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Watch Out For Mortality Shocks!

by Ronald L. Klein

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Many articles have been written about improvements in mortality, both in the general population and, particularly, in the context of insured lives. These commentaries tend to point to published mortality studies which make it clearly evident that the rate of mortality is on the decline. One such study was undertaken by the Society of Actuaries, the major U.S.-based professional body for life insurance actuaries. This is an insured-life study performed between 1976 and 1990, using data from major insurance companies in the United States. Figure 1 on page five illustrates the downward mortality trend.

For any actuary reading these figures, it must be hard to resist the temptation to project such encouraging results into the future. After all, this is what actuaries are supposed to do. Using a "Least Squares Estimator"—a mathematical projection tool used by our profession—yields the results shown in Figure 2 on page five.

As mortality continues to improve along the projection period, an interesting phenomenon occurs: in the year 2035, the mortality line hits the x-axis, and immortality kicks in, albeit only for those who had the foresight to purchase life insurance in the United States! Projecting the trend onwards gives us reincarnation and, with it, further confusion: should life insurers seek to recover death benefits from those who come back to life, and with interest? ... Back in the real world, clearly no actuary is going to price for immortality (except maybe those who price annuities), but the fact that mortality is improving and—we believe—will continue to do so, is too great to ignore. The question is, will the road be smooth and steady?

In examining trends in mortality, there is a risk that pricing actuaries fail to look closely enough at the variability around the forecasts they make. At Swiss Re, we have looked closely at what we call mortality "shocks."

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Life Reinsurance Data From The Munich American Survey

by David M. Bruggeman

Munich American's annual survey, which is conducted on behalf of the Statistical Research Committee of the Reinsurance Section, covers Canadian and U.S. ordinary and group life reinsurance new business production and in force. The ordinary numbers are further subdivided into:

- (1) Recurring reinsurance¹: conventional reinsurance covering an insurance policy with an issue date in the year in which it was reinsured,
- (2) Portfolio reinsurance: reinsurance covering an insurance policy with an issue date in a year prior to the year in which it was reinsured, or financial reinsurance, and,
- (3) Retrocession reinsurance: reinsurance not directly written by the ceding company.

Complete survey results are available from the authors upon request. These results may also be obtained at Munich American's Web site: www.marclife.com (look under Research).

Life Reinsurance Production

The recent reinsurance acquisition activity has played a large role in the life reinsurance production numbers over the last few years. Looking solely at the total number for 2002, we see that a 14.6 percent decrease in production was reported (15.9 percent decrease in the U.S., 4.9 percent increase in Canada). However, the overall numbers are heavily impacted by a couple of recent reinsurance acquisitions—Swiss Re's acquisition of Lincoln Re in 2001 and Employers/ERC's acquisition of AUL in 2002. Excluding these acquisitions from the portfolio category reveals a much different and, we believe, a more accurate picture of the market.

So let's take a look at the results, excluding these two acquisitions. Recurring was the only category in the United States to show an increase, however the solid increase more than made up for the decreases

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Figure 1

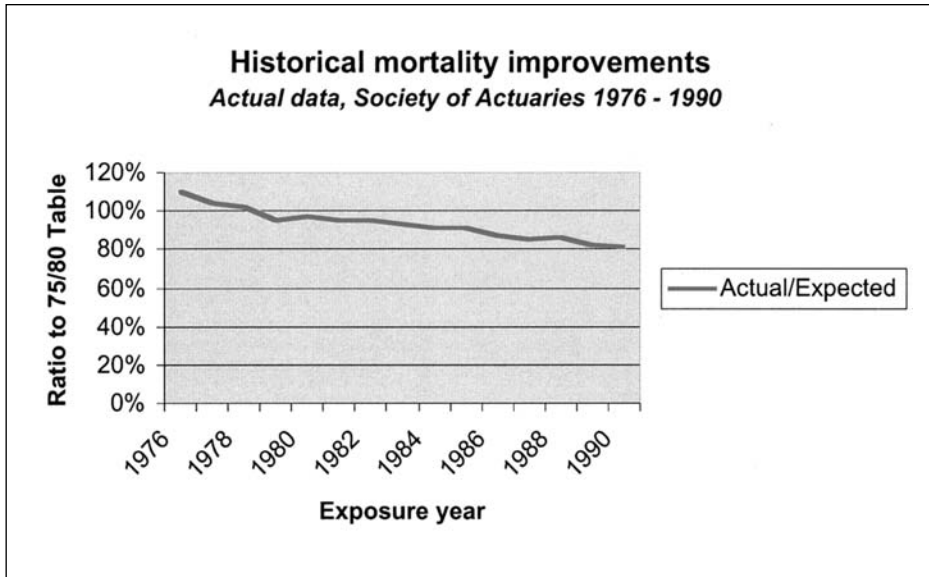
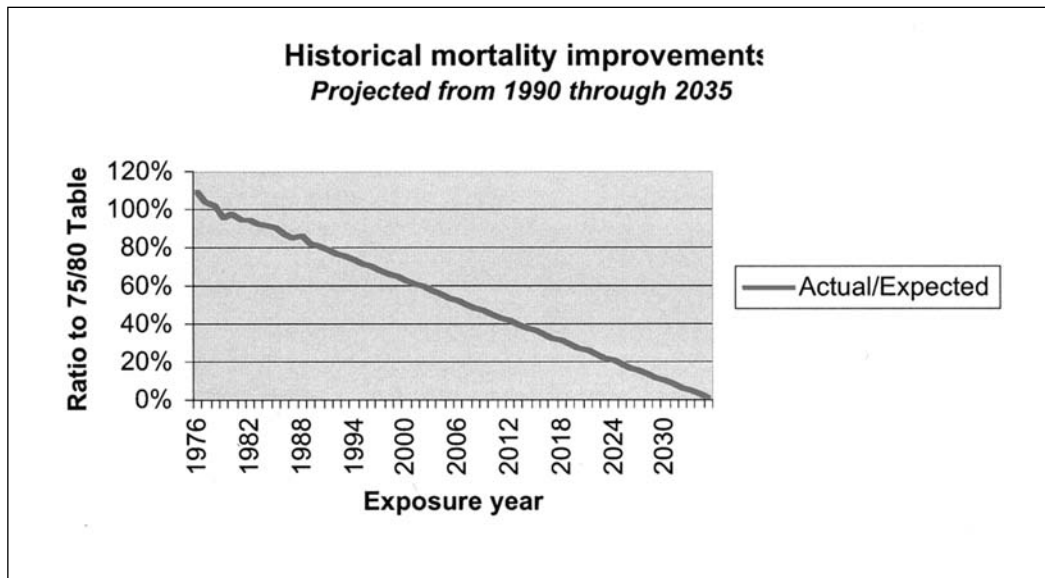


Figure 2



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These shocks come in the form of natural disasters such as flooding or earthquakes, man-made occurrences like terrorism and war, or epidemics including flu and AIDS. Counting the deaths caused by shocks around the world produces some quite astounding numbers. While pricing actuaries may fail to pay sufficient regard to these events in the way they price risk, the insurance-buying public seems to be more aware of possible shocks to mortality. Since 11 September, 2001 insurance sales have increased in the U.S.¹ and the U.K.² This follows an event that—in terms of lives lost—does not even begin to compare with some of the other tragedies noted in Figure 3, which shows some major mortality shocks during the past century.

In one of our internal studies, we looked at the assumed rates of mortality improvement in the U.S. based upon a report published by Milliman USA, a leading actuarial consulting firm, entitled “Americans Are Getting Healthier.” Using these rates of mortality improvement for the U.S. population and mortality data published by the National Center for Health Statistics, we created a model of how many additional lives would be ‘saved’ as a result of the implied mortality improvement. While an earthquake like the one in India in 1993 could wipe out two or three years’ worth of mortality improvements, a major event such as the 1918 flu epidemic (which killed an estimated 675,000 Americans³) or a large-scale war

Figure 3: Negative Mortality Shocks During The Past Century

Year	Event	Location	Deaths
1902	Volcano	Martinique	40,000
1908	Earthquake	Messina	75,000
1914	WWI	Worldwide	16,000,000
1918	Flu Epidemic	Worldwide	20,000,000
1919	Volcano	Kelut	5,000
1923	Earthquake	Kanto	150,000
1931	Flood	China	3,700,000
1939	WW2	Worldwide	50,000,000
1950	Korean War	Korea	5,000,000
1954	Flood	Iran	10,000
1965	Vietnam War	Vietnam	3,000,000
1970	Earthquake	Peru	50,000
1971	Flood	Vietnam	100,000
1976	Earthquake	Tangshan	500,000
1984	Chemical Plant	Bhopal	6,500
1985	Earthquake	Mexico City	10,000
1985	Volcano	Bogota	25,000
1984	Chemical Plant	Bhopal	6,500
1987	Nuclear Plant	Chemobyl	8,000
1988	Earthquake	Armenia	25,000
1990	Earthquake	Gilan, Iran	40,000
1993	Earthquake	India	22,000
1995	Earthquake	Kobe	6,500
2001	Earthquake	Gujarat	15,000
2001	Terrorism	New York	3,500

1 Life Insurance Marketing and Research Association (LIMRA)

2 Association of British Insurers (ABI)

3 Stanford University

could destroy decades worth of improvements. Turning to terrorism, our experience to date in terms of lives lost has not been as devastating as other man made, natural or epidemic losses. However, we researched the possibility of certain nuclear events in major cities, including so-called “dirty bombs,” attacks on nuclear power plants and nuclear bombs. The effect on mortality for the worst of these events would be catastrophic and wipe out scores, or even centuries, of mortality improvement.

Finally, there is one further epidemic that is—or at least should be—receiving increasing attention: the growing epidemic of obesity. In America, obesity has been linked to as many as 300,000⁴ deaths per year. This is more than 10 percent of all deaths annually, ranking it second only to cigarette smoking as one of the leading causes of preventable death. Indeed, many believe that obesity-related deaths will soon overtake those that come about from smoking. Furthermore, these two killers may be closely linked in that stopping smoking may prompt an increase in obesity. Curbing this epidemic would allow room for vast, and swift, improvements in mortality. Unfortunately, the opposite seems to be occurring. Studies performed in England⁵, Canada⁶ and the United States.⁷ show a dramatic increase of obesity in children. Other countries such as Russia, China, Brazil and Australia are experiencing similar trends⁸. In fact, the report stemming from the U.S. study shows that obesity rates doubled in the past 20 years for children aged between six and 11. This finding, together with a strong correlation between adult obesity and childhood obesity, paints a grim picture of future mortality. An increase in—or even a levelling of—obesity may cause mortality improvements to tail-off, or even evaporate, in the future.

So, where is the good news? To reinforce a point made previously: we firmly believe that mortality will improve in the future. Advances

in medicine—such as AIDS vaccines and drugs to control diabetes and high blood pressure; surgical techniques, like robotics; diagnostic capabilities, including prenatal testing; and genetic research, such as markers to identify those at risk, drugs designed to modify genetic disorders and cardiovascular gene therapy—will most likely outweigh any shocks in the long run. In addition, preventative measures such as air bags, workplace safety laws and inoculations could produce positive mortality ‘shocks’. Finally, we are currently researching the effects of disease elimination on mortality. What if cancer or heart disease could be cured? Eliminating certain cancers, for example, could have a greater impact on mortality than to simply reduce the deaths caused by those cancers. Consider a woman who, through years of chemotherapy, overcomes cancer but then dies at an early age from pneumonia. Clearly, she does not die of cancer, but the cancer treatment may affect her immune system to such an extent that the cancer certainly has a stake in her death. These, as well as other complicated scenarios, will be included in our research model.

With all the pluses and minuses, how can we lowly pricing actuaries ever dream about taking all of these factors into account? While some may disagree, pricing actuaries should not be called upon to forecast the future, but to ensure that the assumptions we use remain within a certain tolerance level. This means allowing for enough contingencies in pricing to cover reasonable scenarios or, even better, to actually reduce the risk. Clearly, ceding risk to a professional global reinsurance company that has business spread all around the world is one answer. Unlike direct companies concentrating in one market or one geographic region, reinsurers have the advantage of being sufficiently diversified to weather negative mortality shocks and take advantage of the improving trends in mortality. Passing this risk to a reinsurer helps pricing actuaries, and their managers, sleep better at night—and is certainly a safer bet than to price assuming immortality, which could certainly create a few shocks! ✍



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4 U.S. Center for Disease Control

5 British Medical Journal

6 Canadian Medical Journal

7 Center for Disease Control

8 *The Hungry Gene*, Shell