

Table of contents

Preface	vii
1 Introduction	1
1.1 Asset pricing theory	6
1.2 Transaction cost	6
1.3 Example: Limit-order markets	12
1.4 Capacity of a portfolio strategy	17
1.5 Trading game	19
1.6 Exercises	19
I Theory	21
2 Trading frictions	25
2.1 Noninformational frictions	25
2.1.1 Order-processing costs	26
2.1.2 Risk-averse liquidity supply	27
2.2 Informational frictions	30
2.2.1 Private information	31
2.2.2 Public information	34
2.3 Exercises	41
3 Finite-horizon model	43
3.1 Symmetric information	44
3.1.1 Periods	45
3.1.2 Equilibrium price dynamics	46

Table of contents

3.1.3	Equilibrium illiquidity	52
3.2	Asymmetric information	53
3.2.1	Equilibrium price dynamics	55
3.2.2	Equilibrium illiquidity	57
3.3	Illustration of the VW12 model	61
3.3.1	Liquidity	67
3.3.2	Perturbing the equilibrium	72
3.4	Welfare	80
3.5	Imperfect competition	83
3.5.1	Liquidity demanders compete imperfectly	84
3.5.2	Liquidity suppliers compete imperfectly	88
3.6	Model perturbations	89
3.6.1	Adding exogenous intermediaries	89
3.6.2	Dispersing uninformed traders across time or space	91
3.7	Exercises	102
4	Recursive model	105
4.1	Continuous-time model	105
4.2	Model-implied discrete-time dynamics	113
4.3	Exercises	117
II	Empirics	119
5	Bid–ask spread decomposition	123
5.1	Classic decomposition	123
5.2	More refined decomposition	126
5.3	Exercises	128
6	Linear models	131
6.1	ARIMA framework	132
6.1.1	Hilbert spaces and the projection theorem	132
6.1.2	Special case: Cross moments	135

6.1.3	Moving average model	136
6.1.4	Autoregressive model	138
6.1.5	Integrated time series	142
6.1.6	Efficient price and pricing error	144
6.1.7	Variance ratio	149
6.2	Single security, single price series	150
6.2.1	Sample of price series only	152
6.2.2	Sample of price and net volume series	168
6.3	Single security, multiple price series	185
6.4	Multiple securities, multiple price series	190
6.5	Exercises	191
7	State space models	193
7.1	A local level model	195
7.1.1	Kalman filter	197
7.1.2	Estimation	200
7.1.3	Kalman smoother	203
7.2	The general state space model	207
7.3	Illustration of state space model estimation	208
7.4	Exercises	229
8	Additional tools	231
8.1	Gross trading revenue decomposition	232
8.2	Exercises	251
III	Appendices	253
9	Trading game	255
9.1	Overview	256
9.2	Steps in the game	256
9.2.1	Baseline game	256
9.2.2	Second game	258

Table of contents

10 Jupyter notebooks	263
11 Glossary	265
References	267