Why do listed firms pay for market making in their own stock?

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and

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\textsuperscript{b}University of Stavanger

www.norges-bank.no/research/skjeltorp/
We study:

- Designated Market Makers (DMM) at Oslo Stock Exchange
- DMM (brokerage house/bank) hired by the firm, annual fee
- ensure a liquid secondary market in firm’s stock
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Main question in the paper:

- Why are firms willing to pay a cost to improve the secondary market liquidity of their issued shares?
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Main question in the paper:

- Why are firms willing to pay a cost to improve the secondary market liquidity of their issued shares?

Contribution:

- earlier studies, effect on market price and liquidity
- we look at DMMs from the firm’s perspective, what determines the hiring choice?
Overview of presentation

1. Stock market liquidity
2. Question and motivation
3. Related literature
4. Data
5. Results
   - Why improve liquidity?
   - Asset pricing implications
6. Conclusion
Liquidity example - limit order market

Snapshot of a limit order book for a stock

depth (shares)

price
Liquidity example - limit order market

Snapshot of a limit order book for a stock

depth (shares)

<table>
<thead>
<tr>
<th>Price</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_b^3$</td>
<td>40</td>
</tr>
<tr>
<td>$p_b^2$</td>
<td>10</td>
</tr>
<tr>
<td>$p_b^1$</td>
<td>20</td>
</tr>
</tbody>
</table>

Buy orders (bid)
Liquidity example - limit order market

Snapshot of a limit order book for a stock

- **Buy orders (bid):**
  - $p_b^3$: 40 shares
  - $p_b^2$: 10 shares
  - $p_b^1$: 20 shares

- **Sell orders (ask):**
  - $p_a^1$: 10 shares
  - $p_a^2$: 20 shares
  - $p_a^3$: 70 shares
  - $p_a^4$: 30 shares

**Depth (shares):**
- 70
- 60
- 50
- 40
- 30
- 20
- 10
- 0
Liquidity example - limit order market

Snapshot of a limit order book for a stock

depth (shares)

price

Buy orders (bid)

Sell orders (ask)

Liquidity supply
Liquidity example - limit order market

Snapshot of a limit order book for a stock

- **Price**
- **Depth (shares)**

![Chart showing a snapshot of a limit order book with bid and ask prices and associated depth in shares. The spread is highlighted between the bid and ask prices.]
Liquidity example - limit order market

Snapshot of a limit order book for a stock

Depth

Buy orders (bid)

Sell orders (ask)
Liquidity example - limit order market

Snapshot of a limit order book for a stock

Buy orders (bid)

Sell orders (ask)

Price impact

Depth (shares)
Evolution towards electronic Limit Order Markets

- **no** market makers, liquidity supplied by patient traders
- problem: low liquidity supply in small-caps
Background

Evolution towards electronic Limit Order Markets

- **no** market makers, liquidity supplied by patient traders
- problem: low liquidity supply in small-caps

**Response:** Designated Market Makers (DMM)

- listed firms can hire a financial intermediary (DMM) to provide liquidity in its stock.

**typical contract**

- practice market making at least 85% of the time
- maximum bid/ask spread of 4%
- ensure minimum NOK 40k available at best quotes
Background

Evolution towards electronic Limit Order Markets

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  typical contract
  - practice market making at least 85% of the time
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Prior research: When firms hire a DMM, liquidity improves.

  ..but that is what the DMM is paid to do.

  this paper: why do firms pay to improve market liquidity?
Previous studies $\Rightarrow$ Value of firm increases

- initially, DMM should not affect firms operations.
- having a DMM is costly: $V = (X - c^{DMM})/r$
- increase in $V$ must come from effect on $X$, $r$ or both
Previous studies ⇒ Value of firm increases

- initially, DMM should not affect firms operations.
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Potential effects on cash flow \((X)\)

- reduced equity issuance costs (fees) [Butler et.al, 2005]
- lower direct cost of debt issuance [Butler/Wan, 2010]
- lower costs of stock repurchases [Brockman et.al, 2008]
Motivation

Previous studies ⇒ Value of firm increases

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Potential effects on cash flow (\( X \))

- reduced equity issuance costs (fees) [Butler et.al, 2005]
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Potential effect on discount rate (\( r \))

- liquidity risk priced [e.g. Pastor/Stambaugh (2003), Acharya/Pedersen (2005)]
- DMM reduces liquidity risk ⇒ lower \( r \)
Traders/owners perspective

- lower transaction costs
- cheaper exit for current owners/founders/venture capitalists
- however, not clear why this is relevant for the firm
  - short term traders benefit most
  - why subsidize short term trading/speculation?
Main hypothesis: Decision to hire a DMM related to the probability of the firm interacting with the stock market in the near future.

What we do: Use data on DMM hirings at the Oslo Stock Exchange to empirically investigate the question.

What we find:

- Liquidity improves and price increase after DMM deals
- DMM hirers are more likely to need new capital (Q)
- DMM firms more likely to issue or repurchase shares ex post
- Hiring a DMM reduces liquidity risk loading
- Cost of (equity) capital drops significantly
Two Strands:

- Market microstructure
- The interaction of market liquidity and corporate finance
Prior literature: Market microstructure and DMM

Studies of DMM initiations

- **Stockholm** [Anand et.al, 2008], **Deutsche Börse** [Hengelbrock, 2008], **EuroNext** [Menkveld/Wang, 2009], **Paris Bourse** [Venkataraman/Waisburd, 2007]

Typically find

- Liquidity improves after the introduction of a DMM
- Positive liquidity externality from having a DMM, attract more traders to the stock
- The stock market views the hiring of DMMs as a positive signal
Prior literature: Corporate finance and market liquidity

An evolving literature that link market microstructure to corporate finance.

Some examples:

- Lipson/Mortal [2009] – firms with better market liquidity have lower leverage and prefer equity financing.
- Butler/Grullon/Weston [2005] – investment banking fees (issuing costs) lower for more liquid firms
- Brockman/Howe/Mortal [2008] – firms with more liquid equity more likely to use repurchases relative to dividends (flexibility vs. transaction costs)

⇒ treats liquidity as an *exogenous* property of the stock.
By hiring a DMM, liquidity can be directly influenced by the firm that has issued the stock.

We treat the hiring of Designated Market Makers as *endogenous decisions*, and ask:

- What influences this decision?
Oslo Stock Exchange (OSE) – Electronic limit order market, main market for trading of Norwegian stocks

- DMMs allowed at the OSE from October 2004
- look at DMM hirings from 2004 through 2010
- the DMM is paid by the firm to “maintain an orderly market”
  - little info on actual costs
  - Anand et.al [2009], USD 25k – 100k per year in Swedish data, 28 contracts
  - Norway - USD 30k per year
- OSE monitor stocks with DMM to ensure that the DMM fulfills obligations
### Describing DMM deals at the OSE

<table>
<thead>
<tr>
<th>Year</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total active stocks at OSE</td>
<td>207</td>
<td>238</td>
<td>258</td>
<td>292</td>
<td>286</td>
<td>263</td>
<td>235</td>
</tr>
<tr>
<td>Active DMM contracts</td>
<td>7</td>
<td>30</td>
<td>42</td>
<td>50</td>
<td>57</td>
<td>47</td>
<td>48</td>
</tr>
<tr>
<td>% of firms with contract</td>
<td>3%</td>
<td>13%</td>
<td>16%</td>
<td>17%</td>
<td>20%</td>
<td>18%</td>
<td>20%</td>
</tr>
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</table>
### Describing DMM deals at the OSE

#### Yearly Active Stocks and DMM Contracts

<table>
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</tr>
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</table>

#### Firm size (MCAP) groups

<table>
<thead>
<tr>
<th>Size Quartile</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>N(firms) in size quartile 1 (small)</td>
<td>0</td>
<td>4</td>
<td>11</td>
<td>17</td>
<td>24</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>N(firms) in size quartile 2</td>
<td>2</td>
<td>16</td>
<td>19</td>
<td>15</td>
<td>18</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>N(firms) in size quartile 3</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>14</td>
<td>11</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>N(firms) in size quartile 4 (large)</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
What is the effect on the market of hiring a DMM?

First, check that effect of DMM initiations is similar at the OSE as other markets

1. Does liquidity improve?
2. Does the market react?
Does liquidity improve?

Liquidity measures before and after market maker deals.

<table>
<thead>
<tr>
<th></th>
<th>6 months</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>before</td>
<td>after</td>
<td>change</td>
</tr>
<tr>
<td>Relative Spread</td>
<td>3.9%</td>
<td>2.4%</td>
<td>-1.5%***</td>
</tr>
<tr>
<td>LOT</td>
<td>4.1%</td>
<td>3.1%</td>
<td>-1.1%***</td>
</tr>
<tr>
<td>Amihud ILR</td>
<td>0.62</td>
<td>0.41</td>
<td>-0.21**</td>
</tr>
<tr>
<td>Turnover (month)</td>
<td>4.3%</td>
<td>5.1%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Fraction days traded</td>
<td>0.76</td>
<td>0.82</td>
<td>0.06***</td>
</tr>
</tbody>
</table>

***1%, **5%, *10% significance level
Does liquidity improve?

Liquidity measures before and after market maker deals.

<table>
<thead>
<tr>
<th></th>
<th>6 months before</th>
<th>6 months after</th>
<th>change</th>
<th>1 year before</th>
<th>1 year after</th>
<th>change</th>
</tr>
</thead>
<tbody>
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<td>2.4%</td>
<td>-1.5%***</td>
<td>3.9%</td>
<td>2.6%</td>
<td>-1.3%***</td>
</tr>
<tr>
<td>LOT</td>
<td>4.1%</td>
<td>3.1%</td>
<td>-1.1%***</td>
<td>4.3%</td>
<td>3.7%</td>
<td>-0.6%*</td>
</tr>
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<td>Amihud ILR</td>
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<td>0.41</td>
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<td>0.57</td>
<td>0.44</td>
<td>-0.13</td>
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<td>5.8%</td>
<td>1.6%**</td>
</tr>
<tr>
<td>Fraction days traded</td>
<td>0.76</td>
<td>0.82</td>
<td>0.06***</td>
<td>0.75</td>
<td>0.82</td>
<td>0.07***</td>
</tr>
</tbody>
</table>

***1%, **5%, *10% significance level
Event study, centered at date of DMM introduction.

\[ AR_{i,t} = r_{i,t} - [\hat{\alpha}_i + \hat{\beta}_i r_{m,t}] \]  (1)
Market reaction to DMM introduction

Event study, centered at date of DMM introduction.

\[ AR_{i,t} = r_{i,t} - \left[ \hat{\alpha}_i + \hat{\beta}_i r_{m,t} \right] \]  

<table>
<thead>
<tr>
<th>t</th>
<th>C(\bar{A})R</th>
<th>(J_1)</th>
<th>(J_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2.05%</td>
<td>7.337***</td>
<td>8.310***</td>
</tr>
<tr>
<td>1</td>
<td>1.80%</td>
<td>5.982***</td>
<td>6.669***</td>
</tr>
<tr>
<td>2</td>
<td>2.04%</td>
<td>6.324***</td>
<td>6.631***</td>
</tr>
<tr>
<td>3</td>
<td>1.17%</td>
<td>4.899***</td>
<td>4.527***</td>
</tr>
<tr>
<td>4</td>
<td>1.41%</td>
<td>3.917***</td>
<td>3.650***</td>
</tr>
<tr>
<td>5</td>
<td>1.12%</td>
<td>3.115***</td>
<td>2.791***</td>
</tr>
</tbody>
</table>

⇒ Significant t=-5 to +5 day CAR around 1% associated with DMM hirings.
What is the effect on the market of hiring a DMM?

Summarizing results:

1. Liquidity improves
2. The market reacts positively

Similar results in our sample as other studies on DMMs for other markets.
What determines the decision to hire a DMM?

- Decision theoretic empirical analysis (Probit)
- \( Pr(\text{Hire DMM}) = f(\text{likelihood of accessing market}) \)
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Determinants of the hiring decision:

- Likelihood of capital needs
- Likelihood of stock repurchase (cash distribution)
- Other variables
Analyzing decision to hire DMM

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  \[ Pr(\text{Hire DMM}) = f(\text{likelihood of accessing market}) \]

Determinants of the hiring decision:

- Likelihood of capital needs
  - ex-ante: growth potential (Tobin’s Q)
  - ex post: actual stock issuance
- Likelihood of stock repurchase (cash distribution)

- Other variables
Analyzing decision to hire DMM

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- Likelihood of stock repurchase (cash distribution)
  - ex-ante: repurchase program announcements
  - ex-post: actual repurchases over next year

- Other variables
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Determinants of the hiring decision:

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  - ex-post: actual stock issuance

- **Likelihood of stock repurchase** (cash distribution)
  - ex-ante: repurchase program announcements
  - ex-post: actual repurchases over next year

- **Other variables**
  - insider transactions (ex-post exit motivation)
  - <2 years since listing (ex-ante exit motivation)
  - Pre-DMM liquidity
Probit analysis: Ex-ante variables

<table>
<thead>
<tr>
<th>Model</th>
<th>New DMM hire</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Liquidity (RelSpread)</td>
<td>-7.40**</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>Q last year</td>
<td>0.30***</td>
<td>0.30***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Repurchase program</td>
<td>0.15</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.49)</td>
<td>(0.49)</td>
<td></td>
</tr>
<tr>
<td>Listed &lt; 2 years</td>
<td>0.40**</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-1.33***</td>
<td>-1.62***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>N (firm/years)</td>
<td>368</td>
<td>425</td>
<td></td>
</tr>
<tr>
<td>Pseudo R²</td>
<td>0.12</td>
<td>0.09</td>
<td></td>
</tr>
</tbody>
</table>
# Probit analysis: Ex-ante variables

<table>
<thead>
<tr>
<th>Model</th>
<th>New DMM hire</th>
<th>New/maintain DMM</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Liquidity (RelSpread)</td>
<td>-7.40**</td>
<td>-17.42***</td>
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<tr>
<td></td>
<td>(0.03)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Q last year</td>
<td>0.30***</td>
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<tr>
<td></td>
<td>(0.00)</td>
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<tr>
<td></td>
<td>(0.49)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Listed &lt; 2 years</td>
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<td>0.37***</td>
</tr>
<tr>
<td></td>
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<td>(0.01)</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.33***</td>
<td>-1.62***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

|                  | (3)          | (4)              |
| N (firm/years)   | 368          | 425              |
| Pseudo R²        | 0.12         | 0.09             |
### Probit analysis: Ex-post variables

<table>
<thead>
<tr>
<th>Model</th>
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<tr>
<td></td>
<td>(0.06)</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Issue equity</td>
<td>0.41**</td>
<td>0.36***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Actual repurchase</td>
<td>0.42**</td>
<td>0.35**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.02)</td>
<td></td>
</tr>
<tr>
<td>Insider trades (sells)</td>
<td>0.02</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>(0.34)</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.26***</td>
<td>-1.54***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
</tbody>
</table>

| N (firm/years)      | 329          | 559 |
| Pseudo R²           | 0.07         | 0.03 |
## Probit analysis: Ex-post variables

<table>
<thead>
<tr>
<th>Model</th>
<th>New DMM hire (1)</th>
<th>New DMM hire (2)</th>
<th>New/maintain DMM (3)</th>
<th>New/maintain DMM (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquidity (RelSpread)</td>
<td>-6.73*</td>
<td>.</td>
<td>-16.73***</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>.</td>
<td>(0.00)</td>
<td>.</td>
</tr>
<tr>
<td>Issue equity</td>
<td>0.41**</td>
<td>0.36***</td>
<td>0.23</td>
<td>0.24**</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.01)</td>
<td>(0.12)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Actual repurchase</td>
<td>0.42**</td>
<td>0.35**</td>
<td>0.36***</td>
<td>0.40***</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.02)</td>
<td>(0.01)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Insider trades (sells)</td>
<td>0.02</td>
<td>.</td>
<td>-0.02</td>
<td>.</td>
</tr>
<tr>
<td></td>
<td>(0.34)</td>
<td>.</td>
<td>(0.46)</td>
<td>.</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.26***</td>
<td>-1.54***</td>
<td>-0.14</td>
<td>-1.07***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.45)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

| N (firm/years)         | 329              | 559              | 392                  | 633                  |
| Pseudo R²              | 0.07             | 0.03             | 0.10                 | 0.02                 |
Summary so far

**Ex ante:**
- Proxy for future capital needs (Q) an important determinant of hiring a DMM
- some support for planned repurchases
- newly listed firms more likely to hire DMM (insider exit?)

**Ex post:**
- firms that hire DMMs more likely to issue/repurchase shares
  - ex post
- post-DMM insider exits not significant
Asset pricing with liquidity risk


DMM effect on liquidity risk

- traditional market makers control their risk and inventory by changing spread and/or price
- DMMs unable to do this, i.e. paid to take liquidity risk that otherwise would be present in the market

**Implications:**
- reduction in liquidity risk for stocks that hire DMM
- i.e. lower risk premium for DMM stocks
Does hiring a DMM affect liquidity risk?

Estimate a two-factor market model:

\[ er_{i,t} = \alpha_i + \beta_i^m er_{m,t} + \beta_i^{liq} LIQ_t + \varepsilon_{i,t} \]  \hspace{1cm} (2)

- \( er_{m,t} \) = market return (excess of risk free)
- \( \beta_i^m \) = loading on market risk (market beta)
- \( LIQ_t \) = return difference between low/high liquidity portfolios
- \( \beta_i^{liq} \) = loading on liquidity risk

Liquidity beta (\( \beta_i^{liq} \)) Test for difference

<table>
<thead>
<tr>
<th>Pre DMM</th>
<th>Post DMM</th>
<th>change</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMM stocks</td>
<td>mean 0.114</td>
<td>-0.062</td>
<td>-0.176</td>
</tr>
<tr>
<td>DMM stocks</td>
<td>median 0.044</td>
<td>-0.022</td>
<td>-0.157</td>
</tr>
</tbody>
</table>

\( \Rightarrow \) Significant drop in liquidity risk loading
\( \Rightarrow \) liquidity risk loading closer to larger/liquid stocks after DMM
Does hiring a DMM affect liquidity risk?

Estimate a two-factor market model:

\[ er_{i,t} = \alpha_i + \beta_i^m er_{m,t} + \beta_i^{liq} LIQ_t + \epsilon_{i,t} \]  

\( er_{m,t} \) = market return (excess of risk free)

\( \beta_i^m \) = loading on market risk (market beta)

\( LIQ_t \) = return difference between low/high liquidity portfolios

\( \beta_i^{liq} \) = loading on liquidity risk

\[ \begin{array}{cccc}
\text{Liquidity beta (} \beta_i^{liq} \text{)} & \text{Pre DMM} & \text{Post DMM} & \text{Test for difference} \\
\text{change} & \text{p-value} \\
\hline
\text{DMM stocks, mean} & 0.114 & -0.062 & -0.176^{***} & 0.002 \\
\text{DMM stocks, median} & 0.044 & -0.022 & -0.157^{**} & 0.014 \\
\end{array} \]

⇒ Significant drop in liquidity risk loading

⇒ liquidity risk loading closer to larger/liquid stocks after DMM
Economic significance of liquidity risk reduction

Is there a liquidity risk premium at the Oslo Stock Exchange?

*Risk premia estimates, Oslo Stock Exchange 1980-2010*

<table>
<thead>
<tr>
<th>Factor</th>
<th>CAPM</th>
<th>Two factor model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\lambda[k])</td>
<td>p-val.</td>
</tr>
<tr>
<td>(e_{rm})</td>
<td>0.014 (0.00)</td>
<td></td>
</tr>
<tr>
<td>(liq)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GMM J-test</th>
<th>(J(\chi^2(8)))</th>
<th>p-val.</th>
<th>(J(\chi^2(7)))</th>
<th>p-val.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24.47 (0.00)</td>
<td></td>
<td>9.26 (0.16)</td>
<td></td>
</tr>
</tbody>
</table>

- Significant risk premium associated with liquidity
- Reduction in liquidity beta following a DMM hiring implies
  - 2.5% lower expected returns for DMM stocks (annualized)
- Suggest an economically significant effect on cost of capital
Conclusion

Why pay for a DMM?

- Secondary market liquidity matters to the firm because of the market’s role when new capital is raised.
- Firms pay to improve liquidity when they plan on accessing the stock market in the near future.

Implications for asset pricing

- Liquidity risk loading drops, liquidity risk transferred to DMM.
- 2.5% lower expected return (annualized).

⇒ Suggest an economically significant effect on cost of capital.
⇒ Likely to cover the cost of having a DMM.
EXTRA SLIDES
## Panel A: Market and liquidity risk loadings

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>$a_i$</th>
<th>$\beta^m_i$</th>
<th>$\beta^{liq}_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (low spread)</td>
<td>-0.003</td>
<td>1.06 (0.00)</td>
<td>-0.40 (0.00)</td>
</tr>
<tr>
<td>2</td>
<td>-0.003</td>
<td>0.98 (0.00)</td>
<td>-0.37 (0.00)</td>
</tr>
<tr>
<td>3</td>
<td>-0.002</td>
<td>1.08 (0.00)</td>
<td>-0.24 (0.00)</td>
</tr>
<tr>
<td>4</td>
<td>-0.001</td>
<td>0.90 (0.00)</td>
<td>-0.19 (0.00)</td>
</tr>
<tr>
<td>5</td>
<td>-0.001</td>
<td>0.95 (0.00)</td>
<td>-0.09 (0.26)</td>
</tr>
<tr>
<td>6</td>
<td>-0.001</td>
<td>0.88 (0.00)</td>
<td>-0.13 (0.01)</td>
</tr>
<tr>
<td>7</td>
<td>0.000</td>
<td>0.89 (0.00)</td>
<td>0.04 (0.58)</td>
</tr>
<tr>
<td>8</td>
<td>0.003</td>
<td>0.93 (0.00)</td>
<td>0.32 (0.00)</td>
</tr>
<tr>
<td>9</td>
<td>0.004</td>
<td>1.00 (0.00)</td>
<td>0.44 (0.00)</td>
</tr>
<tr>
<td>10 (high spread)</td>
<td>0.006</td>
<td>1.06 (0.00)</td>
<td>0.68 (0.00)</td>
</tr>
</tbody>
</table>

## Panel B: Risk premia estimates

<table>
<thead>
<tr>
<th>Factor</th>
<th>CAPM</th>
<th>Two factor model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\lambda[k]$</td>
<td>p-val.</td>
</tr>
<tr>
<td>$er_m$</td>
<td>0.014 (0.00)</td>
<td></td>
</tr>
<tr>
<td>$liq$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24.47 (0.00)</td>
<td></td>
</tr>
</tbody>
</table>