, actuarial)
- Definition of scope (universe of companies, case types, predictive variables)
- Selection of data providers/sources
- Coverages to be modeled (traditional, A-Side only)
- Analysis (frequency, severity, dismissal rates and related cases)
- Model Functionality
- Testing
- Documentation

A well-defined project plan for building a D&O pricing model will likely touch on each of these areas and potentially more. Feel free to direct any questions or comments to Dave Moore at david.moore@mooreactuarial.com or by phone at 773-614-7577.

About the Author:

Dave Moore is the president of Moore Actuarial Consulting, LLC which provides actuarial consulting services for commercial and specialty lines of (re)insurance. He is a Fellow of the Casualty Actuarial Society, a Chartered Enterprise Risk Analyst, a Management Liability Insurance Specialist, a Fellow in the Conference of Consulting Actuaries and a member of the American Academy of Actuaries. Dave has over 20 years of actuarial experience and a diverse background. He has extensive pricing and reserving experience for a broad range of (re)insurance products.

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Contact Information:

Company: Moore Actuarial Consulting, LLC
Name: David P. Moore
Phone: 773-614-7577
Email: david.moore@MooreActuarial.com
Address: 700 Commerce Drive, Suite 500, Oak Brook, IL 60523