

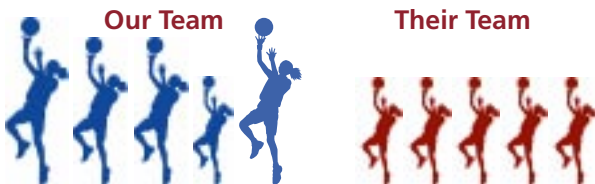
Understanding Insurance, Part I

Comparing Written Premium With Paid Losses

AS ACTUARIES, we like to think that our skills, professional training, and insurance expertise give us an edge in drawing reasonable conclusions and predicting with some degree of certainty the outcome of future insurable events. Not unexpectedly, actuaries occasionally attempt to apply their skills outside the realm of insurance. From coaching our children to watching professional athletes compete, the authors have attempted to use their actuarial skills in order to predict the outcomes of various sporting events.

It was with this sense of pride in the actuarial professional's quantification and forecasting skills that Rich walked into one of his 12-year-old daughter's basketball games last year. Within minutes he knew which team had the advantage, who was faster, who could only dribble with her right hand. He generously shared all his observations with the coach—who just loved to see him walk into the gym!

Then the day came when Rich realized that any advice he'd offered in the past would have no impact on the outcome of the game. The result was a near certainty. Here is what he saw when he entered the gym.



This wasn't going to be pretty. All skills aside, the height advantage of his daughter's team was too much for the opponents to overcome. Who among us would fail to draw a similar conclusion, given the importance of height in winning basketball games at such a young age? The objective information (e.g., years of NBA TV training) tells each of us that it's all over but the cheering.

Now, what if your daughter's coach was Magnum, P.I.? Suppose that Magnum learned with a little more investigation that the opposing coach had entered a team of short 18-year-old ringers in the 12-and-under tournament. Now wait a minute! Is that a fair contest? Surely the 18-year-old players have six years of additional experience, not to mention natural development on their side. This misrep-

resentation must be exposed for the sake of fairness.

Although we've exaggerated the age and height differences in Rich's example, many of us may remember the sad story of the Little League coach who doctored his pitcher's age in order to win big games in the

Little League World Series. Age does matter!

Does this scenario sound familiar? Have we seen situations in which erroneous insurance conclusions are drawn because of improper comparisons? Have we seen situations in which investors, public officials, reporters, and consumers are misled by improper comparisons? Anyone who thinks baseball dominates the market of statistical comparisons (ERA, LOB, slugging average, etc.) should look at all the possible ways insurance data can be compared, used, or manipulated to illustrate different points.

As practicing actuaries, we have a tendency to hold many of the basic insurance concepts as self-evident or unwritten rules. For individuals who don't analyze insurance industry financials for a living, our unwritten rules are often difficult to understand and challenging to glean from a quick read of our current actuarial literature. That's why we've decided to prepare a series of articles directed at serving a broader public audience. The consistent theme in our series will be the proper matching of insurance revenues with insurance costs.

Our first topic will address the comparison of written premiums and paid losses, which has garnered some press lately in the ongoing medical malpractice tort reform debate. Sharp actuaries may notice that we've focused on the inverse of the traditional loss ratio, to be consistent with recent studies. Future topics will include some of the following themes:

- The impact of survivor bias on financial comparisons
- Losses and expenses as separate cost components
- Long-tail vs. short-tail lines of business
- The impact of inflation
- Steady-state vs. start-up vs. runoff operations.

We hope the publics served by the actuarial profession find this series helpful in understanding several basic approaches to evaluating, and questioning, the implications and conclusions presented in any form of a study focusing on the insurance industry. Our series can't address all the applicable issues, interests, and considerations, but we

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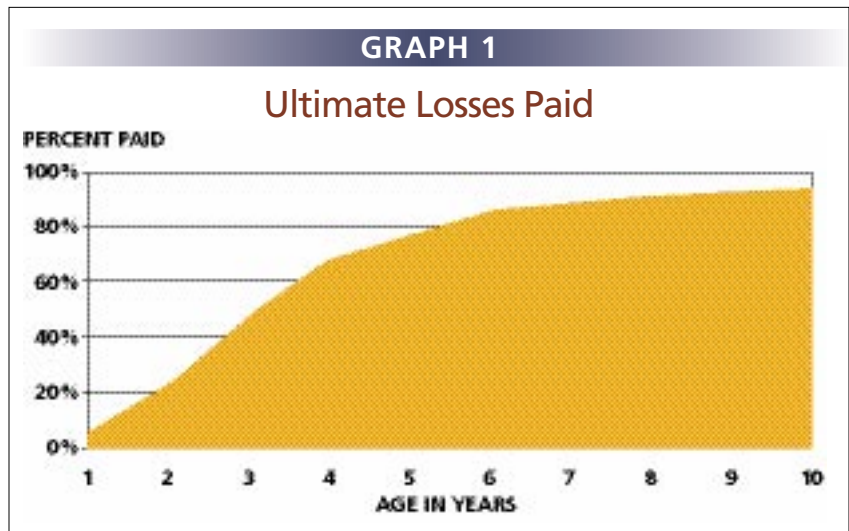
do believe that this series will help researchers and consumers of public studies make more informed decisions regarding the validity of the conclusions they read.

And when readers need more information, we hope they will reach out and ask an actuary about shocking conclusions and catchy ratios that may appear too good to be true. The actuarial resources are there. For public officials, their insurance departments are filled with qualified actuaries ready and able to provide a detailed review of each new study. The American Academy of Actuaries (www.actuary.org) and Casualty Actuarial Society (www.casact.org) are filled with volunteer actuaries and committees focusing on the important insurance issues of the day. Pick up the phone, and we believe our profession will answer the call.

Apples to Oranges

Given the considerable confusion in the news media over the past year regarding the reasonableness of comparing calendar-year written premiums to calendar-year paid losses, we thought we would start our series with a simple question: Are researchers comparing apples and oranges when they compare calendar-year written premiums to calendar-year paid losses?

First, some key assumptions and definitions. Calendar-year written premium equals the number of policies sold in the year, multiplied by the average premium per policy. Twenty percent of



the premium charged to the customer is related to the insurer's expenses (premium taxes, commissions, etc.). Eighty percent of the premium charged (i.e., 100 percent minus 20 percent expense ratio) goes toward paying losses, claim investigation, medical examination, defense attorney fees, and fees/salaries for claim adjusters and others working on the defense of a claim. Finally, for illustrative purposes, we've selected a payout pattern from a line of business that generally takes a long time for claims to be submitted and settled (See Graph 1).

As one can see, only 4 percent of the ultimate medical malpractice payments are made in the first year. After three years, less than 50 percent of the medical malpractice payments have been

TABLE 1

Medical Malpractice—Long-Tail Example, Static Environment

YEAR	TOTAL WRITTEN PREMIUM	20% EXPENSE RATIO	TOTAL EXPECTED LOSSES	CALENDAR-YEAR PAYOUT					
				2000	2001	2002	2003	2004	2005
2000	25,000,000	5,000,000	20,000,000	791,144	3,757,936	4,776,534	3,636,990	2,390,627	1,589,785
2001	25,000,000	5,000,000	20,000,000		791,144	3,757,936	4,776,534	3,636,990	2,390,627
2002	25,000,000	5,000,000	20,000,000			791,144	3,757,936	4,776,534	3,636,990
2003	25,000,000	5,000,000	20,000,000				791,144	3,757,936	4,776,534
2004	25,000,000	5,000,000	20,000,000					791,144	3,757,936
2005	25,000,000	5,000,000	20,000,000						791,144
			Calendar-Year Paid Losses	791,144	4,549,080	9,325,614	12,962,604	15,353,231	16,943,016
			Report-Year Written Premium	25,000,000	25,000,000	25,000,000	25,000,000	25,000,000	25,000,000
			WP/PL Ratio	3160%	550%	268%	193%	163%	148%
			Written Premium Less Expenses	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
			WP (X-Expenses)/PL Ratio	2528%	440%	214%	154%	130%	118%
			Outstanding Loss Reserves	19,208,656	34,659,776	45,334,161	52,371,558	57,018,327	60,075,311

TABLE 2

Medical Malpractice—Long-Tail Example, Increase in Physician Exposure

YEAR	TOTAL WRITTEN PREMIUM	20% EXPENSE RATIO	TOTAL EXPECTED LOSSES	CALENDAR-YEAR PAYOUT					
				2000	2001	2002	2003	2004	2005
2000	25,000,000	5,000,000	20,000,000	791,144	3,757,936	4,776,534	3,636,990	2,390,627	1,589,785
2001	25,000,000	5,000,000	20,000,000		791,144	3,757,936	4,776,534	3,636,990	2,390,627
2002	25,000,000	5,000,000	20,000,000			791,144	3,757,936	4,776,534	3,636,990
2003	25,000,000	5,000,000	20,000,000				791,144	3,757,936	4,776,534
2004	100,000,000	20,000,000	80,000,000					3,164,577	15,031,743
2005	300,000,000	60,000,000	240,000,000						9,493,732
	Calendar-Year Paid Losses			791,144	4,549,080	9,325,614	12,962,604	17,726,664	36,919,411
	Report-Year Written Premium			25,000,000	25,000,000	25,000,000	25,000,000	100,000,000	300,000,000
	WP/PL Ratio			3160%	550%	268%	193%	564%	813%
	Written Premium Less Expenses			20,000,000	20,000,000	20,000,000	20,000,000	80,000,000	240,000,000
	WP (X-Expenses)/PL Ratio			2528%	440%	214%	154%	451%	650%
	Outstanding Loss Reserves			19,208,856	34,659,776	45,334,161	52,371,558	114,644,894	317,725,483

made. After 10 years, 6 percent of the medical malpractice claims still remain unpaid (the reason for the name “long tail”).

Table 1 displays five years of calendar-year results assuming \$25 million in written premium (e.g., 500 physicians x \$50,000 average premium). In the example, we’ve assumed the insurance company charges rates that allow the company to break even over the five-year period and that all policies have been written on Jan. 1 (i.e., will be fully earned by year-end). Although most actuaries will develop instant heartburn reading the next few words, case reserves have been ignored.

In order for the medical malpractice line to reach a steady-state environment (WP/PL ratio = 125 percent or WP (X-expenses)/PL ratio = 100 percent), the analysis would have to extend beyond 15 years (the length of time it takes to pay out all medical malpractice claims for a single year of policies).

If one were to quote the WP/PL ratio in 2000, the medical malpractice ratio would say that WP exceeded paid losses by an amazing 3,160 percent. Using a more appropriate comparison excluding expenses, the ratio would still indicate that WP (X-expenses) exceeds paid losses by 2,528 percent. Can one infer from the above ratios that the company over priced its business by 2,528 percent in its first year of operation?

Absolutely not! Since losses pay out over multiple years and premiums are recorded entirely in the year written, the WP/PL ratio significantly mismatches the timing of the two cash flows. As a matter of fact, our example started with each policy priced to break even (i.e., written premium = paid losses + expenses). Therefore, it’s obvious that the WP/PL ratio is a poor measure of premium adequacy. Even if a steady-state environment is reached, the ratio still produces an incorrect answer unless expenses are excluded from the comparison.

Table 2 illustrates the impact of significant exposure growth. In this example, the insurance company’s insured physician count increases from 500 policies in 2003 to 2,000 policies in 2004 and 6,000 policies in 2005, with no change in the \$50,000 average premium.

The WP (X-expenses)/PL ratio spikes to 451 percent in 2003 and 650 percent in 2004. Can one infer from the increase in the above ratios that the company overpriced its business by 451 percent to 650 percent in these years?

Of course not! Selling new policies in the current year results in significant premium growth, while the payout of losses associated with the newer policies is spread out over a number of future years. Another example of the significant timing mismatch.

Table 3 illustrates the impact of a company exiting the medical malpractice line of business, not a rare event over the past few years. The insurance company’s insured physician count decreases from 500 policies in 2005 to 250 policies in 2006, 125 policies in 2007, 63 policies in 2008, and 10 policies in 2009, with no change in the \$50,000 average premium.

The WP (X-expenses)/PL ratios decreases in 2009 to 4 percent. Can one infer from the decrease in the above ratio that the company drastically underpriced its business? Are paid losses really 2,351 percent higher than the premiums being charged to insurance customers?

No way! Since the company adds only \$500,000 of written premium in 2009 (10 policies x \$50,000), the roughly \$9.4 million in loss payments on prior report years overwhelms the drastically reduced current-year premium. Even if the company has no policies left in 2010, it still must pay out over \$22.6 million in outstanding loss reserves. Another significant timing mismatch.

TABLE 3

Medical Malpractice—Long-Tail Example, Runoff Environment

YEAR	TOTAL WRITTEN PREMIUM	20% EXPENSE RATIO	TOTAL EXPECTED LOSSES	CALENDAR-YEAR PAYOUT				
				2005	2006	2007	2008	2009
2000	25,000,000	5,000,000	20,000,000	1,589,785	870,933	452,230	351,241	250,505
2001	25,000,000	5,000,000	20,000,000	2,390,527	1,589,785	870,933	452,230	351,241
2002	25,000,000	5,000,000	20,000,000	3,636,990	2,390,627	1,589,785	870,933	452,230
2003	25,000,000	5,000,000	20,000,000	4,776,534	3,636,990	2,390,627	1,589,785	870,933
2004	25,000,000	5,000,000	20,000,000	3,757,936	4,776,534	3,636,990	2,390,627	1,589,785
2005	25,000,000	5,000,000	20,000,000	791,144	3,757,936	4,776,534	3,636,990	2,390,627
2006	12,500,000	2,500,000	10,000,000		395,572	1,878,968	2,388,267	1,818,495
2007	6,250,000	1,250,000	5,000,000			197,786	939,484	1,194,134
2008	3,125,000	625,000	2,500,000				98,893	469,742
2009	500,000	100,000	400,000					15,823
	Calendar-Year Paid Losses			16,943,016	17,418,376	15,793,852	12,718,450	9,403,514
	Report-Year Written Premium			25,000,000	12,500,000	6,250,000	3,125,000	500,000
	WP/PL Ratio			148%	72%	40%	25%	5%
	Written Premium Less Expenses			20,000,000	10,000,000	5,000,000	2,500,000	400,000
	WP (X-Expenses)/PL Ratio			118%	57%	32%	20%	4%
	Outstanding Loss Reserves			60,075,311	52,656,935	41,863,082	31,644,632	22,641,118

Although we've provided some very simple examples, we think it's easy to see that the comparison of calendar-year written premiums to calendar-year paid losses is about as valuable as comparing apples to oranges. In order for the WP/PL ratio to work, one would have to find an insurance company where the premiums remained constant, expense ratios stayed fixed, and paid losses didn't vary. Given the fact that loss payments are volatile, inflation does exist, investment income fluctuates, case reserves can't be ignored, prior-year reserve estimates increase or decrease over time as more information is gathered, and exposures do fluctuate as companies decide to enter and exit the marketplace, the authors believe that the ratio of apples to oranges consumed by insurance company staff might produce information with as much predictive power as the ratio of WP/PL.

As we noted in our basketball example, age does matter. It's easy to comprehend that an 18-year-old basketball player is much more developed than a 12-year-old player. The basketball player develops skills over time through practice, effective coaching, playing in games, and the body's ability to grow. Similarly, paid losses develop over time as claims are filed; insurance adjusters research the circumstances of the claims; lawyers perform depositions; and claims close without payment, settle, or go to litigation. The proper matching of insurance revenues with insurance expenses must consider the age of the data, or else you'll end up watching a basketball game where one team (Paid Losses) is inappropriately matched against the older and more mature team (Written Premium).

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