

# Trades With Price Improvement

# What is TWPI? Background ..

Equity market products must be traded on a lit market (ASX trading platform).

Why? Promotes liquidity and price formation.

Exception:

- block trade
- portfolio trade
- out-of-hours trade
- Trade with price improvement (TWPI)

# What is TWPI? Technically ..

Price Improvement:

- higher than best bid, lower than best offer (show visual example)
- better price than lit market -> investor's gain

TWPI occurred on the broker's internal system (dark market), for example: crossing system.

TWPI is reported to trading platform in immediate manner.

# Research Problem

## Background:

1. Rule change in 2013: TWPI must be better than lit market price ..
  - ensuring liquidity, better price formation in the lit market (investor POV)
  - ASX business model: public owned company, seeking for profit (ASX POV)
2. ASIC review of TWPI in 2022:
  - TWPI reported not exactly occurred at better prices.

## Questions:

- How many violations on TWPI rule?
- Who did the violation?
- What conditions that make the violation occurred? Develop a model ...

# Data

- Now: Trading data for one stock, one year
- Next: Whole ASX200 trading data for six years, 2011 - 2016 (using Big Machine)

## Big Machine

- aaaaa
- bbbbb

# Data

## Trading Data

mykey	RecordDate	HourMinuteSecond	MilliSecond	RecordType	Price	Volume
158992400	2015-01-02	10:00:32	854	ENTER	1.190	10000
158992401	2015-01-02	10:06:28	776	ENTER	1.180	20000
158992402	2015-01-02	10:06:28	776	TRADE	1.185	1253
158992403	2015-01-02	10:06:28	776	TRADE	1.180	18747
158992404	2015-01-02	10:06:49	921	ENTER	1.180	20000
158992405	2015-01-02	10:06:49	921	TRADE	1.180	10914

## L1 Data

mykey	RecordDate	HourMinuteSecond	MilliSecond	L1BidPrice	L1BidVolume
2440989525	2015-01-02	07:00:00	100	1.140	300
2440989526	2015-01-02	09:59:46	29	1.190	22000
2440989527	2015-01-02	09:59:47	403	1.185	1253
2440989528	2015-01-02	10:00:32	854	1.185	1253
2440989529	2015-01-02	10:06:28	776	1.180	10914
2440989530	2015-01-02	10:06:49	921	1.160	3389

## Combined Data

mykey	RecordDate	HourMinuteSecond	MilliSecond	RecordType	Price	Volume	UndisclosedVolume	DollarValue	Qualifiers	BidID	AskID	BidID
158992400	2015-01-02	10:00:32	854	ENTER	1.190	10000	0	11900.000			6505906787991053321	
158992401	2015-01-02	10:06:28	776	ENTER	1.180	20000	0	23600.000	OB0		6505906787991062575	
158992402	2015-01-02	10:06:28	776	TRADE	1.185	1253	NA	1484.805	Si	6505906787990991241	6505906787991062575	
158992403	2015-01-02	10:06:28	776	TRADE	1.180	18747	NA	22121.460	Si	6505906787990992156	6505906787991062575	
158992404	2015-01-02	10:06:49	921	ENTER	1.180	20000	0	23600.000			6505906787991063494	
158992405	2015-01-02	10:06:49	921	TRADE	1.180	10914	NA	12878.520	Si	6505906787990992156	6505906787991063494	

# Challenges

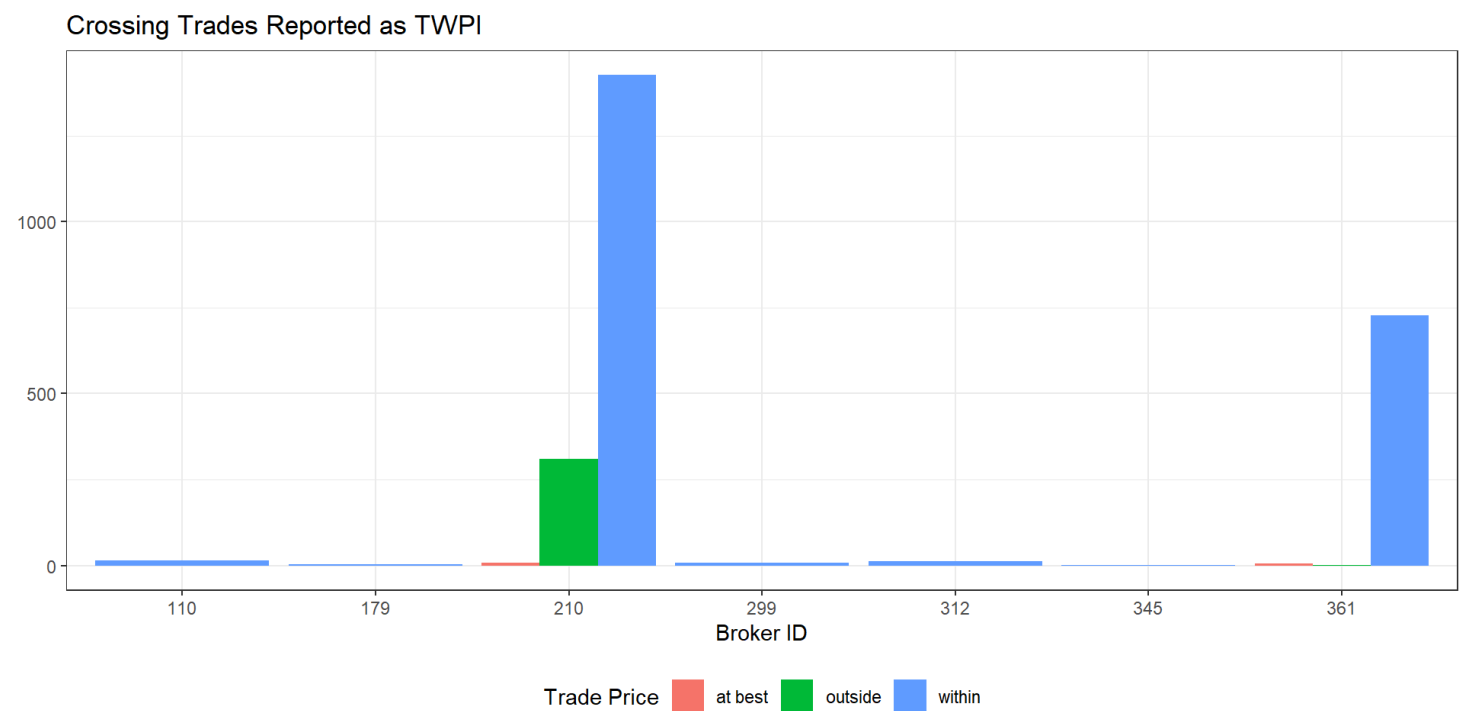
- Latest open data available only until 2016
- Handling large amount of data need huge processing power
- Big Machine can handle it, but ...
  - still need days
  - new issues every weeks, still on progress to make it work

# Result and Discussion

Price	Count	Percentage
at best	16	0.63
outside	313	12.38
within	2199	86.99

Broker Type	TWPI	Violation
HFT-Broker	1757	320
Institution	758	9
Unclassified	13	0

- 13% of reported TWPIs violated the rule
- HFT Brokers have done the most TWPI, as well as violation





# Result and Discussion - Modelling

Five machine learning modelling to understand violation pattern:

- Logistic Regression
- LDA
- Decision Tree
- Random Forest
- Boosted Tree (xgboost)

Logistic Regression and LDA give the best result for this classification problem. Random Forest has highest balance accuracy score, but lower true violation.

# Result and Discussion - Modelling

Logistic Regression

violation	cl_acc	0	1
0	0.6579670	479	249
1	0.6909091	34	76

```
1 bal_accuracy_logistic
```

```
[1] 0.6744381
```

LDA

violation	cl_acc	0	1
0	0.6813187	496	232
1	0.7000000	33	77

```
1 bal_accuracy_lda
```

```
[1] 0.6906593
```

Random Forest

violation	Accuracy	0	1
0	0.9519231	693	35
1	0.5545455	49	61

```
1 bal_accuracy_rf
```

```
[1] 0.7532343
```

term	logreg_est	lda_coef
(Intercept)	-2.0488864	NA
Volume	-16.5825046	-1.5813406
DollarValue	12.9541072	2.0710686
DescriptionInstitution	-2.7122448	-1.4305830
month5	0.6076385	0.6832949
month6	-0.8452584	-1.0080138
month7	-0.2517291	-0.1887093
month8	0.0653476	0.3293706
month9	0.1029304	0.4159168
month10	-0.1204500	0.1913036
month11	-0.8804823	-0.6815653
month12	-1.0017338	-0.4568380
date	-0.2885516	-0.3497301
dayofweek3	-1.0379909	-0.9817993
dayofweek4	0.2381441	0.1715348
dayofweek5	0.0580754	0.0705273
dayofweek6	-0.0261969	-0.0220093
hour11	0.4518003	0.3475419
hour12	0.7845899	0.7921792
hour13	0.1646974	-0.0260414
hour14	0.6198249	0.4264185
hour15	0.4416449	0.3555191

# Conclusion

- Violation of TWPI is mostly correlated with broker type, trade volume, and trade value in dollar. Particular month and day of the week also play some part.
- There is no measure from ASX to reject TWPI from being reported if the condition is not met -> ASX need to address this issue

# Future Work

- Analyse the whole ASX200 stocks
- How much potential losses for ASX due to TWPI violation?