



# Financial Economics

Frank J. Fabozzi | Edwin H. Neave | Guofu Zhou

---

---

# FINANCIAL ECONOMICS

Frank J. Fabozzi

Edwin H. Neave

Guofu Zhou

常州大学图书馆  
藏书章



WILEY

John Wiley & Sons, Inc.

---

---

Vice President/Publisher:	George Hoffman
Acquisitions Editor:	Lacey Vitetta
Project Editor:	Jennifer Manias
Editorial Assistant:	Erica Horowitz
Associate Director of Marketing:	Amy Scholz
Marketing Assistant:	Courtney Luzzi
Production Manager:	Janis Soo
Assistant Production Editor:	Pauline Tan
Designer:	Seng Ping Ngieng

This book was set in 10/12 Times Roman by MPS Limited, a Macmillan Company and printed and bound by Courier Westford.

This 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](http://www.wiley.com/go/citizenship).

Copyright © 2012, John Wiley & Sons, Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except as permitted under Sections 107 or 108 of the 1976 United States Copyright Act, without either the prior written permission of the Publisher, or authorization through payment of the appropriate per-copy fee to the Copyright Clearance Center, Inc. 222 Rosewood Drive, Danvers, MA 01923, website [www.copyright.com](http://www.copyright.com). Requests to the Publisher for permission should be addressed to the Permissions Department, John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774, (201)748-6011, fax (201)748-6008, website <http://www.wiley.com/go/permissions>.

Evaluation copies are provided to qualified academics and professionals for review purposes only, for use in their courses during the next academic year. These copies are licensed and may not be sold or transferred to a third party. Upon completion of the review period, please return the evaluation copy to Wiley. Return instructions and a free of charge return mailing label are available at [www.wiley.com/go/returnlabel](http://www.wiley.com/go/returnlabel). If you have chosen to adopt this textbook for use in your course, please accept this book as your complimentary desk copy. Outside of the United States, please contact your local sales representative.

***Library of Congress Cataloging-in-Publication Data***

Fabozzi, Frank J.

Financial economics/Frank J. Fabozzi, Edwin H. Neave and Guofu Zhou.

p. cm.

Includes index.

ISBN 978-0-470-59620-3 (hardback)

1. Finance. 2. Economics. I. Neave, Edwin H. II. Zhou, Guofu. III. Title.

HG173.F28 2012

332—dc23

2011022695

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1





---

## PREFACE

There are many excellent finance textbooks for undergraduate and MBA courses. However, to us those textbooks could benefit from offering more economic reasoning and from showing how that reasoning derives from theoretical models. On the other hand, books at the doctoral level can be too detailed and unnecessarily complex. Hence, this textbook attempts to fill a gap by providing rigorous coverage aimed at assisting undergraduate and master's level students to understand better the principles and practical application of financial economic theory. In addition, the book can serve as a supplemental reference for doctoral students in economics and finance, as well as for practitioners who are interested in knowing more about the theory and intuition behind many common practices in finance. The book selectively covers recent research findings and presents them within a structured framework. In short, the book focuses on economic principles and on putting these principles to work in the various fields of finance—financial management, investment management, risk management, and asset and derivatives pricing.

After our introductory chapter sketches the book's approach, we organize our survey in eight parts. The traditional findings of neoclassical financial economics, the subject of Part I, examine finance in a certainty world with a perfect capital market. In Part II we sketch the real-world institutional setting of financial economics, describing the essential elements of a modern financial system and providing a unified theory of how those elements function in relation to each other and to the rest of the economy. Modern financial economics is largely a study of risk management, and Part III examines tools for measuring and coping with risk. Part IV, concerned with portfolio theory and its recent developments, examines the selection and pricing of risky assets, particularly corporate securities. Continuing to examine risk management, Part V is concerned with the nature and pricing of derivative instruments. Research in modern financial economics is progressing well beyond the findings of its original neoclassical perspectives, and in recognition of this progress, Part VI examines the effects of capital market imperfections and limits to arbitrage. Part VII considers capital structure decisions in the presence of capital market imperfections, while the final part of this book, Part VIII, examines the tasks of making capital budgeting decisions under conditions of risk. Background information regarding both institutional aspects of finance and a variety of technical issues is presented in a series of 16 web appendices. Web-Appendix A to P are online only at [www.wiley.com/college/fabozzi](http://www.wiley.com/college/fabozzi) and referred to as web-Appendix throughout this book.

In order to provide additional detail, we now consider the contents of each of the eight parts. In our presentation of neoclassical financial economics in Part I, we examine the theory of consumer financial decisions, how wealth is created by investing in productive opportunities, how investors value firms, the nature and importance of firms' financing decisions in a perfect capital market, as well as the nature and importance of firms' investment decisions in the same neoclassical environment. This part intends particularly to emphasize the great contributions of neoclassical financial analysis, both as intellectual contributions in their own right and as a set of guidelines to financial decision making in the more complex world of market imperfections. Although financial economics is sometimes discussed as if there were on the one hand a theoretical world divorced from reality, and on the other a real world in which actual finance is studied, we contend that the two form a complementary whole. In our view, the road maps provided by neoclassical analysis provide the structure that has and will continue to guide both further research and practical applications.

In our discussion of a modern financial system's institutional nature, Part II, we introduce the notion of financial governance. We present a theory of financial system organization arguing that the three main types of financial governance—financial markets, financial intermediaries, and the internal financial decisions administered by firms—are complementary ways of overseeing financial arrangements. In the complex world beyond the domain of neoclassical economics, all three administrative mechanisms are needed to carry out financial system activity and to monitor that activity effectively. Indeed, recognizing how these mechanisms complement each other is necessary to progress beyond the findings of neoclassical economics to a broader understanding of how applied financial decisions are made in practice, as well as of their implications for the firms and investors who make them.

In our coverage of the tools for coping with risk in Part III, we discuss topics that include the microeconomic foundations of financial economics, the roles of both contingent claims analysis and contingency strategies, the nature of risk and risk management, and the recently burgeoning field of choosing risk measures.

The selection and pricing of risky assets in Part IV begins with the topics of mean-variance portfolio choice and the capital asset pricing model, then turns to the arbitrage pricing theory and factor models. Next, the guiding principles of asset pricing theory are examined, closing with a review of how these theories contribute to our current understanding of pricing corporate securities.

Part V examines the nature and valuation of derivative instruments—both derivatives with linear payoff functions (such as forward and futures contracts) and more complex types of derivatives with nonlinear payoff functions (such as options). We show how both types of contracts can be valued by assuming the absence of arbitrage opportunities. These valuation tasks can either be carried out directly or with the aid of the risk-neutral probabilities that the absence of arbitrage opportunities implies.

Although the first five parts of the book acknowledge and sketch out the roles of market imperfections, they recognize imperfections largely as requiring extensions and modifications of the neoclassical theory. Part VI turns explicitly to a more detailed recognition of capital market imperfections, the limits to arbitrage, and the detailed consequences of recognizing these complications.

The themes of recognizing and understanding complications presented by market imperfections are continued in Part VII. Here we consider why market

imperfections mean that capital structure decisions matter, and the kinds of decisions that are needed to cope with these complications. In addition, we consider the implications of making financing decisions in practice, as contrasted with their implications in a neoclassical environment. Finally, we examine the importance of financial contracting and contract terms for coping with different kinds of market imperfections. In its early days, neoclassical analysis assumed away these complications in order to develop an initial understanding of the complex financial world with which practice contends. In those earlier days, financial economics was necessarily concerned with getting the large-scale maps of the territory correct. Once those tasks had been accomplished, it became possible to grapple systematically with the effects of imperfections and hence to fill in the details of smaller-scale maps that fitted within the large-scale context.

Part VIII is a parallel to Part VII, focused this time on capital budgeting decisions rather than on capital structure issues. We consider capital expenditure plans in a risky world and the implications for capital budgeting decisions of recognizing project risk.

The web appendices provide both institutional and technical information. The first 10 appendices, Web-Appendices A through J, are concerned with institutional complications that arise in the practice of finance, and the remaining six appendices (Web-Appendices K through P) are concerned with topics of a mathematical background nature. All of the appendices are intended to provide supplementary information where we think it would be helpful, and to provide it in a form that does not distract the reader from the main presentation.

Most of the chapters in this book were written to be readily accessible to undergraduate students, and we believe that the remaining chapters are also accessible to those readers if they are willing to take on modest challenges. To us, the more challenging chapters are 12, 16, 24, and 25. We have included this material not only for the sake of completeness but also to give students a perspective on where we see the field of financial economics currently moving forward.

The material in the book lends itself to a number of different presentations. We provide the suitability of chapters for undergraduates and graduate students on the next page. Also provided is a list of selected chapters that can be used for various courses.

---

 LEVEL COVERAGE AND SUGGESTED USAGE BY TYPE OF COURSE
 

---

## Suitability

UT	Theory suitable for undergraduates
UA	Applications suitable for undergraduates
GT	Theory suitable for graduates
GA	Applications suitable for graduates

## Course

1	One semester undergraduate or introductory graduate course in financial economics
2	Two semester undergraduate course in financial economics
3	One semester undergraduate or introductory graduate course focusing on financial management
4*	One semester advanced undergraduate or advanced graduate course focusing on financial management
5	One semester undergraduate or introductory graduate course focusing on asset pricing and derivatives pricing
6*	One semester advanced undergraduate or advanced graduate course focusing on asset pricing and derivatives pricing fundamentals
7*	One semester quantitative finance course
8*	Introductory doctoral finance course

---

\* Assumes students are familiar with the fundamentals

Chapter	Course No.	1	2	3	4	5	6	7	8	
		Suitability								
1	Introduction	X	X	X	X	X	X	X	X	
	PART I: FINANCE IN A CERTAINTY WORLD WITH A PERFECT CAPITAL MARKET									
2	Consumer Financial Decisions	UT	X	X		X				
3	Creating Wealth by Investing in Productive Opportunities	UT	X	X		X				
4	How Investors Value Firms	UT	X	X		X				
5	Firm Financing Decisions in a Perfect Capital Market	UT	X	X		X		X		
6	Firm Investment Decisions	UT	X	X		X		X		
	PART II: FINANCIAL SYSTEM									
7	Financial Systems, Governance, and Organization	UA	X	X		X		X	X	
8	Market, Intermediary, and Internal Governance	UA	X	X		X		X	X	
	PART III: TOOLS FOR COPING WITH RISK									
9	The Microeconomic Foundations of Financial Economics	UT	X	X		X		X	X	
10	Contingent Claims and Contingent Strategies	UT	X	X		X		X	X	
11	Risk and Risk Management	UA	X			X		X	X	
12	On Choosing Risk Measures	GT				X		X	X	
	PART IV: SELECTION AND PRICING OF RISKY ASSETS									
13	Mean-Variance Portfolio Choice	UT	X	X		X		X	X	
14	Capital Asset Pricing Model	UT	X	X		X		X	X	
15	The APT and Factor Models	UT	X	X		X		X	X	
16	General Principles of Asset Pricing	GT				X		X	X	
17	Pricing Corporate Securities	GT	X			X		X	X	
	PART V: DERIVATIVE INSTRUMENTS									
18	Pricing Derivatives by Arbitrage: Linear Payoff Derivatives	UT	X	X		X		X	X	
19	Pricing Derivatives by Arbitrage: Nonlinear Payoff Derivatives	UT	X	X		X		X	X	







---

## ACKNOWLEDGMENTS

The idea for this book was proposed to us by George Lobell, former acquisitions editor of Blackwell. George argued the need for a book that focused on the principles of financial economics, fully using the mathematical and statistical training that economics students now acquire, and at the same time assisting those students with the practicalities of applying their economics training. George was especially keen on providing the students both with unusual intellectual challenges and with exciting new research results. We have attempted to achieve those goals.

George handed the reins to Lacey Vitetta, the acquisitions editor at Wiley who guided us to the completion of this project. Along the way she obtained helpful comments from the following reviewers:

Turan G. Bali, Baruch College  
Gerard Caprio, Williams College  
Martin Cherkes, Columbia University  
Ahmet Duran, University of Michigan-Ann Arbor  
Brian Henderson, George Washington University  
Thomas Jeitschko, Michigan State University  
Alexander Koch, Royal Holloway, University of London  
Lenny Kostovetsky, University of Rochester  
Alex Michaelides, London School of Economics  
Andrew Samwick, Dartmouth College  
Emanuela Scubba, Birkbeck University of London  
Koray D. Simsek, Sabanci University, Turkey  
Anne Villamil, University of Illinois at Urbana-Champaign  
Brian Wright, The University of Nottingham, China

There are end-of-chapter questions for each chapter. For a good number of chapters, these questions were prepared by graduate students who also provided the solutions, which appear in the book's *Solutions Manual*. In addition, the students provided us with helpful feedback and suggestions for improving the exposition in the chapters. These students and the chapters that they worked on are listed below:

Faye (Fei) Wu (New York University): Chapters 1–5  
Peter Kelly (Yale): Chapters 7 and 8  
Li Cai (University of Massachusetts): Chapters 9 and 12  
Chen Chang (New York University): Chapters 10 and 11  
Dashan Huang (Washington University at St. Louis): Chapters 13–16  
Chao Guo (New York University): Chapters 17 and 18  
Taym Moustapha (New York University): Chapters 20 and 21  
Jian Du (University of Massachusetts): Chapters 22–24  
Li (Luke) Tian (New York University): Chapters 25 and 26

We are grateful to Pamela P. Drake, Gray Ferguson Professor of Finance and Department Head at James Madison University, for allowing us to use the illustrations in Chapter 26 from her joint work with one of the authors and for coauthoring several of the web-appendices. We also thank Sergio M. Focardi, Professor of Finance at EDHEC Business School, for coauthoring Web-Appendix O.

Some of the earlier results presented in this book represent extracts from Edwin H. Neave and John C. Winton, *Financial Management: Theory and Strategies* published in 1982 by Prentice Hall. We are grateful to Prentice Hall and to John C. Winton for transferring their copyrights of the book to one of the present book's coauthors.

Frank J. Fabozzi, New Hope, Pennsylvania  
Edwin H. Neave, Kingston, Ontario  
Guofu Zhou, St. Louis, Missouri  
June 2011



---

## ABOUT THE AUTHORS

**Frank J. Fabozzi** is Professor of Finance at EDHEC Business School and a member of the EDHEC-Risk Institute. He held various professorial positions in finance at Yale University's School of Management from 1994 to 2011 and from 1986 to 1992 was a visiting professor of finance and accounting at MIT's Sloan School of Management. He earned a doctorate in economics from the City University of New York in 1972. In 2002, he was inducted into the Fixed Income Analysts Society's Hall of Fame and is the 2007 recipient of the CFA Institute's C. Stewart Sheppard Award. He has authored and edited numerous books in finance. His research papers have been published in *Journal of Finance*, *Journal of Financial and Quantitative Analysis*, *Econometric Theory*, *Econometric Journal*, *Operations Research*, *Journal of Banking and Finance*, *Journal of Economic Dynamics and Control*, and *European Financial Management*.

**Edwin H. Neave**, B. Comm., Ph. D., is a Professor Emeritus in the Queen's University School of Business. He has held the positions of Assistant Professor, Northwestern University; Bank of Montreal Professor of Business and Finance, School of Business, Queen's University; Director, Queen's Financial Economics, Queen's University; and Professor of Economics, Queen's University. A former Finance Departmental Editor for *Management Science*, he is the author of almost 60 articles and 17 books focusing on asset pricing, derivatives pricing, financial system theory, and financial system practice. His book *Financial Systems: Principles and Organisation* (Routledge) has been translated into Chinese and published by Renmin University Press, Beijing. In recognition of his banking education programs being used in more than 40 countries, he has been appointed an Honorary Fellow of the Institute of Canadian Bankers, being the only academic ever to receive this honor.

**Guofu Zhou** is Frederick Bierman and James E. Spears Professor of Finance at Olin Business School of Washington University in St. Louis. He has a BS degree from Chengdu College of Geology, China, and a PhD in economics from Duke University. Prior to his PhD studies, he was interested in mathematics with publications in number theory, function theory, and numerical solutions to partial differential equations. His current research interests are primarily in asset pricing and investments. He has published numerous papers in *Journal of Financial Economics*, *Review of Financial Studies*, *Journal of Financial and Quantitative Analysis*, and *Journal of Finance*, as well as in industry journals such as *Journal of Portfolio Management* and *Financial Analyst Journal*. He has won awards for teaching MBA and MSF students and for his research.





---

# TABLE OF CONTENTS

Preface		ix
Acknowledgments		xv
About the Authors		xvii
<b>CHAPTER 1</b>	Introduction	1
<b>PART I</b>	<b>FINANCE IN A CERTAINTY WORLD WITH A PERFECT CAPITAL MARKET</b>	<b>13</b>
<b>CHAPTER 2</b>	Consumer Financial Decisions	15
<b>CHAPTER 3</b>	Creating Wealth by Investing in Productive Opportunities	31
<b>CHAPTER 4</b>	How Investors Value Firms	50
<b>CHAPTER 5</b>	Firm Financing Decisions in a Perfect Capital Market	78
<b>CHAPTER 6</b>	Firm Investment Decisions	102
<b>PART II</b>	<b>FINANCIAL SYSTEM</b>	<b>119</b>
<b>CHAPTER 7</b>	Financial Systems, Governance, and Organization	121
<b>CHAPTER 8</b>	Market, Intermediary, and Internal Governance	151
<b>PART III</b>	<b>TOOLS FOR COPING WITH RISK</b>	<b>177</b>
<b>CHAPTER 9</b>	The Microeconomic Foundations of Financial Economics	179
<b>CHAPTER 10</b>	Contingent Claims and Contingency Strategies	199
<b>CHAPTER 11</b>	Risk and Risk Management	216
<b>CHAPTER 12</b>	On Choosing Risk Measures	234
<b>PART IV</b>	<b>SELECTION AND PRICING OF RISKY ASSETS</b>	<b>255</b>
<b>CHAPTER 13</b>	Mean-Variance Portfolio Choice	257
<b>CHAPTER 14</b>	Capital Asset Pricing Model	287
<b>CHAPTER 15</b>	The APT and Factor Models	317
<b>CHAPTER 16</b>	General Principles of Asset Pricing	339
<b>CHAPTER 17</b>	Pricing Corporate Securities	366

<b>PART V</b>	<b>DERIVATIVE INSTRUMENTS</b>	<b>383</b>
<b>CHAPTER 18</b>	Pricing Derivatives by Arbitrage: Linear Payoff Derivatives	385
<b>CHAPTER 19</b>	Pricing Derivatives by Arbitrage: Nonlinear Payoff Derivatives	414
<b>PART VI</b>	<b>CAPITAL MARKET IMPERFECTIONS AND THE LIMITS TO ARBITRAGE</b>	<b>449</b>
<b>CHAPTER 20</b>	Capital Market Imperfections and Financial Decision Criteria	451
<b>CHAPTER 21</b>	Impediments to Arbitrage	479
<b>PART VII</b>	<b>CAPITAL STRUCTURE DECISIONS IN IMPERFECT CAPITAL MARKETS</b>	<b>499</b>
<b>CHAPTER 22</b>	When Capital Structure Decisions Matter	501
<b>CHAPTER 23</b>	Financing Decisions in Practice	522
<b>CHAPTER 24</b>	Financial Contracting and Deal Terms	545
<b>PART VIII</b>	<b>INCORPORATING RISK IN CAPITAL BUDGETING DECISIONS</b>	<b>577</b>
<b>CHAPTER 25</b>	Capital Expenditure Plans in a Risky World	579
<b>CHAPTER 26</b>	Evaluating Project Risk in Capital Budgeting	607
<b>SUBJECT INDEX</b>		<b>639</b>
<b>AUTHOR INDEX</b>		<b>650</b>
<b>FINANCE APPENDICES</b>		
<b>WEB-APPENDIX A</b>	Deal Terms	653
<b>WEB-APPENDIX B</b>	Corporate Debt Funding Instruments	658
<b>WEB-APPENDIX C</b>	Investment Bankers and the Issuance of Securities	665
<b>WEB-APPENDIX D</b>	Credit Risk	668
<b>WEB-APPENDIX E</b>	Financial Statements	677
<b>WEB-APPENDIX F</b>	Financial Ratio Analysis	682
<b>WEB-APPENDIX G</b>	Estimating Cash Flows of Capital Budgeting Projects	692
<b>WEB-APPENDIX H</b>	Merger and Acquisition Strategies	697
<b>WEB-APPENDIX I</b>	Conglomerates as a Means of Overcoming Capital Market Imperfections	701
<b>WEB-APPENDIX J</b>	Lease Financing	705

**MATHEMATICAL AND STATISTICAL APPENDICES**

<b>WEB-APPENDIX K</b>	Taylor Series Approximation	716
<b>WEB-APPENDIX L</b>	Some Elementary Concepts Involving Probability	717
<b>WEB-APPENDIX M</b>	Continuous Probability Distributions	722
<b>WEB-APPENDIX N</b>	Continuous Interest Rates	730
<b>WEB-APPENDIX O</b>	Fundamentals of Matrix Algebra	733
<b>WEB-APPENDIX P</b>	Principal Component Analysis in Finance	745
<b>SUBJECT INDEX (WEB-APPENDIX A TO P)</b>		<b>751</b>
<b>AUTHOR INDEX (WEB-APPENDIX A TO P)</b>		<b>754</b>

\* Web-Appendix A to P are online only—please go to [www.wiley.com/college/fabozzi](http://www.wiley.com/college/fabozzi)

# INTRODUCTION

*T*his book presents the foundations of financial economics, a specialized area within economics that utilizes many of the analytical tools developed in the field of microeconomics. Common to both financial economics and microeconomics is a theoretical framework for analyzing the decisions by individuals and managers of firms, and also the interplay of these decisions on the prices of financial assets. In studying these decisions, both fields look at the allocation of limited resources to optimize some measure, with the optimization subject to some constraints. In fact, because of the commonality of topics and tools in the chapters of this book, some consider financial economics a specialized area within microeconomics rather than as a separate branch of economics.

In this chapter, we provide a broad overview of the major types of decisions with which the field of financial economics is concerned. We begin this chapter with the decisions made by individuals and managers, along with the role of markets in which these agents transact. These decisions fall into the area of microeconomics. Then we look at the same kinds of decisions and markets that fall under the purview of financial economics.

---

## 1.1 MICROECONOMIC THEORY: INDIVIDUALS, MANAGERS, AND MARKETS

Microeconomic theory provides a theoretical framework for analyzing the economic behavior of individuals who are regarded either as consumers of products or as managers of firms. Let's look at the types of decisions these agents make.

*Consumer choice* describes the economic behavior of consumers who, based on their preferences, allocate an expenditure budget amongst alternative products. Those preferences are described mathematically by the individual's *utility function*. Consumer choice theory states that individuals seek to maximize their utility function subject to a budget constraint. It is from this theory that the individual's demand curve for products is derived and, through aggregation, the market's demand curve is obtained. Individuals are assumed to take prices as given when they address these maximization problems.



Product prices are determined by the interaction of market demand and market supply. Consumer choice theory provides the framework for obtaining the demand for products, both for individual consumers and, by aggregation, for the markets in which consumers purchase the products. The supply of products is determined by the decisions made by managers of firms, and market supply is the aggregate of firms' individual supply functions.

The branch of microeconomics that looks at how managers should make their operating decisions is called *production theory*. Again, the decision-making agent, the manager in this case, is assumed to maximize an objective function subject to constraints. In production theory, the objective function is profits and the constraints are the production inputs and production technology. In classical production theory it is often assumed that managers cannot influence the prices of inputs and outputs.

Microeconomic theory then puts demand and supply together to analyze equilibrium in both the markets for production inputs (such as labor) and the product markets. Microeconomics is sometimes referred to as *price theory* because it explains how product prices and production costs are determined in equilibrium.

### 1.1.1 Risk and Uncertainty and Economic Decisions

The scope of microeconomic theory has been extended to real-world situations in which individuals and managers face either risk or uncertainty. In the first half of the eighteenth century, Daniel Bernoulli, a mathematician known for his work in probability and statistics, introduced risk in the context of the theory of choice.<sup>1</sup> Almost 200 years later, in his book *Risk, Uncertainty and Profit*, Frank Knight suggested that both risk and uncertainty are important in economics.<sup>2</sup> Moreover, he differentiated between “risk” and “uncertainty,” the former being defined as circumstances where the decision maker is able to assign probabilities to the potential outcome of the decision whereas the latter is one in which probabilities cannot usefully be assigned (often referred to as “Knightian uncertainty”).

Between 1921 and 1944, several economists began to recognize the importance of risk in economic decisions involving profit maximization, production planning, inventory management, firm financing decisions, and investment decisions. For example, Sir John Hicks, the 1972 corecipient of the Nobel Prize in Economic Sciences,<sup>3</sup> was one of several economists who saw the need to separate the attitudes of individuals towards risk from their preferences for different outcomes.<sup>4</sup> However, the

<sup>1</sup> See Bernoulli (1738).

<sup>2</sup> Knight (1921).

<sup>3</sup> The official title for this most prestigious award in economics has changed over the years. Presently, it is the “Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.” Previously, it was the “Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel.” Other translations of the official title, which in Swedish is *Sveriges riksbanks pris i ekonomisk vetenskap till Alfred Nobels minne*, are “Prize in Economic Science dedicated to the memory of Alfred Nobel,” “Prize in Economic Science,” “Prize in Economic Science in Memory of Alfred Nobel,” and “Prize in Economic Sciences in Memory of Alfred Nobel.” We shall simply refer to it as the Nobel Prize in Economic Sciences and to the winner of this prestigious award as a Nobel Laureate.

<sup>4</sup> See Hicks (1931).