Trades With Price Improvement, Always Better Than Market Price?

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Project Summary

Background:

- Recent concern from regulator (ASIC) on the violation of `Trade With Price Improvement` rule occurred on the `ASX TRADE` (exchange market for stocks)
- TWPI rule was introduced in May 2013

Purpose:
Understand how effective the rule change was, and understand the pattern of the violation

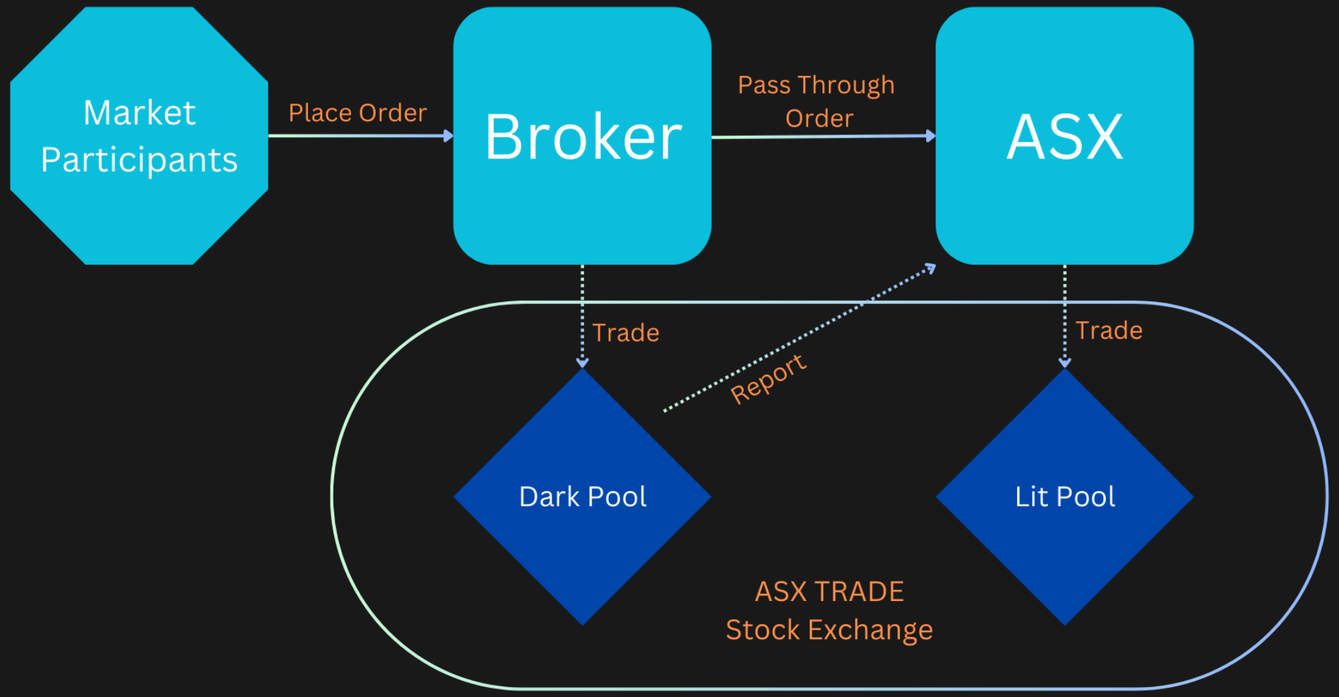
Data:
ASX200 trading data from 2012 - 2015. Source: Securities Industry Research Centre of Asia-Pacific (SIRCA)

Method:
Compare TWPI before and after the rule change, then examine the pattern of violation from May 2013 onward

Result

The rule change in 2013 significantly decreased the proportion of `at-the-spread` crossings from 52% to 1.23%. However, the proportion of the violation rose from 1% to 4.5%.

Definition - Lit vs Dark Pool



Lit pool:

- traders can see the price and volume of all orders, real time
- Ex: ASX trading platform
- establish fair price, transparency

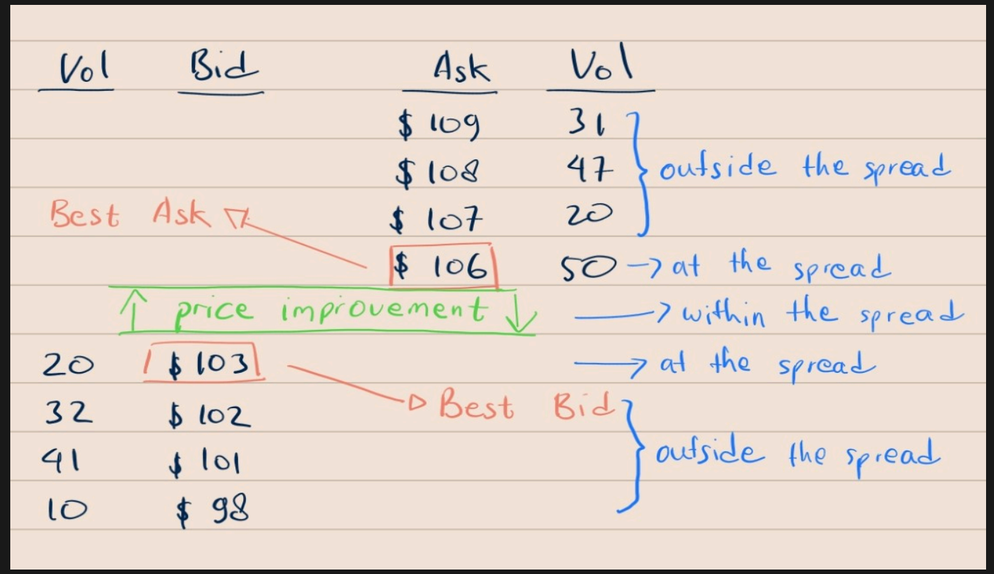
Dark pool:

- details of orders are not disclosed, until transactions are completed
- Ex: brokers internal crossing system (reported to ASX)
- cause less fluctuation to the market

Definition - Trade With Price Improvement

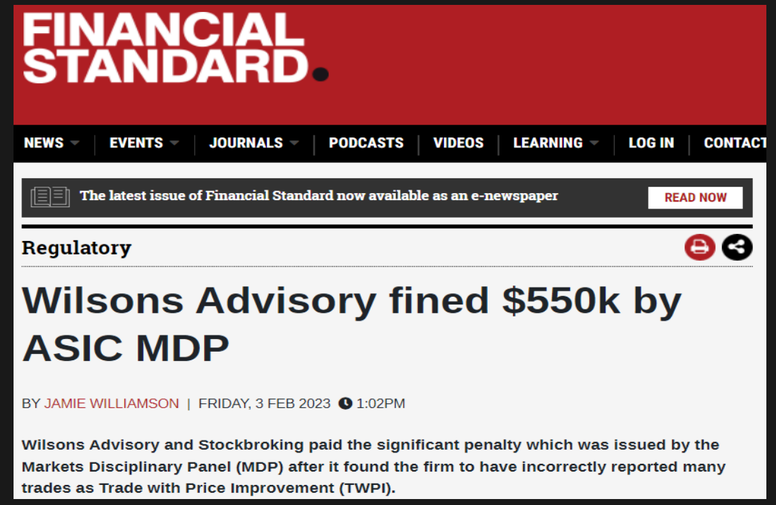
ASIC Rule: Stocks must be traded on **lit market**, like ASX trading platform. Except …

1. block trade: large volume
2. portfolio trade: a number of different stocks, on a single agreement
3. out-of-hours trade: outside open-session
4. **Trade with price improvement**:
   - crossings (trades within a broker) at a better price than what is available on the lit-market
   - benefit the traders
   - reported, but not executed on ASX. Hence, can be violated, e.g. reported as TWPI but actually traded at the spread



Research Problem

1. Before TWPI, crossings in the dark pool can be done `at-the-spread` and `within-the-spread`.
2. Amendment in May 2013 $\rightarrow$ `Trade with price improvement`
   - exclude `at-the-spread` crossings
   - more trading in the lit market, ensuring better price and liquidity - ASIC Report 394
   - Other POV: ASX as a for-profit organisation get fees from trading in their platform $\rightarrow$ more trading, more fees
3. Key motivation: **Recent finding by ASIC on the violation of TWPI rule**
   $\rightarrow$ TWPI should be done `within-the-spread`
   $\rightarrow$ not `at-the-spread` or `outside-the-spread`



Key Questions

1. Is there any significant decrease in the number of `at-the-spread` crossings after the rule amendment on May 2013?
2. How many `TWPI` violations occurred after the rule change?
3. Who did the violations?
4. What conditions contributed to the occurrence of the violations? Develop a model …

Data

- ASX200 data from 2012 to 2015
- Source: Securities Industry Research Centre of Asia-Pacific (SIRCA)
- Extracted with Nectar Cloud Computing
- 10Million+ of `TWPI` observations.

Nectar Cloud Computing

- Developed and maintained by Australian Research Data Commons (ARDC)
- Provide large scale computing infrastructure

Data - Example

Trading Data

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

Best Bid/Ask Data

mykey	RecordDate	HourMinuteSecond	MilliSecond	L1BidPrice	L1BidVolume	L1AskPrice	L1AskVolume
2440989525	2015-01-02	07:00:00	100	1.140	300	1.185	11488
2440989526	2015-01-02	09:59:46	29	1.190	22000	1.195	11567
2440989527	2015-01-02	09:59:47	403	1.185	1253	1.195	11567
2440989528	2015-01-02	10:00:32	854	1.185	1253	1.190	10000
2440989529	2015-01-02	10:06:28	776	1.180	10914	1.190	10000
2440989530	2015-01-02	10:06:49	921	1.160	3389	1.180	9086

Combined Data

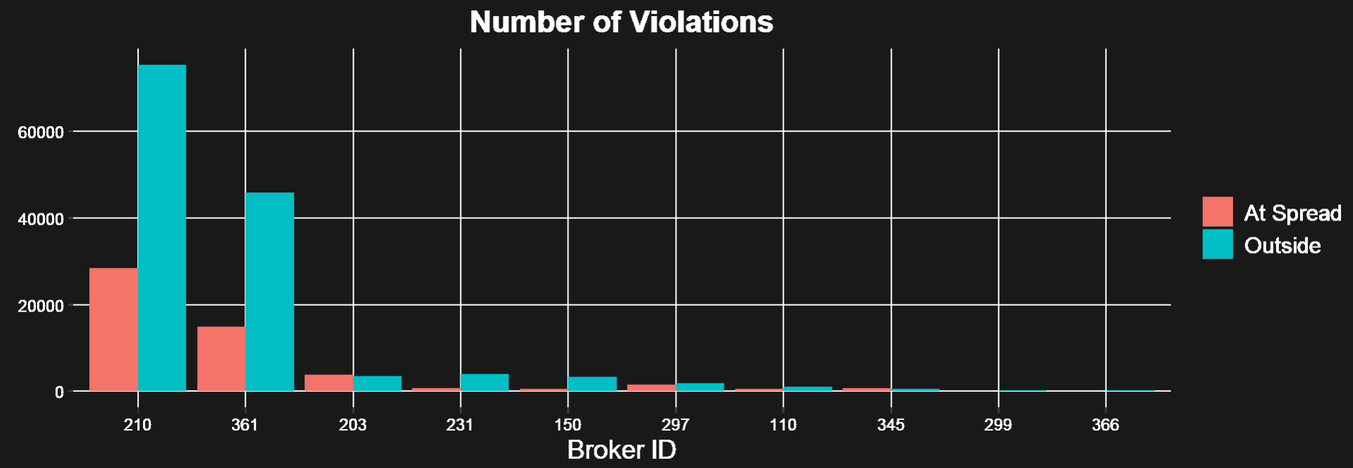
mykey	RecordDate	HourMinuteSecond	MilliSecond	RecordType	Price	Volume	UndisclosedVolume	DollarValue	Qualifiers	BidID	AskID	BuyerBrokerID	SellerBrokerID	bid_before	ask_before
158992400	2015-01-02	10:00:32	854	ENTER	1.190	10000	0	11900.000			6505906787991053321	NA	NA	1.185	1.195
158992401	2015-01-02	10:06:28	776	ENTER	1.180	20000	0	23600.000	OB0		6505906787991062575	NA	NA	1.185	1.190
158992402	2015-01-02	10:06:28	776	TRADE	1.185	1253	NA	1484.805	Si	6505906787990991241	6505906787991062575	122	638	1.185	1.190
158992403	2015-01-02	10:06:28	776	TRADE	1.180	18747	NA	22121.460	Si	6505906787990992156	6505906787991062575	140	638	1.185	1.190
158992404	2015-01-02	10:06:49	921	ENTER	1.180	20000	0	23600.000			6505906787991063494	NA	NA	1.180	1.190
158992405	2015-01-02	10:06:49	921	TRADE	1.180	10914	NA	12878.520	Si	6505906787990992156	6505906787991063494	140	179	1.180	1.190

Result and Discussion

	PERCENTAGE	
Marks	**Before**	**After**
Within	46.94	95.54
At Spread	52.00	1.23
Outside	1.05	3.23

Broker Type	TWPI	Violation	Percent
HFT-Broker	2,014,948	108,635	5.39
HFT-Prop	261,795	7,309	2.79
Institution	1,916,287	71,323	3.72
Retail-Discount	6,126	113	1.84
Retail-Full Service	2,445	86	3.52
Unclassified	5,709	250	4.38

- Significant decrease in the number of `at-the-spread` crossings after the rule change, dropping from 52% to 1.23% $\rightarrow$ more trades on ASX platform, more fees
- Violation of the rule increased from 1.05% to approximately 4.46% after the rule change $\rightarrow$ still marginal
- HFT Brokers have done the most TWPI, as well as the most violation. Look closer at individual brokers (Top 10):



Modelling (1)

- Only TWPI data from the top 5 brokers is used to model the **violation**, due to their dominant proportion.
- Preprocessing and cleaning the data, include data scaling
- Selecting relevant variables
- The independent variable is binary, violation or non-violation
- Dependent variables:

```
[1] "DollarValue"   "AskVol_before" "BidVol_before" "Volume"
[5] "Hour"          "Year"          "Month"         "Date"
[9] "Dayofweek"
```

Modelling (2)

We try four machine learning modelling to understand violation pattern:

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

Random Forest gives the best result for this classification problem: highest balance accuracy score on the test set.

Modelling (3)

Logistic Regression

Violation	cl_acc	0	1
0	0.6705368	794747	390493
1	0.6133251	23238	36859

```
1 bal_accuracy_logistic
```

```
[1] 0.6419309
```

Random Forest

Violation	Accuracy	0	1
0	0.7899835	936320	248920
1	0.7721517	13693	46404

```
1 bal_accuracy_rf2
```

```
[1] 0.7810676
```

Variables importance from the Random Forest Model:

	0	1	MeanDecreaseAccuracy	MeanDecreaseGini
DollarValue	161.06057	203.5223	309.9214	12932.043
AskVol_before	435.08456	397.4673	485.4454	23207.125
BidVol_before	417.66525	422.8720	530.8331	23130.516
Volume	164.54704	217.6188	317.2079	12629.889
Date	97.77479	305.8460	301.0975	13255.853
Hour	78.21799	126.6891	136.8460	5907.657
Year	162.17166	616.0610	585.3168	5630.567
Month	114.19433	439.0454	434.0923	8433.228
Dayofweek	67.17229	262.7428	256.8236	5497.704

- `Ask/BidVol_before` refers to the volume of the best ask/bid price in the lit market. They have the highest Gini coefficient, indicating their importance in distinguishing between violation and non-violation.
- `DollarValue`, `Volume`, `Date` are also important factors in differentiating result.
- Meanwhile, `Year` and `Month` play a role in enhancing the accuracy of the model.

Conclusion

- The purpose of the rule amendment in May 2013 has been met, as the number of `at-the-spread` crossings has drastically reduced. This type of trades moves to ASX platform $\rightarrow$ more trades, more fees
- Violation of `TWPI` can be associated with the depth of the liquidity available just before the trades. Date, Volume, and the transaction values also play important roles in the `TWPI` violation pattern.
- There are no measures from ASX to reject `TWPI` reports if the conditions are not met $\rightarrow$ ASX need to address this issue

Future Work

- Analyse violation pattern with other variables, such as stock industry sector, market cap, lagged price values, bid-ask spread, etc.
- Try different methods to analyse the pattern, such as PCA and factor modelling.
- More research questions:
  - How much profit did ASX make due to the rule amendment in May 2013?
  - Why do only a few brokers dominate the TWPI?

Thank You ..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