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# Measuring Subsidization in LTC

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## PREVALENCE OF SUBSIDIZATION IN LTC

The long-term care insurance industry has made the decision to use unisex premium rates, despite the fact that females have much higher claim costs. According to various studies, at some ages female claim costs are over 100 percent greater than those of a corresponding male. Unisex rates result in significant subsidization across gender. Given the fact that females are the ones receiving the subsidized premium rates in LTC, one would expect that more females than males would purchase LTC policies, and this is in fact the case.

It could be argued that unisex rates are good for society and the industry, and this article isn't intended to advocate change. However, the acceptance of subsidization across something as fundamental as gender sets a precedent for broad subsidization that may find its way into other cell characteristics such as rating class, age and even policy options. That being the case, good risk management stipulates that the subsidization and inherent risks be understood and monitored. Otherwise, an unfavorable mix of business sold under a subsidized pricing structure may come as a surprise.

When there is deliberate subsidization across pricing cells, *subsidization risk*<sup>1</sup> is created. The 2000 LTCI Model Regulation requires that the initial premium rate schedule be sufficient to cover anticipated costs under moderately adverse experience and that it be sustainable over the life of the policy form. In the context of subsidized pricing structures, whether a rate structure is in fact sustainable can hinge on whether a favorable business mix is sold and remains in force. Thus, selling an unfavorable business mix should be considered adverse experience, and the actuary must consider moderately adverse experience in this context. Furthermore, ASOP 18 Section 3.5 stipulates that actuaries should perform sensitivity testing on reasonable variations in assumptions. With subsidized pricing structures, the business mix is in fact a key assumption, and thus should be analyzed with sensitivity testing.

The balance of this article will explore the hazards of subsidization risk and give some insights into how subsidization risk can be analyzed to comply with the 2000 LTCI Model Regulation and ASOP 18.

## HAZARDS OF SUBSIDIZATION RISK

When rating structures are subsidized, antiselection forces emerge, which could cause your business mix to turn unfavorable. Antiselection has been informally described as “that annoying tendency people have of doing what’s best for themselves.”<sup>2</sup> Whenever you have one cohort subsidizing another, you create multiple opportunities for others to do what’s best for themselves—to your detriment. First, you are giving your competitors an opportunity to profitably beat you on price. Second, assuming one of your competitors takes advantage of that opportunity, you are giving your most profitable potential clients an incentive to go with your competitor.

Sales forces and management teams have arguments for the specific subsidizations that they champion. However, subsidization can be dangerous. Companies that can correctly assign risk and minimize subsidization better than their competitors will have a significant competitive advantage. Regardless of whether your objective is to justify or to minimize subsidization, the actuary needs a clear understanding of how much subsidization exists in a given pricing structure so that it can be effectively monitored and managed.

## HOW SUBSIDIZATION CAN BE MEASURED

Whenever different cohorts are priced with different anticipated profit margins, there is a degree of subsidization present.<sup>3</sup> When analyzing subsidization, there are three fundamental components:

1. Profit measures by pricing cell.
2. Assumed sales distribution.
3. Actual sales distribution.

When the business is being priced, the first and second items are combined to calculate target profits, and the anticipated subsidization can be measured. After a block of business is sold, the expected profits can be recalculated using the first and third items, and the actual subsidization can be measured. To the extent that profits can be different solely due to the difference between the actual sales distribution and the assumed sales distribution, subsidization risk exists that should be quantified and managed.



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The easiest way to begin analyzing subsidization is simply to look at the profit margins by pricing cell. As a simplified example, see Exhibit A.

Exhibit A: Profit Margin By Cell		
Age	Female	Male
45	25%	35%
55	-5%	30%
65	-15%	25%
75	-25%	20%

By looking at this type of table, cells that project losses can be easily identified and the range of returns can be observed. Of course for a real block of business with multiple ages, classes and benefit elections, such a table would become unwieldy and difficult to readily grasp. One way to summarize the data would be with a histogram that would show the number of pricing cells in different profit ranges.

Exhibit B: Assumed Sales Distribution		
Age	Female	Male
45	15%	10%
55	15%	10%
65	15%	10%
75	15%	10%
Total	60%	40%

However, this type of analysis ignores the sales distribution. The actual risk we are trying to analyze is the uncertainty of the sales distribution, not varying profit margins across cells. A first attempt at incorporating the sales distribution is simply to use the distribution assumed in pricing. Continuing with our simple example, see Exhibit B.

Exhibit C: Expected Cumulative Return						
Cell	Premium	Profit	Profit Margin	Cumulative Premium	Cumulative Profit	Cumulative Return
75F	\$15.00	\$(3.75)	(25.0%)	\$15.00	\$(3.75)	(25.0%)
65F	\$15.00	\$(2.25)	(15.0%)	\$30.00	\$(6.00)	(20.0%)
55F	\$15.00	\$(0.75)	(5.0%)	\$45.00	\$(6.75)	(15.0%)
75M	\$10.00	\$2.00	20.0%	\$55.00	\$(4.75)	(8.6%)
65M	\$10.00	\$2.50	25.0%	\$65.00	\$(2.25)	(3.5%)
45F	\$15.00	\$3.75	25.0%	\$80.00	\$1.50	1.9%
55M	\$10.00	\$3.00	30.0%	\$90.00	\$4.50	5.0%
45M	\$10.00	\$3.50	35.0%	\$100.00	\$8.00	8.0%

Knowing this sales distribution, it is a straightforward weighted-average exercise to see that the expected profit margin for the entire block will be 8.0 percent. However, when this is done the subsidization becomes camouflaged into the total return. Furthermore, this approach subtly creates the impression that the actual returns would be normally distributed around 8.0 percent (e.g., selling a higher-than-expected concentration of the ultra-profitable cells is just as likely as selling a lower-than-expected concentration).

In order to illustrate the amount and effect of subsidization in a given set of pricing assumptions, consider the following. First, make a table with a row for each pricing cell. Include in the table the profit margin and its underlying components (present value of premium and present value of profits), weighted according to the sales distribution. Then, order the table by profit margin. Finally, add columns that accumulate the premium and profit by row, and calculate the cumulative return (Exhibit C).

It may be easy to sell unprofitable, under-priced cells—the more profitable a cell, the more challenging it will be for the agent to sell his quota. Thus, the reason this exhibit should be ordered by profit margin is because that is the order in which sales would be the easiest to make. Note that the bottom number in the cumulative return column is the 8.0 percent you get from the weighted average of the pricing cells.

When the expected cumulative return is graphed as a function of the cumulative premium, you get a curve named the Subsidization Signature, shown in Exhibit D on page 9.

## INTERPRETING THE SUBSIDIZATION SIGNATURE

The subsidization signature illustrates how much subsidization is taking place in order to achieve the 8.0 percent expected return. Hypothetically, if only one pricing cell were to be sold, it would most likely be the 75-year-old female's, resulting in a negative 25 percent profit margin. If one more cell were to be sold, it would likely be 65-year-old female's, resulting in a combined profit margin of a negative 20 percent. Following the line up, if you were to make all of the sales *except* the two most profitable cohorts, the combined profit margin would only be 1 percent—barely breaking even. In order to get the 8 percent profit margin that was hoped for in pricing, you are heavily reliant upon making sufficient sales in the most profitable—and hence least likely—cells.

Of course the real likelihood of achieving the business mix assumed in pricing depends upon how that business mix assumption was made: if your assumed business mix is based upon credible data with a suitable antiselection model and conservative assumptions, then it could actually be quite likely that you'll achieve a favorable business mix. However, as long as subsidization exists, antiselection pressures could persist that may eventually cause things to

shift against you. As William Bluhm said, “antiselection seems to reflect human nature. It’s annoying to those who work in this industry, however, because it keeps sneaking up to bite us in the nose when we least expect it.”<sup>4</sup> That being the case, and however unlikely it may seem, it is prudent to remain vigilant about how much subsidization is present and what the downside risk is.

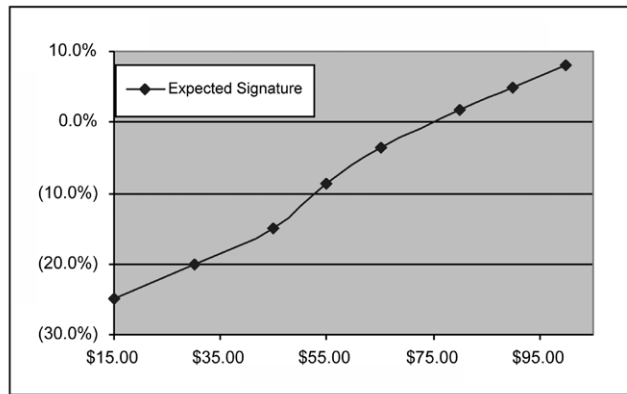
By measuring the amount of subsidization this way, you can set up quantifiable objectives to limit the amount of subsidization. For example, you could set the criteria that your pricing structure won’t have *any* cells with negative profit expectations. Or, for another example, you could set the criteria that by 75 percent of the cumulative premium, the cumulative return would be equal to the risk-free rate of return.

The previous example of the subsidization signature was based upon the business mix that was assumed in pricing. After a cohort is sold, its expected profits can be re-calculated, and a subsidization signature of the actual business mix can be created. Exhibit E compares the expected subsidization signature with the actual subsidization signature.

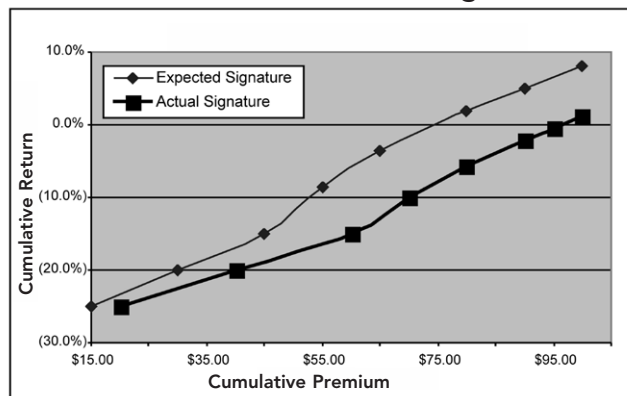
In this example, the actual cohort that was sold had fewer sales in the profitable cohorts, and more sales in the unprofitable cohorts, leading to a subsidization signature where the total return builds up to only 1.3 percent. As a minor consolation (with tongue in cheek), because the range of the actual business mix is smaller than the range in the expected business mix, there is less subsidization taking place than was assumed in pricing.

The subsidization signature gives you a framework to assess the sustainability of a proposed rating structure in compliance with the 2000 LTCI Model Regulation. In this example, if failing to sell the most profitable 25 percent of cells assumed in pricing was determined to be moderately adverse experience, then this analysis demonstrates that even with moderately adverse experience the company would still be projected to get a 1 percent profit margin. Furthermore, this gives you a way to speak to the sensitivity of the business mix assumptions in the spirit of ASOP Number 18. In this example, you could say that if you removed the most profitable 10 percent of pricing cells, the profit margin would decrease by 3 percent. ■

**Exhibit D: Subsidization Signature**



**Exhibit E: Subsidization Signature**



**FOOTNOTES**

- <sup>1</sup> “Subsidization risk” is sometimes called “distribution risk.” See “The Cross-Subsidization Risk” by David N. Wylde in December 2004 *The Messenger* newsletter published by Transamerica Reinsurance [http://www.transamericareinsurance.com/Media/media\\_associateArticle.aspx?id=184](http://www.transamericareinsurance.com/Media/media_associateArticle.aspx?id=184)
- <sup>2</sup> William Bluhm, *Individual Health Insurance*, Actex 2007, pg. 83.
- <sup>3</sup> This is assuming that each cohort is equally risky. A sophisticated player might determine that some pricing cells are riskier than others and hence are deliberately priced at a higher return to compensate for the higher risk and not to subsidize other cells. If that is the case, then risk-adjusted returns should be used in this analysis.
- <sup>4</sup> Ibid