

Accounting and causal effects:
Econometric challenges

Douglas A. Schroeder
Fisher College of Business
Ohio State University

2010

to Bonnie

Contents

Contents	iii
List of Tables	xi
List of Figures	xix
Preface	xxi
1 Introduction	1
1.1 Problematic illustration	2
1.2 Jaynes' desiderata for scientific reasoning	4
1.2.1 Probability as logic illustration	4
1.3 Overview	7
1.4 Additional reading	8
2 Accounting choice	9
2.1 Equilibrium earnings management	10
2.1.1 Implications for econometric analysis	11
2.2 Asset revaluation regulation	12
2.2.1 Numerical example	13
2.2.2 Implications for econometric analysis	14
2.3 Regulated report precision	14
2.3.1 Public precision choice	15
2.3.2 Private precision choice	15
2.3.3 Regulated precision choice and transaction design	16

2.3.4	Implications for econometric analysis	16
2.4	Inferring transactions from financial statements	17
2.4.1	Implications for econometric analysis	17
2.5	Additional reading	18
3	Linear models	19
3.1	Standard linear model (<i>OLS</i>)	19
3.2	Generalized least squares (<i>GLS</i>)	21
3.3	Tests of restrictions and <i>FWL</i> (Frisch-Waugh-Lovell)	22
3.4	Fixed and random effects	26
3.5	Random coefficients	31
3.5.1	Nonstochastic regressors	31
3.5.2	Correlated random coefficients	32
3.6	Ubiquity of the Gaussian distribution	33
3.6.1	Convolution of Gaussians	35
3.7	Interval estimation	36
3.8	Asymptotic tests of restrictions: Wald, <i>LM</i> , <i>LR</i> statistics	38
3.8.1	Nonlinear restrictions	41
3.9	Misspecification and <i>IV</i> estimation	41
3.10	Proxy variables	43
3.10.1	Accounting and other information sources	45
3.11	Equilibrium earnings management	48
3.12	Additional reading	54
3.13	Appendix	55
4	Loss functions and estimation	59
4.1	Loss functions	59
4.1.1	Quadratic loss	60
4.1.2	Linear loss	61
4.1.3	All or nothing loss	61
4.2	Nonlinear Regression	62
4.2.1	Newton's method	62
4.2.2	Gauss-Newton regression	63
4.3	Maximum likelihood estimation (<i>MLE</i>)	65
4.3.1	Parameter estimation	65
4.3.2	Estimated asymptotic covariance for <i>MLE</i> of $\hat{\theta}$	66
4.4	James-Stein shrinkage estimators	70
4.5	Summary	75
4.6	Additional reading	76
5	Discrete choice models	77
5.1	Latent utility index models	77
5.2	Linear probability models	78
5.3	Logit (logistic regression) models	78
5.3.1	Binary logit	79

5.3.2	Multinomial logit	80
5.3.3	Conditional logit	80
5.3.4	<i>GEV</i> (generalized extreme value) models	81
5.3.5	Nested logit models	81
5.3.6	Generalizations	84
5.4	Probit models	86
5.4.1	Conditionally-heteroskedastic probit	86
5.4.2	Artificial regression specification test	87
5.5	Robust choice models	92
5.5.1	Mixed logit models	92
5.5.2	Semiparametric single index discrete choice models	92
5.5.3	Nonparametric discrete choice models	93
5.6	Tobit (censored regression) models	94
5.7	Bayesian data augmentation	94
5.8	Additional reading	95
6	Nonparametric regression	97
6.1	Nonparametric (kernel) regression	97
6.2	Semiparametric regression models	99
6.2.1	Partial linear regression	99
6.2.2	Single-index regression	99
6.2.3	Partial index regression models	101
6.3	Specification testing against a general nonparametric benchmark	101
6.4	Locally linear regression	103
6.5	Generalized cross-validation (<i>GCV</i>)	104
6.6	Additional reading	105
7	Repeated-sampling inference	107
7.1	Monte Carlo simulation	108
7.2	Bootstrap	108
7.2.1	Bootstrap regression	108
7.2.2	Bootstrap panel data regression	109
7.2.3	Bootstrap summary	111
7.3	Bayesian simulation	111
7.3.1	Conjugate families	111
7.3.2	<i>MCMC</i> simulations	117
7.4	Additional reading	122
8	Overview of endogeneity	123
8.1	Overview	124
8.1.1	Simultaneous equations	124
8.1.2	Endogenous regressors	126
8.1.3	Fixed effects	127
8.1.4	Differences-in-differences	129
8.1.5	Bivariate probit	130

8.1.6	Simultaneous probit	131
8.1.7	Strategic choice model	135
8.1.8	Sample selection	142
8.1.9	Duration models	143
8.1.10	Latent <i>IV</i>	146
8.2	Selectivity and treatment effects	147
8.3	Why bother with endogeneity?	148
8.3.1	Sample selection example	148
8.3.2	Tuebingen-style treatment effect examples	149
8.4	Discussion and concluding remarks	155
8.5	Additional reading	155
9	Treatment effects: ignorability	157
9.1	A prototypical selection setting	157
9.2	Exogenous dummy variable regression	158
9.3	Tuebingen-style examples	159
9.4	Nonparametric identification	164
9.5	Propensity score approaches	169
9.5.1	<i>ATE</i> and propensity score	169
9.5.2	<i>ATT</i> , <i>ATUT</i> , and propensity score	170
9.5.3	Linearity and propensity score	172
9.6	Propensity score matching	172
9.7	Asset revaluation regulation example	175
9.7.1	Numerical example	176
9.7.2	Full certification	177
9.7.3	Selective certification	183
9.7.4	Outcomes measured by value x only	190
9.7.5	Selective certification with missing "factual" data	193
9.7.6	Sharp regression discontinuity design	196
9.7.7	Fuzzy regression discontinuity design	198
9.7.8	Selective certification setting	199
9.7.9	Common support	201
9.7.10	Summary	202
9.8	Control function approaches	203
9.8.1	Linear control functions	203
9.8.2	Control functions with expected individual-specific gain	203
9.8.3	Linear control functions with expected individual-specific gain	204
9.9	Summary	204
9.10	Additional reading	204
10	Treatment effects: <i>IV</i>	207
10.1	Setup	207
10.2	Treatment effects	208
10.3	Generalized Roy model	210

10.4	Homogeneous response	211
10.4.1	Endogenous dummy variable <i>IV</i> model	211
10.4.2	Propensity score <i>IV</i>	212
10.5	Heterogeneous response and treatment effects	212
10.5.1	Propensity score <i>IV</i> and heterogeneous response	213
10.5.2	Ordinate control function <i>IV</i> and heterogeneous response	213
10.5.3	Inverse Mills control function <i>IV</i> and heterogeneous response	214
10.5.4	Heterogeneity and estimating <i>ATT</i> by <i>IV</i>	217
10.5.5	<i>LATE</i> and linear <i>IV</i>	217
10.6	Continuous treatment	236
10.7	Regulated report precision	239
10.7.1	Binary report precision choice	239
10.7.2	Continuous report precision but observed binary	253
10.7.3	<i>Observable</i> continuous report precision choice	266
10.8	Summary	273
10.9	Additional reading	273
11	Marginal treatment effects	275
11.1	Policy evaluation and policy invariance conditions	275
11.2	Setup	277
11.3	Generalized Roy model	277
11.4	Identification	278
11.5	<i>MTE</i> connections to other treatment effects	280
11.5.1	Policy-relevant treatment effects vs. policy effects	282
11.5.2	Linear <i>IV</i> weights	283
11.5.3	<i>OLS</i> weights	284
11.6	Comparison of identification strategies	286
11.7	<i>LIV</i> estimation	286
11.8	Discrete outcomes	288
11.8.1	Multilevel discrete and continuous endogenous treatment	289
11.9	Distributions of treatment effects	291
11.10	Dynamic timing of treatment	292
11.11	General equilibrium effects	293
11.12	Regulated report precision example	293
11.12.1	Apparent nonnormality and <i>MTE</i>	293
11.13	Additional reading	300
12	Bayesian treatment effects	301
12.1	Setup	302
12.2	Bounds and learning	302
12.3	Gibbs sampler	303
12.3.1	Full conditional posterior distributions	303
12.4	Predictive distributions	305
12.4.1	Rao-Blackwellization	306

12.5	Hierarchical multivariate Student t variation	306
12.6	Mixture of normals variation	306
12.7	A prototypical Bayesian selection example	307
12.7.1	Simulation	308
12.7.2	Bayesian data augmentation and <i>MTE</i>	309
12.8	Regulated report precision example	311
12.8.1	Binary choice	313
12.8.2	Continuous report precision but observed binary selection	316
12.8.3	Apparent nonnormality of unobservable choice	319
12.8.4	Policy-relevant report precision treatment effect	326
12.8.5	Summary	328
12.9	Probability as logic and the selection problem	330
12.10	Additional reading	331
13	Informed priors	333
13.1	Maximum entropy	334
13.2	Complete ignorance	336
13.3	A little background knowledge	337
13.4	Generalization of maximum entropy principle	337
13.5	Discrete choice model as maximum entropy prior	340
13.6	Continuous priors	342
13.6.1	Maximum entropy	343
13.6.2	Transformation groups	344
13.6.3	Uniform prior	346
13.6.4	Gaussian prior	347
13.6.5	Multivariate Gaussian prior	348
13.6.6	Exponential prior	349
13.6.7	Truncated exponential prior	349
13.6.8	Truncated Gaussian prior	350
13.7	Variance bound and maximum entropy	351
13.8	An illustration: Jaynes' widget problem	355
13.8.1	Stage 1 solution	356
13.8.2	Stage 2 solution	359
13.8.3	Stage 3 solution	362
13.8.4	Stage 4 solution	370
13.9	Football game puzzle	370
13.10	Financial statement example	371
13.10.1	Under-identification and Bayes	371
13.10.2	Numerical example	373
13.11	Smooth accruals	376
13.11.1	<i>DGP</i>	377
13.11.2	Valuation results	377
13.11.3	Performance evaluation	380
13.11.4	Summary	382
13.12	Earnings management	382

13.12.1	Stochastic manipulation	382
13.12.2	Selective earnings management	393
13.13	Jaynes' A_p distribution	398
13.13.1	Football game puzzle revisited	400
13.14	Concluding remarks	401
13.15	Additional reading	401
13.16	Appendix	401
A	Asymptotic theory	413
A.1	Convergence in probability (laws of large numbers)	413
A.1.1	Almost sure convergence	414
A.1.2	Applications of convergence	415
A.2	Convergence in distribution (central limit theorems)	417
A.3	Rates of convergence	422
A.4	Additional reading	423
	Bibliography	425
	Index	444

List of Tables

3.1	Multiple information sources case 1 setup	45
3.2	Multiple information sources case 1 valuation implications . . .	46
3.3	Multiple information sources case 2 setup	47
3.4	Multiple information sources case 2 valuation implications . . .	47
3.5	Multiple information sources case 3 setup	47
3.6	Multiple information sources case 3 valuation implications . . .	48
3.7	Results for price on reported accruals regression	51
3.8	Results for price on reported accruals saturated regression	51
3.9	Results for price on reported accruals and propensity score re- gression	52
3.10	Results for price on reported accruals and estimated propensity score regression	53
3.11	Results for price on reported accruals and logit-estimated propen- sity score regression	54
5.1	Variations of multinomial logits	82
5.2	Nested logit with moderate correlation	84
5.3	Conditional logit with moderate correlation	85
5.4	Nested logit with low correlation	85
5.5	Conditional logit with low correlation	85
5.6	Nested logit with high correlation	85
5.7	Conditional logit with high correlation	85
5.8	Homoskedastic probit results with heteroskedastic DGP	90
5.9	BRMR specification test 1 with heteroskedastic DGP	90

5.10	BRMR specification test 2 with heteroskedastic DGP	91
5.11	BRMR specification test 3 with heteroskedastic DGP	91
5.12	Heteroskedastic probit results with heteroskedastic DGP	92
5.13	Homoskedastic probit results with homoskedastic DGP	92
5.14	BRMR specification test 1 with homoskedastic DGP	93
5.15	BRMR specification test 2 with homoskedastic DGP	93
5.16	BRMR specification test 3 with homoskedastic DGP	94
5.17	Heteroskedastic probit results with homoskedastic DGP	94
7.1	Conjugate families for univariate discrete distributions	113
7.2	Conjugate families for univariate continuous distributions	114
7.3	Conjugate families for multivariate discrete distributions	115
7.4	Conjugate families for multivariate continuous distributions	116
8.1	Strategic choice analysis for player B	138
8.2	Strategic choice analysis for player A	139
8.3	Parameter differences in strategic choice analysis for player B	140
8.4	Parameter differences in strategic choice analysis for player A	140
8.5	Production data: Simpson's paradox	149
8.6	Tuebingen example case 1: ignorable treatment	151
8.7	Tuebingen example case 1 results: ignorable treatment	152
8.8	Tuebingen example case 2: heterogeneous response	152
8.9	Tuebingen example case 2 results: heterogeneous response	152
8.10	Tuebingen example case 3: more heterogeneity	153
8.11	Tuebingen example case 3 results: more heterogeneity	153
8.12	Tuebingen example case 4: Simpson's paradox	154
8.13	Tuebingen example case 4 results: Simpson's paradox	154
9.1	Tuebingen example case 1: extreme homogeneity	159
9.2	Tuebingen example case 1 results: extreme homogeneity	160
9.3	Tuebingen example case 2: homogeneity	160
9.4	Tuebingen example case 2 results: homogeneity	161
9.5	Tuebingen example case 3: heterogeneity	162
9.6	Tuebingen example case 3 results: heterogeneity	163
9.7	Tuebingen example case 4: Simpson's paradox	163
9.8	Tuebingen example case 4 results: Simpson's paradox	164
9.9	Exogenous dummy variable regression example	165
9.10	Exogenous dummy variable regression results	166
9.11	Nonparametric treatment effect regression	167
9.12	Nonparametrically identified treatment effect: exogenous dummy variable regression results	168
9.13	Nonparametric treatment effect regression results	168
9.14	Investment choice and payoffs for no certification and selective certification	176
9.15	Investment choice and payoffs for full certification	177

9.16	OLS results for full certification setting	179
9.17	Average treatment effect sample statistics for full certification setting	179
9.18	Adjusted outcomes OLS results for full certification setting	181
9.19	Propensity score treatment effect estimates for full certification setting	182
9.20	Propensity score matching average treatment effect estimates for full certification setting	183
9.21	OLS parameter estimates for selective certification setting	188
9.22	Average treatment effect sample statistics for selective certification setting	189
9.23	Reduced OLS parameter estimates for selective certification setting	189
9.24	Propensity score average treatment effect estimates for selective certification setting	190
9.25	Propensity score matching average treatment effect estimates for selective certification setting	190
9.26	OLS parameter estimates for $Y=x$ in selective certification setting	191
9.27	Average treatment effect sample statistics for $Y = x$ in selective certification setting	192
9.28	Propensity score average treatment effect for $Y = x$ in selective certification setting	192
9.29	Propensity score matching average treatment effect for $Y = x$ in selective certification setting	192
9.30	OLS parameter estimates ignoring missing data for selective certification setting	193
9.31	Treatment effect OLS model estimates based on augmentation of missing data for selective certification setting	195
9.32	Sharp RD OLS parameter estimates for full certification setting	196
9.33	Average treatment effect sample statistics for full certification setting	197
9.34	Sharp RD OLS parameter estimates for selective certification setting	197
9.35	Sharp RD OLS parameter estimates with missing data for selective certification setting	198
9.36	Fuzzy RD OLS parameter estimates for full certification setting	199
9.37	Fuzzy RD 2SLS-IV parameter estimates for full certification setting	199
9.38	Fuzzy RD OLS parameter estimates for selective certification setting	200
9.39	Fuzzy RD 2SLS-IV parameter estimates for selective certification setting	200
9.40	Fuzzy RD OLS parameter estimates with missing data for selective certification setting	200

9.41	Fuzzy RD 2SLS-IV parameter estimates with missing data for selective certification setting	201
9.42	Fuzzy RD OLS parameter estimates for full certification setting	202
9.43	Average treatment effect sample statistics for full certification setting	202
10.1	Tuebingen IV example treatment likelihoods for case 1: ignorable treatment	223
10.2	Tuebingen IV example outcome likelihoods for case 1: ignorable treatment	223
10.3	Tuebingen IV example results for case 1: ignorable treatment	224
10.4	Tuebingen IV example treatment likelihoods for case 1b: uniformity fails	224
10.5	Tuebingen IV example treatment likelihoods for case 2: heterogeneous response	225
10.6	Tuebingen IV example outcome likelihoods for case 2: heterogeneous response	226
10.7	Tuebingen IV example results for case 2: heterogeneous response	226
10.8	Tuebingen IV example treatment likelihoods for case 2b: LATE = ATT	227
10.9	Tuebingen IV example outcome likelihoods for case 2b: LATE = ATT	227
10.10	Tuebingen IV example results for case 2b: LATE = ATT	228
10.11	Tuebingen IV example treatment likelihoods for case 3: more heterogeneity	228
10.12	Tuebingen IV example outcome likelihoods for case 3: more heterogeneity	229
10.13	Tuebingen IV example results for case 3: more heterogeneity	229
10.14	Tuebingen IV example treatment likelihoods for case 3b: LATE = ATUT	230
10.15	Tuebingen IV example outcome likelihoods for case 3b: LATE = ATUT	230
10.16	Tuebingen IV example results for case 3b: LATE = ATUT	231
10.17	Tuebingen IV example treatment likelihoods for case 4: Simpson's paradox	231
10.18	Tuebingen IV example outcome likelihoods for case 4: Simpson's paradox	232
10.19	Tuebingen IV example results for case 4: Simpson's paradox	232
10.20	Tuebingen IV example treatment likelihoods for case 4b: exclusion restriction violated	233
10.21	Tuebingen IV example outcome likelihoods for case 4b: exclusion restriction violated	233
10.22	Tuebingen IV example results for case 4b: exclusion restriction violated	234

10.23	Tuebingen IV example outcome likelihoods for case 5: lack of common support	234
10.24	Tuebingen IV example treatment likelihoods for case 5: lack of common support	235
10.25	Tuebingen IV example results for case 5: lack of common support	235
10.26	Tuebingen IV example outcome likelihoods for case 5b: minimal common support	236
10.27	Tuebingen IV example outcome likelihoods for case 5b: minimal common support	236
10.28	Tuebingen IV example results for case 5b: minimal common support	237
10.29	Report precision OLS parameter estimates for binary base case .	242
10.30	Report precision average treatment effect sample statistics for binary base case	242
10.31	Report precision saturated OLS parameter estimates for binary base case	243
10.32	Report precision adjusted outcome OLS parameter estimates for binary base case	245
10.33	Report precision adjusted outcome OLS parameter estimates for binary heterogeneous case	247
10.34	Report precision average treatment effect sample statistics for binary heterogeneous case	247
10.35	Report precision poor 2SLS-IV estimates for binary heterogeneous case	248
10.36	Report precision weak 2SLS-IV estimates for binary heterogeneous case	249
10.37	Report precision stronger 2SLS-IV estimates for binary heterogeneous case	250
10.38	Report precision propensity score estimates for binary heterogeneous case	251
10.39	Report precision propensity score matching estimates for binary heterogeneous case	251
10.40	Report precision ordinate control IV estimates for binary heterogeneous case	252
10.41	Report precision inverse Mills IV estimates for binary heterogeneous case	253
10.42	Continuous report precision but observed binary OLS parameter estimates	255
10.43	Continuous report precision but observed binary average treatment effect sample statistics	255
10.44	Continuous report precision but observed binary propensity score parameter estimates	256
10.45	Continuous report precision but observed binary propensity score matching parameter estimates	256

10.46	Continuous report precision but observed binary ordinate control IV parameter estimates	257
10.47	Continuous report precision but observed binary inverse Mills IV parameter estimates	258
10.48	Continuous report precision but observed binary sample correlations	259
10.49	Continuous report precision but observed binary stronger propensity score parameter estimates	260
10.50	Continuous report precision but observed binary stronger propensity score matching parameter estimates	260
10.51	Continuous report precision but observed binary stronger ordinate control IV parameter estimates	261
10.52	Continuous report precision but observed binary stronger inverse Mills IV parameter estimates	262
10.53	Continuous report precision but observed binary OLS parameter estimates for Simpson's paradox DGP	264
10.54	Continuous report precision but observed binary average treatment effect sample statistics for Simpson's paradox DGP	264
10.55	Continuous report precision but observed binary ordinate control IV parameter estimates for Simpson's paradox DGP	265
10.56	Continuous report precision but observed binary inverse Mills IV parameter estimates for Simpson's paradox DGP	266
10.57	Continuous treatment OLS parameter estimates and average treatment effect estimates and sample statistics with only between individual variation	268
10.58	Continuous treatment 2SLS-IV parameter and average treatment effect estimates with only between individual variation	269
10.59	Continuous treatment OLS parameter and average treatment effect estimates for modest within individual report precision variation setting	270
10.60	Continuous treatment ATE and ATT sample statistics and correlation between treatment and treatment effect for modest within individual report precision variation setting	270
10.61	Continuous treatment 2SLS-IV parameter and average treatment effect estimates for modest within individual report precision variation setting	271
10.62	Continuous treatment OLS parameter and average treatment effect estimates for the more between and within individual report precision variation setting	272
10.63	Continuous treatment ATE and ATT sample statistics and correlation between treatment and treatment effect for the more between and within individual report precision variation setting	272
10.64	Continuous treatment 2SLS-IV parameter and average treatment effect estimates for the more between and within individual report precision variation setting	272

11.1	Comparison of identification conditions for common econometric strategies (adapted from Heckman and Navarro-Lozano's [2004] table 3)	285
11.2	Continuous report precision but observed binary OLS parameter estimates for apparently nonnormal DGP	295
11.3	Continuous report precision but observed binary average treatment effect sample statistics for apparently nonnormal DGP	295
11.4	Continuous report precision but observed binary ordinate control IV parameter estimates for apparently nonnormal DGP	295
11.5	Continuous report precision but observed binary inverse Mills IV parameter estimates for apparently nonnormal DGP	296
11.6	Continuous report precision but observed binary LIV parameter estimates for apparently nonnormal DGP	297
11.7	Continuous report precision but observed binary sample correlations for apparently nonnormal DGP	298
11.8	Continuous report precision but observed binary stronger ordinate control IV parameter estimates for apparently nonnormal DGP	299
11.9	Continuous report precision but observed binary average treatment effect sample statistics for apparently nonnormal DGP	299
11.10	Continuous report precision but observed binary stronger inverse Mills IV parameter estimates for apparently nonnormal DGP	299
11.11	Continuous report precision but observed binary stronger LIV parameter estimates for apparently nonnormal DGP	300
12.1	McMC parameter estimates for prototypical selection	310
12.2	McMC estimates of average treatment effects for prototypical selection	310
12.3	McMC average treatment effect sample statistics for prototypical selection	311
12.4	McMC MTE-weighted average treatment effects for prototypical selection	311
12.5	Binary report precision McMC parameter estimates for heterogeneous outcome	315
12.6	Binary report precision McMC average treatment effect estimates for heterogeneous outcome	315
12.7	Binary report precision McMC average treatment effect sample statistics for heterogeneous outcome	315
12.8	Binary report precision McMC MTE-weighted average treatment effect estimates for heterogeneous outcome	317
12.9	Continuous report precision but observed binary selection McMC parameter estimates	318
12.10	Continuous report precision but observed binary selection McMC average treatment effect estimates	318

12.11	Continuous report precision but observed binary selection McMC average treatment effect sample statistics	319
12.12	Continuous report precision but observed binary selection McMC MTE-weighted average treatment effect estimates	319
12.13	Continuous report precision but observed binary selection McMC parameter estimates for nonnormal DGP	322
12.14	Continuous report precision but observed binary selection McMC average treatment effect estimates for nonnormal DGP	322
12.15	Continuous report precision but observed binary selection McMC average treatment effect sample statistics for nonnormal DGP	322
12.16	Continuous report precision but observed binary selection McMC MTE-weighted average treatment effect estimates for nonnormal DGP	324
12.17	Continuous report precision but observed binary selection stronger McMC parameter estimates	324
12.18	Continuous report precision but observed binary selection stronger McMC average treatment effect estimates	324
12.19	Continuous report precision but observed binary selection stronger McMC average treatment effect sample statistics	325
12.20	Continuous report precision but observed binary selection stronger McMC MTE-weighted average treatment effect estimates	326
12.21	Policy-relevant average treatment effects with original precision cost parameters	327
12.22	Policy-relevant average treatment effects with revised precision cost parameters	328
13.1	Jaynes' widget problem: summary of background knowledge by stage	356
13.2	Jaynes' widget problem: stage 3 state of knowledge	364
13.3	Jaynes' widget problem: stage 3 state of knowledge along with standard deviation	366

List of Figures

3.1	Price versus reported accruals	50
8.1	Fixed effects regression curves	128
8.2	Strategic choice game tree	136
11.1	<i>MTE</i> and weight functions for other treatment effects	281
12.1	<i>MTE</i> (u_D) versus $u_D = p_\nu$ for prototypical selection	312
12.2	<i>MTE</i> (u_D) versus $u_D = p_\nu$ for binary report precision	316
12.3	<i>MTE</i> (u_D) versus $u_D = p_\nu$ for continuous report precision but binary selection	320
12.4	<i>MTE</i> (u_D) versus $u_D = p_\nu$ for nonnormal DGP	323
12.5	<i>MTE</i> (u_D) versus $u_D = p_\nu$ with stronger instruments	325
12.6	<i>MTE</i> (u_D) versus $u_D = p_\nu$ for policy-relevant treatment effect	329
13.1	"Exact" distributions for daily widget demand	369
13.2	Directed graph of financial statements	374
13.3	Spanning tree	375
13.4	Stochastic manipulation σ_d known	386
13.5	Incidence of stochastic manipulation and posterior probability	386
13.6	Stochastic manipulation σ_d unknown	393
13.7	Selective manipulation σ_d known	395
13.8	Incidence of selective manipulation and posterior probability	395
13.9	Selective manipulation σ_d unknown	398

Preface

In this book, we synthesize a rich and vast literature on econometric challenges associated with accounting choices and their causal effects. Identification and estimation of endogenous causal effects is particularly challenging as observable data are rarely directly linked to the causal effect of interest. A common strategy is to employ logically consistent probability assessment via Bayes' theorem to connect observable data to the causal effect of interest. For example, the implications of earnings management as equilibrium reporting behavior is a centerpiece of our explorations. Rather than offering recipes or algorithms, the book surveys our experiences with accounting and econometrics. That is, we focus on why rather than how.

The book can be utilized in a variety of venues. On the surface it is geared toward graduate studies and surely this is where its roots lie. If we're serious about our studies, that is, if we tackle interesting and challenging problems, then there is a natural progression. Our research addresses problems that are not well understood then incorporates them throughout our curricula as our understanding improves and to improve our understanding (in other words, learning and curriculum development are endogenous). For accounting to be a vibrant academic discipline, we believe it is essential these issues be confronted in the undergraduate classroom as well as graduate studies. We hope we've made some progress with examples which will encourage these developments. For us, the Tuebingen-style treatment effect examples, initiated by and shared with us by Joel Demski, introduced (to the reader) in chapter 8 and pursued further in chapters 9 and 10 are a natural starting point.

The layout of the book is as follows. The first two chapters introduce the philosophic style of the book — we iterate between theory development and numerical

examples. Chapters three through seven survey standard econometric background along with some scattered examples. An appendix surveys standard asymptotic theory. Causal effects, our primary focus, are explored mostly in the latter chapters — chapters 8 through 13. The synthesis draws heavily and unabashedly from labor econometrics or microeconometrics, as it has come to be known. We claim no originality regarding the econometric theory synthesized in these pages and attempt to give credit to the appropriate source. Rather, our modest contribution primarily derives from connecting econometric theory to causal effects in various accounting contexts.

I am indebted to numerous individuals. Thought-provoking discussions with colloquium speakers and colleagues including Anil Arya, Anne Beatty, Steve Coslett, Jon Glover, Chris Hogan, Pierre Liang, Haijin Lin, John Lyon, Brian Mittenfior, Anup-menon Nandialath, Pervin Shroff, Eric Spires, Dave Williams, and Rick Young helped to formulate and refine ideas conveyed in these pages. In a very real sense, two events, along with a perceived void in the literature, prompted my attempts to put these ideas to paper. First, Mark Bagnoli and Susan Watts invited me to discuss these issues in a two day workshop at Purdue University during Fall 2007. I am grateful to them for providing this important opportunity, their hospitality and intellectual curiosity, and their continuing encouragement of this project. Second, the opportunity arose for me to participate in Joel Demski and John Fellingham's seminar at the University of Florida where many of these issues were discussed. I am deeply indebted to Joel and John for their steadfast support and encouragement of this endeavor as well as their intellectual guidance. I borrow liberally from their work for not only the examples discussed within these pages but in all facets of scholarly endeavors. I hope that these pages are some small repayment toward this debt but recognize that my intellectual debt to Joel and John continues to dwarf the national debt. Finally, and most importantly, this project would not have been undertaken without the love, encouragement, and support of Bonnie.

Doug Schroeder
Columbus, Ohio