

Index

- Abandonment option
 - agency problems, 827, 843
 - asset structure, 840–843
 - balance sheet, 823
 - capital budgeting, 825
 - case studies, 652–657
 - Compustat data, 831
 - empirical testing, 823, 828, 835
 - European and American, 825
 - exercising, 845
 - exit value, 824, 828
 - financial distress, 843–845
 - hysteresis, 165
 - put option, 296
 - PVCF calculations, 847, 849
 - sample selection, 833–835
 - sensitivity tests, 845–848
 - sequential decision, 661n
 - theory and predictions, 825–828
- Abandonment value
 - capital budgeting, 295
 - cash flows, 297
 - equation, 850
 - investor, 175, 823
 - numerical examples, 301
 - payout ratios, 297
 - problem, 296–299
 - project life, 295
 - salvage, 299, 305, 308
 - sensitivity analysis, 302
 - solution procedure, 299
- Accounting
 - multinationals, 758–760
 - value-relevant, 823
- Across-country options, 745, 748
- Acquisitions. *See* Strategic acquisitions
- Adjusted discount rates, 175
- Aircraft industry, 273, 421
- Airlines, ticket pricing, 465
- American options, 707, 825
- Analyst forecasts, future earnings, 824, 829
- Approximation techniques, 575–582
 - binomial, 575, 578
 - errors and convergence, 580
 - finite difference, 577
 - Monte Carlo simulation, 575
 - option valuation, 571
 - principles, 572–574
 - stability, 578, 581
- Arbitrage
 - basic concepts, 176n
 - oil reserves, 781
- Asia, global sourcing, 743
- Asset pricing
 - equilibrium model, 3
 - investment timing, 256
 - standard model, 259
 - stochastic, 256–258
- Assets. *See also* Abandonment option
 - cash flows, 601
 - financial, 668, 670
 - flexibility, 668
 - managing, 704
 - market value, 842
 - nonfinancial, 668, 670
 - physical, 299
 - replacement value, 851
 - return variance, 387
 - structure, 840–843
- At-the-money options, 373
- Bad news principle, 163, 169
- Balance sheet, abandonment option, 823
- Barraquand-Martineau model, Monte Carlo simulation, 614, 616
- Berger, P. G., 823
- Beta risk. *See also* Volatility
 - abandonment option, 830
 - asset pricing, 139
 - real options, 4
- Binomial approximation
 - call options, 591
 - computer costs, 587
 - option valuation, 584
- Biotechnology firms, volatility, 68
- Bjerksund, P., 689
- Black-Scholes model, option pricing, 409, 560, 583
- Bonds
 - call options, 30
 - corporate, 2, 559
- Book value
 - abandonment option, 828
 - asset classes, 824, 841
 - excess, 835, 851n
- Break-even price, uncertain investments, 700
- Brealey-Myers Second Law, 26
- Brennan, M. J., 135, 335, 559
- Brennan-Schwartz model, option valuation, 614–618
- Brownian motion
 - correlated, 2242
 - geometric, 240, 254
- Budgeting. *See* Capital budgeting
- Building valuation, 807–811
 - business and commercial, 808, 815
 - empirical results, 807–811
 - industrial and residential, 810, 815
 - land prices, 721
 - market prices, 817
 - observation errors, 811–813

- Building valuation (cont.)
 - option pricing, 8–7–811
 - size and price, 721, 820n
 - uncertain investment, 727
 - zoning categories, 807, 820n
- Buy-and-hold strategy, 519, 525
- Bystander strategy, 519
- Call options, 583–590
 - American, 583
 - binomial approximation, 591
 - Black-Scholes model, 583
 - computer costs, 587, 589
 - dividends, 584–590
 - European, 583
 - exercising, 310n, 368
 - expansion, 380n
 - futures contracts, 648
 - irreversible, 200
 - oil reserves, 780
 - pricing models, 780
 - vs. real options, 82, 98n
 - solution techniques, 30
 - strategic investment, 453
 - valuing, 37, 98n, 559, 583
 - volatility, 68
- Capacity choice
 - dynamics, 326
 - firm valuation, 313, 316
 - incremental, 233–236
 - irreversible, 313
 - real options, 313
 - simple model, 316–324
 - utilization, 326
- Capital
 - abandonment option, 831
 - expenditures, 831
 - firm-specific, 313
 - marginal value, 332n
 - market returns, 25, 32n
 - opportunity cost, 20
 - staged financing, 127
 - timing commitment, 41
- Capital asset pricing model (CAPM), 49, 139
- Capital budgeting
 - abandonment option, 295, 825
 - dissatisfaction, 47
 - empirical issues, 438
 - general model, 422–427
 - growth option, 33
 - interrelated projects, 419–421
 - long-range planning, 44
 - managerial flexibility, 59
 - natural resources, 135, 335
 - optimal investment, 432–438
 - options approach, 79, 103
 - practical implementation, 438
 - process, 493n
 - real options, 93, 419, 687n
 - strategic, 21, 36, 87
 - techniques, 5
 - urgency of decision, 89
- Capital investments
 - oil reserves, 72
 - options approach, 61–76
- strategic, 6
- volatility, 68
- uncertainty, 70
- CAPM, 49, 139
- Cash flow. *See also* Discounted cash flow
 - abandonment option, 297
 - asset value, 601
 - binomial technique, 551
 - estimating, 28
 - forecasting, 27, 297
 - interrelated projects, 423
 - jumps in, 261–263
 - past-dependent, 601
 - Poisson-Wiener process, 261
 - proportional, 379n
 - risk premiums, 601
 - valuation model, 338, 341
- CCA, 51, 59, 82
- Childs, P. D., 419
- CIM, 528
- Claims. *See* Contingent claims; Real asset claims
- Closed-end funds, 22
- Commitment
 - growth options, 509
 - real options, 383
 - strategic value, 383, 455
- Commodities
 - cash flow, 1
 - convenience yield, 136, 338
 - pricing models, 13n, 75, 333n
 - production and demand, 265
 - spot prices, 147
 - volatility, 75, 238
- Competition
 - capital budgeting, 419–421
 - commitment, 451
 - contrarian, 459–467
 - Cournot-type, 456
 - flexibility, 451
 - industry dynamics, 169–172
 - interrelated projects, 419
 - monopoly game, 462, 469, 472
 - Nash-Cournot model, 461, 469, 472

- numerical calculations, 171
- option pricing, 517–519
- real options, 383
- reciprocating, 459–467
- Stackelberg leadership, 464, 469, 472
- strategic acquisitions, 405
- strategic options, 112
- technological innovations, 517–519
- tough or accommodating, 456, 458
- Competitive strategies
 - critical demand zones, 481–487
 - effects, 467–481
 - goodwill, 479–481
 - modeling, 459–467
 - monopoly outcome, 483
 - Nash model, 483
 - numerical examples, 467
 - offensive and inoffensive, 458
 - proprietary and shared, 474, 482
 - Stackelberg model, 483
 - two-stage game, 460
- Competitive options, 8–10
- Compound options, 186
 - Geske-Johnson method, 543–551
 - interproject, 86, 89
 - valuing, 275, 649
- Compulsive strategy, technological innovation, 518, 524
- Computer-integrated manufacturing (CIM), 528
- Computer costs, option valuation, 585, 587, 589
- Computers, hardware and software, 571
- Conglomerates, 22
- Construction. *See also* Building valuation
 - default options, 126
 - flexibility value, 288
- Consulting firms, strategic planning, 21
- Contingent claims
 - Black-Scholes equation, 560
 - finite differences, 559
 - jump processes, 559–569
 - pricing methods, 559–569
 - riskless arbitrage, 562
 - valuing, 297, 319, 330
- Contingent claims analysis (CCA), 51, 59, 82
- Contraction options, 118, 193
- Contrarian competition, 456
 - critical demand zones, 486
 - modeling strategies, 462–465
 - project values, 472
 - proprietary and shared, 490
 - Stackelberg leader, 494n
 - strategic investment, 477, 490
- Convenience yield
 - commodities, 136
 - futures prices, 2, 11
 - net margin, 218
- Convertible bonds, 30, 559
- Copper mines
 - hysteresis effect, 229
 - Monte Carlo simulation, 614
 - real options, 143
 - timing option, 349
 - valuation, 146, 347
- Copper prices, 348
 - convenience yield, 143
 - volatility, 75
- Corporate bonds
 - default risk, 2
 - pricing, 2
 - valuation, 559
- Corporations. *See also* Firms; *specific names*
 - financial strategy, 21
 - growth options, 8
 - resource allocation, 45
- Cortazar, G., 601
- Costs
 - Kolmogorov equation, 740
 - mean and variance, 740
 - uncertainty, 3
- CPU, 585
- Critical demand zones, competitive strategies, 481–487
- Crude oil distiller, abandonment option, 652–657
- Cumulative volatility, 387

- DCF. *See* Discounted cash flow
- Decision-making, major insights, 658
- Decision tree analysis (DTA)
 - capital budgeting, 59, 79
 - contingent claims, 129n
 - generic example, 49
 - real options, 5
- Default option, oil company, 117, 126
- Deferrable options
 - capital budgeting, 89, 95
 - natural resources, 379n
 - oil company, 117, 123
 - sensitivity analysis, 378
- Delayed investments, 200
- Demand shocks, 177n
- Developed property, Williams model, 820n
- Diffusion processes, option valuation, 572
- Discontinued operations, 7
- Discount rates
 - computing, 259–261
 - project value, 660n
 - risk-adjusted, 1, 310n
 - selecting, 64

- Discounted cash flow (DCF)
 - capital budgeting, 80
 - classical model, 137–140
 - criticism, 47
 - forecasting, 27
 - formula, 20
 - limitations, 6, 29, 107
 - major insights, 658
 - offshore leases, 775
 - option value vs, 785
 - real options, 5, 103
 - strategic planning, 20
 - traditional techniques, 49
- Discrete transition probability, flexibility option, 678
- Discretionary investments, 6
- Disinvestment, 65, 165
- Diversification, flexibility option, 410–414
- Divestiture option, strategic acquisitions, 406, 414
- Dividends. *See also* Cash flow
 - binomial technique, 551
 - call options, 584–590
 - liquidating, 846
 - option value, 583
 - put options, 592–595
- Dixit, A. K., 61, 153
- Drift equations, 3, 260
- DTA. *See* Decision tree analysis
- Dual-fuel steam boiler, 663–675
- DCF techniques, 664
 - flexibility value, 663–675
 - simple formula, 664–666
- Dual funds, valuing, 559
- Dynamic programming, 187, 213, 242

- Early investing, growth options, 40
- Economic policy, investment behavior, 236–238
- Economy, uncertain investments, 691
- Ekern, S., 689
- Electric utilities, 74
- Embedded options, 517, 531
- Energy prices, recession, 246n
- Energy projects, put options, 12
- Environmental pollution, 12, 115
- Equity value, percentage change, 851
- Escrow accounts, investment costs, 379n
- Excess book value, 835, 851n
- Exchange option, 518
- Exchange rates
 - critical, 766n
 - hysteresis, 752
 - imports, 65, 153
 - multinationals, 758
 - Ornstein-Uhlenbeck process, 766
 - plant location, 9
 - threshold values, 757
 - trade deficits, 229
- Ex-dividend date, 588
- Exercise price, 636
 - call options, 200
 - option value, 588, 590
 - put options, 594
- Exit value
 - abandonment option, 836
 - asset classes, 824, 826
 - estimating, 828
 - excess, 826, 850
 - market price, 841
- Expansion options, 118, 124, 193
- Expiration date, 588, 636
- Expiring investments, 89
- Expiring options, 702
- Exports
 - exchange rates, 162
 - hysteresis, 756
- Exotic options, 624

- Factory. *See also* Building valuation
 - time-to-build, 275–279
 - valuation, 333n
- Finance theory, 19
 - analysis limitations, 23
 - asset flexibility, 668
 - cash flow, 20
 - criticism, 23
 - decision-making, 637
 - misuse, 24
 - planning process, 31
 - problems, 27
 - relevance, 19–21
 - strategic planning, 19–23
- Financial options
 - irreversibility, 204–206
 - vs. real options, 713n
- Finite difference methods
 - computer costs, 587, 589
 - contingent claims, 559–569
 - explicit and implicit, 560, 584
 - forward and backward, 597n
 - option valuation, 563–568
- Firms. *See also* Corporations; *specific names*
 - abandonment option, 835–843
 - capacity choice, 313, 316
 - irreversible investment, 313
 - optimal capacity, 322–324
 - option valuation, 840–843
 - sensitivity analysis, 325
 - valuing, 313, 324, 326

- Flexibility option
 - cancellation, 681
 - competition, 383
 - costless switching, 673
 - decision tree, 666
 - discrete transition, 678
 - diversification, 410–414
 - dual-fuel steam boiler, 663
 - expansion, 681
 - general model, 666–670
 - natural resources, 681
 - product and process, 195
 - real options, 179
 - risk adjustment, 668–670
 - salvage and deferral, 681, 685
 - sensitivity analysis, 683
 - simple formula, 664–666
 - strategic acquisitions, 406
 - types, 681
 - valuation, 663–675
- Foreign exchange, market volatility, 749
- Foreign investment, real options, 12, 115, 745
- Foreign trade, hysteresis, 677n
- Frictionless markets, real estate, 731n
- Future investments
 - Black-Scholes formula, 698
 - call options, 33
 - uncertainty, 697–699
- Futures contracts, 1, 648
- Futures prices
 - applications, 623
 - convenience yield, 2, 11
 - spot prices, 2
 - stochastic model, 340
 - theory, 623
- Game theory, competitive interaction, 87
- Gas prices, 664, 673
- Geological uncertainty, 3
- Geske, R., 571
- Geske-Johnson method, compound options, 543–551
- Global manufacturing
 - flexibility factor, 750
 - heuristic rules, 757–761
 - hysteresis, 756
 - location and scheduling, 746
 - multinationals, 743, 746
 - operating procedures, 757–761
 - planning models, 746
 - plant location, 764
 - relative cost, 749
 - shifting production, 746
 - sourcing, 752, 762
 - wage rates, 748
 - within-country options, 745, 756
 - volatility, 76
- Global warming, 12, 115
- Gold, spot prices, 142, 148
- Gold mines
 - real options, 140–143
 - valuation, 2, 146
- Goods prices, flexibility option, 670
- Goodwill, 479, 756
- Government
 - regulation, 12, 67
 - subsidies, 114
- Grenadier, S. R., 517
- Growth options, 33–45
 - benchmark model, 501–503
 - call options, 34
 - capital budgeting, 33
 - case studies, 646–652
 - characteristics, 42
 - corporate, 8, 120
 - early investing, 40
 - exercising, 515n
 - expiring, 43
 - framework, 42
 - monopoly investment, 501
 - multinationals, 756
 - new perspective, 44
 - oil company, 120, 124
 - planning situation, 647
 - pricing formula, 409, 417n
 - proprietary and shared, 39, 43
 - real options, 105
 - selected companies, 35
 - simple and compound, 43
 - strategic acquisitions, 406–410
 - valuing, 12, 37, 327, 332n, 409
- Harvard Business School, 45, 761
- Hedging, 577, 602
- Heuristic rules, global manufacturing, 757–761
- Hurdle rates, 153, 176n, 820n
- Hysteresis
 - abandonment option, 165
 - Dixit model, 229
 - exchange rates, 752
 - flexibility option, 663, 667
 - foreign trade, 677n
 - global manufacturing, 756
 - investment, 153, 167
 - multiple options, 110
 - prevalence, 229
 - real options, 7, 153
 - sunk costs, 227–230

- IBM, 37, 530
- Immediate development, uncertain investment, 695–697
- Imperfect competition, strategic growth, 503–507
- Imports, exchange rates, 65, 153
- Incremental investments
 - basic models, 234
 - Bertola model, 234
 - capacity choice, 233–236
 - dynamic model, 234
 - Manne model, 234
 - Pindyck model, 234
 - stochastic models, 236
 - technology choice, 235
- Industry
 - competitive dynamics, 169–172
 - real options, 452–459
 - volatility, 68
- Inflation
 - land prices, 730
 - treatment, 25
- Input costs, uncertain investments, 734
- Institutional Brokers Estimate System (IBES), 833
- Insurance contracts, 624
- Interest rates
 - growth options, 38
 - investments, 236
- Interproject options, 47, 86
- Interrelated projects
 - capital budgeting, 419–421
 - cash flows, 423, 448n
 - derivations and proofs, 443–445
 - distribution-free, 422–427
 - empirical issues, 438
 - general model, 422–427
 - implementation, 438
 - normally distributed case, 427
 - optimal investment, 432–438
 - parallel and sequential, 422, 427, 439
 - real options, 419–421
 - valuation models, 440–443
- In-the-money options, 374, 414
- Intraproject options, 85, 89
- Inventory, convenience yield, 356n
- Investments. *See also* Capital investments; Uncertain investments
 - abandonment option, 175, 823
 - anticipated, 315
 - asset price, 256–258
 - bang-bang solution, 279
 - base case, 283
 - Bellman equation, 243
 - call options, 161
 - capital budgeting, 432–438
 - characteristics, 215, 273
 - competitive dynamics, 169, 457
 - decision-making, 47, 61, 221, 273, 432
 - delayed, 200
 - discount rates, 259–261
 - deferring, 53–55
 - economic policy, 236–238
 - extensions and qualifications, 163
 - firm-specific, 199
 - foreign, 12, 115, 745
 - hurdle rates, 153
 - hysteresis, 153
 - industry-specific, 199
 - interest rates, 236
 - interrelated projects, 432–438
 - irreversible, 66, 199
 - lumpy, 329
 - market value, 276, 279
 - Marshallian trigger, 156, 161
 - monopolist decision, 265–267
 - natural resources, 135, 335, 679
 - noneconomic applications, 173
 - numerical examples, 263–265
 - opportunity, 28, 214, 360
 - optional policy, 159, 315
 - optimal rule, 215
 - option interactions, 359
 - option pricing, 517–519
 - parameters, 263
 - price uncertainty, 689
 - problem solving, 211–213
 - project value, 217–221
 - real options, 1, 153, 199, 335
 - sequential, 230–233
 - technological innovations, 517
 - theory, 153
 - time to build, 273–275
 - timing, 154, 209, 214, 243, 256
 - triggers, 159
 - United States and Japan, 168
 - valuation model, 338–344
 - waiting, 154, 253
- Irreversible investments, 199–202
 - basic models, 209, 736
 - capacity choice, 313, 316
 - financial options, 204–206
 - firm valuation, 313
 - interest rates, 236
 - MacDonald-Siegel model, 209
 - option models, 269n
 - real options, 199, 313
 - simulation models, 238
 - stochastic process, 208, 225, 239

- trade reforms, 237
- two-period example, 202–208
- Ito's lemma, investment timing, 212, 241
- Japan
 - exchange rates, 229
 - investments, 168
 - production switching, 767n
- Jump processes
 - contingent claims, 559
 - mean and variance, 569
 - option valuation, 572
- Kemna, A. G., 641
- Kester, W. C., 33
- Kogut, B., 743
- Kolmogorov equation, cost model, 740
- Kulatilaka, N., 179, 499, 663, 743
- Labor
 - markets, 167
 - training, 626
- Laggard strategy, technological innovation, 519, 525
- Land
 - development, 11, 114
 - empirical tests, 813–818
 - real options, 11, 114
 - transactions, 803–806
 - value, 813–818
- Land prices
 - applications, 728
 - building activity, 727
 - comparative statics, 724
 - extensions, 728
 - inflation, 730
 - numerical example, 723
 - options, 803
 - timing model, 804–806
 - uncertainty, 719–721
 - valuation techniques, 720, 722
- Latent assets, 447n
- Leapfrog strategy, technological innovation, 518, 525
- Leasing, option valuation, 11, 30, 114
- Lewent, J., 633
- Licensing, strategic option, 396
- Log-transformed binomial technique
 - adjustments and applications, 551–554
 - algorithm structure, 541–543
 - comparative analysis, 543–551
 - flow chart, 542
 - multiple options, 539
 - risk-neutral probability, 555
 - stability and consistency, 550
 - theoretical design, 540
- London Stock Exchange, 779
- Luehrman, T. A., 385
- MacDonald-Siegel model, irreversible investments, 209
- Majd, S., 273, 295
- Managerial flexibility
 - asymmetry, 48, 80
 - generic example, 48
 - NPV analysis, 80, 361
 - operating options, 53
 - real options, 359
 - simple examples, 53
 - special case, 703
 - uncertain investments, 703
 - valuation, 47–59
- Managerial options, 295, 309n
- Manne model, incremental investing, 235
- Manufacturing. *See also* Global manufacturing
 - flexibility, 11, 114
 - scientific, 633–639
- Marginal cost
 - investment, 320
 - measuring, 328
 - pricing, 333n
 - unit capacity, 318
- Market value
 - abandonment option, 826, 836
 - exit value, 836, 841
 - investments, 276, 279
 - manufacturing firm, 330
- Marshall trigger, investments, 156, 161
- Mason, S. P., 47
- Merck
 - option analysis, 636
 - real options, 11
 - scientific management, 633
- Merton, R. C., 623
- Mesh ratio, approximation techniques, 578
- Microprocessors, 534n
- Migration strategy
 - adoption behavior, 525, 534
 - equilibrium argument, 522
 - likelihood and speed, 524, 527
 - optional investment, 521–524
 - probability analysis, 533
 - technological innovation, 518, 524
- Mines and mining
 - boundary conditions, 145
 - Brennan-Schwartz model, 614–618
 - cash flows, 145
 - exhaustion, 145

- Mines and mining (cont.)
 - flexibility option, 413
 - infinite resource, 344–347
 - inventory size, 350
 - investment decision, 349–351
 - Monte Carlo simulation, 614
 - opening and closing, 346
 - operating decisions, 145
 - output rates, 354
 - premature abandonment, 145
 - real options, 144, 679
 - time-to-build, 273
 - valuation model, 338–34
- Monopoly investment
 - benchmark model, 501
 - decision-making, 265–267
 - growth option, 501–503
 - net profit, 501, 503, 513n
- Monte Carlo simulation
 - mine problem, 614–618
 - model extensions, 617
 - option valuation, 575–577
 - state variables, 613
- Mortgage pricing, valuation model, 814
- Multinational companies
 - accounting practices, 758–760
 - exchange rates, 758
 - foreign subsidiaries, 743
 - global manufacturing, 743, 746
 - growth options, 756
 - heuristic rules, 757–761
 - managerial discretion, 745
 - natural resources, 679
 - network activity, 745
 - operating flexibility, 743
 - option valuation, 743–746
 - real options, 679
- Multiple options
 - heuristic rules, 544
 - interdependent, 110
 - numerical techniques, 539, 544
 - research and development, 552
 - valuation, 539
- Multiple real options
 - assumptions, 362–365
 - binomial model, 553, 362
 - interactions, 359
 - numerical technique, 370–377
 - opportunity, 360–365
 - project description, 360
 - specification, 362–365
 - valuation, 359
- Multiplicative binomial model, options analysis, 539, 555
- Mutual funds, options strategy, 628n
- Myers, S. C., 19, 295
- Nash-Cournot model, competition, 461, 469, 472
- Natural resources. *See also* Mines and mining
 - base case analysis, 681–683
 - convenience yield, 338
 - infinite case, 344–347
 - investment, 135, 335, 614, 679
 - Miller-Upton model, 337
 - project description, 679–681
 - real options, 11, 113, 135, 335, 679
 - stochastic models, 335
 - valuation model, 338–344
- Nested options, business strategy, 396–401
- Net present value (NPV)
 - capital budgeting, 59, 80, 419
 - dissatisfaction, 47
 - expanded and passive, 93, 80, 103, 362
 - growth options, 37
 - hurdle rates, 65
 - irreversible investments, 203, 313
 - limitations, 487
 - managerial flexibility, 80, 361
 - positive and negative, 9, 24
 - probability distribution, 81, 98n
 - real options, 103
 - strategic planning, 19, 23, 454
 - timing option, 643
 - volatility effect, 509
- New York Stock Exchange, 779
- Nonadditive options, 365–369
- Nonfinancial assets, flexibility option, 669
- Noninventory items, book value, 852n
- NPV. *See* Net present value
- Nuclear power plants
 - cancellation, 741n
 - critical capacity, 739
 - operating costs, 742n
 - uncertainty, 736–739
- Numerical techniques
 - binomial techniques, 539, 544
 - accuracy and efficiency, 592
 - applications, 551–554
 - alternative, 543, 609
 - approximation, 571
 - binomial, 539
 - comparison, 582, 609
 - computer costs, 598n
 - finite difference, 544–551, 559
 - Johnson method, 544
 - jump processes, 559–569
 - multiple options, 539
 - option valuation, 10, 556n, 571, 601

- Parkinson method, 544
- quadratic approximation, 544
- real options, 4
- stability and consistency, 550
- types, 10, 582
- Whaley method, 544

- Ofek, E., 823
- Offshore leases
 - comparison, 784, 794
 - data sources, 786
 - DCF approach, 775, 798n
 - depreciation allowance, 799n
 - developed and undeveloped, 774, 780
 - development costs, 777, 797n
 - economics, 774
 - empirical results, 786–796
 - exploration, 776, 784, 788, 795
 - extraction stage, 778
 - field size, 799n
 - government auctions, 72
 - industry bids, 791
 - investment timing, 784
 - market value, 798n
 - option value, 773
 - real asset claims, 773
 - relinquishment, 790, 799n
 - reserves, 787
 - royalties and taxes, 799n
 - stage characteristics, 776
 - technology, 774
 - timing investment, 795
 - tract valuation, 775–785
 - valuation equation, 787–791
 - variance estimates, 788
- Oil and gas industry
 - abandonment option, 652–657
 - capital investment, 72
 - development cost, 713n
 - field valuation, 706
 - lease value, 7, 11
 - Norway, 714n
 - offshore projects, 642–646
 - options approach, 72
 - real options, 11
 - refinery, 652–657
 - reserves, 72
 - sequential investment, 232
 - timing option, 642–646
- Oligopoly, 164
- Operating options, 314
 - capital markets, 329
 - combinations, 371
 - managerial flexibility, 53
 - multinationals, 743, 746
 - types, 57
 - valuing, 137, 359, 362
- Opportunity
 - capital cost, 20, 27, 201
 - investment, 28, 263
 - numerical examples, 263
 - stochastic process, 258, 268
 - valuing, 85
- Opposite-type options, 368
- Option interactions
 - exercise times, 372
 - expanding, 373
 - investment valuation, 359
 - nonadditivity, 365–369
 - usual properties, 376
- Option pricing
 - arbitrage, 2, 109
 - basic models, 6
 - binomial technique, 208
 - Black-Scholes equation, 409, 560, 583
 - building values, 807–811
 - competition, 465, 479, 517
 - dynamic models, 712n
 - empirical results, 803, 807
 - equilibrium argument, 522
 - goodwill, 479–481
 - investment opportunity, 401, 517
 - land values, 813–818
 - major insights, 657
 - market and transfer, 760
 - model and assumptions, 519–521
 - Monte Carlo simulation, 615, 618
 - multinationals, 760
 - no-arbitrage hedge, 97n
 - numerical examples, 705–710
 - pioneer venture, 647
 - real assets, 803, 807
 - reciprocating strategy, 465–467
 - risk-neutral, 2
 - spanning assumption, 210
 - strategy, 521–524
 - technology, 517, 623
 - theory, 623–628
 - timing problem, 209, 804
 - uncertain investments, 689–691
 - wait and see, 689–691
- Option space, 387
 - maybe and probably, 389
 - now and never, 389
 - value metrics, 387
- Option valuation
 - accuracy and efficiency, 592
 - alternative techniques, 571

- Option valuation (cont.)
 approximation, 571
 binomial trees, 603
 Black-Scholes equation, 574
 Brennan-Schwartz model, 614–618
 comparisons, 791–794
 computer costs, 585, 598n, 605
 conditions, 744
 DCF approach, 785
 diffusion process, 572
 empirical results, 786–796
 equilibrium model, 778
 finite difference, 606
 importance, 162
 investment rules, 267
 maturity, 607
 Monte Carlo simulation, 575, 609
 multinationals, 743–746
 numerical techniques, 582
 offshore leases, 773
 premiums, 816, 821n
 principles, 572–574
 real asset claims, 773
 risk-neutral technique, 777
 strategic acquisitions, 405
 time-dependent, 745
 uncertain investments, 744
 variance and expiration, 795
 volatility, 652
- Options. *See also specific options*
 acquiring, 31
 additivity, 183, 364, 380n
 asymmetry diagram, 38
 capital investment, 61–76
 classification, 91–93
 competition effect, 87
 conceptual approach, 17, 79
 contracts, 636
 creating, 63, 72
 deferring, 53–55
 exclusive ownership, 87
 exercising, 31, 71, 368
 expanding, 56, 83, 104
 initiating, 98n
 interaction, 105
 killing, 62, 201
 Merck analysis, 636
 operating strategy, 91–93
 opposite-type, 367
 premiums, 803
 real vs. financial, 745
 strategic factors, 31
 switching, 83, 98n, 105, 183
 types, 627
 underinvestment, 17
 value components, 91–93
- Ornstein-Uhlenbeck process, exchange rates, 766
 Ott, S. H., 419
 Out-of-the-money options, 37, 368, 379n
- Paddock, J. L., 773
 Paper industry, flexibility option, 413
 Parallel projects
 capital budgeting, 422, 427
 cash flows, 437
 covariance effects, 435
 empirical issues, 438
 implementation, 438
 investment strategy, 433–438
 program value, 427
 valuation model, 440
- Partial differential equation (PDE), 4, 308
 Payoff functions, monopoly investment, 501, 513n
 Payout ratios, abandonment option, 297, 305
 PDE, 4, 308
 Perfect markets, securities pricing, 1
 Periodicals industry, strategic acquisitions, 408
 Perotti, E. C., 499
 Personal computers, 530
 Petrochemical plant, time-to-build investment, 273
 Petroleum. *See* Oil and gas industry
 Pharmaceutical industry, scientific management, 633–639
 Pindyck, R. S., 61, 199, 273, 313, 733
 Pindyck model, incremental investing, 234
 Pioneer venture
 capital and production, 650
 growth option, 646–652
 option pricing, 646
 stand-alone project, 646
 valuing, 12
- Plants
 exchange rates, 9
 location, 9
 closings, 12
 valuing, 12
- Poisson-Wiener process, cash flows, 261
 Portfolio strategy
 real options, 385
 self-financing, 336, 356n
- Pollution, real options, 12, 115
 Present value of expected cash flow (PVCF)
 empirical results, 837
 proxies, 829–833
 sample selection, 834
 sensitivity tests, 845
 theory and predictions, 826
- Printing industry, strategic acquisitions, 415

- Probability measures, risk-adjusted, 1
- Production
 - Cobb-Douglas function, 265
 - demand, 265–267
 - flexibility option, 412, 418n
 - hysteresis, 756
 - investment, 265–267
 - shadow value, 741n
 - technology, 295
 - temporary shutdown, 83
 - uncertainty, 3
- Production shifting
 - continuous-time, 763
 - costless, 747
 - flexibility factor, 755
 - global manufacturing, 746
 - heuristic rules, 757–761
 - hysteresis, 756
 - model uncertainty, 748
 - numerical example, 753
 - principal results, 754
 - stochastic models, 746
- Profits, incremental, 315
- Projects. *See also* Parallel projects
 - abandonment option, 295
 - classification, 84–87
 - contracting, 56
 - cutoff value, 284–287
 - deferring, 53–55
 - evaluation, 43
 - flexible and rigid, 179
 - infinite, 244n
 - interdependent, 58
 - investments, 217–221
 - partial, 419
 - payout rates, 282
 - rigid technology, 182
 - risk factor, 37
 - salvage value, 85
 - scrapping, 256, 259
 - sensitivity analysis, 377
 - stand-alone, 646
 - valuing, 128n, 219, 243
- Property tax rates, 341
- Proprietary investment
 - capital budgeting, 87
 - critical demand zones, 482
 - inoffensive strategy, 480
 - negative effect, 480
 - numerical example, 468
 - offensive strategy, 471–473
 - option strategy, 87
 - research and development, 471
 - strategic effect, 478
- Provance model, flexibility option, 671
- Put options
 - American, 592
 - binomial approximation, 592
 - Black-Scholes equation, 544
 - computer costs, 594, 596
 - dividends, 592–595
 - energy projects, 12
 - exercising, 368, 574
 - numerical techniques, 544–551, 571, 592
 - salvage value, 8
 - scrapping, 245n
 - solution techniques, 30
 - theory and applications, 624
 - valuation techniques, 592–595
- PVCF. *See* Present value of expected cash flow
- Quantity competition
 - contrarian strategy, 462–465
 - proprietary and shared, 468
 - research and development, 467
- Quigg, L., 803
- Rate of return, internal ranking, 25
- Real asset claims
 - empirical results, 786–796
 - offshore leases, 773
 - option valuation, 773
- Real estate
 - divestiture, 415
 - flexibility, 413
 - Seattle market, 806, 808
- Real options. *See also specific options*
 - acquisitions, 115
 - advantages, 4
 - American, 611–618
 - applications, 113–115
 - base case analysis, 681–683
 - basic models, 6, 101
 - binomial techniques, 6, 10, 603
 - Black-Scholes equation, 602
 - building valuation, 807–811
 - capacity choice, 313
 - capital budgeting, 93, 419, 687n
 - case studies, 641
 - classification, 90–93
 - commitment, 451
 - common types, 104
 - competition, 383, 452
 - conceptual approaches, 5, 82, 108
 - criticism, 107
 - DCF analysis, 682
 - defining, 627
 - empirical results, 12, 803, 807

- Real options (cont.)
 European, 602
 examples, 116–126
 expansion, 681
 explanatory power, 12
 financial options vs., 665
 flexibility, 103–106
 foreign investment, 115
 foundations, 108
 future research, 115
 general model, 422–427
 gold mines, 140, 422
 government subsidies, 114
 hysteresis, 153, 179
 individual, 8
 industrial organization, 452–459
 interactions, 359
 interrelated projects, 419–421
 investment, 1, 153, 199, 273, 385
 irreversibility, 199–202
 land development, 114
 lattice approach, 10
 leasing, 114
 literature, 5, 106, 823
 main ideas, 1–5
 major insights, 657–659
 managerial flexibility, 359
 manufacturing, 114
 mining operations, 144–146
 Monte Carlo methods, 4
 multinationals, 745
 multiple, 8, 359
 natural resources, 113, 135, 335, 679
 numerical methods, 4, 10, 111, 539, 601
 oil company, 117–120
 operating strategy, 91–93
 portfolio management, 31, 385
 pricing strategies, 689–691
 project description, 679–681
 research and development, 115
 risk adjustment, 108
 salvage and deferral, 681, 685
 sensitivity analysis, 376, 683
 separate valuation, 109
 simulation methods, 601, 611
 start-up ventures, 115
 strategic acquisitions, 405
 strategy and competition, 8–10
 switching flexibility, 179
 technological innovations, 517–519
 timing, 642–646
 types, 121, 627
 uncertainty, 199–202
 underinvestment, 107
 valuation, 107, 116, 273, 601, 681
- Reciprocating competition
 critical demand zones, 488
 equilibrium prices, 475
 modeling strategies, 465
 proprietary vs. shared, 484, 491
 strategic investment, 491
- Replacement investment, 419
- Research and development
 capital investment, 69
 competitive strategies, 474
 exclusive vs. shared, 495n
 growth option, 120
 investment decisions, 273
 multiple options, 552
 proprietary investment, 471
 quantity competition, 467–469
 real options, 115
 shared investment, 473–479
 strategic investment, 452
 valuing, 12
- Resources. *See* Natural resources
- Restart option, 118, 193
- Return on investment (ROI), 44
- Rights, securities options, 34
- Rigid technology, project valuation, 182
- Risk. *See also* Beta risk
 adjustment, 108, 668
 aversion, 259
 flexibility option, 668
 Risk-neutral valuation, 108, 196n
 Riskless arbitrage, 562
 ROI, 44
- Salvage value
 abandoned options, 119, 194, 299
 base case example, 302
 put options, 8
 uncertainty, 305–307
- Schwartz, E. S., 1, 135, 335, 559
- Scrapping projects, 256, 259
- Securities options, 34
- Separate options
 abandoning, 370
 contracting, 371
 deferring, 370
 switching, 371
 valuing, 370
- Sequential investments, 230–233
 Majd-Pindyck model, 231
 production decisions, 245n
 random opportunities, 274, 291n

- Roberts-Weitzman model, 233
- Sequential projects
 - capital budgeting, 422, 427
 - cash flows, 437
 - covariance effects, 435
 - development, 444
 - empirical issues, 438
 - implementation, 438, 444
 - investment strategy, 432
 - program value, 428–432
 - valuation model, 442
- Shadow value, production, 741n
- Shared investment
 - critical demand zones, 482
 - inoffensive strategy, 480
 - numerical example, 468
 - offensive strategy, 473
 - options strategy, 88, 94
 - research and development, 473
- Shastri, K., 571
- Shipping industry, real options, 12, 115
- Shortfall, rate of return, 713n
- Shutdown option, 118, 193
- Siegel, D. R., 253, 773
- Simple growth options, 43
- Simulation. *See* Monte Carlo simulation
- Simultaneous entry, growth options, 509–511
- Smit, H. T., 451
- Smith, J. L., 773
- Smith, K. W., 405
- Sourcing, global, 743, 752, 762
- Space-time hyperplane, approximation techniques, 575
- Spanning assumption, option pricing, 210, 317
- Spot prices, commodities, 147, 691, 712n
- Spreads, mean-preserving, 502, 506
- Staged investments, 104
- Start-up ventures, real options, 12, 115
- Stock options, employee, 623
- Stock prices, 636
 - option valuation, 586
 - stochastic variable, 597n
 - timing, 576
- Stackelberg leader, competitive strategy, 464, 483, 494n
- Stopping region, optional scrapping, 269
- Strategic growth options, 499
 - commitment, 501–503
 - imperfect competition, 503–507
 - net gain function, 505, 507
 - sensitivity analysis, 508, 511
 - simultaneous entry, 509–511
 - systematic risk, 512
 - volatility effect, 509
- Strategic investment
 - call options, 453
 - Cournot competition, 493n
 - pioneer venture, 493n
 - proprietary and shared, 456
 - real options, 451
- Strategic options, 8–10
 - competition, 112
 - commitment, 451
 - dynamic approach, 395
 - gardening metaphor, 386
 - flexibility, 451
 - harvesting, 391–394
 - licensing, 396
 - types, 407
 - volatility, 387
- Strategic planning
 - acquisitions, 406–410
 - analysis, 30
 - capital budgeting, 87, 419
 - consulting firms, 21
 - contrarian competition, 477, 490
 - DCF analysis, 20
 - diversification, 410–414
 - divestiture, 414–416
 - finance theory, 19–23
 - flexibility option, 410
 - growth options, 406–410
 - interrelated projects, 419–421
 - nested options, 396–401
 - option pricing, 517–519
 - real options, 383, 452
 - synergy gains, 415
 - technological innovations, 517
- Strike price, flexibility option, 677n
- Sunk costs
 - consumer spending, 230
 - hysteresis, 166, 227
 - irreversibility, 199
 - types, 227
- Supply contracts in natural resources, 351–353
- Swary, I., 823
- Switching option. *See also* Production shifting
 - additivity, 183–185
 - compound interactions, 186
 - costs, 183–191
 - flexibility, 182–191
 - hysteresis, 192, 196
 - oil company, 119, 124
- Synthetic options, 108
- Systematic risk, growth options, 512

- Tax issues, option pricing, 625
- Tax rates, property, 341
- Technological innovation
 - adoption behavior, 525–531
 - buy-and-hold, 519, 525
 - bystander strategy, 519
 - competition, 517–519
 - current and future, 519, 522
 - environment, 525–532
 - flexibility, 182–191
 - investment, 517–524
 - intuitive model, 528
 - migration strategy, 524
 - model and assumptions, 519
 - option pricing, 517–519
 - path-dependent, 519
 - strategic option, 396
 - switching value, 182–191
 - uncertainty, 3, 534n
- Telecommunications industry, volatility, 68
- Time-to-build investments
 - aircraft manufacturing, 273
 - dynamic programming, 282
 - numerical example, 282–288
 - option valuation, 273–275
- Timing investments, 209–216
 - asset price, 256–258
 - risk neutral, 254
 - value of waiting, 256
- Timing options
 - case studies, 642–646
 - DCF analysis, 643
 - offshore projects, 642
- Titman, S., 719
- Trade
 - deficits, 229
 - exchange rates, 229
 - foreign, 677n
 - reforms, 237
- Triantis, A. J., 405, 419
- Trigeorgis, L., 1, 47, 79, 103, 179, 359, 451, 539, 679
- Twin security, 49, 109, 692
- Two-period irreversible investment, 202–208
- Two-stage game, competitive strategy, 460
- Uncertain investments
 - applications, 728
 - abandonment option, 707
 - asset value, 709
 - break-even price, 700
 - Brownian motion, 712
 - commitment, 691, 694, 713n
 - cost vs. payoff, 733–739
 - expiration, 702
 - fixed date, 711
 - flexibility, 693, 702, 705
 - future development, 697–699
 - hysteresis, 153, 169
 - immediate development, 695
 - interest rates, 236
 - irreversibility, 199–202
 - land prices, 719–721
 - managerial flexibility, 703
 - nuclear power plant, 736–739
 - numerical examples, 705–710
 - perpetual opportunity, 710
 - pricing strategies, 689–691
 - project description, 692
 - real options, 199–202
 - salvage value, 305–307
 - simulation models, 238
 - timing development, 699–701
 - two-period example, 208
 - types, 734
 - valuing, 700
- Underinvestment, real options, 5, 17, 107
- Undeveloped property, valuation equation, 805, 819n
- United States
 - investments, 168
 - land prices, 719
 - production, 764
 - trade deficit, 230
- United States Geological Survey (USGS), 786, 791
- Upgrade option, 532
- Urban land prices
 - comparison, 724–727
 - numerical example, 723
 - uncertainty, 719–721
- Urgency, capital budgeting, 89
- Utility planning, options approach, 73
- Vacant land
 - comparative statics, 724
 - derivative security, 722
 - valuation methods, 720
- Valuation grid, Monte Carlo simulation, 615
- Value Line Investment Survey*, 35
- Value-to-cost option, 387
- Venture capital, real options, 127
- Vertical investments, multinationals, 756
- Volatility. *See also* Beta risk
 - biotechnology, 68
 - commodity prices, 75
 - cumulative, 387
 - foreign exchange, 749
 - growth options, 509

- industry, 68
- market, 238, 332n, 749
- option value, 652
- real options, 663, 688n
- strategic options, 387, 509

- Wage rates, global manufacturing, 748
- Waiting strategies
 - asset price, 256–258
 - effect, 155–158
 - investments, 253
 - option pricing, 689
 - valuing, 174, 253
- Warrants, 30
- Waste disposal, flexibility option, 413
- Weighted average cost of capital, 64
- Weiss, A. M., 517
- Whaley method, multiple options, 544–551
- Weiner process, investment timing, 209, 240, 254
- Williams model, developed property, 820n
- Within-country options, global manufacturing,
745, 756
- Working capital, abandonment option, 832