

Is liquidity provision informative? Evidence from agricultural futures markets

Forthcoming in *American Journal of Agricultural Economics*

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August 8, 2024

Motivation

- ▶ CME futures markets have transitioned into order-driven electronic trading.
 - Traders may use various order types to do trading, e.g., marketable order, limit order, complex orders, etc.
 - Massive limit order messages have sent to exchange every trading day.
 - Around 100k limit order messages in continuous trading sessions.
 - Best quote to trade ratio is greater than 20 on average.
 - Quote changes are much more frequent than transactions (trades).
- ▶ Are massive (limit) order messages really informative? Are they useful?
 - Patterns of limit orders in CME ag futures markets.
 - Informativeness of limit orders vs. trades: Price discovery.
 - How limit orders and/or trades contribute to the permanent (efficient) price?

Related literature

- ▶ In order-driven markets, both market and limit orders can incorporate information
 - ▶ Informed traders face a trade-off between market and limit orders
 - ▶ Market orders need to pay bid-ask spread while limit orders receive bid-ask spread.
 - ▶ Theory: Goettler, Parlour, and Rajan (2009, JFE); Hoffmann (2014, JFE)
 - ▶ Informed traders tend to face lower adverse selection costs.
 - ▶ Empirics: Ieming, Mizrahi, and Nguyen (2018); Brogaard, Hendershott, and Riordan (2019); Chaboud, Hjalmarsson, and Zikes (2021)

Related literature

- ▶ Price discovery in a single asset market
 - ▶ Informativeness of (various) trades and different type of limit orders.
 - ▶ Do they have permanent price impacts? – Moving fundamental value.
 - ▶ How do they contribute to the variance of permanent price movements? – information shares
 - ▶ Hasbrouck (1991, JF) VAR and subsequent extensions.
- ▶ Recent research (Arzandez and Frank, 2019) finds liquidity at deep depths in the book to be highly relevant in price discovery following Hasbrouck (1995, JF).
 - ▶ Their setting is not consistent with “one security, many markets” setting and midpoint prices down the book are not likely to represent the equilibrium prices.

Contributions

- ▶ Literature on the informativeness of limit orders and trades.
 - ▶ Most limit orders play the traditional role of uninformed liquidity provision
 - ▶ Challenging previous findings (Arzandeh and Frank, 2019) that emphasized the role of limit orders beyond the BBO in price discovery.
- ▶ Debate on fast trading in commodity markets .
 - ▶ e.g., Fishe, Haynes, and Onur (2019).
 - ▶ Providing direct evidence of limit order activity latency.
- ▶ A new dimension in the literature on price discovery during announcements.
 - ▶ Most previous studies focus on price behavior, such as volatility, which hardly reflects how trading strategies change around announcements.
 - ▶ Limit orders dominate price discovery during the pre-announcement period and trades play a major role after public information is released.
 - ▶ Consistent with Huang, Serra and Garcia (2022)'s findings.

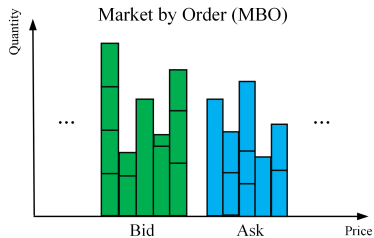
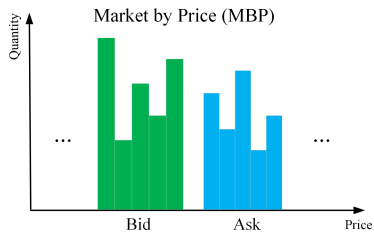
Data and institutional details

Data

- ▶ We use Market by Order (MBO) data from CME.
 - Message-based order-level data that records complete details of all limit orders.
 - Showing a complete history of a limit order.
 - Similar as ITCH data in Nasdaq.
- ▶ CME ag futures markets are electronically traded at CME Globex.
 - Two pre-open (batch auction) sessions and two continuous (day–08:30–13:20 and night–19:00–07:45) trading sessions.
 - Tick size is 0.25 cents/bushel with contract size 5,000 bushels. The price is quoted as cents/bushel (like ¢500.25/bushel rather than \$5.0025/bushel).
- ▶ Limit order messages include submissions, revisions, executions, and deletions.
 - Submission: A limit order is placed and a unique order ID is assigned for tracking.
 - Revision: Quantity and/or price changed. Revision messages show the updated info.
 - Execution: Trade summary with details of full or partial fill for a limit order.
 - Deletion: A limit order disappears after deletion.

Data and institutional details

MBO vs. MBP



Data and institutional details

Data

- ▶ Our sample period spans from January 7, 2019 to June 26, 2020, for CME corn, soybean, and wheat futures markets.
- ▶ We focus on the most-traded contract.
- ▶ We use MBO event time (tick) data as opposed to regularly resampled data, which allows to better measure price discovery.
- ▶ We only focus on revisions & deletions initiated by traders to avoid double counting, as when a limit order is partially executed (or concluded as full execution), a revision (deletion) message is automatically generated by CME to update the order.

Descriptive analysis

Limit order activities

	Corn					Soybean					Wheat				
	Mean	Std	Min	Med	Max	Mean	Std	Min	Med	Max	Mean	Std	Min	Med	Max
<i>Panel A: Number of limit orders and trades.</i>															
Limit orders ($\times 1000$)	71.88	27.27	14.53	65.41	217.49	111.38	31.28	21.60	108.86	266.01	60.69	16.50	29.14	58.23	126.18
Trades ($\times 1000$)	51.42	20.89	9.94	46.75	167.10	53.58	15.70	9.16	52.43	134.03	33.10	9.50	12.33	31.96	74.48
<i>Panel B: Limit order activity.</i>															
Execution rate (%)	27.82	3.39	18.98	27.70	36.31	24.45	2.98	13.19	24.59	32.13	27.77	3.39	15.39	28.02	35.63
Revision rate (%)	7.91	1.60	3.63	7.72	17.29	6.83	1.30	3.90	6.61	15.52	7.42	1.34	3.29	7.27	12.67
Deletion rate (%)	78.05	3.10	70.81	78.30	86.57	78.73	2.67	71.53	78.63	88.17	75.29	2.99	68.19	75.18	86.00
<i>Panel C: Limit order activity by aggressiveness.</i>															
Submission (BBO, %)	71.01	4.68	55.57	71.39	83.39	72.54	3.23	58.76	72.71	81.13	67.15	4.66	56.63	67.21	80.73
Submission (Non-BBO, %)	28.99	4.68	16.61	28.61	44.43	27.46	3.23	18.87	27.29	41.24	32.85	4.66	19.27	32.79	43.37
Execution (BBO, %)	35.19	5.09	19.06	34.70	47.54	29.95	3.89	15.16	30.02	40.89	36.33	3.61	23.81	36.70	44.77
Execution (Non-BBO, %)	10.28	2.09	5.38	10.02	22.74	10.07	1.65	5.67	9.97	16.01	10.51	2.55	4.12	10.46	17.62
Deletion (BBO, %)	73.07	4.68	61.02	73.37	87.62	74.22	3.49	64.85	74.26	86.65	67.95	3.28	60.03	67.60	78.81
Deletion (Non-BBO, %)	89.68	1.94	82.65	89.74	94.45	90.47	1.61	85.08	90.56	94.68	90.06	2.36	83.28	90.14	96.00
Revision (BBO, %)	6.78	1.74	2.58	6.52	16.65	5.18	1.47	2.23	4.90	15.71	4.59	1.00	2.33	4.43	7.84
Revision (Non-BBO, %)	10.64	2.87	5.30	10.17	34.63	11.14	1.88	6.64	11.13	16.73	13.36	2.98	5.33	13.66	22.53

Descriptive analysis

Limit order executions after revisions and before cancellations

	Corn			Soybean			Wheat		
	Total	BBO	Non-BBO	Total	BBO	Non-BBO	Total	BBO	Non-BBO
<i>Panel A: Executions after revisions.</i>									
Mean	41.94%	48.73%	33.11%	37.33%	43.36%	31.45%	41.87%	66.12%	25.34%
Std. Dev	7.38%	10.41%	7.67%	7.27%	10.77%	6.62%	6.86%	8.73%	6.91%
Min.	18.72%	15.37%	13.56%	11.53%	9.59%	13.67%	23.56%	41.66%	9.14%
Median	42.51%	49.25%	32.75%	37.89%	43.26%	31.84%	42.31%	67.93%	24.10%
Max.	62.10%	73.67%	50.72%	56.44%	67.88%	54.75%	60.50%	82.45%	48.06%
Diff.		t-stat.	23.30***		t-stat.	18.17***		t-stat.	70.63***
<i>Panel B: Executions before deletions.</i>									
Mean	8.34%	11.42%	2.37%	4.33%	5.67%	1.44%	4.36%	6.34%	1.32%
Std. Dev	1.39%	1.99%	0.66%	0.79%	1.07%	0.33%	0.91%	1.11%	0.45%
Min.	4.99%	6.50%	1.21%	1.77%	2.09%	0.66%	1.70%	2.56%	0.35%
Median	8.32%	11.38%	2.33%	4.43%	5.76%	1.41%	4.34%	6.36%	1.26%
Max.	12.70%	17.67%	8.46%	6.47%	8.85%	2.73%	6.93%	9.17%	3.16%
Diff.		t-stat.	83.30***		t-stat.	72.67***		t-stat.	81.14***

Descriptive analysis

Limit order activity latency during continuous trading sessions

	Corn			Soybean			Wheat		
	Total	BBO	Non-BBO	Total	BBO	Non-BBO	Total	BBO	Non-BBO
<i>Panel A: Execution latency—submission to the 1st execution.</i>									
Mean	506.51s	155.68s	3369.26s	293.74s	94.92s	1860.00s	326.93s	99.24s	1959.42s
Std. Dev	3154.06s	1042.88s	8547.12s	2197.17s	765.88s	5955.93s	2352.48s	776.64s	6152.50s
Min.	—	—	—	—	—	—	—	—	—
P25	0.81s	0.50s	62.94s	0.20s	0.08s	25.11s	0.31s	0.12s	28.41s
Median	11.53s	7.93s	330.88s	5.46s	3.76s	125.60s	7.54s	5.10s	133.53s
<i>Panel B: Deletion latency—submission to deletion.</i>									
Mean	935.67s	149.75s	2468.55s	446.88s	83.96s	1235.38s	598.70s	117.37s	1324.76s
Std. Dev	4818.60s	1243.50s	7869.94s	3077.50s	850.16s	5250.69s	3598.60s	1013.00s	5482.64s
Min.	238.42ns	238.42ns	0.16 μ s	—	238.42ns	—	—	—	—
P25	0.09s	0.02s	1.86s	0.02s	4.87ms	1.39s	0.10s	0.01s	1.77s
Median	4.33s	1.71s	38.87s	2.00s	0.87s	16.75s	4.74s	1.65s	21.91s
<i>Panel C: Revision latency—submission to the 1st revision.</i>									
Mean	711.39s	131.59s	1585.32s	343.88s	74.41s	680.49s	413.79s	101.62s	633.26s
Std. Dev	3778.42s	1135.67s	5707.96s	2425.09s	804.31s	3495.02s	2672.37s	904.20s	3386.88s
Min.	238.42ns	238.42ns	0.15 μ s	238.42ns	238.42ns	2.86 μ s	238.42ns	238.42ns	4.29 μ s
P25	0.19s	5.92ms	5.02s	0.01s	2.45ms	1.07s	0.81s	0.51s	1.00s
Median	8.29s	2.03s	52.55s	2.92s	0.60s	11.09s	8.01s	6.06s	9.90s

Price discovery

Informativeness of trades vs. limit orders

- ▶ Permanent price impacts
 - Contemporaneous price impacts are captured immediately after a trade/limit order activity. However, they contain transitory pricing errors.
 - We calculate permanent price impacts by cumulative IRF up to 150 steps (numerical evidence shows that cumulative IRF is stable at around 150 steps).
- ▶ Information shares
 - Information shares are calculated targeting the **permanent (efficient) price movement**.
- ▶ Public information arrival may change the price discovery. We investigate how the price discovery evolves around the USDA WASDE announcements.

Price discovery

Message categories

Aggressiveness	Variable name	Description
Move the BBO	<i>Trades – change price</i> ($Trades^{change}$)	Buy-initiated (+1) or sell-initiated (−1) trades that deplete full liquidity at the BBO and move the midpoint price.
	<i>Improving Submission</i> ($Submit^{improve}$)	Limit order placements either increasing the current best bid price (+1) or decreasing the current best ask price (−1).
	<i>Worsening cancellation</i> ($Cancel^{worsen}$)	Limit order cancellations either decreasing the current best bid (−1) price or increasing the current best ask price (+1).
At the BBO	<i>Trades – same price</i> ($Trades^{same}$)	Buy-initiated (+1) or sell-initiated (−1) trades that do not deplete full liquidity at the BBO and do not move the midpoint price.
	<i>Submission at BBO</i> ($Submit^{BBO}$)	Limit orders adding liquidity at the current best bid price (+1) or the current best ask price (−1).
	<i>Cancellation at BBO</i> ($Cancel^{BBO}$)	Limit orders removing liquidity at the current best bid price (−1) or the current best ask price (+1).
Behind the BBO	<i>Submission at Non-BBO</i> ($Submit^{Non-BBO}$)	Limit orders adding liquidity below the current best bid price (+1) or above the current best ask price (−1).
	<i>Cancellation at Non-BBO</i> ($Cancel^{Non-BBO}$)	Limit orders removing liquidity below the current best bid price (−1) or above the current best ask price (+1).

Price discovery

Msg frequency & contemporaneous price impacts

	Corn			Soybean			Wheat		
	# event	\$ values	Contemporaneous price impacts	# event	\$ values	Contemporaneous price impacts	# event	\$ values	Contemporaneous price impacts
<i>Panel A: Day trading session.</i>									
Trades – change price	0.15%	0.33%	3.32	0.23%	0.45%	1.40	0.30%	0.73%	2.45
Trades – same price	2.48%	1.98%		1.95%	2.49%		2.17%	2.86%	
Improving submission	0.34%	0.37%	3.32	0.72%	0.67%	1.40	0.88%	0.98%	2.45
Submission at BBO	22.53%	19.00%		21.11%	16.39%		17.24%	12.99%	
Submission at Non-BBO	29.20%	36.69%		33.56%	39.08%		34.50%	43.88%	
Worsening cancellation	0.13%	0.09%	3.32	0.27%	0.22%	1.40	0.33%	0.35%	2.45
Cancellation at BBO	21.69%	16.99%		21.48%	15.87%		16.84%	12.34%	
Cancellation at Non-BBO	26.95%	24.16%		29.30%	24.50%		31.47%	25.93%	
Median event time per day	332,078			581,801			346,433		
<i>Panel B: Night trading session.</i>									
Trades – change price	0.19%	0.40%	3.32	0.34%	0.71%	1.40	0.30%	0.59%	2.45
Trades – same price	2.40%	2.32%		2.25%	2.72%		2.14%	2.21%	
Improving submission	0.51%	0.62%	3.32	1.10%	1.18%	1.40	1.11%	1.19%	2.45
Submission at BBO	18.19%	15.06%		16.63%	12.30%		13.40%	9.95%	
Submission at Non-BBO	33.87%	40.38%		37.75%	42.94%		37.88%	45.45%	
Worsening cancellation	0.21%	0.18%	3.32	0.46%	0.39%	1.40	0.53%	0.45%	2.45
Cancellation at BBO	17.17%	13.15%		16.99%	11.80%		12.68%	9.13%	
Cancellation at Non-BBO	31.78%	27.55%		33.22%	27.10%		35.09%	31.02%	
Median event time per day	86,075			145,569			105,616		

Price discovery

Methodologies

- Our structural VAR model is defined as follows:

$$\underbrace{\begin{bmatrix} 1 & 0 & -a_{13} & -a_{14} & 0 & 0 & -a_{17} & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}}_A \underbrace{\begin{bmatrix} r_t \\ \text{trades}_t^{\text{same}} \\ \text{trades}_t^{\text{change}} \\ \text{submit}_t^{\text{improve}} \\ \text{submit}_t^{\text{BBO}} \\ \text{submit}_t^{\text{Non-BBO}} \\ \text{cancel}_t^{\text{worse}} \\ \text{cancel}_t^{\text{BBO}} \\ \text{cancel}_t^{\text{Non-BBO}} \end{bmatrix}}_{y_t} = \sum_{i=1}^p B_i \underbrace{\begin{bmatrix} r_{t-i} \\ \text{trades}_{t-i}^{\text{same}} \\ \text{trades}_{t-i}^{\text{change}} \\ \text{submit}_{t-i}^{\text{improve}} \\ \text{submit}_{t-i}^{\text{BBO}} \\ \text{submit}_{t-i}^{\text{Non-BBO}} \\ \text{cancel}_{t-i}^{\text{worse}} \\ \text{cancel}_{t-i}^{\text{BBO}} \\ \text{cancel}_{t-i}^{\text{Non-BBO}} \end{bmatrix}}_{y_{t-i}} + \underbrace{\begin{bmatrix} \epsilon_{1,t} \\ \epsilon_{2,t} \\ \epsilon_{3,t} \\ \epsilon_{4,t} \\ \epsilon_{5,t} \\ \epsilon_{6,t} \\ \epsilon_{7,t} \\ \epsilon_{8,t} \\ \epsilon_{9,t} \end{bmatrix}}_{\epsilon_t}$$

Price discovery

Information shares

- ▶ Following Hasbrouck (1991) and Chaboud, Hjalmarsson, and Zikes (2021)
 - Infinite Wold moving-average (Wold-MA) process

$$\mathbf{y}_t = \Phi_0 \epsilon_t + \Phi_1 \epsilon_{t-1} + \Phi_2 \epsilon_{t-2} + \dots$$

- Following Beveridge and Nelson (1981), the above equation can be decomposed as

$$\mathbf{y}_t = \tilde{\Phi}(1) \epsilon_t + s_t.$$

where $\tilde{\Phi}(1) = \sum_{i=0}^{\infty} \Phi_i$. For mid-quote return equation, $\tilde{\Phi}(1) \epsilon_t$ measures the permanent (**efficient**) component, while s_t are the returns generated by the transitory (**noise**) component.

Price discovery

Information shares

- ▶ The variance of the permanent component of \mathbf{y}_t is

$$\Omega = \tilde{\Phi}_1(1) \tilde{\Phi}_1(1)'$$

- ▶ The information share (IS) of the i th variable is defined as the contribution of variable i to the permanent variance of returns

$$IS_i = \frac{\tilde{\Phi}_{1i}(1)^2}{\sum_{j=1}^k \tilde{\Phi}_{1j}(1)^2} = \frac{\tilde{\Phi}_{1i}(1)^2}{\omega_{11}}.$$

where $\omega_{11} = \tilde{\Phi}_{11}(1)^2 + \dots + \tilde{\Phi}_{1k}(1)^2$. $\tilde{\Phi}_{1k}$ is the k th element in the first row of $\tilde{\Phi}_1(1)$.

Price discovery

Permanent price impacts

	Corn (bps)				Soybean (bps)				Wheat (bps)			
	Mean	Std.	Med	% sig.	Mean	Std.	Med	% sig.	Mean	Std.	Med	% sig.
<i>Panel A: Day trading session.</i>												
<i>Trades – change price</i>	3.23	1.39	3.08	100.00%	2.12	0.64	2.00	100.00%	8.23	2.46	8.09	99.73%
<i>Trades – same price</i>	0.71	0.37	0.64	100.00%	0.58	0.23	0.53	100.00%	1.99	0.85	1.95	99.46%
<i>Improving submission</i>	2.14	1.00	1.99	99.46%	1.66	0.64	1.58	100.00%	5.29	2.55	4.93	98.92%
<i>Submission at BBO</i>	0.13	0.13	0.09	98.92%	0.23	0.15	0.19	100.00%	1.15	0.68	1.01	100.00%
<i>Submission at Non-BBO</i>	−0.02	0.01	−0.01	56.18%	−0.01	0.01	−0.01	53.23%	−0.05	0.03	−0.04	25.81%
<i>Worsening cancellation</i>	4.14	2.65	3.73	89.25%	2.61	1.09	2.42	98.39%	7.52	3.21	6.94	97.58%
<i>Cancellation at BBO</i>	0.03	0.05	0.01	16.94%	0.08	0.09	0.05	43.01%	0.56	0.38	0.48	79.03%
<i>Cancellation at Non-BBO</i>	0.06	0.06	0.04	87.63%	0.08	0.06	0.08	53.23%	0.25	0.13	0.22	80.11%
<i>Panel B: Night trading session.</i>												
<i>Trades – change price</i>	7.78	4.89	6.35	98.37%	3.21	1.34	3.04	99.73%	14.19	5.45	13.33	99.46%
<i>Trades – same price</i>	1.00	0.64	0.81	89.40%	0.58	0.32	0.53	95.38%	2.66	1.38	2.40	96.74%
<i>Improving submission</i>	5.32	3.93	4.31	98.64%	1.94	1.04	1.75	99.73%	8.52	5.00	7.69	100.00%
<i>Submission at BBO</i>	0.25	0.27	0.15	73.91%	0.36	0.21	0.31	99.73%	1.67	1.01	1.52	98.91%
<i>Submission at Non-BBO</i>	−0.02	0.02	−0.01	4.08%	−0.01	0.01	−0.01	8.97%	0.01	0.05	0.01	1.90%
<i>Worsening cancellation</i>	9.82	7.68	7.97	89.67%	3.95	1.97	3.85	98.37%	13.14	7.16	12.46	96.20%
<i>Cancellation at BBO</i>	0.18	0.17	0.12	51.90%	0.23	0.14	0.19	86.68%	1.02	0.62	0.87	78.53%
<i>Cancellation at Non-BBO</i>	0.10	0.09	0.09	51.90%	0.10	0.05	0.09	80.98%	0.33	0.20	0.30	66.03%

Price discovery

Information share results

	Corn			Soybean			Wheat		
	Mean	Std.	Med	Mean	Std.	Med	Mean	Std.	Med
<i>Panel A: Day trading session.</i>									
Trades – change price	31.68%	17.23%	29.71%	29.13%	12.29%	27.48%	42.62%	15.18%	41.80%
Trades – same price	1.91%	2.02%	1.14%	2.31%	1.55%	1.94%	2.81%	2.03%	2.31%
Improving submission	14.88%	10.57%	12.10%	18.24%	10.54%	16.36%	18.08%	10.73%	16.36%
Submission at BBO	0.09%	0.14%	0.03%	0.41%	0.49%	0.25%	0.99%	1.00%	0.71%
Submission at Non-BBO	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Worsening cancellation	43.95%	22.74%	44.63%	40.47%	15.76%	39.49%	34.19%	14.94%	33.22%
Cancellation at BBO	0.01%	0.02%	0.00%	0.07%	0.14%	0.01%	0.24%	0.28%	0.15%
Cancellation at Non-BBO	0.02%	0.03%	0.00%	0.06%	0.07%	0.04%	0.05%	0.05%	0.03%
Limit total vs. Trades (<i>p</i> -value)	<0.001			<0.001			<0.001		
Improve vs. Worsen (<i>p</i> -value)	<0.001			<0.001			<0.001		
<i>Panel B: Night trading session.</i>									
Trades – change price	33.96%	20.76%	30.21%	33.59%	17.77%	32.58%	43.89%	20.92%	39.55%
Trades – same price	0.99%	1.64%	0.45%	1.32%	1.29%	0.90%	1.87%	1.93%	1.26%
Improving submission	16.76%	15.23%	12.38%	13.17%	10.45%	10.65%	16.54%	12.80%	13.47%
Submission at BBO	0.08%	0.20%	0.02%	0.48%	0.48%	0.33%	0.74%	0.81%	0.46%
Submission at Non-BBO	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Worsening cancellation	46.28%	23.18%	47.51%	45.41%	20.50%	45.65%	36.23%	19.66%	34.50%
Cancellation at BBO	0.03%	0.06%	0.01%	0.21%	0.25%	0.12%	0.28%	0.33%	0.18%
Cancellation at Non-BBO	0.01%	0.03%	0.00%	0.04%	0.04%	0.03%	0.03%	0.04%	0.02%
Limit total vs. Trades (<i>p</i> -value)	<0.001			<0.001			<0.001		
Improve vs. Worsen (<i>p</i> -value)	<0.001			<0.001			<0.001		

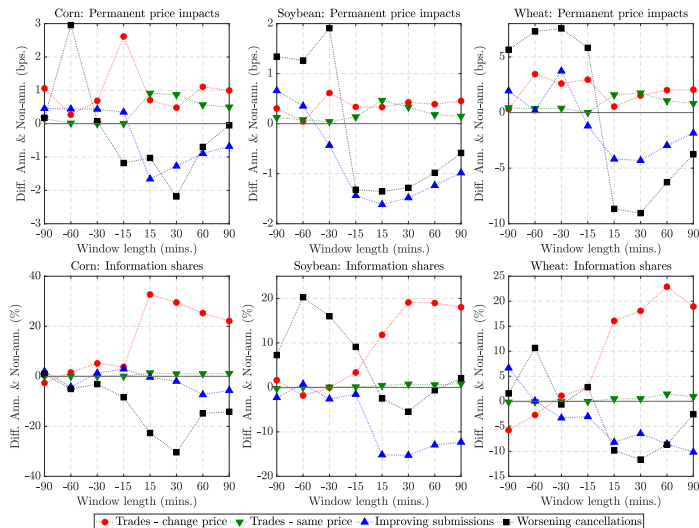
Price discovery

USDA WASDE announcements

- ▶ Following Fleming, Mizrach, and Nguyen (2018)
 - USDA WASDE announcements are released monthly at 11:00 CT.
 - we focus on time interval of 15, 30, 60, and 90 minutes before and after the WASDE announcements.
 - Non-announcement counterparts are selected five days preceding and following the announcements
 - We compare the permanent price impacts and information shares on announcement days with their non-announcement counterparts.
 - Our sample includes 17 announcement days and 170 non-announcement days for every market.

Price discovery

USDA WASDE announcements



Conclusions

- ▶ This paper investigates price discovery using message order-level data.
 - ▶ Around 75%-79% of the limit orders submitted are finally deleted, which contrasts with a much smaller proportion of these orders getting executed (25%-28%) or revised (7%-8%).
 - ▶ Latency of limit orders is low, with half of the limit orders being deleted, revised or executed within 5 to 12 seconds after their placement across markets.
 - ▶ Aggressive limit orders jointly contribute more to the price discovery than trades, while non-aggressive trades and limit orders play a marginal role.
 - ▶ We find an increased role of trades in price discovery while a decreased role of aggressive limit orders following releases of public information.

Practical implications

- ▶ Trades are not the only way that affects price discovery
 - ▶ Incorporating at least best-bid-offer data or enhanced market depth data.
- ▶ Market design
 - ▶ Most CME commodity futures markets have binding tick sizes where the bid-ask spreads are always one tick.
 - ▶ Werner et al. (2023) suggest that quotes are more likely to be heavily clustered at the top of book when the tick size is binding.
 - ▶ In this scenario, trades have limited ability to move the midpoint price.
 - ▶ Reducing (nominal) tick sizes may alter the informativeness of trades and limit orders.
 - ▶ Regulators might additionally consider requiring that quotes remain in the LOB for a specified duration unless matched to ensure bona fide limit order submission.

Thank you