

Contents

Preface	14	2.5 Elasticities	54
Chapter 1 Introduction	25	Demand Elasticity	54
1.1 Microeconomics: The Allocation of Scarce Resources	25	Solved Problem 2.2	55
Trade-Offs	26	APPLICATION <i>The Demand Elasticities for Google Play and Apple Apps</i>	56
Who Makes the Decisions	26	Solved Problem 2.3	59
How Prices Determine Allocations	26	Supply Elasticity	60
APPLICATION <i>French Bonus-Malus Incentive System</i>	27	Solved Problem 2.4	62
1.2 Models	27	Long Run Versus Short Run	62
APPLICATION <i>Income Threshold Model and China</i>	27	APPLICATION <i>Oil Drilling in the Arctic National Wildlife Refuge</i>	63
Simplifications by Assumption	28	Solved Problem 2.5	64
Testing Theories	29	2.6 Effects of a Sales Tax	65
Maximizing Subject to Constraints	29	Effects of a Specific Tax on the Equilibrium	66
Positive Versus Normative	30	The Same Equilibrium No Matter Who Is Taxed	68
New Theories	31	Firms and Customers Share the Burden of the Tax	68
1.3 Uses of Microeconomic Models in Your Life and Career	32	Solved Problem 2.6	70
Summary	33	APPLICATION <i>Subsidizing Ethanol</i>	71
Chapter 2 Supply and Demand	34	The Similar Effects of Ad Valorem and Specific Taxes	71
CHALLENGE <i>Quantities and Prices of Genetically Modified Foods</i>	34	2.7 Quantity Supplied Need Not Equal Quantity Demanded	72
2.1 Demand	35	Price Ceiling	73
The Demand Function	36	APPLICATION <i>Venezuelan Price Ceilings and Shortages</i>	75
Summing Demand Functions	40	Price Floor	76
APPLICATION <i>Aggregating Corn Demand Curves</i>	41	2.8 When to Use the Supply-and-Demand Model	77
2.2 Supply	41	CHALLENGE SOLUTION <i>Quantities and Prices of Genetically Modified Foods</i>	78
The Supply Function	42	Summary 79 ■ Exercises 80	
Summing Supply Functions	44	Chapter 3 A Consumer's Constrained Choice	86
How Government Import Policies Affect Supply Curves	44	CHALLENGE <i>Why Americans Buy E-Books and Germans Do Not</i>	86
2.3 Market Equilibrium	45	3.1 Preferences	88
Finding the Market Equilibrium	46	Properties of Consumer Preferences	88
Forces That Drive a Market to Equilibrium	47	APPLICATION <i>You Can't Have Too Much Money</i>	89
2.4 Shocking the Equilibrium: Comparative Statics	48	Preference Maps	90
Comparative Statics with Discrete (Large) Changes	49	Indifference Curves	91
APPLICATION <i>The Opioid Epidemic's Labor Market Effects</i>	50	Solved Problem 3.1	93
Comparative Statics with Small Changes	50	3.2 Utility	93
Solved Problem 2.1	52	Utility Function	93
Why the Shapes of Demand and Supply Curves Matter	53	Willingness to Substitute Between Goods	96

Solved Problem 3.2	98	Solved Problem 4.7	151
APPLICATION <i>MRS Between Recorded Tracks and Live Music</i>	99	Slutsky Equation	151
Curvature of Indifference Curves	99	4.4 Cost-of-Living Adjustment	153
Solved Problem 3.3	102	Inflation Indexes	153
APPLICATION <i>Indifference Curves Between Income and Health</i>	103	Effects of Inflation Adjustments	155
3.3 Budget Constraint	103	APPLICATION <i>Reducing the CPI Substitution Bias</i>	158
3.4 Constrained Consumer Choice	105	4.5 Revealed Preference	159
Finding an Interior Solution Using Graphs	106	Recovering Preferences	159
Solved Problem 3.4	108	Substitution Effect	160
Finding an Interior Solution Using Calculus	108	CHALLENGE SOLUTION <i>Paying Employees to Relocate</i>	161
Solved Problem 3.5	110	<i>Summary</i> 162 ■ <i>Exercises</i> 163	
Solved Problem 3.6	111		
Solved Problem 3.7	113		
APPLICATION <i>Utility Maximization for Recorded Tracks and Live Music</i>	113	Chapter 5 Consumer Welfare and Policy Analysis	166
Finding Corner Solutions	114		
Minimizing Expenditure	118	CHALLENGE <i>Per-Hour Versus Lump-Sum Childcare Subsidies</i>	166
Solved Problem 3.8	119	5.1 Uncompensated Consumer Welfare	167
3.5 Behavioral Economics	120	Willingness to Pay	168
Tests of Transitivity	121	An Individual's Consumer Surplus	168
Endowment Effect	121	A Market's Consumer Surplus	169
APPLICATION <i>How You Frame Policy Requirements Matters</i>	122	APPLICATION <i>A Day with the President of the European Council</i>	170
Saliency	122	Effect of a Price Change on Consumer Surplus	171
CHALLENGE SOLUTION <i>Why Americans Buy E-Books and Germans Do Not</i>	124	Solved Problem 5.1	171
<i>Summary</i> 124 ■ <i>Exercises</i> 125		5.2 Compensated Consumer Welfare	172
		Indifference Curve Analysis	172
		APPLICATION <i>Compensating Variation and Equivalent Variation for Smartphones and Facebook</i>	174
		Compensated Demand Curves and Consumer Welfare	175
		Comparing the Three Welfare Measures	176
		Solved Problem 5.2	178
		5.3 Effects of Government Policies on Consumer Welfare	179
		Quotas	179
		Food Stamps	181
		APPLICATION <i>Cash, Food, or Vouchers?</i>	183
		5.4 Deriving Labor Supply Curves	183
		Labor-Leisure Choice	183
		Solved Problem 5.3	186
		Income and Substitution Effects	187
		Solved Problem 5.4	188
		APPLICATION <i>Fracking Causes Students to Drop Out</i>	188
		Solved Problem 5.5	189
		Shape of the Labor Supply Curve	190
		Income Tax Rates and the Labor Supply Curve	191
		Solved Problem 5.6	193
		CHALLENGE SOLUTION <i>Per-Hour Versus Lump-Sum Childcare Subsidies</i>	194
		<i>Summary</i> 196 ■ <i>Exercises</i> 197	
Chapter 4 Demand	129		
CHALLENGE <i>Paying Employees to Relocate</i>	129		
4.1 Deriving Demand Curves	130		
System of Demand Functions	130		
Graphical Interpretation	131		
APPLICATION <i>Airplane versus Train Travel</i>	134		
4.2 Effects of an Increase in Income	134		
How Income Changes Shift Demand Curves	135		
Solved Problem 4.1	136		
Consumer Theory and Income Elasticities	137		
Solved Problem 4.2	138		
APPLICATION <i>Fast-Food Engel Curve</i>	140		
Solved Problem 4.3	142		
4.3 Effects of a Price Increase	142		
Income and Substitution Effects with a Normal Good	143		
Solved Problem 4.4	145		
APPLICATION <i>Substituting Cannabis for Prescription Drugs</i>	146		
Solved Problem 4.5	146		
Income and Substitution Effects with an Inferior Good	147		
Solved Problem 4.6	147		
Compensated Demand Curve	148		

Chapter 6 Firms and Production 201

CHALLENGE <i>Labor Productivity During Downturns</i>	201
6.1 The Ownership and Management of Firms	202
Private, Public, and Nonprofit Firms	202
APPLICATION <i>Chinese State-Owned Enterprises</i>	203
The Ownership of For-Profit Firms	203
The Management of Firms	204
What Owners Want	204
6.2 Production	205
Production Functions	205
Time and the Variability of Inputs	205
6.3 Short-Run Production: One Variable and One Fixed Input	206
Solved Problem 6.1	207
Interpretation of Graphs	208
Solved Problem 6.2	210
Law of Diminishing Marginal Returns	210
APPLICATION <i>Malthus and the Green Revolution</i>	211
6.4 Long-Run Production: Two Variable Inputs	213
Isoquants	213
APPLICATION <i>Self-Driving Trucks</i>	216
Substituting Inputs	217
Solved Problem 6.3	218
Diminishing Marginal Rates of Technical Substitution	218
The Elasticity of Substitution	218
Solved Problem 6.4	221
6.5 Returns to Scale	221
Constant, Increasing, and Decreasing Returns to Scale	221
Solved Problem 6.5	222
APPLICATION <i>Returns to Scale in Various Industries</i>	223
Varying Returns to Scale	224
6.6 Productivity and Technical Change	225
Relative Productivity	225
Innovations	226
APPLICATION <i>Robots and the Food You Eat</i>	227
APPLICATION <i>A Good Boss Raises Productivity</i>	228
CHALLENGE SOLUTION <i>Labor Productivity During Downturns</i>	228
<i>Summary</i> 229 ■ <i>Exercises</i> 230	

Chapter 7 Costs 233

CHALLENGE <i>To Automate or not to Automate?</i>	233
7.1 Measuring Costs	234
Opportunity Costs	235
APPLICATION <i>The Opportunity Cost of an MBA</i>	235

Solved Problem 7.1	236
Opportunity Cost of Capital	236
Sunk Costs	237
7.2 Short-Run Costs	238
Short-Run Cost Measures	238
APPLICATION <i>The Sharing Economy and the Short Run</i>	239
Solved Problem 7.2	240
Short-Run Cost Curves	241
Production Functions and the Shape of Cost Curves	242
APPLICATION <i>Short-Run Cost Curves for a Japanese Beer Manufacturer</i>	244
Effects of Taxes on Costs	245
Short-Run Cost Summary	245
7.3 Long-Run Costs	246
Input Choice	247
Solved Problem 7.3	250
Solved Problem 7.4	252
How Long-Run Cost Varies with Output	254
Solved Problem 7.5	255
Solved Problem 7.6	257
The Shape of Long-Run Cost Curves	257
APPLICATION <i>3D Printing</i>	258
Estimating Cost Curves Versus Introspection	259
7.4 Lower Costs in the Long Run	259
Long-Run Average Cost as the Envelope of Short-Run Average Cost Curves	259
APPLICATION <i>A Beer Manufacturer's Long-Run Cost Curves</i>	260
APPLICATION <i>Choosing an Inkjet or Laser Printer</i>	261
Short-Run and Long-Run Expansion Paths	262
How Learning by Doing Lowers Costs	262
APPLICATION <i>Solar Power Learning Curves</i>	264
7.5 Cost of Producing Multiple Goods	264
CHALLENGE SOLUTION <i>To automate or not to automate?</i>	266
<i>Summary</i> 267 ■ <i>Exercises</i> 268	

Chapter 8 Competitive Firms and Markets 272

CHALLENGE <i>Deregulating the Norwegian Taxi Market</i>	272
8.1 Perfect Competition	273
Price Taking	273
Why a Firm's Demand Curve Is Horizontal	274
Perfect Competition in the Chicago Commodity Exchange	275
Deviations from Perfect Competition	275
Derivation of a Competitive Firm's Demand Curve	276
Solved Problem 8.1	278
Why Perfect Competition Is Important	278

8.2 Profit Maximization	278
Profit	279
Two Steps to Maximizing Profit	280
8.3 Competition in the Short Run	283
Short-Run Competitive Profit Maximization	283
Solved Problem 8.2	285
APPLICATION <i>Fracking and Shutdowns</i>	288
Short-Run Firm Supply Curve	289
Solved Problem 8.3	290
Short-Run Market Supply Curve	291
Short-Run Competitive Equilibrium	293
Solved Problem 8.4	294
8.4 Competition in the Long Run	295
Long-Run Competitive Profit Maximization	295
Long-Run Firm Supply Curve	295
APPLICATION <i>The Size of Ethanol Processing Plants</i>	296
Long-Run Market Supply Curve	297
APPLICATION <i>Industries with High Entry and Exit Rates</i>	298
APPLICATION <i>Upward-Sloping Long-Run Supply Curve for Cotton</i>	300
APPLICATION <i>Reformulated Gasoline Supply Curves</i>	304
Solved Problem 8.5	305
Long-Run Competitive Equilibrium	306
CHALLENGE SOLUTION <i>Deregulating the Norwegian Taxi Market</i>	307
<i>Summary</i>	308
<i>Exercises</i>	309
Chapter 9 Properties and Applications of the Competitive Model	314
CHALLENGE <i>Liquor Licenses Freeze</i>	314
9.1 Zero Profit for Competitive Firms in the Long Run	315
Zero Long-Run Profit with Free Entry	315
Zero Long-Run Profit When Entry Is Limited	316
APPLICATION <i>What's a Name Worth?</i>	318
The Need to Maximize Profit	318
9.2 Producer Surplus	318
Measuring Producer Surplus Using a Supply Curve	318
Using Producer Surplus	320
Solved Problem 9.1	320
9.3 Competition Maximizes Welfare	321
Measuring Welfare	322
Why Producing Less Than the Competitive Output Lowers Welfare	322
Solved Problem 9.2	324
APPLICATION <i>The Deadweight Loss of Christmas Presents</i>	325
9.4 Policies That Shift Supply or Demand Curves	326
APPLICATION <i>Welfare Effects of Delaying 5G Technology</i>	327

9.5 Policies That Create a Wedge Between Supply and Demand Curves	328
Welfare Effects of a Sales Tax	328
APPLICATION <i>The Deadweight Loss from Gas Taxes</i>	330
Welfare Effects of a Price Floor	330
Solved Problem 9.3	333
APPLICATION <i>How Big Are Farm Subsidies and Who Gets Them?</i>	334
Welfare Effects of a Price Ceiling	334
Solved Problem 9.4	335
APPLICATION <i>The Social Cost of a Natural Gas Price Ceiling</i>	336
9.6 Comparing Both Types of Policies: Trade	336
Free Trade Versus a Ban on Imports	337
Solved Problem 9.5	339
APPLICATION <i>Russian Food Ban</i>	339
Free Trade Versus a Tariff	340
Solved Problem 9.6	342
A Tariff Versus a Quota	343
Rent Seeking	344
CHALLENGE SOLUTION <i>Liquor Licenses Freeze Summary</i>	345
<i>Exercises</i>	347
Chapter 10 General Equilibrium and Economic Welfare	351
CHALLENGE <i>Price Ceilings in a Pandemic</i>	351
10.1 General Equilibrium	353
Competitive Equilibrium in Two Interrelated Markets	354
APPLICATION <i>Partial-Equilibrium Versus Multimarket-Equilibrium Analysis in Corn and Soybean Markets</i>	355
Minimum Wages with Incomplete Coverage	356
Solved Problem 10.1	358
APPLICATION <i>Urban Flight</i>	359
10.2 Trading Between Two People	359
Endowments	359
Mutually Beneficial Trades	361
Solved Problem 10.2	363
Deriving the Contract Curve	363
Solved Problem 10.3	364
Bargaining Ability	364
10.3 Competitive Exchange	364
Competitive Equilibrium	365
Solved Problem 10.4	367
The Efficiency of Competition	367
Obtaining Any Efficient Allocation Using Competition	367
10.4 Production and Trading	368
Comparative Advantage	368
Solved Problem 10.5	370
Efficient Product Mix	372
Competition	372

10.5 Efficiency and Equity	374	APPLICATION <i>Natural Gas Regulation</i>	419
Role of the Government	374	Increasing Competition	420
Efficiency	375	APPLICATION <i>Movie Studios Attacked</i>	
Equity	375	<i>by 3D Printers!</i>	421
APPLICATION <i>Extremely Unequal Wealth</i>	376	Solved Problem 11.8	421
Efficiency Versus Equity	381	11.6 Internet Monopolies: Networks Effects,	
Theory of the Second Best	382	Behavioral Economics, and Economies	
CHALLENGE SOLUTION <i>Price Ceilings</i>		of Scale	422
<i>in a Pandemic</i>	384	Network Externalities	422
<i>Summary</i> 385 ■ <i>Exercises</i> 385		APPLICATION <i>Critical Mass and eBay</i>	423
Chapter 11 Monopoly and Monopsony	389	Introductory Prices: A Two-Period	
CHALLENGE <i>Brand-Name and</i>		Monopoly Model	424
<i>Generic Drugs</i>	389	Two-Sided Markets	424
11.1 Monopoly Profit Maximization	391	Economies of Scale on the Internet	425
The Necessary Condition for Profit		Disruptive Technologies	425
Maximization	391	11.7 Monopsony	426
Marginal Revenue and the Demand		Monopsony Profit Maximization	426
Curves	391	Welfare Effects of Monopsony	428
Solved Problem 11.1	393	Solved Problem 11.9	429
Marginal Revenue Curve and the Price		CHALLENGE SOLUTION <i>Brand-Name</i>	
Elasticity of Demand	393	<i>and Generic Drugs</i>	430
APPLICATION <i>Amazon Prime Revenue</i>	395	<i>Summary</i> 431 ■ <i>Exercises</i> 431	
An Example of Monopoly Profit		Chapter 12 Pricing and Advertising	436
Maximization	395	CHALLENGE <i>Sale Price</i>	436
APPLICATION <i>Apple's iPad</i>	397	12.1 Conditions for Price Discrimination	438
Solved Problem 11.2	397	Why Price Discrimination Pays	438
Choosing Price or Quantity	399	Which Firms Can Price Discriminate	438
APPLICATION <i>Taylor Swift Concert</i>		APPLICATION <i>Disneyland Pricing</i>	439
<i>Pricing</i>	399	Preventing Resale	439
Solved Problem 11.3	399	APPLICATION <i>Preventing Resale of</i>	
Effects of a Shift of the Demand Curve	400	<i>Designer Bags</i>	440
11.2 Market Power and Welfare	401	Not All Price Differences Are Price	
Market Power and the Shape of the		Discrimination	440
Demand Curve	401	Types of Price Discrimination	441
The Lerner Index	403	12.2 Perfect Price Discrimination	441
Solved Problem 11.4	403	How a Firm Perfectly Price Discriminates	441
Sources of Market Power	404	Solved Problem 12.1	443
Effect of Market Power on Welfare	404	Perfect Price Discrimination Is Efficient	
11.3 Taxes and Monopoly	405	but Harms Some Consumers	444
Effects of a Specific Tax	406	APPLICATION <i>Botox and Price</i>	
Solved Problem 11.5	407	<i>Discrimination</i>	446
Welfare Effects of Ad Valorem Versus		Transaction Costs and Perfect Price	
Specific Taxes	409	Discrimination	447
11.4 Causes of Monopolies	410	APPLICATION <i>Google Uses Bidding for</i>	
Cost Advantages	410	<i>Ads to Price Discriminate</i>	447
Solved Problem 11.6	412	12.3 Group Price Discrimination	447
Government Actions That Create		APPLICATION <i>Tesla Price Discrimination</i>	448
Monopolies	412	Prices and Elasticities	449
APPLICATION <i>The Botox Patent</i>		APPLICATION <i>Age Discrimination</i>	450
<i>Monopoly</i>	414	Solved Problem 12.2	450
11.5 Government Actions That Reduce		Identifying Groups	452
Market Power	415	APPLICATION <i>Buying Discounts</i>	452
Regulating Monopolies	415	Solved Problem 12.3	453
Solved Problem 11.7	417	Welfare Effects of Group Price Discrimination	454

12.4 Nonlinear Price Discrimination	455
12.5 Two-Part Pricing	457
Two-Part Pricing with Identical Consumers	458
Two-Part Pricing with Differing Consumers	459
APPLICATION Pricing iTunes	461
12.6 Tie-In Sales	461
Requirement Tie-In Sales	462
APPLICATION Ties That Bind	462
Bundling	462
12.7 Advertising	465
Deciding Whether to Advertise	466
How Much to Advertise	467
Solved Problem 12.4	468
APPLICATION Super Bowl Commercials	469
CHALLENGE SOLUTION Sale Price	469
Summary 471 ■ Exercises 471	
Chapter 13 Game Theory	476
CHALLENGE Intel and AMD's Advertising Strategies	476
13.1 Static Games	478
Normal-Form Games	479
Failure to Maximize Joint Profits	482
APPLICATION Strategic Advertising	484
Pricing Games in Two-Sided Markets	485
Multiple Equilibria	486
Solved Problem 13.1	487
Mixed Strategies	488
APPLICATION Boomerang Millennials	489
Solved Problem 13.2	490
13.2 Repeated Dynamic Games	490
Strategies and Actions in Dynamic Games	491
Cooperation in a Repeated Prisoners' Dilemma Game	491
Solved Problem 13.3	493
13.3 Sequential Game	493
Game Tree	493
Subgame Perfect Nash Equilibrium	494
Credibility	496
Dynamic Entry Game	497
Solved Problem 13.4	499
APPLICATION Keeping Out Casinos	499
Solved Problem 13.5	500
13.4 Auctions	501
Elements of Auctions	501
Bidding Strategies in Private-Value Auctions	503
Winner's Curse	504
APPLICATION Bidder's Curse	504
13.5 Behavioral Game Theory	505
APPLICATION GM's Ultimatum	505
CHALLENGE SOLUTION Intel and AMD's Advertising Strategies	506
Summary 507 ■ Exercises 508	

Chapter 14 Oligopoly and Monopolistic Competition	514
CHALLENGE Government Aircraft Subsidies	514
14.1 Market Structures	516
14.2 Cartels	517
Why Cartels Form	518
Why Cartels Fail	519
Laws Against Cartels	520
APPLICATION Employer "No-Poaching" Cartels	521
Maintaining Cartels	522
APPLICATION Cheating on the Maple Syrup Cartel	523
Mergers	524
APPLICATION Airline Mergers	524
14.3 Cournot Oligopoly Model	525
The Duopoly Nash-Cournot Equilibrium	525
The Cournot Model with Many Firms	529
APPLICATION Mobile Number Portability	532
The Cournot Model with Nonidentical Firms	533
Solved Problem 14.1	533
APPLICATION How Do Costs, Price Markups, and Profits Vary Across Airlines?	534
Solved Problem 14.2	535
APPLICATION Differentiating Bottled Water Through Marketing	536
14.4 Stackelberg Oligopoly Model	536
Calculus Solution	537
Graphical Solution	538
Why Moving Sequentially Is Essential	539
Strategic Trade Policy: An Application of the Stackelberg Model	539
Solved Problem 14.3	542
Comparison of Collusive, Nash-Cournot, Stackelberg, and Competitive Equilibria	543
14.5 Bertrand Oligopoly Model	544
Nash-Bertrand Equilibrium with Identical Products	545
Nash-Bertrand Equilibrium with Differentiated Products	547
APPLICATION Rising Market Power	550
14.6 Monopolistic Competition	550
APPLICATION Monopolistically Competitive Food Truck Market in the Philippines	551
Monopolistically Competitive Equilibrium	552
Fixed Costs and the Number of Firms	553
Solved Problem 14.4	554
APPLICATION Subsidizing the Entry Cost of Dentists	555
CHALLENGE SOLUTION Government Aircraft Subsidies	555
Summary 557 ■ Exercises 558	

Chapter 15 Factor Markets	563	16.3 Reducing Risk	613
CHALLENGE <i>Does Going to College Pay?</i>	563	Just Say No	613
15.1 Factor Markets	564	Obtaining Information	614
A Firm's Short-Run Factor Demand Curve	564	Diversification	614
Solved Problem 15.1	567	APPLICATION <i>Investing in Your Employer</i>	616
A Firm's Long-Run Factor Demand Curves	569	Insurance	616
Competitive Factor Markets	571	Solved Problem 16.5	617
APPLICATION <i>Black Death Raises Wages</i>	573	APPLICATION <i>Flight Insurance</i>	618
Solved Problem 15.2	574	APPLICATION <i>Earthquake Insurance in Japan</i>	619
15.2 Capital Markets and Investing	574	16.4 Investing Under Uncertainty	620
Interest Rates	575	How Investing Depends on Attitudes	
Discount Rate	576	Toward Risk	620
Stream of Payments	576	Investing with Uncertainty and Discounting	622
APPLICATION <i>Saving for Retirement</i>	578	Solved Problem 16.6	622
Investing	578	16.5 Behavioral Economics and Uncertainty	623
Solved Problem 15.3	580	Biased Assessment of Probabilities	623
Solved Problem 15.4	581	APPLICATION <i>Biased Estimates</i>	624
Durability	581	Violations of Expected Utility Theory	625
APPLICATION <i>Durability of Telephone Poles</i>	582	Prospect Theory	626
Time-Varying Discounting	583	Comparing Expected Utility and Prospect Theories	627
APPLICATION <i>Behavioral Economics: Falling Discount Rates and Self-Control</i>	584	CHALLENGE SOLUTION <i>BP and Limited Liability</i>	628
Capital Markets, Interest Rates, and Investments	584	<i>Summary</i> 629 ■ <i>Exercises</i> 630	
Solved Problem 15.5	585	Chapter 17 Property Rights, Externalities, Rivalry, and Exclusion	634
15.3 Exhaustible Resources	586	CHALLENGE <i>Trade and Pollution</i>	634
When to Sell an Exhaustible Resource	586	17.1 Externalities	635
Price of a Scarce Exhaustible Resource	587	APPLICATION <i>Disney's Positive Externality</i>	636
APPLICATION <i>Redwood Trees</i>	590	17.2 The Inefficiency of Competition with Externalities	636
Why Price Might Not Rise	591	Supply-and-Demand Analysis	637
CHALLENGE SOLUTION <i>Does Going to College Pay?</i>	592	Cost-Benefit Analysis	639
<i>Summary</i> 594 ■ <i>Exercises</i> 594		APPLICATION <i>Spam: A Negative Externality</i>	641
Chapter 16 Uncertainty	598	17.3 Regulating Externalities	641
CHALLENGE <i>BP and Limited Liability</i>	598	Emissions Standard	642
16.1 Assessing Risk	599	Emissions Fee and Effluent Charge	643
Probability	600	Solved Problem 17.1	644
APPLICATION <i>Risk of a Cyberattack</i>	601	APPLICATION <i>Why Tax Drivers</i>	644
Expected Value	602	Benefits Versus Costs from Controlling Pollution	645
Solved Problem 16.1	602	Taxes Versus Standards Under Uncertainty	645
Variance and Standard Deviation	603	17.4 Market Structure and Externalities	647
16.2 Attitudes Toward Risk	604	Monopoly and Externalities	647
Expected Utility Theory	604	Monopoly Versus Competitive Welfare with Externalities	648
Risk Aversion	605	Solved Problem 17.2	648
Solved Problem 16.2	607	Taxing Externalities in Noncompetitive Markets	649
Solved Problem 16.3	608	17.5 Allocating Property Rights to Reduce Externalities	649
APPLICATION <i>Stocks' Risk Premium</i>	608	Coase Theorem	650
Risk Neutrality	609		
Risk Preference	610		
APPLICATION <i>Gambling</i>	610		
Degree of Risk Aversion	611		
Solved Problem 16.4	613		

APPLICATION *Buying a Town* 651
 Markets for Pollution 652
APPLICATION *Acid Rain Program* 652

17.6 Rivalry and Exclusion 653
 Open-Access Common Property 653
APPLICATION *Road Congestion* 654
 Club Goods 655
APPLICATION *Microsoft Word Piracy* 655
 Public Goods 656
Solved Problem 17.3 657
APPLICATION *Free Riding on Measles Vaccinations* 658
Solved Problem 17.4 660
 Reducing Free Riding 660
APPLICATION *What's Their Beef?* 660
 Valuing Public Goods 661
CHALLENGE SOLUTION *Trade and Pollution* 662
Summary 664 ■ *Exercises* 664

Chapter 18 Asymmetric Information 669

CHALLENGE *Dying to Work* 669

18.1 Adverse Selection 671
 Insurance Markets 671
 Products of Unknown Quality 672
Solved Problem 18.1 674
Solved Problem 18.2 675

18.2 Reducing Adverse Selection 676
 Equalizing Information 676
APPLICATION *Discounts for Data* 677
APPLICATION *Adverse Selection and Remanufactured Goods* 678
 Laws to Prevent Opportunism 679

18.3 Price Discrimination Due to False Beliefs About Quality 680
APPLICATION *Reducing Consumers' Information* 681

18.4 Market Power from Price Ignorance 681
 Tourist-Trap Model 682
Solved Problem 18.3 683
 Advertising and Prices 684

18.5 Problems Arising from Ignorance When Hiring 684
 Cheap Talk 684
APPLICATION *Cheap Talk in eBay's Best Offer Market* 686
 Education as a Signal 686
Solved Problem 18.4 687
 Screening in Hiring 690
CHALLENGE SOLUTION *Dying to Work* 691
Summary 692 ■ *Exercises* 693

Chapter 19 Contracts and Moral Hazards 696

CHALLENGE *Clawing Back Bonuses* 696

19.1 Principal-Agent Problem 698
 A Model 699
 Types of Contracts 699
 Efficiency 700
Solved Problem 19.1 701
APPLICATION *Honest Cabbie?* 702

19.2 Production Efficiency 702
 Efficient Contract 702
 Full Information 704
Solved Problem 19.2 707
 Asymmetric Information 708
APPLICATION *Sing for Your Supper* 709

19.3 Trade-Off Between Efficiency in Production and in Risk Bearing 710
 Contracts and Efficiency 710
Solved Problem 19.3 711
 Choosing the Best Contract 712
APPLICATION *Health Insurance and Moral Hazard* 713
Solved Problem 19.4 714

19.4 Monitoring to Reduce Moral Hazard 715
 Bonding 715
Solved Problem 19.5 716
APPLICATION *Capping Oil and Gas Bankruptcies* 717
 Deferred Payments 718
 Efficiency Wages 718
APPLICATION *Walmart's Efficiency Wages* 719
 After-the-Fact Monitoring 719

19.5 Contract Choice 720

19.6 Checks on Principals 721
APPLICATION *Layoffs Versus Pay Cuts* 721
CHALLENGE SOLUTION *Clawing Back Bonuses* 723
Summary 724 ■ *Exercises* 725

Calculus Appendix E-1
 Regression Appendix E-29
 Answers to Selected Exercises E-32
 Definitions E-53
 References E-59
 Sources for Applications and Challenges E-68
 Index E-77
 Credits E-109