

EDITORIAL

An Insurance Paradox

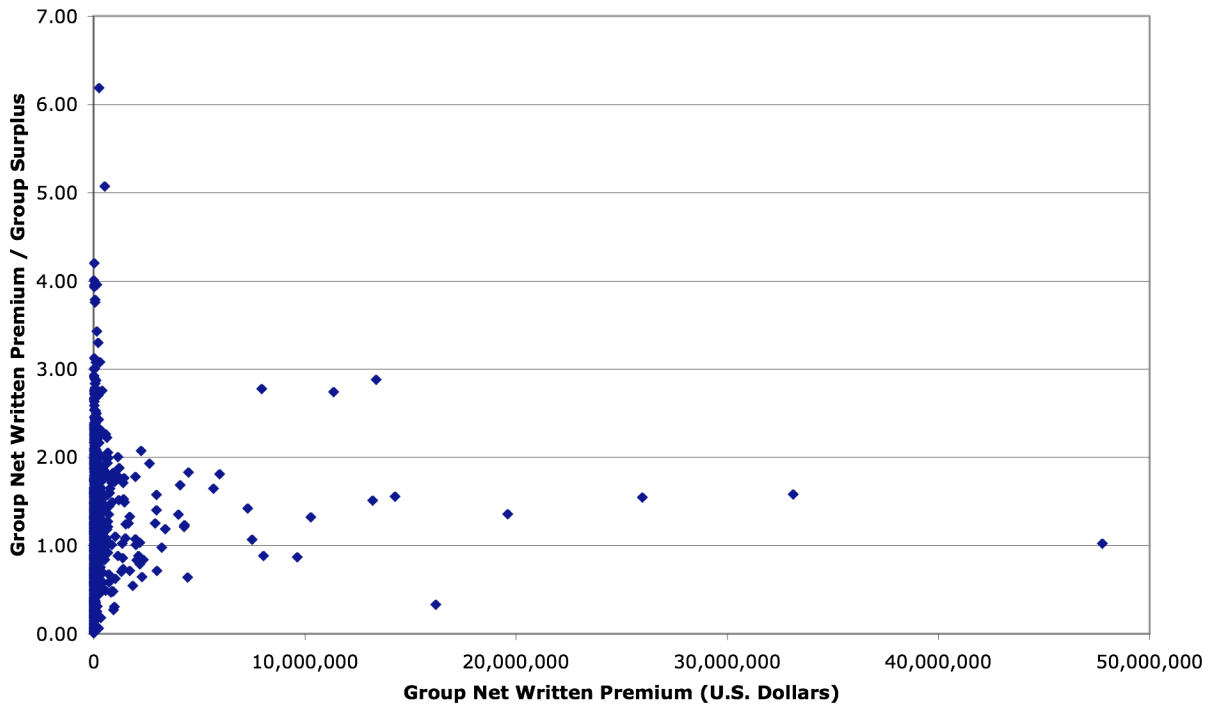
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Ask most informed laypeople to define “insurance”, and chances are they will say something about the “pooling” of risks and/or the “law of large numbers” (LLN). In this, they would be in good company. Most textbook definitions of insurance make clear mention of the benefits of “risk pooling,” and even the U.S. federal courts recognize insurance as consisting of both “risk shifting” and “risk distribution” (where the latter term is taken to be synonymous with “risk pooling”).^[1] Nevertheless, an intriguing paradox lies within this conventional view of insurance. Specifically, there is no overt evidence that the LLN, as associated with the pooling of large numbers of insureds, plays a significant role in determining an insurer’s overall financial leverage.

Throughout the risk and insurance literature, the premium-to-surplus (P/S) ratio^[2] is viewed as a fundamental measure of leverage for an insurance company or insurance group. Consequently, one would expect this ratio to provide some evidence of the benefits of the LLN. In particular, one might anticipate seeing the P/S ratio increase as a function of premium, since companies or groups with more premium – and hence a larger number of insureds – should enjoy greater financial stability, and thus be able to operate at greater leverage. However, a simple analysis of aggregate insurance-group data belies this hypothesis.

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**Chart 1. Premium-to-Surplus Ratio vs. Premium
(U.S. Property-Liability Insurance Groups, Calendar Year 2004)**



Source: A. M. Best Company (2005)^[3]

The scatter plot in Chart 1 presents the P/S ratio *versus* premium for U.S. property-liability insurance groups doing business in calendar year 2004. While a cursory inspection of these data might suggest an inverse power relationship, such as

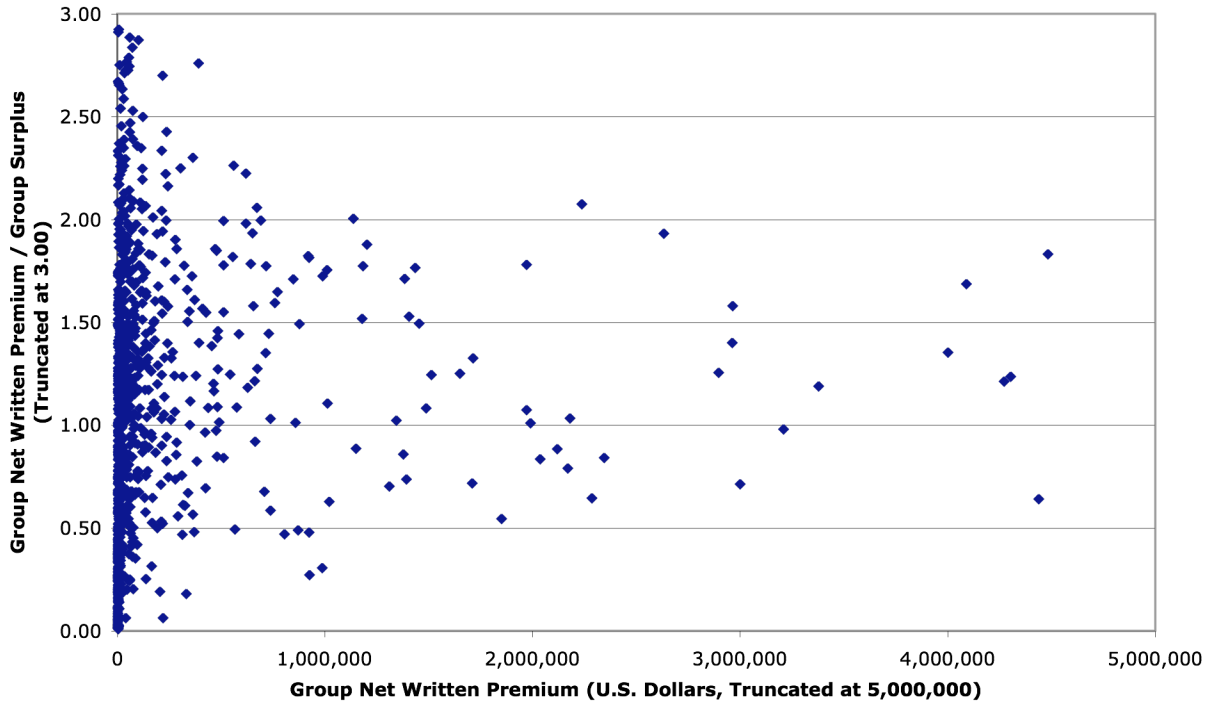
$$P/S = a(\text{Premium})^{-b} + \text{random error},$$

this type of model would give too much credence to a few *outliers*; namely, the points from the highly unusual groups with rather small premium volumes and large P/S ratios. To get a better idea of the true relationship between P/S and premium, we truncate the data by removing all groups whose P/S ratio is greater than 3.0, and whose premium is greater than \$5,000,000.

While the latter set – i.e., those groups with a premium volume greater than \$5,000,000 – are clearly not outliers (in fact, they comprise many of the most successful and stable insurers in the

U.S. market), their removal helps one see better what is going on with the cluster of smaller groups at the left of the plot, and does not alter any conclusions.

**Chart 2. Premium-to-Surplus Ratio vs. Premium
(Truncated Data, U.S. P-L Insurance Groups, Calendar Year 2004)**



Source: A. M. Best Company (2005)

From Chart 2, we see that the principal relationship between the P/S ratio and premium is essentially a constant function,

$$P/S = a + \text{random error},$$

where $a \approx 1.25$. In other words, a group's premium volume has no appreciable impact on the magnitude of its overall leverage. The only discernible effect of premium volume is on the variation of the P/S ratio: as groups write more business, there is less statistical dispersion among their leverage ratios. This latter effect is unsurprising; after all, one would expect smaller companies to be either (1) less-established firms that are naturally somewhat removed from

market equilibrium, or (2) niche players that intentionally deviate from market norms. However, the complete absence of any increase in the P/S ratio is surprisingly counterintuitive.

So how can this paradox be explained?

To seek an answer, we must look for the presence of other, less benign, effects arising from an increase in the number of insureds. Jotting down a quick list of phenomena associated with increased writings, we see that the *positive* effects (like the LLN) clearly outnumber the *negative* effects:

Positive effects

- (a) LLN (as more losses are averaged);
- (b) Reduced parameter-estimation error (as more data are collected);
- (c) Reduced model-selection error (as more data are collected);
- (d) Reduced underwriting error (as underwriters gain more experience);
- (e) Enhanced quality of risks (as buyer self-selection becomes less significant); and
- (f) Capital accretion (as profit loadings are collected from more insureds).

Negative effects

- (g) Increased underwriting error (as less-familiar risks are sought);
- (h) Reduced quality of risks (as poorer risks are sought); and
- (i) Decline in ratio of initial net worth to number of insureds (as more insureds are covered).

Unfortunately, it is not the number of negative effects that is determinative, but rather their relative significance. As any experienced insurance regulator knows, insurers are most likely to get themselves into financial trouble by writing an excessive number of poor-quality risks. This can arise: (1) by a company's attempt to expand its book of business through new lines or new types of risk that it cannot underwrite effectively, as in (g); (2) by a company's

attempt to expand its book of business by lowering underwriting standards, as in (h); or (3) through a combination of the two preceding effects.

What is particularly interesting is that the data from Charts 1 and 2 strongly suggest that many insurers – not just those unfortunate enough to end up insolvent – engage in these same activities. This behavior may well be described as a sort of “Peter Principle”^[4] for insurance markets. In other words, insurers frequently convert the benefits of the LLN (and other positive effects of writing increased numbers of insureds) into economic subsidies for expanded writings, investing in less familiar and/or inferior classes of risks until their P/S ratios approach the market average.

Why this apparent inefficiency exists is a fundamental question warranting further study. One obvious possibility is that insurers derive economic benefits from increased market shares that offset the disadvantages of poorer underwriting. Whatever its origin, such an industry practice is unlikely to be challenged by those who monitor the distribution of P/S ratios most closely – i.e., government regulators. Although clearly concerned with all conceivable threats to insurer solvency, regulators invariably find it difficult, if not impossible, to impede voluntary company efforts to expand the availability of the insurance product.

Reference

Porat, M. M. and Powers, M. R. (1999), “What is insurance? Lessons from the captive insurance tax controversy,” *Risk Management and Insurance Review*, Vol. 2, No. 2, pp. 72-80.

^[1] See Porat and Powers (1999).

^[2] More precisely, the ratio of *annual net written premium* to surplus.

^[3] The data shown in the scatter plot represent all U.S. property-liability groups (formed of both primary insurers and reinsurers) operating in calendar year 2004 for which A. M. Best recorded, on a consolidated basis: (1) a positive net written premium, (2) a positive surplus, and (3) a net written premium-to-surplus ratio in the range (0.01, 10).

[⁴] “The theory that employees within an organization will advance to their highest level of competence and then be promoted to and remain at a level at which they are incompetent. After Laurence Johnston Peter, 1919-1990.” (See the *American Heritage Dictionary of the English Language*, Fourth Edition, 2000.)