

# Actuarial Implications Of Entitlement

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## 1. The Age of Entitlement

Americans are truly blessed to live in such a great nation. Social benefits that we consider to be entitlements are beyond the imagination of people in certain other parts of the world. Prosperity has not always been the case here; at the time of the Jamestown Settlement in the early 1600's, John Smith ordered "He who will not work shall not eat." In the throes of the Great Depression, America enacted sweeping social reforms. In 1935, the Social Security Act was passed in the U.S. That year, in his annual message, President Roosevelt declared that the day of great private fortunes was ended, and that instead, wealth must be better distributed. He said that every citizen must be guaranteed "a proper security, a reasonable leisure, and a decent living throughout life".<sup>1</sup>

Robert J. Samuelson has just completed a new book entitled: *The Good Life and Its Discontents: The American Dream in the Age of Entitlement 1945-1995*. As excerpted by *Newsweek*, Samuelson says the following:

"Call our era the Age of Entitlement. Stretching from the close of World War II to the mid-1990s, it is best defined by its soaring ambitions. We had a grand vision. We didn't merely expect things to get better. We expected all social problems to be solved. In our new society, most workers would have rising income and stable jobs. Business cycles would disappear. Poverty, racism and crime would recede. Compassionate government would protect the poor, old and unlucky. We expected almost limitless personal freedom and self fulfillment. We not only expected these things. After a while, we thought we were entitled to them as a matter of right."

"Government began to operate on the assumption that resources, if not infinite, were nearly so. Future costs would be covered by new tax revenues,

which would flow from faster economic growth. Today's budget deficit would become tomorrow's surplus. Thus reassured, government could spend more on the old, the poor, the cities and the schools. In 1965, Congress enacted Medicare and Medicaid: health insurance for the old and poor. In the early 1970s, President Nixon dramatically expanded food stamps. In 1972, Congress indexed social-security benefits to inflation. Buoyant economic growth would reconcile Americans' historic dislike of government with their postwar taste for more government."

"Of course, it didn't quite work out that way. The result has been the politics of over-promise. By making more promises than it can keep, government systematically generates distrust. People who get benefits often find them inadequate—or fear they may be cut. People who don't receive benefits often resent those who do. Almost everyone fears higher taxes. The irony is that, as government has grown, popular esteem for it has fallen. The more it does (or promises to do), the more chance it has to offend."<sup>2</sup>

Our nation faces a crisis today because it is not clear how we are going to pay for promises which many Americans have come to believe are entitlements. Entitlements are subject to the basic laws of economics. Scarce resources are insufficient to provide for unlimited wants, and unfortunately we either have to devote more of our income to entitlements or entitlements must be scaled back.

In August 1994, the Bipartisan Commission on Entitlement and Tax Reform chaired by Senator Kerrey (D-NE), presented an interim report to President Clinton with the following findings:

- To ensure that today's debt and spending commitments do not unfairly burden America's children, the government must act now. A bipartisan coalition of Congress, led by the President,

must resolve the long-term imbalance between the government's entitlement promises and the funds it will have available to pay for them.

- To ensure the level of private investment necessary for long-term economic growth and prosperity, national savings must be raised substantially.
- To ensure that funds are available for essential and appropriate government programs, the nation cannot continue to allow entitlements to consume a rapidly increasing share of the federal budget.
- To be effective, any attempt to control long-term entitlement growth must take into account the projected increases in health care costs.
- To be effective, any attempt to control long-term entitlement growth must also take into account fundamental demographic changes.
- To respond to the Medicare Trustees' call to action and ensure Medicare's long-term viability, spending and revenues available for the program must be brought into long-term balance. Medicare provides an important source of health security for the nation's seniors and disabled persons.
- To respond to the Social Security Trustees' call to action and ensure the long-term viability of Social Security, spending and revenues available for the program must be brought into long-term balance. Any savings that result should be used to restore the long-term soundness of the Social Security Trust Fund.<sup>3</sup>

## 2. Entitlement or Individual Responsibility

Sometimes people confuse the role of the private sector with the public sector when it comes to who should pay for entitlements. By their nature, entitlements should be provided by the public sector. The public sector should not be permitted to shift the cost of an entitlement to the private sector. This is not to judge whether any entitlement program is good or bad; it is rather a question of who should pay.

- In a great nation like the U.S., no one should have to go to bed hungry. But we do not require farmers and grocers to give away their food or restaurants to provide free meals. Instead, we have programs such as food stamps and meals on wheels which are funded by the government.
- Similarly, it can be decided that everyone is entitled to a minimum level of medical care. This should not mean that doctors and hospitals

must give away their services or that health insurers are not entitled to compensation for the benefits they pay.

- Life insurance is often considered an individual responsibility. However, there is a level of entitlement that is provided as part of the Social Security System. A lump sum of about \$255 is payable on the death of an insured worker who leaves a spouse with whom he/she had been living, or a spouse or child who is eligible for immediate monthly survivor benefits.<sup>4</sup> This modest benefit resulted in payments of \$218 million in fiscal year 1994. More important is the monthly income benefit to survivors of deceased workers which amounted to \$63.3 billion in fiscal year 1994 or 22.9% of all Social Security benefit payments.<sup>5</sup> This is double the \$31.7 billion payments to life insurance beneficiaries in the U.S. in 1994<sup>6</sup>

Nevertheless, there may be opportunities for the public and private sectors to cooperate in joint ventures. For example, the public sector may establish a mandatory program such as Medicare where the private sector can provide supplementary coverage. Alternatively, the private sector may offer a broad voluntary program with the public sector providing additional coverage for those risks which cannot be handled privately such as is done with flood insurance.

## 3. Social Insurance and Private Insurance

Entitlement programs are often considered social insurance whereas private insurance is used to fund risks which are an individual responsibility. The distinction between adequacy for social insurance and equity for private insurance was discussed in 1938 by the noted actuary Reinhard Hohaus. Writing about the new Social Security Act, Hohaus said:

"Private insurance offers protection against a wide variety of risks pertaining to life, health, and property. As a rule, it is entirely voluntary. An individual decides whether he wishes to have one, or a number, of the various types of protection offered; and, if so, how much of it he wants or can afford (subject, of course, to the underwriting rules and limits of the insurance company), regardless of the extent to which this may meet his needs. Private insurance exists for those who feel the need for protection against certain contingencies sufficiently to join voluntarily with others, exposed to a similar risk, in maintaining a fund from which will be paid the risks that occur within the group.

Because of its voluntary nature, then, private insurance must be built on principles which assure the greatest practicable degree of equity between the various classes insured. Not only would the very nature of the case make it basically unfair to have one homogeneous group of insured designedly pay for part of the costs of providing insurance for another group for which the actuarial measure of the risk is quite different, but such a practice would lead to a cessation of insurance soon after the former group came to understand that it could save money by being treated as an independent, financially self-contained unit.

Social insurance, on the other hand, is of vastly different character and is generally assigned a considerably different function . . . Directed against a dependency problem, social insurance is generally compulsory - not voluntary - giving the individual for whom it is intended no choice as to membership. Nor can he as a rule select the kind and amount of protection or the price to be paid for it. All this is specified in the plan, and little, if any, latitude is left for individual treatment . . . "

"Private insurance, then, is adapted to the individual's need for, and his ability to afford, protection against one or more of a large variety of risks. Social insurance, on the other hand, is molded to society's need for a minimum of protection against one or more of a limited number of recognized social hazards. . . . Hence, just as considerations of equity of benefits form a natural and vital part of operating private insurance, so should considerations of adequacy of benefits control the pattern of social insurance. Likewise, as private insurance would collapse if it stressed considerations of adequacy more than those of equity so will social insurance fail to remain undisturbed if considerations of equity are allowed to predominate over those of adequacy.""

#### 4. Principles of Insurance and Actuarial Science

A knowledge of the principles underlying insurance and actuarial science is helpful in understanding the operation of private insurance in general and the importance of proper risk classification in particular. Issues related to voluntary programs offered by the private sector should be decided on the basis of principle rather than as a reaction to individual cases. For instance, issues of risk classification should not be decided on the basis of a gene related to a specific disease such as breast cancer without recognizing that

there may be later discoveries of genetic ties to other forms of cancer, heart disease, diabetes, alcoholism, obesity, or other conditions.

In 1992, the Society of Actuaries (SOA) published a statement of "Principles of Actuarial Science." The first two principles are:

- Statistical Regularity

"Phenomena exist such that, if a sequence of independent experiments is held under the same specified conditions, the proportion of occurrences of a given event stabilizes as the number of experiments becomes larger."<sup>8</sup>

- Stochastic Modeling

"A phenomenon displaying statistical regularity can be described by a mathematical model that can estimate within any desired degree of uncertainty the proportion of occurrences of a given event in a sufficiently long sequence of experiments."<sup>9</sup>

Phenomena such as mortality exhibit statistical regularity and can be modeled stochastically. Dr. Brackenridge, in his classic text on Medical Selection of Life Risks, quotes G. M. Low, Manager of the Scottish Equitable Life Assurance Society (1900-1920) and President of the Faculty of Actuaries in Scotland as having said:

"The business of life assurance is founded on the principle that the number of deaths which occur among a large number of persons in a given time is not a matter dependent entirely on what is called chance, but is subject to a law of average so uniform in its operation and so trustworthy as to its results as to be capable of forming the basis of calculation on which the shareholder may stake his capital..."<sup>10</sup>

Risk Classification and Pooling are also very important actuarial principles:

- Risk Classification

"For a group of risks associated with a given actuarial risk, it is possible to identify characteristics of the risks and to establish a set of classes based on these characteristics so that :

- a. each risk is assigned to one and only one class; and
- b. probabilities of occurrence, timing and/or severity may be associated with each class in a way that results in an actuarial model which, for some degree of accuracy, is:
  - (1) valid relative to observed results for each class or group of classes having sufficient available data, and
  - (2) potentially valid for every class."<sup>11</sup>

- Pooling

"If the actuarial risk associated with a risk

classification system displays statistical regularity, it is possible to combine risk classes so as to ensure that there is an actuarial model associated with the new set of risk classes that is valid within a specified degree of accuracy."<sup>12</sup>

The American Academy of Actuaries (AAA) statement on Risk Classification states:

"The grouping of risks with similar risk characteristics for the purpose of setting prices is a fundamental precept of any workable private, voluntary insurance system. This process, called risk classification, is necessary to maintain a financially sound and equitable system. It enables the development of equitable insurance prices, which in turn assures the availability of needed coverage to the public. This is achieved through the grouping of risks to determine averages and the application of these averages to individuals...

To achieve and maintain viable insurance systems, the process of risk classification should serve three primary purposes. It should:

- ~ protect the insurance system's financial soundness;
- ~ be fair;
- ~ permit economic incentives to operate and thus encourage widespread availability of coverage."<sup>13</sup>

Another principle enumerated by the SOA is:

- Insured Experience

"The experience rates for the insurable events of an insurance system will tend to differ from the overall rates of occurrence of the same events among all those subject to a given actuarial risk."<sup>14</sup>

There is a significant difference between population mortality and that for newly insured lives. Even more than 15 years after issue, insured mortality typically is better than overall population mortality.

Differences in levels of mortality and pooling present opportunities for antiselection, which was described by the SOA in another actuarial principle:

- Antiselection

"If the premium structure of a voluntary insurance system is based on a risk classification system such that a refinement of the system could result in significant differentials in considerations between risks originally assigned to the same class, there will be a tendency for relatively greater participation by those whose considerations would increase if the refinement were put in place."<sup>15</sup>

The AAA statement on Risk Classification also

stressed the significance of adverse selection.

"The financial threat to an insurance program's solvency is primarily through a complex economic concept called adverse selection. It results from the interaction of economic forces between buyers and sellers of insurance. In markets where buyers are free to select among different sellers, normally with a motivation to minimize the price for the coverages provided, adverse selection is possible. In such markets sellers have a limited ability to select buyers and have a basic need to maintain prices at a level adequate to assure solvency.

In many cases, these economic forces are in equilibrium; occasionally, they are not. The freedom of choice and the economic incentive of price may create a dramatic movement of buyers to different sellers within an insurance market, or even movements into or out of a market. This relocation is the concept of adverse selection, which creates economic instability and can threaten the insurance program's financial stability. ... "

"Since adverse selection occurs when the prices are not reflective of expected costs, a reasonable risk classification system designed to minimize adverse selection tends to produce prices that are valid and equitable—i.e., not unfairly discriminatory. Differences in prices among classes should reflect differences in expected costs with no intended redistribution or subsidy among the classes.

Ideally, prices and expected costs should also match within each class. That is, each individual risk placed in a class should have an expected cost which is substantially the same as that for any other member of that class. Any individual risk with a substantially higher or lower cost than average expected cost should be placed in a different class."<sup>16</sup>

The importance of classification and adverse selection are further commented on by C. L. Trowbridge in a monograph on Fundamental Concepts of Actuarial Science:

"The cluster of ideas surrounding classification, selection, and antiselection are fundamental actuarial concepts. The statistical element is the sorting of risks into homogenous classifications, and the estimation of the appropriate probability for each; but the psychological component is of at least equal importance. Human beings can be expected to act on their perception of their own best interests, and to select against any system that permits choices."<sup>17</sup>

Examples abound of people selecting against systems that permit choices. Consumers take advantage of discontinuities of price between companies as well

as within one company.

The fundamental risk assumed by an insurance program is not the risk of an individual loss, but rather the risk that there is an error in the underlying assumptions for the statistical distributions used in pricing and modeling the business. Adverse selection can cause just such deviations in actual and expected experience and thus be devastating to an insurance system.

## 5. Utility Theory and Insurance

If insurance is provided on a voluntary basis, then both the consumer and the insurer must decide the basis on which to participate or not participate in the process. Typically, the expected value is thought of as a fair value for a transaction. For example, if a coin is unbiased, the expected value of a payment of \$1 for heads and nothing for tails would be \$0.50. If on the other hand, the coin were to be biased so that it came up heads 40% of the time and tails 60% of the time, then the expected value would be  $40\% * \$1 + 60\% * \$0 = \$0.40$ . If one player knew that the coin was biased and withheld the information from the other player, the game would not be fair and the player with the additional information would be selecting against the other player.

Although the expected value may be considered a mathematically fair price, there are often other considerations. For instance, a person who is willing to wager \$1 on the toss of a coin may not be willing to wager \$1,000,000 on a single toss of a coin. \$500,000 may be the expected value of a single toss of an unbiased coin which pays \$1 million for heads and nothing for tails, but the prospect of losing \$500,000 may be more than the individual can afford. In this case, even though the game is fair, a participant who declines to play may be said to be "risk averse" whereas a participant who could still be willing to play would be described as a "risk taker".

While the consumer may consider the expected value to be a fair price, an insurer would not be expected to be willing to accept the expected value as a fair price. First, the insurer incurs a cost of doing business and must collect enough to cover the expected value as well as pay a reasonable share of the expenses. In addition, an insurer which exposes its capital to risk to support an insurance operation would expect a fair return on the capital. An investor would be better off to invest funds in a risk free investment, traditionally thought of as U.S. government bonds, rather than an insurance operation which takes risk but provides no return on

capital. Thus, the insurer would want a price which would at least cover expected claims, expenses and cost of capital.

If the insurer must charge somewhat more than the expected value, there is a question as to why an individual would be willing to pay more than the expected value. If the price ultimately set by the insurer is too high, the individual may decline to purchase the coverage. However, someone who purchases insurance may be thought to be risk averse and therefore willing to pay something somewhat in excess of the expected value. If an individual who owns an ocean front home valued at \$500,000 experiences a hurricane which destroys the home, the uninsured individual would suffer a loss of \$500,000. On the other hand, an individual may be risk averse and thus willing to pay a reasonable premium in excess of expected value in order to avoid an economic loss if it occurred.

For example, an individual with the potential loss of \$500,000 with a 2% probability may be willing to pay a premium of 2.4% of the maximum loss. That is, an individual may be willing to pay \$12,000 (i.e., 2.4% of \$500,000) rather than face the uncertainty of either losing \$500,000 with a 2% likelihood or no loss with a 98% likelihood. This is exchanging the certainty of a premium for the uncertainty of a larger loss. The maximum premium someone would pay to make such an exchange may be analyzed mathematically by Utility Theory.<sup>18</sup>

If an insurer charges a gross premium which is too great for a certain individual, then it may be assumed that the individual will either decline the coverage or look for another insurer. For an insurer, if the minimum premium needed to produce the required return on equity is greater than the acceptable premium level for most individuals in the market, it may be assumed that the insurer will retreat from that business.

## 6. Information and Decision Making

Basic principles of insurance require that the insurer should have the same information that is available to the applicant with respect to the applicant's medical condition. Sometimes it is presumed that information such as the results of genetic tests would be negative, but it is also possible that such information is positive and thus beneficial to the applicant in the decision making process.

Obtaining relevant information is an essential element in decision making. For example, in selecting the

CEO for a major charitable organization, it would be essential to know that one of the applicants had recently been convicted of fraud and embezzlement. In fact, failure to obtain such relevant information could be construed as negligence and extremely detrimental to the overall organization.

Information which does not add value should not be obtained. For instance, it may be possible to determine if an applicant for life insurance prefers baseball or football. However, if this formation is irrelevant to the decision making process, it adds no value. Collection of such useless information adds cost which may have a detrimental effect on premium rates.

Possession of information by one individual may be unfair to others. An individual may consider obtaining an advance copy of a final exam to be highly valuable. However, possession of such information by one individual is clearly unfair to all others who are being classified according to the results of the final exam.

Possession of information may result in an opportunity for personal gain. Arbitrage is based on the utilization of knowledge of discontinuities in different financial markets. If an individual knows that a stock is trading at a different price in London than it is in New York, and the difference is greater than the expense of a trade, then a profit can be made by buying the stock in one market while selling it simultaneously in another market. So long as such information is readily available to everyone, such arbitrage transactions are proper.

Utilization of information which is not available to others may be illegal. For example, it is illegal to use certain insider information as the basis for financial transactions. Insider trading is one of the clearest examples of someone using self knowledge for antiselection purposes.

## 7. Health Care Reform

One of the major issues regarding entitlement in recent time has been health care reform. The concept of universal coverage of health care was widely supported as an entitlement; however, when the American public understood the full implications of the various proposals, the massive proposals died aborning. In his analysis of the reasons health care reform did not pass, Howard Bolnick indicated:

"What the public aspired to—covering every American while allowing freedom to choose one's own providers, and yet, at the same time, controlling

costs—simply cannot be accomplished. The goals are inherently in conflict: People may *think* they can have all three, but in fact a reformed health care system can never satisfy more than two.

If Americans choose a social insurance system that guarantees universal coverage, then we also have to choose between controlling costs and quality. This uncomfortable choice is driven by an unavoidable trade-off between the two. Americans did not understand the need for a trade-off.

In fact, to maintain freedom of choice and patient-physician autonomy in treatment decisions, the public must be willing to increase its health care expenditures if they want to bring all Americans currently outside the existing system into it. On the other hand, controlling total costs, while guaranteeing universal access, means limiting the amount of health care available to everyone.

Similar trade-offs would be required if the public opted for a system that emphasizes either cost control or maintaining their definition of quality. Controlling costs as a primary goal means deciding between not expanding coverage to Americans currently outside the system, and limiting provider choice and patient-physician autonomy in order to fund expanded coverage. Choosing to maintain quality as a primary goal means facing a trade-off between controlling costs and expanding access."<sup>19</sup>

Without a compulsory system providing universal coverage, there has been interest in guaranteed issue plans which provide universal access. Discussing the difference between these concepts, a Work Group of the American Academy of Actuaries (AAA) said:

"Universal access means that, by law, every consumer of health care who is not eligible for a *public* insurance program has the right to purchase comprehensive health insurance from a *private* health insurance carrier. Note that universal access, which involves purely voluntary coverage, is not the same as universal coverage, under which every citizen would be required, by law, to have health insurance.

'Guaranteed Issue' is the same concept as universal access, but from the insurer's point of view. It implies that the company will have to 'guarantee' - issue a qualified insurance plan to consumers or their employers. Under current laws, insurers have the right to deny coverage, for reasons such as poor health."<sup>20</sup>

Although guaranteed issue may sound like a good way to achieve universal coverage, care must be taken to see that government does not foist on the private insurance sector the cost of health care which it is nei-

ther able nor willing to pay for itself. The results can be disastrous. Consider what happened with Medicare where the federal government was neither willing nor able to pay the full costs of Medicare benefits. The government merely limited the amount it was willing to pay while requiring services to be provided. This resulted in massive cost shifting to health care providers, insurers, employers, and ultimately private citizens.

The danger of guaranteed issue programs is anti-selection. The AAA Work Group defined the problem as follows:

“‘Adverse Selection’ is a term used in the insurance industry to describe what happens when individuals take advantage of information about their own health to minimize their premium payments at the expense of insurers and others purchasing insurance coverage. If guaranteed-issue provisions are in effect, and health coverage is voluntary, there is nothing to check a major increase in adverse selection.

In particular, if guaranteed issue applies to only one market segment, the effect of adverse selection can be pernicious. If, for example, guaranteed-issue provisions pertain only to the individual-coverage market, the sickest people will tend to buy their coverage in this market. As a result, the carriers who offer individual policies will see their costs go up. To recoup these costs, the premiums for all people in the individual market—irrespective of health status—will have to be more expensive.

The disruptions in the market caused by adverse selection can have additional important consequences. First, if individuals can postpone purchasing health insurance coverage until they really need it (presumably, to pay bills resulting from poor health), the premiums for people who continuously pay for coverage will rise.... Health insurers are, of course, in business to assume the risk of variations in health care costs, in exchange for a premium. But in a guaranteed-issue environment, with its strong tendency to produce unequal risks for various carriers, it will be very difficult for these carriers to remain financially robust and competitive.”<sup>21</sup>

## 8. Life Insurance and Entitlement

There are sometimes misunderstandings regarding the nature of life insurance when contrasted to health insurance. For example, life insurance policies issued in most states become incontestable after two

years and may not thereafter be terminated by the insurer. Some have suggested that there should be a minimum amount of life insurance available without underwriting or with the applicant being allowed to withhold knowledge about his or her medical condition from the insurer. If the insurer must provide a specified amount of coverage, this is essentially guaranteed issue, the provision of which has significant costs over those of traditional insurance products. If the applicant may withhold significant medical information, then there is a tremendous potential for anti-selection.

Requiring life insurance to be provided through guaranteed issue is an entitlement and should be provided by the public sector rather than the private sector. It should be emphasized that there is already a life insurance benefit provided as survivor benefits under Social Security. To require a fixed amount to be available to everyone does not take into account a needs basis for life insurance. With Social Security survivorship benefits, there is at least a requirement for a surviving spouse or other dependent, and the benefit is somewhat related to earnings through covered compensation.

It is very difficult to quantify the impact of risk classification on life insurance mortality. For illustration purposes, calculations have been made of the present value of expected claims over a twenty-year period. The present values were calculated at 5% interest and recognized mortality but not lapses in survivorship. The following mortality bases were used:

- A modification of the 1975-80 Basic Mortality Tables to reflect preferred male nonsmokers. A preferred risk is a risk which meets qualifications which are beyond what would normally be required to be classified a standard risk. The “1992 Bragg Preferred/Standard Life Tables and Guides to Underwriting” were used to modify the 1975-80 Basic Mortality Tables assuming 50% of the applications qualify for preferred classification.
- A modification of the 1975-80 Basic Mortality Tables to reflect standard male nonsmokers. In this case, the applicant would be assumed to meet requirements for standard classification but not those for preferred risks.
- 100% of the 1975-80 Basic Mortality Tables for males as published by the Society of Actuaries(SOA). This is the most recent inter-company mortality study published by the SOA. As a basic table, it does not include loadings or margins which might be appropriate for valua-

tion mortality tables.

- The 1991 U.S. Life Tables for males as published by the U.S. National Center for Health Statistics. This reflects U.S. population mortality experience.
- A modification of the 1975-80 Basic Mortality Tables for males to reflect application-only direct marketed business. This modification reflects the results of a survey of mortality assumptions conducted by Tillinghast - Towers Perrin for simplified issue business where there are only limited medical questions and there is no telephone follow-up. Although this mortality is generally higher than population mortality, it is expected that guaranteed issue mortality would be even worse than direct mail assumptions.

Using the 1975-80 Basic Mortality Tables as an index of 100%, the relative present values of claims over a twenty-year period were as follows:

	Age 35	Age 45	Age 55
Preferred	38%	43%	49%
Standard (non-preferred)	63%	60%	58%
1975-80 qx	100%	100%	100%
Population	172%	152%	144%
Direct Mail	272%	253%	220%

Using the preferred risk as an index of 100%, the relative present values of claims range from 290% to 450% for population mortality and from 445% to 710% for direct mail. Compulsory participation could be expected to develop mortality along the lines of general population. Guaranteed issue would be expected to be higher than direct mail, and would indicate incentive for adverse selection in a voluntary system.

Although these values cannot be used as precise estimates of mortality differentials under varying risk classification scenarios, they do show that there are potentially significant differences based on varying levels of mortality.

To require a certain amount of life insurance without proper risk classification is to subject private insurance to the same issues of adverse selection described above. In discussing fairness in risk classification, Cummins *et al* noted the following:

"The traditional economic argument in favor of risk classification maintains that offering coverage at the same price to insureds with high- and low-loss probabilities will prompt the high-risk insureds to buy larger policies than the low-risk insureds and/or will cause some or all of the low risks to remain uninsured. If the insurance company fails to foresee these devel-

opments and charges an average price to all insureds, the losses will exceed collected premiums and the insurance scheme will fail. The tendency of high risks to be more likely to buy insurance or to buy larger amounts than low risks is known as *adverse selection*."<sup>22</sup>

### 9. A Simulation Model illustrating Antiselection

In order to better illustrate the implications of anti-selection, a hypothetical simulation model has been developed.

Consider an Assessment Society which has been formed to pay a benefit of \$1 on each death of its members. The Society consists of three groups of 1,000 members each. These groups are CATS, DOGS and MICE. CATS, who are sometimes said to have 9 lives, generally have the lowest mortality rates of these groups. DOGS, who often chase cars, have higher rates of mortality than CATS. MICE have the highest mortality rates of the three groups. The hypothetical annual death rates ( $q_x$ ) assumed for the model are:

Year	CATS	DOGS	MICE
1	0.10	0.20	0.36
2	0.13	0.22	0.40
3	0.16	0.24	0.44
4	0.19	0.26	0.48
5	0.22	0.28	0.52
6	0.25	0.30	0.56
7	0.28	0.32	0.60
8	0.31	0.34	0.64
9	0.34	0.36	0.68
10	0.37	0.38	0.72
11	0.40	0.40	0.76
12	0.43	0.42	0.80
13	0.46	0.44	0.84
14	0.49	0.46	0.88
15	0.52	0.48	0.92
16	0.55	0.50	0.96
17	0.58	0.52	1.00

For purposes of the model, let

$l_x$  = the number alive at the beginning of year  $x$

$q_x$  = the death rate for year  $x$ ,

$d_x = q_x * l_x$  = the number who die in year  $x$ , and

$l_{x+1} = l_x - d_x$  = the number alive at the beginning of year  $x+1$ .

For example, if we begin the model with 1,000 CATS and if the first year death rate for CATS is 0.10, then  $0.10 * 1,000 = 100$  CATS die in year 1. The number of CATS alive at the beginning of year 2 is  $1,000 - 100$



or 900 CATS. This process can be repeated for each year and each group to show the number alive at the

premium payable by each of the 3,000 members would be \$660/3000 or \$0.22.

Given that all risks are pooled together and charged an overall average premium, individual inequities arise. In the first year, for example, the CATS pay a premium of \$0.22 but their actual mortality experience is only 0.10. That means that the CATS pay a premium which is more than double their actual experience. The first year result for DOGS is more reasonable; they pay a premium of \$0.22 and experience a death rate of 0.20. While the CATS are significantly disadvantaged, the average assessment works in favor of the MICE. In the first year, the MICE pay \$0.22 but have a death rate of 0.36. Clearly, the CATS are subsidizing the MICE.

In real life, markets are efficient and, in a voluntary system, the consumers can be expected to act in their own best interest. For this model, knowing the results of the first year can be expected to result in a change in behavior for future years. Given that the CATS are paying a price far in excess of their mortality experience, it can be expected that many of the CATS, the better risks in the model, will lapse their membership. On the other hand, the MICE, who get back far more than the premiums they pay, can be expected to easily recruit additional members. The DOGS may or may not adjust their membership, depending on whether they perceive that they are getting a fair value or not.

In order to introduce a market reaction to perceived value into the model, the following equation was used to reflect lapses for members who experience excessive costs and project additional new risks for those who find the program to be of exceptionally high value:

**LAPSES = K\*(PREMIUM/q<sub>x</sub> - 1)**  
**Where K = 0.5 for CATS, 0.8 for DOGS and 2.0 for MICE**

Although this assumption is hypothetical, it is logical given expected behavior. For example, the higher the premium rate in relation to the underlying mortality (or benefit), the larger the lapses will be (Of course, the model should have positive lapses limited to the number alive at the beginning of the year.) If the premium is less than the underlying mortality, the above adjustment results in negative "lapses" which are treated in the model as new entrants.

The model described above can be entered into a relatively simple spreadsheet and used to simulate the results of different assumptions as to the manner or extent that individual members of the Assessment Society respond to perceived value. In looking at the

x	~CATS~		~DOGS~		~MICE~	
	<i>l<sub>x</sub></i>	<i>d<sub>x</sub></i>	<i>l<sub>x</sub></i>	<i>d<sub>x</sub></i>	<i>l<sub>x</sub></i>	<i>d<sub>x</sub></i>
1	1000	100	1000	200	1000	360
2	900	117	800	176	640	256
3	783	125	624	150	384	169
4	658	125	474	123	215	103
5	533	117	351	98	112	58
6	416	104	253	76	54	30
7	312	87	177	57	24	14
8	225	70	120	41	10	6
9	155	53	79	28	4	3
10	102	38	51	19	1	1
11	64	26	32	13	0	0
12	38	16	19	8	0	0
13	22	10	11	5	0	0
14	12	6	6	3	0	0
15	6	3	3	1	0	0
16	3	2	2	1	0	0
17	1	1	1	1	0	0

beginning of each year and the number dying within the year.

Given the above, the assessment premium can be

Year	Number Alive	Deaths	Death Rate = Premium
1	3000	660	0.2200
2	2340	549	0.2346
3	1791	444	0.2479
4	1347	351	0.2606
5	996	273	0.2741
6	723	210	0.2905
7	513	158	0.3080
8	355	117	0.3296
9	238	84	0.3529
10	154	58	0.3766
11	96	39	0.4063
12	57	24	0.4211
13	33	15	0.4545
14	18	9	0.5000
15	9	4	0.4444
16	5	3	0.6000
17	2	2	1.0000

calculated by dividing the total deaths during the year by the number alive at the beginning of the year.

In the first year, there were 3,000 risks at the beginning of the year and 660 deaths during the year, for a total payout of \$660 in benefits. For purposes of simplifying the model, the assessments or premiums are taken as the net mortality rates, without provision for expenses or any other loading. Thus, the first year pre-

model over the full 17-year time horizon, if it is assumed that participation is mandatory (i.e., no individual selection), the CATS would have paid \$390 more than they received in benefits, the DOGS would have paid \$29 more than they received in benefits, and the MICE would have received \$420 more in benefits than they paid in.

If the system is voluntary, then each member could decide whether or not to modify its participation in accordance with the lapse (new entrant) formula assumed. For example, if the MICE perceive that they are getting more than their fair share out of the system, they may decide to select against the system and encourage other MICE to join. The model shows that if only MICE modify their behavior, then MICE collectively would make a profit of \$1,306 instead of \$420, whereas the cost incurred by CATS as a group would increase from \$390 in the mandatory system to \$929 in this case, and the cost for DOGS would go from \$29 to \$377. This shows that antiselection by a group that is not covering its expected costs would drive up the costs for other participants. In a voluntary system, the increased costs due to antiselection would create an even greater incentive for the better risks not to participate because the premiums become exorbitantly high and they decide it is no longer to their economic benefit to participate or perhaps even because they can no longer afford to participate at the higher premium levels.

In real life, antiselection occurs when risks are permitted to join a group without paying a cost commensurate with the risk they add. Similarly, increases in premiums as a result of including non-homogeneous groups within the system results in increased premium for the better risks and ultimately a lapse and assessment increase spiral. This can be illustrated by the disastrous results of the Assessment and Dividing Societies that existed in Great Britain before life insurance was introduced on scientific principles.

In the hypothetical model discussed herein, results can be simulated assuming that the groups will either modify their participation or not and determine the economic consequences of each possible situation. Such

results are given in the following table where a negative cost is a benefit:

For this model, the optimal result for each group occurs when its members elect to modify their participation in accordance with perceived value. For example, the CATS lowest values occur when they select yes. Given that the CATS have selected yes, the DOGS lowest cost occurs when they select yes as well. Given that both CATS and DOGS have selected yes, the MICE best value also occurs when they select yes. Although the model is hypothetical, the underlying principles that it illustrates are realistic. Antiselection does occur and to the extent it drives up prices, it may result in lapse spirals which increase cost or deny coverage to better than average risks

### 10. Conclusion

For entitlements granted by government, the essential actuarial issue is how they will be funded. Entitlements should be funded by the public sector and the private sector should resist any unfunded mandate that the public sector tries to hand it.

Entitlements are not exempted from the basic laws of economics. As the economist Thomas Sowell has noted:

“For society as a whole, nothing comes as a ‘right’ to which we are ‘entitled.’ Even bare subsistence has to be produced—and produced at a cost of heavy toil for much of human history.

The only way anyone can have a right to something that has to be produced is to force someone else to produce it for him. The more things are provided as rights, the less the recipients have to work and the more others have to carry the load.”<sup>23</sup>

Finally, the willingness to share our bounty with those less fortunate has been a hallmark of our generous nation. To the extent our largess is made up of unfunded mandates and promises to be paid by future generations, we need to reevaluate the promises we have made and determine in a fiscally responsible way how we are going to keep them.

CATS Select	DOGS Select	MICE Select	CATS Cost	DOGS Cost	MICE Cost
No	No	No	390	29	-420
No	No	Yes	929	377	-1306
No	Yes	No	390	30	-420
No	Yes	Yes	962	139	-1100
Yes	No	No	187	166	~352
Yes	No	Yes	190	473	-663
Yes	Yes	No	188	130	-318
Yes	Yes	Yes	188	157	-345

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