

INDEX

- Acquisition cost, 87
- Action tables:
 in hybrid system
 one-stage, 210, 216–218, 219
 two-stage, 223, 228, 234
 in segmentation process, 272, 274
- Activity-based costing, 87
- Adjusted R², 167, 173
- Advocacy program, 36, 37, 38
- Age, 54. *See also* Disparities
- Alternative payment data, 7–8, 234–237. *See also* Data; Hybrid systems; Thin-file consumers; Underbanked consumers
- Ameriquet, 5
- Analysis of covariance (ANCOVA), 92, 93, 105, 107
- Analysis of variance (ANOVA), 95–105
 log-linear model and, 205, 254
 in pricing analysis (*See also* Pricing)
 interpreting results of, 104
 multiple comparisons in, 104–105, 106
 nonparametric, 102–104
 one-way, 96–99, 143, 144
 overview, 94, 95
 role of, 92, 93
 t-test versus, 99–100
 two-way and *n*-way, 97–99, 143, 144–145
 validating assumptions in, 100–102
 when to use, 42, 101
- Annual percentage rate (APR), 24, 90–91
- Applicant profile analysis, 216, 217
- Appraisal fraud, 90
- Asset quality disparity index, 83
- Audits, 12, 29, 217. *See also* Compliance examinations
- Auto loans, 197, 235, 255–257, 258
- Backward rates, 284
- Bank cards, 235, 257, 259–260. *See also* Credit card portfolio analysis
- Bankruptcy/nonbankruptcy split, 287
- Basel II compliance, 11, 305n, 306n, 307
- Base rates, 87
- Behavioral simulation method (BSM), 41, 283–284, 298–300
- Benchmarking, 339–341
- Bias, in sampling, 29, 32
- Binning, 320
- Bonferroni correction, 105
- Bootstrap method, 167, 181–182
- Borrower credit risk, 89
- Borrower negotiation skills, 90
- Borrower/product options, 90
- Brokers, monitoring of, 113
- Brown-Mood test, 103–104
- Bureau score disparity index (BDI), 57
- Business constraints, 338
- Business rules, 33–35
- Candidate handles. *See* Handles
- Case-control stratified sampling, 32
- Census Bureau, data from, 6, 25, 93. *See also* Data
- Channels, price monitoring of, 90–91
- Chi-square test. *See also* Pearson chi-square statistic
 Hosmer-Lemeshow, 167, 328
 in model validation, 315, 316
 in pricing analysis, 42, 91, 93, 94–95
 in record selection, 59, 61
 in simple hypothesis testing, 35
- Choice-based sampling, 32
- Clustering, 72
- Collinearity, 148, 165–166, 331
- Community Reinvestment Act (CRA), 9. *See also* Regulation BB
- Company internal data, 24. *See also* Data
- Competitive influences, 90, 310
- Compliance constraints, 337–338
- Compliance examinations. *See also* Audits
 exposure distribution by area of, 20
 guidelines for, 23, 36–38, 46–49
 matching statistical methods to, 42–43
- Compliance intelligence:
 lending policy business rules in, 33–35
 matching methods to regulatory exams, 42–43

- Compliance intelligence: (*continued*)
 role of data in, 23–29 (*See also* Data)
 sampling in, 29–33 (*See also* Sampling)
 self-testing strategy matrix, 36–38, 39–40
 statistical analysis in, 35–36
 systematic approach to, 43–44
- Compliance Program Discrimination Factors (C), 36, 39, 46
- Compliance program maturity, 13–14, 15
- Compliance risk, defined, 17
- Concentration disparity index, 84
- Concentrations, and policy rules, 34–35
- Concessions, 116, 118, 133–136
- Conference of State Bank Supervisors, 5
- Constraints, in credit compliance
 optimization, 337–339
- Control group (CG)/nonprotected group, 54, 55–57, 242
- Credit access:
 in changing markets, 6–8
 credit risk connection to, 1–2 (*See also* Credit risk)
 laws and regulations, 4–5
 return on compliance, 14–16, 18–21
- Credit and compliance optimization (CCOP), 334–339
 constraints in, 337–339
 decision variables in, 336
 objective functions in, 336–337
 process overview, 334–336
- Credit card portfolio analysis, 197, 285–287, 288. *See also* Bank cards
- Credit concentration (CC), 40, 41
- Credit history, 156, 222–223
- Credit portfolio analysis, 283–296. *See also* Multilayered segmentation (MLS)
 behavioral simulation method, 283–284, 298–300
 credit cards, 285–287, 288
 heterogeneity in (*See* Heterogeneity of accounts)
 small business, 287, 288–289
- Credit risk. *See also* Risk
 challenges in managing, 8–14 (*See also* Transparency)
 compliance strategy development, 13–14
 critical concerns, 8–9
 process validation, 9–10
 surfacing culture, 10–12
 credit access connection to, 1–2 (*See also* Credit access)
 defined, 17
 enterprise risk management, 2–4, 11, 279–280
 judgment and credit scoring models for, 184–185 (*See also* Credit-scoring models; Hybrid systems; Judgmental systems)
 model validation and, 309, 328–329
 self-testing strategy matrix, 38, 40–42
- Credit risk constraints, 338
- Credit scores, 7, 156. *See also* Credit access; Credit-scoring models; Thin-file consumers
- Credit scoring (CS) approach, 41
- Credit-scoring models, 188–195
 complexity of, 305–306 (*See also* Model validation)
 examples, 250–253
 judgmental systems versus, 184–185
 overrides in, 240–241 (*See also* Override analysis)
 overview, 188–190
 population shift affecting, 310
 review of scorecards and overrides, 37, 38, 39–40
 scorecard and cutoff score in, 190–192, 219–222
 strengths and weaknesses of, 192–195
 validation of, 314–315
- Credit terms and conditions, 89
- Cumulative gains charts and lift, 315, 316
- Current ratio, 229, 230
- Customer advocacy (L3), 37, 38, 39–40
- Customer empowerment, 278
- Cutoff score, 190–192, 219–222. *See also* Credit-scoring models
- Data:
 alternative payment, 7–8, 234–237
 categories and sources of, 23–24, 93–94
 in creating model variables, 26, 27
 for generating indices, 59, 60
 insufficient
 in dynamic conditional process, 153, 159–160, 169, 170
 in model validation, 306–307, 314–315, 329–330
 in relationship pricing, 278
 remedy for, 62–63

- metadata management, 26–29
- for override analysis, 241–242
- preprocessing considerations, 26
- in pricing analysis
 - collection, 93–94, 119
 - prescreening, 91, 94
 - sample size, 102
- for self-testing, 25
- Data aggregation, 62
- Data independence, 101–102
- Debt-to-income disparity index (DTIDI), 57
- Debt-to-income (DTI) ratio, 149, 156, 236
- Decision-based disparity indices, 55, 57, 70–72, 280. *See also* Disparities
- Decision variables, 163, 336. *See also*
 - Primary factors; Secondary factors
- Default values, 62–63
 - probability of default (PD), 328
- Demand disparity index, 84
- Denial disparity index (DDI), 55
- Department of Housing and Urban Development (HUD), 89
- Depository Institutions Deregulation and Monetary Control Act, 5
- Descriptive statistics, 35
- Discretization, 161, 311
- Discriminant analysis (DA), 314–315, 317
- Discrimination. *See also* Disparities; Redlining
 - Fair lending Examination Guidelines on, 36, 39, 46, 47–48
 - lending lawsuit based on, 86
 - statistical, 7n
- Disparities. *See also* Control group (CG)/nonprotected group; Treatment group (TG)/protected group; Universal performance indicator (UPI) method
 - in categorizing indicators, 70–72, 280
 - defined, 53
 - index calculation, 63–65, 83–84
 - interpretation, 57–58
 - pricing, 126–132
 - types of, 55–57
- Distance calculation, 67–68, 72–74
- Drilldown reporting (DR), 41
- Dunnett's two-tailed multiple test, 104–105, 106
- Durbin-Watson test, 101–102
- Dynamic conditional process (DCP), 151–179. *See also* Regression analysis
 - benefits of, 151–152
 - introduction to, 41, 151
 - loan information and data in, 153–154
 - model consensus session in, 33, 154, 158–159
 - modeling framework, 154–168
 - business and compliance focus, 155–158
 - emulating scenarios, 163–164
 - flagging exceptions, 160
 - handle in, 158, 161–163, 320, 331
 - interpreting findings, 168
 - missing data, 159–160
 - model assessment, 166–168, 181–182
 - model development, 164–166
 - overview, 154–155
 - performing trimming, 160
 - primary/secondary factors, 161–162
 - in relationship pricing process, 279, 280
 - simplifying modeling process, 154
 - simulation, 168–179
 - analyzing results, 172–178
 - data processing, 169–172
 - reporting, 178–179
- Dynamic customer relationship management (DCRM), 276–280
- Dynamic relationship pricing (DRP), 277–280, 301–303
- Education programs, 36
- Efficient samples, 29
- Ensemble modeling, 41n
- Enterprise intelligence platform (EIP), 9
- Enterprise risk management (ERM), 2–4, 11, 279–280
- Equal Credit Opportunity Act (ECOA) of 1975, 18, 333
- Equal probability sampling methods, 32
- Equal variances, 100–101
- Error rate and cost matrix approach, 72. *See also* Type I errors; Type II errors
- Ethnicity. *See* Race/ethnicity
- Euclidean distance, 72, 73–74
- Examination focal points, 42. *See also* Compliance examinations
- Exceptions, flagging, 160. *See also* Override analysis
- Fair Housing Act, 6, 18
- Fair Lending Examination Guidelines, 36–38, 46–49
- Fallout disparity index (FDI), 56

- False negatives. *See* Type II errors
- False positives. *See* Type I errors
- Family-wise error (FWE) rate, 104
- Fannie Mae, 89
- Federal Financial Examination Interagency Council (FFIEC):
- as data source, 24, 90, 93
 - Fair Lending Examination Guidelines, 23, 36–38, 46–49
- Federal Reserve Board (FRB):
- on Home Mortgage Disclosure Act, 23
 - peer data from, 5, 6
 - on prepayment restrictions, 89
 - rate spread tables, 91, 93, 126, 127, 128, 155
- File reviews, versus statistical analysis, 35–36
- Financial securities pledged as collateral, 90
- Financial simulation models, 231–232
- Fisher's exact chi-square test, 35, 42. *See also* Chi-square test
- Forecasting:
- behavioral simulation in (*See* Behavioral simulation method (BSM))
 - in credit analysis, 283 (*See also* Credit portfolio analysis)
 - in hybrid system construction, 209–210, 211–213, 214–216
- Forward rates, 284
- Funding disparity index, 83
- Funding ratio, 83n
- Funds transfer pricing (FTP) system, 87
- Gap, between risks and risk controls, 18, 20–21
- Gender, 54. *See also* Disparities
- General linear model (GLM), 95
- Geographical information and mapping (N5), 37, 38, 39–40
- Gini coefficient, 315, 316–317
- Globalization, as profit concern, 15
- Goals. *See* Objectives
- Graphing/charting (GC) approach, 41
- Guilt by association, 12
- Handle cell, 202
- Handles. *See also* Dynamic conditional process (DCP)
- defined, 158
 - in dynamic conditional process, 161–163, 172
 - in hybrid process development, 202
 - in model validation (*See* Risk distributions)
 - in segmentation process, 269–270, 318 (*See also* Multilayered segmentation (MLS))
- Heterogeneity of accounts, 289–296. *See also* Credit portfolio analysis
- credit risk in, 290, 291–292, 296
 - portfolio trends in, 294–295, 296
 - segmenting by dimension, 289–290
 - transition matrices in, 293, 296
- High-side overrides (HSOs), 238, 239, 240. *See also* Override analysis
- Home equity loans, 197, 235, 260, 261–262. *See also* Mortgages
- Home Mortgage Disclosure Act (HMDA):
- data required by, 23, 24
 - impacting price monitoring, 86
 - Loan Application Register, 24
 - on overrides (*See* Override analysis)
 - peer data from, 5, 6
 - pricing analysis for, 126–132
 - Regulation C, 21, 24, 42
- Home ownership, trends in, 6
- Honestly significant difference (HSD) comparison, 105
- Hosmer-Lemeshow chi-square test, 167, 328. *See also* Chi-square test
- Household Finance, 5
- HUD (Department of Housing and Urban Development), 89
- Hybrid systems, 200–248
- defined, 185
 - development process, 201–216 (*See also* Structural modeling)
 - action tables and sensitivity reports, 211, 213–216, 217–219
 - defining scope, 201–202
 - flowchart, 201
 - forecasting and risk indices, 209–210, 211–213, 214–216
 - model consensus session, 202, 203, 320
 - in dynamic relationship pricing process, 279, 280
 - flexibility of, 200, 213
 - loan overrides in (*See* Override analysis)
 - maintenance, 216–218
 - need for, 183

- with nontraditional credit information, 234–237
- policy formulation, 218, 219–222
- in risk-based pricing analysis, 115
- with traditional credit information, 222–234
 - bank cards, 197, 235, 257, 259–260
 - direct auto loans, 197, 235, 255–257
 - home equity loans, 197, 235, 260, 261–262
 - home mortgage loans, 197, 222–225, 226, 227, 228
 - indirect auto loans, 197, 235, 257, 258
 - other secured installment loans, 197, 260, 262–264
 - small business loans, 197, 225, 227, 229–234, 235
- validating (*See* Model validation)
- Hypothesis testing, 35

- Income disparity index (IDI), 57
- Indebtedness ratio, 229, 230
- Indeterminate behavior, 195, 309
- Indicators of Potential Discriminatory Redlining (R), 36, 39–40, 47–48. *See also* Redlining
- Indicators of Potential Disparate Treatment by Steering (S), 36, 46–47. *See also* Steering
- Indicators of Potential Disparate Treatment in Marketing (M), 36, 48–49
- Indicators of Potential Disparate Treatment in Pricing (P), 36, 48–49. *See also* Pricing
- Indicators of Potential Disparate Treatment in Underwriting (U), 36, 47–48. *See also* Underwriting
- Individual subjective overrides, 237–238. *See also* Override analysis
- Inferential statistics, 35–36
- Informational overrides, 237. *See also* Override analysis
- Information evolution model, 13–14
- Information Policy Institute, 7
- Input validation, 308–311. *See also* Model validation
- Installment loans, 197, 260, 262–264
- Interaction effects, 29n, 150
- Interaction plot, 107
- Interest rate risk, 17, 89

- Internal control, 10–12. *See also* Self-testing strategy matrix
- Internal lender data, 93–94. *See also* Data

- Jackknife method, 167, 182
- Judgmental systems, 184–188. *See also* Override analysis

- Kennedy, Joseph, 5
- Kolmogrov-Smirnov (KS) test:
 - in dynamic conditional process, 162
 - in model validation, 315–317, 319, 323, 325
- Kullback, Solomon, 189
- Kullback divergence statistic, 313, 314n, 330n

- Least squares regression, 95
- Levene's squared residuals test for variance homogeneity, 101
- Lien status, 89
- Likelihood-ratio statistic, 206, 328, 329, 332, 334
- Linear regressions, 35. *See also* Regression analysis
- Liquid assets formula, 83n
- Liquidity risk, 17, 83–84
- Loan Application Register (LAR), 24
- Loan-to-value disparity index (LTVDI), 57
- Loan-to-value (LTV) ratio, 89, 149, 156
- Logistic regressions, 35, 206, 254. *See also* Regression analysis
- Log-likelihood testing, 328
- Log-linear model, 205–208, 254, 272, 275
- Low-side overrides (LSOs), 237, 238, 240. *See also* Override analysis

- Mahalanobis distance (MD), 67–68, 73, 78
- Main effects, 205, 206
- Main-effects regression model, 29–30, 148–150. *See also* Regression analysis
- Mainstreaming, 234
- Maintenance. *See* Model maintenance/monitoring
- Management information system (MIS) reporting (N6), 37, 38, 39–40
- Marginal funding costs, 87
- Market-based funds formula, 83n
- Market penetration index (MPI), 56, 59
- Market/price risk, 90
- Market risk, 3

- Markov chain. *See* Behavioral simulation method (BSM)
- Matched-pair analysis. *See also* Paired comparisons
 applications of, 108, 148–149
 in dynamic conditional process, 174–175, 177–181
 market condition changes in, 111–112
 in override analysis, 246, 247, 265–266
 problems with, 150
 reporting, 110, 111
 role of, 92, 107–109
 rules for, 109
 steps in, 111
- Matched pair file reviews (N4), 37, 38, 39–40
- Materiality, 123, 124, 168. *See also* Significance
- Maturity model, 13–14
- Maximum likelihood estimation techniques, 203
- Mean separation tests, 104
- Metadata, 26–29
- Miller, Thomas J., 5, 85
- Misclassification rate, 167, 174
- Model aging index (MAI), 341
- Model consensus session (MCS). *See also* Dynamic conditional process (DCP)
 in hybrid process development, 202, 203
 in model validation, 311, 312, 329–333
 overview, 158–159
 role of, 33, 152, 157, 161
- Model development:
 in dynamic conditional process, 154, 164–166
 in validation process, 311–313, 329–331
- Modeling. *See specific modeling systems*
- Model life cycle management, 343–344. *See also* Model validation
- Model lift decay index (MLI), 340, 343
- Model maintenance/monitoring:
 in behavioral simulation method, 41, 283–284, 298–300
 in hybrid system, 216–222
 in multilayered segmentation, 275, 279
 in override system, 246
- Model management (MM), 40, 41
- Model performance residual index (MRI), 340, 343
- Model profitability index (MPRI), 341, 343
- Model risk, 305. *See also* Model validation
- Model selection, 312, 313, 331–332
- Model stability index (MSI), 340–341, 343
- Model testing power, 166
- Model usage index (MUI), 341
- Model validation, 305–344
 challenges in, 306–307
 in compliance preparedness, 9–10
 credit and compliance optimization, 334–339
 framework for, 317–318
 model consensus session in, 329–333
 multilayered segmentation in, 318–329
 compliance indications, 324–326
 performance, 326–329
 risk distribution, 319–324
 override analysis, 333–334
 results interpretation, 343
 role of, 9–10, 305–306
 statistical metrics, 314–317
 universal performance indicator, 339–343
 update and rebuild decisions, 343–344
 validation areas and components of, 308–314
 inputs, 308–311
 output, 308, 313–314
 processing, 308, 311–313
- Monitoring. *See* Model maintenance/monitoring
- Monte Carlo method (MCM), 18–21, 40–41
- Mortgage-back securities (MBSs), 87
- Mortgages. *See also* Home equity loans
 hybrid system in underwriting, 222–225, 226, 227, 228
 traditional factors in underwriting, 197
- Multilayered segmentation (MLS), 267–303
 applications, 275–296 (*See also* Credit portfolio analysis)
 dynamic customer relationships, 276–280, 301–303
 neighborhoods, 281–282
 underbanked consumers, 282
 approach to, 269–275
 defining objectives, 270–271
 likelihood of success, 273–274
 monitoring and maintenance, 275
 multistage segmentation scheme, 271
 primary action table, 272
 relative segment size, 272–273
 segmentation process, 269–270

- strategy implementation, 274–275
- in model validation, 318–329
 - compliance indications, 324–326
 - performance, 326–329
 - risk distribution, 319–324
 - purpose of, 267–269
- Multiple-comparison procedures (MCPs), 104
- Multistage segmentation scheme, 271
- Multivariate analysis, 35
- Multivariate models, 35
- Multiway analysis, 120
- Mystery shopping (L2), 37, 38, 39–40

- NAACP, discrimination lawsuit by, 86
- Neighborhood assessments, 281–282
- Net-credit loss estimates, 87
- No-file consumers. *See* Thin-file consumers
- Nonparametric ANOVA, 42, 101, 102–104.
 - See also* Analysis of variance (ANOVA)
- Nonprotected group. *See* Control group (CG)/nonprotected group
- Nontraditional credit information. *See* Alternative payment data
- Normality, 100, 101
- N-way ANOVA testing, 97–99

- Objectives, 270–271, 276, 281, 282
- Odds, in credit scoring, 250–253
- Odds ratio, 204
- Office of the Comptroller of the Currency (OCC), 3, 29n, 32, 51–52
- One-way ANOVA testing, 96–99, 143, 144
- Operational risk, 3
- Operational risk control self-assessment (L4), 37, 38, 39–40
- Operational risk KRIs (N7), 37, 38, 39–40
- Operations compliance testing, 36
- Optimal matched pairs, 175n
- Ordinary least square (OLS), 41, 42, 283
- Origination disparity index (ODI), 55–56
- Ostrich approach, 10
- Output validations, 308, 313–314. *See also* Model validation
- Outreach programs, 36
- Overage fees, 112. *See also* Pricing
- Overage/underage analysis, 112–125
 - concessions, 116, 118
 - data collection, 119
 - data model, 137–138
 - importance of monitoring, 112–113
 - loan inclusion considerations, 121–123
 - matched-pairs in, 108
 - materiality, 123
 - noncompliance, 123–125
 - overview, 118–119
 - reporting, 139–141
 - risk-based considerations, 114–116, 117
 - significance testing, 120–121
- Override analysis, 237–248. *See also*
 - Judgmental systems
 - analysis areas, 239–241
 - data collection and summary reporting, 241–242
 - hybrid model and, 248
 - matched pairs, 108, 246, 247
 - in model validation, 318, 333–334
 - monitoring process, 246–247, 265–266
 - policy rules on, 34
 - review of scorecards and overrides, 37, 38, 39–40
 - statistical testing and regressions, 242–245
 - treatment and control groups in, 242
 - types and examples, 42, 237–239
- Overt Indicators of Discrimination (O), 36, 47

- Paired comparisons, 120, 143. *See also* Matched-pair analysis
- Pearson chi-square statistic. *See also* Chi-square test
 - in credit compliance optimization, 336–337
 - in dynamic conditional process, 161n, 165, 166, 167, 173
- Performance monitoring. *See also* Model maintenance/monitoring; Model validation
 - alternate contexts, 78–80
 - process overview, 75–76
 - ranking in, 76–78
 - in universal performance indicator framework, 53
- Points, charging excessive, 85, 91. *See also* Pricing
- Policy assessments (L1), 37, 39–40
- Policy business rules, 33–34
- Policy formulation and credit control (PF), 40, 41, 218, 219–222
- Policy overrides, 237–238. *See also* Override analysis
- Portfolio constraints, 339

- Portfolio monitoring (PM), 40, 41. *See also*
 Credit portfolio analysis; Forecasting
- Predatory lending, 6, 51–52, 80, 85
- Predictor strength measurement, 311–312
- Prepayment restrictions, 89
- Preprocessing, 26, 31
- Prescreening, 91
- Price risk, 17, 18–21
- Pricing. *See also* Underwriting
 concessions, 116, 118, 133–136
 criteria for, 184
 effect of policy changes in, 310
 governance of, 87–88
 Home Mortgage Disclosure Act data
 analysis, 126–132
 importance of monitoring, 85–86
 Indicators of Potential Disparate Treatment
 in Pricing, 36, 39, 48–49
 overages and underages (*See*
 Overage/underage analysis)
 quantifying and modeling, 19–20
 relationship-based, 277–280
 sample size, 102, 142–146
 self-testing for, 40, 41
 systematic analysis, 91–112 (*See also*
 Analysis of variance (ANOVA);
 Chi-square test; Matched-pair analysis)
 ANCOVA testing, 92, 93, 105, 107
 data collection, 93–94
 preliminary screening, 94
 steps in, 91–93
 taxonomy of, 89–91
- Pricing spread formula, 87, 88
- Primary factors:
 auto loan, 255, 257, 258
 bank card, 257, 259
 categorizing, 161, 171–172
 home mortgage loan, 222–223, 225
 list of traditional, 197–198
 in model consensus session, 158–159,
 330
 mortgage loan, 156
 multistage segmentation scheme, 271
 small business loan, 232
- Primary handle, 161. *See also* Handles
- Principle component analysis (PCA), 67, 68
- Probability of default (PD), 328
 default values, 62–63
- Probability proportional to size (PPS)
 sampling, 32
- Processing cost, 90
- Processing validation. *See also* Model
 validation
 aspects of, 308, 311–313
 in compliance preparedness, 9–10
 model consensus session in, 329–332
- Product disparity index (PDI), 56
- Product interest rate risk, 89
- Profitability ratio, 229, 230
- Program subsidies and special
 accommodations, 89
- Protected group. *See* Treatment group
 (TG)/protected group
- Public data, 24, 93. *See also* Data
- Qualitative approaches (L), 37–40, 307
- Quantitative approaches (N), 37–40, 307
- Quick ratio, 229
- Race/ethnicity:
 dynamic conditional process considering,
 153
 home ownership and, 6
 in model validation, 306–307
 in override analysis, 243–245
 in pricing analysis (*See* Pricing)
 subprime home loans and, 85–86
 thin credit statistic, 7n
- Ratio analysis. *See also specific ratios*
 in descriptive statistics, 35
 of disparities, 55–57, 126–132
 in small business loan underwriting, 227,
 229–230
 using alternative payment data, 236–237
- Receiver operation characteristic curve
 (ROC), 315, 316, 317
- Record selection, 59, 61–62
- Redlining. *See also* Discrimination
 Indicators of Potential Discriminatory
 Redlining, 36, 39–40, 47–48
 quantifying and modeling, 18, 19–20
 universal performance indicator in
 identifying, 52, 80
- Reference point values, 70
- Regression analysis. *See also specific
 methods*
 limitations with, 149–150, 152
 linear and logistic, 35, 206, 254
 for loan underwriting, 157
 main-effects approach, 29–30, 148–150
 in override analysis, 244

- in risk self-testing, 41
- role of, 147–148
- sample size for, 145–146
- in systematic pricing analysis, 92, 93
- when to use, 42
- Regulation AA, 21. *See also* Unfair and Deceptive Acts and Practices (UDAP)
- Regulation BB, 21. *See also* Community Reinvestment Act (CRA)
- Regulation C, 21, 24, 42. *See also* Home Mortgage Disclosure Act (HMDA)
- Regulation Z, 21, 112
- Regulatory examinations. *See* Compliance examinations
- Reporting. *See also* Transparency
 - on concessions, 118
 - on dynamic conditional process results, 178–181
 - on loan overrides, 241–242, 246
 - management information system in, 37, 38, 39–40
 - matched-pair analysis, 110, 111
 - in model validation, 339–343
 - in pricing analysis, 123–124, 139–141
 - sensitivity reports, 210, 219
 - standard reporting approach, 41
 - timeliness of, 15
- Reputation risk, 17
- Reserves, in underwriting decisions, 160
- Residual error, 95
- Response index, 273
- Results-based disparity indices. *See also* Disparities
 - in categorizing indicators, 70–72
 - interpreting, 57
 - in relationship pricing, 280
 - types of, 55–56
- Retail lending, 113
- Review of scorecards and overrides (N3), 37, 38, 39–40. *See also* Override analysis
- Risk. *See also* Credit risk
 - operational, 37, 38
 - as profit concern, 15
 - ranking of, 76–78
 - types of, 17, 83–84, 89, 90, 305
- Risk-based pricing, 114–116, 117
- Risk distributions, 209, 319–324. *See also* Model validation
- Risk evaluation for underwriting/pricing (RE), 40, 41, 42
- Risk evaluation/policy formulation system (REPFS), 274. *See also* Hybrid systems; Multilayered segmentation (MLS); Structural modeling
- Risk-free point, 65, 73. *See also* Universal performance indicator (UPI) method
- Risk profile, 3–4
- Roll rates, 284
- R² measures, 167, 173
- Sampling:
 - bias in, 29, 32
 - choice-based, 32
 - considerations in, 29–31
 - holdout sample analysis, 315
 - in model validation, 309, 310
 - in pricing analysis, 102, 142–146
 - process, 31–32
 - statistical schemes, 32–33
- Sarbanes-Oxley Act, 2–3
- Saturated model, 206
- Scenarios, in dynamic conditional process, 163, 172
- Schedules, variances from, 90–91
- Scorecard development process, 185, 201. *See also* Credit-scoring models
- Secondary factors:
 - auto loan, 257, 258
 - bank card, 260
 - categorizing, 161, 171–172
 - home mortgage loan, 223, 225, 227, 228
 - list of traditional, 197–198
 - in model consensus session, 158–159, 330–331
 - small business loan, 232
 - for underwriting and pricing, 156–157
- Segmentation, uses for, 267–269. *See also* Multilayered segmentation (MLS)
- Self-testing strategy matrix, 36–38, 40–42
- Sensitivity analysis, 167, 287–288
- Sensitivity reports, 210, 219
- Service Bureau, 7
- Significance, 120–123. *See also* Materiality
- Simulation approach, 70
- Singular indicator method, 73–74
- Small business loans:
 - behavioral simulation in, 287, 288–289
 - hybrid system in, 225, 227, 229–234
 - nontraditional factors in, 235
 - traditional factors in, 197
- Social Compact, 281

- Standard reporting (SR) approach, 41
- Statistical analysis, types of, 35–36
- Statistical discrimination, 7n
- Statistical testing/modeling (N2), 37, 38, 39–40
- Status quo strategy, 21
- Stay-put rates, 284
- Steady-state bad rate, 289
- Steering:
 - Indicators of Potential Disparate Treatment by Steering, 36, 39, 46–47
 - quantifying and modeling, 18, 19–20
- Strategic segmentation, 267–268. *See also* Multilayered segmentation (MLS)
- Strategy risk, 17
- Structural modeling, 202–209. *See also* Hybrid systems
 - estimation techniques, 202–205
 - log-linear model in, 205–208
 - processing output from, 208
 - reject inference in, 208–209
 - role of, 202, 208
- Subprime product application mix disparity index (SPAMDI), 56
- Subprime product origination mix disparity index (SPOMDI), 56
- System updates, in hybrid models, 217, 218
- Tactical segmentation, 268. *See also* Multilayered segmentation (MLS)
- Technology:
 - making case for investment in, 11
 - in maturity model, 13–14
 - return on, 14–16, 18–21
- Telecom payment history. *See* Alternative payment data
- Thin-file consumers. *See also* Alternative payment data; Underbanked consumers
 - buying power of, 183
 - overcoming, 7, 234
 - risk estimates on, 208
 - underbanked consumers as, 81, 280
- Third-party data, 24, 93. *See also* Data
- Thresholds. *See also* Type I errors; Type II errors
 - choosing appropriate, 72
 - compliance self-testing, 37
 - disparity indices, 57
 - dynamic conditional process framework, 154
 - model validation, 323–324
 - pricing analysis, 95, 111, 131–132
- Total monthly obligations to total monthly income (OBRAT) ratio, 150
- Transaction risk, 17
- Transparency, 12, 29, 122, 239. *See also* Reporting
- Treatment group (TG)/protected group. *See also* Disparities; Race/ethnicity
 - dynamic conditional process, 168
 - hybrid model, 207–208
 - override analysis, 242
 - UPI methodology, 54, 55–57
- Tree models, 35
- Trending, 229–230, 241
- Trimming, 26, 160
- t*-testing, 35, 42, 99–100, 143
- Tukey method, 105
- Two-way ANOVA testing, 97–99, 143–145
- Type I errors:
 - analysis of variance in reducing, 100, 101, 104, 105
 - in error rate and cost matrix approach, 72
 - in model consensus session, 158
 - in model validation measures, 316
 - sample size and, 142
- Type II errors:
 - analysis of variance in reducing, 100, 104
 - in dynamic conditional process, 173
 - in error rate and cost matrix approach, 72
 - in model consensus session, 158
 - in model validation measures, 316
 - sample size and, 142
- Unbiased sampling, 29
- Underage discounts, 112. *See also* Overage/underage analysis; Pricing
- Underbanked consumers, 269, 282. *See also* Alternative payment data; Thin-file consumers
- Underwriting. *See also* Pricing
 - with credit scoring, 250–253 (*See also* Credit-scoring models)
 - criteria for, 184, 195–200
 - effect of policy changes in, 310
 - Indicators of Potential Disparate Treatment in Underwriting, 36, 39, 47–48
 - matched-pair analysis of, 108, 148–149
 - quantifying and modeling, 18, 19–20 (*See also* Dynamic conditional process (DCP))

INDEX

357

- Risk evaluation for underwriting/pricing, 40
- Unfair and Deceptive Acts and Practices (UDAP), 18. *See also* Regulation AA
- Uniform Financial Institutions Rating System (CAMELS), 8
- Universal performance indicator ranking
 - CRA/HMDA analysis (N1), 37, 38, 39–40
- Universal performance indicator (UPI)
 - method, 51–84
 - application example, 83–84
 - defining disparities in (*See* Disparities)
 - deriving indices, 58–65
 - data aggregation, 62
 - data collection, 59, 60
 - data insufficiencies, 62–63
 - index calculations, 63–65
 - process overview, 58
 - record selection, 59, 61–62
 - in dynamic relationship pricing process, 279, 280
 - framework and role of, 41, 51–53
 - generating, 65–75
 - distance calculation, 67–68, 72–74
 - formula for, 74–75
 - index transformation, 68–69
 - process flow, 65–67
 - reference creation, 70
 - singular indicator categorization, 70–72
 - graphical representation in, 65, 71, 79, 80, 81
 - in model validation reporting, 339–343
 - in systematic approach, 43
- Unscorable consumers. *See* Alternative payment data; Thin-file consumers
- U.S. Census Bureau, data from, 6, 25, 93. *See also* Data
- Utility payment history. *See* Alternative payment data

- Validation. *See* Model validation
- Vantage score, 156n
- Vintage cohort analysis (VCA), 40–41
- Visualization techniques:
 - in heterogeneity analysis, 290, 291–296
 - interaction plot, 107
 - in performance monitoring, 75–80, 81

- Weighted average approach, 66, 74
- Weight of evidence (WOE), 250–253
- Welch ANOVA, 101

- Yield spread premiums (YSPs), 5, 114













