Cambridge University Press<br>0521848059-Microeconometrics: Methods and Applications<br>A. Colin Cameron and Pravin K. Trivedi<br>Index<br>More information

## Subject Index

accelerated failure time (AFT) model, 591-2
coefficient interpretation, 606-7
definition, 592
leading examples, 585
accept-reject methods, 413-4, 445
ACD. See average completed duration
acronyms, 17
AD estimator. See average derivative
adaptive estimator, 323, 328, 684
adding-up constraints, 210
additive model, 323, 327, 523
additive random utility model (ARUM)
binary outcome models, 476-8
generalized random utility models, 515-6
identification, 504
multinomial outcome models, 504-7
nested logit model, 509, 526-7
RPL model, 513
welfare analysis in, 506-7
admissible estimator, 435
AFT. See accelerated failure time aggregated data
binary outcomes, 480-2
cohort-level, 772
nonlinear models, 482, 487
multinomial outcomes, 513
time-aggregated durations, 578, 600-3
see also discrete-time duration data
AIC. See Akaike information criterion
AID. See average interrupted duration
Akaike information criterion (AIC), 278-9, 284, 624
almost sure convergence, 947-8
analog estimator, 135
analogy principle, 135
and method of moments estimators, 167
analysis of covariance, 733
analysis of variance, 733
Anscombe residual, 289
antithetic sampling, 408-9, 445
applications with data
competing risks models, 658-62
duration models, 603-8, 632-6
IV estimation, 110-2
kernel regression, 295-7, 300
logit and probit models, 464-6, 486
multinomial and nested logit models, 491-5, 511
Poisson and negative binomial models, 671-4, 690
panel fixed and random effects estimation, 708-15
panel GMM linear estimation, 754-6
panel nonlinear estimation, 792-5
quantile regression, 88-90
selection and two-part models, 553-6, 565
survival function, 574-5, 582
treatment evaluation estimation, 889-96
see also data sets used in applications
Archimedean family, 654
Arellano-Bond estimator, 765-6, 777
application, 754-6
nonlinear models, 791
unit roots, 768
ARMA. See autoregressive moving average
artificial nesting, 283
ARUM. See additive random utility model
asymptotic distribution, 953-4
asymptotic efficiency, 954
asymptotic normal distribution, 953
definition, 74, 120, 953
estimated asymptotic variance, 954
of extremum estimators, 127-31
of FGLS estimator, 82-3
of FGNLS estimator, 156-7
of first-differences estimator, 730-1
of fixed effects estimator, 727-9
of GMM estimator, 173-4, 182-3, 185-6, 194-5, 745-6
of Hausman test statistic, 271-4

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

of kernel density estimator, 301-2, 330-1
of kernel regression estimator, 313, 331-3
of LM test statistic, 235, 237-8
of LR test statistic, 235, 237
of m-estimators, 119-21
of MD estimator, 292
of ML estimator, 142-3
of MM estimator, 134, 174
of MSL estimator, 394-5
of MSM estimator, 400-2
of m-test statistics, 260, 263
of NLS estimator, 152-4
of NL2SLS estimator, 195-6
of OIR test statistic, 181, 183
of OLS estimator, 73-4, 80-1
of panel GMM estimator, 745-6
of quasi-ML estimator, 146
of random effects estimator, 735
of Wald test statistic, 226-8
see also asymptotic theory
asymptotic efficiency, 954
of optimal GMM, 177
asymptotic refinement, 359, 371-2
by bootstrap, 256, 363-7, 371-2, 378-9
definition, 359
by Edgeworth expansion, 371-2
by nested bootstrap, 374, 379
asymptotic theory definitions, 943-55
asymptotic distribution, 953
asymptotic variance, 954
central limit theorems, 949-52
consistency, 945
convergence in distribution, 948-9
convergence in probability, 944-7
laws of large numbers, 947-8
limit distribution, 948
limit variance, $952-3$
stochastic order of magnitude, 954
summary of definitions and theorems, 944
asymptotic variance, $74,120,954$
estimated asymptotic variance, 74,954
see also asymptotic distribution
asymptotically pivotal statistic, 359-60, 363-4, 366, 372, 374, 379-80
ATE. See average treatment effect
ATET. See average treatment effect on the treated
attenuation bias, 903-5, 911, 915, 919-20
attrition bias, 739, 800-1, 940
augmented regression model, 429
autocorrelation
in panel model errors, 705-8, 714-5, 722-5, 745-6
dynamic panel models, 763-8, 791-2, 797-9,
806-7
see also panel-robust inference
autoregressive moving average (ARMA) errors
definition, 159
NLS estimator, 159
panel data, 722-5, 729
auxiliary model, 404
auxiliary regression
bootstrapping, 379, 382
example, 241-3, 269-71
Hausman test, 276, 718-9
LM test, 240-1, 274
m-test, 261-4, 544
available case analysis. See pairwise deletion
average completed duration (ACD), 626
average derivative (AD) estimator
definition, 326
uses, 317, 483
average interrupted duration (AID), 626
average selection bias, 868
average squared error, 315
average treatment effect (ATE), 33-4, 866-71
definition, 866
difficulties estimating, 866
local ATE, 883-6
matching estimators, 871-8
potential outcome model, 33-4
selection on observables only, 868-9
selection on unobservables, 868-71
see also ATET; LATE; MTE
average treatment effect on the treated (ATET),
866-78
application, 889-6
definition, 866
difficulties estimating, 866
matching estimators, 871-8, 894-6
selection on observables only, 868-9
selection on unobservables, 868-71
see also ATE; LATE; MTE
averaged data. See aggregated data
backward recurrence time, 626
balanced bootstrap, 374
balanced repeated replication, 855
balancing condition, 864, 893-4
bandwidth, 299, 307, 312
bandwidth choice for kernel density estimator, 302-4
cross validation, 304
example, 296-7
optimal, 303, 306
Silverman's plug-in estimate, 304
bandwidth choice for kernel regression estimator, 314-6
cross validation, 314-6
example, 297, 316
optimal, 314,318
plug-in estimate, 314
baseline hazard, 591
in AFT model, 592
identification in mixture models, 618-20
in multiple spells models, 655-6
in PH model, 591, 596-7, 601-2
Bayes factors, 456-8
Bayes rule. See Bayes theorem

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

Bayes theorem, 421
example, 422-4, 435-9
Bayesian central limit theorem, 433
Bayesian information criterion (BIC), 278, 284
see also AIC
Bayesian methods, 419-59
Bayes 1764 example, 458-9
Bayesian approach, 420-35
binary outcome models, 475
compared to non-Bayesian, 164, 424-5, 432-41, 439-41
count models, 687
data augmentation, 454-5, 932-3, 935-9
decision analysis, 434-5
examples, 452-4
hierarchical linear model, 847
importance sampling, 443-5
linear regression, 435-43, 449-50, 452-4
Markov chain Monte Carlo simulation, 445-54, 935-9
measurement error model, 915
mixed linear model, 775
model selection, 456-8
multinomial outcome models, 514, 519
panel data, 775, 809
posterior distribution, 421, 430-4
prior distribution, 425-30
Tobit model, 563
BCA method. See bias-corrected and accelerated
before-after comparison
application, 890-1
Berkson error model, 920
Berkson's minimum chi-square estimator, 480-1
Berndt, Hall, Hall, and Hausman (BHHH) estimate, 138, 241, 395
Berndt, Hall, Hall, and Hausman (BHHH) iterative method, 343-4
Bernoulli distribution, 140, 148, 468, 475, 483
Bernstein-von Mises Theorem, 433, 459
best linear unbiased predictor, 738, 776
between estimator, 702, 736, 841
application, 710-3
between-group variation, 709, 733
between model, 702
BFGS algorithm. See Boyden, Fletcher, Goldfarb, and Shannon
BHHH estimate. See Berndt, Hall, Hall, and Hausman
BHHH method. See Berndt, Hall, Hall, and Hausman
bias-corrected and accelerated (BCA) bootstrap method, 360
biased sampling, 42-5, 626-7
see also sample selection; endogenous stratification
BIC. See Bayesian information criterion
binary endogenous variable, 562
binary outcome models, 463-89
additive random utility model, 476-8
aggregated data, 480-2
alternative-invariant regressors, 478
alternative-varying regressors, 478
choice-based samples, 478-9
corrected score estimator, 916-8
definition, 466
example, 464-5
identification, 476, 483
index function model, 475-6
marginal effects, 467, 470-1
measurement error in dependent variable, 914
measurement error in regressors, 919
ML estimator, 468-9
model misspecification, 472
multiple imputation example, 937-8
OLS estimator, 471
panel data, 795-9
semiparametric estimation, 482-6
see also logit models; probit models
binding function, 404-5
bivariate counts, 215, 685-7
bivariate negative binomial distribution, 686-7
bivariate ordered probit model, 523
bivariate Poisson distribution, 686
bivariate Poisson-lognormal mixture, 686
bivariate probit model, 522-3
bivariate sample selection model, 547-53
application, 553-5
bounds, 566
conditional mean, 548-50
conditional variance, 549-50
definition, 547
Heckman two-step estimator, 550-1
identification, 551, 565-6
marginal effects, 552
ML estimator, 548
outcome equation, 547
participation equation, 547
semiparametric estimator, 565-6
versus two-part model, 546, 552-3
Bonferroni test, 230
bootstrap hypothesis tests
asymptotic refinement, 363-4, 366-7, 371-2, 378-9
bootstrap critical value, 256, 363
bootstrap p-value, 256, 363
example, 366-8
nonsymmetrical test, 363,380
power, 372-3
symmetrical test, 363
without asymptotic refinement, 363, 367-8, 378
bootstrap methods, 357-83
asymptotic refinement, 359, 366-7
bias estimate, 365
bias-corrected estimator, 365, 368
clustered data, $363,377-8,845$
confidence intervals, 364-5, 368
consistency, 369-70
critical value, 363

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

examples, 254-6, 366-8
for functions of parameters, 363
general algorithm, 360
for GMM, 379-80
heteroskedastic data, 363, 376-7
introduction, 254-6
for nonsmooth estimators, 373, 380-1
number of bootstrap samples, 361-2
panel data, $363,377-8,708,746,751$
p-value, 363
recentering, 374, 379
rescaling, 374
sampling methods for, 360
smoothness requirements, 370
standard error estimate, 362, 366
time series data, 381
variance estimate, 362
without asymptotic refinement, $358,367-8$
see also bootstrap hypothesis tests
bounds identification, 29
in measurement error models, 906-8
bounds in selection model, 566
Boyden, Fletcher, Goldfarb, and Shannon (BFGS) algorithm, 344

CAIC. See consistent Akaike information criterion calibrated bootstrap, 374
caliper matching, 874,895
canonical link function, 149, 469, 783
case-control analysis, 479, 823
causality, 18-38
examples, 69-70, 98
Granger causality, 22
identification frameworks and strategies, 35-3
in linear regression model, 68-9
in potential outcome models, 32-4, 862-5
in simultaneous equations model, 26-7
in single-equation model, 31
and weighting, 820-1
see also endogeneity
cdf. See cumulative distribution function
censored least absolute deviations (CLAD) estimator, 564-5, 808
censored models, 530-44, 579-80
conditional mean, 535
count models, 680
definitions, 532, 579-80
examples, 530-1,535
ML estimator, 533-4
semiparametric estimation, 563-5
see also duration model; selection models; Tobit models; truncated models
censored normal regression model. See Tobit model censoring mechanisms, 532, 579-80
censoring from above, 532, 579
censoring from below, 532, 579
left censoring, 532, 579, 588
independent censoring, 580
interval censoring, 579, 588
noninformative censoring, 580
random censoring, 579
right censoring, 532, 579, 581, 589
sample selection, 44-5,547
type 1 censoring, 579
type 2 censoring, 580
census coefficient, 819
central limit theorem (CLT), 949-2
Cramer linear transformation, 952
Cramer-Wold device, 951
definition, 950
examples of use, 80, 130
Liapounov CLT, 950
Lindeberg-Levy CLT, 950
multivariate, 951-2
sample average, 949
sampling scheme, 131, 950
CGF tests. See chi-square goodness-of-fit
characteristic function, 370, 913, 950
chatter, 394, 410
Chebychev's inequality, 946
chi-square goodness-of-fit (CGF) tests, 266-7, 270-1, 474
choice-based samples, 823
binary outcome models, 478-9
see also endogenous stratification
Choleski decomposition, 416, 448
CL model. See conditional logit
CLAD estimator. See censored least absolute

## deviations

Clayton copula, 654
CLT. See central limit theorem
clustered data, 829-53
application, 848-53
cluster bootstrap, 363, 377-8, 845
cluster-robust inference, $707,834,842$, 845
cluster sampling, 41-2
cluster-specific effects, 830-2, 837-45
comparison to panel data, 831-2
diagnostic tests, 841
dummy variables model, 840
fixed effects estimator, 840-1, 843-5
hierarchical models, 845-8
large clusters, 832
nonlinear models, 841-5
OLS estimator, 75, 833-7
quasi-ML estimator, 150
random effects estimator, 837-9, 843
small clusters, 832
see also panel data
cluster-robust standard errors
bootstrap, 363, 377-8, 845
clustered data, 834,842
panel data, 706-7, 745-6, 789
see also robust standard errors

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

cluster-specific fixed effects (CSFE) estimator, 839-41, 843-4
application, 848-53
between estimator, 840-1
nonlinear models, 843-4
within estimator, 140-1
cluster-specific fixed effects (CSFE) model, 831, 843
cluster-specific random effects (CSRE) estimator,

$$
837-9,843-4
$$

application, 848-53
cluster-specific random effects (CSRE) model, 831, 843-4
cluster variable, 707
CM tests. See conditional moment
coefficient interpretation
in binary outcome models, 467, 473
in competing risks model, 646
in count model, 669
in duration models, 606-7
in misspecified linear model, 91-2
in multinomial outcome models, 493-4, 501-3
in nonlinear models, 122-4, 162-3
in Tobit model, 541-2
see also marginal effects
coherency condition, 562
cohort-level data. See pseudo panels
cointegration, 382, 767
common parameters, 801
compensating variation, 500-7, 512
competing risks model (CRM), 642-8, 658-62
application, 658-62
censoring, 642
coefficient interpretation, 646
definitions, 642-4
dependent risks, 647-8
exit route, 643
identification, 646
independent risks, 644-6
ML estimator, 644-5
proportional hazards, 645-6
spell duration, 643
with unobserved heterogeneity, 647, 659
complementary log-log model, 466-7, 603
complete case analysis. See listwise deletion
complex surveys, 41-2, 814-6, 853-6
composition methods, 415
computational difficulties, 350-2
concentration parameter, 109
conditional analysis, 717
conditional expectations, 955-6
conditional independence assumption, 23, 863, 865
definition, 863
for participation, 863
given propensity score, 865
selection on observables only, 868
unconfoundedness, 863
conditional likelihood, 139-40, 824
panel models, 731-2, 782-3, 796-9, 805
conditional logit (CL) model, 500-3, 524-5
application, 491-4
definition, 500
fixed effects binary logit, 797, 844
marginal effects, 493, 501-3, 525
ML estimator, 501
from ARUM, 505
see also multinomial outcome models
conditional ML estimator, 731-2, 782-3, 796-9, 805, 824
conditional moment (CM) tests, 264-5, 267-9, 319
consistent CM test, 268
in duration models, 632
example, 269-71
in Tobit model, 544
see also m-tests
conditional mean
squared error loss, 67-9
conditional mode
step loss, 68
condition number, 350
conditional quantile
asymmetric absolute loss, 68
confidence intervals, 231-2, 316, 364-5, 368
consistent Akaike information criterion (CAIC), 278
consistent test statistic, 248
consistency
definition, 945
of extremum estimators, 125-7, 132-3
of GMM estimator, 173-4, 182
of m-estimator, 132-3
of ML estimator, 142, 146-50
of NLS estimator, 155
of OLS estimator, 73, 80
strong consistency, 947
weak consistency, 947
see also asymptotic distribution; identification;
pseudo-true value
constant coefficients model. See pooled model
contagion, 612
contamination bias, 903-4
contemporaneous exogeneity assumption, 748-9, 752, 781
continuous mapping theorem, 949
control function approach, 37
control function estimator, 869-70, 890
control group, 49
conventions, 16-17
convergence criteria, 339-40, 458
convergence in distribution, 948-9
continuous mapping theorem, 949
definition, 948
limit distribution, 948
transformation theorem, 949
vector random variables, 949
see also central limit theorem
convergence in probability, 944-7
alternative modes of convergence, 945

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

consistency, 945
definition, 945
probability limit, 945
Slutsky's theorem, 945
uniform convergence, 126, 301
vector random variables, 945
see also law of large numbers
copulas, 216, 651-5
count example, 687
definition, 651-2
dependence parameter, 653-4
leading examples, 654
ML estimator, 655
survival copulas, 652
correlated random effects model, 719, 786
counterfactual, $32,555,861,871$
see also potential outcome model
count data, 665
examples, 665
heteroskedasticity, 665
right-skewness, 665
see also count models
count models, 665-93
censored, 680
application, 671-4, 690
endogenous regressors, 683, 687-9
endogenous sampling, 823
finite mixture models, 678-9
hurdle models, 680-1
measurement error in dependent variable, 915
measurement error in regressors, 915-8
mixture models, 675-7
multivariate, 685-7
OLS estimator, 684
negative binomial model, 675-7
NLS estimator, 684
panel data, 792-5, 802-8
Poisson model, 666-74
sample selection, 680
semiparametric regression, 684-5
truncated, 679-80
zero-inflated, 681
covariance matrix. See variance matrix
covariance structures, $177,379,753,766-7$
covariates. See regressors
Cox CRM model. See competing risks
Cox PH model. See proportional hazards
Cox-Snell residual, 289, 631, 633-6
CPS. See Current Population Survey
Cramer linear transformation, 952
Cramer-Rao lower bound, 143, 954
see also semiparametric efficiency bound
Cramer's theorem, 949
Cramer-Wold device, 130, 951
CRM. See competing risks model
cross-equation parameter restrictions, 210
cross-section data, 47
cross-validation, 304, 314-6, 318, 321

CSFE estimator. See cluster-specific fixed effects
CSRE. See cluster-specific random effects
cumulant, 370
cumulative distribution function (cdf), 576
cumulative hazard function
definition, 577-8
in competing risks model, 644-5
as diagnostic tool, 631-2
in likelihood function, 588
Nelson-Aalen estimator, 582-4, 605-6, 662
in proportional hazards model, 590
Current Population Survey (CPS), 58, 814-5
curse of dimensionality
in Bayesian methods, 419-20
multivariate kernel density estimator, 306
multivariate kernel regression estimator, 319
high-dimensional integrals, 393
data augmentation, 454-5, 932
imputation step, 455, 932
for missing data, 932-8
prediction step, 455, 933
regression example, 933
data-generating process (dgp), 72-3, 124
misspecified, 90, 132
data mining, 285-6
data sets. See microdata
data sets used in applications
Current Population Survey Displaced Workers
Supplement (McCall), 603-8, 632-6, 658-62
fishing-mode choice data (Kling and Herriges), 463-6, 486, 491-5
National Longitudinal Survey (Kling), 110-2
National Supported Work demonstration project (Dehejia and Wahba), 889-95
Panel Survey of Income Dynamics cross-section sample, 295-7, 300
Panel Survey of Income Dynamics panel sample (Ziliak), 708-15, 754-6
patents-R\&D panel data (Hausman, Hall, and Griliches), 792-5
Rand Health Insurance Experiment expenditures, 553-6, 565
Rand Health Insurance Experiment medical doctor contacts, 671-4, 692
strike duration data (Kennan), 574-5, 582
Vietnam World Bank Livings Standards Survey, 88-90, 848-53
see also applications with data
data structures, 39-62
data sources, 58-9
handling microdata, 59-61
natural experiments, 54-8
observational data, 40-8
social experiments, 48-54
data summary approach to regression, 820
Davidon, Fletcher, and Powell (DFP) algorithm, 344, 350-1

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

decomposition of variance, 955-6
degenerate distribution, 948
degrees-of-freedom adjustment, $75,102,138,185-6$, 278, 841
delta method, 231-2
bootstrap alternative, 363
density kernel, 421
density-weighted average derivative (DWAD) estimator, 326
dependent variable, 71
descriptive approach to regression, 820
deviance, 149, 244
deviance residual, 289, 291
DFP algorithm. See Davidon, Fletcher, and Powell algorithm
dgp. See data-generating process
diagnostic tests. See specification tests
DID estimator. See differences-in-differences
differences-in-differences (DID) estimator, 55-7, 768-70, 878-9
application, 890-1
consistency, 770
definition, 768
introduction, 55-7
natural experiments, 878
with controls, 878-9
without controls, 878
direct regression, 906
disaggregated data
contrasted with aggregated data, 5-10
discrete factor models, 678
see also finite mixture models
discrete outcomes. See binary outcomes; counts; multinomial outcomes
discrete-time duration data, 577-8, 600-3
cumulative hazard function, 578
discrete-time proportional hazards, 600-3
gamma heterogeneity, 620
hazard function, 578
logit model, 602
ML estimator, 601
nonparametric estimation, 581-4
probit model, 602
survivor function, 578
dissimilarity parameter, 509
disturbance term. See error term
double bootstrap, 374
dummy endogenous variable model, 557
dummy variable estimator, 784-5, 800, 805, 840
see also LSDV estimator
duration data, 573-664
different types, 626, 641
duration models, 573-664
accelerated failure time, 591-2
applications, 574-5, 583, 589, 603-8, 632-6, 658-62
censoring, 579-82, 587-9, 595, 642
competing risks, 642-8, 658-62
cumulative hazard function, 577-8
discrete time, 577-8, 600-3
generalized residual, 631
hazard function, 576, 578
key concepts, 576-8
mixture models, 613-25
ML estimator, 587-9
multiple spells, 655-8
multivariate, 648-55
nonparametric estimators, 580-4
OLS estimator, 590-1
panel data, 801-2
parametric models, 584-91
proportional hazards, 592-7
risk set, 581, 594
semiparametric estimation, 594-600, 610-2
specification tests, 628-32
survivor function, 576, 578
time-varying regressors, 597-600
see also proportional hazards model
DWAD estimator. See density-weighted average derivative
dynamic panel models, 763-8, 791-2, 797-9, 806-7
Arellano-Bond estimator, 765-6
binary outcome models, 806-7
count models, 806-7
covariance structures, 766-7
inconsistency of standard estimators, 764-5
initial conditions, 764-5
IV estimators, 764-5
linear models, 763-8
MD estimator, 767
nonlinear models, 791-2, 797-9, 806-7
nonstationary data, 767-8
transformed ML estimator, 766
true state dependence, 763-4
unobserved heterogeneity, 764
weak exogeneity, 749
EDF bootstrap. See empirical distribution function bootstrap
Edgeworth expansions, 370-1
efficient score, 141
Eicker-White robust standard errors, 74-5, 80-1, 112, 137, 164, 175
see also heteroskedasticity robust-standard errors
EM algorithm see expectation maximization
empirical Bayes method, 442
empirical distribution function (EDF) bootstrap, 360
see also paired bootstrap
empirical likelihood, 203-6
empirical likelihood bootstrap, 379-80
encompassing principle, 283
endogeneity
definition, 92
due to endogenous stratification, 78, 824-5
Hausman test for, 271-2, 275-6

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

identification frameworks and strategies, 35-7
see also endogenous regressors; exogeneity
endogenous regressors, 78
binary, 557, 562
in count models, 683-4, 687-9
in discrete outcome models, 473
in duration models, 598
dummy, 557, 562
inconsistency of OLS, 95-6
in linear panel models, 744-63
in linear simultaneous equations model, 23-30
in nonlinear panel models, 792
in potential outcome model, 30-3
returns-to-schooling example, 69-70
in selection models, 559-62
in single-equation models, 30
see also GMM estimator; IV estimator
endogenous sampling, 42-5, 78, 822-9, 856
consistent estimation, 827-9
leading examples, 823
see also censored models; endogenous
stratification; sample selection models
endogenous stratification, 820, 826-7, 856
equation-by-equation OLS, 210
equicorrelated errors, 701, 722-4, 804
equidispersion, 668,670
error components model. See RE model
error components SEM, 762
error components SUR model, 762
error components 2SLS estimator, 760
error components 3SLS estimator, 762
error term, 71, 168
additive, 168
nonadditive, 168
errors-in-variables. See measurement error
estimated asymptotic variance, 954
see also asymptotic distribution
estimated prediction error. See cross-validation
estimating equations estimator, 13-5
asymptotic distribution, 134-5, 174
clustered data, 842
computation, 339
definition, 134
generalized, 134, 790, 794, 804
variance matrix estimation, 137-9
weighted, 829
see also MM estimator
Euler conditions, 171, 749
exact identification. See just identification
exchangeable errors, 701, 804
exhaustive sampling, 815-6
exogeneity, 22-3
conditional independence, 23
Granger causality, 22
of instrument, 106
overidentifying restrictions test for, 277
panel data assumptions, 700, 748-52, 754, 781
strong exogeneity, 22
weak exogeneity, 22
exogenous sampling, 42-3
exogenous stratified sampling, 42, 78, 814-5, 820, 825, 856
exogenous regressor. See exogeneity
expectation maximization (EM) algorithm, 345-7
for data imputation, 930-2
E (Expectation) step, 346
for finite mixture model, 623-5
M (Maximization) step, 346
compared to NR algorithm, 625
expected elapsed duration, 626
experimental data, 48-58
control group, 49
natural experiments, 54-8
social experiments, 48-54
treatment group, 49
explanatory variables. See regressors
exponential conditional mean, 124, 155, 669
coefficient interpretation, 124, 162-3, 669
exponential distribution, 140, 584-6
for generalized (Cox-Snell) residual, 631
exponential family density, 427
conjugate prior for, 427-8
see also linear exponential family
exponential-gamma regression model, 616, 633-4
exponential-IG regression model, 634
exponential regression model
application with censored data, 606-8, 633
example with uncensored data, 159-63
extreme value distribution. See type 1 extreme value
extremum estimator, 124-39
asymptotic distribution, 127-31
consistency, 125-7
definition, 125
formal proofs, 130-2
informal approach, 132-3
statistical inference, 135-9
variance matrix estimation, 137-9
factor analysis, 650
factor loadings, 517, 650-1, 689
factor model, 517, 648, 686
Fairlee-Gumble-Morgenstern copula, 654
fast simulated annealing (FSA) method, 347-8
FD estimator. See first-differences
FE estimator. See fixed effects
feasible generalized least squares (FGLS) estimator, 81-3
asymptotic distribution, 82
definition, 82
example, 84-5
in fixed effects model, 729
in mixed linear model, 775
nonlinear, 155-8
in pooled model, 720-1

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

feasible generalized least squares (cont.)
in random effects model, 705, 734-6, 738, 837-9, 849-51
as sequential two-step m-estimator, 201
systems FGLS, 208-9
feasible generalized nonlinear least squares (FGNLS) estimator, 155-8
asymptotic distribution, 156
definition, 156
example, 159-63
as optimal GMM estimator, 180-1
systems FGNLS, 217
FGLS estimator. See feasible generalized least squares
FGNLS estimator. See feasible generalized nonlinear least squares
FIML estimator. See full information maximum likelihood
finite mixture models, 621-5
counts, 678-9
definition, 622
EM algorithm, 623-5
latent class interpretation, 623
number of components, 624-5
panel data, 786
see also mixture models
finite-sample bias
of GMM estimator, 177
of IV estimator, 108-12
of tests, 250-4, 262
finite-sample correction term
for sampling without replacement, 817
first-differences (FD) estimator, 704-5, 729-31
application, 710-11, 714
asymptotic distribution, 730-1
compared to FE estimator, 731
consistency, 730, 764
definition, 704-5, 730
IV estimator, 758
first-differences (FD) model, 704, 729-31, 758
first-differences (FD) transformation, 783-4
fixed effects (FE) estimator, 704, 726-9, 756-9, 781-5, 791-2
application, 710-3, 792-5
asymptotic distribution, 727-9
binary outcome models, 796-9
clustered data, 839-41
compared to DID estimator, 768
compared to FD estimator, 729
as conditional ML estimator, 732
consistency, 727, 764, 781-2, 784-5
count models, 802-8
definition, 704, 726, 781-4
duration models, 802
dynamic models, 764-6, 791-2, 797-9, 806-7
as FGLS estimator, 729
Hausman test for, 717-9
identification, 702
incidental parameters, 704, 726
inconsistency, 764, 781-2, 784-5
IV estimators, 758
as LSDV estimator, 733
multinomial outcome models, 798
selection models, 801
Tobit model, 800
versus random effects, 701-2, 715-9, 788
fixed effects (FE) model, 704, 726-33, 756-9, 781-5, 791-2
cohort-level, 772
clustered data, 831, 843
definition, 700, 726
dynamic models, 764-6, 791-2, 797-9, 806-7
endogenous regressors, 756-9
identification, 702
incidental parameters, 704, 726
marginal effects, 702
nonlinear models, 781-5, 796-808, 791
time-varying regressors, 702
versus random effects, 701-2, 715-9, 788
see also fixed effects estimators
fixed coefficient, 846
fixed design. See fixed in repeated samples
fixed in repeated samples, 76-7
bootstrap sampling method, 360
in kernel regression, 312
Liapounov CLT, 951
Markov LLN, 948
Monte Carlo sampling method, 251
fixed regressors. See fixed in repeated samples
flexible parametric models
count models, 674-5
hazard models, 592
selection models, 563
flow sampling, 44, 626
forward orthogonal deviations IV estimator, 759
forward orthogonal deviations model, 759
forward recurrence time, 626
Fourier flexible functional form, 321
frailty, 612, 662
see also unobserved heterogeneity
Frank copula, 654
Frechet bounds, 653-4
frequentist approach, 421-2, 424, 439-40
FSA method. See fast simulated annealing
full conditional distributions, 431
see also Gibbs sampler
full information maximum likelihood (FIML)
estimator, 214
nested logit model, 510-2
nonlinear models, 219
functional approach
to measurement error, 901
functional form misspecification, 91-2
diagnostics for, 272-3, 277-8
gamma distribution, 585-6, 614
gamma function, 586

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

Gaussian quadrature, 389-90, 393, 809
Gauss-Hermite quadrature, 389-90
Gauss-Laguerre quadrature, 389-90
Gauss-Legendre quadrature, 389-90
Gauss-Newton (GN) algorithm, 345
example, 348
GEE estimator. See generalized estimating equations general to specific tests, 285
generalized additive model, 323,327
generalized cross-validation, 315
generalized estimating equations (GEE) estimator, 790, 794, 804, 809
generalized extreme value (GEV) distribution, 508
see also nested logit model
generalized information matrix equality, 142, 145, 264
generalized inverse, 261
generalized IV estimator, 187
generalized least squares (GLS) estimator, 81-5
asymptotic distribution, 82
definition, 82
as efficient GMM, 179
example, 84-5
nonlinear, 155-8
generalized linear models (GLMs), 149-50, 155
count data, 683
conditional ML estimator, 783
GEE estimator, 791
quasi-ML estimator, 149-50
see also LEF models
generalized method of moments (GMM) estimator, 166-222
asymptotic distribution, 173-4, 182-3
based on additional moment restrictions, 169, 178-9
based on moment conditions from economic theory, 171
based on optimal conditional moment, 179-80
bootstrap for, 379-80
computation, 339
definition, 173
endogenous counts, 683-4, 687-9
with endogenous stratification, 827
with exogenous stratification, 823-4
examples, 167-71, 178-9
finite-sample bias, 177
identification, 173, 182
linear IV, 183-92
linear systems, 211-2
nonlinear IV, 192-9
one-step GMM estimator, 187, 196, 746, 755
optimal GMM, 176
optimal moment condition, 179-81, 188
optimal weighting matrix, 175-6
panel data, 744-66, 789-90, 792
practical considerations, 219-20
test based on, 245
two-step, 176, 187, 746, 755
variance matrix estimation, 174-5
weak instruments, 177-8
see also panel GMM estimator
generalized nonlinear least squares (GNLS) estimator.
See feasible generalized nonlinear least squares
generalized partially linear model, 323
generalized random utility models, 515-6
generalized residual, 289-90
in duration models, 631
in LM test, 239-40
plots of, 633-6
generalized Tobit model, 548
generalized Weibull distribution, 584-6
genetic algorithms, 341
GEV distribution. See generalized extreme value
Geweke, Hajivassiliou, Keane (GHK) simulator, 407-8
for MNP model, 518
GHK simulator. See Geweke, Hajivassiliou, Keane simulator
Gibbs sampler, 448-50
data augmentation, 454-5, 933
example, 452-4
in latent variable models, $514,519,563$
see also Markov chain Monte Carlo
GLMs. See generalized linear models
GLS estimator. See generalized least squares
GMM estimator. See generalized method of moments
GN algorithm. See Gauss-Newton
GNLS estimator. See feasible generalized nonlinear least squares
Gompertz distribution, 585-6
Gompertz regression model, 606-8
gradient methods, 337-48
see also iterative methods
Granger causality, 22
grid search methods, 337, 351
grouped data. See aggregated data
Halton sequences, 409-10
Hausman test, 271-4
applications, 719, 850-1
asymptotic distribution, 272
auxiliary regressions, 273
bootstrap, 378
computation, 272-3, 378, 717-9
definition, 271-2
for endogeneity, 271-2, 275-6
for fixed effects, 717-9, 737, 788, 839
for multinomial logit model, 503
power, 273-4
robust versions, 273, 378, 718-9
Hausman-Taylor IV estimator, 761
Hausman-Taylor model, 760-2
Hawthorne effect, 53
hazard function
baseline in PH model, 591
cumulative hazard, 577-8, 582-4
definition, 576, 578

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

hazard function (cont.)
in mixture models, 616-8
multivariate, 649
nonparametric estimator, 581, 583
parametric examples, 585
piecewise constant, 591
see also duration models
Health and Retirement Study (HRS), 58
Heckit estimator. See Heckman two-step estimator
Heckman two-step estimator
application, 554
in Roy model, 556
in selection model, 550-1
semiparametric estimator, 565-6
in Tobit model, 543, 567-8
Hessian matrix
estimate, 137
Newton-Raphson algorithm, 341-2
singular, 350-1
heterogeneous treatment effects, 882, 885-7
IV estimator, 886-7
LATE estimator, 885
RD design, 882
heterogeneity
within-cell, 480
see also unobserved heterogeneity
heteroskedastic errors
adaptive estimation, 323, 328
conditional heteroskedasticity, 78
definition, 78
in GLMs, 149-50
in linear model, 84-5, 94-5
multiplicative, 84-5, 86-7
in nonlinear model, 157-63
residuals, 289-90
tests for, 241, 267, 275
Tobit MLE inconsistency, 538
working matrix for, 82-3, 156-8
heteroskedasticity-robust standard errors
bootstrap, 379-80
clustered data, 834
example, 84-5
for extremum estimator, 137, 164
intuition, 81
for NLS estimator, 155, 164
for OLS estimator, 74-5, 80-1, 112
panel data, 705
for WLS estimator, 83
see also robust standard errors
hierarchical linear models (HLMs), 845-8
Bayesian analysis, 847
clustered data, 845
coefficient types, 846-7
individual-specific effects, 848
mixed linear models, 774-6, 847
panel data, 847-8
random coefficients model, 847
two-level model, 846
hierarchical models, 429
Bayesian analysis, 441-2, 447, 450, 514
see also hierarchical linear models
histogram, 298
see also kernel density estimator
HLM. See hierarchical linear model
hot deck imputation, 929, 940
HRS. See Health and Retirement Study
Huber-White robust standard errors, 137, 144, 146
see also robust standard errors
hurdle model, 680-1, 690
see also two-part model
hyperparameters, 428,847
hypothesis tests, 223-58
based on extremum estimator, 224-33
based on ML estimator, 233-43
based on GMM estimator, 245
based on m-estimator, 244
bootstrap, 254-6, 363-8, 372-3, 378-9
for common misspecifications, 274-7, 670-1
examples, 236, 241-3, 252-4, 254-6, 372-3
induced test, 230
joint versus separate, 230-1, 285, 629-30
power, 247-50, 253-4
size, 246-7, 251-3
see also LM tests; LR test; Wald tests, m-tests
identification
in additive random utility models, 504
in binary outcome models, 476, 483
bounds identification, 29
definitions, 29-31
in fixed effects model, 702
of GMM estimator, 173, 182
just identification, 31, 214
in linear regression model, 71-2
in measurement error models, 905-14
in mixture models, 618-20
in multinomial probit model, 517
in natural experiments, 57-8
observational equivalence, 29
order condition, 31, 213
over identification, 31, 214
rank condition, 31
in sample selection model, 551, 565, 566
set identification, 29
in simultaneous equations model, 29-31, 213-4
in single-index models, 325
and singular Hessian, 351
weak identification, 100
see also identification strategies
identification strategies, 36-7
control function approach, 37
exogenization, 36
incidental parameter elimination, 36-7
instrumental variables, 37
matching, 37
reweighting, 37

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

identified reduced form, 36
IG distribution. See inverse-Gaussian
ignorable missingness, 927
estimator consistency if MCAR, 927
estimator inconsistency if MAR only, 927
problems if nonignorable, 940
weak exogeneity, 927
ignorability assumption, 863
see also conditional independence assumption
importance sampling, 407-8, 443-5, 518
accelerated, 409
GHK simulator, 407-8
importance sampling density, 444
importance sampling estimator, 444
importance weight, 445
target density, 444
imputation methods, 928-39
data augmentation, 454-5, 932-4
example, 936-8
hot deck imputation, 929
listwise deletion, 928
mean imputation, 928-9
multiple imputation, 934-5
pairwise deletion, 928
regression-based imputation, 930-2
imputation (I) step, 455, 932
IM test. See information matrix test
IMSE. See integrated mean squared error
incidental parameters, 36
clustered data FE model, 832, 840, 844
panel data FE model, 704, 726, 781-2, 805
inclusive value, 510-1
incomplete gamma function, 586
incomplete panels. See unbalanced panels
independence of irrelevant alternatives, 503, 505, 527
independent variables. See regressors
independently-weighted IV estimator, 192
independently-weighted optimal GMM estimator, 177
index function model
binary outcome model, 475-6, 482-3
bivariate probit model, 522-3
ordered multinomial model, 519-20
Tobit model, 536
see also single-index model
indicator function, 298
indirect inference, 404-5
individual-specific effects model
additive, 780
binary outcome models, 795-6
cluster-specific effects, 830
count models, 802-3
definitions, 700, 780
duration models, 802
multiplicative, 780, 793
one-way, 700
parametric, 780
selection models, 801
single-index, 780

Tobit models, 800-1
two-way, 738
see also FE models; RE models
induced test, 230
information criteria, 278-9, 283-4
Akaike, 278-9, 284, 624
Bayesian, 278, 284
consistent Akaike, 278
Kullback-Liebler, 147, 169, 278, 280
Schwarz, 278, 284
information matrix, 142
block-diagonal, 144, 240, 329
information matrix equality, 141-2, 145
generalized, 142, 145
see also BHHH estimate; OPG version
information matrix (IM) test, 265-6
bootstrap, 378
computation, 261-2, 378
definition, 265
example, 270
power, 267
instrumental variables (IV) estimator
alternative estimators, 190-2
application, 110-2
definition, 100-1
example, 102-3
finite-sample bias, 108-12, 191-2, 196
identification, 100, 105-7
independently-weighted IV estimator, 192
jackknife IV estimator, 192
LIML estimator, 191, 214
in linear model, 98-112, 183-92, 211-2
linear IV as GMM estimator, 170, 186
local average treatment effects estimator, 883-9
in measurement error models, 908-10, 912-3
in natural experiments, 54-5
in nonlinear models, 192-9
in panel models, 764-5, 757-61
quantile regression, 190
in selection models, 559
split-sample estimator, 191-2
systems IV estimator, 211-2, 218-9
in treatment effects models, 883-9
two-stage IV estimator, 102, 187
two-stage least squares estimator, 101-2, 187-91
Wald estimator, 98-9
see also GMM estimator; panel GMM estimator
instruments
definition, 96-7, 100
examples, 97-8
by exclusion restriction, 106
by functional form restriction, 106
invalid, 100, 105-7
optimal, 180
for panel data, 750-1, 754-6
relevance, 108
weak, 100, 104-12, 177-8, 191-2, 196, 751-2, 756
see also instrumental variables estimator

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

integrated hazard function. See cumulative hazard function
integrated mean squared error (IMSE), 303
integrated squared error (ISE), 302, 314
interval data models
definition, 532-3, 579
ML estimator, 534-5
interruption bias, 626
intraclass correlation, 816, 831, 835-8
inverse-Gaussian (IG) distribution, 614-5, 677
inverse law of probability, 421
inverse-Mills ratio, 540-1, 553-4
inverse transformation method, 409, 412-3
inverse-Wishart distribution, 443, 453, 514
irrelevant regressors, 93
ISE. See integrated squared error
iterated bootstrap, 374
iterative methods, 337-48
BFGS, 344
BHHH, 343-4
convergence criteria, 339-40
DFP, 344, 350-1
expectation maximization, 345-7, 623-5, 930-2
fast simulated annealing, 347-8
Gauss-Newton, 345, 348
line search, 338
Newton-Raphson, 338-9, 341-3, 348
numerical derivatives, 340
simulated annealing, 347
starting values, 340, 351
step size adjustment, 338
IV estimator. See instrumental variables
jackknife, 374-6
bias estimate, 375
bias-corrected estimator, 375
example, 376
IV estimator, 192
standard error estimate, 375, 855
Jensen's inequality, 956
jittered data, 290
joint duration distributions, 648-55
copulas, 651-5
mixtures, 650-1
multivariate hazard function, 649
multivariate survivor function, 649-50
joint limits, 767
joint versus separate tests, 230-1, 285, 629-30
just identification, 31, 100, 173
Kaplan-Meier (KM) estimator, 581-3
application, 575, 583, 604-5
for baseline hazard, 596-7
confidence bands for, 583
definition, 581
tied data, 582
kernel density estimator, 298-306
alternatives to, 306
application, 296-7, 300
asymptotic distribution, 301-2, 330-1
bandwidth choice, 302-4
bias, 301, 330-1
confidence interval for, 305
consistency, 300
convergence rate, 302
definition, 299
derivative estimator, 305
examples, 252-3, 367-8
multivariate, 305-6
Nadaraya-Watson kernel regression estimator, 312
optimal bandwidth, 303
optimal kernel, 303
variance, 301, 331
kernel functions, 299-300
comparison, 300
definition, 299
higher-order, 299, 306, 313
leading examples, 300
optimal for density estimation, 303
properties, 299
kernel matching, 875, 895-6
kernel regression estimator, 311-9
alternatives to, 319-22
asymptotic distribution, 313, 331-3
bandwidth choice, 314-6
bias, 313, 331-2
bootstrap confidence interval for, 380-1
boundary problems, 309, 320-1
conditional moment estimator, 317-8
confidence interval for, 316
consistency, 313
convergence rate, 314
definition, 312
derivative estimator, 317
introduction to nonparametric regression, 307-11
multivariate, 318-9
optimal bandwidth, 314
optimal kernel, 314
undersmoothing, 380
variance, 301,331
see also nonparametric regression
Khinchine's theorem, 948
KLIC. See Kullback-Liebler information criterion
KM estimator. See Kaplan-Meier
k-NN estimator. See nearest neighbors estimator
Kolmogorov LLN, 80, 111, 947
Kolmogorov test, 267
Kullback-Liebler information criterion (KLIC), 147, 169, 278, 280

LAD estimator. See least absolute deviations
Lagrange multiplier (LM) test
asymptotic distribution, 235, 237-8
based on GMM-estimator, 245
based on m-estimator, 244
bootstrap, 379

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

comparison with LR and Wald tests, 238-9
computation, 239-41, 256, 274
definition, 234-5
examples, 236, 241-3
for heteroskedasticity, 241, 267, 275
in duration models, 632
interpretation, 239-40
for omitted variables, 274
OPG version, 240-1
for random effects, 737, 841
score test, 234-5
in Tobit model, 544
for unobserved heterogeneity, 630, 636
see also hypothesis tests
Laplace approximation, 390
Laplace distribution, 178, 541
Laplace transform, 577
LATE estimator. See local average treatment effects
latent class model, 622
see finite mixture models
latent variable, 475, 532
latent variable models
additive random utility model, 476-8, 504-7
binary outcomes, 475-8
endogenous, 560-1
ordered multinomial model, 519-20
see also censored models; truncated models
law of iterated expectations, 955
law of large numbers (LLN), 947-8
definition, 947
examples of use, 80,129
Khinchine's theorem, 948
Kolmogorov LLN, 947
Markov LLN, 948
sampling schemes, 131, 948
strong law, 947
weak law, 947
least absolute deviations (LAD) estimator
application, 88-90
asymptotic distribution, 88
binary outcome models, 484
bootstrap, 381
censored LAD, 564-5, 808
definition, 87
two-stage LAD, 190
see also quantile regression
least-squares dummy variable (LSDV) estimator, 704, 732-3, 840
least-squares dummy variable (LSDV) model, 704, 732, 840
least squares (LS) estimators
clustered data, 833-7
feasible generalized LS, 81-3, 155-8
generalized LS, 81-5, 155-8
linear, 70-85
nonlinear LS, 150-9
ordinary LS, 70-81
panel data, 211, 702-3, 720-5
systems of equations, 207-8, 211, 217
see also FGLS; FGNLS; OLS; NLS
leave-one-out estimate, 192, 304, 315, 375
LEF. See linear exponential family
length-biased sampling, 43-4, 626
Liapounov CLT, 80, 131, 950
likelihood-based hypothesis tests, 233-43
comparisons of, 235-6, 238-9
definitions, 234-5
examples, 236-7, 241-3
see also LM tests; LR tests; Wald tests
likelihood function, 139-41
conditional likelihood function, 139, 731-2, 824
definition, 139
joint, 19, 824-7
leading examples, 140-1
marginal, 432, 595
partial, 594-6
likelihood principle, 139, 420, 433
likelihood ratio (LR) test
asymptotic distribution, 235, 237
based on GMM-estimator, 245
based on m-estimator, 244
comparison with LM and Wald tests, 238-9
definition, 234
examples, 236, 241-3
nonnested models, 279-83
quasi-LR test statistic, 244
uniformly most powerful test, 237
see also hypothesis tests
LIML estimator. See limited information maximum likelihood
limit distribution, 948
see also asymptotic distribution
limit variance matrix, 952-3
definition, 952
replacement by consistent estimate, 952
sandwich form, 953
limited information maximum likelihood (LIML) estimator, 191, 214
Lindeberg-Levy CLT, 80, 131, 950
line search, 338
linear exponential family (LEF) models, 147-9
conjugate priors, 427-8
conditional ML estimator, 782
consistency, 148
leading examples, 148
pseudo- $\mathrm{R}^{2}, 288$
residuals, 289-90
tests based on, 240, 268, 274-5
see also generalized linear models
linear panel estimators, 695-778
application, 708-15, 725
Arellano-Bond estimator, 764-5
between estimator, 703
covariance estimator, 733
conditional ML estimator, 731-2
differences-in-differences estimator, 768-70

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

linear panel estimators (cont.)
error components 2SLS estimator, 760
error components 3SLS estimator, 762
first differences estimator, 704-5, 729-31
first differences IV estimator, 758
fixed effects estimator, 704, 726-9
fixed effects IV estimators, 757-9
forward orthogonal deviations IV estimator, 759
Hausman-Taylor IV estimator, 761
LSDV estimator, 704, 732-3
MD estimator, 753, 76-7
panel bootstrap, 708, 377-8, 708, 746, 751
panel GMM estimators, 744-68
panel-robust inference, 705-8, 722, 745-6, 751
pooled OLS estimator, 702-3, 720-5
random effects estimator, 705, 734-6
random effects IV estimator, 759-60
within estimator, 704, 726-9
within IV estimator, 758
linear panel models, 695-778
analysis-of-covariance model, 733
application, 708-15, 725
between model, 702
dynamic models, 763-8
endogenous regressors, 744-63
first differences model, 704, 730, 758
fixed effects model, 700-2, 726-34, 757-9
fixed versus random effects, 701-2, 715-9
forward orthogonal deviations model, 759
Hausman-Taylor model, 760-2
incidental parameters problem, 704, 726
individual dummies, 699
individual-specific effects model, 700
LSDV model, 704, 732
minimum distance estimator, 753, 766-7
mean-differenced model, 758
measurement error, 739, 905
mixed linear models, 774-6
pooled model, 699, 720-5
random effects differenced model, 760-1
random effects model, 700-2, 734-6, 759-60
residual analysis, 714-5
strong exogeneity, 700, 749-50, 752
time dummies, 699
time-invariant regressors, 702, 749-51
time-varying regressors, 702, 749-51
two-way effects model, 738
unbalanced data, 739
weak exogeneity, $749,752,758$
within model, 704, 758
see also linear panel estimators
linear probability model, 466-7
linear programming methods, 341
linear regression model
definition, 16-17, 70-1
linear systems of equations, 207-14
panel data models as, 211
seemingly unrelated regressions, 209-10
simultaneous equations, 22-31, 213-4
systems FGLS estimator, 208
systems GLS estimator, 208
systems GMM estimator, 208
systems ML estimator, 214
systems OLS estimator, 211
systems 2SLS estimator, 212
linearization method, 855
link function, 149, 469, 783
listwise deletion, 60, 928
consistency under MCAR, 928
example, 936-8
inconsistency under MAR only, 928
Living Standards Measurement Study (LSMS), 59, 88-90, 848-53
LLN. See law of large numbers
LM test. See Lagrange multiplier test
local alternative hypotheses, 238, 247-8, 254
local average treatment effects (LATE) estimator, 883-9
assumptions, 884-5
comparison with IV estimator, 885
definition, 884
heterogeneous treatment effect, 885
monotonicity assumption, 885
selection on unobservables, 883
Wald estimator, 886
see also ATE; ATET; MTE
local linear regression estimator, 320-1, 333
local polynomial regression estimator, 320-1
local running average estimator, 308,320
local weighted average estimator, 307-8
logistic distribution, 476-7
logistic regression. See logit model
logit model, 469-70
application, 464-5
as ARUM, 477, 486-7
clustered data, 844
definition, 469
for discrete-time duration data, 602
GLM, 149
imputation example, 937-9
index function model, 476
marginal effects, 470
measurement error example, 919
ML estimator, 468-9
multinomial logit, 494-5, 500-3, 525
nested logit, 509-12, 526-7
ordered logit, 520
panel data, 795-9
probit model comparison, 471-3
random parameters logit, 512-6
see also binary outcome models
log-likelihood function. See likelihood function
length-biased sampling, 43-4
log-logistic distribution, 585-6, 592
log-normal distribution, 585-6, 592
log-normal model, 533, 545-6

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

log-odds ratio, 470, 472
log-sum, 510
log-Weibull distribution. See type 1 extreme value
long panel, 723-5, 767
longitudinal data. See panel data
loss function, 66-69
absolute error, 67
asymmetric expected error, 67
Bayesian decision analysis, 434-5
expected, 66
KLIC, 68, 147, 168, 278-9
squared error, 67-9, 156
step, 67-8
Lowess regression estimator, 320-1
application, 297, 309-10, 712-5
LR test. See likelihood ratio test
LS estimators. See least squares
LSDV. See least-squares dummy variable
LSMS. See Living Standards Measurement Study
MAR. See missing at random
marginal analysis of panel data, 717, 787
marginal effects, 122-4
in binary outcome models, 466-5, 467, 470-1
calculus method, 123
computing, 122-4
definition, 122
example, 162-3
finite-difference method, 123
in fixed effects model, 702, 788
in multinomial models, 493-4, 501-3, 519-23, 525
population-weighted, 821
in sample selection models, 552
in single-index models, 123
in Tobit model, 541-2
see also coefficient interpretation
marginal likelihood, 432, 595
marginal treatment effects (MTE) estimator, 886
market-level data, 482, 513
Markov chain Monte Carlo (MCMC) methods, 445-54
convergence, 449,458
in data augmentation, 933
examples, 452-4, 512, 687, 936-9
Gibbs sampler, 448-50, 514, 519, 563
Metropolis algorithm, 450-1
Metropolis-Hastings algorithm, 451-2, 512
Markov LLN, 77, 131, 948
Marshall-Olkin method, 649-51, 686
matching assumption, 864
see also overlap assumption
matching estimators, 871-8, 889-96
application, 889-96
assumptions, 863-5
ATE matching estimator, 877
ATET matching estimator, 874, 877, 894-6
balancing condition, 893
caliper matching, 874
counterfactuals, 871
exact matching, 872,891
inexact matching, 873
interval matching, 875-6
kernel matching, 875, 895-6
nearest-neighbor matching, 875, 894-6
propensity score matching, 873-8, 892
radius matching, 876, 895-6
selection on observables only, 871
stratification matching, 875-6, 893-6
variance computation, 877-8, 895
maximum empirical likelihood (MEL) estimator, 206
maximum likelihood (ML) estimator, 139-46
asymptotic distribution, 142-3
conditional ML estimator, 731-2, 782-3, 796-9
consistency, 142, 824
definition, 141
endogenous stratification, 824-7
example, 143-4
exogenous stratification, 824
MSL estimator, 393-8
quasi-ML estimator, 146-50
regularity conditions, 141, 145-6
restricted, 233
unrestricted, 233
variance matrix estimation, 144
weighted ML estimator, 828
see also quasi-ML estimator
maximum rank correlation estimator, 485
maximum score estimator, 341, 381, 483-4, 800
maximum simulated likelihood (MSL) estimator, 393-8
asymptotic distribution, 394-5
bias-adjusted MSL, 396-7
compared to MSM, 402-3
count model examples, 677-8, 687, 689
definition, 394
example, 397-8
multinomial probit model, 518
number of simulations, 396
random parameters logit model, 522
MCAR. See missing completely at random
MD estimator. See minimum distance estimator
mean-differenced estimator, 783, 805-6
mean-differenced model, 758, 783
mean imputation, $928,936-8$
mean integrated squared error (MISE), 303, 314
mean-scaling estimator, 783, 805-6
mean-square convergence, 946
mean substitution. See mean imputation
measurement error
in cohort-level data, 772-3
in dependent variable, 913-4
in microdata, 46, 60
in panel data, 739, 905
in regressors, 899-922
see also measurement error model estimators; measurement error models

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

measurement error model estimators, 899-922
attenuation bias, 903-5, 911, 915, 919-20
bounds identification, 906-8
corrected score estimator, 916-8
IV estimator, 908-10, 912-3
linear models, 900-11
nonlinear models, 911-20
OLS estimator inconsistency, 902-4
using additional moment restrictions, 909-10
using instruments, 908-9
using known measurement error variance, 902-3, 910
using replicated data, 910-1, 913
using validation sample, 911
measurement error models, 899-922
attenuation bias, 903-5, 911, 915, 919-20
classical measurement error model, 901-2
dependent variable measured with error, 913-4
examples, 919-20
identification, 905-14
linear models, 900-11
multiple regressors, 904
nonclassical measurement error, 904, 920
nonlinear models, 911-20
panel models, 905
scalar regressor, 903
serial correlation, 909
variance inflation, 904, 916
see also measurement error model estimators
median regression. See LAD estimator
MEL. See maximum empirical likelihood
m-estimator, 118-22
asymptotic distribution, 120
clustered data, 842-3
definition, 118-9
sequential two-step, 200-2
simulated m-estimator, 398-9
tests based on, 244, 263-4
weighted m-estimator, 829,856
see also extremum estimators
method of moments (MM) estimator
asymptotic distribution, 134, 174
definition, 172
examples, 167
see also estimating equations estimator; GMM estimator
method of scoring, 343,348
method of simulated moments (MSM) estimator, 399-404
asymptotic distribution, 400-2
compared to MSL, 402-3
definition, 400
example, 403
MNP model, 497, 518
number of simulations, 399
method of simulated scores (MSS) estimator
for MNP model, 519
method of steepest ascent, 344

Metropolis algorithm, 450-1
Metropolis-Hastings algorithm, 451-2, 512
microdata sets, 58-61
handling, 59-61
leading examples, 58-9
microeconometrics overview, 1-17
midpoint rule, 388, 391-2
minimum chi-square estimator, 203
see also Berkson's minimum chi-square estimator
minimum distance (MD) estimator, 202-3, 753, 766-7
asymptotic distribution, 202
bootstrap for, 379-80
covariance structures, 766-7
definition, 202
equally-weighted, 202
generalized, 222
indirect inference, 404-5
OIR test, 203
optimal, 202, 753
panel data, 753, 766-7
relation to GMM, 203, 753
misclassification, 914
MISE. See mean integrated squared error
missing at random (MAR), 926-7
definition, 926
and ignorable missingness, 927,932
relation to MCAR, 927
missing completely at random (MCAR), 926-7
definition, 927
and ignorable missingness, 927
relation to MCAR, 927
missing data, 923-41
deletion methods, 928
examples, 924
ignorable assumption, 927
imputation with models, 929-41
imputation without models, 928-9
MAR assumption, 926-7
MCAR assumption, 927
nonignorable missingness, 927, 940
see also imputation methods
misspecification tests. See specification tests
mixed estimator, 439-41
mixed linear model, 774-6
Bayesian methods, 775
FGLS estimator, 775
fixed parameters, 774
ML estimator, 776
random parameters, 774
restricted ML estimator, 776
nonstationary panel data, 767-8
prediction, 776
see also hierarchical linear model
mixed logit model, 500-3
example, 495
definition, 500
see also RPL model

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

mixed proportional hazards (MPH) model, 611-25
Weibull-gamma mixture, 615
see also mixture models
mixture hazard function, 616-8
mixture models, 611-25
application, 623-6
counts, 675-9
durations, 611-25
identification, 618-20
MSL estimator, 393-8, 687
multinomial outcomes, 515-6
multiplicative heterogeneity, 613
specification tests, 628-32
see also finite mixture models; unobserved heterogeneity
ML estimator. See maximum likelihood
MM estimator. See method of moments
MNL estimator. See multinomial logit
MNP estimator. See multinomial probit
model diagnostics, 287-91
binary outcome models, 473-4
duration models, 628-32
example, 290-1
multinomial outcome models, 499
pseudo- $\mathrm{R}^{2}$ measures, 287-9, 291
residual analysis, 289-91
see also model selection methods
model misspecification, 90-4
see also endogeneity; functional form misspecification; heterogeneity; omitted values; pseudo-true value
model selection methods
Bayesian, 456-8
nested models, 278-81
nonnested models, 278-84
order of testing, 285
see also model diagnostics; specification tests
moment-based simulation estimators,

## 398-404

see MSL estimator; MSM estimator
moment-based tests. See m-tests
moment matching. See indirect inference
Monte Carlo integration, 391-2
direct, 391
example, 392
importance sampling, 407, 443-5
simulators, 393-4, 406-10
see also quadrature
Monte Carlo studies, 250-4
example, 251-4
moving average estimator, 308
moving blocks bootstrap, 373,381
MPH model. See mixed proportional hazards
MSL estimator. See maximum simulated likelihood
MSM estimator. See method of simulated moments MSS estimator. See method of simulated scores
MTE. See marginal treatment effects
m-tests, 260-71
asymptotic distribution, 260, 263
auxiliary regressions, 261-3
bootstrap, 261, 379
chi-square goodness of fit, 266-7, 270-1, 474
conditional moment test, 264-5, 267-9, 319
CM test interpretation, 268
computation, 261-3
definition, 260
Hausman test, 271-4, 717-9
information matrix tests, 265-6, 270
outer-product-of-the-gradient form, 262
overidentifying restrictions test, 181, 183, 267, 747
power, 268
rank, 261
multicollinearity, 350-1
in multinomial probit model, 517
in panel model, 752
in sample selection model, 542, 551
multilevel models. See hierarchical models
multinomial logit (MNL) model, 500-3, 525
application, 494-5
as additive random utility model, 505
definition, 500
marginal effects, 494, 501-3, 525
ML estimator, 501
panel data, 798
see also multinomial outcome models
multinomial outcome models, 490-528
application, 491-5
alternative-invariant regressors, 498
alternative-varying regressors, 497
conditional logit, 500-3, 524-5
definition, 496-7
identification, 504
index function model, 519-20
marginal effects, 501-3, 524-5
mixed logit, 500-3
ML estimator, 496, 501
multinomial logit, 500-3, 525
multinomial probit, 516-9
ordered models, 519-20
OLS estimator, 471
panel data, 798
random parameters logit, 512-6
random utility model, 504-7
semiparametric estimation, 523-4
multinomial probit (MNP) model, 516-9
Bayesian Methods, 519
definition, 516-7
identification, 517
ML estimator, 518
MSL estimator, 518
MSM estimator, 518
MSS estimator, 518
see also multinomial outcome models

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

multiple duration spells, 655-8
fixed effects, 656
lagged duration dependence, 657
ML estimator, 658
random effects, 657
recurrent spells, 655
multiple imputation, 934-9
estimator, 934
examples, 935-9
relative efficiency, 935
variance of estimator, 934-5
multiple treatments, 860
multiplicative errors
multistage surveys, 41-2, 814-6, 853-6
variance estimation, 853
multivariate data
binary outcomes, 521-3
counts, 685-7
durations, 640-64
see also systems of equations
multivariate- $t$ distribution, 442

NA estimator. See Nelson-Aalen
National Longitudinal Survey (NLS), 58, 110-2
National Longitudinal Survey of Youth (NLSY), 58-9
National Supported Work (NSW) demonstration project, 889-95
natural conjugate pair, 427-8
natural experiments, $32,54-8$
definition, 54
differences-in-differences estimator, 55-7, 768-70, 878-9
examples, 54
exogenous variation, 54-5
identification, 57-8
instrumental variables, 54-5
regression discontinuity design, 879-83
ncp. See noncentrality parameter
nearest neighbors (k-NN) estimator, 319-20
definition, 319
example, 308-9
symmetrized, 308, 320
see also nonparametric regression
nearest-neighbor matching, 875, 894-6
negative binomial distribution, 675
negative binomial model, 675-7
application, 690
bivariate, $215,686-7$
hurdle model, 681
ML estimator, 677
MSL estimator, 677-8
NB1 variant, 676
NB2 variant, 676
panel data, 804,806
negative hypergeometric distribution, 806
neglected heterogeneity. See unobserved
heterogeneity

Nelson-Aalen (NA) estimator, 582-4
application, 605-6, 662
confidence bands for, 584
definition, 582
tied data, 582
nested bootstrap, 374, 379
nested logit model, 507-12, 526-7
from ARUM, 526-7
definition 510-1
different versions of, 511-2
example, 511
GEV model, 508, 526
ML estimator, 510
sequential estimator, 510
welfare analysis, 510
see also multinomial models
nested models 278, 281
see also nonnested models
neural network models, 322
Newey-West robust standard errors, 137, 175, 723
definition, 175
see also robust standard errors
Newton-Raphson (NR) method, 341-3
examples, 338-9, 348
NLFIML estimator. See nonlinear full-information maximum likelihood
NLS estimator. See nonlinear least squares
NLSY. See National Longitudinal Survey of Youth
NL2SLS estimator. See nonlinear two-stage least squares
NL3SLS estimator. See nonlinear three-stage least squares
noise-to-signal ratio, 903
noncentral chi-square distribution, 248
noncentrality parameter (ncp), 248
nonclassical measurement error, 904, 920
nongradient methods, $337,341,347-8$
nonignorable missingness, 927,940
attrition bias due to, 940
selection bias due to, $927,932,940$
nonlinear estimators
coefficient interpretation, 122-4
extremum estimator
m-estimator, 118-22
GMM estimator, 166-222
ML estimator, 139-46
NLS estimator, 150-9
overview, 117-22
panel models, 779-810
nonlinear full-information maximum likelihood
(NLFIML) estimator, 219
nonlinear GMM estimator, 192-9
asymptotic distribution, 194-5
definition, 194-5
example, 197-8, 199, 688
instrument choice, 196
NL2SLS estimator, 196

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

optimal, 195
panel data, 789-90
nonlinear in parameters, 27
nonlinear in variables, 27
nonlinear IV estimator. See nonlinear GMM
nonlinear least squares (NLS) estimator, 150-9
asymptotic distribution, 152-4
consistency, 152-3
definition, 151
example, 155, 159-64
time series, 158-9
variance matrix estimation, 154-5
nonlinear panel estimators, 779-810
application, 792-5
conditional ML estimator, 781-2, 805
dummy variable estimator, 784-5, 800, 805
first-differences estimator, 783-4
fixed effects estimator, 783-5, 794, 796-802, 805-8
GEE estimator, 790, 794, 804
mean-differenced estimator, 783, 805-6
mean-scaling estimator, $783,805-6$
ML estimator, 785-6
NLS estimator, 787, 794
panel GMM estimator, 789-90
panel-robust inference, 788-91
quadrature, 785-6, 796, 800
quasi-differenced estimator, 783-4
quasi-ML estimator, 791
random effects estimator, 785-6, 794-6, 800-1, 803-4
selection models, 801
semiparametric, 808
nonlinear panel models, 779-810
application, 792-5
binary outcome models, 795-6
conditional mean models, 780-1
count models, 792-5, 802-6
dynamic models, 791-2, 797-9, 806-7
endogenous regressors, 792
exogeneity assumptions, 781
finite mixture models, 786
fixed effects models, 781-5, 791-2
fixed versus random effects, 788
incidental parameters problem, 781-2, 805
individual-specific effects models, 780-1
parametric models, 780, 782-3, 785-7, 792
pooled models, 787, 794
random effects models, 785-6, 792
selection models, 801
semiparametric, 808
Tobit models, 800-1
transition models, 801-2
nonlinear regression model, 151
additive error, 168, 193, 217
nonadditive error, 168, 193, 218
nonlinear systems of equations, 214-9
additive errors, 217
copulas, 651-5
mixtures, 650-1
ML estimator, 215-6
NLFIML estimator, 219
NL3SLS estimator, 219
nonadditive errors, 217-8
nonlinear panel model, 216
nonlinear SUR model, 216
quasi-ML estimator, 150
seemingly unrelated regressions, 216
simultaneous equations, 219
systems FGNLS estimator, 217
systems GMM estimator, 219
systems IV estimator, 218-9
systems MM estimator, 218
systems NLS estimator, 217
nonlinear three-stage least squares (NL3SLS)
estimator, 219
nonlinear two-stage least squares (NL2SLS) estimator
asymptotic distribution, 195-6
definition, 195-6
example, 199
see also nonlinear GMM estimator
nonnested models
Cox LR test, 279-80
definition, 278
example, 283-4
information criteria comparison, 278-9
overlapping, 281
strictly nonnested, 281
Vuong LR test, 280-3
nonparametric bootstrap. See paired bootstrap
nonparametric density estimation. See kernel density estimator
nonparametric maximum likelihood (NPML) estimator, 622
nonparametric regression, 307-22
convergence rate, 311,314
kernel, 311-9
local linear, 320
local weighted average, 307-8
Lowess, 320
nearest-neighbors, 308-9, 319-20
series, 321
statistical inference intuition, 309-11
test against parametric model, 319
see also semiparametric regression
nonrandomly varying coefficient, 846
normal copula, 654
normal distribution, 140
truncated moments, 540, 566-7
normal limit product rule. See Cramer linear transformation
NPML estimator. See nonparametric maximum likelihood
NR method. See Newton-Raphson method
NSW demonstration project. See National Supported Work
nuisance parameters. See incidental parameters

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

numerical derivatives, 340, 350
numerical integration. See quadrature
observational data, 40-8, 814-7
biased samples, 42-5
clustering, 42
identification strategies, 36-7
measurement error, 46
missing data, 46
population, 40
sample attrition, 47
sampling methods, 40-4, 815-7
sampling units, 41,815
sampling without replacement, 816-7
survey methods, 41-2, 814-7
survey nonresponse, 45-6
types of data, 47-8
observational equivalence, 29
odds ratio, 470
see also posterior odds ratio
OIR test. See overidentifying restrictions test
OLS estimator. See ordinary least squares
omitted variables bias, 92-3, 700, 716
LM tests for, 274
one-step GMM estimator, 187, 196
panel, 746, 755
see also two-stage least squares
one-way individual-specific effects model. See individual-specific effects model
on-site sampling, 43, 823
optimal Bayesian estimator, 434
optimal GMM estimator, 176, 179-81, 187, 195
compared to 2SLS, 187-8
optimal MD estimator, 202, 753
OPG. See outer-product of the gradient
Orbit model, 914
order of magnitude, 954
ordered logit model, 520, 682
ordered multinomial models, 519-20
ordered probit model, 520, 535
ordinary least squares (OLS) estimator, 70-81
asymptotic distribution, 73-4, 80-1
bias in standard errors with clustering, 836-7
binary data, 471
clustered data, 833-7
coefficient interpretation in misspecified model, 91-2
consistency 72, 80
definition, 71
example, 84-5
finite-sample distribution, 79
heteroskedasticity-robust standard errors, 74-5, 81
identification, 71-2
inconsistency, 91, 95-6
inefficiency, 80
nonlinear, 150-9
panel data, 702-3, 720-5
see also least squares estimators
orthogonal polynomials, 321, 329, 390
definition 390
orthogonal regression approach, 920
orthonormal polynomials, 321, 329, 390
outcome equation, 547, 867
outer product (OP) estimate, 138, 241, 395
outer-product of the gradient (OPG) version
LM test, 240-1
m-test, 262-4
small-sample performance, 262
overdispersion, 670-1, 674-6, 690
measurement error, 915-6
panel data, 794, 806
tests for, 671
overidentification, 31, 100, 173, 176, 379-80, 747
see also GMM estimator
overidentifying restrictions (OIR) test
asymptotic distribution, 181, 183
bootstrap, 379-80
definition, 181, 267, 277
panel data, 747, 756
overlap assumption, 864,871
in RD design, 881
oversampling, 41, 478-9, 814, 872
paired bootstrap, 360, 366-8, 376, 378
pairwise deletion, 928
biased standard errors, 928
panel attrition, 739, 801
panel bootstrap, 377, 707, 746, 751, 789
panel data, 47
panel data models and estimators, 695-810
comparison to clustered data, 831-2
see also linear panel; nonlinear panel
panel GMM estimators, 744-68, 789-90
application, 754-6
Arellano-Bond estimator, 765-6
asymptotic distribution, 745-6
bootstrap, 389-90
compared to MD estimator, 753
computation, 751-2
definition, 745
efficiency, 747, 756
exogeneity assumptions, 748-52
instruments, 744, 747-51
IV estimators for FE model, 757-9
IV estimators for RE model, 759-60
just-identified, 745
nonlinear, 789-90
OIR test, 747, 756
one-step GMM estimator, 746, 755
overidentified, 745
2SLS estimator, 746, 755
two-step GMM estimator, 746, 755
variance matrix estimation, 751
panel GMM model, 744-66
application, 754-6
dynamic, 763-6

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

with individual-specific effects, 750-62
without individual-specific effects, 744-53
see also panel GMM estimators
panel IV estimators. See panel GMM estimators
panel-robust statistical inference, 377, 705-7, 722,
746, 751, 788-90
for Hausman test, 718
Panel Study in Income Dynamics (PSID), 58, 889
parametric bootstrap, 360
Pareto distribution
of the first kind, 609
of the second kind, 616
partial additive model, 323
partial equilibrium analysis, 53, 862, 972
see also SUTVA
partial F-statistic, 105, 109, 111
partial likelihood estimator, 594-6
partial ML estimator, 140
partial R-squared, 104-5, 111
partially linear model, 323-5, 327, 565, 684
participation equation, 547,551
Pearson chi-square goodness-of-fit test, 266
Pearson residual, 289, 291
peer-effects model, 832
percentile, 86
percentile method, 364-5, 367-8
percentile- $t$ method, 364, 366-7
PH model. See proportional hazards
piecewise constant hazard model, 591
Pitman drift, 248
PML estimator. See pseudo-ML estimator
Poisson distribution, 668
Poisson-gamma mixture, 675
Poisson-IG mixture, 677
Poisson regression model, 666-74
application, 671-4, 690, 792-5, 850-3
asymptotic distribution of estimators, 668-9
bivariate, 686
censored MLE, 535
with clustered data, 844, 850-3
coefficient interpretation, 669
definition, 668
equidispersion, 668
example, 117-8, 121-2
LEF density, 148
measurement error, 915-8
mixtures, 675-9
ML estimator, 668
overdispersion, 670-1
panel data, 792-5, 802-6
quasi-ML estimator, 668-9, 682-3
truncated MLE, 535
underdispersion, 671
zero-truncated, 680
see also count models
polynomial baseline hazard, 591, 636
pooled cross-section time series model. See pooled model
pooled estimators, 702-3, 720-5
application, 710-2, 725
FGLS estimator, 720-1
GEE estimator, 790, 794
NLS estimator, 794
OLS estimator, 211, 702-3, 720-5
WLS estimator, 702-3, 721
pooled model, 699, 720-5, 787-8
pooling tests, 737
population-averaged model. See pooled model
population moment conditions
for estimation, 172
for testing, 260
see also GMM estimator; MM estimator; m-tests
posterior distribution, 421, 430-4
asymptotic behavior, 432-4
conditional posterior, 431
definition, 421
expected posterior loss, 434
expected posterior risk, 434
full conditional distribution, 431
highest posterior density interval, 431
highest posterior density region, 431
marginal posterior, 430
observed-data posterior, 930
posterior density interval, 431
posterior mean, 423, 434
posterior mode, 433
posterior moments, 430
posterior precision, 423
see also Bayesian methods
posterior odds ratio, 456
posterior ( P ) step, 455, 933
potential outcome model, 30-4, 861-5
see also treatment effects; treatment evaluation
power of tests, 247-50, 253-4
bootstrapped tests, 372-3
conditional moment test, 267-9
example, 253-4
Hausman test, 273-4
local alternative hypotheses, 247-8
uniformly most powerful test, 237
Wald tests, 248-50
precision parameter, 423
predetermined instruments. See weak exogeneity
prediction, 66-70
best linear, 70
conditional, 66
error, 66-70
in linear panel models, 738
in mixed linear model, 774-6
optimal, 66-70
rotation groups, 814
in structural model, 28
weighted, 821
pretest estimator, 285
primary sampling units (PSUs), 41, 815, 845-55

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

prior distribution, 425-30
conjugate prior, 427
definition, 420
Dickey's prior, 439
diffuse prior, 426
flat prior, 426
hierarchical priors, 428-9, 441-2
improper prior, 426
informative prior, 437-9
Jeffreys' prior, 426
noninformative prior, 425, 435-7
normal-gamma prior, 437
sensitivity analysis for, 429-30
see also Bayesian methods
probit model, 470-71
application, 465-6
as additive random utility model, 477
bivariate probit, 522-3
bootstrap example, 254-6
definition, 470
discrete-time duration data, 602
as GLM, 149
index function model, 476
logit model comparison, 471-3
marginal effects, 467, 471
ML estimator, 470
Monte Carlo study example, 251-4
multinomial probit, 516-9
ordered probit, 520, 535
panel data, 795-6
simultaneous equations probit, 523, 560-1
see also binary outcome models
probit selection equation, 548
product copula, 654
product integral, 578
product rule, 949
see also Cramer linear transformation
program evaluation. See treatment evaluation
projection pursuit model, 323
propensity score, 864-5
application, 893-4
balancing condition, 864, 893-4
conditional independence assumption, 865
definition, 864
matching, 873-8, 892
see also treatment evaluation
proportional hazards ( PH ) model, 592-7
application, 605-7
baseline survivor function estimator, 596-7
coefficient interpretation, 606-7
competing risks model, 645-6
definition, 591
discrete-time model, 600-3
leading examples, 585
mixed PH, 611-25
panel data, 802
partial likelihood estimator, 594-6
pseudo-ML estimator (PML). See quasi-ML estimator
pseudo panels, 771-3
cohort, 771
cohort fixed effects, 772-3
measurement error, 772-3
pseudo-random number generators, 410-6, 957-9
accept-reject methods, 413-4
composition methods, 415
inverse transformation method, 413
leading distributions, 957-9
multivariate normal, 416
transformation method, 413
uniform variates, 412
see also MCMC methods
pseudo R-squared measures
for binary outcome models, 473-4
definitions, 287-9
example, 290-1
for multinomial outcome models, 499
pseudo-true value, $94,132,146,281$
PSID. See Panel Study in Income Dynamics
PSUs. See primary sampling units
pure exogenous sampling, 825
p-value, 226, 229, 234, 286, 363
quadrature, 388-90
Gaussian, 389-90
multidimensional, 393
in nonlinear panel models, 785-6, 796, 800
see also Monte Carlo integration
qualititative response models. See binary outcomes,
multinomial outcomes
quantile, 86-7
quantile regression, 85-90
application, 88-90
asymmetric absolute loss, 68,85
asymptotic distribution, 88
bootstrap, 381
computation, 341
definition, 87
IV estimator, 190
multiplicative heteroskedasticity, 86-7
quasi-difference, 783-4
quasi-experiment. See natural experiment
quasi-maximum likelihood (QML) estimator, 146-50
asymptotic distribution, 146
in binary outcome models, 469
in clustered models, 842-3
definition, 146
in LEF, 147-9
with multivariate dependent variable, 150
in nonlinear systems, 216
in panel models, 768, 786
in Poisson model, 668-9, 682-3
quasi-random numbers. See pseudo-random numbers
QML estimator. See quasi-ML estimator
random assignment, 49-50, 862
see also sampling schemes

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

random coefficients model, $94,385,774-6,786$
see also hierarchical models
random effects (RE) estimator, 705, 734-6, 759-62, 785-6
application, 710-1, 725
asymptotic distribution, 735
clustered data, 837-9, 843-4
consistency, 699, 764
definition, 705, 734
error components 2SLS estimator, 760
error components 3SLS estimator, 762
FGLS estimator, 734-6
GEE estimator, 790, 794, 804
Hausman test, 717-9
incidental parameters, 704, 726
IV estimators, 759-60
ML estimator, 736, 785-6, 794-7, 800-1, 803-4
NLS estimator, 787, 794
quasi-ML estimator, 791
two-way effects model, 738
versus fixed effects, 701-2, 715-9
random effects (RE) model, 700-2, 734-6, 759-62, 785-6
binary outcome models, 795-6
Chamberlain model, 719, 786
clustered data, 831, 843-4
count models, 794, 803-4
definition, 700, 734
dynamic models, 792
duration models, 801-2
endogenous regressors, 756-7, 759-62
Mundlak model, 719
nonlinear models, 785-6
selection models, 801
Tobit model, 800-1
two-way effects model, 738
versus random effects, 701-2, 715-9
see also hierarchical models; random effects estimator
random number generators. See pseudo-random numbers
random parameters logit (RPL) model, 512-6
Bayesian methods, 514
definition, 513
ML estimator, 513-4
random parameters model. See random coefficients model
random utility models. See ARUM
randomization bias, 53, 867
randomized experiment, 50-3
National Supported Work demonstration project, 889
randomized trials, 49-53
randomly varying coefficient, 847-8
rank condition for identification, 31, 182, 214
rank-ordered logit model, 521
rank-ordered probit model, 521
raw residual, 289, 291

RD design. See regression discontinuity design
receiver operators characteristics (ROC) curve, 474
reduced form, 21, 25, 213
see also structural model
RE estimator. See random effects
regression-based imputation, 930-2
EM algorithm, 932
nonignorable missingness, 932
regression discontinuity (RD) design, 879-83
fuzzy RD design, 882
heterogeneous treatment effects, 882
RD estimator, 882-3
sharp RD design, 880-1
treatment assignment mechanism, 879-81
regressors, 71
alternative-varying, 478, 497-8
endogenous, 23-33
fixed, 76-7
irrelevant, 93
omitted, 92-3
stochastic, 77
time-varying, 597-600, 702, 749-51
see also endogenous regressors
regularity conditions for ML, 141-2, 151-6
relative risk, 470, 503
reliability ratio, 903
renewal function, 626
renewal process, 626, 638
repeated cross section data, 47, 770-3
see also differences-in-differences
repeated measures. See panel data
replicated data, $910-1,913$
RESET test, 277-8
residual analysis
definitions, 289-90
duration data, 633-6
example, 290-1
panel data, 714-5
small-sample correction, 289
residual bootstrap, 361
response-based sampling, 43
restricted ML estimator, 233, 776
revealed preference data, 498,516
ridge regression estimator, 440
Robinson difference estimator, 324-5, 565
robust sandwich variance matrix estimate. See sandwich variance matrix
robust standard errors
bootstrap, 362-3, 376-8
Eicker-White, 74-5, 80-1, 112, 137
for extremum estimator, 137-9
Huber-White, 137, 144, 146
Newey-West, 137, 175, 723
see also cluster-robust; heteroskedasticity-robust; panel-robust; systems-robust
ROC curve. See receiver operators characteristics curve
rotating panels, 739

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

Roy model, 555-7, 562
definition, 556
dummy endogenous variable, 557
Heckman two-step estimator, 556
ML estimator, 556
panel semiparametric estimation, 808
as treatment effects model, 867
RPL model. See random parameters logit
R-squared, 287
pseudo, 287-9
uncentered, 241, 263
running mean estimator, 308
SA method. See simulated annealing
sample attrition, 47
sample moment conditions
see population moment conditions
sample selection bias, 44-5
sample weights, 817-21, 853-6
see also weighting
sampling schemes
assumptions for OLS, 76-78
case-control, 479, 823
choice-based sampling, 43, 478-9, 823
endogenous sampling, 42-5, 78, 822-9, 856
endogenous stratified sampling, $78,820,825-6$, 856
exogenous stratified sampling, $42,78,814-5,820$, 825, 856
fixed in repeated samples, 76-7
flow sampling, 44, 626
multi-stage surveys, 41-2, 814-6, 853-6
on-site sampling, 43, 823
simple random sampling, 41, 76-7, 816
stock sampling, 44, 626-7
with replacement, 816
without replacement, 816-7
sandwich variance matrix
clustered data, 834, 842
extremum estimator, 132, 137-9
GMM estimator, 175
ML estimator, 144, 148
NLS estimator, 150
OLS estimator, 74
panel data, 705-7, 722, 746, 751
for Wald test, 277
see also robust standard errors
Sargan test, 277
see also overidentifying restrictions test
scale parameter, 509
scanner data, 499
Schwarz criterion. See BIC
SCLS estimator. See symmetrically censored least squares
score test, see Lagrange multiplier test
score vector, 141
secondary sampling units (SSUs), 41, 815, 854
seed, 411
seemingly unrelated regressions (SUR) model,
209-10, 216
Bayesian MCMC example, 452-4
count data, 685
error components, 762
nonlinear, 216
selection bias, 445
nonignorable missingness, $927,932,940$
treatment effects models, 867-71
see also selection models
selection models, 546-62
bivariate sample selection model, 547-53
count models, 680
example, 553-5
panel data, 801
Roy model, 555-7, 867
sample selection, 546
self selection, 546
semiparametric estimation, 565-6
structural models, 558-62
treatment effects model, 862-4
versus selection on observables only, 552-3, 864, 868-71
versus two-part models, 546, 552-3
see also Tobit models
selection on observables only, 552-3, 862-4, 868-9, 878-3, 889-96
compared to selection models, 552-3, 864, 871
conditional independence assumption, 868
control function estimator, 869
definition, 868-9
DID estimator, 878-9
RD design estimator, 879-83
treatment effects model, 862-4, 889-96
selection on unobservables, 552-3, 865-71, 883-9
definition, 868
in treatment effects model, 862-4
IV estimators, 883-9
Roy model, 867
selection bias, 867-71
selection model, 552-3
self-weighting sample, 818
SEM. See simultaneous equations model
seminonparametric ML estimator, 328-9, 485
semiparametric efficiency bounds, 323, 329-30, 485
semiparametric estimators, 322-30
adaptive, 323
application, 565
average derivative estimator, 326
efficiency bounds, 323, 329-30
nonparametric FGLS, 328
Robinson difference estimator, 324-5, 565
semiparametric least squares, 327, 483
seminonparametric ML estimator, 328-9, 485
see also semiparametric models
semiparametric heterogeneity model, 622
see also finite mixture models
semiparametric least squares, 327, 483

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

semiparametric ML estimator, 328-9, 485
semiparametric models, 322-30
additive models, 327
binary outcome models, 482-6
censored models, 563-5
count models, 684-5
definition, 322
duration models, 594-600, 601-2
flexible parametric models, 563
heteroskedastic linear model, 323, 328
identification, 325-6
leading examples, 322
multinomial outcome models, 523-4
panel data models, 808
partially linear model, 324-5
selection models, 565-6
single-index models, 325-7
see also semiparametric estimators
sequential limits, 767
sequential multinomial models, 520-1
sequential two-step m-estimator, 200-2
bootstrap for, 362
sequence of random variables, 943,945
serial correlation. See autocorrelation
set identification, 29
series estimator, 321
for binary outcomes, 483
shared frailty model, 662
short panel
definition, 700
statistical inference in, 705-8, 721-2, 746, 751, 768
shrinkage estimator, 440
Silverman's plug-in estimate, 304
simple random sampling (SRS), 41, 76-7, 816
simple stratified sampling, 818
Simpson's rule, 388-9
simulated annealing (SA) method, 347
simulated m-estimator, 398-9
simulation-based estimation methods, 364-418
motivating examples, 385-6
see MSL, MSM, indirect inference, simulators
simulators, 393-4, 406-10
antithetic sampling, 408-9
direct, 393
frequency, 406
GHK, 407-8
Halton sequences, 409-10
importance sampling, 407
smooth, 407
subsimulator, 394
unbiased, 394, 400
see also quadrature
simultaneous equations model (SEM), 22-31, 213-4, 219
causal interpretation, 26
error components, 762
extension to nonlinear models, 27
FIML estimator, 214
identification, 29-31, 213-4
LIML estimator, 214
nonlinear, 219
order condition, 213
rank condition, 214
reduced form, 25, 213
single-equation models, 31
structural form, 25, 213
structural model, 24
2SLS estimator, 214
3SLS estimator, 214
simultaneous equations probit, 523,560-1
simultaneous equations Tobit, 560-1
single-index models, 123, 323, 325-7
definition, 123
identification, 325
marginal effects, 123
nonlinear panel model, 780
semiparametric estimators, 325-7
SIPP. See Survey of Income and Program Participation
size of test, 246-7, 251-3
nominal size, 251
size-corrected test, 251
true size, 251-3
Sklar's theorem, 652
Slutsky's Theorem, 945-6
alternative version, 949
small-sample bias. See finite-sample bias
smooth maximum score estimator, 484
smoothing parameters, 307
smoothing spline estimator, 321
social experiments, 32, 48-54
advantages, 50-2
examples, 51, 889
limitations, 52-4
randomization, 49-50
span, 320
specific to general test, 285
specification tests, 259-78
for clustered data, 840
for duration models, 628-32
for endogeneity, 275-6
for exogeneity, 277
for heteroskedasticity, 275
for individual-specific effects, 737
for omitted variables, 274
for overdispersion, 670-1
for pooling, 737
for unobserved heterogeneity, 628-32
for Tobit model, 543-4
see also m-tests; model diagnostics
spherical errors, 78
split-sample IV estimator, 191-2
SRS. See simple random sampling
SSUs. See secondary sampling units
stable family of distributions, 621
stable unit treatment value assumption (SUTVA), 872
standard errors. See robust standard errors

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

starting values, 340, 351
state dependence. See true state dependence
stated preference data, 498, 516
stationary population, 40
statistical packages, 349
step size adjustment, 338
stochastic order of magnitude, 954-5
stock sampling, 44, 626-7
strata, 41, 815
see also sampling schemes; weighting
stratification matching, 875-6, 893-6
stratified random sampling, 76-7, 814-5
use of Liapounov CLT, 951
use of Markov LLN, 948
see also sampling schemes; weighting
strict exogeneity. See strong exogeneity
strong consistency, 947
strong exogeneity, 22
in panel models, 700, 749-50, 752, 781
structural approach
to measurement error, 901
to weighting, 820-1
structural economic models, 28, 171
with selection, 558-60
structural form, 20, 25, 223
structural model, 20-31, 35-6
based on economic model, 28
exogeneity, 22-3
full information, 35
limited information, 35
reduced form, 21, 25, 223
structural form, 20, 25, 223
structure, 20
see also simultaneous equations model
structural selection models, 558-62
based on utility maximization, 558-60
endogenous regressors, 561-2
simultaneous equations Tobit, 560-1
studentized statistic, 359
subsampling method, 373
substitution bias, 53, 867
sufficient statistic, 732, 782, 799, 805
definition, 782
summation assumption, 748, 752
superpopulation, 40,816
supersmoother, 321
SUR model. See seemingly unrelated regressions survey methods, 41-2, 84-7, 814-8, 853-6
survey nonresponse, 45-6, 60, 739
see also attrition bias; imputation methods
Survey of Income and Program Participation (SIPP), 59
survival analysis. See duration models
survival function. See survivor function
survivor function
aggregate survivor function, 619
definition, 576-8
estimator in PH model, 596-7

Kaplan-Meier estimator, 581-2, 604-5
in mixture models, 615-6
multivariate, 649-50
parametric examples, 585
SUTVA. See stable unit treatment value assumption
switching regressions model. See Roy model
symmetrically censored least squares (SCLS) estimator, 565
synthetic panels. See pseudo panels
systems of equations, 206-19
linear systems, 206-14
nonlinear systems, 214-9
seemingly unrelated regression, 209-10, 216
simultaneous equations model, 22-31, 213-4, 219
systems-robust standard errors, 208-9, 212, 219
target density, 444
tests. See hypothesis tests, m-tests, specification tests
three-stage least squares (3SLS) estimator, 214
3SLS estimator. See three-stage least squares
time series data
bootstrap, 381
NLS estimator, 158-9
Newey-West standard errors, 137, 175, 727
time-varying regressors
in duration models, 597-9
in panel data models, 702, 749-51
Tobit model, 536-44
Bayesian methods, 563
censored mean, 538-41
censoring mechanism, 532, 579
consistency of MLE, 538
definition, 536
example, 530-1
generalized, 548
Heckman two-step estimator, 543, 567-8
identification, 536
as imputation method, 932
inverse-Mills ratio, 540-1
marginal effects, 541-2
measurement error in dependent variable, 914
ML estimator, 537-8
NLS estimator, 542
OLS estimator, 543
panel data, 800-1
simultaneous equations, 560-1
specification tests, 543-4
with stochastic thresholds, 547
with truncated data, 538
truncated mean, 538-41, 566-7
two-limit, 536
type 2, 547
type 5, 557
see also selection models
top-coded data, 532-3, 541, 563
transformation methods, 413
transformation theorem, 949
transformed ML estimator, 766

# Cambridge University Press <br> 0521848059-Microeconometrics: Methods and Applications <br> A. Colin Cameron and Pravin K. Trivedi <br> Index <br> More information 

## SUBJECT INDEX

transition data. See duration models
trapezoidal rule, 388
treatment-control comparison
application, 890-1
treatment effects framework, 862-5, 871-8, 889-96
balancing condition, 864, 893-4
binary treatment variable, 862
conditional independence assumption, 863, 865
conditional mean independence assumption, 864
heterogeneous treatment effects, 882,885
multiple treatments, 860
overlap assumption, 864, 871
propensity score, 864-5
Roy model, 867
stable unit treatment value assumption, 872
see also treatment evaluation
treatment evaluation, 860-98
application, 889-96
IV estimators, 883-9
matching estimators, 871-8
DID estimators, 878-9
selection bias, 865-71
selection on observables, 862-4, 878-3, 889-96
selection on unobservables, 865-71, 883-9
regression discontinuity design, 879-83
see also treatment effects framework
treatment group, 49, 862
trimming, 316, 333
trivariate reduction, 686
true state dependence
duration models, 612, 630, 636
dynamic panel models, 763-4, 798, 802
see also unobserved heterogeneity
truncated models, 530-44
conditional mean, 535
count models, 679-80
definition, 532
examples, 530-1, 535
ML estimator, 534
see also Tobit model; selection models
truncated moments of standard normal, 540, 566-7
truncation mechanisms, 532
truncation from above, 532
truncation from below, 532
2SLS estimator. See two-stage least squares
two-limit Tobit model, 536
two-part model, 544-6
application, 553-5
compared to selection models, 546, 552-3
definition, 545
example, 545-6
see also hurdle model
two-stage IV estimator, 187
two-stage least squares (2SLS) estimator, 101-2, 187-91
alternatives to, 190-2
Basmann's approach, 190-1
compared to optimal GMM, 187-8
as GLS in transformed model, 188-9
as GMM estimator, 187
nonlinear, 195-6, 199
panel data, 746, 755
in SEM, 214
Theil's interpretation, 189-90
two-stage sampling, 41, 818
two-step estimators
GMM, 176, 187
Heckman, 543, 550-1, 556, 567-8
sequential m-estimator, 200-2
two-step GMM estimator, 176, 187
panel, 746, 755
two-way effects model, 738
type I error, 246-7
type II error, 246-7
type 1 extreme value distribution, 477, 486-7
duration model error, 590
multinomial logit model, 505
type 2 Tobit. See bivariate sample selection model
type 5 Tobit. See Roy model
ultimate sampling units (USUs), 41, 815
unbalanced panels, 739
uncentered explained sum of squares (ESS), 241
uncentered R-squared, 241, 263
unconfoundedness assumption. See conditional
independence assumption
underrecording, 915
undersmoothing, 305, 333, 380
uniform convergence in probability, 126, 301
uniform number generators, 412
uniformly most powerful (UMP) test, 247
unit roots, 382 , 767-8
universal logit model, 500
unobserved heterogeneity
application, 632-6
in competing risks model, 647
in count models, 675-7, 686
distributions for, 614-5, 620-1
in duration models, 611-25
finite mixture models for, 621-5
identification, 618-20
IM test for, 267
individual-specific effects, 700, 764
mixture models for, 613-21
MSL example, 397-8
MSM example, 403
multiplicative, 613, 686
in nonlinear systems, 215
specification tests for, 629-32
variance inflation, 614
versus true state dependence, $612,630,636,763-4$,
798, 802
USUs. See ultimate sampling units
validation sample, 911
variance components, 735,845

Cambridge University Press<br>0521848059-Microeconometrics: Methods and Applications<br>A. Colin Cameron and Pravin K. Trivedi<br>Index<br>More information

## SUBJECT INDEX

variance matrix estimation
BHHH estimate, 138
degrees-of-freedom adjustment, 75, 102, 138, 185-6, 278, 841
expected Hessian estimate, 138
for extremum estimator, 137-9
for GMM estimator, 174-5
Hessian estimate, 138
for NLS estimator, 154-5
OPG estimate, 138
robust estimate, 137
sandwich estimate, 137, 144
for weighted estimators, 854-6
see also robust standard errors
variance reduction for simulation, 478

Wald estimator
in treatment effects models, 886
Wald test, 136-7, 224-33
asymptotic distribution, 226-8
comparison with LM and, LR tests, 238-9
definition, 136
examples, 236, 241-3
exclusion restrictions, 227
F-test version, 226
introduction, 136-7
lack of invariance, 232-3
likelihood based, 234, 241-3
linear models, 224-5
linear restrictions, 136-7
in misspecified models, 229-30
nonlinear restrictions, 224, 229
power, 248-50
of statistical significance, 228
t-test version, 226-8
see also hypothesis tests
weak consistency, 947
weak exogeneity, 22
in panel data, 749, 752, 758
weak instruments, 100, 104-12
application, 110-2
definition, 104
finite sample bias, 108-12, 177-8, 191-2, 196
GMM estimator, 177-8
inconsistency, 105-7
indicators 104-5, 756
panel data, 751-2, 756
Weibull distribution, 584-6
Weibull-gamma regression model, 615
Weibull regression model, 143-4, 589, 606-8, 635
weighted estimation
endogenous stratification, 828-9
exogenous stratification, 818-20
weighted exogenous sampling ML (WESML)
estimator, 828
weighted least squares (WLS) estimator, 81-5
asymptotic distribution, 83
contrasted with GLS, 83
definition, 83
example, 84-5
in pooled model, 702-3, 721
see also FGLS estimator
weighted maximum likelihood (WML) estimator, 828
weighted semiparametric least squares (WSWL) estimator, 327
for binary outcome models, 485
weighting, 817-21, 827-9, 853-6
descriptive versus structural approach, 820
with endogenous stratification, 827-9
sample weights, 817-8
variance estimation, 853-6
weighted prediction, 821
weighted regression, 818-20
whether to weight, 820-1
welfare analysis
with ARUM, 506-7
with nested logit model, 512
WESML estimator. See weighted exogenous sampling ML
White standard errors. See robust standard errors
wild bootstrap, 377-8
window width, 299, 307, 312
Wishart distribution, 443
see also inverse-Wishart distribution
within estimator. See fixed effects estimator
within model. See fixed effects model
within-group variation, 709, 733
with-zeros model, 681
WLS estimator. See weighted least squares
WML estimator. See weighted maximum likelihood
WNLS estimator, 156-7
asymptotic distribution, 156
definition, 156
example, 159-63
as GLM, 158
working matrix
definition, 82
for GLM estimator, 158
for pooled GEE estimator, 794
for pooled WLS estimator, 721
for WLS estimator, 82-3
WSLS estimator. See weighted semiparametric least squares
zero-inflated count model, 680-1

