Contents

About the Authors 8
Preface 9
Walkthrough 24

Part *I* **Money and the Financial System** 43

CHAPTER 1 An Introduction to Money and the Financial System 44
The Six Parts of the Financial System 44
The Five Core Principles of Money and Banking 47
Core Principle 1: Time Has Value 47
Core Principle 2: Risk Requires Compensation 47
Core Principle 3: Information Is the Basis for Decisions 48
Core Principle 4: Markets Determine Prices and Allocate Resources 49
Core Principle 5: Stability Improves Welfare 50
Special Features of This Book 50
Your Financial World 50
Applying the Concept 52
Lessons from the Crisis 52
In the News 52
Tools of the Trade 54
The Organization of This Book 54

Learning Tools
Your Financial World: Guard Your Identity 51

Terms 55
Chapter Lessons 55
Conceptual Problems 56
Analytical Problems 57
Appendix to Chapter 1: Measuring Economic Activity, Prices, and the Inflation Rate 58

CHAPTER 2 Money and the Payments System 61
Money and How We Use It 62
Means of Payment 62
Unit of Account 62
Store of Value 63
The Payments System 64
Commodity and Fiat Monies 64
Checks 66
Electronic Payments 69

The Future of Money 71
Measuring Money 72

Learning Tools

Your Financial World: Debit Cards versus Credit Cards 63
Your Financial World: Paper Checks Become Digital Images 68
Lessons from the Crisis: Market Liquidity, Funding Liquidity, and Making Markets 70
In the News: Dad, Can You Text Me $200? 72
Tools of the Trade: Consumer Price Indices in the U.S. and Europe 76
Applying the Concept: Where Are All Those $100 Bills? 77

Terms 79
Chapter Lessons 80
Conceptual Problems 80
Analytical Problems 81

CHAPTER 3 **Financial Instruments, Financial Markets, and Financial Institutions 83**

Financial Instruments 85
Uses of Financial Instruments 85
Characteristics of Financial Instruments: Standardization and Information 86
Underlying versus Derivative Instruments 89
A Primer for Valuing Financial Instruments 89
Examples of Financial Instruments 90
Financial Markets 92
The Role of Financial Markets 92
The Structure of Financial Markets 93
Characteristics of a Well-Run Financial Market 100
Financial Institutions 102
The Role of Financial Institutions 102
The Structure of the Financial Industry 103

Learning Tools

Lessons from the Crisis: Leverage 87
Your Financial World: Disability Income Insurance 91
Tools of the Trade: Trading in Financial Markets 94
In the News: Lessons of the Financial Crisis—One Year Later 98
Lessons from the Crisis: Interbank Lending 101
Lessons from the Crisis: Shadow Banks 103
Your Financial World: Shop for a Mortgage 105

Terms 106
Chapter Lessons 106
Conceptual Problems 107
Analytical Problems 108

Part II Interest Rates, Financial Instruments, and Financial Markets 110

CHAPTER 4 Future Value, Present Value, and Interest Rates 111

Valuing Monetary Payments Now and in the Future 112

Future Value and Compound Interest 112

Present Value 116

Applying Present Value 120

Internal Rate of Return 121

Bonds: The Basics 124

Real and Nominal Interest Rates 128

Learning Tools

Your Financial World: How Long Does Your Investment Take to Double? 115

Lessons from the Crisis: Risk Taking and the Search for Yield 117

Tools of the Trade: Computing Compound Annual Rates 120

Your Financial World: Should You Buy a New Car Now or Wait? 121

Applying the Concept: Early Retirement 123

In the News: Economic Scene: Pentagon Shows That It Doesn't Always Pay to Take the Money and Run 124

Your Financial World: Pay Off Your Credit Card Debt as Fast as You Can 129

Applying the Concept: High Interest Rates, Low Interest Rates 131

Terms 132

Chapter Lessons 132

Conceptual Problems 133

Analytical Problems 134

Appendix to Chapter 4: The Algebra of Present-Value Formulas 136

CHAPTER 5 Understanding Risk 138

Defining Risk 139

Measuring Risk 140

Possibilities, Probabilities, and Expected Value 140

Measures of Risk 143

Risk Aversion, the Risk Premium, and the Risk-Return Trade-off 151

Sources of Risk: Idiosyncratic and Systematic Risk 152

Reducing Risk through Diversification 154

Hedging Risk 154

Spreading Risk 155

Learning Tools

Applying the Concept: It's Not Just Expected Return That Matters 141

Applying the Concept: Country Risk 145

Tools of the Trade: The Impact of Leverage on Risk 148

Lessons from the Crisis: Systemic Risk 150

Your Financial World: Your Risk Tolerance 153
In the News: How to Achieve Effective Portfolio Diversification 156

Terms 159
Chapter Lessons 159
Conceptual Problems 160
Analytical Problems 161
Appendix A to Chapter 5: A Quick Test to Measure Investment Risk Tolerance 163
Appendix B to Chapter 5: The Mathematics of Diversification 165

CHAPTER 6 **Bonds, Bond Prices, and the Determination of Interest Rates 167**
Bond Prices 168
Zero-Coupon Bonds 168
Fixed-Payment Loans 169
Coupon Bonds 169
Consols 170
Bond Yields 171
Yield to Maturity 171
Current Yield 172
Holding Period Returns 173
The Bond Market and the Determination of Interest Rates 175
Bond Supply, Bond Demand, and Equilibrium in the Bond Market 175
Factors That Shift Bond Supply 179
Factors That Shift Bond Demand 180
Understanding Changes in Equilibrium Bond Prices and Interest Rates 183
Why Bonds Are Risky 184
Default Risk 186
Inflation Risk 188
Interest-Rate Risk 189

Learning Tools
Your Financial World: Know Your Mortgage 170
Tools of the Trade: Reading the Bond Page 176
Your Financial World: Understanding the Ads in the Newspaper 182
Applying the Concept: When Russia Defaulted 185
Applying the Concept: Securitization 187
Your Financial World: Inflation-Beating Bonds: A Global Phenomenon 188
In the News: Revival in 'Private-Label' Mortgage Securities? 190

Terms 192
Chapter Lessons 192
Conceptual Problems 193
Analytical Problems 194

CHAPTER 7 The Risk and Term Structure of Interest Rates 196
Ratings and the Risk Structure of Interest Rates 197
Bond Ratings 197
Commercial Paper Ratings 200
The Impact of Ratings on Yields 202
Differences in Tax Status and Municipal Bonds 204
The Term Structure of Interest Rates 206
The Expectations Hypothesis 206
The Liquidity Premium Theory 210
The Information Content of Interest Rates 212
Information in the Risk Structure of Interest Rates 212
Information in the Term Structure of Interest Rates 213

Learning Tools
Lessons from the Crisis: Subprime Mortgages 199
Lessons from the Crisis: Rating Agencies 200
Your Financial World: Your Credit Rating 204
Lessons from the Crisis: Asset-Backed Commercial Paper 205
Tools of the Trade: Reading Charts 210
Applying the Concept: The Flight to Quality 213
In the News: Banks Decline Yield Curve Invitation to Party On 216

Terms 218
Chapter Lessons 219
Conceptual Problems 219
Analytical Problems 220

CHAPTER 8 Stocks, Stock Markets, and Market Efficiency 222
The Essential Characteristics of Common Stock 223
Measuring the Level of the Stock Market 226
The Dow Jones Industrial Average 226
The Standard & Poor's 500 Index 227
Other U.S. Stock Market Indexes 229
World Stock Indexes 229
Valuing Stocks 230
Fundamental Value and the Dividend-Discount Model 231
Why Stocks Are Risky 233
Risk and the Value of Stocks 234
The Theory of Efficient Markets 236
Investing in Stocks for the Long Run 238
The Stock Market's Role in the Economy 240

Learning Tools
Your Financial World: Depository Receipts 225
Tools of the Trade: Reading Stock Indexes in the Business News 228
Your Financial World: Beware Percentage Changes 234

Applying the Concept: The Chinese Stock Market 236
Your Financial World: Should You Own Stocks? 239
In the News: Efficient Market Theory and the Crisis 240
Applying the Concept: What Was the Internet Bubble All About? 242

Terms 243
Chapter Lessons 243
Conceptual Problems 244
Analytical Problems 245

CHAPTER 9 **Derivatives: Futures, Options, and Swaps 247**
The Basics: Defining Derivatives 248
Forwards and Futures 249
Margin Accounts and Marking to Market 251
Hedging and Speculating with Futures 251
Arbitrage and the Determinants of Futures Prices 252
Options 255
Calls, Puts, and All That: Definitions 255
Using Options 256
Pricing Options: Intrinsic Value and the Time Value of the Option 258
The Value of Options: Some Examples 261
Swaps 263
Interest-Rate Swaps 263
Credit-Default Swaps 267

Learning Tools
Lessons from the Crisis: Centralized Counterparties and Systemic Risk 253
Your Financial World: Using Currency Options 257
Your Financial World: Risks of OTC Derivatives 261
Applying the Concept: What Was Long-Term Capital Management Doing? 264
In the News: AIG Still Faces Billions in Credit Losses 266

Terms 268
Chapter Lessons 268
Conceptual Problems 270
Analytical Problems 271

CHAPTER 10 **Foreign Exchange 273**
Foreign Exchange Basics 274
The Nominal Exchange Rate 274
The Real Exchange Rate 276
Foreign Exchange Markets 278

Exchange Rates in the Long Run 280
The Law of One Price 280
Purchasing Power Parity 281
Exchange Rates in the Short Run 285
The Supply of Dollars 286
The Demand for Dollars 286
Equilibrium in the Market for Dollars 287
Shifts in the Supply of and Demand for Dollars 287
Explaining Exchange Rate Movements 289
Government Policy and Foreign Exchange Intervention 291

Learning Tools
Tools of the Trade: Following Exchange Rates in the News 278
Your Financial World: Investing Overseas 281
Applying the Concept: The Big Mac Index 284
Your Financial World: Don't Bet on Exchange Rates 287
Lessons from the Crisis: Currency Risk and Rollover Risk 290
In the News: U.S. in Standoff with Beijing over Chinese Currency 292

Terms 293
Chapter Lessons 294
Conceptual Problems 295
Analytical Problems 295
Appendix to Chapter 10: Interest-Rate Parity and Short-Run Exchange Rate Determination 297

Part *III* **Financial Institutions 299**

CHAPTER 11 The Economics of Financial Intermediation 300
The Role of Financial Intermediaries 301
Pooling Savings 304
Safekeeping, Payments System Access, and Accounting 305
Providing Liquidity 307
Diversifying Risk 307
Collecting and Processing Information 308
Information Asymmetries and Information Costs 308
Adverse Selection 310
Solving the Adverse Selection Problem 311
Moral Hazard: Problem and Solutions 314
Financial Intermediaries and Information Costs 318
Screening and Certifying to Reduce Adverse Selection 318
Monitoring to Reduce Moral Hazard 319
How Companies Finance Growth and Investment 320

Learning Tools

Applying the Concept: International Financial Intermediation 306
Applying the Concept: The Madoff Scandal 310
Your Financial World: Private Mortgage Insurance 312
Applying the Concept: Deflation, Net Worth, and Information Costs 313
Lessons from the Crisis: Information Asymmetry and Securitization 317
In the News: In a Tight Market, Borrowers Turn to Peers 320

Terms 322
Chapter Lessons 322
Conceptual Problems 323
Analytical Problems 324

CHAPTER 12 Depository Institutions: Banks and Bank Management 326

The Balance Sheet of Commercial Banks 327
Assets: Uses of Funds 327
Liabilities: Sources of Funds 330
Bank Capital and Profitability 333
Off-Balance-Sheet Activities 336
Bank Risk: Where It Comes from and What to Do about It 338
Liquidity Risk 339
Credit Risk 342
Interest-Rate Risk 343
Trading Risk 345
Other Risks 347

Learning Tools

Applying the Concept: Sovereign Risk in Europe 331
Tools of the Trade: A Catalog of Depository Institutions 334
Applying the Concept: Growth and Banking in China and India 336
Applying the Concept: Are Big Banks Well-Capitalized? 337
Lessons from the Crisis: Insufficient Bank Capital 344
In the News: Rogue Flight: Societe Generale's Kerviel Tags Leeson 346
Applying the Concept: Japanese and U.S. Commercial Banking in the 1990s 350

Terms 350
Chapter Lessons 351
Conceptual Problems 352
Analytical Problems 353

CHAPTER 13 Financial Industry Structure 355

Banking Industry Structure 356
A Short History of U.S. Banking 357
Competition and Consolidation 358
The Globalization of Banking 362

The Future of Banks 364
Nondepository Institutions 365
Insurance Companies 367
Pension Funds 371
Securities Firms: Brokers, Mutual Funds, and Investment Banks 374
Finance Companies 374
Government-Sponsored Enterprises 378

Learning Tools
Applying the Concept: Banking Across Borders 360
Your Financial World: How Much Life Insurance Do You Need? 369
Applying the Concept: Reinsurance and "Cat Bonds" 371
Applying the Concept: Public Pensions and the Social Security System 373
Tools of the Trade: Hedge Funds 375
In the News: Fed's Tarullo Says Dividing Banks May Not Curb Too Big to Fail 376
Your Financial World: Annuities 380

Terms 380
Chapter Lessons 380
Conceptual Problems 382
Analytical Problems 382

CHAPTER 14 Regulating the Financial System 384
The Sources and Consequences of Runs, Panics, and Crises 386
The Government Safety Net 388
The Unique Role of Banks and Shadow Banks 389
The Government as Lender of Last Resort 390
Government Deposit Insurance 393
Problems Created by the Government Safety Net 393
Regulation and Supervision of the Financial System 396
Restrictions on Competition 398
Asset Holding Restrictions and Minimum Capital Requirements 400
Disclosure Requirements 402
Supervision and Examination 404
Evolving Challenges for Regulators and Supervisors 404
Micro-prudential Versus Macro-prudential Regulation 405

Learning Tools
Applying the Concept: The Government Safety Net: A Very Early View 391
Applying the Concept: The Day the Bank of New York Borrowed $23 Billion 392
Lessons from the Crisis: Should the Lender of Last Resort Also Supervise? 394
Applying the Concept: Does Deposit Insurance Really Work? 397
Your Financial World: Are Your Deposits Insured? 399

Tools of the Trade: The Basel Accords, Old and New 402
In the News: New Bank Rules Sink Stocks 406

Terms 410
Chapter Lessons 410
Conceptual Problems 411
Analytical Problems 412

Part IV Central Banks, Monetary Policy, and Financial Stability 413

CHAPTER 15 Central Banks in the World Today 414

The Basics: How Central Banks Originated and Their Role Today 415
The Government's Bank 415
The Bankers' Bank 416
Stability: The Primary Objective of All Central Banks 419
Low, Stable Inflation 420
High, Stable Real Growth 421
Financial System Stability 423
Interest-Rate and Exchange-Rate Stability 423
Meeting the Challenge: Creating a Successful Central Bank 424
The Need for Independence 426
Decision Making by Committee 427
The Need for Accountability and Transparency 428
The Policy Framework, Policy Trade-offs, and Credibility 429
Fitting Everything Together: Central Banks and Fiscal Policy 431

Learning Tools

Applying the Concept: Why Is Stable Money Such a Big Deal? 417
Your Financial World: Why Inflation Is Bad for You 421
Lessons from the Crisis: Threats to Fed Independence 425
Applying the Concept: Independent Central Banks Deliver Lower Inflation 428
In the News: Beware the Result of Outrage 432

Terms 435
Chapter Lessons 435
Conceptual Problems 436
Analytical Problems 437

CHAPTER 16 The Structure of Central Banks: The Federal Reserve and the European Central Bank 439

The Structure of the Federal Reserve System 440
The Federal Reserve Banks 440
The Board of Governors 443
The Federal Open Market Committee 445

Assessing the Federal Reserve System's Structure 449
Independence from Political Influence 450
Decision Making by Committee 450
Accountability and Transparency 450
Policy Framework 451
The European Central Bank 453
Organizational Structure 453
Accountability and Transparency 457
The Price Stability Objective and Monetary Policy Strategy 459

Learning Tools

Your Financial World: Treasury Direct 445
Tools of the Trade: Decoding the FOMC Statement 449
Applying the Concept: The Evolution of Central Bank Independence 451
Your Financial World: The Fed Can't Save You from a Stock-Market Crash 452
In the News: Fed Adopts De facto Inflation Target 458
Lessons from the Crisis: Government Funding in the Euro Area 460

Terms 461
Chapter Lessons 461
Conceptual Problems 462
Analytical Problems 463

CHAPTER 17 The Central Bank Balance Sheet and the Money Supply Process 464
The Central Bank's Balance Sheet 465
Assets 466
Liabilities 467
The Importance of Disclosure 469
The Monetary Base 470
Changing the Size and Composition of the Balance Sheet 470
Open Market Operations 471
Foreign Exchange Intervention 472
Discount Loans 473
Cash Withdrawal 474
The Deposit Expansion Multiplier 475
Deposit Creation in a Single Bank 477
Deposit Expansion in a System of Banks 478
The Monetary Base and the Money Supply 481
Deposit Expansion with Excess Reserves and Cash Withdrawals 481
The Arithmetic of the Money Multiplier 482
The Limits of the Central Bank's Ability to Control the Quantity of Money 486

Learning Tools

Applying the Concept: The Fed's Balance Sheet: Impact of the Crisis 468
Your Financial World: Why We Still Have Cash 473
Applying the Concept: Temporary and Emergency Changes in Reserves 476
Your Financial World: Your Excess Reserves 484
Lessons from the Crisis: The Impact on Money Supply 485
Applying the Concept: Monetary Policy in the 1930s 487

Terms 489
Chapter Lessons 489
Conceptual Problems 490
Analytical Problems 491

CHAPTER 18 Monetary Policy: Stabilizing the Domestic Economy 492
The Federal Reserve's Conventional Policy Toolbox 495
The Target Federal Funds Rate and Open Market Operations 496
Discount Lending, the Lender of Last Resort, and Crisis Management 499
Reserve Requirements 501
Operational Policy at the European Central Bank 503
The ECB's Target Interest Rate and Open Market Operations 503
The Marginal Lending Facility 505
The Deposit Facility 505
Reserve Requirements 506
Linking Tools to Objectives: Making Choices 508
Desirable Features of a Policy Instrument 508
Operating Instruments and Intermediate Targets 510
A Guide to Central Bank Interest Rates: The Taylor Rule 512
Unconventional Policy Tools 517
Policy Duration Commitment 518
Quantitative Easing 519
Credit Easing 520
Making an Effective Exit 521
Concluding Remarks 524

Learning Tools

Your Financial World: How Overnight Interest Rates Affect You 500
Applying the Concept: The Channel System and the Future of Monetary Policy 504
Tools of the Trade: Some Unconventional Policy Tools 507
Applying the Concept: Inflation Targeting 510
In the News: Fed May Take Chance End to Debt Purchases Won't Hurt Housing 514
Your Financial World: Economic History Is Constantly Changing 523

Terms 525
Chapter Lessons 525
Conceptual Problems 526
Analytical Problems 527

CHAPTER 19 Exchange-Rate Policy and the Central Bank 529
Linking Exchange-Rate Policy with Domestic Monetary Policy 530
Inflation and the Long-Run Implications of Purchasing Power Parity 531
Interest Rates and the Short-Run Implications of Capital Market Arbitrage 532
Capital Controls and the Policymakers' Choice 533
Mechanics of Exchange-Rate Management 536
The Central Bank's Balance Sheet 536
Sterilized Intervention 538
The Costs, Benefits, and Risks of Fixed Exchange Rates 540
Assessing the Costs and Benefits 540
The Danger of Speculative Attacks 541
Summarizing the Case for a Fixed Exchange Rate 544
Fixed Exchange-Rate Regimes 544
Exchange-Rate Pegs and the Bretton Woods System 544
Hard Pegs: Currency Boards and Dollarization 546

Learning Tools
Your Financial World: Emerging Market Crises and You 533
Applying the Concept: Malaysia Imposes Capital Controls 535
Applying the Concept: The Gold Standard: An Exchange-Rate Regime Whose Time Has Passed 543
Your Financial World: Should You Buy Gold? 545
Applying the Concept: Implications of China's Exchange-Rate Regime 546
In the News: As Budget Deficit Grows, So Do Doubts on Dollar 548

Terms 551
Chapter Lessons 551
Conceptual Problems 552
Analytical Problems 553
Appendix to Chapter 19: What You Really Need to Know about the Balance of Payments 555

Part V Modern Monetary Economics 557

CHAPTER 20 Money Growth, Money Demand, and Modern Monetary Policy 558
Why We Care about Monetary Aggregates 559
The Quantity Theory and the Velocity of Money 562
Velocity and the Equation of Exchange 562
The Quantity Theory of Money 564

The Facts about Velocity 566
The Demand for Money 568
The Transactions Demand for Money 569
The Portfolio Demand for Money 571
Targeting Money Growth in a Low-Inflation Environment 572
The Instability of U.S. Money Demand 573
Targeting Money Growth: The Fed and the ECB 577

Learning Tools
Applying the Concept: Inflation and the Collapse of the Soviet Union 561
Your Financial World: Understanding Inflation Statistics 564
Applying the Concept: The ECB's Reference Value for Money Growth 569
Your Financial World: Free Checking Accounts Are Rarely Free 571
Tools of the Trade: Using Statistical Models in Policy Evaluation 575
Applying the Concept: Financial Innovation and the Shifting Velocity of Money 576
In the News: The Issing Link 578

Terms 581
Chapter Lessons 581
Conceptual Problems 582
Analytical Problems 583

CHAPTER 21 Output, Inflation, and Monetary Policy 584
Output and Inflation in the Long Run 585
Potential Output 585
Long-Run Inflation 586
Monetary Policy and the Dynamic Aggregate Demand Curve 587
Aggregate Expenditure and the Real Interest Rate 588
Inflation, the Real Interest Rate, and the Monetary Policy Reaction Curve 594
The Dynamic Aggregate Demand Curve 598
Aggregate Supply 603
Short-Run Aggregate Supply 603
Shifts in the Short-Run Aggregate Supply Curve 603
The Long-Run Aggregate Supply Curve 605
Equilibrium and the Determination of Output and Inflation 608
Short-Run Equilibrium 608
Adjustment to Long-Run Equilibrium 608
The Sources of Fluctuations in Output and Inflation 610
What Causes Recessions? 611

Learning Tools
Your Financial World: Using the Word *Inflation* 586
Applying the Concept: Investment and the Business Cycle 594

Your Financial World: It's the Real Interest Rate that Matters 600
Applying the Concept: Inflation Changes and Output Gaps 606
Tools of the Trade: Output Growth and Output Gaps 608
In the News: Independence Day for the Fed 612

Terms 614
Chapter Lessons 614
Conceptual Problems 615
Analytical Problems 616

CHAPTER 22 Understanding Business Cycle Fluctuations 618
Sources of Fluctuations in Output and Inflation 620
Shifts in the Dynamic Aggregate Demand Curve 620
Shifts in the Short-Run Aggregate Supply Curve 625
Using the Aggregate Demand–Aggregate Supply Framework 628
How Do Policymakers Achieve Their Stabilization Objectives? 628
What Accounts for the Great Moderation? 633
What Happens When Potential Output Changes? 635
What Are the Implications of Globalization for Monetary Policy? 638
Can Policymakers Distinguish a Recessionary Gap from a Fall in Potential Output? 639
Can Policymakers Stabilize Output and Inflation Simultaneously? 641

Learning Tools
Tools of the Trade: Defining a Recession: The NBER Reference Cycle 626
Applying the Concept: Do Inflation Targets Affect Expected Inflation? 631
Your Financial World: The Problem with Measuring GDP 642
In the News: Inflation Worry Limits Fed Flexibility 645

Terms 646
Chapter Lessons 646
Conceptual Problems 647
Analytical Problems 647

CHAPTER 23 Modern Monetary Policy and the Challenges Facing Central Bankers 649
The Monetary Policy Transmission Mechanism 651
The Traditional Channels: Interest Rates and Exchange Rates 651
Bank-Lending and Balance-Sheet Channels 653
Asset-Price Channels: Wealth and Investment 657
Financial Crisis Obstructs Monetary Policy Transmission 658
The Challenges Modern Monetary Policymakers Face 659
Booms and Busts in Property and Equity Prices 660
Deflation and the Zero Nominal-Interest-Rate Bound 664
The Evolving Structure of the Financial System 667

Learning Tools

Tools of the Trade: Correlation Does Not Imply Causality 652
Your Financial World: Don't Count on Inflation to Bail You Out 654
Applying the Concept: What Happened in Japan? 660
Your Financial World: Is Your Central Bank's Inflation Rate Your Inflation Rate? 664
In the News: Bernanke's How-To on Rate Increase Lacks a When 668

Terms 670
Chapter Lessons 671
Conceptual Problems 671
Analytical Problems 672

Glossary G-1
Photo Credits PC
Index I-1