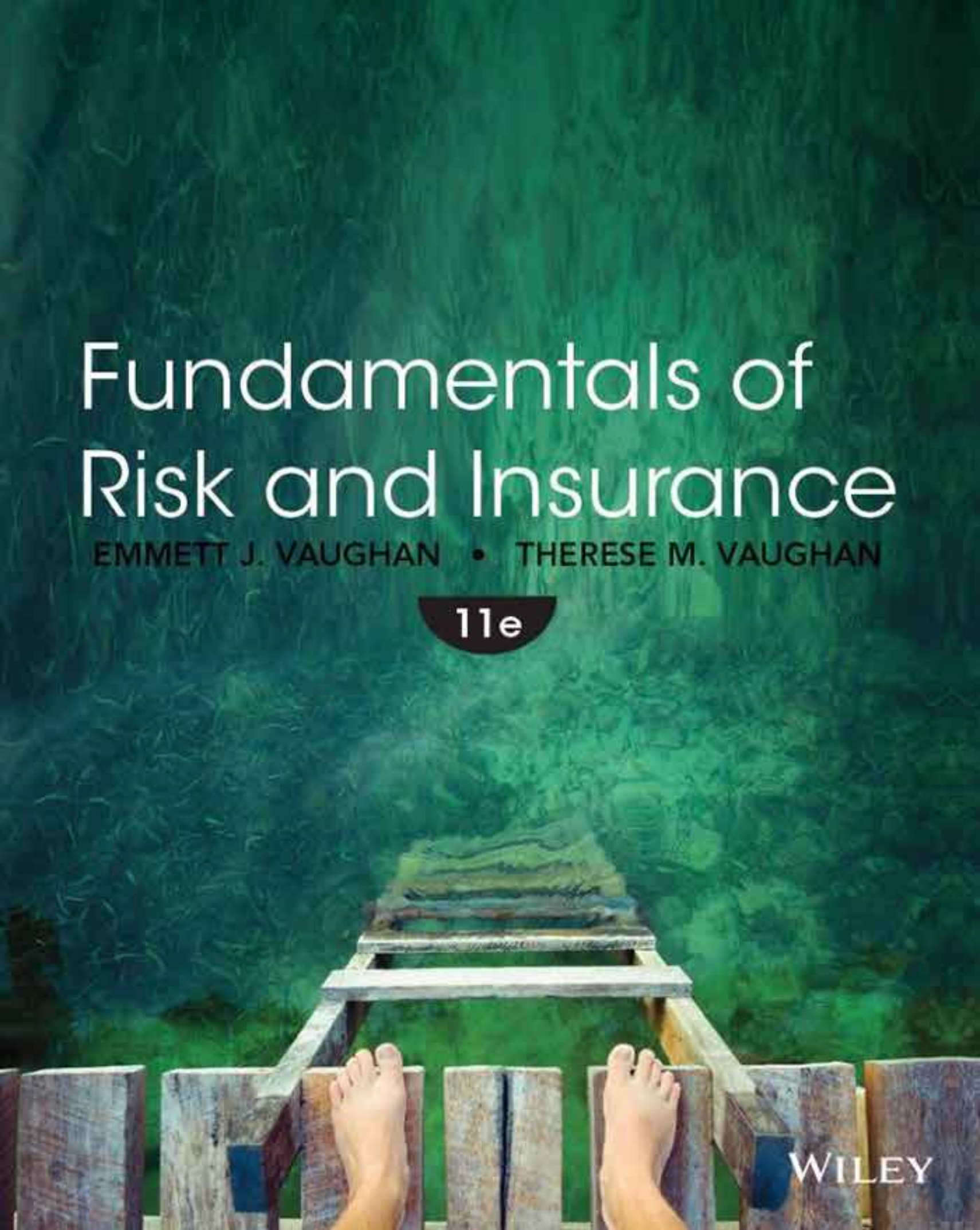
Fundamentals of Risk and Insurance

EMMETT J. VAUGHAN • THERESE M. VAUGHAN

11e



WILEY

FUNDAMENTALS OF RISK AND INSURANCE

FUNDAMENTALS OF RISK AND INSURANCE

ELEVENTH EDITION

EMMETT J. VAUGHAN
THERESE M. VAUGHAN

WILEY

VICE PRESIDENT & EXECUTIVE PUBLISHER	George Hoffman
EXECUTIVE EDITOR	Joel Hollenbeck
CONTENT EDITOR	Jennifer Manias
ASSISTANT EDITOR	Courtney Luzzi
SENIOR EDITORIAL ASSISTANT	Erica Horowitz
DIRECTOR OF MARKETING	Amy Scholz
ASSISTANT MARKETING MANAGER	Puja Katariwala
MARKETING ASSISTANT	Mia Brady
SENIOR PRODUCT DESIGNER	Allison Morris
SENIOR PRODUCTION MANAGER	Janis Soo
ASSOCIATE PRODUCTION MANAGER	Joel Balbin
COVER DESIGNER	Kenji Ngieng
COVER CREDIT	Bart Sadowski/iStockphoto

This book was set in 10/12 Cheltenham Light by Aptara, Corp. and printed and bound by Courier/Kendallville. The cover was printed by Courier/Kendallville.

The book is printed on acid-free paper ⊗.

Founded in 1807, John Wiley & Sons, Inc. has been a valued source of knowledge and understanding for more than 200 years, helping people around the world meet their needs and fulfill their aspirations. Our company is built on a foundation of principles that include responsibility to the communities we serve and where we live and work. In 2008, we launched a Corporate Citizenship Initiative, a global effort to address the environmental, social, economic, and ethical challenges we face in our business. Among the issues we are addressing are carbon impact, paper specifications and procurement, ethical conduct within our business and among our vendors, and community and charitable support. For more information, please visit our website: www.wiley.com/go/citizenship.

Library of Congress Cataloging-in-Publication Data

Vaughan, Emmett J.
Fundamentals of risk and insurance / Emmett J. Vaughan, Therese M. Vaughan. — Eleventh edition.
pages cm
Includes bibliographical references and index.
ISBN 978-1-118-53400-7 (pbk.)
1. Insurance. 2. Risk (Insurance) I. Vaughan, Therese M. II. Title.
HG8051.V35 2014
368—dc23

2013033075

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

To Bob, Kevin,
and Tommy

ABOUT THE AUTHORS

Emmett J. Vaughan was a Professor of Insurance at the University of Iowa for over 40 years, where he held the Partington Professorship in Insurance until his death in 2004. Professor Vaughan earned his undergraduate degree in economics from Creighton University and his M.A. and Ph.D. in economics and insurance from the University of Nebraska. He was an enthusiastic teacher, prolific scholar, and beloved by his students. He inspired hundreds of students to choose careers in insurance.

Therese M. Vaughan has spent her career in academia and insurance regulation. She was the Robb B. Kelley Distinguished Professor of Insurance and Actuarial Science at Drake University. Prior to joining Drake, she served as Iowa Insurance Commissioner for over 10 years, and most recently, she was the CEO of the National Association of Insurance Commissioners. Vaughan earned her undergraduate degree in economics and insurance from the University of Iowa and her Ph.D. in risk and insurance from the University of Pennsylvania.

PREFACE

This eleventh edition of *Fundamentals of Risk and Insurance* marks the 41st anniversary of the first edition, published in 1972. Over the years, the book has undergone major changes as the field of risk management and insurance has changed. Emmett J. Vaughan, the original author and architect of the text, guided the revisions over the years to maintain the text's primary focus, that of a consumer-oriented text. He was passionate about the field of risk and insurance, and his passion was reflected in the book through the decades. Professor Vaughan saw risk and insurance implications everywhere, from personal life events to the changing world around him to the fairy tales he read to his children (with commentary). His enthusiasm for the field was infectious and influenced many students to pursue careers in risk and insurance. I was fortunate to have him as a teacher, advisor, role model, and father.

Professor Vaughan died in October 2004, just as we were beginning to discuss the tenth edition of the book. This text had been a proud accomplishment of his for over 30 years., and, in nearly all respects, this is still his book. Though I have updated it to reflect recent developments and tried to shorten it in parts, the bulk of the text reflects his thoughts over his forty-plus year career. I hope I have been able to capture some of the enthusiasm with which he approached the field.

At the time the first edition was published, the field of insurance differed from what it is today. Many of the current forms of insurance coverage did not exist; the world seemed a simpler place. Medicare was not yet ten years old, and had no Parts C and D. Richard Nixon was president of the United States. Automobile no-fault insurance was an experiment that had been adopted by a single state (Massachusetts), and only three states had compulsory automobile insurance (New York, North Carolina, and Massachusetts). The 1943 Standard Fire Policy was the standard form of coverage for most commercial entities, and the Family Auto Policy was the standard for personal automobile insurance. Universal life insurance was not yet on the drawing board and endowment policies were a staple for the life insurance agent. There was no such thing as long-term care insurance, no individual retirement accounts, and Employee Retirement Income Security Act of 1974 (ERISA) was not yet a gleam in a Congressperson's eye. The Social Security tax base was $9000, the Medicare Part B premium was $5.60, and there was no such thing as Obamacare.

Although the book has changed over the years, its purpose, organization, and approach remain essentially the same. The original goal was to create a consumer-oriented text, and this orientation is continued in the present edition. The first edition of this book was written in response to a perceived need for an insurance textbook that addressed the principles of risk management without abandoning the discussion of insurance. The reception to the book over the past three and a half decades has been gratifying. At least a part of the book's success is due to the fascinating subject matter with which it deals. Experience shows that insurance can be an exciting subject. This comes as no surprise to those of us who find this field an exciting one. It is satisfying, however, to find that our excitement can be shared by our students.

SCOPE OF THE SUBJECT

As the title indicates, *Fundamentals of Risk and Insurance* is about *risk* and about *insurance*. Its objective is to summarize the pervasive nature of pure risk on the individual and on society, and to illustrate the way in which insurance can be used to deal with the problems posed by such risk. It is a book on insurance theory as well as on how students can use insurance personally.

The main emphasis is on the insurance product and the use of insurance within the risk management framework. The traditional fields of life insurance, health insurance, property and liability insurance, and social insurance are treated in terms of their relationship to the wide range of insurance risks to which the individual and the business firm are exposed.

The text is designed for use in a college-level survey of the area of risk and insurance. As an introduction to the subject, it is intended for students who have had little or no prior education in insurance. It may serve as the basis for more advanced texts for those students who intend to specialize in the field of insurance, and at the same time, it constitutes a compendium of what an informed citizen and consumer should know about the subject.

WHY STUDY INSURANCE?

The reasons for studying insurance are varied. For some, the study is undertaken in preparation for a career in the field. Others study to improve their knowledge of the subject to become more knowledgeable consumers. The average individual will spend a significant percentage of his or her disposable income on insurance over a lifetime, and one of the logical reasons for studying insurance is to learn how it can be used in personal financial planning. Still others study insurance as a part of the discipline of risk management, the managerial function that aims at preserving the operating effectiveness of the organization.

Although each of these reasons is adequate justification for the study of insurance, whether that study should be considered essential for business students depends on the approach and the specifics of what is studied. Some have argued that the study of insurance per se is a narrow specialty, yet the broader discipline of risk management, of which insurance buying is a part, is a function that all future managers should understand. A proper understanding of the methods of dealing with exposures to loss is essential for organizational leaders. Although insurance is only one of the techniques that can be used to deal with pure risks, risk management decisions presuppose a thorough understanding of the nature and functions of insurance.

We believe that insurance and risk management is a subject that needs to be taught in colleges and universities. Far from being the narrow specialty it is sometimes characterized as, the study of insurance has a breadth that few disciplines equal. As you progress through the book, you will encounter applications from economics, statistics, finance, accounting, law, decision theory, and ethics.

Because the study of risk management and insurance draws on these different disciplines, it is sometimes considered a subset of one of them. Thus, in many colleges and universities, insurance and risk management are a part of the finance curriculum, reflecting the financial nature of the risk management function. In other schools, it is considered a part of economics; in still others, it is located in another department. This organizational ambiguity reflects the confusion concerning what the study of risk management and insurance entails.

In fact, risk management and insurance is a separate and distinct discipline, which draws on and integrates the knowledge from other business fields. In a micro sense, it is a discipline in which various methodologies are brought to bear on a significant problem.

Viewed from a macro perspective, the study of insurance addresses important issues facing society today: the high cost of medical care, crime, the tort system, pollution and the environment, climate change, and the broad subject of ethics. Indeed, it is not an exaggeration to say that the debates in the insurance arena address questions of what kind of society we will have and who will pay for what. Debates over the cost of insurance and the way in which insurance prices should be determined have intensified over the past two decades. Increasingly, the debates over insurance availability and affordability have come to center stage as the challenges of the cost of automobile insurance, access to health care, responsibility for pollution, damage from hurricanes, product liability, and medical malpractice have become crises. As consumers, we are all affected by the way in which insurance operates.

Finally, the study of risk management and insurance is a fertile field for considering the subject of ethics in business and in society. Indeed, the ubiquitous presence of ethical problems in the field of insurance transactions raises an important question: is ethics something to be studied and learned, or is it something innate in the individual?

ORGANIZATION OF THE BOOK

This book is divided into three major sections. The first section examines the concept of risk, the nature of the insurance device, and the principles of risk management. This section also provides an overview of the insurance industry and the manner in which it operates.

The second section examines the traditional fields of life and health insurance as solutions to the risks connected with the loss of income. The Social Security system, workers compensation, and other social insurance coverages are discussed in this section to permit students to integrate the coverage under these programs in planning income protection. The final section deals with the risks associated with the ownership of property and legal liability. The coverages applicable to the individual or family are treated in chapters that are separate from those designed for the business firm, permitting those instructors who prefer to concentrate on insurance for the individual to give only slight treatment to commercial coverages.

The book is designed to fit a one-semester or two-quarter course, but it may be adapted to longer and shorter sequences. We have composed what we consider to be a logical sequence of subject matter, but the book can be used flexibly. Sections Two and Three in particular may be taken in different order.

CHANGES IN THE TENTH EDITION

The forty-one years that have passed since the publication of the first edition of *Fundamentals of Risk and Insurance* have been marked by significant change in the field of insurance. The second through tenth editions are a chronology of that change.

The insurance industry and its environment continue to change, and the authors have attempted to capture the flavor of that change in each revision. Changes in the legal environment, revisions in policy forms, the introduction of new types of insurance, and a myriad of new problems continue to make insurance an exciting field of study but a challenge to the authors of textbooks.

This edition has been updated to reflect new policy forms (including ISO's 2010 Commercial Auto Policy, 2011 Homeowners Policy, 2012 Commercial Property Policy, and 2013 Commercial Liability Policy), cyber risk, recent laws affecting health insurance and Medicare, changes in regulation stemming from the financial crisis, and other changes in the market. Where possible, I have eliminated extensive discussion of old topics. Unfortunately, the text continues to be lengthy, reflecting the breadth of the subject matter with which it deals.

As in the last edition, there is a companion website for individuals using the text. In prior editions, sample policy forms were included as an appendix to the book (from the first through sixth editions), as a separate bound volume (the seventh and eighth edition), or on a CD-ROM that came with the book (the ninth edition). With this edition, as in the last, sample policy forms will be posted to the website, allowing more forms to be provided (www.wiley.com/college/vaughan). In addition, Chapter 34, Insurance in the Future, which deals with current events and trends, will be published on the website.

ACKNOWLEDGMENTS

Many people have provided support and encouragement as I have worked on this revision. First, of course, are the members of my family, including my husband, children, mother, and siblings. I am particularly grateful for their patience.

As a book progresses through successive editions, the number of persons to whom an author is indebted increases geometrically, since the efforts of so many people become a part of the work. Over the years, my father recognized many people for their efforts, and I continue that appreciation. Our teachers, reviewers, and users have helped shape our thoughts and the book. Although much has changed over the years, colleagues and students who provided comments on earlier editions continue to influence it. As a result, there are many to whom special thanks are due. They include our former colleague and my teacher, Professor Michael Murray, who shared his insights with us over the years and whose influence has been significant. They include my colleague, Professor Robert W. Cooper, who generously provided his support and guidance over the years. The reviewers of the earlier editions, whose contributions helped to shape this one as well, were Tom Auippa, Richard C. Allgood,

Garth H. Allen, Albert L. Auxier, W. Oscar Cooper, Robert W. Cooper, Richard Corbett, Darlene Dicco, Bill Feldhaus, Roger A. Formisano, John W. Hanye, Kenneth J. Krepas, E.J. Leverett, Aaron Lieberman, Jim Milanese, Joseph R. Morrin, Robert J. Myers, John J. O'Connell, Mike Thorne, S. Travis Pritchett, Dede Paul, Gary K. Stone, and Robert Witt.

A number of my father's former graduate teachings assistants offered many suggestions over the years: Lois Anderson, Phillip Brooks, Robb Fick, Tim Hamann, Terry Leap, Lacy McNeill, Joseph Panici, Mark Power, Lori Rider, Roger Stech, Ellen Steele, Mike Steele, Patrick Steele, Art Cox, Robert Carney, and Changsu Ouh. Their suggestions contributed to the earlier editions, and their influence carries through to this edition.

This edition benefited from the insights of many people, and it would be impossible to thank them all. I owe special thanks to Dana Ramundt, who supplied many of the sample premiums used to illustrate various points in the text. Many others contributed advice or insights. Todd Sells was particularly helpful. Others who in some way influenced the text include Elise Liebers, Poojah Rahman, Ethan Sonnichsen, Eric Thompson, Mark Sagat, David Vacca, Mary Sarrazin, Diane Munns, Ed Toy, Eric Nordman, Jane Koenigsman, Aaron Brandenburg, Josh Goldberg, Kris DeFrain, Larry Bruning, Kay Noonan, Rob Esson, Cathy Weatherford, Glenn Pomeroy, Sandy Praeger, and Dean Brooks. While their assistance improved the final result, all errors are entirely mine.

Thank you to the folks at John Wiley and Sons, who were so helpful in completing this revision, especially Joel Balbin and Courtney Luzzi. Thanks also to Robert Saigh at Razorsharp Communications, who was delightful to work with during the editing process.

Finally, thank you to all of the students we have had over the years. Their many comments and intelligent questions contributed to the design of the book and to the examples and illustrations used. Thank you to all of the users of the first ten editions who took time to write with their suggestions and comments.

I would be grateful to receive advice from the teachers who will use this book, particularly concerning any errors that should be corrected and any materials should be added or omitted when it is again revised. To the students who will be compelled to read it, I extend the hope that the material will seem as exciting and interesting as it has seemed to both of its authors.

Therese M. Vaughan
Des Moines, Iowa

September 2013

BRIEF CONTENTS

CONTENTS

CHAPTER 1

THE PROBLEM OF RISK

CHAPTER OBJECTIVES

When you have finished this chapter, you should be able to do the following:

- Define and explain the meaning of the term *risk*
- Distinguish among the terms *risk*, *peril*, and *hazard*
- Identify and explain the classes of hazards
- Differentiate between pure risk and speculative risk
- Differentiate between fundamental and particular risk
- Describe the categories into which pure risk may be subdivided
- Identify and explain the principal methods of handling risk

You see the mangled metal of two cars that have collided on an interstate highway. A fire engine with its siren screaming roars down the street. A building in your neighborhood burns, or you see an ambulance racing to the hospital. Such tragic events arouse your interest and emotions. After the noise and excitement have died down, you are grateful that the loss did not happen to you and you may feel sorry for whoever suffered the loss. But you're glad that it wasn't you. Losses like these happen to some people, whereas others go along happily, free from misfortune. The fact that these losses or similar events could happen to you, and the fact that you can't tell for sure whether or not they will, is a condition we call *risk*. Risk is a pervasive condition of human existence. Although our instinctive understanding of the concept of risk is clear enough, terms that have a simple meaning in everyday usage sometimes have a specialized connotation when used in a particular field of study. In this chapter, we will examine the concept of risk as the fundamental problem with which insurance deals. In addition, we will examine several related concepts.

THE CONCEPT OF RISK

It would seem that the term *risk* is a simple enough notion. When someone states there is risk in a particular situation, the listener understands

what is meant: In the given situation, there is uncertainty about the outcome, and the possibility exists that the outcome will be unfavorable. This loose, intuitive notion of risk, which implies a lack of knowledge about the future and the possibility of some adverse consequence, is satisfactory for conversational usage, but for our purpose, a somewhat more rigid definition is desirable.

Economists, statisticians, decision theorists, and insurance theorists have long discussed the concepts of risk and uncertainty in an attempt to construct a definition of risk that is useful for analysis in each field of investigation. So far, they have not been able to agree on a single definition that can be used in each field. A definition of risk that is suitable for the economist or statistician may be worthless as an analytic tool for the insurance theorist. Because each group treats a different body of subject matter, each requires a different concept of risk. Although the statistician, the decision theorist, and the insurance theorist use the term *risk*, each may mean something different.

Insurance is in its infancy as a body of theory. As a result, we find contradictory definitions of risk throughout the literature dealing with this phenomenon from an insurance point of view. One reason for these contradictions is that insurance theorists have attempted to borrow the definitions of risk used in other fields. Surprising as it may seem, insurance text writers have not been able to agree on a definition of this basic concept.

To compound the problem, the term *risk* is used by people in the insurance business to mean either a peril insured against (e.g., fire is a risk to which most property is exposed) or a person or property protected by insurance (e.g., many insurance companies believe young drivers are not good risks). In this text, however, we will use the term in its general meaning to indicate a situation in which an exposure to loss exists.

Current Definitions of Risk

If we were to survey the best-known insurance textbooks used in colleges and universities today, we would find a general lack of agreement concerning the definition of risk.[1] Although the insurance theorists have not agreed on a universal definition, there are common elements in all the definitions: indeterminacy and loss.

- The notion of an indeterminate outcome is implicit in all definitions of risk: The outcome must be in question. For risk to exist, there must be at least two possible outcomes. If we know for certain that a loss will occur, there is no risk. Investment in a capital asset, for example, usually involves a realization that the asset is subject to physical depreciation and its value will decline. Here, the outcome is certain, so there is no risk.
- At least one of the possible outcomes is undesirable. This may be a loss in the generally accepted sense in which something the individual possesses is lost, or it may be a gain smaller than the gain that was possible. For example, the investor who fails to take advantage of an opportunity "loses" the gain that might have been made. The investor faced with the choice between two stocks may be said to lose if he or she chooses the one that increases in value less than the alternative.

Our Definition of Risk

We define *risk* as a condition of the real world in which there is an exposure to adversity. More specifically,

> Risk is a condition in which there is a possibility of an adverse deviation from a desired outcome that is expected or hoped for.

First, in this definition, risk is a condition of the real world; it is a combination of circumstances in the external environment. Second, in this combination of circumstances, there is a *possibility* of loss. When we say that an event is possible, we mean that it has a probability between zero and one; it is neither impossible nor definite. Third, there is no requirement that the possibility be measurable but only that it must exist. We may or may not be able

[1] The term *risk* is variously defined as (1) the chance of loss, (2) the possibility of loss, (3) uncertainty, (4) the dispersion of actual from expected results, or (5) the probability of any outcome different from the one expected.

to measure the degree of risk, but the probability of the adverse outcome must be between zero and one.[2]

The undesirable event is described as "an adverse deviation from a desired outcome that is *expected* or *hoped for*." The reference to a desired outcome that is either expected or hoped for contemplates individual and aggregate loss exposures. The individual hopes that adversity will not occur, and it is the possibility that this hope will not be met that constitutes risk. If you own a house, you hope that it will not catch fire. When you make a wager, you hope that the outcome will be favorable. That the outcome in either event may be something other than what you hope for constitutes the possibility of loss or risk.

In the case of an insurer, actuaries predict some specified number and amount of losses and charge a premium based on this expectation. The amount of predicted losses is the desired outcome that is expected by the insurer. For the insurer, risk is the possibility that losses will deviate adversely from what is expected.

Uncertainty and Its Relationship to Risk

Because the term *uncertainty* is often used in connection with the term *risk* (sometimes even interchangeably), it seems appropriate to explain the relationship between the two terms.

The most widely held meaning of *uncertainty* refers to a state of mind characterized by doubt, based on a lack of knowledge about what will or will not happen in the future. It is the opposite of certainty, which is a conviction or certitude about a particular situation. A student says "I am certain I will get an A in this course," which means the same as "I am positive I will get an A in this course." Both statements reflect a conviction about the outcome. Uncertainty, on the other hand, is the opposite mental state. If one says "I am uncertain what grade I am going to get in this course," the statement reflects a lack of knowledge about the outcome. Uncertainty, then, is simply a psychological reaction to the absence of knowledge about the future.[3] The existence of risk—a condition or combination of circumstances in which there is a possibility of loss—creates uncertainty on the part of individuals when that risk is recognized.

The individual's conviction or lack thereof (certainty or uncertainty) about a specific fact or situation may or may not coincide with the conditions of the real world. The student who says "I am certain I will get an A in this course" may actually get a B, a C, a D, or even an F. Uncertainty varies with the knowledge and attitudes of the person. Different attitudes are possible for different individuals under identical conditions of the real world. It is possible, for example, for a person to experience uncertainty in a situation in which he or she imagines there is a chance of loss but where no chance of loss exists. Similarly, an individual may feel no uncertainty regarding a particular risk when the exposure to loss is not recognized. Whether or not a risk is recognized, however, does not alter its existence. When there is a possibility of loss, risk exists whether or not the person exposed to loss is aware of the risk.[4]

[2] We measure probability on an imaginary ruler, marked at one end with a zero and unity at the other. The high end of the scale, marked unity, represents absolute certainty. Any proposition about which there is no doubt whatsoever finds its place at this point on the scale. For example, the probability that the reader will eventually die is equal to 1 because we will all die. Using the letter p to stand for probability, we would write $p = 1$. The bottom end of the scale, marked zero, represents absolute impossibility. The probability that the reader could run a mile in 30 seconds is zero because failure would be absolutely certain. The statistician here would write $p = 0$. Events that are neither certain nor impossible lie between the two ends of our imaginary ruler and are assigned values that vary with the likelihood of their occurrence. Thus, the probability of drawing the ace of spades from a deck of cards is 1/52, or .019. The probability of drawing any ace is 1/13; the probability of drawing a black card is 1/2, or .5.

[3] In addition to its meaning as a psychological phenomenon, a second possible meaning of the term *uncertainty* relates to probability and is contrasted with a second meaning of *certainty:* a situation in which the probability of an event is 100 percent. An event may be said to be impossible (probability = 0), certain (probability = 1), or uncertain. Used in reference to the likelihood of an event, uncertain means that the probability is judged to be between 0 and 1.

[4] Some authors equate our notion of uncertainty with subjective risk, which is a person's perception of risk. An individual may perceive risk where it does not exist. (Navigators in Columbus's day perceived a risk of falling off the edge of the world.) They may fail to perceive risk when it does exist. The distinction between objective risk and subjective risk (i.e., between risk and uncertainty) is important because subjective risk affects the decisions people make. Ideally, they should make decisions based on actual risk (i.e., objective risk). Better information reduces uncertainty (improves subjective risk estimates) and leads to better decisions.

The Degree of Risk

It is intuitively obvious that there are some situations in which the risk is greater than in other situations. Just as we should agree on what we mean when we use the term *risk*, we should agree on the way(s) in which risk can be measured. Precisely what is meant when we say that one alternative involves "more risk" or "less risk" than another?

It would seem that the most commonly accepted meaning of *degree of risk* is related to the likelihood of occurrence. We intuitively consider those events with a high probability of loss to be riskier than those with a low probability. This intuitive notion of the degree of risk is consistent with our definition of risk. When risk is defined as the possibility of an adverse deviation from a desired outcome that is expected or hoped for, the degree of risk is measured by the probability of the adverse deviation. In the case of the individual, the hope is that no loss will occur, so the probability of a deviation from what is hoped for (which is the measure of risk) varies directly with the probability that a loss will occur. In the case of the individual, we measure risk in terms of the probability of an adverse deviation from what is hoped for. Actuarial tables tell us, for example, that the probability of death at age 60 is approximately 1 percent, and at age 83 it is about 10 percent. At age 96, the probability of death increases to nearly 30 percent. Using the probability of an adverse deviation from the outcome that is hoped for, we view the risk of death at age 83 as greater than that at age 60 but less than that at age 96. The higher the probability that an event will occur, the greater the likelihood of a deviation from the outcome that is hoped for and the greater the risk, as long as the probability of loss is less than one.

If the probability of loss is 1.0, there is no chance of an outcome other than that which is expected and, therefore, no hope of a favorable result. Similarly, when the probability of loss is zero, there is no possibility of loss and, therefore, no risk.

In the case of a large number of exposure units, estimates can be made about the likelihood that a given number of losses will occur, and predictions can be made on the basis of these estimates. Here the expectation is that the predicted number of losses will occur. In the case of aggregate exposures, the degree of risk is not the probability of a single occurrence or loss; it is the probability of some outcome different from that predicted or expected. Insurance companies make predictions about losses that are expected to occur and charge a premium based on this prediction. For the insurance company, the risk is that its prediction will be inaccurate. Suppose that based on past experience, an insurer estimates that 1 out of 1,000 houses will burn. If the company insures 100,000 houses, it might predict that 100 houses will burn out of the 100,000 insured, but it is highly unlikely that 100, and only 100, houses will burn. The actual experience will undoubtedly deviate from the expectation, and insofar as this deviation is unfavorable, the insurance company faces risk. Therefore, the insurance company predicts the number of houses that will burn, and it estimates the range of error. The prediction might be that 100 losses will occur and that the range of possible deviation will be plus or minus 10. Some number of houses between 90 and 110 are expected to burn, and the possibility that the number will be more than 100 is the insurer's risk. Students who have studied statistics will note that when one of the standard measures of dispersion (such as the standard deviation) is used, risk is measurable, and we can say that more risk or less risk exists in a given situation, depending on the standard deviation.

At times we use the terms *more risk* and *less risk* to indicate a measure of the possible size of the loss. Many people would say that there is more risk involved in a possible loss of $1000 than in that of $1 even though the probability of loss is the same in both cases. The probability that a loss may occur and the potential severity of the loss if it does occur contribute to the intensity of one's reaction to risk. It seems, therefore, that a measurement of risk should recognize the magnitude of the potential loss. Given two situations, one involving a $1,000 exposure and the other a $1 exposure and assuming the same probability in each case, it seems appropriate to state that there is a greater risk in the case of the possible loss of 1,000 dollars. This is consistent with our definition of risk since the loss of $1,000 is a greater deviation from what is hoped for (i.e., no loss) than is the loss of 1 dollar. On the other hand, given two situations in which the amount exposed is the same (e.g., $1,000), there is more risk in the situation with the greater probability of loss.

While it may be difficult to relate the size of the potential loss and the probability of that loss in the measurement of risk, the concept of expected

value may be used to relate these two facets of a given risk situation. The expected value of a loss in a given situation is the probability of that loss multiplied by the amount of the potential loss. If the amount at risk is $10 and the probability of loss is 0.10, the expected value of the loss is $1. If the amount at risk is $100 and the probability is 0.01, the expected value is also $1. This is a very useful concept, as we will see later.

Risk Distinguished from Peril and Hazard

The terms *peril* and *hazard* are commonly used interchangeably with each other and with *risk*. However, to be precise, it is important to distinguish these terms. A peril is a cause of a loss. We speak of the peril of fire, windstorm, hail, or theft. Each of these is the cause of the loss that occurs. A hazard, on the other hand, is a condition that may create or increase the chance of a loss arising from a given peril. It is possible for something to be both a peril and a hazard. For instance, sickness is a peril causing economic loss, but it is also a hazard that increases the chance of loss from the peril of premature death. Hazards are normally classified into three categories:

1. *Physical hazard* consists of those physical properties that increase the chance of loss from the various perils. Examples of physical hazards that increase the possibility of loss from the peril of fire are the type of construction, the location of the property, and the occupancy of the building.
2. *Moral hazard* refers to the increase in the probability of loss that results from dishonest tendencies in the character of the insured person. More simply, it is the dishonest tendencies on the part of an insured that may induce that person to attempt to defraud the insurance company. A dishonest person, in the hope of collecting from the insurance company, may intentionally cause a loss or may exaggerate the amount of a loss in an attempt to collect more than the amount to which he or she is entitled. Fraud is a significant problem for insurance companies and increases the cost of insurance.
3. *Morale hazard*, not to be confused with moral hazard, acts to increase losses where insurance exists, not necessarily because of dishonesty but because of a different attitude toward losses that will be paid by insurance. When people have purchased insurance, they may have a more careless attitude toward preventing losses or may have a different attitude toward the cost of restoring damage. Morale hazard is also reflected in the attitude of persons who are not insureds. The tendency of physicians to provide more expensive levels of care when costs are covered by insurance is a part of the morale hazard. Similarly, the inclination of juries to make larger awards when the loss is covered by insurance, the so-called deep-pocket syndrome, is another example of morale hazard. In short, morale hazard acts to increase the frequency and severity of losses when such losses are covered by insurance.

In addition to these three traditional types of hazard, a fourth hazard—the legal hazard—should be recognized. *Legal hazard* refers to the increase in the frequency and severity of loss that arises from legal doctrines enacted by legislatures and created by the courts. Jurisdictions in which legal doctrines favor a plaintiff represent a hazard to persons or organizations who are sued at tort. Although legal hazard is greatest in the field of legal liability, it also exists in the case of property exposures. In jurisdictions where building codes require that new buildings conform to statutory requirements, the destruction of a building that does not meet the requirements may force an owner to incur additional costs in reconstruction, thereby increasing the exposure to loss.

Classifications of Risk

In its broadest context, the term *risk* includes all situations in which there is an exposure to adversity. Risks may be classified in many ways; however, certain distinctions are particularly important for our purposes. These include the following.

Static and Dynamic Risks An important distinction exists between static and dynamic risks.[5]

[5] The dynamic–static distinction was made by Willett. See Alan H. Willett, *The Economic Theory of Risk and Insurance* (Philadelphia: University of Pennsylvania Press, 1951), pp. 14–19.

Dynamic risks are those resulting from changes in the economy. Changes in the price level, consumer tastes, income and output, and technology may cause financial loss to members of the economy. These dynamic risks normally benefit society over the long run since they are the result of adjustments to misallocation of resources. Although these dynamic risks may affect a large number of individuals, they are generally considered less predictable than static risks since the former do not occur with any precise degree of regularity.

Static risks involve those losses that would occur even if there were no changes in the economy. If we could hold consumer tastes, output and income, and the level of technology constant, some individuals would still suffer financial loss. These losses arise from causes other than the changes in the economy, such as the perils of nature and the dishonesty of other individuals. Unlike dynamic risks, static risks are not a source of gain to society. Static losses involve the destruction of the asset or a change in its possession as a result of dishonesty or human failure. Static losses tend to occur with a degree of regularity over time, and as a result, are generally predictable. Because they are predictable, static risks are more suited to treatment by insurance than are dynamic risks.

Fundamental and Particular Risks The distinction between fundamental and particular risks is based on the difference in the origin and consequences of the losses.[6] *Fundamental risks* involve losses that are impersonal in origin and consequence. They are group risks caused, for the most part, by economic, social, and political phenomena although they may result from physical occurrences. They affect large segments or even all of the population. *Particular risks* involve losses that arise out of individual events and are felt by individuals rather than by the entire group. They may be static or dynamic. Unemployment, war, inflation, earthquakes, and floods are all fundamental risks. The burning of a house and the robbery of a bank are particular risks.

Since fundamental risks are caused by conditions more or less beyond the control of the individuals who suffer the losses and since they are not the fault of anyone in particular, it is held that society rather than the individual has a responsibility to deal with them. Although some fundamental risks are dealt with through private insurance,[7] usually some form of social insurance or government transfer program is used to deal with fundamental risks. Unemployment and occupational disabilities are fundamental risks treated through social insurance. Flood damage or earthquakes make a district a disaster area eligible for federal funds.

In the final analysis, whether a risk is considered fundamental or particular depends on current public opinion concerning the responsibility for the causes and consequences of the risk. In the aftermath of the terrorist attack on the World Trade Center on September 11, 2001, Congress and the insurance industry debated the question of whether terrorist attacks are a fundamental or particular risk. Reinsurers, the insurers that provide insurance to insurance companies, announced their intent to exclude acts of terrorism from the coverage they provide to other insurers. Faced with the loss of backup coverage, the insurers that deal with the public developed an endorsement for their policies excluding loss from terrorist acts. In response to these developments, Congress established a federal terrorism reinsurance program in November 2002.

Particular risks are considered to be the individual's own responsibility, inappropriate subjects for action by society as a whole. They are dealt with by the individual through the use of insurance, loss prevention, or some other technique.

Pure and Speculative Risks One of the most useful distinctions is that between pure risk and speculative risk.[8] *Speculative risk* describes a situation

[6] The distinction between fundamental and particular risks is based on C. A. Kulp's discussion of risk, which he referred to as "hazard". See C. A. Kulp, *Casualty Insurance*, 3rd ed. (New York: Ronald Press, 1956), pp. 3, 4.

[7] For example, earthquake insurance is available from private insurers in most parts of the country, and flood insurance is frequently included in contracts covering movable personal property. Flood insurance on real property is available through private insurers only on a limited basis.

[8] Although the distinction between pure and speculative risk had been introduced earlier, Albert H. Mowbray formalized the distinction. See Albert H. Mowbray and Ralph H. Blanchard, *Insurance, Its Theory and Practice in the United States*. 5th ed. (New York: McGraw-Hill, 1961), pp. 6, 7.

in which there is a possibility of loss but also a possibility of gain. Gambling is a good example of a speculative risk. In a gambling situation, risk is deliberately created in the hope of gain. The student wagering $10 on the outcome of Saturday's game faces the possibility of loss, but this is accompanied by the possibility of gain. The entrepreneur or capitalist faces speculative risk in the quest for profit. The investment made may be lost if the product is not accepted by the market at a price sufficient to cover costs, but this risk is borne in return for the possibility of profit. The term *pure risk,* in contrast, is used to designate those situations that involve only the chance of loss or no loss. One of the best examples of pure risk is the possibility of loss surrounding the ownership of property. The person who buys an automobile, for example, immediately faces the possibility that something may happen to damage or destroy the automobile. The possible outcomes are loss or no loss.

The distinction between pure and speculative risks is an important one because normally only pure risks are insurable. Insurance is not concerned with the protection of individuals against those losses arising out of speculative risks. Speculative risk is voluntarily accepted because of its two-dimensional nature, which includes the possibility of gain. Not all pure risks are insurable, and a further distinction between insurable and uninsurable pure risks may be made. A discussion of this difference will be delayed until Chapter 2.

Systemic Risk The global financial crisis of 2008 to 2009 has increased attention on another category of risk known as systemic risk. Generally, systemic risk refers to a risk that can affect an entire system, rather than just one entity. In economics, the term is often used where a shock, such as the failure of a single entity, could cause cascading effects and severely disrupt the financial system. For example, in March 2008, Bear Stearns, the fifth largest U.S. investment bank, was threatened with failure. Concerned about the potential for contagion and disruption in the financial markets, the Federal Reserve and U.S. Treasury arranged for JP Morgan Chase to acquire Bear Stearns with financial assistance from the Federal Reserve Bank of New York (NY Fed). In September 2008, the NY Fed agreed to lend up to $85 billion to prevent the bankruptcy of American International Group (AIG). Over the next several years, the U.S. Treasury and the Federal Reserve provided additional support to financial institutions, primarily banks. Public outrage has led to a number of changes in regulation to address systemic risk, particularly the problem of institutions that are "too big to fail" or TBTF.

Classifications of Pure Risk Although it would be impossible in this book to list all the risks confronting an individual or business, we can briefly outline the nature of the various pure risks that we face. For the most part, these are static risks. Pure risks that exist for individuals and business firms can be classified under one of the following:

1. *Personal risks*. These consist of the possibility of loss of income or assets as a result of the loss of the ability to earn income. In general, earning power is subject to four perils: (a) premature death, (b) dependent old age, (c) sickness or disability, and (d) unemployment.
2. *Property risks*. Anyone who owns property faces property risks because such possessions can be destroyed or stolen. Property risks embrace two distinct types of loss: *direct loss* and *indirect* or "consequential" *loss*. Direct loss is the simplest to understand: If a house is destroyed by fire, the owner loses the value of the house. This is a direct loss. However, in addition to losing the value of the building, the property owner no longer has a place to live. During the time required to rebuild the house, it is likely that the owner will incur additional expenses living somewhere else. This loss of use of the destroyed asset is an indirect, or consequential, loss. An even better example is the case of a business firm. When a firm's facilities are destroyed, it loses the value of those facilities and the income that would have been earned through their use. Property risks, then, can involve two types of losses: (a) the loss of the property and (b) loss of use of the property resulting in lost income or additional expenses.
3. *Liability risks*. The basic peril in the liability risk is the unintentional injury of other persons or damage to their property through negligence or carelessness; however, liability may result from intentional injuries or damage. Under our legal system, the laws provide that one who has injured another, or damaged another's property through

negligence or otherwise, can be held responsible for the harm caused. Liability risks, therefore, involve the possibility of loss of present assets or future income as a result of damages assessed or legal liability arising out of either intentional or unintentional torts, or invasion of the rights of others.

4. *Risks arising from failure of others*. When another person agrees to perform a service for you, he or she undertakes an obligation that you hope will be met. When the person's failure to meet this obligation would result in your financial loss, risk exists. Examples of risks in this category would include failure of a contractor to complete a construction project as scheduled, or failure of debtors to make payments as expected. With the development of the Internet, the rapid evolution of e-commerce, and the increased trend toward outsourcing by big businesses, a variety of new risks relating to the failure of others have emerged.

THE BURDEN OF RISK

Regardless of the manner in which risk is defined, the greatest burden in connection with risk is that some losses will occur. When a house is destroyed by fire, money is stolen, or a wage earner dies, there is a financial loss. When someone is negligent and that negligence results in injury to a person or damage to property, there is a financial loss. These losses are the primary burden of risk and the primary reason that individuals attempt to avoid risk or alleviate its impact.

In addition to the losses, there are other detrimental aspects of risk. The uncertainty as to whether the loss will occur requires the prudent individual to prepare for its possible occurrence. In the absence of insurance, one way this can be done is to accumulate a reserve fund to meet the losses if they do occur.[9] Accumulation of such a reserve fund carries an opportunity cost, for funds must be available at the time of the loss and must, therefore, be held in a highly liquid state. The return on such funds will presumably be less than if they were put to alternative uses. If each property owner accumulates his or her own fund, the amount of funds held in such reserves will be greater than if the funds are amassed collectively.

Furthermore, the existence of risk may have a deterrent effect on economic growth and capital accumulation. Progress in the economy is determined to a large extent by the rate of capital accumulation, but the investment of capital involves risk that is distasteful. Investors as a class will incur the risks of a new undertaking only if the return on the investment is sufficiently high to compensate for the dynamic and static risks. The cost of capital is higher in those situations in which the risk is greater, and the consumer must pay the resulting higher cost of the goods and services or they will not be forthcoming.

Finally, the uncertainty connected with risk usually produces a feeling of frustration and mental unrest. This is particularly true in the case of pure risk. Speculative risk is attractive to many individuals. The gambler obviously enjoys the uncertainty connected with wagering more than the certainty of not gambling otherwise he or she would not gamble. But the possibility of gain or profit, which exists only in the speculative risk category, is attractive. In the case of pure risk, where there is no compensating chance of gain, risk is distasteful. Most people hope that misfortunes will not befall them and that their present state of well-being will continue. While they hope that no misfortune will occur, people are nevertheless likely to worry about possible mishaps. This worry, which induces a feeling of diminished well-being, is an additional burden of risk.

THE GROWING NUMBER AND VARIETY OF PURE RISKS

From the dawn of civilization, humans have faced the possibility of loss. Our ancestors confronted an environment characterized by incredible perils and hazards. The earliest perils giving rise to risk were those of nature and predators (including savage beasts and human predators). Humans learned to anticipate and prepare for adversity, collectively and individually. They built shelter and they saved for the

[9] One great danger of this approach is the possibility that a loss may occur before a sufficient fund has been accumulated.

future. This provided protection from the elements and savage beasts, but it created new risks. Structures constructed for protection were vulnerable to damage, and saving meant accumulation of wealth, which inevitably created new risks. Those who saved were exposed to the predatory inclinations of those who did not (an exposure that continues to the present day). Despite progress in learning how to deal with risks, the challenge of dealing with risk continued to grow. As new ways of addressing risk are found, new risks appear, often as a result of progress.

Harnessing energy has made life easier, but it has created new risks. Until about 200 years ago, the major sources of energy were muscle (from humans and animals), wind, and water, and the risks associated with energy sources were modest. Since the early 1800s, advances in technology have increased the sources of energy available to humankind, and with each new source have come new risks. For example, the Industrial Revolution witnessed the application of steam to the production process, and with steam came new risks. The early steam engines were hazardous mechanisms and explosions were common. Steam power produced the risk of explosion, and it created other risks as well. Steam engines were far less likely to stop in an accident; they continued to grind away, oblivious to the hands and arms that got entangled in gears. As with the application of steam, the introduction of electric power, the internal combustion engine, and nuclear power have created new risks.

One can argue that the invention of the legal system was an effort to address risk. By defining individual rights and responsibilities, the legal system created a framework whose basic function was to protect those rights. At the same time, the legal system became a source of risk by creating a system in which those who are injured or damaged by others may seek compensation. As the concept of rights and responsibilities has developed, new causes of action have emerged. Many of the current legal risks were unknown a generation ago. These include potential liability for a profusion of new transgressions: environmental damage, discrimination in employment, sexual harassment, and violence in the workplace.

The most recent expansion of risks we face, like many previous expansions, is traceable to advances in technology. The information age in which we are immersed embodies a variety of new exposures. Information has value, and as such, its exposure to loss represents risk. Information has, of course, always had value. What has changed is the way information is collected, sorted, and communicated electronically. In an earlier era, when information was recorded on hard media, it was easier to protect. Equally important, it was easy to detect when the information security system had been breached. The interconnectivity of the Internet and electronic communication generally exposes valuable information to loss in ways not previously imagined, and businesses and individuals are increasingly worried about this *cyber risk*.

One example of cyber risk is *cyber crime*. Pirates and thieves have been a constant source of potential loss throughout history. Hackers who commit vandalism and electronic larceny have replaced the bandits and pirates who threatened early traders.[10] Modern thieves steal not only assets but sometimes one's identity. According to the Federal Bureau of Investigation (FBI), *identity theft* is the fastest growing white-collar crime in the nation.[11]

With each advance in technology, new risks arise. Because many of the old risks remain, the inventory of risks that must be addressed increases geometrically. Daily newspapers indicate the simultaneous threat of new-age hazards and age-old perils of nature. The hazards posed by the nuclear age were demonstrated by the incident at the Three Mile Island nuclear facility in Pennsylvania in 1979 and the accident at the Soviet Union's Chernobyl plant in April 1987. The destruction that can be wreaked

[10] In May 2013, the U.S. Department of Justice accused a global cyber crime ring of stealing $45 million by hacking into credit card processing firms and withdrawing funds from ATMs in 27 countries. Astonishingly, $40 million was stolen in a 10-hour period, making it one of the largest bank heists ever.

[11] In 2003, Congress enacted amendments to the Fair Credit Reporting Act to provide consumers with some protection against indentity theft. Nonetheless, identity theft continues to be a problem, and it is estimated that millions of Americans are victims each year. In early 2005, a number of firms reported their data had been stolen or misplaced, heightening concerns about possible identity theft. In February 2005, ChoicePoint disclosed that it had sold sensitive information on at least 166,000 people to a Nigerian con artist posing as a debt collector. The Federal Trade Commission (FTC) fined ChoicePoint $10 million and ordered it to set aside $5 million to aid the victims of its error.