Index

Abandon or contract option, 153, 163, 165, 167
Accommodated entry, xi, 65, 119, 120, 122–23, 132
Action region, 312–313, 453, 455
Advertising strategies, 264–70
 soft investment in, 129, 266–67, 269
Aguerrevere, Felipe, 418
Airbus, 6, 7, 8, 12, 63, 99, 353, 422
Akerlof, George, 31, 40, 41n
Altruism, reciprocal, 143, 144
American call option, xiv-xv, 294n, 307, 308, 326
 perpetual (early exercise of), 446
American investment option, 285
Antitrust regulation
 and German chocolate, 140–41
 and joint research ventures, 409
 and sleeping patents, 410
Arithmetic Brownian motion, 297–98, 429–31, 457
 expected discount factor for, 450
 expected first-hitting time for, 448
 forward NPV for, 443
Arithmetic Ornstein–Uhlenbeck process, 438–39
Asymmetric Cournot duopoly/oligopoly, 106, 235–38, 381, 382
Asymmetric or incomplete information, 30–31, 424
 games of, xiii, 83n
 investment with, 411–15
 market structure under, 102–105, 107
 and R&D spillover, 414
Atoms function, 362n, 398
Auction, 367, 414–15
Aumann, Robert, 24, 40, 40–41
 interview with, 145, 146–47

Backward induction, 109, 112, 131, 135
Baldursson, Fridrik, 325
Bargaining, 135–38
Bargaining power, of suppliers and customers, 65–66
Barriers to entry, xi, 51, 63, 72
 strategic (endogenous), 64, 65
 structural (exogenous), 64–65
Basic option valuation, 169, 174
Bayesian Nash equilibrium, 116
BCG matrix, 71, 71n
Bellman equation, 327, 433
Bellman's principle of optimality, 441
Benefit parity/proximity, 71
Bertola, Giuseppe, 305n
Bertrand, Joseph, 84
Bertrand paradox, 84, 87, 90, 266, 267, 270
Bertrand price competition, 33n, 84, 86–92, 97, 126–28
 with cost symmetry, 106
 differentiated, 87–88, 90–92
  equilibrium profits in, 270
  and investment options, 238–40, 241, 242
  tough vs. soft commitment in, 127
"Best-practices" approach, 10
Binomial tree/lattice, 177, 183, 220n
 on evolution of demand, 210, 211
 on evolution of market prices, 210, 212
 on evolution of market uncertainty, 201
 for patent fighting strategies, 206
Black, Fischer, 40, 175. *See also* Black–Scholes model
Black–Scholes (BS) model, 174, 176, 185–187, 189, 404–405, 435–38, 458–59
Blockaded entry, xi, 65, 119, 410
Boeing
 in duopoly, 63, 99, 422
 interview with Scott Matthews, 11–12
 787 Dreamliner, 6–9, 353
Boston Consulting Group (BCG), 198–99
 BCG matrix, 71, 71n
 interview with Rainer Brosch and Peter Damisch, 198–99

Boundary conditions
 smooth-pasting, 293n, 328–29, 329n, 456, 458
 value-matching, 293n, 328, 374, 455–56
Bounded rationality, 86
Boyer, Marcel, 389n, 420, 421, 423, 424
Brand-name reputation
 and early-mover advantage, xii
 as soft commitment, 269
Brazil, real options applications, 172–73
Brennan, Michael, 358
Brosch, Rainer, 13, 198–99
 interview with, 198–99
Brownian motion, 427, 458–59
 arithmetic (ABM), 297–98, 429–31, 443, 448, 450, 457
 fundamental quadratic for, 416, 445–46
 geometric (GBM), 298, 431–38, 457 (*see also* Geometric Brownian motion)
 standard, 287, 312, 327, 344, 427–28

Calculus, stochastic, 42, 227, 294n, 425, 426, 428, 433, 458–59
Call option, xi
 American, xiv-xv, 294n, 307, 308, 326
  perpetual, 446
 European, 193, 227, 189, 190
  Black–Scholes pricing of, 185, 187, 435–38
  capacity units under construction as, 418
  and oil reserve development, 280
Capabilities, 3, 10, 11, 47, 50, 73, 331. *See also* Dynamic capabilities
Capacity expansion (investment), 422
 in duopoly, 332–33, 352, 354–55
  in existing market, 389–95
 lumpy (repeated), 419–21
 lumpy vs. incremental, 299, 299n, 353 (*see also* Incremental capacity investment; Lumpy capacity investment)
 as monopolist's option, 278, 298–306
 for oligopoly
  and incremental investment, 317–22, 323
  and lumpy investment, 312–317
 options approach to
  and oil reserves, 279–80
  and utilities, 280–81
 in perfect competition, 322, 324–25
  and social optimality, 324–25
Capacity utilization, optimal, 417–19
Capital, cost of, xii
Cartel, 59n
 and Cournot duopoly, 95
Case applications, 209–16, 247–70
Cash flow, expected, 174. *See also* Discounted cash-flow (DCF) method
Certainty equivalent, 19n, 174, 178, 436. *See also* Risk-neutral valuation
Cheap talk, 112, 134
Chicken game. *See* War of attrition
Closed-form solution, xi
Closed-loop equilibrium, xi-xii, 361n, 366, 389, 394, 398, 399, 400
Closed-loop strategies, xi, xvi, 83n, 121n, 325n, 398, 399
Coca-Cola, 53, 266
Co-opetition, 147–50
Collaboration. *See also* Cooperation
 in investment, 392, 394
 on patent, 395
Collaborative (tacit-collusion) equilibrium, 393
 symmetric, 401–402
Collusion
 and oligopolists' expansion, 312–17
 tacit, 145, 147, 107–108, 151–52
  by Cournot duopolists, 95–96
  in existing market, 371–72, 389n
  in real-estate development, 406
  perfect equilibria of, 372, 400
  sustainability of, 422
  symmetric, 401
Commitment (strategic), xvi, 12, 30, 107–108, 110–12, 117–18, 151–52
 credibility of, 117, 118
 and reaction functions, 97
 and sequential Stackelberg game, 131, 133–34
 strategic effect of, 271n
 taxonomy of strategies for, 118–119, 123–25, 126
  and Bertrand competition, 126–28 (*see also* Bertrand price competition)
  and Cournot quantity competition, 128, 130–31 (*see also* Cournot quantity competition)
  entry strategies, 119–23
  tough vs. soft, 121, 131, 194 (*see also* Soft commitment; Tough commitment)
  in differentiated Bertrand competition, 127
Commitment or flexibility. See Flexibility or commitment trade-off
Commitment value, xii
Competition
 and co-opetition, 147–50
 exogenous, 404–405
 imperfect, 24n, 421
 perfect, 23, 24n, 63, 322, 324–25 *(see also* Perfect competition)
 in R&D, 409–10
 and real options analysis, 14

reciprocating vs. contrarian, 271, 272 (*see also* Soft commitment; Tough commitment)
Competitive advantage, 17, 74, 471
creating and sustaining of, 66, 72–73
and generic competitive strategies, 70–72
through innovation, 54
and isolating mechanisms, xiii, 73
through value creation, 66–70
external vs. internal perspectives on, 48–50
and patent strategy, 395
static vs. dynamic, 109, 112, 151, 195
Competitive analysis, 50, 56
"five-forces" analysis, 59–66
macroeconomic, 57–58
microeconomic (industry level), 58–59
Competitive erosion, 35, 343, 350, 351, 375, 389, 404, 405, 421, 423
Competitive landscape, change in, 52
Competitive strategy. *See* Strategy
Competitive value erosion, 35, 421
Complements. *See* Strategic complements
Complementors, 148
Complete information, 115, 403
Compound option(s), 163, 167–68
in R&D setting, 163, 408, 410–11, 412
Concentration (industry)
in "five-forces" analysis, 61
Herfindhal–Hirschman index of, 62–64
Consolidation, in corporate environment, 4
Constant-elasticity demand function, 78–79
Consumer surplus, 66–67
Contestable market, 119
Contingent-claims analysis, 307n, 308–309, 326
Continuation or inaction region, 312–13, 316, 453, 455
Continuation strategy, 397–98
Continuous-time option analysis, 275, 277, 278, 184–89, 380n
Continuous-time stochastic processes, 426–427, 458
Brownian motion, 427–438 (*see also* Brownian motion)
general Itô or diffusion process, 440–441
mean-reversion process, 438–440
Contract or abandon option, 163, 165, 167
Contrarian actions. *See* Strategic substitutes
Cooperation, 135, 143
Aumann on, 146–147
and co-opetition, 147–50
between Cournot duopolists in repeated games, 138–39, 141–42, 145, 147
in existing market, 370–72
and prisoner's dilemma, 29
and symmetric vs. asymmetric firms in capacity expansion, 420–21
Co-opetition, 147–49
Coordination failure, 235, 369, 370, 378, 384, 392. *See also* Coordination problem
Coordination problem, 226n, 359, 384, 386, 387
in deterministic case, 362
and focal-point argument, 234, 235, 379–380
and mixed-strategy approach, 235
and precommitment, 361
and preemption, 366
and war of attrition, 363
Corporate environment, 3–10
Corporate finance. *See* Finance, corporate
Corporate strategy. *See* Strategy
Cost(s)
of capital, xii
fixed, xiii
opportunity, xii, 277, 284
sunk, xvii, 117, 117n, 271n, 275
variable, xvii, 162
Cost advantage, xii
large, 382–84, 385, 388–89
small, 384–89
Cost asymmetry
in Cournot duopoly, 96–97, 106, 229–35
in Cournot oligopoly, 99, 100–101, 106, 235–38
Cost leadership, 70–71
and Cournot duopoly models, 92, 96
Costly reversibility, 117
Cost parity/proximity, 72
Cost symmetry
in Cournot duopoly, 92–96, 106, 227–29
in Cournot oligopoly, 101, 106
Counterthreats, and game theory, 2
Cournot, Antoine Augustin, 113
Cournot quantity competition, 84, 91–92, 128, 130–31
duopoly, 33n, 92–99, 102–105, 107
cooperation in repeated games and folk theorem, 138–39, 141–42, 145, 147
with cost asymmetry, 106, 381, 382
with cost symmetry, 106
with information asymmetry, 102–105, 107
and investment options, 224–35
in new markets, 375–76
probability of simultaneous investment in, 364

Cournot quantity competition (cont.)
and R&D investment, 247
in Stackelberg game, 134
oligopoly, 99, 100–102
with cost asymmetry, 106, 235–38
with cost symmetry, 106
and incremental investment, 318
and investment timing, 315–17
and option games, 240
and Stackelberg game, 131
Cox, John, 190, 243, 436, 448n. *See also* Cox–Ross–Rubinstein (CRR) binomial model
Cox–Ross–Rubinstein (CRR) binomial model, 174, 184, 185, 190–91
Credibility of strategic moves, 117, 118
CRR. *See* Cox–Ross–Rubinstein (CRR) binomial model
Customer
market power, 65–66
segment, 70
switching costs, and early-mover advantage, xii
value, factors in, 68

Damisch, Peter, 13, 198–99
interview with, 198–99
DFC. *See* Discounted cash-flow (DCF) method
Decision theory, static and dynamic, 39
Decision time, 224–25
Decision-tree analysis (DTA), 19
and real options analysis, 19–20 (*see also* Real options analysis)
Defensive patent wall, 207
Deferral or waiting (timing) option, xiv-xv, 163, 163–64
examples of, 179–180, 182–84
of follower in duopoly, 341
of monopolist, 219–24, 278, 347, 351
in deterministic case, 281–84
in stochastic case, 284–98
and NPV rule, 275
for patent, 395
Demand, isoelastic, 321–22, 323
Demand functions (inverse), 78
Demographic trends, 55
Deterministic profit, 301
Deterred entry, xii, 65, 119–20, 120–21
Deterrence, 110
Deutsche Bank, 196
Días, Marco A. G., 13, 172
interview with, 172–73
Differentiated Bertrand model, 63, 87–88, 90–92
equilibrium profits in, 270
and investment options, 238–40, 241, 242
tough vs. soft commitment in, 127
Differentiation strategy, 71, 129, 265–66
horizontal, 71–72
vertical, 72
Diffusion (sequential ordering), 338
Diffusion (stochastic process), 425–26, 440, 449
Discounted cash-flow (DCF) method, 16, 22, 169. *See also* Net present value (NPV) method
Discount factor, 282. *See also* Expected discount factor
and Brownian motion
arithmetic, 298
geometric, 287, 313
elasticity of, 292, 293, 298, 300, 302, 350
and monopolist's option to defer, 282, 283, 286
and Wicksell model, 283
Discount rate, 174, 177, 178n, 277n, 279, 282, 286n, 287n, 294n, 298, 307n, 437, 442, 445
Discrete-time option games. *See* Option games (discrete-time)
Discrete-time option valuation, 174, 176–84, 185
Diversification, 17, 168, 279
Dividend yield or opportunity cost, 16, 282, 289, 297, 308, 313, 335, 346, 375, 404, 435n, 437, 438n, 444, 445
Dixit, Avinash, 12, 13, 32, 33, 49, 109, 111, 117, 118, 188, 189, 242, 278n, 279–81, 285n, 291, 292n, 293, 294, 298n, 301n, 305n, 307, 312n, 318n, 325, 333, 373, 378n, 379n, 396, 397, 439n, 451, 445, 453, 455, 456n
interview with, 32–33
on game theory basics, 28–32
Dixit–Pindyck model (investment timing), 333, 373
Dominant firm, 63
Dominant strategy, xii, 28–29, 111, 207–208
and cost asymmetry, 230
for investment options, 239
"Doomsday Machine," 110, 117, 118, 121n
Drift (diffusion), 425–426
Dr. Strangelove . . . (movie), 110, 117, 121n
Duopoly, 81–82, 84
adoption-timing decisions in, 421
and Bertrand price competition, 33n, 84, 86–88, 90–92, 97, 106
Boeing and Airbus as, 63, 99, 422 (*see also* Boeing)
and cooperation in existing market, 370–72
and Cournot quantity competition, 33n, 84, 91–99, 102–105, 106, 107, 134 (*see also under* Cournot quantity competition)

exit policies in, 415
and folk theorem, 145
and expansion of existing market, 389–95
and investment in new market, 372–89
and investment in new technologies, 411
and lumpy capacity expansion, 419–21
and preemption, 360, 363, 365–70
sequential investment in, 331–39
and capacity expansion, 352, 354–55
under uncertainty, 339–48, 351–52, 356–57
and signals, 414, 415
Dynamic capabilities, 50
Dynamic decision theory, 39
Dynamic (sequential) game, 83
Dynamic game theory, 39
Dynamic models, 151
Dynamic programming, 39n, 298n, 308, 326–29
Dynamic strategic interactions, 39

Early-mover advantage. *See* First-mover advantage
Economic profit, xii, 16, 17, 67
Economics. *See also* Economic sciences
experimental, 85
heuristics in, 85
macroeconomic analysis, 57
Economic sciences
areas of research in, 32–33
Nobel Prizes awarded in, 40
rationality assumed in, 146
Economies of scale, xii, 70, 76, 280–81
Economies of scope, xii, 70–71, 76
Efficient-market hypothesis (EMH), 427
Elasticity, xii-xiii
of discount factor, 292, 293, 298, 300, 302, 350
price elasticity of demand, 78, 321–22, 323
and Lerner index (markup rule), 80–81
Elasticity markup rule, 80–81
Electricity market, 132
European, 154, 155 (*see also* European electricity industry)
Finnish, 422
Italian (Enel), 131, 132
and real options, 162–69
reserve margins, 154–56
scale vs. flexibility in, 280, 281
uncertainties for, 156–57
firm-specific risks, 156
idiosyncratic business risks, 156, 157–58
generation technologies and business risk exposure, 159–62
technology-related business risks, 158
Energy sector, European, 154. *See also* European electricity industry
Entry
accommodated, xi, 65, 119, 120, 122–23, 132
barriers to, xi, 51, 63, 64–65, 72 (*see also* Barriers to entry)
blockaded, xi, 65, 119, 410
deterred, xii, 65, 119–20, 120–21
threat of, 64–65
Entry strategies, 119–23
Equilibrium concepts
Bayesian Nash, 116
closed-loop, xi-xii
path dependence, xv, 73, 285n
Markov perfect, xv, 325n, 427, 452
Nash, xiv, 25–26, 28, 89, 103, 109, 113–14, 116, 239, 398
open-loop, xiv, xvi, 360–61, 393–94, 396
rationalizability, 89n
solution concept, 27n, 38n, 39n, 85, 89, 92n, 112, 113, 116, 119, 135
subgame perfect Nash, xvii, 109, 114–15, 116
"trembling hand," 115
Erosion. *See* Competitive erosion
EU Emission Trading Scheme (EU ETS), 159
European call options, 189, 190, 193, 227
Black–Scholes pricing of, 187, 435–38
capacity units under construction as, 418
pricing of, 185
European electricity industry, 155
additional generation capacity required in, 156
business risk exposure of generation technologies in, 160–62
Emission Trading Scheme (ETS) for, 159
idiosyncratic business risks for, 158
Italian electricity authority (Enel), 4–5, 131, 132, 166
in examples, 181, 182–83, 184, 188, 202–206, 222, 343–44
liberalization in, 132
and real options, 163–64, 166–67, 168–69, 170
European energy sector, 154
European liberalization, 129, 132
European option, xiii, 220n. *See also* European call options
Evolutionary games, 114
Exercise price or investment cost, 164, 165, 167, 188, 190, 198, 267, 280, 289n, 299, 308, 327, 346, 348, 430, 435, 442
Exercise timing, and first-hitting time, 447
Existing market model
cooperation in, 370–72
and oligopolists' lumpy expansion, 312–17

Existing market model (cont.)
and option to expand, 389
for asymmetric case, 393–95
for symmetric case, 389–92
Exit strategies, 415–17
Exogenous competition, 404–405
Expanded or extended net present value (E-NPV), xiii, xv, 208, 288, 343, 351–52, 352, 384, 385
Expand or extend option, 163, 164–65
business applications of, 279–81
and capacity utilization, 418
in duopoly, 352, 354–55, 389–95
example of, 180–81
in existing market, 389
for asymmetric case, 393–95
for symmetric case, 389–92
and investment timing, 311
Expansion of capacity. *See* Capacity expansion
Expected discount factor, 448–51. *See also* Discount factor
for arithmetic Brownian motion, 297, 450
elasticity of, 351
for geometric Brownian motion, 287, 293, 451
and other exponentials, 451
for mean-reverting process, 451
and Wicksell model, 283
Expected profit function, 102
Expected-value term, 425–26
Experience effects. *See* Learning curve effects
Experimental economics, 85
Exponential demand function, 78, 79
Exponentials of Brownian motion, 431–38, 444, 445, 451, 452, 457
Extended (expanded) net present value, xiii, xv, 208, 288, 343, 351–52, 352
"Extended-rivalry" interactions, 59
in "five-forces" analysis, 60
Extensive form, of bargaining game under complete information, 136
Externalities
negative, 35, 64, 320, 333n, 334, 355, 408, 409
positive, 35, 408, 409, 421, 423
External view of firm, 48, 50

Fairness, as source of cooperation, 29
Fat cat strategy, 124–25, 267, 269
Fight mode, in patenting, 395
Finance, corporate
and industrial organization, 37
and strategy, 15–20
Financial economics and strategic management, 49
Financial options, 5n, 153, 174
Firm (company)
external view of, 48, 50
internal view of, 50
knowledge-based view of, 47
as portfolio of businesses, 198–99
resource-based view of, 73
Firm profitability, drivers of, 56
Firm roles, 359, 361 (*see also* Coordination problem; Industry structure; Leadership)
endogenous, 374–75
probabilities of, 364
Firm-specific risks, 156
First-hitting time, 447–48
and investment trigger, 285
First-(early-)mover advantage, xii, 34, 335n, 338–39, 342, 343, 345, 357. *See also* Leadership
in auction, 367
and asymmetric case, 393
and capacity expansion, 354
and Nash equilibria, 360
and precommitment, 361
and preemption, xv, 362–63, 391–92
in Reinganum model, 360
Fisher separation theorem, 15
"Five-forces" analysis, 51, 59–66, 147
Fixed costs, xiii
Flex-fuel technology, 172, 173
Flexibility
in managerial decision-making, 19, 284
for multinational firms (exchange rate risk), 422
and optionality, 198
and real options analysis, 13–14, 21–22
and uncertainty, 271, 271n
in utility planning, 280–81
Flexibility or commitment trade-off, xxv-xxvi, 5, 12, 47, 118, 195, 195n, 197, 272–73
Dixit on, 32
and integrative approach, 15
in option games, 217
quantification of, 243
Focal-point argument, xiii, 231n, 234, 235, 339, 345, 361, 380
Focal-point equilibrium, 360, 383
Focus strategy, 70, 72
Folk theorem, 145, 145n
Follower or second mover, 34, 99, 106, 131, 133–137, 272, 334, 342, 344, 345–47, 350, 351–352, 357, 359, 360, 361–93, 406, 407, 408, 409, 411, 413, 415–17, 421, 422
Forward net present value, 441–47, 453
for arithmetic Brownian motion, 443
for geometric Brownian motion and other exponentials, 444

for powers of geometric Brownian motion, 444, 447
France
EDF electric utility in, 202–206
GDF gas utility in, 166–67
Friedman, James, 139, 145, 151
Fudenberg–Tirole model of investment timing, 332, 359, 360, 361, 362, 372, 396, 397
Fudenberg, Drew, 39n, 81n, 107, 108, 118–21, 124, 129, 132, 139n, 145, 152, 194, 243, 246n, 249, 286n, 324n, 332, 333, 359, 360, 361, 362, 365, 366, 371, 372, 373, 390, 396, 397, 406n, 415, 420
Fundamental quadratic, 416, 445–46, 450

Games
of complete information, 115, 403
of imperfect information, 83n, 115, 414
of incomplete information, xiii, 83n, 102–105, 107, 115, 414
multistage, 139n
of perfect information, xiii, 83n
repeated (supergames), 135n, 139, 147
cooperation between Cournot duopolists in, 138–39, 141–42, 145, 147
infinitely, 139n
and prisoner's dilemma, 144
and tacit collusion, 145, 147
and "rules of the game," 27, 82–83
sequential or dynamic, 83
simultaneous, 83, 139n, 224, 229
of timing, 332, 396, 397
for duopoly, 332–39
in Fudenberg–Tirole model, 362, 396
two-stage, 271–72
in goodwill and advertising, 264–70
innovative (R&D), 243, 246–50
in patent licensing, 262
Game theory, xiii, 1–3, 6, 12, 14, 20–34, 49, 50, 81, 84, 107–108, 143, 151–52, 153, 195, 209, 254
advantages and drawbacks in (comparison), 38
applications of, 2–3, 36–37
in business decision-making, 24–26
basics of (Dixit), 28–32
in Boeing's strategic thinking, 12
in continuous time, 332 (*see also* Investment timing)
development of, 113–15
fields of application of, 27
integrated with real options analysis (option games), 6, 32, 173, 195, 199, 423
and irreversible commitments, xxiii
metaphorical vs. literal interpretation of, 27, 33
mixing moves in, 29–30
options analysis with, 39–40
origins of, 24
Selten on, 85–86
static and dynamic, 39
Gardening metaphor, for managing options portfolio, 170
General Itô or diffusion processes, 440
Generation technologies, and business risk exposure, 159–62
Generic competitive strategies, 70–72
Geometric Brownian motion (GBM), 298, 431–38, 457
and closed-form solutions, 329
and continuous-time option analysis, 184, 186
in example of Black–Scholes formula, 187
expected discount factor for, 313, 451
expected first-hitting time for, 448
forward NPV for, 444, 447
powers of, 435
present value with stochastic expiration for, 452–53, 454
Geometric Ornstein–Uhlenbeck (GOU) process, 439–40, 457
Germany
antitrust actions in, 140–41
Deutsche Bank in, 196, 196n
telecom market of, 129
Globalization, 53
Goodwill strategies, 264–70
Gordon perpetuity formula, 444
Grenadier, Steven, 49, 317, 320, 322, 325, 326, 373n, 403n, 405, 406, 407, 414, 418, 423, 424
Growth options, 47, 163, 167, 168, 284, 311, 318n, 418, 419, 421
Growth trend, 425–26

Hamilton–Jacobi–Bellman (HJB) equation, 433, 443
Harrison, Michael, 39n, 436, 451n, 452n, 458
Harsanyi, John C., 40, 40–41, 115
Hedging, 156, 175
Herfindhal–Hirschman index (HHI), 62–64
Heuristics,in economic analysis, 85
Horizontal differentiation, 71–72
Huisman, Kuno J. M., 49, 317n, 332n, 362n, 367n, 373n, 392n, 396, 397, 406n, 408, 414, 423, 424, 455n
Hysteresis, 307n, 422

Idiosyncratic business risks, for electricity industry, 156, 157–58
Imperfect competition, games of, 24n, 421

Imperfect information, 83n, 115, 414. *See also* Information
Inaction region, 312–13, 316, 453, 455
Incomplete or asymmetric information, 30–31, 424
 games of, xiii, 83n, 115
 investment with, 411–15
 market structure under, 102–105, 107
 and R&D spillover, 414
Incremental capacity investment, 303–306
Induction, backward, 109, 112, 131, 135
Industrial organization, 34, 37, 75, 107–108, 151–52
 dynamic, 39
 and finance, 37
 and game theory, 40
 static, 39
Industry analysis
 "five-forces" analysis, 51–52, 59–66, 147
 structure–conduct–performance (SCP), 58–59
Industry structure(s)
 assumptions, 78
 evolution of, 378
 probability of occurrence of, 364, 369, 386
Infinitesimal generator, 133
Information
 complete, 115, 403
 imperfect, 83n, 115, 414
 incomplete or asymmetric, 30–31, 424 (*see also* Uncertainty)
  games of, xiii, 83n, 115
  investment with, 411–15
  market structure under, 102–105, 107
  and R&D spillover, 414
 perfect, xiii, 83n
 in Stackelberg model, 134
Information cascade, 414
Information economics, 31
Information set, xiii, 83
Innovation. *See also* R&D
 competitive advantage through, 54
 and patents, 59
Innovative investment strategies, and time-to-build delays, 410
Integrative approach to strategy, 35–41
Intellectual property (IP) rights. *See also* Patent
 licensing of, 254
 and option games, 408
Interest rate, 176, 180, 183, 186, 187, 201, 208, 211, 271n, 295, 305, 313, 333, 336, 348, 356, 374, 410, 438. *See also* Risk-free rate
Internal rivalry, in "five forces" analysis, 61
Internal view of the firm, 50
International Energy Agency, suggestions of risk from, 189
Investment. *See also* Commitment; Strategic investment
 collaborative, 392
 and commitment, 360
 decision-theoretic models of, 408
 game-theoretic models of, 408
 with information asymmetry, 411–15
 joint, 371–72, 384, 394
  Pareto-superior equilibrium of, 391
 Jorgensonian rule of, 284, 336
  modified, 295–97, 324, 356, 374, 381
  modified (risk-neutral), 345
 in new technologies, 411
 in oil reserves, 279–80
 and preemption, 366
 Tobin's *q* theory of, 284
 sequential, 331, 357 (*see also* Sequential investment)
 simultaneous, 311, 331, 364 (*see also* Simultaneous investment)
 tough vs. soft, 266 (*see also* Soft commitment; Tough commitment)
 two-stage (R&D), 410
 under uncertainty, 5
 in utilities, 280–81
Investment, R&D, 243–53
Investment option(s), xiv-xv
 American, 285
  call option, xiv-xv, 294n, 307, 308, 326, 446
 for Cournot duopoly, 224–27
  under cost asymmetry, 229–35
  under cost symmetry, 227–29
 for Cournot oligopoly (asymmetric), 235–38
 for differentiated Bertrand price competition, 238–40, 242
 in duopoly under uncertainty, 339
 example, 186, 332
 monopolist's deferral option, 219–24
 multiple, 419, 421–22
 in new market, 357, 372–73
  in asymmetric case, 379–89
  in symmetric case, 373–79
 shared, xvi, 35, 35n, 344, 356
 valuation of, 284–85
Investment option value, for oligopoly, 316
Investment staging, 164
Investment strategy, 285–88
 optimal, 285n, 288–98, 334, 341, 372
 and time-to-build delays, 410
Investment threshold. *See* Investment triggers

Investment timing, 195, 195n, 275, 277, 307–308, 325–26, 332, 333, 357, 360, 361, 382, 456.
for capacity expansion, 278, 298–306
for duopolist, 332–39
for monopolist, 219–24, 278, 308–309, 347
in deterministic case, 281–84
in stochastic case, 284–98
for oligopoly, 311
for incremental capacity investment, 317
with lump-sum capacity expansion, 312–17
for perfect competition, 322, 324–25
under uncertainty, 196–97, 307
Investment timing game, 362–63
Investment triggers, 227, 240, 455
and capacity expansion(optimal), 327, 352, 354
for Cournot duopolist, 226, 237–38
under cost asymmetry, 229, 231, 232, 233–35, 237–38, 262, 420
under cost symmetry, 227–28
under differentiated Bertrand price competition, 241
and first-hitting time, 285
for follower in new-market investment (optimal), 341, 373–74, 380, 381
in goodwill/advertising case, 267–70
joint, 371
for leader in asymmetric new-market investment (optimal), 384
for monopolist, 221–23, 237, 288–91, 305–306, 321
incremental capacity investment, 306
for oligopoly, 311, 313, 316, 349, 350
incremental expansion, 320–21, 322
lump-sum expansion, 315, 316
perfect competition, and social optimality, 324
and R&D investment, 246–47, 248–49, 250
in duopoly with high spillover, 251–53
in duopoly with low spillover, 251, 252
Irrationality, 89n
Aumann on, 146
Selton on, 85–87
Irreversible investment, 32, 280, 285n, 297, 325, 356, 373, 381, 389, 410, 415n, 420, 442
Isoelastic demand, 321–22, 323
Isolating mechanisms, xiii, 73
Italy
Enel electricity authority in, 4–5, 131, 132, 166
in examples, 181, 182–83, 184, 188, 202–206, 222, 343–44

Itô process, 175, 288, 292, 293n, 326, 427, 440, 458–59
general Itô process, 440
Markov property for, 452
and standard Brownian motion, 427
time-homogeneous, 440, 449
Itô's lemma, 432, 433

Joaquin, Domingo C., 331n, 339, 344, 346, 356, 358
Joint investment, 371–72, 384, 394
Pareto-superior equilibrium of, 391
Joint venture, 315
Jorgensonian rule of investment, 284, 336
modified, 295–97, 324, 345, 356, 374, 381

Kamien, Morton I., 254n, 255n, 261n
Karatzas, Ioannis, 325, 458, 459
Kester, W. Carl, 35
Knowledge-based view of firm, 47
Kort, Peter M., 317n, 373n, 380n, 392n, 393, 396, 397, 406n, 408, 414, 424
Kulatilaka, Nalin, 21

Lamarre, Eric, xxvii
interview with, 199–200
Lambrecht, Bart M., 379n, 410, 412
Large cost advantage, in preemption games, 382–84, 385, 388–89
Late-mover advantage, 363, 366, 386, 414, 421. *See also* Second-mover advantage
Leader or leadership, 361
in duopoly, 334–39
capacity expansion, 354–55
new market, 374–75, 376, 377, 378
under uncertainty, 339–43, 345–48
in Stackelberg duopoly, 99, 106, 131, 133–34
Leahy, John V., 324–26
Lean and hungry look strategy, 124
Learning-curve effect, xiii, 71
and early-mover advantage, xii
Lerner index (markup rule), 80–81
Licensing, Patent. *See* Patent licensing
Linear demand function, 78, 79
Luehrman, Timothy, 170–71
Lumpy capacity investment, 299–303
repeated capacity expansion, 419–21, 423

Macroeconomic analysis, 57–58
Managerial flexibility, 5, 12–16, 19, 38, 51, 55, 169, 198, 247, 271n, 288, 423
Market, and threat of substitute products, 64
Market equilibrium, in monopoly, 81
Market share, bargaining over, 135–37

Market structure
at beginning of investment game, 379
probabilities of, 370
Market structure games, xiii, 58–59, 217–18
dynamic approach to, 109
bargaining and cooperation, 135–145, 147–50
commitment in, 110–112, 117–28, 130–34 (*see also* Commitment)
static approach to, 107
duopoly, 81–82, 84, 86–99, 102–105, 107
monopoly, 76–81, 106
oligopoly, 99–102
Market uncertainty, xxv, 5, 372, 373 (*see also* Uncertainty)
Markov process, xiv, 325n, 427
arithmetic Brownian motion, 429
geometric Brownian motion, 431–38
and Itô process, 440, 452
mean-reversion process, 438–40, 451
standard Brownian motion, 427, 428
Markup rule (Lerner index), 80–81
Matthews, Scott (Boeing), xxvii
interview with, 11–12
Maturity, xiv, 23, 164, 165, 183, 185, 187, 188, 190, 191, 193, 201, 202–203, 206, 208, 251n, 256, 262–63, 265–68, 271n, 289n, 418, 430, 435–36, 441
McDonald Robert L., 165n, 188n, 29, 275, 278n, 288, 294, 296n, 301n, 307, 333, 347, 446. *See also* McDonald–Siegel timing option value
McDonald–Siegel timing option value, 275, 288, 294n, 301n, 333, 347
McKinsey & Company
interview with Eric Lemarre, 199–200
Mean-reversion process, 438–40
expected discount factor for, 451
Merton, Robert C., xxvii, 40, 174, 174n, 189
interview with, 175–76
Microeconomic theory, 58–59
and strategic management, 49
Microsoft, 24, 25
Minimax solution, 113
Mining/chemicals industry, option-games application in, 209–17
Mixed strategy(ies), 113, 367–70
and coordination problem, 235, 359, 360, 362
Monopolistic differentiated competition, 63
Monopoly, 23, 24n, 58, 62–63, 76–81, 106, 231, 235, 321
vs. Cournot duopoly, 226
and differentiated Bertrand price competition, 240
and innovation, 59
and investment timing, 275, 277, 278
option to expand capacity, 298–306
option to invest, 219–24, 278, 281–98, 308–309, 347
natural, xxv, 76, 129
Morgenstern, Oskar, 2, 24, 27, 40, 113
Multinational corporations, 57, 301, 302, 320–22
Multiplicative stochastic demand shock, 381, 416
Multistage games, 139n
Myers, Stewart C., 43, 167n
Myopic firm and strategy, xiv, 324

Nalebuff, Barry J., 33n, 49, 109, 117, 118, 148, 149
Nash, John, 26, 27, 40, 113–14. *See also* Nash equilibrium
Nash equilibrium, xiv, 25–26, 28, 103, 109, 113–14, 116, 239, 398
and Bertrand price competition, 88, 89, 90
and Cournot quantity competition, 84, 93, 95, 100
and duopoly investment, 337, 337–38
and focal point argument, 231n
mixed-strategy profile, 368
in multistage setting, 112
refinements of, 114, 115, 116
subgame perfect, xvii, 398
Natural monopolies, xxv, 76, 129
Nature (as player), xiv, 82
Net present value (NPV) method, xiv, 16, 174, 177. *See also* Discounted cash-flow (DCF) method
advantages of, 38
drawbacks of, 18–19, 21, 22, 22–23, 38
expanded (extended) E-NPV, xiii, xv, 208, 288, 343, 351–352, 352, 384, 385
and finance-strategy gap, 17–18
forward, 441–47, 453
for arithmetic Brownian motion, 443
for geometric Brownian motion and other exponentials, 444
for powers of geometric Brownian motion, 444, 447
NPV rule, 16, 221, 227, 281, 284, 292
revision of, 275
under timing flexibility, 279
proper use of, 18
vs. real options analysis, 196
Network effects, 55–56
Neumann, John von, 2, 24, 27, 40, 113
New market, 314–17, 340, 357
option to invest in, 372–73
for asymmetric case, 379–89
for symmetric case, 373–379

Niche, in focus strategy, 70, 72
NPV. *See* Net present value method
NPV rule, 16, 221, 277, 281, 284, 292. See also Discounted cash-flow (DCF) method
 revision under timing flexibility, 275

Observability, of strategic move, 117
Oil reserves, investment in (options approach), 279–80
Oligopoly, 63, 81, 99–102
 Cournot, 99, 100–102
  under cost asymmetry, 106, 235–38
  under cost symmetry, 106
  and incremental investment, 318
  and investment timing, 315–17
 dynamic models of, 39n
 expansion threshold for, 418
 and investment timing, 311
  for incremental capacity investment, 317–22, 323
  with lump-sum capacity expansion, 312–17
Open-loop equilibrium, xiv, 360–61, 393–94
Open-loop (precommitment) strategies, xiv, xvi, 83n, 121n, 325n
Opportunity cost, xii
 and investment timing, 284 (*see also* Investment timing)
 and NPV rule, 277
Optimal investment timing, 195, 195n
Optimal stopping, 453, 455–56, 458
 under uncertainty, 196–97
Option(s) xiv, 153. *See also* Call option; Real options
 American, xiv-xv, 294n, 307, 308, 326
  perpetual (early exercise of), 446
 compound, 410
 European, xiii, xiv, 193, 220n (*see also* European call options)
 proprietary, xv, 35, 35n
 R&D, 245–46
 real, xv, 153–54, 162–63 (*see also* Real options)
 shared, xvi, 35, 35n, 344, 356
Option analysis or approach
 to capital investment, 279
  in oil reserves, 279–80
  in utilities, 280–81
 continuous-time, 184–89
 with game theory, 39–40
Option games, xxvi, 1, 6, 41, 195, 217, 242, 403, 423
 in Boeing's strategic thinking, 12
 Brosch and Damisch (BCG) on, 199
 Días (Petrobras) on, 173
 issues arising in, 395
 Lamarre (McKinsey) on, 200
Option games (continuous-time), 275, 277, 278, 184–89, 380n
Option games (discrete-time), 1, 6, 35, 41, 184, 185, 193, 206–208, 210, 217–18, 253, 272, 273, 275, 333, 423
 applied to mining/chemicals industry, 209–17
 illustration of, 197, 201–206
Option markup formula, 290–91, 293
Option-pricing formula, 179
 for multistep CRR, 190–91
Option-pricing theory, 153, 175, 178
Option valuation, xv, 169, 174, 189
 discrete-time, 176–84, 185
Option value erosion, 423
Ornstein–Uhlenbeck process
 arithmetic, 438–39
 geometric (GOU), 439–40, 457
Outsourcing
 of Boeing 787 Dreamliner, 7, 8–9
 and value chain redesign, 148
Overinvestment, 250

Pareto optimality, and sequential investment, 339n, 345
Pareto-superior joint-investment equilibrium, 390–91
Passive management, 18
Patent(s), 253–54
 and innovation, 59
 in investment-timing example, 278
 sleeping, 207, 410
Patent bracketing, 150
Patent leveraging strategies, 395
Patent licensing, 253–56, 263–64, 272–73, 410
 and drastic innovation, 254, 256–57, 260, 262, 263–64
 fixed-fee, 254, 257–58, 259, 261
 and nondrastic innovation, 260, 262
 royalty rate, 254, 258–59, 261
 under small vs. larger cost savings, 261
 and spillover effects, 249, 253
 under uncertainty, 261–64
Patent race, 408–11
Patent strategy, 149–50, 206–208
Patent wall, 150
Path dependence, xv, 73, 285n
Patience
 in bargaining, 135, 136, 138
 in cooperative behavior, 142
Payoff, xv, 27, 38, 83, 244
Paxson, Dean A., 411, 421
Payoff matrix, 209

Perfect Bayesian equilibrium, 116
Perfect competition, 23, 24n, 63, 325–26
 and investment timing, 322, 324–25
 quantity produced, 99–105, 107
Perfect information, xiii, 83n
Perfect Nash equilibrium. *See* Subgame perfect Nash equilibrium
Pindyck, Robert S., 12, 49, 111, 189, 190, 242, 278n, 279–81, 285n, 289n, 291, 292n, 293, 294, 298n, 301n, 305n, 307, 312n, 318n, 321n, 325, 326, 333, 373, 378n, 379n, 396, 397, 439n, 445, 451, 453n, 455, 456n. *See also* Dixit–Pindyck model (investment timing)
Porter, Michael, 59, 66, 70, 147
Portfolio Matrix (BCG), 199
Portfolio(s) of real options, 14, 168, 169, 170–71, 175, 176, 177–78, 185, 198–99, 285n
Potential entrants, 64–65
Prahalad, Coimbatore K., 49, 51
Precommitment strategies, 360–61. *See also* Open-loop strategies
Preemption, xv, 99, 317n, 325n, 360, 363, 365–70, 375–79, 391–92, 396, 397, 409
 asymmetric, 381–82
  with large cost advantage, 382–84, 385, 388–89
  with small cost advantage, 384–89
 fear of, 393
 and first-mover advantage, 362–63
Preemption timing, 366
Present value. *See also* Net present value (NPV) method
 with stochastic expiration (for geometric Brownian motion), 452–53, 454
Price competition. *See* Bertrand price competition
Pricing problem
 in Cournot duopoly, 93, 94–95, 105
 in Cournot oligopoly, 101
 factors determining, 65–66
 in monopoly, 76, 77, 79, 291–92
Pricing, risk-neutral, 436
Prisoner's dilemma, 24–25, 28–29, 139, 143–44
 repeated, 144, 147
Producer surplus, 67
Production costs, drivers of, 69
Product redesign, 71, 72
Profit
 deterministic, 102, 301
 economic, xii, 16, 17, 50, 63n, 64n, 67, 76n, 86–87, 99, 102, 119, 148, 162
 stochastic, 301
Profitability index, 284, 294, 298, 319, 324, 336, 343, 376, 406
 gross, 292–93
Profit-flow stream, with stochastic termination, 452–58
Profit values, stochastically evolving, 339
Proprietary option, xv, 35, 35n
Puppy dog ploy (strategy), 124, 126, 267
Pure strategy, 89, 113, 307, 338, 339, 345, 347n, 357, 359, 360, 368, 379, 383
Put option, 18, 153, 165, 167, 172, 181, 415n, 417, 425n

q investment index (Tobin's *q*), 284, 292–93
Quantity competition. *See* Cournot quantity competition

Random rival entry, 404–405
Rationality, 86, 146
 and game theory, 26, 84, 85–86, 89, 89n, 113–14, 145
R&D (innovation) investment, 272–273, 407–11, 423
 and drastic vs. nondrastic innovation, 262
 options created by, 244–46
 and patent licensing, 253–64
 proprietary vs. shared investment in, 248
 and spillover effects, 243, 246–53, 414
Reaction function, 88, 90, 91, 93, 94, 96, 97, 97–98, 99, 102–103, 128, 337
Real estate development, 405–407, 424
 waves in, 403
Real options, xv, 153–54, 162–63, 189–90, 307, 332
 investmentexample of, 186
 and opportunity cost, 277
 portfolios of, 168–69, 170
 and R&D, 244
 strategy as portfolio of, 170–71
 types of
  abandonment for salvage value, 153, 167
  compound growth option, 163, 167–68
  contract (scale down) or abandon, 163, 165
  expand or extend, 163, 164–65, 279–81 (*see also* Expand or extend option)
 growth option, 421
 investment timing, xiv-xv, 163, 163–64, 224–40, 242, 372–89, 453 (*see also* Deferral or waiting option; Investment options)
  shut down (and re-start), 165, 188
  staging or time-to-build, 163, 164
  switch use, 163, 165–67
Real options analysis (ROA), xv, xxiii, 5–6, 19–20, 23, 40, 153–54, 189, 195, 425
 advantages and drawbacks in, 38
 and basic option valuation, 169, 174

at Boeing, 11
in Brazil, 172
and continuous-time option analysis, 184–89
discrete-time vs. continuous-time approach in, 197n (*see also* Option games (continuous time); Option games (discrete time))
and discrete-time option valuation, 176–84, 185
and dynamic programming, 39n
and game theory, 32, 173
and mining-industry application, 216
and optimal investment timing, 196
and proprietary vs. shared options, 35
and R&D investment, 243
and stochastic investment timing, 285n
Reciprocal altruism, 143, 144
Reciprocating actions. *See* Strategic complement
Reinganum, Jennifer F., 286n, 331, 332, 333, 335n, 338, 339, 357, 358, 360, 361, 366, 396, 397
Reinganum model of investment timing, 331n, 332, 338, 339, 360
Rent dissipation, 388
Rent equalization, 366, 367, 376, 382, 406, 413n, 420
Repeated games, 135n, 139, 147
cooperation between Cournot duopolists in, 138–39, 141–42, 145, 147
infinitely, 139n
of prisoner's dilemma, 144, 147
and tacit collusion, 145
Reputation, 34, 65, 73, 89, 118, 147
Research and development. *See* R&D
Resource-based view of the firm, 73
Return on investment, and investment timing, 283–84
Risk-free interest rate, 180, 183, 185, 186, 201, 208, 211, 313, 348, 374
Risk management
beta as risk measure, 418
and real options analysis (Lamarre), 200
Risk neutral
expected discount factor, 449
probability, 178–79
valuation, xv-xvi, 436
"Rules of the game," 27, 82–83, 111, 112

Salvage value, 117n, 153, 167, 295n, 416n. *See also* Abandon or contract system
Samuelson, Paul, 40, 175–76
Scale, economies of, xii, 70, 76, 280–81
Schelling, Thomas, 24, 30, 40, 40–41
Scholes, Myron, 40, 175. *See also* Black–Scholes model
Schwartz, Eduardo S., 273, 409
Scope, economies of, xii, 70–71, 76
Second-mover advantage, 34, 99, 363, 366, 386, 414, 421
Selten, Reinhard, xxvii, 30, 40–41, 114–15
interview with, 85–86
Sensitivity analysis, 19
Sequence of the play, 27
Sequential equilibrium, 115
Sequential game, 83
Sequential investment, 357. *See also* Investment timing
and asymmetric information, 412
and asymmetric positions, 393, 393–94
and cost asymmetry, 423
in duopoly, 331–39
and capacity expansion, 352, 354–55
under uncertainty, 339–48, 351–52, 356–57
in investment timing games, 363
in oligopoly
and capacity expansion, 355–56
under uncertainty, 348–52
preemptive, 409
Sequential investment equilibrium, for real estate, 406–407
Sequential Stackelberg game, 131, 133–34
787 Dreamliner (Boeing), 6–9, 353
Shared option, xvi, 35, 344, 356
Shareholder value, maximizing of, 83
Shock(s), 38n, 157
stochastic, 284, 301, 302
additive, 302
multiplicative, 301, 302, 320–22
Shutdown (and re-start) option, 165, 188
Signaling, 34
Simultaneous game, 83, 139n, 224, 229
Simultaneous investment, 311, 331
and asymmetric information, 412
Cournot, 378
in dynamic setting, 317n
and identical firms, 338
in investment timing game, 363
joint or collaborative, 393
probability of, 364
in R&D, 409
vs. sequential investment, 347
Sleeping patent, 395, 410, 423
Small-cost advantage, in asymmetric preemption, 384–89
Smit, Han, 13
Smit–Trigeorgis model, 193, 197n, 217, 242, 344, 357–58, 411–12
Smooth-pasting condition, 293n, 328–29, 329n, 456, 458
Social-cultural factors, in macroeconomic analysis, 57

Social optimality
and capacity expansion in perfect competition, 324–25
of research, 408–409
and sequential investment, 345
Sødal, Sigbjørn, 278n, 289n, 291, 292n, 307, 451
Soft commitment (accommodating stance), xvi, 121, 123
in advertising, 129, 266–67, 269
in Cournot quantity competition, 130
in differentiated Bertrand competition, 127
Solution concepts, 89, 116
Bayesian equilibrium, 116
Nash equilibrium, 25–26, 28, 109, 113–14, 116
perfect Bayesian equilibrium, 116
rationalizability, 89n
refinements, 113–15
subgame perfect equilibrium, 398
"trembling-hand" equilibrium, 115
Spence, Michael, 31, 40, 41n
Spillover effects, and R&D investment, 243, 246–53, 272
Stackelberg, Heinrich von, 131
Stackelberg game, sequential, 131, 133–34
Stackelberg model of duopoly, 131, 335n
follower, 99, 106, 131, 133–34
leader, 99, 106, 131, 133–34 (*see also* Leadership)
Staging or time-to-build option, 163, 164
Static decision theory or game theory, 39
Stiglitz, Joseph, 31, 40, 41n
Stochastic Itô calculus, references on, 458–59
Stochastic processes, xvi, 425–26, 458–59
continuous-time, 426–27
Brownian motion, 437–38
geometric Brownian motion, 275, 298 (*see also* Geometric Brownian motion), 298
general Itô process, 440–41
mean-reversion process, 438–40
discrete-time, 426
expected discount factor, 448–51
first-hitting time, 447–48
forward net present value, 441–47
optimal stopping, 453, 455–56, 458
properties of (basic processes), 457
Stochastic profit, 301–303, 304,
Stochastic shock, 284, 301, 302
additive, 302
multiplicative, 301, 302, 320–22
Stopping, optimal, 453, 455–56, 458
Stopping or action region, 312–13, 453, 455
Strategic commitment. *See* Commitment
Strategic complements (reciprocating actions), xvi
vs. substitutes, 97–99, 194, 271, 272
Strategic conflict. *See* Game theory
Strategic effects, of commitment, 118, 120–21, 122
Strategic entry barriers, 65
Strategic form, of investment timing games, 363
Strategic investment, 246–53, 271, 285–88, 423
direct effect of, 120, 122
strategic effect of, 120, 122, 123–25, 126, 128, 131, 132
under uncertainty, 243, 396
Strategic management, 47, 73, 74
integrative approach to, 35–41, 195, 217 (*see also* Option games)
paradigms of, 48–50
Strategic move, 11, 117
Strategic substitutes (contrarian actions), xvi
vs. complements, 97–99, 194, 271, 272
Strategic uncertainty, xxv, 5
Strategy (competitive), xvi-xvii, 10, 12–15, 43, 82–83
in changing competitive environment, 51–56
closed-loop, xvi, 83n, 121n, 325n, 398, 399
dominant, xii, 28–29, 207–208
and cost asymmetry, 230
example, 203–204
in investment options, 239
weak, 230
exit, 415–17
generic, 70–72
open-loop, xvi, 83n, 121n, 325n
perspectives on, 15
and corporate finance, 15–20
game theory, 20–34
as portfolio of real options, 170–71
and real options thinking, 198
success factors in, 10
Strategy profile, 83
Strategy space, 397–98
Strengths, weaknesses, opportunities, and threats (SWOT) analysis, 51
Structural entry barriers, 64–65
Structure–conduct–performance (SCP) paradigm, 58–59
Subgame perfect Nash equilibrium, xvii, 109, 114–15, 116
Submissive underdog strategy, 125
and underinvestment, 250n
Substitutes, threat of, 64
Substitutors, 148

Suicidal Siberian strategy, and overinvestment, 125, 250n
Sunk costs, xvii, 117, 117n, 271n, 275
Supergames, 139. *See also* Repeated games
Suppliers, market power of, 65–66
Sustainable competitive advantage, 17, 41, 335n, 342n
Switching costs, 64, 66, 129, 165, 166n, 167n
Switching option(s), 163, 165–67
Symbols used in this book, xix-xxi

Technological changes, in macroeconomic analysis, 57–58
Technologies, for electric industry (and business risk exposure), 159–62
Technology portfolios, 168–169, 170
Technology-related business risks, for electricity industry, 156, 158–59
Temporary shutdown option, 188
Threats
 empty, 112
 of entry, 64–65
 in "five-forces" analysis, 60–61
 and game theory, 2
  counterthreats, 2
 of retaliation, 145
 of substitutes, 64
Time, decision vs. real, 224–25
Timing of investment. *See* Investment timing
Tirole, Jean, xxvi, xxvii, 39n, 81n, 107, 108, 118–21, 124, 129, 132, 139n, 152, 194, 243, 246n, 249, 286n, 324n, 332, 333, 359, 361, 365, 366, 371, 372, 373, 390, 396, 397, 406n, 415, 420
 interview with, 36–37
Tit-for-tat strategy, 29, 142, 143–44
Tobin, James, 40, 284, 292
Tobin's *q*, 284, 292
Top dog strategy, 123–124, 128, 134
Tough commitment or investment (aggressive stance), xvii, 121, 123, 266
 in advertising, 267, 269
 in Cournot quantity competition, 130
"Trembling-hand" equilibrium, 115
Trigeorgis, Lenos, 13, 19, 35n, 41, 49, 119n, 149, 153n, 189, 190, 193, 197n, 206, 209, 217, 218, 219, 242, 243, 249, 272, 273, 301n, 344, 357, 358, 360, 395, 411, 412, 423n, 424, 432n, 441, 445
Trigger strategy, 142, 240, 277. *See also* Investment triggers
Two-stage games, 271–72
 in goodwill and advertising, 264–70
 innovative (R&D), 243, 246–50
 in patent licensing, 262

Uncertainty
 at Boeing, 11–12
 and capacity expansion, 418
 and competition vs. cooperation, 150
 Cournot quantity competition under, 225
 duopoly with sequential investment under, 339–48, 351–52, 356–57
 and electric utilities, 156–57
  firm-specific risks, 156
  generation technologies and business risk exposure, 159–62
  idiosyncratic business risks, 156, 157–58
  technology-related business risks, 158–59
 and flexibility–commitment trade-off, 197
 and game theory, 38, 38n
 growth options under, 421
 and investment in existing market, 392
 investment opportunities under (dynamic programming), 326–29
 and investment timing, 196–97, 307
 and Jorgensonian rule, 295–96
 market, xxv, 5
  and new market investment, 372, 373
 and oil reserve as option, 280
 in oligopoly with sequential investment, 348–52
 option games under, 6, 195, 217, 240
 option models of investment under, 333
 and patent leveraging strategies, 395
 patent licensing under, 261–64
 and patent races, 408
 quantity competition under, 224–38
 and R&D, 243
 and real options, 20–23
 strategic, xxv, 5
 and strategic investment, 243, 396
 technological, and sleeping patents, 410
 and technology adoption, 408
 in utility planning, 280–81
Underinvestment, 16n, 122, 250, 250n
Utility planning. *See also* Electric utilities
 scale vs. flexibility in, 280–81
Utilization of capacity, optimal, 417–19

Valuation, risk-neutral, xv-xvi
Value chain, 51, 60, 69–70
 relationships along, 147, 148
Value creation, 66–70
 external vs. internal perspectives on, 48–50
Value erosion, competitive, 35, 421
Value-matching condition, 293n, 328, 374, 455–56
Value net, 148–49

Value redistribution, 148–49
Variable costs, xvii
 for fuels in electric utility, 162
Vertical differentiation, 72
Volatility, 426

Waiting option. *See* Deferral or waiting option
Waiting region, 314
War of attrition, xvii, 99, 196, 363, 414, 415
 and exit strategy, 416
Weeds, Helen, 408, 409, 410
Wernerfelt, Birger, 49, 50
Wicksell model, 283
Wiener process, 427. *See also* Brownian motion

Yahoo, Microsoft bid for, 24, 25

Zero-sum games, 27n