TABLE 1: Descriptive Statistics (Pseudo Data)

Variable	MEAN	St.dev	5\%	25\%	50\%	75\%	95\%
Quoted Spread - Cents	12.70	3.57	8.87	9.97	11.63	14.20	21.30
Effective Spread - Cents	7.16	2.16	4.87	5.51	6.30	8.28	12.24
Price Improvement - Cents	5.54	1.43	4.00	4.46	5.25	5.92	9.06
Market Maker Revenues - Cents	0.84	2.24	-4.72	0.09	1.13	1.46	4.94
Trades - 1,000s/day	72.59	31.17	34.51	49.60	59.67	96.68	130.88
Number of auctions - 1,000s/day	24.04	9.72	12.39	16.46	21.61	31.86	42.95
Trade size - Contracts	3.28	8.69	1.00	1.00	1.00	3.00	10.00
Trade size - 1,000s \$	4.62	33.28	0.10	0.50	1.29	3.22	15.20
Dollar volume - Billions \$/day	0.34	0.21	0.10	0.18	0.25	0.53	0.80
Options traded - anonymized	.	.	.	.	.	.	.
Trade Price - $	14.15	4.25	9.70	10.92	12.84	15.56	25.19
Call Volume - %	71.88	5.73	63.30	66.92	71.95	76.32	80.53
Put Volume - %	28.12	5.73	19.47	23.68	28.05	33.08	36.70
Days-to-expiration - Days	13.59	3.06	9.12	11.60	13.11	15.06	20.31
|Delta|	0.36	0.02	0.31	0.35	0.36	0.37	0.39
Stock Midpoint - $	213.17	26.32	178.70	194.18	205.47	231.94	257.60
Market Capitalization & \$ Billion	224.87	171.97	29.10	33.44	223.68	367.05	583.21

This table presents descriptive statistics computed using pseudo OPRA data provided online. Option symbols have been removed due to data restrictions; therefore, the number of options traded is set to missing.

TABLE 2: Wholesaler Summary (Pseudo Data) - PANEL A

DMM	Marketable PFOF (\$M)	Marketable PFOF(\%)	Marketable PFOF (Per 100)	Marketable Contract Purch. (M.)	Marketable Contract Purch. (\%)
Citadel	33.01	45.64	47.74	62.92	44.61
Susquehanna	24.04	33.24	50.37	41.31	29.26
Wolverine	6.05	8.38	45.96	11.92	8.44
Dash	5.55	7.72	47.26	12.58	8.95
Morgan	2.46	3.36	39.86	4.88	3.43
WEX	0.25	0.36	31.66	0.79	0.58
Group_One	0.60	0.85	14.77	5.95	4.23
Two_Sigma	0.29	0.39	47.85	0.60	0.42
Matrix	0.04	0.05	31.67	0.11	0.07
Citigroup	0.04	0.06	38.57	0.12	0.09
GTS	0.00	0.00	0.00	0.00	0.00
Goldman	0.00	0.00	0.00	0.00	0.00
XR	0.00	0.00	0.00	0.00	0.00

This table presents payment for orderflow (PFOF) and wholesaler assignment metrics using Rule 606 data and pseudo OPRA data. Due to data restrictions, options and stock symbols are removed; all columns with counts have been set to missing

TABLE 2: Wholesaler Summary (Pseudo Data) - PANEL B

DMM	NMLO PFOF (\$M)	NMLO PFOF(\%)	NMLO PFOF (Per 100)	NMLO Contract Purch. (M.)	NMLO Contract Purch. (\%)
Citadel	31.10	46.34	50.93	54.50	45.44
Susquehanna	18.15	27.02	49.79	32.13	26.76
Wolverine	8.07	12.03	47.46	14.64	12.20
Dash	4.63	6.91	46.80	9.67	8.07
Morgan	2.74	4.04	39.27	5.02	4.16
WEX	1.80	2.68	58.44	2.87	2.39
Group_One	0.45	0.67	61.23	0.73	0.61
Two_Sigma	0.15	0.22	47.56	0.31	0.26
Matrix	0.09	0.12	43.10	0.19	0.15
Citigroup	0.04	0.06	42.58	0.09	0.08
GTS	0.00	0.00	0.00	0.00	0.00
Goldman	0.00	0.00	0.00	0.00	0.00
XR	0.00	0.00	0.00	0.00	0.00

This table presents payment for orderflow (PFOF) and wholesaler assignment metrics using Rule 606 data and pseudo OPRA data. Due to data restrictions, options and stock symbols are removed; all columns with counts have been set to missing

TABLE 2: Wholesaler Summary (Pseudo Data) - PANEL C

DMM	OO PFOF (\$M)	OO PFOF(\ %)	OO PFOF (Per 100)	OO Contract Purch. (M.)	OO Contract Purch. (\%)
Citadel	8.32	41.14	46.55	21.26	43.46
Susquehanna	4.99	24.72	48.84	11.45	23.42
Wolverine	1.30	6.40	51.01	2.95	6.02
Dash	3.60	17.77	40.38	8.58	17.52
Morgan	1.35	6.70	39.81	3.16	6.48
WEX	0.07	0.34	28.39	0.12	0.25
Group_One	0.53	2.64	42.16	1.27	2.59
Two_Sigma	0.01	0.04	47.61	0.01	0.03
Matrix	0.06	0.26	38.95	0.11	0.21
Citigroup	0.05	0.24	40.49	0.10	0.22
GTS	0.00	0.00	0.00	0.00	0.00
Goldman	0.00	0.00	0.00	0.00	0.00
XR	0.00	0.00	0.00	0.00	0.00

This table presents payment for orderflow (PFOF) and wholesaler assignment metrics using Rule 606 data and pseudo OPRA data. Due to data restrictions, options and stock symbols are removed; all columns with counts have been set to missing

TABLE 2: Wholesaler Summary (Pseudo Data) - PANEL D

DMM	Exchanges (\#)	\# Symbols Auction PImpr	Assignments (%)	Options (\#)	Options (%)	Auctions (%)	Price Improvement
Citadel						1.43	1.92
Susquehanna						50.23	8.40
Wolverine						18.96	8.07
Dash						.	.
Morgan						10.42	7.22
WEX						.	.
Group_One						.	.
Two_Sigma						0.01	1.96
Matrix						.	.
Citigroup						0.01	6.34
GTS						18.21	7.66
Goldman						0.49	2.15
XR						0.24	17.83

This table presents payment for orderflow (PFOF) and wholesaler assignment metrics using Rule 606 data and pseudo OPRA data. This table presents payment for orderflow (PFOF) and wholesaler assignment metrics using Rule 606 data and pseudo OPRA data. Due to data restrictions, options and stock symbols are removed; all columns with counts have been set to missing

TABLE 3: Exchange Summary (Pseudo Data)

Exchange	Group	Volume	LOB Volume	PCTSUM_AUC_CHAR	Auction Volume	Model	Auctions
PHLX	NASDAQ	15.44	1.06	14.38	DMMP	PFOF	Yes
GEMX	NASDAQ	10.17	9.98	0.19	DMMP	MT	Yes
CBOE	CBOE	7.56	1.91	5.65	DMMP	PFOF	Yes
MIAX	MIAMI	6.89	1.68	5.21	DMMP	PFOF	Yes
ARCA	ICE	6.85	6.85	.	DMMP	PFOF	No
AMEX	ICE	5.84	2.80	3.04	DMMP	PFOF	Yes
MRX	NASDAQ	2.74	0.52	2.23	DMMP	MT	Yes
ISE	NASDAQ	0.69	0.50	0.19	DMMP	PFOF	Yes
BX	NASDAQ	0.60	0.60	0.00	DMMP	MT	Yes
NOM	NASDAQ	11.24	11.24	.	Non-DMMP	MT	No
EMERALD	MIAMI	10.06	10.06	.	Non-DMMP	MT	No
BATS	CBOE	9.76	9.76	.	Non-DMMP	MT	No
BOX	TMX	3.79	2.69	1.10	Non-DMMP	MT	Yes
EDGX	CBOE	3.71	3.03	0.68	Non-DMMP	PFOF	Yes
PEARL	MIAMI	3.32	3.32	.	Non-DMMP	MT	No
Cboe C2	CBOE	1.33	1.33	.	Non-DMMP	MT	No

This table presents statistics on option exchanges using pseudo OPRA data provided online.

TABLE 4: Option Exchanges and Execution Costs (Pseudo Data)

Exchange	LOB QS	LOB ES	LOB Price Impr.	LOB EQ	AUC QS	AUC ES	AUC Price Impr.	AUC EQ
PHLX	18.30	15.56	2.74	0.90	13.73	4.16	9.56	0.35
GEMX	11.62	9.37	2.26	0.86	10.08	8.19	1.89	0.71
CBOE	14.13	10.48	3.65	0.78	13.73	4.29	9.44	0.34
MIAX	12.96	11.80	1.15	0.95	14.21	4.52	9.69	0.36
ARCA	14.60	13.72	0.88	0.96	.	.	.	.
AMEX	14.07	13.42	0.64	0.98	15.47	4.34	11.13	0.32
MRX	17.94	17.21	0.73	0.98	12.66	4.88	7.78	0.44
ISE	20.94	19.74	1.20	0.96	11.20	6.69	4.50	0.61
BX	14.09	12.12	1.97	0.91	11.97	8.84	3.12	0.71
NOM	12.12	8.20	3.93	0.73	.	.	.	.
EMERALD	12.97	8.92	4.05	0.78	.	.	.	.
BATS	15.48	7.39	8.09	0.56	.	.	.	.
BOX	21.84	13.19	8.66	0.75	13.66	5.69	7.98	0.50
EDGX	15.86	9.25	6.61	0.66	9.12	2.89	6.23	0.37
PEARL	17.10	10.11	6.99	0.67	.	.	.	.
Cboe C2	14.91	8.36	6.56	0.61	.	.	.	.

This table presents execution cost variables across option exchanges using pseudo OPRA data provided online.

Table 5: Execution Costs (Pseudo Data) - PANEL A

Group	All	PFOF	NPFOF	PFOF - NPFOF	\\
Quoted Spread - Cents	12.54	12.89	11.87	1.02	\\
				& (1.28)	\\
Effective Spread - Cents	4.05	4.00	4.14	-0.14	\\
				& (0.38)	\\
Price Improvement - Cents	8.49	8.88	7.72	1.16	\\
				& (0.91)	\\
Trade size Contracts - $	3.86	3.96	3.68	0.28\twoS	\\
				& (0.11)	\\
Trade Price - $	11.73	11.88	11.40	0.48	\\
				& (1.16)	\\
Stock Midpoint - $	281.76	281.98	281.42	0.56	\\
				& (23.52)	\\
EQ	0.37	0.36	0.39	-0.04\threeS	\\
				& (0.01)	\\
Market Maker Revenues - Cents	-2.00	-2.09	-1.83	-0.26	\\
				& (0.70)	\\
Hedge Cost - Cents	6.05	6.08	5.97	0.12	\\
				& (0.84)	\\

This table presents execution costs for trades that execute in auctions or continuous trading using pseudo OPRA data provided online.

Table 5: Execution Costs (Pseudo Data) - PANEL B

Group	All	PFOF	NPFOF	PFOF - NPFOF	\\
Quoted Spread - Cents	12.78	13.10	12.72	0.38	\\
				& (1.19)	\\
Effective Spread - Cents	8.70	11.97	8.05	3.92\threeS	\\
				& (0.95)	\\
Price Improvement - Cents	4.08	1.13	4.67	-3.54\threeS	\\
				& (0.29)	\\
Trade size Contracts - $	3.04	3.03	3.05	-0.02	\\
				& (0.08)	\\
Trade Price - $	15.37	19.37	14.52	4.85\twoS	\\
				& (2.20)	\\
Stock Midpoint - $	282.28	282.49	282.25	0.24	\\
				& (23.10)	\\
EQ	0.75	0.95	0.71	0.24\threeS	\\
				& (0.01)	\\
Market Maker Revenues - Cents	2.24	5.06	1.68	3.38\threeS	\\
				& (0.90)	\\
Hedge Cost - Cents	6.40	6.83	6.32	0.51	\\
				& (0.89)	\\

This table presents execution costs for trades that execute in auctions or continuous trading using pseudo OPRA data provided online.

Appendix TABLE A5: PANEL A

Group	All	PFOF	NPFOF	PFOF - NPFOF
Quoted Spread - Cents	6.18	5.64	6.98	-1.34
				& (0.80)
Effective Spread - Cents	6.18	5.64	6.98	-1.34
				& (0.80)
Price Improvement - Cents	0.00	0.00	0.00	-0.00\threeS
				& (0.00)
Trade size Contracts - $	5.77	5.55	6.11	-0.56\oneS
				& (0.27)
Trade Price - $	6.13	6.01	6.30	-0.29
				& (0.70)
Stock Midpoint - $	281.62	281.62	281.62	0.01
				& (23.67)
EQ	1.00	1.00	1.00	0.00\threeS
				& (0.00)
Market Maker Revenues - Cents	2.04	1.51	2.84	-1.33\oneS
				& (0.71)
Hedge Cost - Cents	4.14	4.12	4.14	-0.01
				& (0.63)

Appendix TABLE A5: PANEL B

Group	ALL	PFOF	NPFOF	PFOF - NPFOF
Quoted Spread - Cents	3.85	3.77	3.97	-0.20
				& (0.25)
Effective Spread - Cents	2.85	2.77	2.97	-0.20
				& (0.25)
Price Improvement - Cents	1.00	1.00	1.00	0.00\threeS
				& (0.00)
Trade size Contracts - $	4.34	4.32	4.38	-0.06
				& (0.20)
Trade Price - $	3.61	3.55	3.71	-0.16
				& (0.35)
Stock Midpoint - $	281.37	281.37	281.36	0.01
				& (23.71)
EQ	0.59	0.57	0.61	-0.04\twoS
				& (0.02)
Market Maker Revenues - Cents	0.05	0.07	0.02	0.05
				& (0.34)
Hedge Cost - Cents	2.79	2.69	2.95	-0.25
				& (0.38)

Appendix TABLE A5: PANEL C

Group	All	PFOF	NPFOF	PFOF - Non-PFOF
Quoted Spread - Cents	12.85	13.98	9.92	4.06\twoS
				& (1.12)
Effective Spread - Cents	5.25	5.55	4.61	0.94\twoS
				& (0.45)
Price Improvement - Cents	7.60	8.43	5.31	3.12\threeS
				& (0.75)
Trade size Contracts - $	5.21	5.25	5.20	0.05
				& (0.35)
Trade Price - $	12.90	14.11	9.78	4.33\twoS
				& (1.38)
Stock Midpoint - $	282.30	282.49	281.82	0.67
				& (23.31)
EQ	0.47	0.45	0.53	-0.08\threeS
				& (0.01)
Market Maker Revenues - Cents	-1.24	-1.30	-0.86	-0.44
				& (0.70)
Hedge Cost - Cents	6.48	6.85	5.47	1.39
				& (0.86)

TABLE 6:Execution Quality, Auctions and PFOF DMMs (Pseudo Data) - PANEL A

Variable	Quoted Spread	Effective Spread	Price Improvement	EQ	Market Maker Revenues
Auction	2.361\threeS	-3.667\threeS	6.028\threeS	-0.408\threeS	-3.737\threeS
	(0.213)	(0.290)	(0.471)	(0.008)	(0.282)
PFOF	-0.934\threeS	1.695\threeS	-2.630\threeS	0.127\threeS	1.783\threeS
	(0.260)	(0.225)	(0.310)	(0.007)	(0.217)
Auction $\times$ PFOF	1.879\threeS	-2.578\threeS	4.457\threeS	-0.199\threeS	-2.701\threeS
	(0.365)	(0.251)	(0.449)	(0.006)	(0.251)
DMMP	-1.547\threeS	1.221\threeS	-2.769\threeS	0.134\threeS	1.229\threeS
	(0.234)	(0.163)	(0.295)	(0.011)	(0.157)
$\vert$Delta$\vert$	40.804\threeS	21.818\threeS	18.985\threeS	-0.039\threeS	8.930\threeS
	(4.213)	(2.295)	(1.938)	(0.007)	(2.025)
Gamma	-96.835\twoS	-48.442\twoS	-48.393\twoS	0.441\threeS	-53.847\twoS
	(39.958)	(20.469)	(19.904)	(0.117)	(23.751)
Vega	52.642\threeS	29.940\threeS	22.702\threeS	0.013\threeS	22.626\threeS
	(6.082)	(3.686)	(2.579)	(0.005)	(3.285)
Underlying Volatility$_{t-1}$	13.795\threeS	8.566\threeS	5.228\threeS	0.029\threeS	
	(3.246)	(1.541)	(1.712)	(0.009)	
Underlying Quoted Spr.	0.406\threeS	0.216\threeS	0.190\threeS	0.000	
	(0.054)	(0.029)	(0.025)	(0.000)	
1/Option Midpoint	2.279\threeS	1.260\threeS	1.019\threeS	0.001	1.262\threeS
	(0.392)	(0.232)	(0.165)	(0.002)	(0.251)
1/Underlying Midpoint	-5600.59\threeS	-5694.15\threeS	93.561	-28.113\twoS	-5485.90\threeS
	(1706.514)	(1845.166)	(935.028)	(13.353)	(1714.940)
Underlying MCAP	18.367	8.529	9.838\oneS	-0.027	15.944
	(9.661)	(7.186)	(4.324)	(0.043)	(7.829)
Trade size	0.142\oneS	0.197\threeS	-0.055\oneS	0.009\threeS	0.207\threeS
	(0.079)	(0.064)	(0.032)	(0.001)	(0.060)
Call	-1.866\threeS	-1.384\threeS	-0.482\threeS	-0.009\threeS	-1.380\threeS
	(0.307)	(0.190)	(0.162)	(0.002)	(0.181)
Days-to-Expiry	0.731	0.125	0.606	-0.009\threeS	-0.485

	(1.148)	(0.580)	(0.584)	(0.001)	(0.609)
Tick Size	9.816\threeS	5.294\threeS	4.522\threeS	-0.015\threeS	5.518\threeS
	(1.288)	(0.676)	(0.624)	(0.003)	(0.716)
Buy	0.107	0.045	0.062	-0.004\oneS	0.029
	(0.125)	(0.110)	(0.091)	(0.002)	(0.113)
Rsq	0.366	0.310	0.182	0.297	0.170
NObs	1161488	1161488	1161488	1161488	1161488

This table presents regression results for execution quality using pseudo OPRA data.

TABLE 6:Execution Quality, Auctions and PFOF DMMs (Pseudo Data) - PANEL B

Variable	Quoted Spread	Effective Spread	Price Improvement	EQ	Market Maker Revenues
Auction	1.572\threeS	-3.680\threeS	5.253\threeS	-0.374\threeS	-3.773\threeS
	(0.240)	(0.323)	(0.449)	(0.010)	(0.312)
PFOF	-1.685\threeS	1.901\threeS	-3.586\threeS	0.185\threeS	1.934\threeS
	(0.282)	(0.149)	(0.279)	(0.008)	(0.149)
Auction $\times$ PFOF	2.292\threeS	-2.602\threeS	4.894\threeS	-0.237\threeS	-2.781\threeS
	(0.447)	(0.279)	(0.550)	(0.006)	(0.302)
DMMP	-1.276\threeS	0.399\threeS	-1.675\threeS	0.059\threeS	0.399\threeS
	(0.305)	(0.107)	(0.343)	(0.010)	(0.106)
$\vert$Delta$\vert$	40.937\threeS	21.456\threeS	19.481\threeS	-0.065\threeS	8.771\threeS
	(4.449)	(2.493)	(2.003)	(0.005)	(2.483)
Gamma	-114.526\twoS	-61.450\threeS	-53.076\twoS	0.244\twoS	-69.510\twoS
	(43.841)	(21.854)	(22.687)	(0.094)	(26.517)
Vega	52.023\threeS	31.616\threeS	20.408\threeS	0.013\twoS	24.790\threeS
	(5.690)	(3.812)	(2.194)	(0.006)	(3.477)
Underlying Volatility$_{t-1}$	12.269\threeS	7.870\threeS	4.399\threeS	0.012\twoS	
	(2.065)	(1.091)	(1.030)	(0.006)	
Underlying Quoted Spr.	0.442\threeS	0.215\threeS	0.227\threeS	-0.001\threeS	
	(0.068)	(0.036)	(0.032)	(0.000)	
1/Option Midpoint	2.167\threeS	1.250\threeS	0.917\threeS	0.002	1.227\threeS
	(0.415)	(0.261)	(0.165)	(0.002)	(0.278)
1/Underlying Midpoint	-5069.26\threeS	-3751.81\threeS	-1317.45	-15.553\twoS	-3629.55\threeS
	(1551.374)	(958.394)	(980.403)	(6.431)	(681.348)
Underlying MCAP	21.158\oneS	8.782	12.376\twoS	-0.064	16.054\oneS
	(8.686)	(6.521)	(4.355)	(0.037)	(6.818)
Trade size	0.058	0.221\threeS	-0.163\threeS	0.012\threeS	0.249\threeS
	(0.059)	(0.060)	(0.057)	(0.001)	(0.062)
Call	-1.790\threeS	-1.272\threeS	-0.518\threeS	0.000	-1.276\threeS
	(0.326)	(0.191)	(0.150)	(0.002)	(0.184)
Days-to-Expiry	0.541	-0.170	0.710	-0.012\threeS	-0.811

	(1.278)	(0.650)	(0.655)	(0.002)	(0.694)
Tick Size	9.726\threeS	5.733\threeS	3.993\threeS	-0.003	5.962\threeS
	(1.430)	(0.800)	(0.649)	(0.003)	(0.824)
Buy	0.164	0.044	0.119	-0.002	0.020
	(0.122)	(0.104)	(0.094)	(0.001)	(0.113)
Rsq	0.367	0.315	0.194	0.449	0.185
NObs	494022.0	494022.0	494022.0	494022.0	494022.0

This table presents regression results for execution quality using pseudo OPRA data.

Appendix TABLE A4 - PANEL A

Variable	Quoted Spread	Effective Spread	Price Improvement	Market Maker Revenues
Auction	0.330\threeS	-0.384\threeS	0.714\threeS	-0.397\threeS
	(0.032)	(0.041)	(0.038)	(0.042)
PFOF	0.146\threeS	0.322\threeS	-0.176\threeS	0.300\threeS
	(0.052)	(0.042)	(0.028)	(0.043)
Auction $\times$ PFOF	-0.027	-0.431\threeS	0.404\threeS	-0.417\threeS
	(0.046)	(0.045)	(0.022)	(0.045)
DMMP	-0.160\threeS	0.111\threeS	-0.271\threeS	0.121\threeS
	(0.028)	(0.018)	(0.034)	(0.020)
$\vert$Delta$\vert$	-1.847\threeS	-1.100\threeS	-0.748\threeS	-0.081
	(0.094)	(0.066)	(0.033)	(0.203)
Gamma	26.865\threeS	18.677\threeS	8.188\threeS	-11.183
	(4.031)	(3.396)	(1.213)	(8.343)
Vega	-2.193\threeS	-1.469\threeS	-0.724\threeS	-1.364\threeS
	(0.204)	(0.163)	(0.104)	(0.205)
Underlying Volatility$_{t-1}$	1.179\threeS	0.764\threeS	0.415\threeS	
	(0.229)	(0.141)	(0.092)	
Underlying Quoted Spr.	0.038\threeS	0.021\threeS	0.017\threeS	
	(0.003)	(0.002)	(0.001)	
1/Underlying Midpoint	-855.542\threeS	-782.176\threeS	-73.366	-1135.59\threeS
	(254.692)	(234.945)	(164.429)	(255.835)
Underlying MCAP	3.996\threeS	2.607\twoS	1.389\twoS	3.988\threeS
	(1.183)	(0.992)	(0.534)	(1.087)
Trade size	0.051\threeS	0.062\threeS	-0.011\oneS	0.065\threeS
	(0.014)	(0.012)	(0.005)	(0.012)
Call	-0.212\threeS	-0.174\threeS	-0.039\threeS	-0.407\threeS
	(0.050)	(0.041)	(0.014)	(0.089)
Days-to-Expiry	0.517\threeS	0.337\threeS	0.180\threeS	0.359\threeS
	(0.103)	(0.074)	(0.042)	(0.088)
Tick Size	2.075\threeS	1.212\threeS	0.862\threeS	0.853\threeS
	(0.178)	(0.121)	(0.072)	(0.129)

Buy	0.059\twoS	0.050\twoS	0.008	0.046\oneS
	(0.022)	(0.024)	(0.008)	(0.025)
Rsq	0.220	0.162	0.141	0.123
NObs	1161488	1161488	1161488	1161488

Appendix TABLE A4 - PANEL B

Variable	Quoted Spread	Effective Spread	Price Improvement	EQ	Market Maker Revenues
Auction	0.216\threeS	-0.392\threeS	0.608\threeS	-0.374\threeS	-0.406\threeS
	(0.033)	(0.047)	(0.029)	(0.010)	(0.050)
PFOF	-0.020	0.278\threeS	-0.298\threeS	0.185\threeS	0.264\threeS
	(0.024)	(0.029)	(0.020)	(0.008)	(0.027)
Auction $\times$ PFOF	0.064\oneS	-0.360\threeS	0.424\threeS	-0.237\threeS	-0.358\threeS
	(0.038)	(0.029)	(0.045)	(0.006)	(0.029)
DMMP	-0.095\threeS	0.052\threeS	-0.148\threeS	0.059\threeS	0.064\threeS
	(0.017)	(0.016)	(0.024)	(0.010)	(0.016)
$\vert$Delta$\vert$	-1.799\threeS	-1.114\threeS	-0.685\threeS	-0.065\threeS	-0.202
	(0.072)	(0.042)	(0.038)	(0.005)	(0.195)
Gamma	26.761\threeS	17.965\threeS	8.796\threeS	0.244\twoS	-7.615
	(4.159)	(3.564)	(1.180)	(0.094)	(7.456)
Vega	-2.019\threeS	-1.372\threeS	-0.647\threeS	0.013\twoS	-1.322\threeS
	(0.267)	(0.164)	(0.141)	(0.006)	(0.213)
Underlying Volatility$_{t-1}$	0.989\threeS	0.660\threeS	0.329\threeS	0.012\twoS	
	(0.136)	(0.103)	(0.062)	(0.006)	
Underlying Quoted Spr.	0.037\threeS	0.019\threeS	0.019\threeS	-0.001\threeS	
	(0.003)	(0.002)	(0.001)	(0.000)	
1/Underlying Midpoint	-942.967\twoS	-676.709\twoS	-266.258\oneS	-15.553\twoS	-1046.50\threeS
	(416.871)	(276.233)	(150.444)	(6.431)	(329.299)
Underlying MCAP	2.971	1.914	1.057	-0.064	4.204\oneS
	(1.665)	(1.113)	(0.908)	(0.037)	(1.783)
Trade size	0.045\twoS	0.060\threeS	-0.014	0.012\threeS	0.062\threeS
	(0.017)	(0.013)	(0.009)	(0.001)	(0.013)
Call	-0.244\threeS	-0.163\threeS	-0.081\threeS	0.000	-0.413\threeS
	(0.060)	(0.041)	(0.026)	(0.002)	(0.093)
Days-to-Expiry	0.529\threeS	0.350\threeS	0.179\threeS	-0.012\threeS	0.397\threeS
	(0.123)	(0.081)	(0.052)	(0.002)	(0.095)
Tick Size	1.982\threeS	1.123\threeS	0.859\threeS	-0.003	0.769\threeS

	(0.143)	(0.102)	(0.051)	(0.003)	(0.114)
Buy	0.050\threeS	0.039\oneS	0.011\oneS	-0.002	0.038
	(0.018)	(0.021)	(0.006)	(0.001)	(0.022)
Rsq	0.214	0.153	0.170	0.449	0.126
NObs	494022.0	494022.0	494022.0	494022.0	494022.0

TABLE 7: PFOF Volume (Pseudo Data) - Panel A

Variable	All	AUCTION	Continuous	SMALL-AUCTION	SMALL-Continuous	LARGE_AUCTION	LARGE_LOB
YES	36.28	22.86	13.42	8.83	7.38	14.03	6.04
NO	63.72	9.79	53.92	4.29	26.36	5.50	27.57

This table presents distribution and regression results for PFOF versus Non-PFOF option volume using pseudo OPRA data.

TABLE 7: PFOF Volume (Pseudo Data) - Panel B - All Trades

Variable	All	Contract <=5	Contract >5
PFOF	2.121\threeS	1.801\twoS	2.509\threeS
	(0.672)	(0.688)	(0.850)
DMMP	-2.284\threeS	-2.295\threeS	-2.359\threeS
	(0.546)	(0.535)	(0.790)
R^{2}	0.012\threeS	0.012\threeS	0.007\threeS
NObs	768.000	768.000	768.000
Stock Fixed	Yes	Yes	Yes

This table presents distribution of volume and regression results for PFOF versus Non-PFOF option volume using pseudo OPRA data.

TABLE 7: PFOF Volume (Pseudo Data) Panel C - Auctions

Variable	All	Contract <=5	Contract >5
PFOF	7.622\threeS	6.692\threeS	7.466\threeS
	(1.389)	(1.264)	(2.001)
DMMP	4.106\threeS	4.174\threeS	5.199\oneS
	(1.002)	(0.998)	(1.249)
RSq	0.092	0.087	0.068
NObs	480.000	480.000	480.000
Stock Fixed	Yes	Yes	Yes

This table presents distribution of volume and regression results for PFOF versus Non-PFOF option volume using pseudo OPRA data.

TABLE 7: PFOF Volume (Pseudo Data) - Panel D - Continuous Trading

Variable	All	Contract <=5	Contract >5
PFOF	0.454	0.511	0.737
	(0.671)	(0.712)	(0.833)
DMMP	-5.021\threeS	-4.923\threeS	-5.347\threeS
	(0.592)	(0.596)	(0.736)
RSq	0.057	0.055	0.037
NObs	768.000	768.000	768.000
Stock Fixed	Yes	Yes	Yes

This table presents distribution of volume and regression results for PFOF versus Non-PFOF option volume using pseudo OPRA data.

TABLE 8: Auction LPM (Pseudo Data)

Variable	REG1	REG2	REG3
PFOF	0.233\threeS	0.233\threeS	0.230\threeS
	(0.013)	(0.013)	(0.013)
Arbitrage$_{t-1}$	-0.115\threeS		-0.114\threeS
	(0.014)		(0.014)
Option Quoted Spread		0.009	0.098\threeS
		(0.006)	(0.008)
DMMP	0.377\threeS	0.377\threeS	0.375\threeS
	(0.012)	(0.012)	(0.011)
$\vert$Delta$\vert$			-0.108\threeS
			(0.009)
Gamma			0.279\oneS
			(0.164)
Vega			-0.067\threeS
			(0.014)
Underlying Quoted Spr.			0.002\threeS
			(0.000)
1/Option Midpoint			-0.004
			(0.003)
1/Underlying Midpoint			23.758
			(26.698)
Underlying MCAP			-0.081
			(0.088)
Trade size			0.021\threeS
			(0.002)
Call			0.021\threeS
			(0.006)
Days-to-Expiry			-0.025\threeS
			(0.006)
Tick Size			-0.021\threeS
			(0.005)
Buy			-0.003
			(0.003)

Rsq	0.340	0.339	0.350
NObs	1161488	1161488	1161488

This table presents results from a linear probability model for auctions using pseudo OPRAdata.

TABLE 9: PFOF LPM: DMMs' Execution Quality Comparison (Pseudo Data)

Variable	(2)	(3)	(4)
EQ Above Average$_{t-1}$	0.001		
	(0.001)		
Price Improvement Below Average$_{t-1}$		0.001	
		(0.001)	
Auction Frequency Below Average$_{t-1}$			-0.001
			(0.002)
Contract Purchases (\%)	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Option Quoted Spread	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Gamma	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)
Vega	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
$\vert$Delta$\vert$	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Trade size	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Underlying Quoted Spread	0.003	0.003	0.003
	(0.003)	(0.003)	(0.003)
Call	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Tick Size	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Days-to-Expiry	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
1/Underlying Midpoint	-35.305\twoS	-35.454\twoS	-35.730\twoS
	(16.414)	(16.432)	(16.586)
1/Option Midpoint	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Underlying MCAP	-0.117\oneS	-0.117\twoS	-0.118\twoS
	(0.057)	(0.057)	(0.057)

Date FE	Yes	Yes	Yes
Underlying FE	Yes	Yes	Yes
RSq	0.156	0.156	0.156
NObs	251600.0	251600.0	251600.0

This table presents results from a linear probability model for auctions at exchanges where the designated market maker (DMM) pays payment for orderflow (PFOF) using Rule 606 data and pseudo OPRA data

Table 10: PFOF LPM: DMMs' Execution Quality Comparison with Competitors (Pseudo Data)

Variable	(2)	(3)	(4)
EQ Above$_{t-1}$	0.000		
	(0.000)		
Price Improvement Below$_{t-1}$		0.001	
		(0.000)	
Auction Frequency Below$_{t-1}$			0.001
			(0.000)
Contracts Purchased (\%)	0.000\twoS	0.000\oneS	0.000\oneS
	(0.000)	(0.000)	(0.000)
$\vert$Delta$\vert$	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Option QS	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
GAMMA	-0.006	-0.005	-0.005
	(0.004)	(0.004)	(0.004)
VEGA	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Stock QS	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)
1/Option Midpoint	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
1/Stock Midpoint	-7.860\oneS	-10.233	-10.233
	(4.509)	(6.654)	(6.654)
MCAP	-0.032\oneS	-0.037	-0.037
	(0.016)	(0.022)	(0.022)
Trade size	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Call	-0.000\oneS	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Days-to-Exp	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Tick Size	-0.000	-0.000	-0.000

	(0.000)	(0.000)	(0.000)
Buy	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
RSq	0.179	0.164	0.164
Date FE	Yes	Yes	Yes
NObs	251600.0	251600.0	251600.0
Underlying FE	Yes	Yes	Yes

This table presents results from a linear probability model for auctions at exchanges where the designated market maker (DMM) pays payment for orderflow (PFOF) Rule 606 DMMs using Rule 606 data and pseudo OPRA data.

Table 11: PFOF Auctions and Competition (Pseudo Data)

Variable	EQ	Price Improvement
PFOF	0.104	-0.769
	(0.081)	(28.355)
EQ Above$t-1$	-0.074	
	(0.086)	
PFOF$\times EQ Above_{t-1}$	0.109	
	(0.086)	
Price Improvement Below$t-1$		-0.866
		(27.975)
PFOF$\times Price Improvement Below$t-1$		0.000
		(27.971)
Contract Purchases (\%)	-0.000	-0.009
	(0.000)	(0.010)
$\vert$Delta$\vert$	-0.145\threeS	28.819\threeS
	(0.009)	(3.313)
Gamma	0.285\twoS	-112.824\threeS
	(0.131)	(27.422)
Vega	0.017\oneS	45.046\threeS
	(0.009)	(3.874)
Underlying Quoted Spr.	-0.105\threeS	26.569\threeS
	(0.017)	(2.996)
1/Option Midpoint	-0.002	1.519\threeS
	(0.002)	(0.294)
1/Underlying Midpoint	-14.434	-3347.79\twoS
	(13.420)	(1590.066)
Underlying MCAP	-0.024	12.339
	(0.051)	(8.480)
Trade size	0.016\threeS	-0.268\threeS
	(0.001)	(0.076)
Call	0.013\threeS	-1.633\threeS
	(0.002)	(0.323)
Days-to-Expiry	-0.019\threeS	-0.670
	(0.003)	(0.627)

Tick Size	-0.013\threeS	6.620\threeS
	(0.004)	(1.075)
Buy	-0.002	0.183
	(0.003)	(0.127)
RSq	0.029	0.342
NObs	251600.0	251600.0
Date FE	Yes	Yes
Underlying FE	Yes	Yes

This table presents regression results for PFOF effective spread to quoted spread (EQ), price improvement and competition for auctions at exchanges where the designated market maker (DMM) pays payment for orderflow (PFOF) using Rule 606 data and pseudo OPRA data.

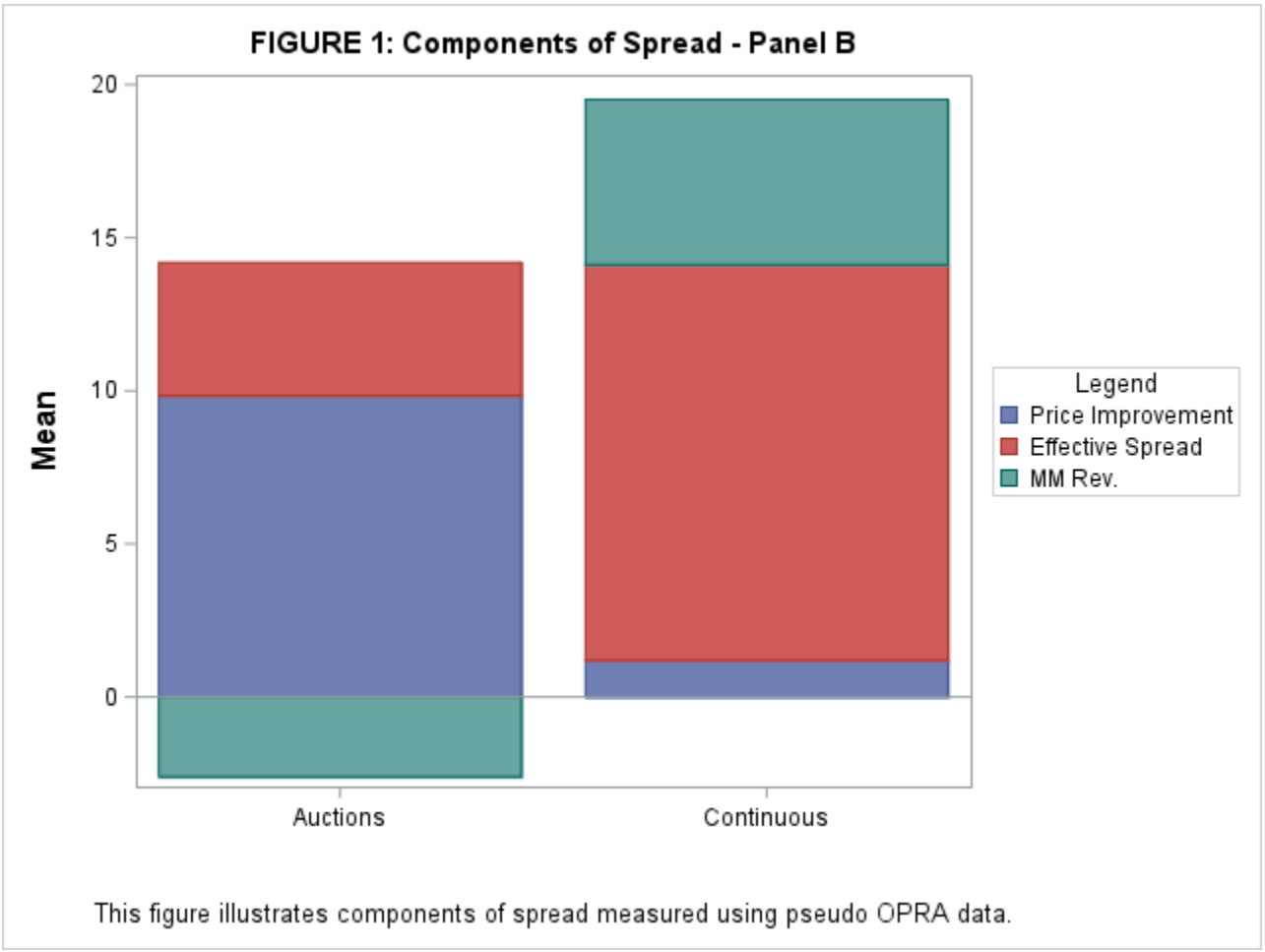
FIGURE 1: Components of Spread - Panel B
Mean
20
15
10
5
0
Auctions
Continuous
Legend
Price Improvement
Effective Spread
MM Rev.
This figure illustrates components of spread measured using pseudo OPRA data.

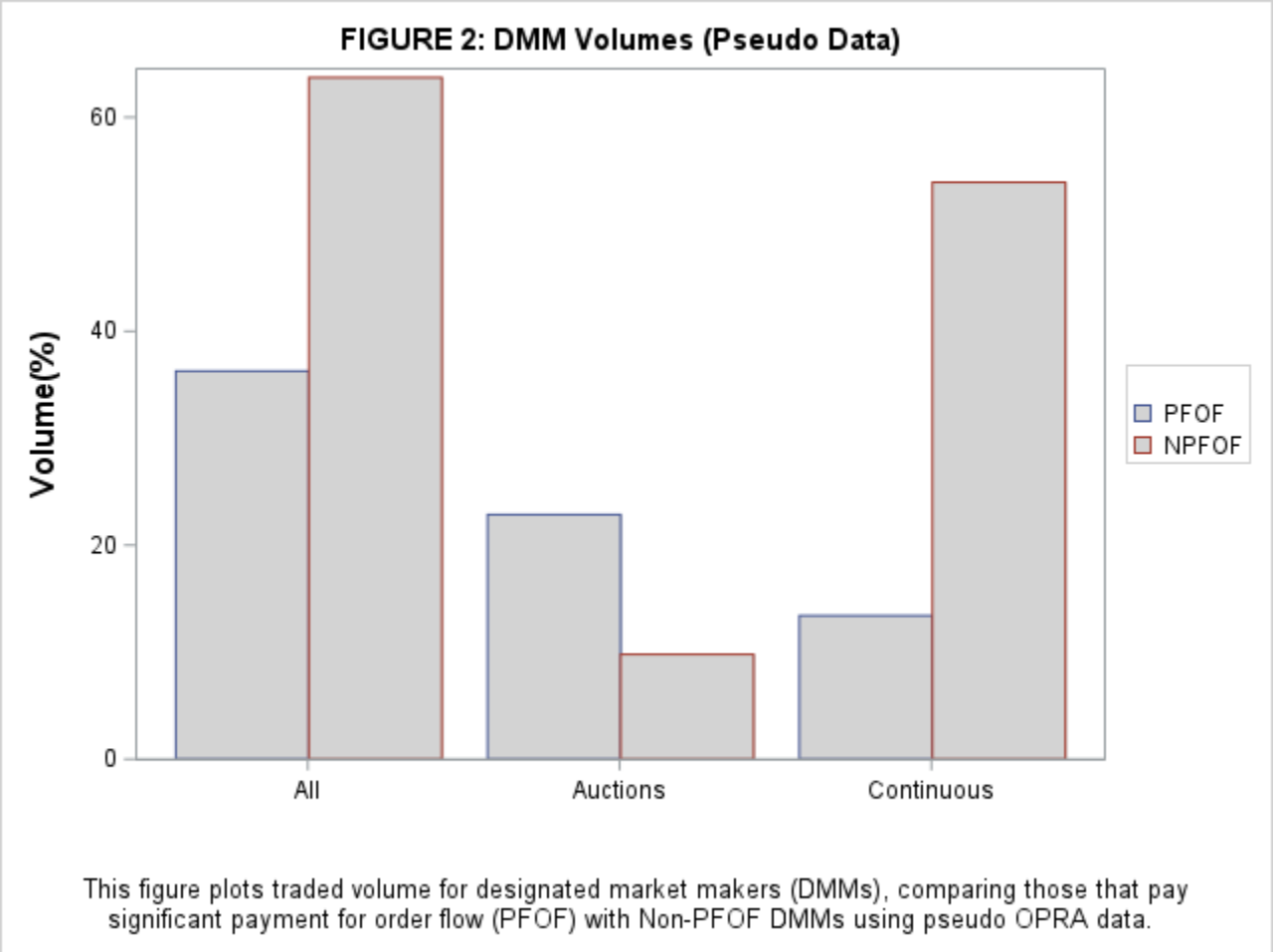
FIGURE 2: DMM Volumes (Pseudo Data)
Volume(%)
60
40
20
0
All
Auctions
Continuous
PFOF
NPFOF
This figure plots traded volume for designated market makers (DMMs), comparing those that pay significant payment for order flow (PFOF) with Non-PFOF DMMs using pseudo OPRA data.

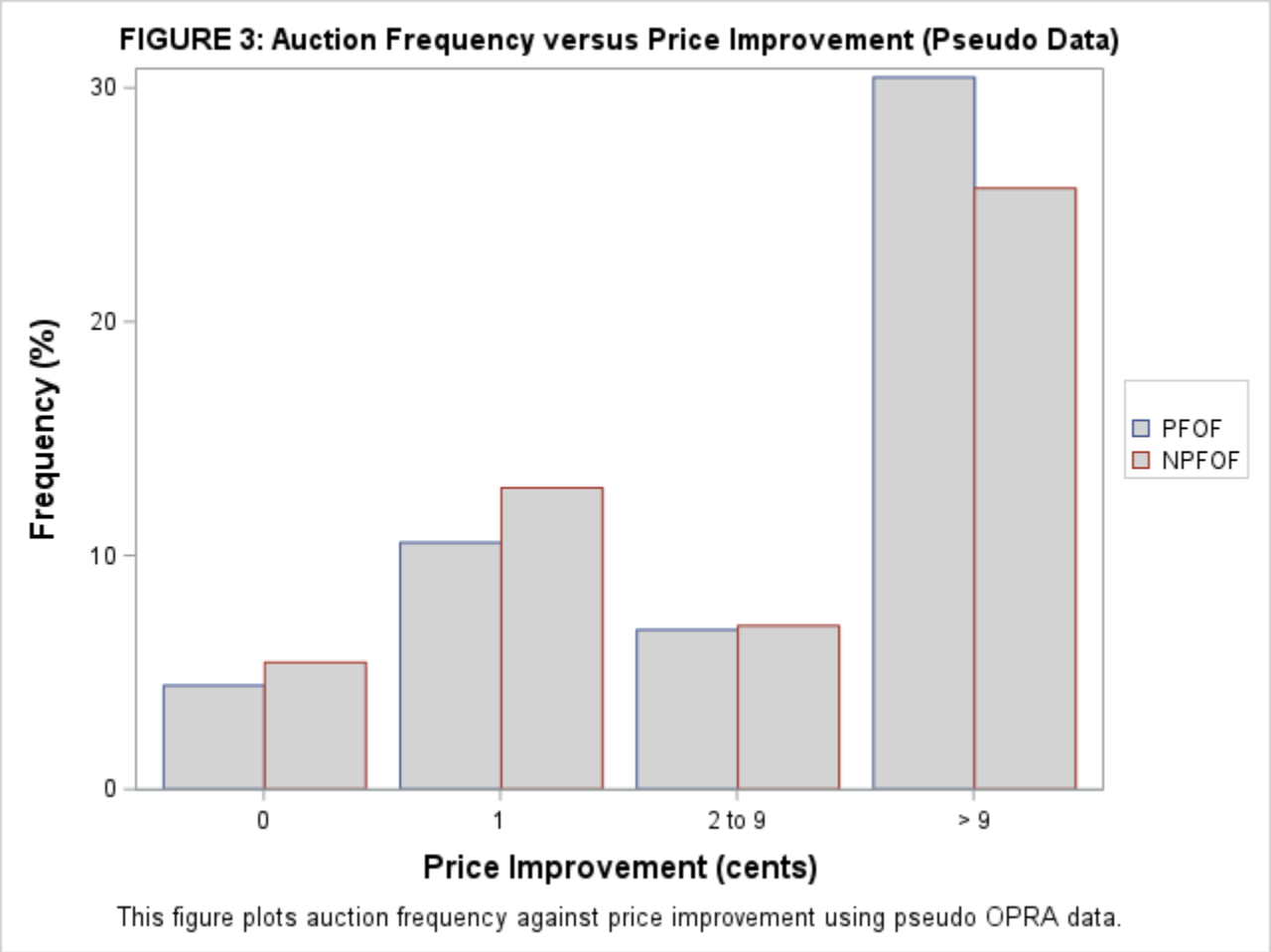
FIGURE 3: Auction Frequency versus Price Improvement (Pseudo Data)
Frequency (%)
30
20
10
0
0
1
2 to 9
> 9
Price Improvement (cents)
PFOF
NPFOF
This figure plots auction frequency against price improvement using pseudo OPRA data.

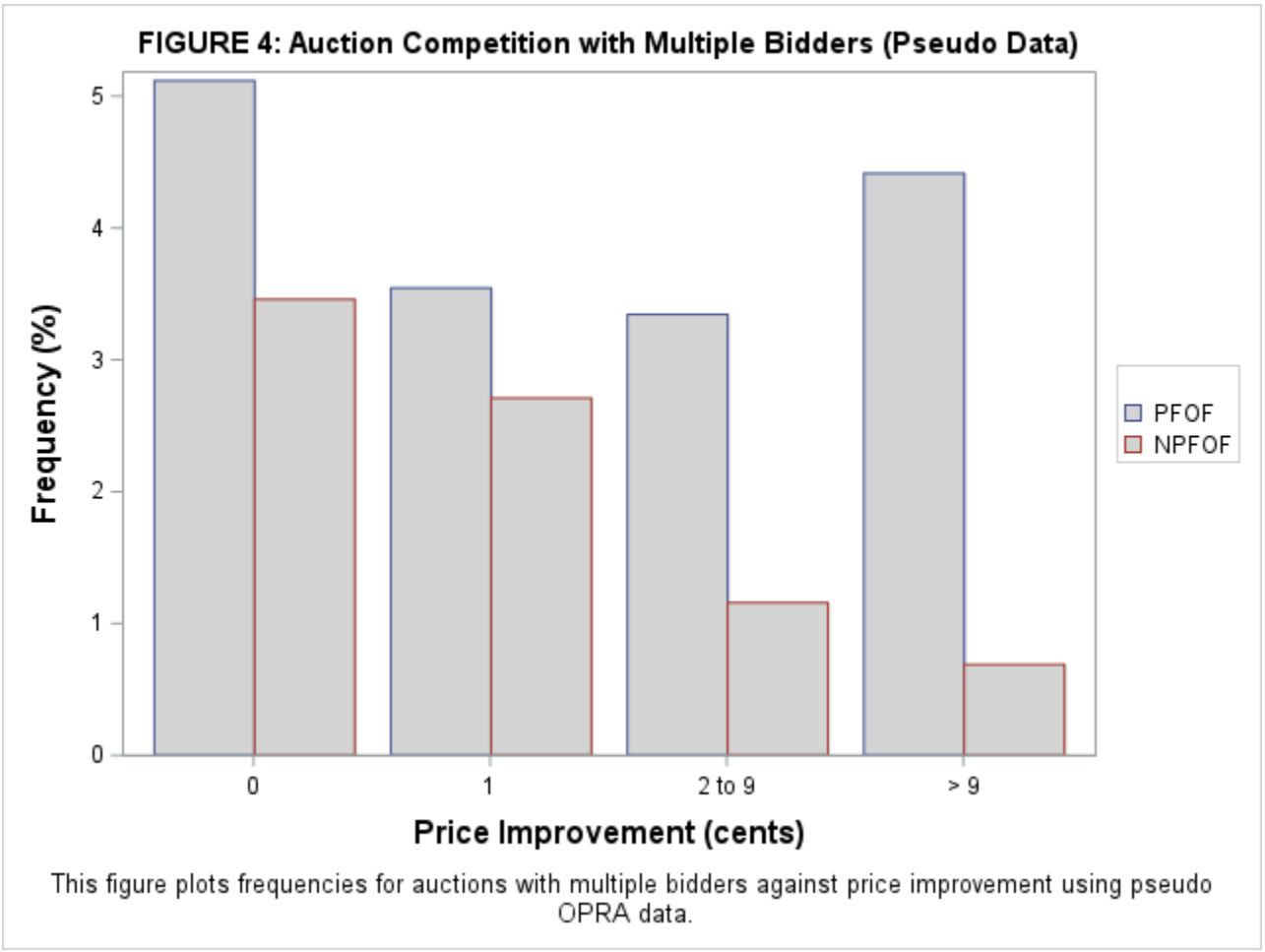
FIGURE 4: Auction Competition with Multiple Bidders (Pseudo Data)
Frequency (%)
0
1
2
3
4
5
0
1
2 to 9
> 9
Price Improvement (cents)
PFOF
NPFOF
This figure plots frequencies for auctions with multiple bidders against price improvement using pseudo OPRA data.