MILLIMAN WHITE PAPER

A quantum leap in benchmarking P&C risk margins under Solvency II

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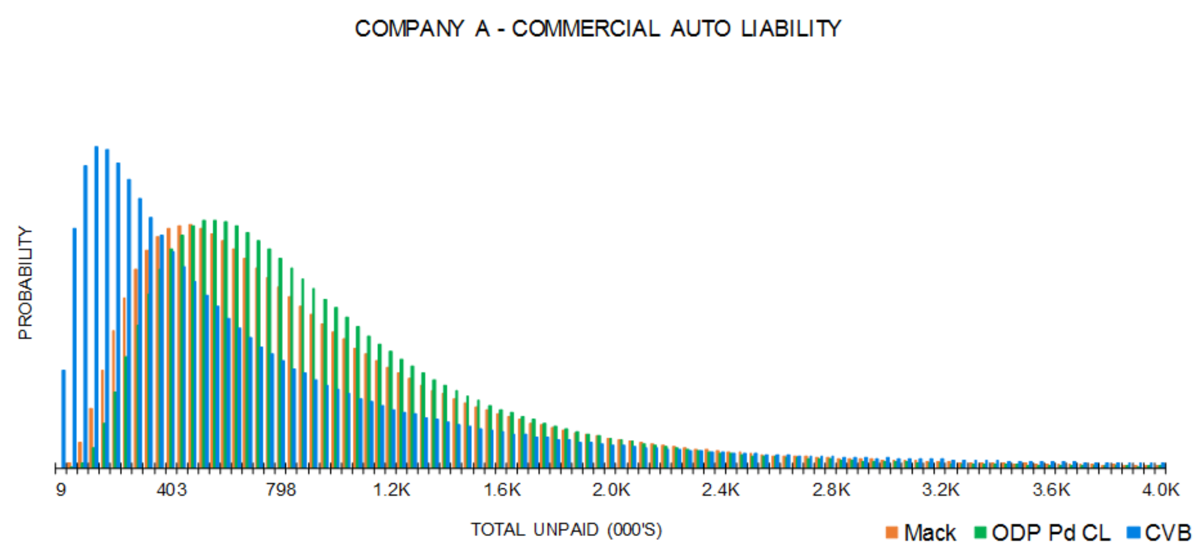
Risk margins are hardly a new concept for insurers, but since the advent of Solvency II, insurers are faced with a number of challenges that can have a pivotal impact on determining the economic value of their liabilities. These challenges start with an insurer's modelled uncertainty with respect to the timing and amount of future cash flows ("FCF"), which sets the stage for nearly every other element of the risk margin from the calibration of the Solvency Capital Requirement (SCR), to the timing of the unpaid claims runoff.

The modeled uncertainty generally starts with the unpaid claim distribution around the Best Estimate (BE) for each accident year and in total, but many models also include other "dimensions" such as calendar year and the runoff by calendar year from which the risk margin is derived.[1] Too wide a calibration and the insurer could be consuming too much capital to support its liabilities. Too narrow a calibration and the insurer risks falling into regulatory or financial difficulty.

FIGURE 1: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS FOR COMPANY A



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	997	793	79.6%	1,251	2,469	4,739	3,742
ODP Pd CL	997	665	66.7%	1,249	2,249	3,956	2,959
CVB	997	1,555	156.0%	1,138	3,344	9,403	8,406
1-Year Time Horizon							
Merz & Wüthrich	997	554	55.5%	1,237	2,045	3,314	2,317
ODP Pd CL	997	464	46.5%	1,218	1,872	2,828	1,831
CVB	997	1,085	108.9%	1,224	2,888	6,577	5,580

[1] In Solvency II, the "Best Estimate" is defined as the probability weighted average of expected future cash flows, which may or may not equate to the mean of the modeled results. In practice, it is quite likely that this also includes weighting of different models and shifting to address inconsistencies. Throughout this paper the "Mean" includes weighting and shifting so it is used interchangeably with "Best Estimate".

Some issues like determining unpaid claim distributions are fundamental to insurers' financial stability with or without the need for a risk margin; others like the calculation of the cost of capital risk margin are specific to Solvency II. In either case, an ill-advised choice can make a huge difference in an insurer's future prospects.

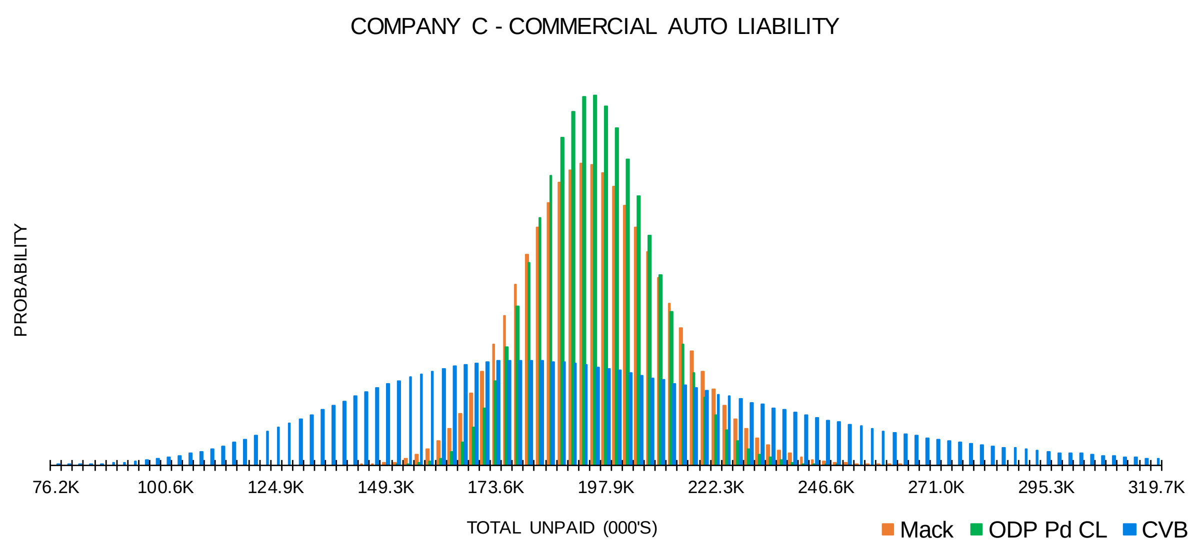
The groundwork

In general, a risk margin is intended to reflect an amount that would compensate a third party for the uncertainty of taking on the liabilities of a company if it were unable to continue to operate because of financial difficulty. In other words, risk margins provide a way of quantifying the uncertainty or added risk a buyer takes on in assuming another insurer's liabilities in an arm's length transaction.

Under Solvency II the approach used for calculating a risk margin is the Cost of Capital (CoC) method, which is based on determining the return an insurer would want to earn on capital set aside to support its liabilities. CoC includes a step to estimate the amount of required capital that needs to be set aside to compensate for the uncertainty of an insurer's liabilities and a subsequent step to quantify a discounted expected return (e.g., 6%) on that capital, which is used as the risk margin.

In calculating the risk margin, Solvency II sets guidance on the risk tolerance (i.e., 1 in 200 year events or 99.5th percentile), the yield curve for discounting, the risk measure (i.e., Value at Risk or VaR), the methodology (i.e., CoC approach), and the 1-year time horizon for running off unpaid claims, among other elements. And, while there are some pre-defined simplifications in the application of these elements, which would affect the risk margin, their calculation is basically mechanical and subservient to two fundamental pillars: the capital required to support the technical provisions and how that capital changes over time as the technical provisions run off.

FIGURE 2: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS FOR COMPANY C



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
				Ultimate Time Horizon			
Mack	197,105	16,022	8.1%	207,510	224,512	242,132	45,027
ODP Pd CL	197,105	12,992	6.6%	205,609	219,175	233,030	35,925
CVB	197,105	49,490	25.1%	225,866	287,110	361,425	164,320
				1-Year Time Horizon			
Merz & Wüthrich	197,105	12,822	6.5%	205,502	218,877	232,527	35,422
ODP Pd CL	197,105	10,397	5.3%	203,955	214,658	225,455	28,350
CVB	197,105	39,604	20.1%	220,993	268,052	322,593	125,488

[2] The example of the Commercial Auto Liability unpaid claims (on an ultimate time horizon basis) of a small company in Figure 1 and a small national company in Figure 2 appeared as Figures 1A and 1C, respectively, in the previous article, *A Quantum Leap in Benchmarking P&C Unpaid Claim Distributions*.

As we have seen in a previous article, '*A Quantum Leap in Benchmarking P&C Unpaid Claim Distributions*', which modeled unpaid claims results for four insurers with increasing exposure bases against a newly developed benchmark approach, common modeling approaches often underestimate the width of a unpaid claim distribution as shown in Figures 1 and 2.[2] This result likewise puts the calculation of a risk margin on unsure footing even before it has begun.

The capital requirement

The claim variability benchmarks in Figures 1 and 2 are based on an ultimate time horizon,[3] so for simplicity we assume that the relationship between the 1-year and ultimate time horizon for the standard deviation of the Mack and Merz & Wüthrich models can be used to adjust the benchmark to a 1-year time horizon basis. For example, for the Mack results in Figure 2 the standard deviation for the 1-year time horizon across all accident years is 80.0% of the standard deviation for the ultimate time horizon (12,826 versus 16,027), so for the benchmark the standard deviation is assumed to be 39,604 (49,490 x 80.0%).[4]

Ordinarily, the capital requirement would be based on the difference between a specific percentile, which for Solvency II purposes is 99.5% over a 1-year time horizon, and the mean, which is shown as the "Capital" column in Figures 1 and 2.[5] By comparing the results in Figures 1 and 2 several interesting results can be seen. First, the capital requirement for the benchmarks is typically significantly higher than for the commonly used Mack or ODP Bootstrap model results.

The second observation, and likely the most impactful, is that as a percent of the mean unpaid claims the capital requirements in Figure 1 are significantly larger than those in Figure 2. This result makes sense statistically as fewer exposures would generally equate to more risk. Interestingly, the Solvency II standard formula, for all Motor Vehicle Liability segments regardless of size, uses one parameter for the CoV, which in this case is 9.0%. While the benchmark CoVs in Figures 1 and 2 are both larger than the standard formula parameter, the Motor parameter is a blend of Commercial and Personal motor so a more complete comparison would need to include Private Passenger Auto models.[6]

Focusing on only the ODP Bootstrap and Merz & Wüthrich results, it could be argued that a capital requirement for Company C (in Figure 2) based on the 9.0% factor is reasonable, but for Company A (in Figure 1) a capital requirement based on the 9.0% factor would appear to be inadequate.[7] Using the benchmarks as a guide, the required capital would be much higher in both cases, which would be a consideration for any company building an internal model.

No easy way out

Building on either the modeled distribution or claim variability benchmark (CVB), the risk margin is also highly sensitive to the assumptions and choice of methodologies used to calculate it.

When using a cost of capital approach, the most common simplification used to approximate the runoff of the required capital is the runoff of the mean, which can be easily derived from other output "dimensions" from modeling software.[8] While the mean runoff is the most common option, actuaries generally recognize that this simplification reduces capital faster than the actual risk, producing a risk margin that is too low. To test this approach, we will consider three other options, the square root of the mean percentages (i.e., a simple adjustment observed in the UK market as a way to reduce capital at a slower rate), the standard deviation, or the CDR. As we will see, each approach runs off the capital at a different rate and can have significantly different impacts on the risk margin.

The basics of the cost of capital approach

Starting with the standard simplification, which uses the runoff of the mean as a proxy for the speed at which required capital runs off, Figure 3 provides an example of a risk margin calculation for the Commercial Auto Liability unpaid claims of a small national insurer (and is based on the results in Figure 2).

3 The claim variability benchmarks could be updated to include a distribution of time horizon values.

4 The ratio of the 1-year time horizon and ultimate time horizon standard deviations varies by line of business and size of exposures. For example, the ratio for Table 1 is 69.8%.

5 A TVaR approach is also commonly used, but the VaR approach is used for consistency with Solvency II.

6 For a more complete discussion of the Solvency II risk margins, pricing risk and correlation between the segments would also need to be included. The claim variability benchmarks includes pricing risk and correlation benchmarks, but this is outside the scope of this paper.

7 Alternatively, an inadequacy for Commercial Motor could be offset by a redundancy in Personal Motor.

8 The claim variability benchmarks also include the runoff of the mean.

FIGURE 3: COMMERCIAL AUTO RISK MARGIN CALCULATION FOR COMPANY C

Calculation of Reserve Risk Margin Guidelines (000's)										
	Shifted Results			Discounted	Standard		Assumed	Capital	Cost of	Discounted
Acc Yr	Mean	Std Dev	CoV	Mean	Formula	Cal Yr	Runoff %	Runoff	Capital	CoC
2009	320	438	136.9%	317	31	2019	100.0%	51,252	3,075	3,045
2010	362	707	195.4%	353	56	2020	60.7%	31,110	1,867	1,812
2011	751	1,087	144.7%	730	120	2021	35.0%	17,914	1,075	1,022
2012	799	1,835	229.6%	775	145	2022	19.6%	10,053	603	562
2013	1,799	2,792	155.2%	1,743	344	2023	11.2%	5,719	343	314
2014	5,508	5,184	94.1%	5,335	985	2024	6.6%	3,403	204	183
2015	16,326	9,429	57.8%	15,802	3,240	2025	4.1%	2,095	126	110
2016	36,591	15,457	42.2%	35,361	6,667	2026	2.5%	1,291	77	67
2017	52,682	24,224	46.0%	50,760	16,199	2027	1.4%	702	42	36
2018	81,967	35,194	42.9%	78,646	23,464	2028	0.4%	189	11	9
Total	197,105	49,490	25.1%	189,822	51,252				4,349	4,115
	Discounted Unpaid & Risk Margin:			193,937						

In the example in Figure 3, key results include the:

- Benchmarked mean of 197,105
- Benchmarked standard deviation of 49,490
- Discounted mean of 189,822
- Standard Formula Capital of 51,252

The cash flows used in the cost of capital approach are typically discounted using a currency specific yield curve, but to simplify this example on a rather mechanical point, a single discount rate of 2% is used as a reasonable alternative. The standard formula capital of 51,252 represents the amount of capital an insurer should hold to support the risks associated with the unpaid claim liabilities at time zero. Assuming a required 6% return on capital, the capital of 51,252 would need to earn 3,075 in year 1 (the cost of capital).

Using the runoff of the mean to approximate the annual release of the capital as the unpaid claims are paid, an insurer would only need capital of 31,110 after one year and require a return of 1, 867 in year 2, and so forth. The total of the expected returns for all future years is 4,349, and the discounted value of the expected returns is 4,115, or the calculated risk margin. Adding the risk margin to the discounted unpaid claims results in a total technical provision for claims of 193,937 under Solvency II.

A deeper look

Before considering the impact of other options for running off the required capital, it is instructive to take a deeper look at the assumption of how the capital is running off. The runoff of the best estimate is the easiest assumption to use in practice because it is typically part of the simulation modeling output and it is part of the claim variability benchmarks. Unfortunately, this choice is least consistent with the rest of the assumptions of the cost of capital approach.

FIGURE 4: COMPARISON OF RUNOFF ASSUMPTIONS

	Option 1: Mean Runoff Values		Option 2: Square Root Runoff Values		Option 3: Std. Dev. Runoff Values		Option 4: CDR Runoff Values	
Cal Yr	Mean	Percent	Mean	Sqr Root	Std. Dev.	Percent	CDR	Percent
2019	197,105	100.0%	100.0%	100.0%	39,604	100.0%	125,488	100.0%
2020	119,645	60.7%	60.7%	77.9%	31,823	80.4%	107,091	85.3%
2021	68,893	35.0%	35.0%	59.1%	23,625	59.7%	84,934	67.7%
2022	38,662	19.6%	19.6%	44.3%	17,447	44.1%	68,156	54.3%
2023	21,995	11.2%	11.2%	33.4%	12,741	32.2%	54,081	43.1%
2024	13,086	6.6%	6.6%	25.8%	9,466	23.9%	43,295	34.5%
2025	8,058	4.1%	4.1%	20.2%	7,693	19.4%	38,281	30.5%
2026	4,965	2.5%	2.5%	15.9%	6,136	15.5%	32,336	25.8%
2027	2,700	1.4%	1.4%	11.7%	5,786	14.6%	30,819	24.6%
2028	728	0.4%	0.4%	6.1%	1,332	3.4%	7,199	5.7%

Knowing that the required capital is related to the uncertainty of the unpaid claims and that this uncertainty increases as the unpaid claims run off (i.e., the more distant the payments the more uncertain they are) leads us to consider alternative proxies in Figure 4 (which would make more economic sense, but not be consistent with the simplifications available under Solvency II). The second option, the square root of the mean runoff percentage, is by definition always slower than option 1 so it has gained some traction in practice as a simple way of being more consistent with the rest of the cost of capital assumptions.

Using option 3 (the runoff of the standard deviation) is more consistent with the rest of the cost of capital assumptions than for option 1, but it is incomplete in the sense that it still only represents one part of the required capital.[9] This observation leads to option 4, the claim development result, for approximating the capital runoff. Since the required capital is generally based on a VaR (or TVaR) measure of the insurer's risk appetite, option 4 relies on the difference between the percentiles and the means to calculate the runoff of the VaR, or CDR, which is most consistent with the rest of the cost of capital assumptions.[10]

In general, option 1 typically exhibits the fastest runoff and option 4 the slowest runoff, which has a significant impact on the calculation of the risk margin.[11]

The impact of the runoff assumption

Square Root. Running off the required capital using the square root of the mean runoff percentages provides a more reasonable approach because it reflects an increasing level of risk, but it is an approximation. The discounted cost of capital of 8,398 is about 2 times the amount using the mean runoff.

Standard Deviation. Using the standard deviation instead of the mean, the required capital runs off much slower compared with that for the mean runoff, and the cost of capital is therefore much greater. In this case, the discounted cost of capital is 8,368, nearly double the amount developed from using the mean. This methodology seems more reasonable because the standard deviation reflects the increasing uncertainty of the FCF over time as the claims run off.

CDR. Using the CDR runoff percentages, the discounted cost of capital is 10,535. The CDR approach makes the most sense because at least in theory it exactly matches the assumptions of the 1-year time horizon, which drives capital requirements, while the other runoff percentages are based on a larger number of simplifying assumptions.

Using the runoff of the mean of the unpaid claims to approximate the runoff of the required capital is the most commonly used simplification in practice, but for each of the other three alternatives explored here, the risk margins (see Figure 5) are significantly greater. In the most extreme case, and arguably the option most consistent with the assumptions of the cost of capital approach, the risk margin is often more than 2.5 times the amount based on the most commonly used Solvency II simplification.

FIGURE 5: COMMERCIAL AUTO RISK MARGINS BY METHOD FOR COMPANY C

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	197,105	17,739	9.0%	193,937	198,219	198,190	200,357
CVB	197,105	39,604	20.1%	199,100	208,757	208,690	213,576

	Discounted	Required		Risk Margin by Runoff Method			
	Mean	Capital		Mean	Sqr Root	Std Dev	CDR
Standard Formula	189,822	51,252		4,115	8,398	8,368	10,535
CVB	189,822	115,563		9,278	18,935	18,868	23,754

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	2.2%	4.4%	4.4%	5.5%
CVB	4.9%	10.0%	9.9%	12.5%

9 Because option 3 is "incomplete", it is not intended as a viable option in practice, but rather as a bridge between options 1 and 4.

10 As previously noted, under Solvency II the standard formula approach uses VaR, but other regulatory regimes, such as the Swiss Solvency Test, use TVaR.

11 Because the standard formula is based on the discounted unpaid claims, it may be more consistent to unwind the discounted values for each runoff option for all runoff percentages in Figure 4. For simplicity, we did not use discounted values, and unwind the discount as they run off, but note that this would increase the risk margin in all cases.

The ultimate challenge in determining risk margins

The differences among the four methodologies are only part of the challenge insurers face. As much as the outcomes from these methodologies can vary, the benchmarked uncertainty measure can have an even larger impact. As shown in Figure 5, the calculated risk margins using the benchmarks for this small national insurer's Commercial Auto Liability claims are more than double the risk margins derived using the standard formula. If the uncertainty measure is underestimated, the risk margin will likewise be less than appropriate for the insurer.

The significance of the risk margin compared with the discounted unpaid claims tends to grow as an insurer's exposure base decreases. For example, the Commercial Auto Liability risk margin for a small insurer based on the benchmark can be larger than the discounted unpaid claims (see Figure A-1.2 in the Appendices). In contrast, the Commercial Auto Liability risk margin for a large national insurer may be 10% of the discounted unpaid claims or less (see Figure D-1.2 in the Appendices).

Like many other financial measures, risk margins flow from an insurer's unpaid claim distributions. If the calibrated uncertainty measure is a poor reflection of an insurer's risk, it is unlikely a risk margin will reflect the economic value of its unpaid claims liabilities. Estimating the required capital and the change in that capital over time as the unpaid claims run off are the two pillars of determining a fair economic value of an insurer's liabilities. One without the other will lead to a serious miscalculation.

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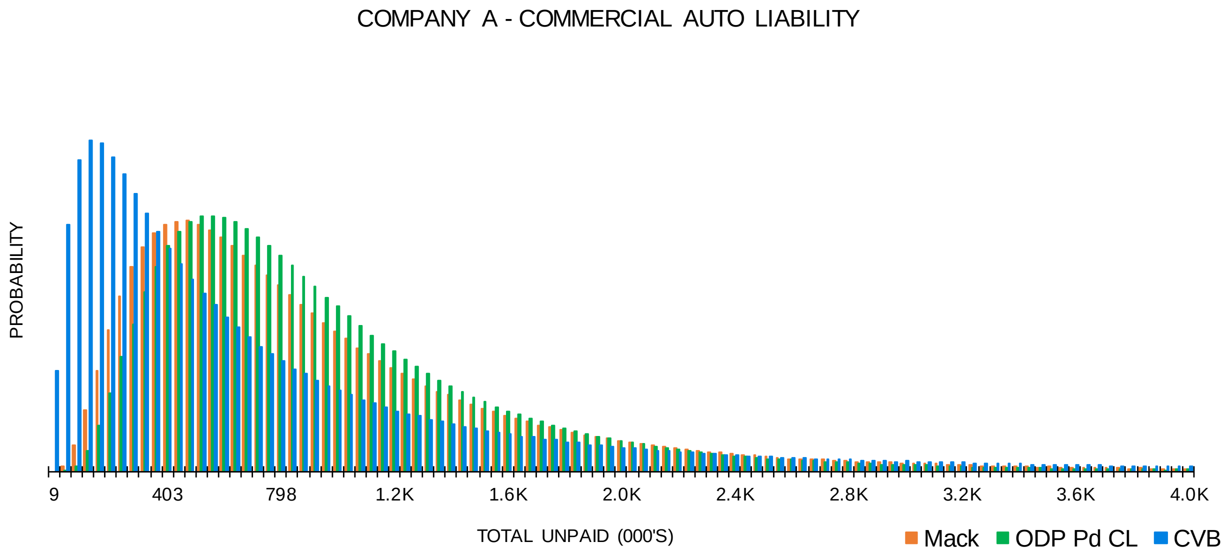
FIGURE A-1.1: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
			Ultimate Time Horizon				
Mack	997	793	79.6%	1,251	2,469	4,739	3,742
ODP Pd CL	997	665	66.7%	1,249	2,249	3,956	2,959
CVB	997	1,555	156.0%	1,138	3,344	9,403	8,406
			1-Year Time Horizon				
Merz & Wüthrich	997	554	55.5%	1,237	2,045	3,314	2,317
ODP Pd CL	997	464	46.5%	1,218	1,872	2,828	1,831
CVB	997	1,085	108.9%	1,224	2,888	6,577	5,580

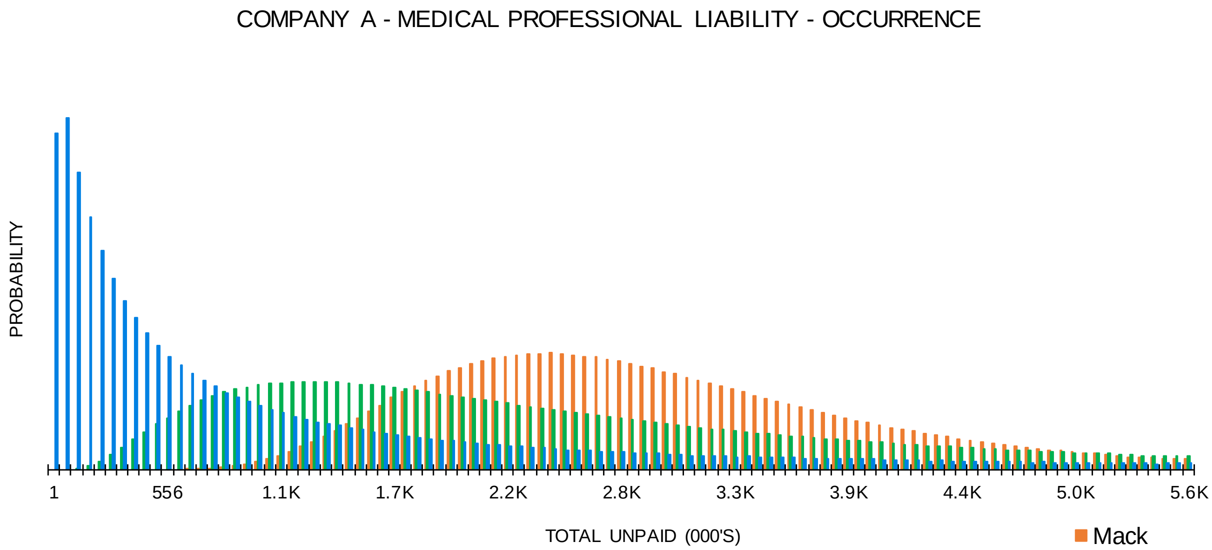
FIGURE A-1.2: COMMERCIAL AUTO RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	997	90	9.0%	980	1,003	1,016	1,013
CVB	997	1,085	108.9%	1,405	1,859	2,113	2,053

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	958	259	23	46	58	55
CVB	958	5,123	447	902	1,155	1,096

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	2.4%	4.8%	6.1%	5.8%
CVB	46.7%	94.1%	120.6%	114.4%

FIGURE A-2.1: MEDICAL PROFESSIONAL LIABILITY – OCCURRENCE UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	3,001	1,150	38.3%	3,597	5,152	7,273	4,272
ODP Pd CL	3,001	2,640	88.0%	3,755	7,827	15,836	12,835
CVB	3,001	12,122	403.9%	2,253	11,597	55,861	52,860
1-Year Time Horizon							
Merz & Wüthrich	3,001	695	23.2%	3,411	4,258	5,267	2,266
ODP Pd CL	3,001	1,594	53.1%	3,710	6,018	9,574	6,573
CVB	3,001	7,322	244.0%	2,911	11,245	41,112	38,111

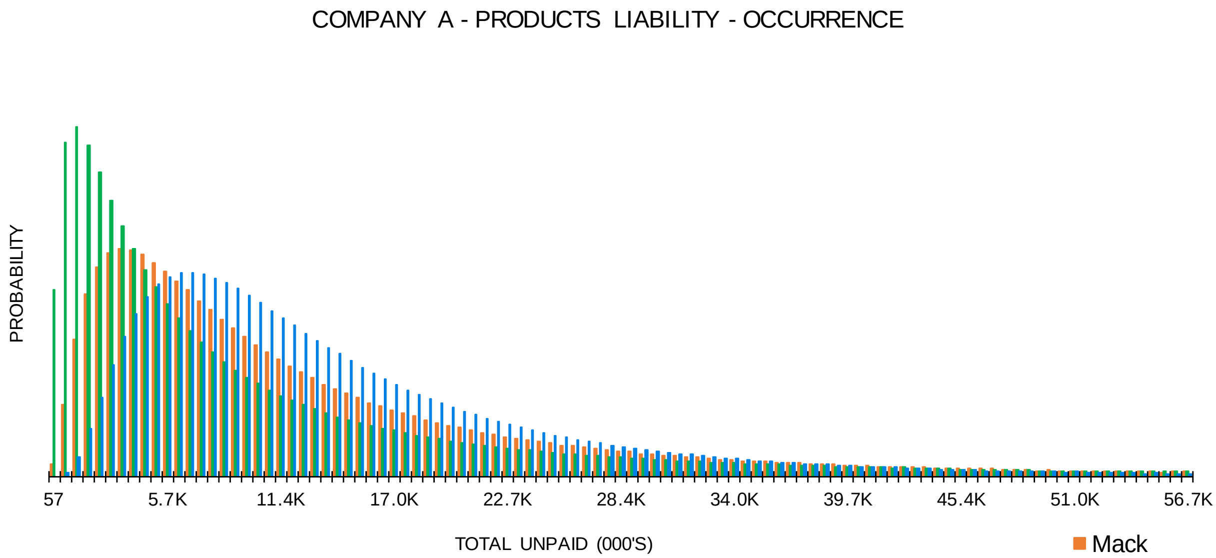
FIGURE A-2.2: MEDICAL PROFESSIONAL LIABILITY – OCCURRENCE RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	3,001	330	11.0%	2,960	3,045	3,070	3,021
CVB	3,001	7,322	244.0%	7,827	10,988	11,920	10,089

	Discounted	Required		Risk Margin by Runoff Method			
	Mean	Capital		Mean	Sqr Root	Std Dev	CDR
Standard Formula	2,826	933		134	219	244	195
CVB	2,826	34,783		5,001	8,162	9,094	7,263

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4.7%	7.7%	8.6%	6.9%
CVB	177.0%	288.8%	321.8%	257.0%

FIGURE A-3.1: PRODUCTS LIABILITY – OCCURRENCE UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	15,176	18,530	122.1%	18,316	46,282	112,633	97,457
ODP Pd CL	15,176	30,881	203.5%	15,866	54,913	180,720	165,544
CVB	15,176	12,493	82.3%	19,033	38,251	74,725	59,549
1-Year Time Horizon							
Merz & Wüthrich	15,176	16,709	110.1%	18,611	44,185	101,285	86,109
ODP Pd CL	15,176	27,845	183.5%	16,471	53,501	165,666	150,490
CVB	15,176	11,265	74.2%	19,051	36,233	67,136	51,960

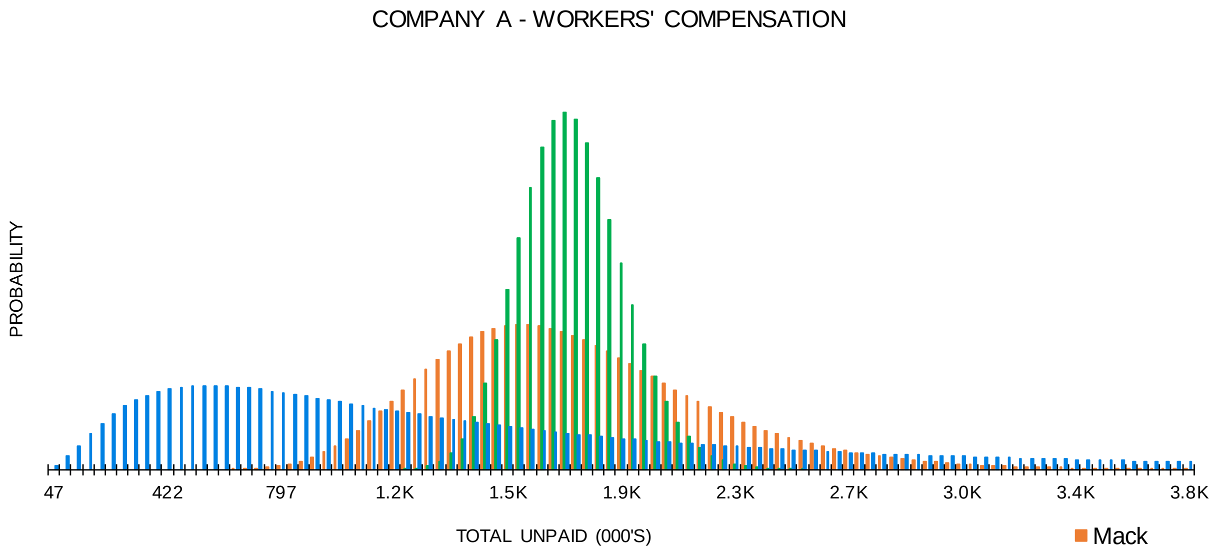
FIGURE A-3.2: PRODUCTS LIABILITY – OCCURRENCE RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	15,176	1,669	11.0%	14,975	15,387	15,246	15,328
CVB	15,176	11,265	74.2%	20,740	24,897	23,472	24,303

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	14,342	4,733	634	1,045	904	987
CVB	14,342	47,785	6,399	10,556	9,130	9,961

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4.4%	7.3%	6.3%	6.9%
CVB	44.6%	73.6%	63.7%	69.5%

FIGURE A-4.1: WORKERS' COMPENSATION UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
			Ultimate Time Horizon				
Mack	1,779	453	25.5%	2,042	2,604	3,288	1,509
ODP Pd CL	1,779	172	9.6%	1,890	2,074	2,269	490
CVB	1,779	1,913	107.5%	2,188	5,123	11,586	9,807
			1-Year Time Horizon				
Merz & Wüthrich	1,779	358	20.1%	1,995	2,420	2,912	1,133
ODP Pd CL	1,779	135	7.6%	1,867	2,010	2,158	379
CVB	1,779	1,510	84.9%	2,229	4,556	9,047	7,268

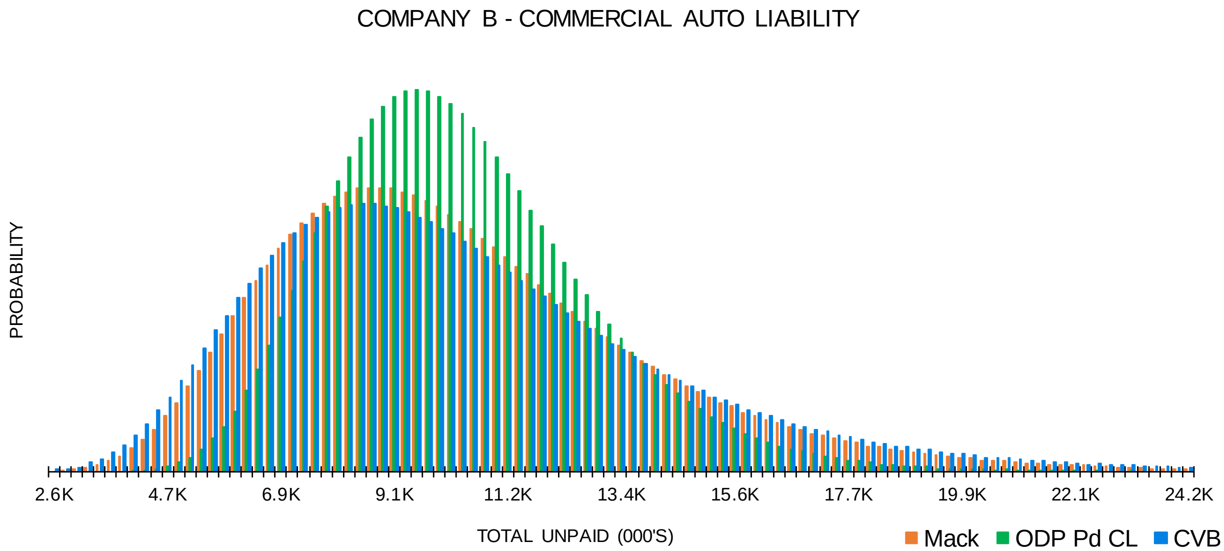
FIGURE A-4.2: WORKERS' COMPENSATION RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1,779	196	11.0%	1,755	1,809	1,820	1,837
CVB	1,779	1,510	84.9%	2,589	3,224	3,351	3,552

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1,677	553	78	132	143	160
CVB	1,677	6,494	912	1,547	1,674	1,875

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4.6%	7.9%	8.5%	9.5%
CVB	54.4%	92.2%	99.8%	111.8%

FIGURE B-1.1: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	10,428	3,560	34.1%	12,346	17,039	23,210	12,782
ODP Pd CL	10,428	2,473	23.7%	11,881	14,909	18,536	8,108
CVB	10,428	3,878	37.2%	12,460	17,668	24,700	14,272
1-Year Time Horizon							
Merz & Wüthrich	10,428	2,745	26.3%	12,008	15,436	19,642	9,214
ODP Pd CL	10,428	1,907	18.3%	11,593	13,824	16,367	5,939
CVB	10,428	2,990	28.7%	12,117	15,917	20,678	10,250

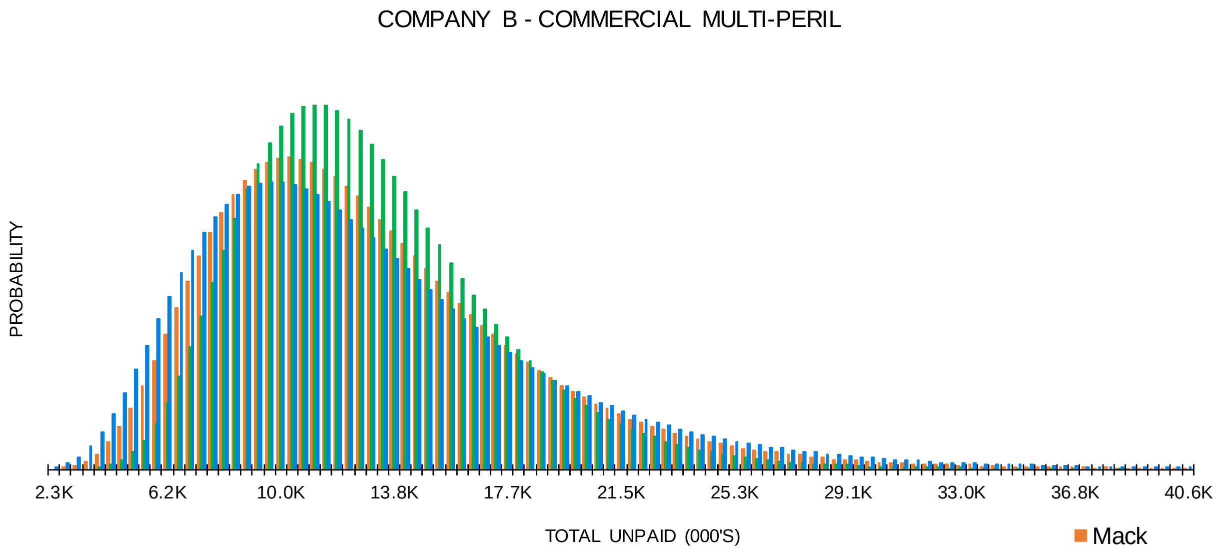
FIGURE B-1.2: COMMERCIAL AUTO RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	10,428	939	9.0%	10,260	10,481	10,542	10,697
CVB	10,428	2,990	28.7%	10,792	11,550	11,761	12,294

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	10,042	2,711	218	439	500	656
CVB	10,042	9,315	750	1,508	1,719	2,252

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	2.2%	4.4%	5.0%	6.5%
CVB	7.5%	15.0%	17.1%	22.4%

FIGURE B-2.1: COMMERCIAL MULTI-PERIL UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
			Ultimate Time Horizon				
Mack	13,209	5,337	40.4%	15,920	23,218	33,346	20,137
ODP Pd CL	13,209	4,272	32.3%	15,547	21,114	28,320	15,111
CVB	13,209	6,090	46.1%	16,129	24,697	37,167	23,958
			1-Year Time Horizon				
Merz & Wüthrich	13,209	4,197	31.8%	15,518	20,966	27,982	14,773
ODP Pd CL	13,209	3,359	25.4%	15,156	19,324	24,395	11,186
CVB	13,209	4,789	36.3%	15,740	22,136	30,703	17,494

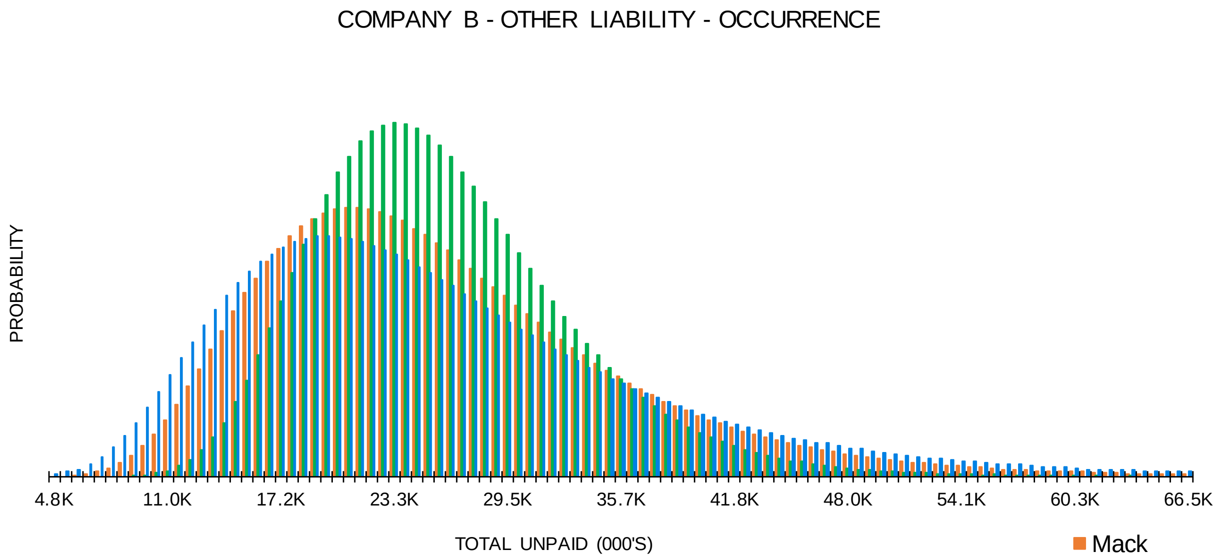
FIGURE B-2.2: COMMERCIAL MULTI-PERIL RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	13,209	1,321	10.0%	13,006	13,373	13,368	13,553
CVB	13,209	4,789	36.3%	14,309	15,848	15,826	16,600

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	12,597	3,779	409	776	771	956
CVB	12,597	15,832	1,711	3,250	3,228	4,003

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	3.2%	6.2%	6.1%	7.6%
CVB	13.6%	25.8%	25.6%	31.8%

FIGURE B-3.1: OTHER LIABILITY – OCCURRENCE UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
				Ultimate Time Horizon			
Mack	26,244	9,874	37.6%	31,395	44,689	62,707	36,463
ODP Pd CL	26,244	6,910	26.3%	30,221	38,852	49,442	23,198
CVB	26,244	11,830	45.1%	31,978	48,541	72,444	46,200
				1-Year Time Horizon			
Merz & Wüthrich	26,244	6,884	26.2%	30,209	38,801	49,334	23,090
ODP Pd CL	26,244	4,817	18.4%	29,185	34,824	41,255	15,011
CVB	26,244	8,248	31.4%	30,795	41,477	55,195	28,951

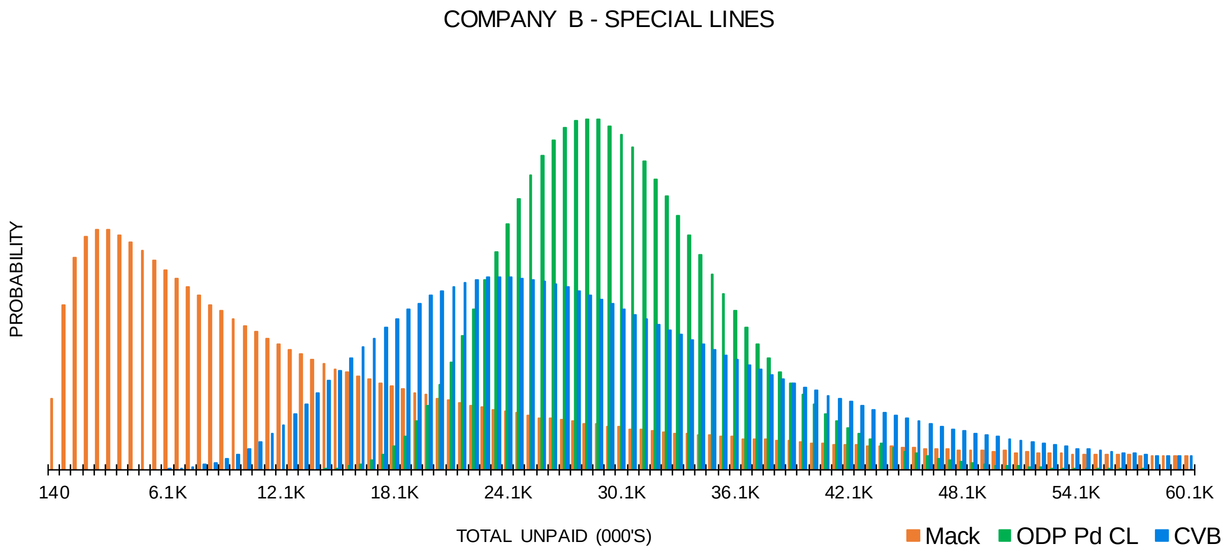
FIGURE B-3.2: OTHER LIABILITY – OCCURRENCE RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	26,244	2,887	11.0%	25,903	26,659	26,779	27,326
CVB	26,244	8,248	31.4%	28,150	30,522	30,897	32,614

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	24,851	8,201	1,052	1,808	1,928	2,475
CVB	24,851	25,723	3,299	5,671	6,047	7,764

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4.2%	7.3%	7.8%	10.0%
CVB	13.3%	22.8%	24.3%	31.2%

FIGURE B-4.1: SPECIAL LINES UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	30,278	57,800	190.9%	32,409	107,869	341,922	311,644
ODP Pd CL	30,278	5,784	19.1%	33,791	40,605	48,431	18,153
CVB	30,278	12,246	40.4%	36,496	53,245	76,499	46,221
1-Year Time Horizon							
Merz & Wüthrich	30,278	45,743	151.1%	34,865	100,422	277,093	246,815
ODP Pd CL	30,278	4,577	15.1%	33,132	38,336	44,094	13,816
CVB	30,278	9,692	32.0%	35,599	48,200	64,465	34,187

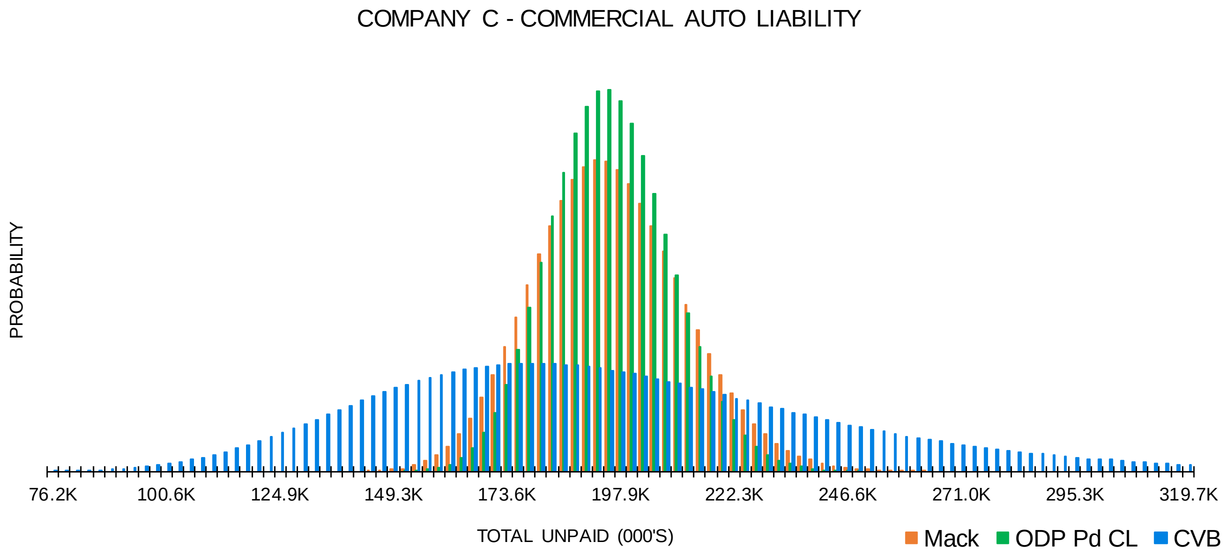
FIGURE B-4.2: SPECIAL LINES RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	30,278	3,331	11.0%	29,917	30,760	30,972	31,480
CVB	30,278	9,692	32.0%	31,976	34,695	35,377	37,018

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	28,992	9,567	925	1,769	1,980	2,489
CVB	28,992	30,855	2,984	5,704	6,385	8,026

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	3.2%	6.1%	6.8%	8.6%
CVB	10.3%	19.7%	22.0%	27.7%

FIGURE C-1.1: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	197,105	16,022	8.1%	207,510	224,512	242,132	45,027
ODP Pd CL	197,105	12,992	6.6%	205,609	219,175	233,030	35,925
CVB	197,105	49,490	25.1%	225,866	287,110	361,425	164,320
1-Year Time Horizon							
Merz & Wüthrich	197,105	12,822	6.5%	205,502	218,877	232,527	35,422
ODP Pd CL	197,105	10,397	5.3%	203,955	214,658	225,455	28,350
CVB	197,105	39,604	20.1%	220,993	268,052	322,593	125,488

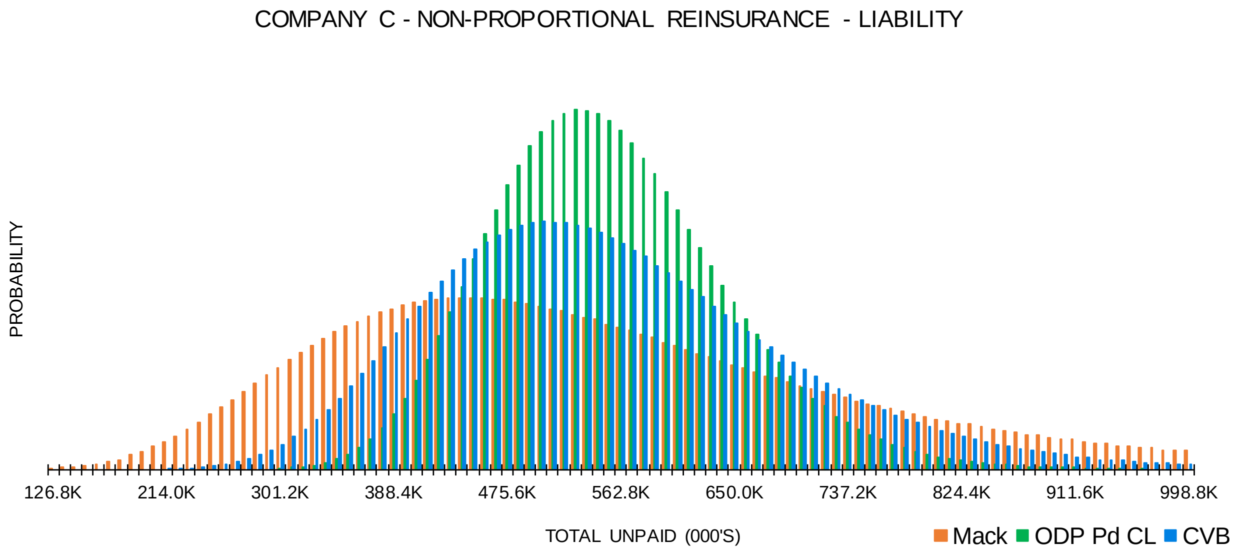
FIGURE C-1.2: COMMERCIAL AUTO RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	197,105	17,739	9.0%	193,937	198,219	198,190	200,357
CVB	197,105	39,604	20.1%	199,100	208,757	208,690	213,576

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	189,822	51,252	4,115	8,398	8,368	10,535
CVB	189,822	115,563	9,278	18,935	18,868	23,754

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	2.2%	4.4%	4.4%	5.5%
CVB	4.9%	10.0%	9.9%	12.5%

FIGURE C-2.1: REINSURANCE – NON-PROPORTIONAL ASSUMED LIABILITY UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	557,316	218,933	39.3%	669,742	967,286	1,376,327	819,011
ODP Pd CL	557,316	89,938	16.1%	613,037	716,239	831,547	274,231
CVB	557,316	136,040	24.4%	636,802	804,245	1,006,137	448,821
1-Year Time Horizon							
Merz & Wüthrich	557,316	206,247	37.0%	665,541	942,227	1,315,248	757,932
ODP Pd CL	557,316	84,726	15.2%	610,124	706,513	813,272	255,956
CVB	557,316	128,157	23.0%	633,004	788,984	974,648	417,332

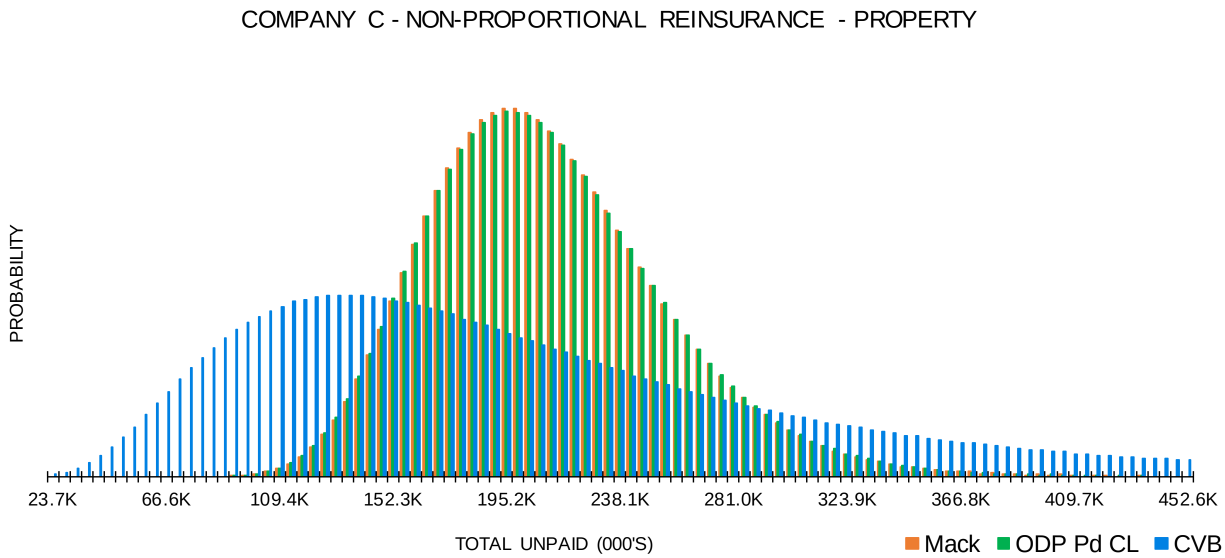
FIGURE C-2.2: REINSURANCE – NON-PROPORTIONAL ASSUMED LIABILITY RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	557,316	111,463	20.0%	572,285	602,879	610,889	630,359
CVB	557,316	128,157	23.0%	580,720	616,351	625,679	648,354

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	521,048	312,629	51,237	81,831	89,841	109,311
CVB	521,048	364,094	59,672	95,303	104,631	127,306

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	9.8%	15.7%	17.2%	21.0%
CVB	11.5%	18.3%	20.1%	24.4%

FIGURE C-3.1: REINSURANCE – NON-PROPORTIONAL ASSUMED PROPERTY UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	212,701	44,920	21.1%	239,598	293,437	356,428	143,727
ODP Pd CL	212,701	45,292	21.3%	239,787	294,150	357,857	145,156
CVB	212,701	126,372	59.4%	264,962	451,748	753,709	541,008
1-Year Time Horizon							
Merz & Wüthrich	212,701	42,234	19.9%	238,218	288,300	346,219	133,518
ODP Pd CL	212,701	42,583	20.0%	238,400	288,967	347,536	134,835
CVB	212,701	118,815	55.9%	263,907	437,591	710,839	498,138

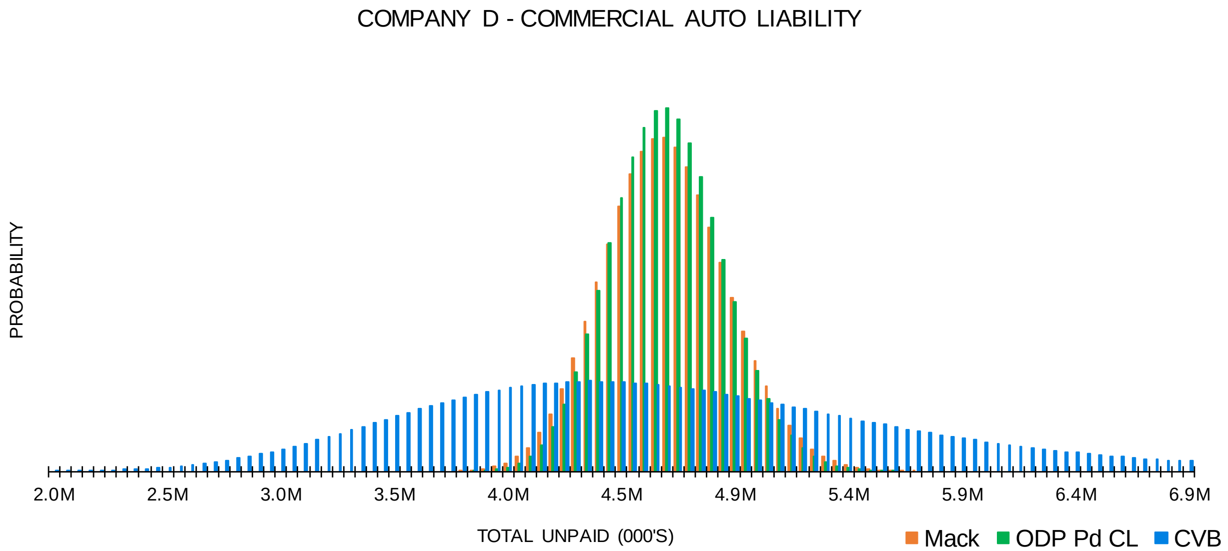
FIGURE C-3.2: REINSURANCE – NON-PROPORTIONAL ASSUMED PROPERTY RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	212,701	42,540	20.0%	215,195	227,191	223,055	225,330
CVB	212,701	118,815	55.9%	246,124	291,590	275,913	284,535

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	204,109	122,466	11,086	23,082	18,945	21,220
CVB	204,109	464,149	42,015	87,481	71,804	80,426

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	5.4%	11.3%	9.3%	10.4%
CVB	20.6%	42.9%	35.2%	39.4%

FIGURE D-1.1: COMMERCIAL AUTO UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	4,674,180	264,555	5.7%	4,848,162	5,121,655	5,398,538	724,358
ODP Pd CL	4,674,180	242,389	5.2%	4,833,953	5,083,250	5,334,504	660,324
CVB	4,674,180	1,039,762	22.2%	5,291,680	6,549,510	8,036,457	3,362,277
1-Year Time Horizon							
Merz & Wüthrich	4,674,180	187,137	4.0%	4,798,226	4,988,226	5,177,582	503,402
ODP Pd CL	4,674,180	171,457	3.7%	4,788,008	4,961,445	5,133,745	459,565
CVB	4,674,180	735,489	15.7%	5,131,040	5,971,893	6,907,857	2,233,677

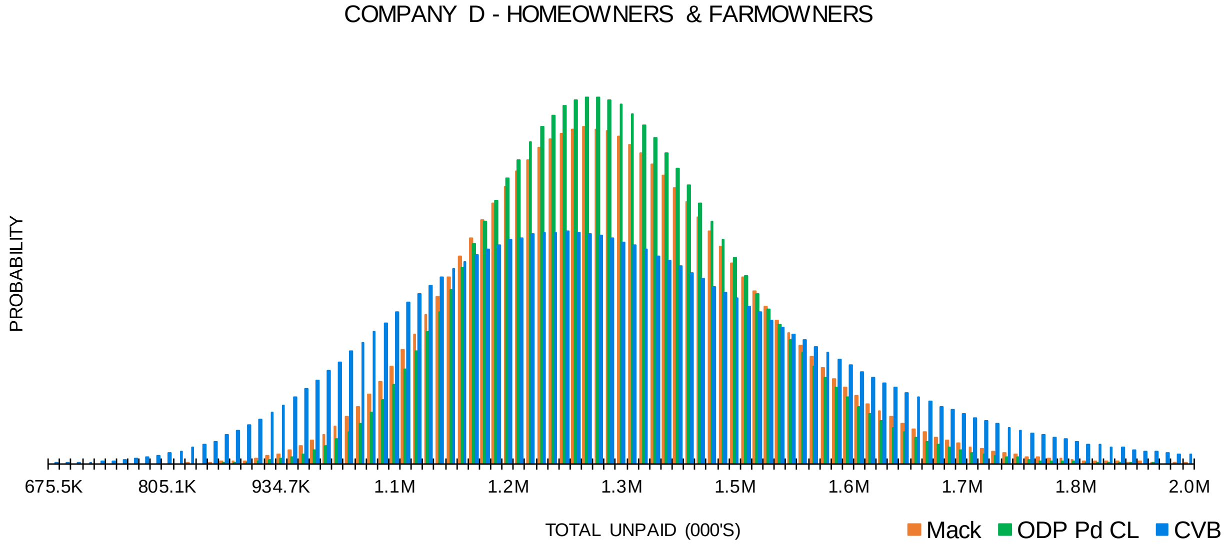
FIGURE D-1.2: COMMERCIAL AUTO RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4,674,180	420,676	9.0%	4,599,098	4,700,552	4,726,818	4,787,263
CVB	4,674,180	735,489	15.7%	4,664,780	4,834,635	4,878,609	4,979,807

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	4,501,675	1,215,452	97,422	198,877	225,142	285,588
CVB	4,501,675	2,034,913	163,104	332,960	376,934	478,132

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	2.2%	4.4%	5.0%	6.3%
CVB	3.6%	7.4%	8.4%	10.6%

FIGURE D-2.1: HOMEOWNERS & FARMOWNERS UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	1,321,026	158,622	12.0%	1,421,838	1,596,877	1,785,032	464,006
ODP Pd CL	1,321,026	144,734	11.0%	1,413,573	1,571,639	1,739,877	418,851
CVB	1,321,026	234,524	17.8%	1,464,786	1,737,843	2,047,547	726,521
1-Year Time Horizon							
Merz & Wüthrich	1,321,026	151,842	11.5%	1,417,818	1,584,532	1,762,876	441,850
ODP Pd CL	1,321,026	138,548	10.5%	1,409,853	1,560,456	1,720,046	399,020
CVB	1,321,026	224,500	17.0%	1,459,339	1,718,958	2,011,352	690,326

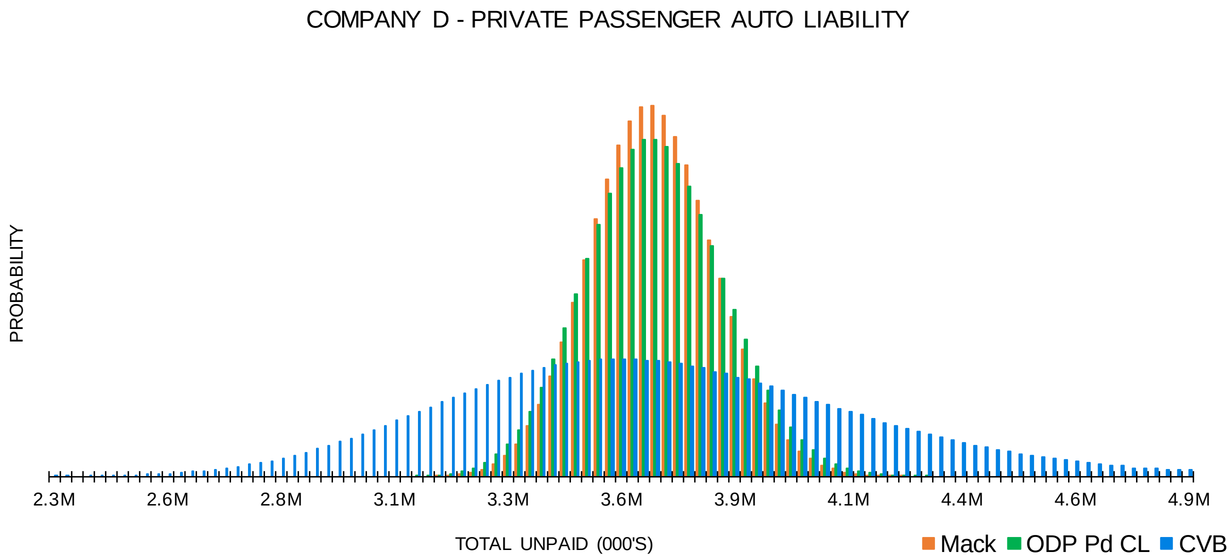
FIGURE D-2.2: HOMEOWNERS & FARMOWNERS RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1,321,026	132,103	10.0%	1,304,043	1,337,786	1,316,755	1,320,838
CVB	1,321,026	224,500	17.0%	1,321,514	1,379,398	1,343,320	1,350,324

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1,279,623	383,887	24,420	58,163	37,132	41,215
CVB	1,279,623	658,530	41,890	99,774	63,697	70,701

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1.9%	4.5%	2.9%	3.2%
CVB	3.3%	7.8%	5.0%	5.5%

FIGURE D-3.1: PRIVATE PASSENGER AUTO LIABILITY UNPAID CLAIM DISTRIBUTIONS



	Mean	Std Dev	CoV	75.0%	95.0%	99.5%	Capital
Ultimate Time Horizon							
Mack	3,692,302	144,128	3.9%	3,787,883	3,934,055	4,079,592	387,290
ODP Pd CL	3,692,302	158,689	4.3%	3,797,346	3,958,986	4,120,528	428,226
CVB	3,692,302	464,946	12.6%	3,986,781	4,502,780	5,060,502	1,368,200
1-Year Time Horizon							
Merz & Wüthrich	3,692,302	110,822	3.0%	3,766,099	3,877,374	3,987,221	294,919
ODP Pd CL	3,692,302	122,019	3.3%	3,773,444	3,896,376	4,018,080	325,778
CVB	3,692,302	357,506	9.7%	3,922,540	4,308,007	4,713,386	1,021,084

FIGURE D-3.2: PRIVATE PASSENGER AUTO LIABILITY RISK MARGINS BY METHOD

				Discounted Mean & Risk Margin by Runoff Method			
	Mean	Std Dev	CoV	Mean	Sqr Root	Std Dev	CDR
Standard Formula	3,692,302	332,307	9.0%	3,638,399	3,714,016	3,706,486	3,736,085
CVB	3,692,302	357,506	9.7%	3,637,694	3,712,425	3,704,984	3,734,236

	Discounted	Required	Risk Margin by Runoff Method			
	Mean	Capital	Mean	Sqr Root	Std Dev	CDR
Standard Formula	3,578,211	966,117	60,188	135,805	128,276	157,874
CVB	3,578,211	954,801	59,483	134,214	126,773	156,025

	Risk Margin as Percent of Discounted Mean			
	Mean	Sqr Root	Std Dev	CDR
Standard Formula	1.7%	3.8%	3.6%	4.4%
CVB	1.7%	3.8%	3.5%	4.4%