# Liquidity Provision Contracts and Market Quality: Evidence from the New York Stock Exchange

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# Research Questions

(1) Do Designated Market Maker contracts have a *causal* effect on market quality for typical stocks?

- In light of the fact that essentially any trader can supply liquidity in limit order markets?

(2) Can we learn anything about the nature of competition in the market for liquidity supply by studying changes in the features of DMM obligations and incentives?

# Timeliness

- MiFID II **requires a firm that engages in algorithmic trading to pursue a market making strategy** to:

- "carry on its market making activity continuously during **a specified proportion of the trading venue's trading day,** except under exceptional circumstances"

- "**enter into a written agreement with the trading venue** stating their market making obligations"

# Empirical Evidence on DMM Adoption Events

- Empirical studies on the adoption of DMMs
  - Venkataraman & Waisburd (2007) – Euronext Paris Stock Exchange
  - Anand, Tanggaard & Weaver (2009) – Stockholm Stock Exchange
  - Menkveld and Wang (2013) – Euronext Amsterdam Stock Exchange
  - Skjeltorp and Odegaard (2015) – Oslo Stock Exchange

- Collectively, document improved liquidity and positive stock price reactions.

- Note, though, that the adoption of DMM contracts is endogenous for those selected firms.

# This paper

- Exploits a discontinuity in both contractual obligations and incentives of DMM firms on the NYSE to identify a causal effect of stronger DMM obligations on market quality.
- Shows that more stringent market making requirements are associated with increased depth, narrower bid-ask spreads, larger rate of price improvement, and improved price efficiency.
- Further, many of the improvements are attributable to increases in liquidity provision on markets other than the NYSE, supporting the reasoning that market making equilibrium is characterized by ***strategic complementarity***.
- Helps to explain both illiquidity spirals and why seemingly minor DMM obligations can have substantive effects on market liquidity.

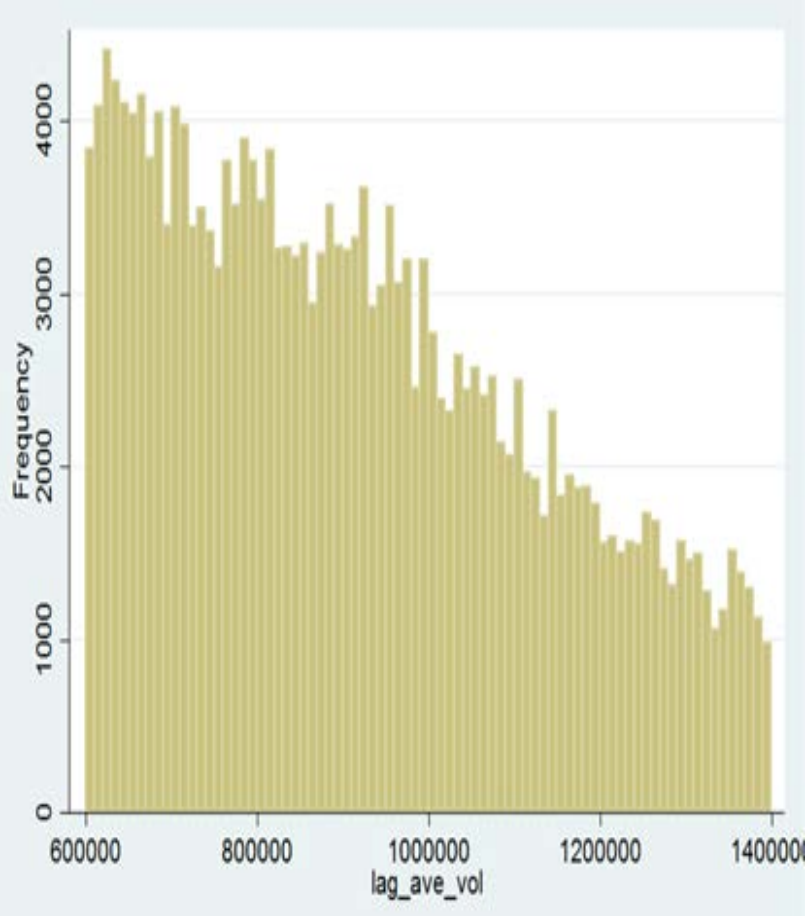
# NYSE DMM Obligations

- Every NYSE listed stock has a DMM.
- Discontinuity at one million average consolidated daily volume in prior month.
  - In DMM Obligation:
    - Lower volume stocks, must post quotations for at least 15% of the trading day.
    - Higher volume stocks, must post quotations for at least 10% of the trading day.
  - In DMM Incentive:
    - Lower volume stocks, rebate of $.0035 per share when supplying liquidity to a trade.
    - Higher volume stocks, rebate of $.0030 per share when supplying liquidity to a trade.
- We study the effect of the “enhanced” DMM contract using a Regression Discontinuity Design.

# Data and Sample

- Database:
  - Trade-and-Quote (TAQ)
- Period:
  - September 2009 to December 2013
- Sample:
  - all NYSE-listed common stocks for which the average consolidated daily trading volume is both less than and greater than the 1 million share threshold for at least one sample month
  - A total of 756 stocks meet this criterion.

# Aggregate volume outcomes near the 1 million share threshold



# The Effect of DMM Obligations on Spreads (middle columns of Table 2)

| | Optimal Bandwidth (0.05 million shares) | |
|---|---|---|
| | Quoted Spread | Effective Spread |
| DMM | -0.941** (-2.15) | -0.866** (-2.09) |
| ln(Vol)-ln(VC) | -10.64 | 12.40* |

Effective spread reduction = 0.866 basis points (10% reduction)

Sample average effective spread = 8 to 9 basis points
Average daily trading volume = 974,000 shares
Average share price = $38.45
Trading day in a year = 252

Transaction cost reduction = $817,000 per firm year

# The Effect of DMM Obligations on Market Depth (Table 3)

| | ln(Share Depth) | ln(Dollar Depth) |
|---|---|---|
| DMM | 0.0113** | 0.0103** |
| | (2.18) | (2.08) |
| ln(Vol)-ln(VC) | 0.316*** | 0.175*** |
| | (6.39) | (3.73) |
| (ln(Vol)-ln(VC))DMM | 0.0958 | 0.163** |
| | (1.55) | (2.78) |
| FE | Yes | Yes |
| N | 82,518 | 82,518 |
| adj. R-sq. | 0.843 | 0.689 |

- Contrasts with the CYZ (2016) results that depth was not significantly changed when the NYSE ceased trading.

# The Effect of DMM Obligations on Rate of Price Improvement

## (Table 5) -- Transactions Executed within the NBBO Quotes

| | Optimal Bandwidth (0.07 mil. shr) |
|---|---|
| DMM | 0.327***<br>(3.88) |
| ln(Vol)-ln(VC) | 3.354**<br>(2.20) |
| (ln(Vol)-ln(VC))DMM | -2.269<br>(-1.07) |
| FE | Yes |
| N | 50,378 |
| adj. R-sq. | 0.592 |

# The Effect of DMM Obligations on Trading Volume (Table 6)

| | Optimal Bandwidth (0.135 mil. shr) |
|---|---|
| DMM | 0.031***<br>(3.96) |
| ln(Vol)-ln(VC) | 0.727***<br>(8.69) |
| (ln(Vol)-ln(VC))DMM | -0.193<br>(-1.85) |
| FE | Yes |
| N | 82,581 |
| adj. R-sq. | 0.184 |

# The Effect of DMM Obligations on Price Efficiency (Absolute Deviations from Random Walk Benchmark)

| | Optimal Bandwidth (0.25 mil. shr) |
|---|---|
| DMM | -0.0433**<br>(-2.00) |
| ln(Vol)-ln(VC) | -0.206*<br>(-1.69) |
| (ln(Vol)-ln(VC))DMM | 0.187<br>(1.25) |
| FE | Yes |
| N | 8,544 |
| adj. R-sq. | 0.032 |

# Placebo tests (Tables 9 and 10) at the 0.5 and 1.5 million share thresholds

| | With Placebo cut at 0.5 million shares | | | | | | |
|---|---|---|---|---|---|---|---|
| | Quoted Spread (0.04 million) | Effective Spread (0.04 million) | ln(Volume Depth) (0.02 million) | ln(Dollar Depth) (0.02 million) | DGTW Return (0.14 million) | Abs \|VR-1\| (0.15 million) | Inside NBBO (0.05million) |
| **DMM** | -0.461 | -0.357 | -0.00644 | -0.0158 | 0.00289 | -0.00098 | -0.126 |
| | (-0.57) | (-0.56) | (-0.49) | (-1.32) | (0.40) | (-0.05) | (-0.26) |
| **ln(Vol)-ln(VC)** | -16.97 | -13.03 | 0.802* | 0.349 | 0.0341 | -0.00166 | -5.184 |
| | (-1.53) | (-1.49) | (1.82) | (0.87) | (0.78) | (-0.02) | (0.77) |
| **(ln(Vol)-ln(VC))DMM** | 20.27 | 15.05 | 1.008* | -0.318 | -0.136** | -0.679 | -11.84 |
| | (1.19) | (1.12) | (1.72) | (-0.59) | (-2.19) | (-0.59) | (-1.30) |

| | With Placebo cut at 1.5 million shares | | | | | | |
|---|---|---|---|---|---|---|---|
| | Quoted Spread (0.13 million) | Effective Spread (0.13 million) | ln(Volume Depth) (0.05 million) | ln(Dollar Depth) (0.05 million) | DGTW Return (0.58 million) | Abs \|VR-1\| (0.44 million) | Inside NBBO (0.2million) |
| **DMM** | -0.202 | -0.163 | -0.0189 | -0.00619 | -0.00620 | -0.0107 | 0.577 |
| | (-0.49) | (-0.47) | (-1.45) | (-1.26) | (-0.98) | (-0.49) | (1.21) |
| **ln(Vol)-ln(VC)** | -4.422 | -3.812 | -1.872*** | 0.169*** | 0.0166 | -0.0274 | -4.784 |
| | (-0.79) | (-0.83) | (-3.89) | (3.56) | (0.59) | (-0.21) | (-0.79) |
| **(ln(Vol)-ln(VC))DMM** | 8.972 | 8.070 | 3.071*** | -0.0245 | -0.0844** | -0.0209 | 2.321 |
| | (1.30) | (1.42) | (4.84) | (-0.42) | (-2.25) | (-0.14) | (0.30) |

# A Potential Mechanism: Strategic Complementarity

- The effects are unlikely to be mechanical.
  - There is no obligation to narrow spreads or to give executions at prices inside the quotes.
  - The increased rebate equates to only 0.13 basis points relative to average share price.
- Off-NYSE Outcomes
  - NYSE-listed stocks are traded on other exchanges as well.
    - In sample, only 21.4% of trades and 25.0% of dollar volume is executed on the NYSE.
  - Direct effects of NYSE DMM obligations should be observed on NYSE only.
  - Assess off-NYSE outcomes for NYSE-listed stocks to study induced changes in the market for liquidity provision.
  - If liquidity provision is characterized by strategic complementarity, then more aggressive quotations on the NYSE should lead to more aggressive quotations off the NYSE.
  - If liquidity provision is characterized by strategic substitutability, then more aggressive quotations on the NYSE should lead to less aggressive quotations off the NYSE.

# ON Vs. OFF NYSE Trades (tables 11 & 12)

| | Optimal Bandwidth (0.07 million shares) | | Optimal Bandwidth (0.05 million shares) | |
|---|---|---|---|---|
| | Off-NYSE Execution within NBBO | On-NYSE Execution within NBBO | Effective Spread for Off-NYSE Executions | Effective Spread for On-NYSE Executions |
| DMM | 0.335*** | 0.0126 | -0.768** | -0.636* |
| | (4.22) | (-0.56) | (-2.13) | (-1.83) |
| ln(Vol)-ln(VC) | 2.844** | -0.323 | 15.45 | 9.706 |
| | (1.98) | (-0.80) | (-1.63) | (-1.11) |
| (ln(Vol)-ln(VC))DMM | -0.756 | -0.581 | 11.88 | 1.560 |
| | (-0.38) | (-0.60) | (1.00) | (0.15) |
| Realized Volatility | 0.0765*** | 0.0768*** | 0.0111** | 0.0104*** |
| | (7.26) | (6.87) | (2.22) | (2.89) |
| Inv. Price | -7.487*** | -10.37*** | 41.28*** | 44.87*** |
| | (-12.19) | (-15.93) | (4.01) | (3.63) |
| FE | Yes | Yes | Yes | Yes |
| N | 50,378 | 50,378 | 27,970 | 27,970 |
| adj. R-sq. | 0.580 | 0.594 | 0.622 | 0.844 |

- More stringent NYSE DMM requirements are associated with more favorable trade executions for NYSE-listed stocks, even for executions off the NYSE.

# Depth at NBBO and Market Shares (Tables 13 and 14)

| | Dollar NBBO depth off NYSE | Dollar NBBO depth on NYSE | NYSE Share of Dollar Volume |
|---|---|---|---|
| DMM | 0.015**<br>(2.89) | 0.005<br>(0.92) | -0.306**<br>(-2.21) |
| ln(Vol)-ln(VC) | 0.188**<br>(4.14) | 0.151<br>(3.28) | -0.928<br>(-0.37) |
| (ln(Vol)-ln(VC))DMM | 0.144<br>(2.55) | 0.217<br>(3.79) | -5.335<br>(-1.58) |
| FE | Yes | Yes | Yes |
| N | 86,985 | 86,985 | 38,905 |
| adj. R-sq. | 0.650 | 0.680 | 0.497 |

# Off-NYSE Results

- Strong (if circumstantial) evidence of strategic complementarity in liquidity supply.
- Can help to explain illiquidity spirals.
  - A shock to one or a few liquidity suppliers causes others to also reduce supply.
- Helps to explain why relatively modest DMM obligations can cause substantive improvements in market liquidity.
  - Anand, Tanggaard, and Weaver (2009) examine DMM contracts on the Stockholm Exchange, and report that compensation payments average only about $3000 per month.

# Conclusion

- We estimate causal effects of more stringent DMM obligations and incentives on market quality by exploiting a discontinuity in the contractual obligations of DMM firms on the NYSE.
- Our results indicate that stronger DMM incentives are associated with narrower spread, larger depth, larger rate of price improvement, and improved price efficiency.
- We further shows that the DMM contractual requirement changes the order submission strategies of *othe*r market participants and the market equilibrium, implying that the market making business is characterized by strategic complements .
- This study contributes to the understanding of how DMM contracts can supplement endogenous liquidity provision to improve the functioning of financial markets.