

1 Background Trading Strategies

Table 1: Background trading strategies included in empirical game-theoretic analysis.

Strategy	ZI ₁	ZI ₂	ZI ₃	ZI ₄	ZI ₅	ZI ₆	ZI ₇	ZI ₈	ZI ₉	HBL ₁	HBL ₂	HBL ₃	HBL ₄
L	-	-	-	-	-	-	-	-	-	2	3	5	8
R_{\min}	0	0	0	0	0	0	250	250	250	250	250	250	250
R_{\max}	1000	1000	1000	2000	2000	2000	500	500	500	500	500	500	500
η	0.4	0.8	1	0.4	0.8	1	0.4	0.8	1	1	1	1	1

2 Market Environments

Table 2: Notations of market environments explored in empirical game-theoretic analysis.

Env	LSHN	MSMN	HSLN
Fundamental Shock Variance σ_s^2	10^5	5×10^5	10^6
Observation Noise Variance σ_n^2	10^9	10^6	10^3

3 Approximate Strategic Equilibria

Table 3: Equilibria for games where the exploiter does not spoof. Each row of the table describes one equilibrium found with its corresponding background surplus, total surplus and HBL adoption rate. Results reported are based on at least 20,000 simulation runs.

Env	K	95% CI background surplus	95% CI total surplus	HBL fraction
LSHN	K0	[42121, 42329]	[42548, 42694]	1.00
LSHN	K1	[41848, 42048]	[42254, 42396]	0.98
LSHN	K1	[41769, 41977]	[42264, 42406]	0.92
LSHN	K2	[41788, 42000]	[42205, 42347]	0.997
LSHN	K4	[41572, 41772]	[42046, 42188]	0.89
MSMN	K0	[41958, 42220]	[42274, 42388]	0.67
MSMN	K1	[41902, 42164]	[42210, 42324]	0.67
MSMN	K1	[41849, 42107]	[42170, 42284]	0.60
MSMN	K1	[41801, 42067]	[42167, 42281]	0.68
MSMN	K2	[41742, 42000]	[42123, 42237]	0.66
MSMN	K4	[41693, 41924]	[42116, 42230]	0.47
MSMN	K4	[38809, 39025]	[39367, 39485]	0.012
HSLN	K0	[41529, 41871]	[41974, 42088]	0.59
HSLN	K0	[41698, 42040]	[42102, 42216]	0.67
HSLN	K0	[41625, 41973]	[42021, 42135]	0.67
HSLN	K1	[41417, 41769]	[41869, 41983]	0.66
HSLN	K2	[41377, 41655]	[41776, 41890]	0.38
HSLN	K2	[39728, 39972]	[40484, 40594]	0
HSLN	K2	[38691, 38965]	[39419, 39537]	0
HSLN	K4	[39557, 39803]	[40256, 40374]	0
HSLN	K4	[39558, 39804]	[40290, 40408]	0

Table 4: Equilibria for games where the exploiter does not spoof. Each row of the table describes one equilibrium found with its corresponding mixture of background strategies.

Env	K	ZI ₁	ZI ₂	ZI ₃	ZI ₄	ZI ₅	ZI ₆	ZI ₇	ZI ₈	ZI ₉	HBL ₁	HBL ₂	HBL ₃	HBL ₄
LSHN	K0	0	0	0	0	0	0	0	0	0	0.70	0	0	0.30
LSHN	K1	0	0	0.02	0	0	0	0	0	0	0.73	0	0	0.25
LSHN	K1	0.05	0	0.03	0	0	0	0	0	0	0	0.88	0	0.04
LSHN	K2	0	0	0	0	0	0	0.003	0	0	0	0.856	0	0.141
LSHN	K4	0	0	0.11	0	0	0	0	0	0	0.29	0.60	0	0
MSMN	K0	0	0	0.33	0	0	0	0	0	0	0.51	0.16	0	0
MSMN	K1	0.11	0.01	0.21	0	0	0	0	0	0	0	0.14	0.53	0
MSMN	K1	0	0.20	0.20	0	0	0	0	0	0	0.20	0.15	0.25	0
MSMN	K1	0	0	0.32	0	0	0	0	0	0	0.14	0.39	0.03	0.12
MSMN	K2	0	0.15	0	0.19	0	0	0	0	0	0.11	0.40	0.15	0
MSMN	K4	0.20	0	0.33	0	0	0	0	0	0	0.40	0	0.07	0
MSMN	K4	0	0	0	0	0	0	0.674	0.312	0.002	0	0	0.012	0
HSLN	K0	0	0	0.12	0	0	0	0.29	0	0	0.49	0.10	0	0
HSLN	K0	0	0	0	0.33	0	0	0	0	0	0.66	0	0	0.01
HSLN	K0	0	0	0	0.19	0.14	0	0	0	0	0	0.50	0.17	0
HSLN	K1	0.05	0	0	0.29	0	0	0	0	0	0	0.09	0.57	0
HSLN	K2	0.27	0.35	0	0	0	0	0	0	0	0.08	0	0.30	0
HSLN	K2	0.03	0.29	0.13	0	0	0	0	0	0.55	0	0	0	0
HSLN	K2	0	0	0	0	0	0	0.25	0.34	0.41	0	0	0	0
HSLN	K4	0	0.35	0	0	0	0	0.65	0	0	0	0	0	0
HSLN	K4	0	0.36	0	0	0	0	0.64	0	0	0	0	0	0

3.1 Markets with spoofing summary

Table 5: Equilibria for games where the exploiter strategically chooses to spoof. Each row of the table describes one equilibrium found with its corresponding background surplus, total surplus, HBL and spoofing adoption rate. Results reported are based on at least 20,000 simulation runs.

Env	K	95% CI background surplus	95% CI total surplus	HBL fraction	Spoofing fraction
LSHN	K0	[41693, 41893]	[42243, 42389]	0.95	1.00
LSHN	K1	[41848, 42048]	[42254, 42396]	0.98	0.00
LSHN	K2	[41788, 42000]	[42205, 42347]	0.997	0.00
LSHN	K4	[41564, 41764]	[42010, 42152]	0.90	0.08
LSHN	K4	[41572, 41772]	[42046, 42188]	0.89	0.00
MSMN	K0	[41652, 41902]	[42151, 42265]	0.65	1.00
MSMN	K0	[41622, 41884]	[42106, 42220]	0.66	1.00
MSMN	K1	[41902, 42164]	[42210, 42324]	0.67	0.00
MSMN	K1	[41849, 42107]	[42170, 42284]	0.60	0.00
MSMN	K1	[41801, 42067]	[42167, 42281]	0.68	0.00
MSMN	K1	[41749, 42031]	[42146, 42260]	0.72	0.71
MSMN	K2	[41700, 41946]	[42109, 42223]	0.54	0.90
MSMN	K4	[41655, 41883]	[42111, 42225]	0.48	0.62
MSMN	K4	[38809, 39025]	[39367, 39485]	0.012	0.00
HSLN	K0	[41538, 41882]	[42047, 42161]	0.69	1.00
HSLN	K1	[41417, 41769]	[41869, 41983]	0.66	0.00
HSLN	K1	[41039, 41345]	[41593, 41707]	0.48	1.00
HSLN	K2	[41080, 41342]	[41719, 41833]	0.28	1.00
HSLN	K4	[39557, 39803]	[40256, 40374]	0	0.00
HSLN	K4	[39558, 39804]	[40290, 40408]	0	0.00

Table 6: Equilibria for games where the exploiter strategically chooses to spoof. Each row of the table describes one equilibrium found with its corresponding mixture of background strategies.

Env	K	ZI ₁	ZI ₂	ZI ₃	ZI ₄	ZI ₅	ZI ₆	ZI ₇	ZI ₈	ZI ₉	HBL ₁	HBL ₂	HBL ₃	HBL ₄
LSHN	K0	0	0	0	0.05	0	0	0	0	0	0.95	0	0	0
LSHN	K1	0	0	0.02	0	0	0	0	0	0	0.73	0	0	0.25
LSHN	K2	0	0	0	0	0	0	0.003	0	0	0	0.856	0	0.141
LSHN	K4	0	0	0.10	0	0	0	0	0	0	0.38	0.52	0	0
LSHN	K4	0	0	0.11	0	0	0	0	0	0	0.29	0.60	0	0
MSMN	K0	0	0.19	0	0.16	0	0	0	0	0	0.65	0	0	0
MSMN	K0	0	0.20	0	0	0	0	0.14	0	0	0.61	0.05	0	0
MSMN	K1	0.11	0.01	0.21	0	0	0	0	0	0	0	0.14	0.53	0
MSMN	K1	0	0.20	0.20	0	0	0	0	0	0	0.20	0.15	0.25	0
MSMN	K1	0	0	0.32	0	0	0	0	0	0	0.14	0.39	0.03	0.12
MSMN	K1	0.28	0	0	0	0	0	0	0	0	0	0.51	0.21	0
MSMN	K2	0	0	0.46	0	0	0	0	0	0	0.35	0	0.19	0
MSMN	K4	0	0.52	0	0	0	0	0	0	0	0.46	0	0	0.02
MSMN	K4	0	0	0	0	0	0	0.674	0.312	0.002	0	0	0.012	0
HSLN	K0	0	0	0	0.31	0	0	0	0	0	0.69	0	0	0
HSLN	K1	0.05	0	0	0.29	0	0	0	0	0	0	0.09	0.57	0
HSLN	K1	0	0	0	0.33	0	0	0.19	0	0	0.08	0.40	0	0
HSLN	K2	0	0.72	0	0	0	0	0	0	0	0	0	0.28	0
HSLN	K4	0	0.35	0	0	0	0	0.65	0	0	0	0	0	0
HSLN	K4	0	0.36	0	0	0	0	0.64	0	0	0	0	0	0