

The **law of large numbers** holds that, as a sample of observations increases in size, the relative variation about the mean declines. An example is given in [Section 6.5 "Appendix: More Exposures, Less Risk"](#). The important point is that, with larger samples, we feel more confident in our estimates.

If it were not for the law of large numbers, insurance would not exist. A risk manager (or insurance executive) uses the law of large numbers to estimate future outcomes for planning purposes. The larger the sample size, the lower the relative risk, everything else being equal. The pooling of many exposures gives the insurer a better prediction of future losses. The insurer still has some risk or variability around the average. Nevertheless, the risk of an insurer with more exposures is relatively lower than that of an insurer with fewer exposures under the same expected distribution of losses, as presented in [Section 6.5 "Appendix: More Exposures, Less Risk"](#).

The importance of the large number of exposures often prompts the question, What can smaller insurers do to reduce the uncertainty in predicting losses? Smaller insurers use the sharing of data that exists in the insurance industry. One such data collection and statistical analysis organization is the Insurance Services Office (ISO). In addition to being a statistical agent, this organization provides the uniform policy forms for the property/casualty industry (a small sample of these policies are in the appendixes at the end of the text). The ISO is both a data collection agent and an advisory organization to the industry on matters of rates and policy forms.

How Insurance Works

Insurance works through the following steps:

- Risk is transferred from an individual or entity (insured) to a third party (insurer).
- The third party (insurer) pools all the risk exposures together to compute potential future losses with some level of accuracy. The insurer uses various forecasting techniques, depending on the distribution of losses. One of the forecasting techniques was demonstrated in [Chapter 4 "Evolving Risk Management: Fundamental Tools"](#).

- The pooling of the risk leads to an overall reduction of risk in society because insurers' accuracy of prediction improves as the number of exposures increases.
 - Insurers pool similar risk exposures together to compute their own risk of missing the prediction.
 - Insurers discriminate via underwriting—the process of evaluating a risk and classifying it with similar risks (see the box below, [Note 6.10 "Fitting into a Lower Risk-Exposure Pooling Group"](#)).
- Both the transfer of risk to a third party and the pooling lead to reduced risk in society as a whole and a sense of reduced anxiety.

Transfer

Insurance is created by an insurer that, as a professional risk-bearer, assumes the financial aspect of risks transferred to it by insureds. The **insurer assumes risk** by promising to pay whatever loss may occur as long as it fits the description given in the policy and is not larger than the amount of insurance sold. The loss may be zero, or it may be many thousands of dollars. In return for accepting this variability in outcomes (our definition of risk), the insurer receives a premium. Through the premium, the policyholder has paid a certain expense in order to transfer the risk of a possible large loss. The insurance contract stipulates what types of losses will be paid by the insurer.

Most insurance contracts are expressed in terms of money, although some compensate insureds by providing a service. A life insurance contract obligates the insurer to pay a specified sum of money upon the death of the person whose life is insured. A liability insurance policy requires the insurer not only to pay money on behalf of the insured to a third party but also to provide legal and investigative services needed when the event insured against occurs. The terms of some health insurance policies are fulfilled by providing medical and hospital services (e.g., a semiprivate room and board, plus other hospital services) if the insured is ill or injured. Whether the insurer fulfills its obligations with money or with services, the burden it assumes is financial. The insurer does not guarantee that the event insured against will not happen. Moreover, it cannot replace sentimental value or bear the psychological cost of a loss. A home may be worth only \$80,000 for insurance purposes, but it may have many times that value to the owner in terms of sentiment. The death of a loved one can cause almost unbearable mental suffering that is in no way relieved by receiving a sum of money from the insurer. Neither of these aspects of loss can be

measured in terms of money; therefore, such risks cannot be transferred to an insurer. Because these noneconomic risks create uncertainty, it is apparent that insurance cannot completely eliminate uncertainty. Yet insurance performs a great service by reducing the financial uncertainty created by risk.

Insurance or Not?

In the real world, a clear definition of what is considered an insurance product does not always exist. The amount of risk that is transferred is usually the key to determining whether a certain accounting transaction is considered insurance or not. A case in point is the product called finite risk. It was used by insurers and reinsurers and became the center of a controversy that led to the resignation of Hank Greenberg, the former chairperson and chief executive officer (CEO) of American International Group (AIG) in 2006. **Finite risk programs** are financial methods that can be construed as financing risk assumptions. They began as arrangements between insurers and reinsurers, but they can also be arrangements between any business and an insurer. Premiums paid by the corporation to finance potential losses (losses as opposed to risks) are placed in an experience fund, which is held by the insurer. Over time, the insured pays for his or her own losses through a systematic payment plan, and the funds are invested for the client. This arrangement raises the question, Is risk transferred, or is it only an accounting transaction taking place? The issue is whether finite risk should be called insurance without the elements of insurance. The rule is that, if there is no transfer of at least 10 percent of the risk, regulators regard the transaction as a noninsurance transaction that has less favorable accounting treatment for losses and taxes. ^[1]

Risk Pooling (Loss Sharing)

In general, the bulk of the premium required by the insurer to assume risk is used to compensate those who incur covered losses. Loss sharing is accomplished through premiums collected by the insurer from all insureds—from those who may not suffer any loss to those who have large losses. In this regard, the losses are shared by all the risk exposures who are part of the pool. This is the essence of pooling.

Pooling can be done by any group who wishes to share in each other's losses. The pooling allows a more accurate prediction of future losses because there are more risk exposures. Being part of pooling is not

necessarily an insurance arrangement by itself. As such, it is not part of the transfer of risk to a third party. In a pooling arrangement, members of the group pay each other a share of the loss. Even those with no losses at all pay premiums to be part of the pooling arrangement and enjoy the benefits of such an arrangement. For this purpose, actuaries, charged with determining appropriate rates (prices) for coverage, estimate the frequency and severity of losses and the loss distribution discussed in [Chapter 2 "Risk Measurement and Metrics"](#). These estimates are made for a series of categories of insureds, with each category intended to group insureds who are similar with regard to their likelihood. An underwriter then has the job of determining which category is appropriate for each insured (see the discussion in [Chapter 7 "Insurance Operations"](#)). Actuaries combine the information to derive expected losses. Estimates generally are based on empirical (in this case, observed) data or theoretical relationships, making them objective estimates. When the actuary must rely on judgment rather than facts, the estimates are termed *subjective*. In most cases, both objective and subjective estimates are used in setting rates. For example, the actuary may begin with industry—determined rates based on past experience and adjust them to reflect the actuary's instincts about the insurer's own expected experience. A life insurer may estimate that 250 of the 100,000 risk exposures of forty-year-old insureds it covers will die in the next year. If each insured carries a \$1,000 policy, the insurer will pay out \$250,000 in claims ($250 \times \$1,000$). To cover these claims, the insurer requires a premium of \$2.50 from each insured ($\$250,000/100,000$), which is the average or expected cost per policyholder. (An additional charge to cover expenses, profit, and the risk of actual losses exceeding expected losses would be included in the actual premium. A reduction of the premium would result from the insurer sharing its investment earnings with insureds.) In [Chapter 7 "Insurance Operations"](#), we provide the loss development calculations that are performed by the actuary to determine the rates and calculate how much the insurer should keep on reserve to pay future expected claims. [Chapter 7 "Insurance Operations"](#) also explains the relationship between rates and investment income of insurers.

Discrimination: The Essence of Pooling

In order for the law of large numbers to work, the pooled exposures must have approximately the same probability of loss (that is, it must follow the same probability distribution, as demonstrated in [Chapter 2 "Risk Measurement and Metrics"](#)). In other words, the exposures need to be homogeneous (similar).

Insurers, therefore, need to **discriminate**, or classify exposures according to expected loss. For this reason, twenty-year-old insureds with relatively low rates of mortality are charged lower rates for life insurance than are sixty-year-old insureds, holding factors other than age constant. The rates reflect each insured's expected loss, which is described in the box "Fitting into a Lower Risk-Exposure Pooling Group."

If the two groups of dissimilar risk exposures were charged the same rate, problems would arise. As previously stated, rates reflect average loss costs. Thus, a company charging the same rate to both twenty-year-old insureds and sixty-year-old insureds would charge the average of their expected losses. The pooling will be *across* ages, not *by* ages. Having a choice between a policy from this company and one from a company that charged different rates based on age, the sixty-year-old insureds would choose this lower-cost, single-rate company, while the young insureds would not. As a result, sixty-year-old policyholders would be overrepresented in the group of insureds, making the average rate insufficient. The sixty-year-old insureds know they represent higher risk, but they want to enjoy lower rates.

Fitting into a Lower Risk-Exposure Pooling Group

Your insurance company relies on the information you provide. Your obligation to the insurance company is not only to provide correct information, but also to provide complete information in order to be placed with your appropriate risk pooling group. The similar exposure in the pooling group is essential for the risk to be insurable, as you saw in this chapter.

Because automobile insurance is an issue of great concern to most students, it is important to know how to handle the process of being placed in the appropriate risk pool group by an insurer. What do you need to tell the insurance agent when you purchase automobile insurance? The agent, usually the first person you talk to, will have routine questions: the make and model of the automobile, the year of manufacture, the location (where the car is parked overnight or garaged), and its usage (e.g., commuting to work). The agent will also ask if you have had any accidents or traffic violations in the past three to five years.

You might be tempted to tell the agent that you keep the automobile at your parents' home, if rates there are cheaper. You may also be tempted to tell the agent that you have not had any traffic violations, when actually you have had three in the past year. Certainly, your insurance premium will be lower if the agent thinks you have a clean record, but that premium savings will mean very little to you when the insurer notifies you of denial of coverage because of dishonesty. This occurs because you gave information that placed you in the wrong risk pool and you paid the wrong premiums for your characteristics.

Safe driving is the key to maintaining reasonable auto insurance premiums because you will be placed in the less risky pool of drivers. The possibility of being placed in a high-risk pool and paying more premiums can be reduced in other ways, too:

- Avoiding traffic violations and accidents helps reduce the probability of loss to a level that promotes the economic feasibility of premiums.
- Steering clear of sports cars and lavish cars, which place you in a group of similar (homogeneous) insureds. Furthermore, a car that is easily damaged or expensive to repair will increase your physical damage premiums.
- Costs can be reduced further if you use your car for pleasure only instead of driving to and from work. Riding the bus or in a friend's car will lower the probability of an accident, making you a more desirable policyholder. Living outside the city limits has a similar effect.
- Passing driving courses, maintaining a grade point average of at least B, and not drinking earn discounts on premiums.

This phenomenon of selecting an insurer that charges lower rates for a specific risk exposure is known as adverse selection because the insureds know they represent higher risk, but they want to enjoy lower rates. Adverse selection occurs when insurance is purchased more often by people and/or organizations with higher-than-average expected losses than by people and/or organizations with average or lower-than-average expected losses. That is, insurance is of greater use to insureds whose losses are expected to be high (insureds "select" in a way that is "adverse" to the insurer). On this basis alone, no problem exists because insurers could simply charge higher premiums to insureds with higher expected losses. Often,

however, the insurer simply does not have enough information to be able to distinguish completely among insureds, except in cases of life insurance for younger versus older insureds. Furthermore, the insurer wants to aggregate in order to use the law of large numbers. Thus, some tension exists between limiting adverse selection and employing the law of large numbers.

Adverse selection, then, can result in greater losses than expected. Insurers try to prevent this problem by learning enough about applicants for insurance to identify such people so they can either be rejected or put in the appropriate rating class of similar insureds with similar loss probability. Many insurers, for example, require medical examinations for applicants for life insurance.

Some insurance policy provisions are designed to reduce adverse selection. The suicide clause in life insurance contracts, for example, excludes coverage if a policyholder takes his or her own life within a specified period, generally one or two years. The preexisting conditions provision in health insurance policies is designed to avoid paying benefits to people who buy insurance because they are aware, or should be aware, of an ailment that will require medical attention or that will disable them in the near future. ^[2]

KEY TAKEAWAYS

In this section you studied the following:

- The essence of insurance, which is risk transfer and risk pooling
- The necessity of discrimination in order to create pools of insureds
- The fact that insurance provides risk reduction

DISCUSSION QUESTIONS

1. What is the definition of insurance?
2. What is the law of large numbers? Why do insurers rely on the law of large numbers?
3. Why is it necessary to discriminate in order to pool?
4. Why are finite risk programs not considered insurance?

[1] The interested student should also explore it further. In the case of AIG, the finite risk arrangements were regarded as noninsurance transactions. In early 2006, AIG agreed to pay \$1.64 billion to settle investigations by the Securities and Exchange Commission and New York State Attorney General Eliot Spitzer, who brought charges against AIG. This recent real-life example exemplifies how the careful treatment of the definition of insurance is so important to the business and its presentation of its financial condition. For more information on finite risk programs, see “Finite Risk Reinsurance,” Insurance Information Institute (III), May 2005, at <http://www.iii.org/media/hottopics/insurance/finite/>; Ian McDonald, Theo Francis, and Deborah Solomon, “Rewriting the Books—AIG Admits ‘Improper’ Accounting Broad Range of Problems Could Cut \$1.77 Billion Of Insurer’s Net Worth A Widening Criminal Probe,” *Wall Street Journal*, March 31, 2005, A1; Kara Scannell and Ian McDonald, “AIG Close to Deal to Settle Charges, Pay \$1.5 Billion,” *Wall Street Journal*, February 6, 2006, C1; Steve Tuckey, “AIG Settlement Leaves Out Life Issues,” *National Underwriter Online News Service*, February 10, 2006. These articles are representative regarding these topics.

[2] Recent health care reforms (HIPAA 1996) have limited the ability of insurers to reduce adverse selection through the use of preexisting-condition limitations.