

When do regulatory interventions work?

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Background

- Algorithmic and high frequency trading continue to be a source of concern globally.
- Exchanges contemplating actions to slow down fast traders – more recently, speed bumps by the futures exchanges (such as the Intercontinental Exchange, LME, Deutsche Borse's Eurex).
- Question: Do such interventions work in line with regulatory concerns?
- This paper: Examine the impact of one such intervention, the orders-to-trade ratio (OTR) fee.

The intervention, and the existing studies

- The intervention: Charge fees / penalise traders with high OTR.
- Rationale: High OTR is a negative externality for other market participants. Also, fears of market manipulation.
- Internationally, exchanges including the NASDAQ, OSE, Borsa Italian and TSX have implemented the fee.
- Existing studies: Friederich and Payne (2015) on the Italian Bourse, Jorgensen et al (2017) on OSE and Malinova et al (2018) on Canadian markets.
- Findings: OTRs decline, but market quality either worsens or remains same.

This paper

- Unique setting where the fee was implemented on the *same* market at *multiple* times, by *different regulators* with *different* objectives and *different* design. provides
- Un-fragmented trading, with almost all of derivatives trading at one exchange. Spot market of the same exchange has more than 75% share.
Measure direct and indirect impact of the fee.
- Microstructural features at NSE provide a neat identification strategy.
- Access to trader category data enables us to trace the trader-level impacts, and draw inferences on the underlying economic mechanism.

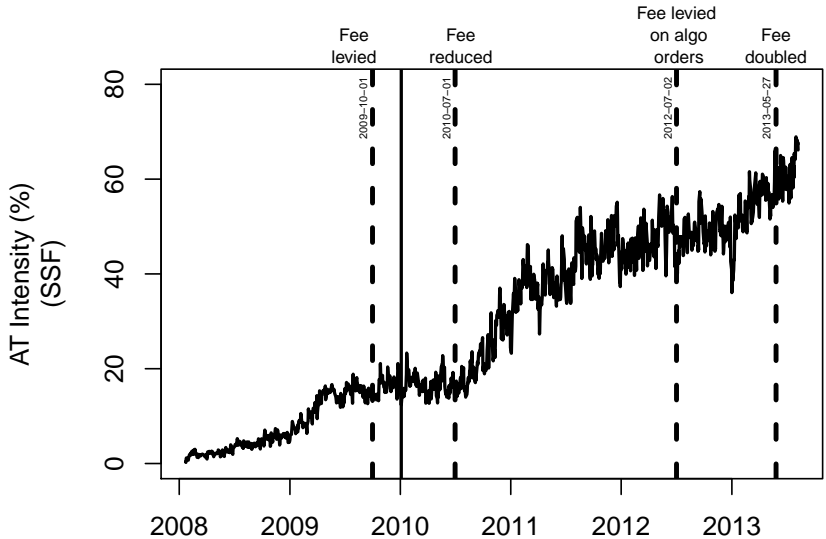
- **Impact when the exchange implemented the fee:**

- Significant **reduction** in the average OTR of the treated stocks on the SSF market relative to the control stocks.
- Significant **improvement** in liquidity and efficiency measures of these stocks.
- Evidence of migration to spot market based on high OTR
- Trader category impacts: **no impact** on institutional or proprietary order flow, **reduced** OTR for “retail” (non-institutional, non-proprietary) order flow.

- **Impact when the market regulator implemented the fee:**
 - **No significant impact** on either the OTR or any market quality variable.
 - Traders modified their behavior by placing orders where the fee did not apply.

Research setting

Rise of algorithmic trading in India, and the OTR fee



Implementation details

- 1 **2009-10**: Fee applied uniformly across **all** market participants and order types.
- 2 **2012-13**: Fee applicable on **algo** orders only on all order types with the following exemptions:
 - 1 Orders within +/-1% LTP price limits not included.
 - 2 Members covered under the LES excluded.
 - 3 Additional penalty of no trading in the first 15 minutes on the next trading day if OTR > 500.
- 3 Fee computed at a member level on a daily basis.
- 4 Fee implemented **only** on the derivatives segment.

- **Period analysed:** Three months around implementations
 - 1 Event 1: Imposition of OTR fee by NSE on Oct 1, 2009.
 - a) Pre event: Jul - Sep 2009
 - b) Post event: Oct - Dec 2009
 - 2 Event 2: Fee hike on SEBI direction on July 2, 2012
 - a) Pre event: Apr - Jun 2012
 - b) Post event: Jul - Sep 2012
- **Sample:** All securities traded on NSE equity segment.
- **Segment analysed:** Near month single stock futures and cash market.
- **Data used:** Tick by tick orders and trades data, with flags identifying if an order or a trade is AT or non AT, and trader category. Flag on type of order event: entry, modification or cancellation.

Issues in inference

- In both the events, the fee only implemented on the derivatives segment.
- Use cash market as control? Possible indirect effects:
 - ① Substitution effect: Higher cost of trading on derivatives turns traders to the cash market.
 - ② Both markets linked by arbitrage. Reduced trading on cash market as well.
- Hence, the inference based on cash market controls likely to be contaminated.

Identification strategy

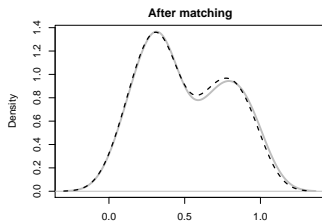
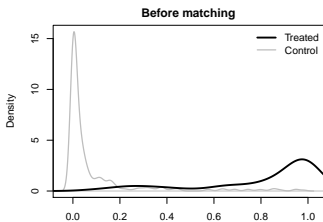
- NSE's eligibility criteria for selection of securities for derivatives trading:
 - ① Stock should be in the top 500 stocks in terms of average **daily market capitalisation** and **average daily traded value** in the previous six months on a rolling basis.
 - ② The stock's median quarter-sigma **order size** over the last six months shall be not less than Rs. 10 lakhs.
 - ③ The **market wide position limit** (determined by number of shares held by non-promoters) in the stock shall not be less than Rs. 300 crores.
- Some non-derivatives stocks will not meet the above criteria around the thresholds.
- We exploit this setting, and match non-derivative stocks with derivative stocks for each event.

Obtaining the set of matched firms

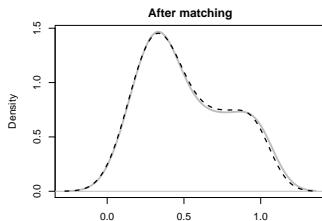
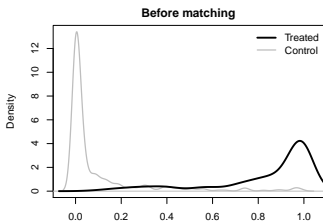
- Define
 - **'Treated'**: stocks with derivatives contract within the event window.
 - **'Comparison'**: stocks without derivatives contract.
- Match stocks using data **before** the fee implementation,
 - **Distance** measure: Propensity score.
 - **Covariates**: market cap, price, turnover, number of trades and percentage of floating stock.
 - One-to-one matching on estimated propensity scores using the nearest neighbor algorithm (without replacement), and a caliper of 0.05.

Empirical distribution of propensity scores before and after matching

Event 1



Event 2



Impact evaluation: diff-in-diff regression

- Use the treated and control (matched) stocks and estimate the following regression:

$$\begin{aligned} \text{MEASURE}_{i,t} = & \alpha + \beta_1 \times \text{TREATED}_i + \beta_2 \times \text{FEEDUMMY}_t + \\ & \beta_3 \times \text{TREATED}_i \times \text{FEEDUMMY}_t + \\ & \beta_4 \times \text{MCAP}_{i,t} + \beta_5 \times \text{INVERSE-PRICE}_{i,t} + \\ & \beta_6 \times \text{NIFTY-VOL}_t + \epsilon_{i,t} \end{aligned}$$

- Measure \in (OTR-measure, market quality measures).

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- Measure \in (OTR-measure, market quality measures).
- Identification assumption: common trends. Tests based on placebo DiD, visual inspection.
- **Hypothesis:** If the event did not have any impact on the level of OTR or market quality, $\beta_3 = 0$.

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- Identification assumption: common trends. Tests based on placebo DiD, visual inspection.
- **Hypothesis:** If the event did not have any impact on the level of OTR or market quality, $\beta_3 = 0$.
- Direct impact on SSF market: DiD regression of treated SSF stocks matched with control stocks on spot market.
- Indirect impact on the spot market: DiD regression of treated stocks on the spot market matched with control stocks on spot market.

Results

Impact on OTR

	Event 1		Event 2	
	Treated SSF- Control Spot	Treated Spot- Control Spot	Treated SSF- Control Spot	Treated Spot- Control Spot
Fee	0.422** (-2.087)	0.037 (1.711)	2.875** (3.188)	1.471** (3.315)
Treated	22.362** (15.115)	0.236** (3.878)	60.69** (8.685)	1.307 (0.854)
Treated \times Fee	-3.453** (-3.191)	0.325** (5.613)	7.41 (0.631)	4.419 (1.487)
Adjusted R ²	0.65	0.34	0.26	0.13
# of obs	6060	6715	7485	9515

Decomposing the source of OTR effects

OTR fee impact across trader classes, Event 1

NINP = retail; INST = institutional; PROP = proprietary

	Treated(SSF)-Control(Spot)			Treated(Spot)-Control(Spot)		
	OTR _{NINP}	OTR _{INST}	OTR _{PROP}	OTR _{NINP}	OTR _{INST}	OTR _{PROP}
Fee	-0.157 (-0.866)	0.091 (1.198)	-0.683 (-1.37)	0.038** (1.983)	0.028 (0.68)	0 (0)
Treated	16.355** (13.095)	3.972** (9.649)	39.261** (12.503)	0.208** (3.342)	-0.07 (-0.93)	0.08 (0.327)
Treated × Fee	-4.149** (-4.423)	-0.673 (-1.677)	-1.904 (-0.746)	0.131** (3.725)	-0.066 (-1.265)	0.894** (4.888)
Adjusted R ²	0.53	0.18	0.54	0.18	0.03	0.26
# of obs	6060	5253	6060	6715	6194	6715

OTR fee impact on orders placed beyond 1% LTP, Event 2

	Treated(SSF)-Control(Spot)	Treated(Spot)-Control(Spot)
	ORDERS-BEYOND	ORDERS-BEYOND
Fee	-2.669 (-1.805)	-3.471** (-2.359)
Treated	-3.462 (-1.004)	11.425** (3.677)
Treated × Fee	-12.182** (-4.09)	-7.012** (-2.63)
Adjusted R ²	0.22	0.30
# of obs	7485	9514

Impact on market quality: Event 1

	Treated(SSF)-Control(Spot)			Treated(Spot)-Control(Spot)		
	$\hat{\beta}_3$	t-stat	Adj-R ²	$\hat{\beta}_3$	t-stat	Adj-R ²
QSPREAD	-0.06**	-6.80	0.46	0.00	0.70	0.10
IC _{250k}	-0.03**	-2.71	0.18	0.01	0.94	0.21
IC _{500k}	-0.05**	-3.41	0.19	0.01	0.52	0.19
TOP1DEPTH	0.13**	2.53	0.83	0.19**	3.90	0.48
TOP5DEPTH	0.15**	2.59	0.81	0.18**	3.50	0.49
ILLIQ	-0.00**	-2.08	0.06	0.00	0.74	0.06
σ_r	-7.47**	-5.73	0.27	0.45	0.75	0.16
$\sigma_{IC,250k}$	-0.05**	-4.15	0.11	-0.01	-0.64	0.10
$\sigma_{IC,500k}$	-0.06**	-4.55	0.09	-0.01	-0.74	0.09
$ VR - 1 $	0.01**	2.28	0.52	-0.00	-0.50	0.10

Impact on market quality: Event 2

	Treated(SSF)-Control(Spot)			Treated(Spot)-Control(Spot)		
	$\hat{\beta}_3$	t-stat	Adj-R ²	$\hat{\beta}_3$	t-stat	Adj-R ²
QSPREAD	-0.04**	-3.20	0.56	-0.00	-1.28	0.67
IC _{250k}	-0.01	-0.46	0.32	-0.02	-1.38	0.34
IC _{500k}	-0.01	-0.76	0.30	-0.03	-1.88	0.33
TOP1DEPTH	0.09	1.04	0.76	0.19**	2.17	0.45
TOP5DEPTH	0.14	1.40	0.67	0.18	1.87	0.35
ILLIQ	0.00	0.16	0.11	0.00	-0.50	0.13
σ_r	-5.57**	-2.99	0.45	-0.65	-1.07	0.58
$\sigma_{IC,250k}$	-0.00	-0.07	0.08	-0.00	-0.43	0.09
$\sigma_{IC,500k}$	-0.01	-0.60	0.03	-0.01	-0.80	0.03
$ VR - 1 $	0.01	1.36	0.38	0.01	1.72	0.21

- **Event 1:** agents sensitive to the fee directly impacted, modified their behavior via reduction in OTR, and migrating some trading activity to the other venue.
- This brought back the liquidity providers who were earlier crowded out by the activity of these *noise* traders.
- **Event 2,** agents modified their behavior by placing orders where the fee was exempted.
- Thus, no impact on OTR and market quality.

Conclusion

- Regulatory interventions are justified when they are targeted to solve a market failure.
- In the absence of a well-defined market failure, it is unclear what is being targeted, and how the proposed intervention will impact the target.
- In the case of the OTR fee, the intervention achieved its intended outcome when the root cause of the problem was well-identified.
- This was not the case in the second event, or and it is unclear if the intervention was only motivated by the need to 'do something'.
- Such interventions increase the costs for the market participants and has implications for the long term growth of markets.
- The evidence thus emphasises on the need for evidence-based policy formulation with well-defined objectives.

Thank you.

Comments / Questions?