When Do Listed Firms Pay for Market Making in Their Own Stock?

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Abstract

A recent innovation in the equity markets is the introduction of market maker services procured by the listed companies themselves. Using data from the Oslo Stock Exchange, we investigate what motivates issuing firms to pay to improve the secondary market liquidity of their listed shares. By examining the timing of market maker hirings relative to corporate events, we find that the likelihood that a firm will interact with the capital markets in the near future is a determinant. A typical firm employing a designated market maker is more likely to raise capital, repurchase shares, or experience an exit by insiders.

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On March 20, 2013, NASDAQ received approval from the SEC to establish a *Market Quality Program* (MQP).[1] This program allows companies to pay financial intermediaries directly for market making services.[2] NASDAQ claims that the prime beneficiaries of the new program are the listed companies.[3] More specifically, they argue that their MQP will "*lower transaction costs and enhance liquidity,*" which will "*help companies access capital to invest and grow.*" NASDAQ also quotes Congressman Patrick McHenry who argues that paying for market making activity "*...would allow small companies to produce an orderly, liquid market for their stocks.*" Thus, through what is typically called a Designated Market Maker (DMM) program, the firms themselves can affect the nature of trading in their stock.

Understanding the mechanisms and effects associated with DMM programs will provide valuable input to policy makers and regulators in the U.S. This is particularly important since the NASDAQ initiative may pave the way for a more general introduction of market quality programs. Due to the obvious lack of U.S. data on DMMs, one needs to look to other markets that already have similar programs in place. In this paper, we examine all Designated Market Maker arrangements at the Oslo Stock Exchange from 2004–2012. In particular, we examine whether corporate decisions to raise equity capital and repurchase shares can be linked to the timing of the hiring of Designated Market Makers.

In the 1980s and 1990s, many European markets shifted from dealer markets and call auction systems (e.g. daily call auctions at the Paris Bourse) to continuous limit order systems without any market makers or floor traders with special obligations to provide liquidity (Biais, Hillion and Spatt, 1995). Since smaller firms typically have higher levels of asymmetric information that discourages liquidity provisions, it was difficult to maintain a liquid market in the smaller stocks. One solution was to introduce Designated Market Maker (DMM) programs, where listed firms are given the option to engage in a contract with a third party who commits to provide liquidity by continuously maintaining bid and ask quotes in the electronic limit order book. The issuing firms pay an out-of-pocket cost for the "liquidity service," which is paid directly to the financial intermediary providing the service.

Our analysis is motivated from two perspectives: 1) from the perspective of the market and 2) from the perspective of the firm. From the market perspective, we can theoretically make the case that there is a potential "inefficiency" in the trading mechanism. Pure limit order markets rely on liquidity provided by the traders themselves without any exchange-assigned intermediary with affirmative obligations. In these markets, there is a potential under-supply of liquidity in stocks with high levels of asymmetric information. For example, in the equilibrium of the classical Glosten and Milgrom (1985) model, a monopolistic market maker sets competitive prices such that the expected losses to informed traders is offset by profits from trading with uninformed (noise) traders. However, once we allow for the free entry of market makers, as in an electronic limit order market, this equilibrium breaks down. Market makers can no longer sustain losses to informed traders since they no longer have any guarantee of recapturing the adverse selection costs from uninformed traders. Therefore, equilibrium spreads will need to increase, especially for stocks with high levels of asymmetric information.

One way to restore an equilibrium with spreads similar to those of the monopolistic market maker case would be to compensate the market maker for the expected losses to informed traders. This is a useful way of thinking about DMM contracts. The level of the fixed fee paid

[1] See the *Federal Register*/Vol. 78, No. 58/Tuesday, March 26, 2013/Notices.

[2] These payments have not been allowed thus far in the U.S. due to FINRA Rule 2460 (Payment for Market Making – FINRA Regulatory Notice 09-60). In 2012, NYSE Arca proposed a similar "Lead Market Maker Program," but the proposal was later withdrawn. (SEC Release No. 34-66966, May 11, 2012 contains the proposal.)

[3] See NASDAQ's initial submission to the SEC, found at `www.sec.gov/rules/sro/nasdaq/2012/34-66765.pdf`.

by the issuing firm must be such that it covers the DMM's expected losses to informed traders, allowing the market maker to maintain a lower spread than the competitive market solution. For stocks with high degrees of asymmetric information, the required fee would potentially be very high, as demonstrated by Bessembinder, Hao, and Zheng (2013).

This brings us to the corporate finance perspective of the paper. Under what circumstances are issuing firms willing to compensate a market maker? The analysis of Bessembinder et al. (2013) provides insight into these questions. Bessembinder et al. (2013) theoretically analyze the case where a firm considers an Initial Public Offering (IPO), and examine how the hiring of a DMM can improve the terms of the IPO. Bessembinder et al. (2013) shows the feasibility of an equilibrium where a firm hires a DMM to support the after-listing market liquidity of the issuing firm's shares against a fee. This allows the firm to charge a higher price in their IPO. Bessembinder et al. (2013) conclude that the DMM contract increases trading volume and enhances allocative efficiency, price discovery, and firm value. Their conclusion is consistent with Ellul and Pagano (2006) who determine, both theoretically and empirically, that underpricing in an IPO is lower if the after-issue stock is more liquid. Thus, if a firm can guarantee that a stock will be more liquid in the future, it can support a higher IPO price today. Thus, the Bessembinder et al. (2013) model supports the NASDAQ claim that payment for market making is in the interest of listed firms if the under-supply of liquidity is due to asymmetric information.

While the Bessembinder et al. (2013) model specifically discusses IPO situations, it clearly generalizes to other cases where the liquidity of the company's stock affects the terms of market transactions. In these cases, firms may want to improve liquidity before they initiate the market transaction. Therefore, we also consider additional corporate events where the terms may be affected by market liquidity, and empirically test whether the likelihood of a firm initiating such actions is related to the firm's decision to hire a DMM. If a firm views the DMM contract as important for its corporate activities, we expect to see that firms that are more likely to interact with the capital market are also those that hire DMMs.

There is an existing empirical literature examining the effect of Designated Market Maker arrangements (Nimalendran and Petrella, 2003; Venkataraman and Waisburd, 2007; Anand, Tanggard, and Weaver, 2009; Anand and Venkataraman, 2013; Menkveld and Wang, 2013). Different from our paper, this literature primarily examines the effects of introducing a DMM on the market process. The consensus in the literature is that the hiring of a DMM improves market liquidity, that this improvement is particularly large for small illiquid stocks, that liquidity risk is reduced, and that companies engaging in a DMM contract experience a significant positive abnormal return around the time of the DMM hiring. The positive price effect of the DMM hiring suggests that the market participants value the presence of a DMM. Our paper complements the existing literature by more closely examining corporate motivations as to why companies engage in a DMM arrangement.

The main result in our paper is that ex-ante measures related to the likelihood that a firm will access the capital market in the near future are significant determinants of the firm's decisions to hire a DMM. This result is also confirmed using ex-post variables that measure the actual equity issuance and repurchase activity of firms. While our results are consistent with the findings in the earlier literature that secondary market liquidity is important for corporate finance decisions, our results suggest that firms themselves can improve the terms in which they raise capital by entering into a DMM contract before they interact with the capital markets.

We also make a contribution to the literature regarding stock repurchases. We find that those firms initiating a repurchase program are more likely to hire a DMM to improve liquidity before they execute the actual repurchases. This result is not consistent with the underpricing explanations for why firms repurchase shares since the liquidity improvement will lower the probability that the stock is undervalued in the first place. Any explanations as to why firms

repurchase shares are more likely to involve rational theories, such as a cost effective way of distributing cash to the firm's owners.

While our results are consistent across various model specifications and robustness checks, our empirical design does not allow us to make any strong causality statements. In other words, we cannot rule out that there are other factors that simultaneously affect both liquidity and the firms' growth prospects. In some cases, the hiring of a DMM is likely to be the result of investment banks actively searching for companies that have experienced recent growth. If the firm accepts the DMM offer and the liquidity provision by the DMM causes the firm's stock price to increase, this may trigger the firm to initiate an equity offering.[4] Another possible case is that a firm that is planning to raise capital is offered a DMM service by the underwriter as part of the total issuance package. If the underwriter can guarantee a liquid market in the company's shares after the public offering, this will benefit both the underwriter and the issuing firm. The DMM activity will potentially increase the demand for the issue ex-ante that will both increase the underwriting spread received by the underwriter and also reduce the probability that the underwriter is stuck with shares not taken up by investors.

However, regardless as to who initiates the DMM contract, the general conclusion will still be that allowing firms to engage in a DMM contract may improve the terms in which firms can raise capital. Thus, our main empirical results should not be construed as a causal statement, although our interpretation is that firms are more likely to engage a DMM if they are planning on accessing the capital market.

The structure of the paper is as follows. First, we provide a short discussion concerning the relevant theory to establish the hypothesis tested in the paper. In Section II, we present some institutional details and descriptive statistics of DMM contracts at the Oslo Stock Exchange. In Section III, we examine what happens to stock liquidity around the DMM hiring, while in Section IV we examine the main research question of the paper; when do issuers choose to hire (or fire) a DMM? Section V provides our conclusions.

I. Theoretical Implications

It is useful to begin by thinking about the market for DMM services as having a supply side and a demand side. The supply side reflects the financial intermediary offering the DMM service. This intermediary can vary the fee it charges for providing the liquidity service, as well as other terms of the contract. Such a contract typically requires the DMM to keep the relative bid/ask spread below a contractual number of, for example, 4%. The DMM would maintain the bid and ask quotes by submitting and updating limit orders to buy and sell, with a maximal relative price difference of 4%.

For a given contractual maximum spread, microstructure theory (Glosten and Milgrom, 1985; Bessembinder et al., 2013) states that the fee charged by the financial intermediary needs to cover the market makers' losses to informed trading (i.e., the adverse selection cost). The expected loss to informed traders is the probability of informed trading times the expected number of trades. This will lead to a fee schedule that is a nonlinear function of liquidity. For the most liquid stocks on the exchange (i.e., those with the largest trading volume), the DMM will charge a high fee. Even if the probability of informed trading is small, the large trading volume will cause the total expected loss to be high and lead to a higher fee. For less frequently traded stocks, however, the lower trading volume will lead to a lower fee until the probability of informed trading becomes the dominating component, at which point the fee becomes an increasing function of the probability of informed trading. This intuition is illustrated more

[4] We thank an anonymous referee for making this point.

formally in the Bessembinder et al. (2013) model where they demonstrate that the relative degree of informational asymmetry is what drives the choice of hiring a DMM, and not liquidity per se.

Thus, for the supply side, we think of the DMM as offering a menu of prices and contractual terms, where the fee the DMM requires for the service will be related to a combination of both the absolute level of the contractual spread and the spread improvement relative to the current level of the spread. The DMM will also have to form expectations about any changes in trading frequency as a result of the improved liquidity. As such, for a given contractual spread, we expect a U-shaped relation between liquidity and the fee.

The demand side reflects the firm that has issued the stock. The firm needs to trade off what it will be charged by the DMM against the perceived benefits to the firm of improved liquidity in the secondary markets. The benefit demonstrated by Bessembinder et al. (2013) is that the terms at which the firm can raise capital in the IPO are affected by the secondary market liquidity of the company's stock. However, we suggest that there are also other corporate actions for which liquidity may matter.

First, we have the case used directly in the Bessembinder et al. (2013) model - IPOs. A firm may pre-commit to having a DMM to ensure the market liquidity of the issued shares for a time after the IPO. This argument also carries over to the second type of corporate actions we consider; that is, issues of new equity (Seasoned Equity Offers - SEOs). SEOs may be affected by liquidity either through the probability of actually being able to raise capital, or the price at which capital is raised (i.e., the underpricing of the issue). With respect to the ability to raise the desired amount of equity, there is empirical evidence that greater liquidity in the stock allows for more equity in the capital structure (Lipson and Mortal, 2009). With respect to underpricing, there is international empirical evidence that liquidity affects the underpricing in SEOs (Ginglinger, Matsoukis, and Riva, 2013; Stulz, Vagias, and van Dijk; 2012). Thus, the presence of a DMM may result in better terms (less underpricing) in the SEO.

The third corporate action we examine is share repurchases. Here, the Bessembinder et al. (2013) argument does not carry over as readily due to competing theories of corporate motivations for repurchases. We refer to Vermaelen (2005) for a survey of the repurchase literature and instead try to contrast the best known arguments. The typical argument as to why a firm repurchases shares is that it is a cost effective way of distributing free cash to the firm's owners, potentially catering to different clienteles, where, for example, the clienteles may be tax-induced. Given this motivation for repurchases, the firm wishes the liquidity to be as good as possible as liquid shares lower trading costs in the repurchase. There is, however, an alternative theory of repurchases that firms strategically repurchase shares when they are undervalued. In these cases, the firm is presumably acting in the interests of its long-term owners. However, the firm would probably not want to hire a DMM in that case since improving the liquidity would also improve the price discovery. A more liquid and actively traded stock is less likely to be underpriced.

For all these corporate actions, the issuing firm will evaluate the current liquidity level of the firm's stock and determine whether the costs of having a DMM are outweighed by the potential improvements in terms of corporate actions. For both IPOs and SEOs, the firm's benefit of liquidity is increasing in the capital needs of the firm. For repurchases, however, the benefits depend upon the corporate motivation behind the repurchases. If the main motivation is to conduct repurchases as cost effectively as possible, the benefits of liquidity are increasing with the likelihood of future repurchases. In contrast, if the main motivation for the repurchases is underpricing, the firm would prefer to keep the stock less liquid, and the benefits of liquidity decrease with the likelihood of future repurchases.

These are the main predictions for corporate demands of liquidity improvement that we

will test in this paper. However, the empirical predictions can not be mapped directly into the estimation. We also need to factor in the cost dimension of the DMM hire. As previously discussed in this section, the fee structure is likely to be a nonlinear function of liquidity with a higher fee for the most heavily traded (and liquid) stocks. It is unlikely that the firms will want to pay for any liquidity improvement of liquid stocks since their liquidity is already very good. Any additional liquidity improvement would be marginal and costly. The firms for which hiring a DMM would be a relevant option are those with less heavily traded stocks and medium levels of asymmetric information. Within this group of less liquid stocks, the Bessembinder et al. (2013) model suggests that the cost of hiring a DMM increases with the relative informational asymmetry of the stock. This is not observable, but is likely to be correlated with stock liquidity.

Over time, the riskiness and profitability of firms change. This can come from the dynamics in the firms' product markets or, more generally, market-wide shocks, such as financial crises. The theory we have discussed is silent on dynamics, although Bessembinder et al. (2013) have an informal discussion, pointing out that:"*DMM contracts may be useful if they require additional liquidity provision at times when perceived fundamental uncertainty and informational asymmetries are temporarily elevated.*"

In our empirical analysis, we treat the decision to hire a DMM as being continually updated to reflect changing circumstances. It is not clear what is the most relevant horizon, but the following arguments motivate our choice. First, at the Oslo Stock Exchange (OSE), the DMM contract is valid for a minimum of three months with a fixed fee paid up front. The financial markets are aware of this pre-commitment. From the perspective of a longer term investor participating in an IPO or SEO, there is a question as to whether the promised improvement in liquidity from hiring a DMM is a credible commitment. In other words, what guarantee do the investors have that the DMM will be kept for longer than the minimum three month period? While there are no explicit commitments from the firms to keep the DMM going, there are potential reputational costs associated with discontinuing the DMM just after the capital has been raised. For most firms, raising capital or conducting repurchases is a recurring activity. Thus, for a firm that is likely to interact with the capital markets in the future, it would be important to keep the DMM long enough after the corporate event to be able to credibly use them to improve the terms in future corporate actions. In the analysis, we examine the typical length of DMM arrangements and find that most DMM arrangements at the OSE last significantly longer than the minimum commitment of three months.

In addition, Næs and Ødegaard (2009) find that the median holding period for an equity owner at the Oslo Stock Exchange is less than half a year. Financial market investors will typically have shorter horizons than the firm's investments, which, for example, in the oil industry may be commitments for several decades. Thus, there is no natural horizon that springs to attention here. In the empirical analysis, we will use what we view as a reasonable middle ground and review this on an annual basis, re-evaluating the decision to hire (or continue) a DMM each year.

II. Institutional Details and Descriptive Statistics

Our sample consists of stocks listed on the Oslo Stock Exchange (OSE) in Norway. The OSE is a medium-sized stock exchange by European standards, and has stayed relatively independent. The current trading structure is an electronic limit order book, where orders must specify a price and are subject to a strict price-time priority rule.[5]

[5]See Bøhren and Ødegaard (2001), Næs and Skjeltorp (2006), Næs, Skjeltorp, and Ødegaard (2008, 2009) for a discussion of the structure of the exchange and descriptive statistics for trading on the OSE.

To illustrate the evolution of market liquidity at the OSE from 2000–2012, Figure 1 reports the time series of the relative (closing) bid/ask spreads for the whole market and for stocks grouped by size. Spreads at the OSE gradually decreased in the 1990s and early 2000s, until they reached their lowest level in 2004. Spreads increased markedly during the 2008 financial crisis, and have yet to return to their historical low. Clear differences in liquidity levels emerge when stocks are grouped relative to their market capitalization. The largest stocks on the OSE are very liquid with relative spreads below 1% (spreads which seems largely unaffected by the financial crisis), while the smaller stocks have spreads in the 3%-7% range, with a clear worsening of liquidity during the crisis.

In 2004, the OSE introduced the possibility for financial intermediaries to declare themselves as Designated Market Makers in a firm's stock, where the firm pays the DMM for the market making service. Formally, the exchange is not a legal party in the contract, which is an agreement directly between the issuing firm and a financial intermediary. The exchange is merely informed that a contract has been established. The presence of a DMM is used by the exchange in grouping the stocks on the exchange into liquid and illiquid segments. The most liquid stocks, and/or those with a DMM, are included in the *OB Match Index*. The less liquid (remaining) stocks are assigned to the *OB Standard Index*.[6]

The design of the contract is such that the DMM contracts to maintain a specified maximum spread "most of the time." The two parties have leeway along several dimensions. The OSE provides a standardized contract, where the DMM and the issuer agree on a percentage of the trading day that the bid and ask quotes should be available, a minimum volume that should be available at the bid and ask quotes, and, finally, a maximum level of the bid/ask spread, typically specified as a percentage of the relative spread. The parties may add other contractual features. These exact features are not made public. All the parties need to announce is that a DMM has been assigned to a stock, and when it will start operating. Unfortunately, we do not have access to the actual contracts, but have been told by stock exchange officials that the "typical" contract has a requirement of bid/ask quotes being available 85% of the trading day, a maximum relative spread requirement of 4%, and a minimum lot size of the best bid and ask of four, which typically amount to 400 shares.

It is useful to contrast this "European style" DMM contract with that used in the NASDAQ OMX Market Quality Program (MQP). In the NASDAQ program, the exchange acts as the middleman in all MQP contracts. The issuing company (ETF sponsor) pays NASDAQ a $50,000 annual fee, which may be topped up (Supplemental Fee) to a maximum of $100,000. This fee is then paid by NASDAQ to qualifying market makers. To qualify, a market maker needs to:[7]

1. Be at or better than the National Best Bid and Offer (NBBO) for 25% of the trading day for 500 shares;

2. Post a market with a bid no less than 2% away from the NBB and an offer that is no greater than 2% away from the NBO 90% of the trading day;

3. Provide an aggregate of 2,500 shares of displayed liquidity on the bid side and an aggregate of 2,500 shares of displayed liquidity on the offer side. Shares must be within the 2% spread threshold and 90% time threshold detailed in the above bullet point.

4. Market Makers' performance will be measured daily and averaged monthly.

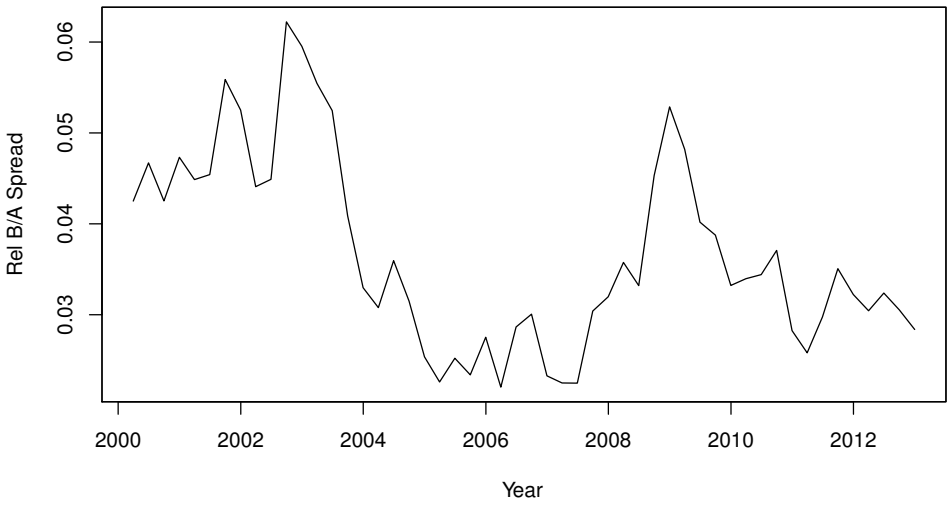
[6]The exchange will typically receive a copy of the contract, but this is privileged information, only to be used by the surveillance department at the exchange to track DMM activity in these stocks, ensuring that the DMMs are fulfilling their obligations in accordance with the contract.

[7]This is taken from "Frequently Asked Questions; NASDAQ OMX Market Quality Program," `www.nasdaqtrader.com/content/etfs/mktqualityprogram.pdf`.

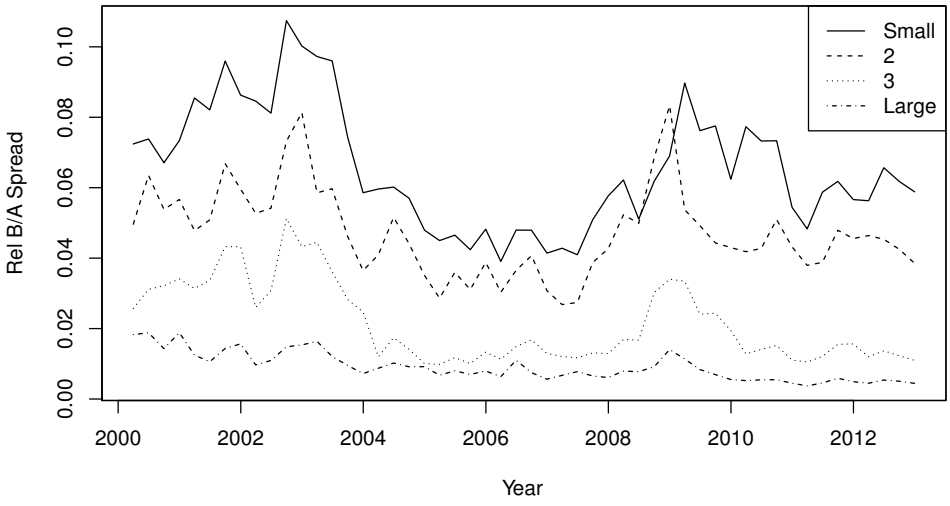
Figure 1 Time Series of Relative Spreads

The figures present relative bid/ask spreads at the Oslo Stock Exchange. The relative spread is calculated as the difference between the best closing bid and offer, divided by the bid/ask midpoint. This is then averaged across all trading days in a quarter. In Panel A, the average spread is calculated for all of the firms at the Oslo Stock Exchange, while in Panel B, the spread is averaged across all of the firms within the same market capitalization quartile. The averages have been winsorized by removing the upper and lower 1% of observations.

Panel A. Average Relative Spread for Whole Market



Panel B. Average Relative Spreads for Four Size Groups



The fee is paid by the exchange on a pro-rata basis to all market makers that satisfy these criteria.

The most important difference between the NASDAQ specification and the standard contract at the OSE is the role played by the NBBO in the U.S. contracts. In the Norwegian case, since the contract specifies an absolute magnitude of the spread, the issuing firm (DMM hirer) has more control over the liquidity in the presence of a DMM. For a NASDAQ type of contract, the spread need not be improved. In fact, it may even deteriorate if the NBBO widens. As long as the DMM is at the NBBO during 25% of the trading day, the DMM is fulfilling its contractual obligations. Thus, there are no direct incentives to reduce the spread.

Let us return to the Norwegian case. When a DMM contract is entered into the first time, it must be announced through the official notice board of the exchange. To generate the sample of DMM contracts, we have collected all of the announcements of new DMM contracts from the OSE. In most cases, discontinuations will also be announced, but this is not a requirement. Thus, we need to use some additional information to identify discontinuations. To do so, we track all of the stocks with a DMM and determine whether the stock is moved from the most liquid OSE index (where all firms with a DMM are also included) to the least liquid index. Since we know for sure that a firm that leaves the liquid index no longer has a DMM, we know that the firm has stopped its DMM contract. While we believe we have caught most discontinuations, the timing of the discontinuations are less certain than the first hires.[8] In addition to the announcements, we use additional data from the OSE data services, which provides daily price quotes, announcements, and accounting data.

Table I Overview of DMM Activity

The table provides an overview of the DMM activity at the OSE. It lists the total number of listed stocks, the fraction (in percent) of the listed firms with a DMM arrangement during the year, the number of active DMM contracts for each year (total and within market capitalization quartiles), and the number of new DMM contracts established during a given year (total and within market capitalization quartiles).

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total listed stocks at OSE	207	240	260	294	292	274	264	268	254
% stocks having DMM	3.3%	12.9%	16.5%	17.3%	19.8%	17.5%	21.9%	20.9%	21.2%
Active DMM contracts	7	31	43	51	58	48	58	56	54
in firm size quartiles:									
1 (small)	0	5	12	19	25	32	15	17	24
2	2	16	19	14	18	11	18	15	17
3	3	5	8	14	11	5	13	15	11
4 (large)	2	5	4	4	4	0	12	9	2
New DMM contracts	7	24	17	20	16	16	21	6	5
in firm size quartiles:									
1 (small)	0	5	6	8	7	8	10	1	2
2	2	13	8	7	7	6	6	1	3
3	3	4	3	5	1	2	2	3	0
4 (large)	2	2	0	0	1	0	3	1	0

[8]There are some cases where the liquidity provider terminates all of its contracts. The most prominent is the Icelandic bank Kaupthing, which left the Norwegian equity markets as a result of the Icelandic Banking Crisis. However, most customers of Kaupthing had either already obtained another DMM provider before Kaupthing left the OSE or shortly after. Cases where the firm hired a new DMM within a month are not classified as terminations.

Table I provides some details concerning the DMM contracts at the OSE. The table reports the total number of listed firms, the fraction (in %) of the listed firms with a DMM contract during the year, the number of active DMM deals (total and within market capitalization quartiles), and the number of new DMM contracts established during a given year (total and within market capitalization quartiles). The number of DMM contracts is small relative to the total number of listed firms. At most (in 2010), about 22% of the listed firms (58 stocks) had a DMM. The firms with DMMs are typically smaller, as noted from the split into four size quartiles. In total over the sample period, we observe 143 cases where firms hire DMMs, but in some of these, the same firm switches or rehires a DMM.

Table II provides various summary statistics that compare firms with a DMM to firms that do not have a DMM (*Other*). The first set of statistics in Part *(a)* presents measures of firm magnitude, using both asset values and accounting figures. A typical firm with an ongoing DMM agreement is smaller than the average OSE firm. This is particularly apparent when looking at the means. However, the means are pushed up by a very skewed size distribution at the OSE. At the OSE, the largest three firms constitute between 35%-50% of the total market capitalization in the 2005–2011 period. Thus, it is more informative to focus on the medians, which confirm that those firms with DMMs are among the smaller ones on the exchange.

We also look at measures that capture firm health (sales growth and Q). Tobin's Q for firms with DMMs is higher than that of the average firm without a DMM. If we review Tobin's Q on a year-by-year basis, we would find this to hold across all but the last year. Sales growth is higher for the non-DMM users, but when reviewed on a year by year basis, we find no systematic differences between the two groups of firms.

We are also interested in the behavior of the firm's owners. In Part *(b)* of the table, we present the trading activity of the firm's insiders. Of particular interest is the exit by individual insiders. We measure insider trading by counting the number of relatively large insider sales (*No Inside Trades*). We define an insider transaction as large if it exceeds NOK 50,000 (about 10,000 USD). The average number of insider trades does not reveal any systematic differences between the two groups of firms.

The third set of statistics in Part *(c)* of the table measures the extent to which firms are active in the capital markets. To this end, we report the fraction of firms that issue new equity or repurchase stocks. With regard to repurchases, we use two definitions. First, we calculate the number of firms that have announced a repurchase plan. At the OSE, firms must obtain approval at the annual shareholders meeting before they can repurchase shares. This approval is valid for a maximum of 15 months before it must be renewed at the annual meeting. If the firm has a valid repurchase approval from the annual meeting, we count this as a planned repurchase event. We also count the number of firms that, ex-post, actually conduct repurchases. For all of these variables, there are some differences between firms with DMMs and firms without a DMM (*Other*), but there are few clear systematic patterns. The differences are small, and the relative sizes may change across the years.

A. Liquidity and DMM Choice

In the theory section, we discussed how a financial intermediary (the supply side) would price its DMM services. We argued that the relevant input to this decision would be the current liquidity of the stock and the relative improvement in liquidity stipulated in the DMM contract.

Now, we specifically examine liquidity differences between firms with and without a DMM. Part *(d)* in Table II reports statistics concerning some common measures of stock liquidity: the quoted and relative spreads, LOT (an estimate of transaction costs introduced by Lesmond, Ogden, and Trzcinka, 1999), and the Amihud illiquidity ratio (the measure of price elasticity

Table II Summary Statistics

The table presents sample statistics for firms with a DMM and without a DMM. The statistics are calculated on an annual basis. The first column reports the averages across all firms with a DMM at some point during a year, while the second column provides the average for all of the firms without a DMM (*Other*) in that year. *Firm Size* is the total value of the firm's assets at year-end. *Operating Income* is the book income for that accounting year. *Q* is an estimate of Tobins' Q. *Sales Growth* is the percentage change in operating income. *No Inside Trades* is the number of large sales by corporate insiders. *Fraction Equity Issuers* is the fraction of companies that issue equity. *Fraction Planned Repurchasers* is the fraction of companies with an active repurchasing program. *Fraction Actual Repurchasers* is the fraction of companies that repurchased stock at least once during the year. *Spread* is the difference between the best closing bid and ask prices in Norwegian kroner (NOK). *Relative Spread* is the spread divided by the closing price midpoint. *LOT* is the Lesmond et al. (1999) estimate of transaction costs. *Amihud* is the Amihud (2002) illiquidity measure. *Annual Turnover* is the average fraction of the firm's outstanding shares traded during the year. *Frac Trading Year* is the fraction of days during the trading year with trades in the stock. The period is from 2005–2012.

	With DMMs	Other
(a) Firm magnitude		
Firm Size (mill)		
Average	1631	10227
Median	621	1553
Operating Income (mill)		
Average	1403	8262
Median	369	925
Q	1.50	1.13
Sales Growth(%)	21.3	28.1
(b) Individual owners		
No Inside Trades	1.0	1.0
(c) Equity market activity		
Fraction Equity Issuers(%)	30.7	29.8
Fraction Planned Repurchasers(%)	22.0	21.8
Fraction Actual Repurchasers(%)	36.0	31.3
(d) Stock liquidity measures		
Spread (NOK)	0.9	2.0
Relative spread(%)	3.0	3.3
LOT(%)	4.3	4.7
Amihud	1.102	1.537
Annual Turnover(%)	57.8	94.7
Frac Trading Year(%)	77.6	80.2

introduced by Amihud, 2002). We also consider two activity measures that provide information regarding the trading activity of a given stock. The first activity measure is annual turnover, the fraction of a given stock's outstanding shares traded in a year. The second statistic is the fraction of trading days within a year that the stock is traded. Since the stocks that are considered for DMM services are among the less liquid at the OSE, they are not necessarily traded every day. To capture this property, we simply calculate the number of days that the stock is actually traded, relative to the number of potential trading days (business days). Across all of the firms traded on the OSE, this average varies between 70%-90% over the sample period. At the OSE, there is a set of stocks (Statoil, Hydro, and Telenor) that are traded very actively, and certainly every day. Thus, this low number suggests that there are quite a number of stocks that trade infrequently.

We note some differences in average liquidity across firms with and without a DMM, but these averages do not provide pertinent information as to how liquidity differences affect the DMM hiring decision. In the theory discussion, we suggested that there should be a nonlinear relation between current liquidity and the DMM fee since the firms choosing to hire a DMM will not be firms with very liquid stocks, but rather those firms with lower liquidity. This nonlinear relationship was also noted in Anand et al. (2009).

We investigate this in more detail by examining the cross-sectional frequency distributions of liquidity. In Figure 2, we demonstrate the distribution of relative spread for firms that never hire a DMM (in Panel A), and firms that, at some point during our sample, hire a DMM (in Panels B and C). For the non-hirers, we note that the distribution is highly skewed and concentrated toward good liquidity (low relative spread). The distributions for firms that hire a DMM at some point (in Panels B and C) are less skewed and these firms are, on average, less liquid. For instance, none of the firms in Panel B have a relative spread lower than 1% before they hire a DMM, while in Panel A, we find that there is a large number of observations of relative spreads (for non-hirers) below this number.

Comparing the spread figures in Panel A (stocks without DMM) and Panel B (stocks that will hire DMM within a year), we find that while the firms without a DMM are even more concentrated toward very liquid stocks, there are still a number of firms that are very illiquid (high spreads) that do not choose to hire a DMM. Thus, the typical DMM stocks are neither the most liquid nor the least liquid ones.

III. What Happens When a Firm Hires a DMM?

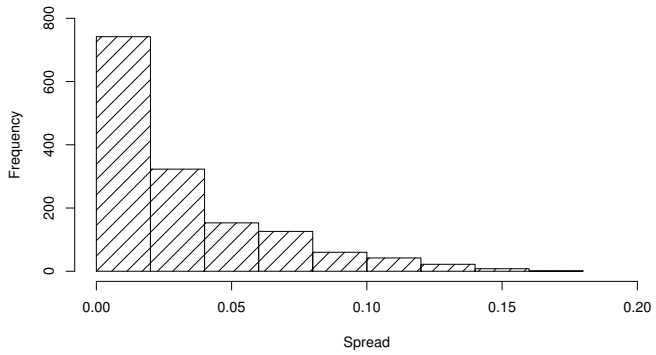
We expect liquidity to improve once a DMM begins to operate. Panels B and C of Figure 2 confirm this. The figures present histograms of the distribution of relative spread one year prior to and one year after the start of the DMM contract. The figure on the right (in Panel C) illustrates the frequency distributions of the liquidity measures for the year after the hiring of a DMM. When compared to the figure on the left (Panel B) that indicates the liquidity of the same firms in the year prior to hiring the DMM, we see a clear shift toward improved liquidity. The spread distribution shifts downward after the DMM has been hired.

To supplement this, and to evaluate the significance of this shift, it is also useful to examine what happens to the average liquidity and trading activity in the secondary market around DMM hirings. The results are presented in Table III, listing averages and changes for five different liquidity and activity measures for one-year and six-month periods before and after the initiation of DMM contracts. For the six-month period, the relative spread, LOT, and Amihud (2002) measures decrease significantly after hiring a DMM. For the one-year window, the reduction in relative spread and the Amihud (2002) measure remains significant, while the change in the LOT measure is rendered insignificant. Interestingly, turnover increases

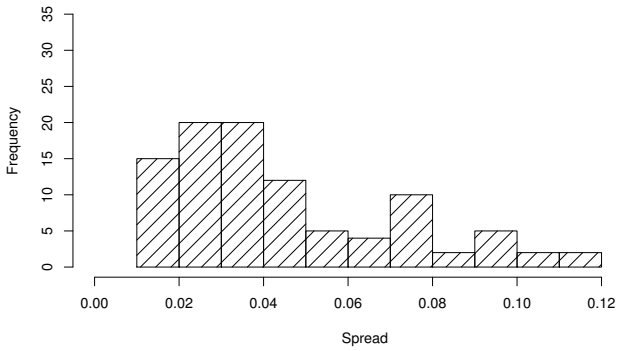
Figure 2 Distribution of Liquidity for Stocks With and Without a DMM

The figures present histograms of the distribution of the average annual relative spread. The top panel (A) only uses those firms that do not have a DMM. The bottom panels (B and C) report the distributions for those firms that have a DMM. Panel B provides the spread distribution one year *before* the DMM is hired, while Panel C presents the corresponding distribution for the year *after* the DMM is hired. The samples in Panels B and C only include firm/years for the first time a firm hires a DMM.

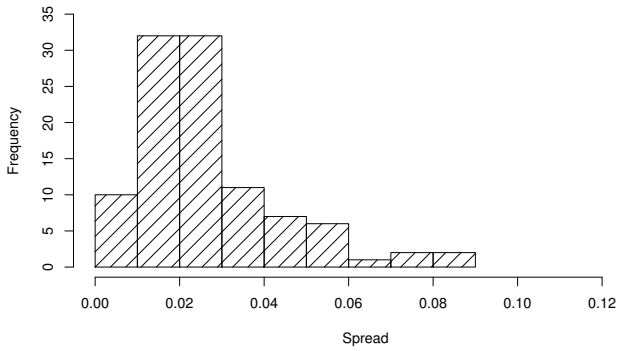
Panel A: Stocks without DMM



Panel B: Year before DMM started



Panel C: Year after DMM started



significantly for the one-year horizon, and the fraction of the trading year the stocks are traded increases for both the six-month and the one-year horizon. This may indicate that the reduction in transaction costs due to the introduction of a DMM attracts new traders to the stock causing trading activity to increase.[9]

Table III Liquidity Measures Before and After DMM Agreements

The liquidity measures are calculated using data for one year and six months before and after the market maker begins. The relative spread is the quoted spread divided by the quote midpoint. The LOT measure is the Lesmond et al. (1999) estimate of transaction costs. *Amihud* is the Amihud (2002) measure. *Monthly Turnover* is the fraction of the firm's stock that is traded in a month. *Fraction of Year Traded* is the number of days that the stock trades, divided by the number of days it is listed. The numbers in parentheses represent p-values from a test of whether the change in liquidity is significantly different from zero. n is the number of observations.

	Period before		Period after		t-test diff				n
	1 year	6 months	6 months	1 year	6 months		1 year		
Relative Spread	0.042	0.042	0.025	0.027	−0.017	(0.00)	−0.014	(0.00)	123
LOT	0.043	0.042	0.034	0.038	−0.009	(0.00)	−0.005	(0.06)	123
Amihud	1.410	1.557	0.537	0.700	−0.867	(0.04)	−0.534	(0.05)	123
Monthly Turnover	0.039	0.039	0.046	0.050	0.008	(0.11)	0.013	(0.01)	123
Fraction of Year Traded	0.739	0.740	0.814	0.807	0.072	(0.00)	0.072	(0.00)	123

Another way to illustrate the effect of hiring a DMM is to look at this on a company-by-company basis, and illustrate the changes in liquidity around the hiring or discontinuation of a DMM. Figure 3 illustrates the time-series of relative spreads for four selected firms. The time(s) where the firms employ a DMM are marked by the grey shaded areas. The four examples are chosen to illustrate the different outcomes related to the hiring or termination of a DMM.

The first two figures demonstrate how the presence of a DMM affects liquidity. The figure in Panel A illustrates how the spread decreases after the hiring of a DMM by the company Copeinca. The second figure (Panel B) presents the pattern for a company (IM Skaugen) that had two short periods without a DMM. It is evident from the figure that the spread jumps up when there is no DMM present, even for the event at the end of 2009 when the firm was without a DMM for just a few days.

Returning to the difference between the Norwegian contracts and the NASDAQ setup, these figures indicate the importance of the maximum spread built into the European style contracts. The spread is pushed down immediately when a DMM begins operations. With the NASDAQ contracts, there is no guarantee that we would see such a picture as there is no maximum spread requirement.

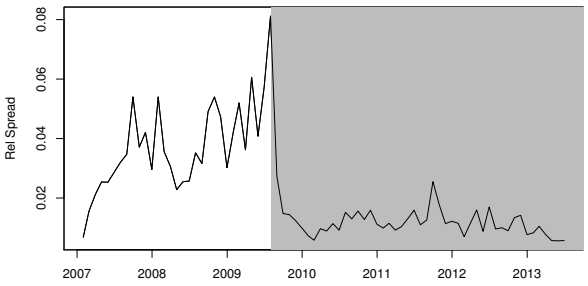
The last two figures, in Panels C and D, illustrate different outcomes when firms terminate a DMM contract. The first, Imarex (Panel C) hired a DMM in 2007. By the end of 2011, the stock went from the most liquid index at the OSE (OB match) to the least liquid (OB Standard). Since stocks with DMM's are automatically included in the OB match, this implies that the stock had no DMM after December of 2011. Imarex's liquidity gradually worsened during 2012, with the relative spread moving from about 2% to above 10% during the year.

[9]This test for difference in means assumes that there are no systematic market-wide changes in liquidity over the same period. This would be a particular worry if there is a trend toward improved liquidity for the whole market in this period. However, as noted in the time series of spreads in Figure 1, there is no long-time trend at the OSE during this period. The liquidity, as measured by spread, was relatively stable in the 2004–2012 period, with some worsening of liquidity during the 2008–2009 financial crisis that soon reverted toward the earlier levels.

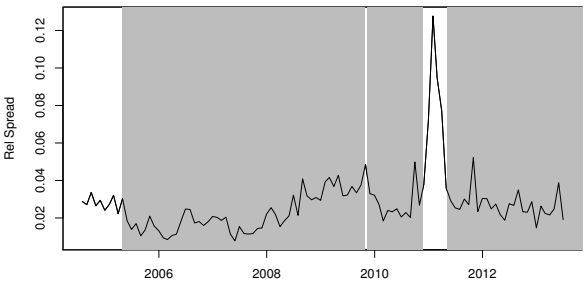
Figure 3 Time Series of Liquidity for Selected Individual Companies

The figures illustrate the time series of liquidity for four example companies (Copeinca, IM Skaugen, Imarex, and Bionor Pharma). For each company, the line provides the average monthly relative spread. The shaded areas indicate when the firms have an active DMM.

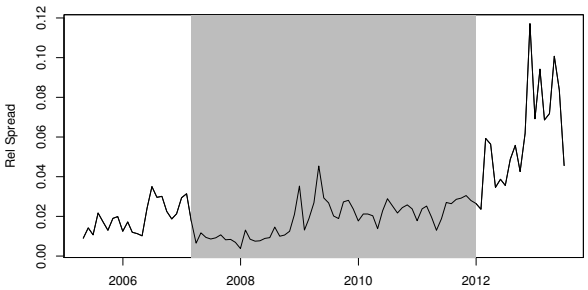
Panel A: Copeinca



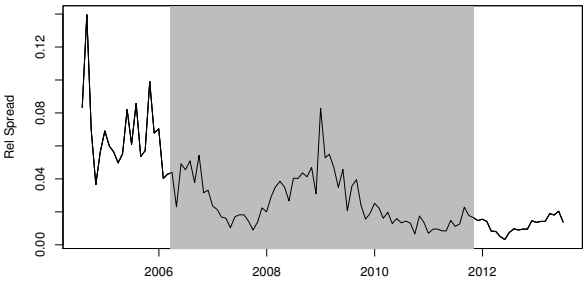
Panel B: I M Skaugen



Panel C: Imarex



Panel D: Nutri Pharma/Bionor Pharma



This suggests that the competitive spread was significantly higher than the contractual DMM spread.

The final example (Panel D) is chosen to illustrate the opposite outcome at the termination of a DMM contract. The company, Bionor Pharma, ended its DMM agreement in 2012 without any apparent effect on the relative spread. In fact, when the DMM arrangement was terminated, the firm issued a press statement stating:[10]

> *"Bionor Pharma ASA has terminated the market making agreement with Sparebank1 Markets for the company's shares. ... Bionor Pharma is one of the most actively traded stocks at the OSE related to its share capital. The Company expects this trend to continue going forward."*

In other words, this particular company does not see any need to pay for DMM services, as the liquidity and activity is so high that the company expects its stocks to continue to be traded actively without a DMM. The time series of the spread bears this presumption out, where the spread remains at the same level after the discontinuation of the DMM arrangement.

As the last two examples indicate, companies will sometimes end their DMM contracts. As such, it is interesting to determine how long firms typically retain their DMMs. In our sample, the mean (median) firm keeps a DMM for 2.8 (2.3) years. The first quartile duration of a DMM contract is 1.4 years. Thus, most of the DMM relationships are longer term, above two years. The longest was 7.7 years, which covers the entire sample period.

Overall, we find that there is an improvement in all liquidity measures around the hiring of a DMM, consistent with prior research in other markets. However, this is a result that we should observe, and confirms that the DMMs fulfill their obligations. The more interesting observation is that the DMM hirings are also associated with an increase in trading activity, as measured by the fraction of trading days and turnover. Thus, there may be liquidity externalities associated with having a DMM in the sense that "liquidity attracts liquidity."

IV. The Corporate Decision to Hire a Designated Market Maker

We now explore the main question of the paper; that is, when do issuers choose to hire a DMM? The main hypothesis we want to test is whether firms that are about to effectuate capital market actions, for which market liquidity matters, are more likely to hire a DMM to improve their secondary market liquidity. Our conjecture is that liquidity enhancement will improve the terms at which they can execute their corporate actions.

In our empirical specification, we consider calendar years. For each year, we determine whether the firm hired a DMM within the year. We view this annual split into calendar years as natural as most of the corporate decisions we examine, such as exchange listing, repurchases, and large capital issues, require approval from the annual meeting that normally occurs only once a year. We implement the actual analysis as a binomial choice model, using a Probit regression with the DMM hiring event as the dependent variable and measures related to capital market events as explanatory variables.

In the theory section, we listed three corporate actions: 1) Seasoned Equity Offerings (SEOs), 2) Repurchases, and 3) Listings (IPOs). In our empirical design, we specify empirical proxies for these three actions, and examine whether they are important for the decision to hire a DMM. In the empirical analysis, we use two approaches. The first is an ex-ante approach, where we use only those explanatory variables that are observable at the point when the decision to hire

[10] Taken from the Oslo Stock Exchange Newsweb, press statement at 14:00 on 16 May 2012. Note that the company changed its name from Nutri Pharma in 2010.

a DMM is made. The second approach is an ex-post analysis, where we consider the actions a firm makes after it has hired a DMM.

Let us first explain the empirical measures relevant for SEOs. In the theoretical section, we argued that the benefit of liquidity increases with the capital needs of the firm. This motivates our use of proxies for capital needs as predictors for the likelihood of an SEO. More specifically, we employ two variables as ex-ante proxies for capital needs. The first is the firm's growth opportunities, measured by Tobin's Q, where we assume that capital needs increase with Q. As an alternative to Q, which has the problem that it may be open to interpretations other than growth potential, we also consider recent sales growth. We assume that a firm that is currently experiencing high growth in sales is more likely to need capital for expansion.

An alternative to Q and growth opportunities is to observe the firm's actions ex-post. Do firms actually perform an SEO after hiring a DMM? For this purpose, we use a dummy for whether the firm issues equity at some point during the three years following the DMM hire.

We also construct proxies for the corporate repurchasing of shares. Again, we apply two specifications, one ex-ante and one ex-post. Our ex-ante measure is motivated by the regulation as to how repurchases must be performed by Norwegian firms. Before a firm can repurchase shares, it is required to obtain approval from the annual shareholders meeting. This approval is required to specify the amount of shares that can be repurchased, up to a maximum of 10% of the firm's outstanding shares. This approval is valid for a maximum of 15 months and must be renewed at the annual meeting or at an extraordinary meeting. Based on this information, our ex-ante measure of "planned" repurchases is defined as whether, in the year of analysis, the firm has obtained approval for a repurchase program. Data regarding these approvals are obtained from the minutes of the annual meetings. As our ex-post measure, we use a dummy for whether the firm actually repurchases shares within three years of the DMM hire. In Norway, firms are required to announce their actual repurchase activity as soon as possible and no later than prior to the beginning of trading the following day.

In addition, we construct proxies for IPOs. The first proxy is a measure of the time since the firm became listed, where we classify IPO firms as those listed for less than two years. A second proxy related to IPOs is the exit of the original owners. Among the motivations for IPOs, the desire of the original owners to lower their stake, for diversification or consumption purposes, is typically included. The original owners often have a holdup period after an IPO before they can begin to divest their stakes. Improved liquidity of the firm's shares would lower the price impact associated with insider sales after the holdup period expires. Most of these cases would be registered as insider trades, which we have access to. Therefore, we use the number of insider trades in the period after the DMM initiation to measure these cases. To proxy for the exit decision by insiders, we calculate the number of large sales by insiders. This is an ex-post measure.[11]

In addition, there are a number of additional factors that are likely to influence whether a firm decides to hire a DMM. One is the current liquidity of its stock. For the most liquid stocks, there is little benefit to be gained from hiring a DMM to further improve liquidity. This feature of the data was discussed earlier and is illustrated by the histograms in Figure 2, where we found that for the firms with very low spreads, there were few DMM contracts. To account for this in our empirical specification, we exclude firms that already have very liquid stocks, and only consider those for which hiring a DMM is a relevant option. We choose to base the selection on the fraction of trading days that the stock is trading. If the firm, in the year prior to the one we are considering, traded on more than 90% of the days, we exclude the firm from

[11]To operationalize a large insider transaction, we limit the analysis to trades larger than NOK 50,000 (about $10,000 USD) in value. Our insider data does not distinguish the holding period of the insiders, so this could be divestitures by owners other than the original founders.

the sample.

In the following subsections, we provide results from Probit estimations for the various specifications discussed above. We first examine the first-time hiring of a DMM. Each year, we use the sample of firms on the OSE without DMMs, and seek to determine why firms hire a DMM (for the first time) during the year. In the next subsection, we examine the problem as an ongoing decision, and also include those firms that already have a DMM contract. We ask whether they want to continue using a DMM. In the final subsection, we explore the terminations of DMM arrangements.

A. First-Time Hires

We begin by examining how firms time their first-time hiring of DMMs. Table IV presents the estimation results for the sample containing only first-time hirings.

When reporting the results from the various estimations, we group the explanatory variables into those available ex-ante (Q, planned repurchases, and listing age) and those only available ex-post (issuing equity, actual repurchases, and actual insider trades). The results are split into separate panels for the ex-ante and ex-post analysis. In each panel, we present the various specifications, where each column contains the estimation results for one specification with the most comprehensive specification first. Note that across the various specifications, the number of observations (firm years) will change. This is due to differences in the availability of some proxies, such as sales growth, as we require accounting information from at least the two previous years. We choose to include the maximal number of observations in each Probit estimation.

Panel A of Table IV reports the results from the ex-ante specifications. In Models (1) and (2), we report results from the specifications that include most of the explanatory variables, with less comprehensive specifications as we move to the right. The coefficient on Q is always positive and highly significant across all of the specifications. A positive coefficient indicates that the probability of hiring a DMM increases with Q. Since Q is commonly used as a measure of growth opportunities, this is supportive of our hypothesis that firms that are more likely to need capital are those that hire a DMM. For our second ex-ante proxy for capital needs, *Sales Growth*, the coefficient is also positive, but it is not significantly different from zero. There may be several reasons for this. First, the number of observations is much lower in this estimation, due to the need for at least two years of sales history to calculate sales growth. In addition, sales growth is a more noisy variable as it is based on year-to-year accounts.

In Panel B of Table IV, we report the results when we use ex-post variables. With respect to actual capital issuance (*Issue Equity*), the coefficient is always positive and highly significant. This ex-post result is consistent with the result in Anand et al. (2009) where, in a hazard function formulation, a measure of changes to future equity (equity issuance/stock splits, etc.) is found to be a determinant of the propensity to hire a DMM, albeit with only a 10% p-value. The positive coefficient supports our hypothesis that firms that hire a DMM are more likely to raise additional equity capital in the following years relative to those firms that do not employ a DMM. Thus, capital needs seems to be an important determinant in the decision to hire a DMM.

For the case of stock repurchases, we find that the coefficients are positive in both panels, indicating that repurchasing firms are more likely to hire a DMM. However, the significance is much lower than for that of capital needs. In the ex-ante analysis, the dummy variable measuring whether the firm has a repurchase program in place is never a significant determinant of the first-time hiring decision. For the ex-post analysis, the results are more significant. One potential reason for this is that the ex-ante variable is more noisy. A firm may want to get the annual meeting's approval of a repurchase program "just in case" since it is not committed to

Table IV Hiring a Designated Market Maker

The table reports the results from probit regressions for various specifications using ex-ante (Panel A) and ex-post (Panel B) variables. The dependent variable is a binary variable equal to one if the firm hires a DMM in a given calendar year, and zero otherwise. The ex-ante specification in Panel A includes the explanatory variables *Q* (market/book value), *Sales Growth* (recent two-year growth in accounting income), *Repurchase Program* (dummy for whether the firm has a repurchase program in place), and *Listed<2 Years* (dummy for whether the firm has been listed for less than two years). In Panel B, the explanatory variables include *Issue Equity* (dummy for whether the firm issues equity in the next three years), *Actual Repurchase* (dummy for whether the firm repurchases shares in the next three years), and *Insider Sales* (number of large insider sales over the next three years). In both panels, *Liquidity (RelSpread)* reflects the relative bid/ask spread over the previous year. The numbers in parentheses are the standard errors associated with each coefficient.

Panel A: Ex-Ante specification

	Dependent variable: Hire DMM			
	(1)	(2)	(3)	(4)
Liquidity (Rel.Spread)	−2.56	−11.78***		
	(2.72)	(4.12)		
Q	0.21***		0.21***	0.22***
	(0.06)		(0.06)	(0.06)
Sales Growth		0.03		
		(0.14)		
Repurchase Program	0.06	0.09	0.07	0.06
	(0.21)	(0.25)	(0.21)	(0.21)
Listed<2 Years	0.19	0.09	0.25	
	(0.18)	(0.25)	(0.17)	
Constant	−1.44***	−0.75***	−1.62***	−1.56***
	(0.20)	(0.26)	(0.12)	(0.11)
Observations	481	322	510	510

Panel B: Ex-Post specification

	(1)	(2)	(3)
Liquidity (Rel.Spread)	−3.47		
	(2.84)		
Issue Equity	0.46***	0.48***	0.48***
	(0.16)	(0.16)	(0.15)
Actual Repurchase	0.21	0.24	0.34**
	(0.16)	(0.16)	(0.15)
Insider Sales	0.06**	0.07***	
	(0.02)	(0.02)	
Constant	−1.43***	−1.68***	−1.58***
	(0.22)	(0.14)	(0.12)
Observations	462	490	547
Note:			*p<0.1; **p<0.05; ***p<0.01

actually execute any repurchases. The actual repurchases are, therefore, a more precise proxy. Overall, we argue that we find evidence to support the notion that repurchases matter in the decision to hire a DMM.

Finally, we consider variables related to new listings. Here, the ex-ante proxy, the age of the firm (*Listed<2 Years*), is always positive, but never significant. Similar to repurchases, the ex-ante proxy in this case is rougher than the ex-post one. The firm's age may not reflect the actual ownership structure at the first listing. As such, actual ex-post insider sales should be a better indicator. When we examine the results for this ex-post variable in Panel B, we find that it is always positive and highly significant in both specifications. Thus, firms hiring a DMM have a greater probability of insiders exiting than firms that do not hire a DMM. However, it should be noted that we cannot make a strong causality statement here. The exit of insiders may be triggered by improved liquidity and a potentially higher price, even if this was not the intention when hiring the DMM.

Finally, we examine the last variable, liquidity, measured as the relative bid/ask spread. In the theoretical discussion, we argued that the fee charged by the DMM for liquidity services has a U-shaped relation with liquidity. The sample we use here is truncated by removing the most liquid stocks. In this sample, we expect that the fee charged for DMM services is increasing with liquidity. This hypothesis is confirmed in the empirical analysis. The coefficient on liquidity is negative. Firms with higher spreads are less likely to hire a DMM.

B. Hiring and Maintaining a DMM

As previously discussed, theory is silent regarding the dynamics of the DMM decision. If we believe that a firm is continuously evaluating whether to continue to pay for the services of a DMM or not, we need to examine empirical specifications that allow us to evaluate this decision. We will consider two such specifications. First, we review cases where a firm determines whether to continue the DMM arrangement for one more period. We implement this by increasing the sample used in the previous probit analysis, where we only explored the first hiring decision, to also include continuations. Thus, in addition to firms that do not hire a DMM, we now also include firms that had a DMM at the beginning of the year and redefine success in the Probit to be whether the firm maintains a DMM at the end of the year. The results from this analysis are summarized in Table V.

The results in Table V confirm our earlier results regarding capital issuance. Both the ex-ante (Q) and ex-post variables (*Issue Equity*) remain highly significant. For repurchases, the results are stronger than in the previous analysis. The ex-ante measure (repurchase program) is now significant in the specifications where we do not include previous year's liquidity. This may be an indication that repurchases are a more important argument for keeping the DMM agreement going. Overall, our earlier results are robust to this alternative specification.

C. Discontinuations

As a final examination of firms' use of DMM arrangements, we examine cases where firms discontinue their DMM contract. In this specification, we change the explanatory variables slightly. While we still investigate equity issues and repurchases, we also review the timing of the terminations of the DMM contracts.

Thus, we include variables that look at issuing activity and repurchase activity just prior to the decision to discontinue the DMM arrangement, as well as the ex-post variables used previously. We first review the equity issuance case. If a company has recently issued equity, it is less likely to need new capital in the near future. As such, the potential benefits of retaining

Table V Hiring and Maintaining a Designated Market Maker

The table reports the results from probit regressions for various specifications using ex-ante (Panel A) and ex-post (Panel B) variables. The dependent variable is a binary variable equal to one if the firm hires or maintains a DMM within a given calendar year, and zero otherwise. The ex-ante specification in Panel A includes the explanatory variables *Q* (market/book value), *Sales Growth* (recent two-year growth in accounting income), *Repurchase Program* (dummy for whether the firm has a repurchase program in place), and *Listed<2 years* (dummy for whether the firm has been listed for less than two years). In Panel B, the explanatory variables include *Issue Equity* (dummy for whether the firm issues equity in next three years), *Actual Repurchase* (dummy for whether the firm repurchases shares in the next three years), and *Insider Sales* (the number of large insider sales over the next three years). In both panels, *Liquidity (RelSpread)* reflects the relative bid/ask spread over the previous year. The numbers in parentheses are the standard errors associated with each coefficient.

Panel A: Ex-Ante specification

	Dependent variable: Have DMM			
	(1)	(2)	(3)	(4)
Liquidity (Rel.Spread)	-14.27^{***}	-22.28^{***}		
	(2.23)	(2.94)		
Q	0.20^{***}		0.22^{***}	0.22^{***}
	(0.05)		(0.05)	(0.04)
Sales Growth		-0.04		
		(0.10)		
Repurchase Program	0.21	0.21	0.29^{**}	0.28^{**}
	(0.14)	(0.16)	(0.14)	(0.14)
Listed<2 Years	0.10	0.02	0.10	
	(0.13)	(0.17)	(0.12)	
Constant	-0.13	0.58^{***}	-0.91^{***}	-0.89^{***}
	(0.14)	(0.17)	(0.08)	(0.08)
Observations	622	437	653	653

Panel B: Ex-Post specification

	(1)	(2)	(3)
Liquidity (Rel.Spread)	-15.72^{***}		
	(2.31)		
Issue Equity	0.26^{**}	0.25^{**}	0.29^{***}
	(0.12)	(0.11)	(0.11)
Actual Repurchase	0.10	0.19^{*}	0.29^{***}
	(0.11)	(0.11)	(0.10)
Insider Sales	0.02	0.04^{**}	
	(0.02)	(0.02)	
Constant	0.08	-0.79^{***}	-0.80^{***}
	(0.15)	(0.09)	(0.08)
Observations	603	633	696
Note:			*p<0.1; **p<0.05; ***p<0.01

a DMM may be lower, leading to a discontinuation. Thus, we include both equity issuance and repurchase activity before and after the decision to hire a DMM.

Table VI provides the results from this analysis. One cautionary note is necessary here. The number of observations is much lower than in the previous analysis as we only use the sample of firms with a DMM at some point in the sample period.

If we first examine the coefficients on the equity issuance, there is a positive coefficient on the *Issued Equity Recently* variable, and a negative coefficient on the *Issue Equity Later* variable. We interpret the signs as follows. A positive coefficient implies that a firm is more likely to discontinue the DMM service, and vice versa. The signs are what we would expect as a recent equity issue suggests that the firm has less need for a liquid secondary market going forward. Conversely, if the firm has not issued yet and plan to issue within the next few years, it is more likely to continue the DMM services. The signs of the variables are consistent with this explanation, but, unfortunately, none of these coefficients are significant. This may be due to the relatively few observations.

The results for repurchases, however, are much stronger. The coefficient on future repurchase activity (*Repurchase Later*) is highly significant and negative suggesting that if the firm is planning to repurchase shares going forward, they are less likely to terminate the DMM contract.

At this point, we note another interesting implication of our results concerning the literature on repurchases. In our analysis, we find that firms who plan to repurchase are more likely to hire a DMM. However, this is inconsistent with the underpricing hypothesis as to why firms repurchase shares. The improved liquidity brought about by the DMM will make undervaluation less likely, as better liquidity is typically associated with better price discovery. As argued by Bessembinder, Hao, and Lemmon (2011), a restriction on spread widths by employing a DMM encourages more traders to become informed, which speeds the rate at which market prices move toward true asset values. Thus, if undervaluation is the main reason for firms' repurchases of shares, it is less likely that management would hire a DMM since improved liquidity is likely to improve price efficiency and reduce any mispricing.

D. Robustness

The main result in our analysis thus far suggests that the likelihood of corporate action, such as capital issues and repurchases, is a determinant of the decision to hire a DMM. To verify the results of this analysis, we have performed a number of additional robustness checks. In this section, we will only summarize the conclusions of these checks. The actual results are provided in an internet appendix.

One issue not addressed thus far is time variation. In particular, the fact that we had a financial crisis in the middle of the sample period may raise concerns about time variation potentially unrelated to the relationship of interest. As such, we have examined two alternative specifications that each aim to control for this time variation.

The first specification is meant to capture time variation in the dependent variable (hiring DMM) that is not directly related to the explanatory variables. We include fixed annual effects to account for this. The results indicate a clear effect of the financial crisis. The dummy for 2009, the first post-crisis year, is highly significantly negative indicating a cutback in the hiring of DMMs post crisis. Like all of the other stock markets, the Norwegian market fell significantly during 2009, but rebounded relatively quickly when compared to most stock markets. This is demonstrated by a lack of significance in the dummy for the next year, 2010. However, the important result from this robustness check is that the fixed annual effects are not removing the significance of the coefficient on the variables *Issuing Equity* and *Repurchase*. Overall, the time variation in the interest of hiring DMMs does not alter our earlier conclusions.

Table VI Discontinuations of DMM Contracts

The table reports the results from probit regressions for various specifications. The dependent variable in each regression is whether the firm discontinues a DMM in a given calendar year. Success in the probit is the discontinuation of a DMM contract. The sample of firm and years only includes firms that currently have a DMM. Each column provides results for different probit regressions. The explanatory variables are *Liquidity (RelSpread)* (relative spread in the previous year), *Issued Equity Recently* (dummy variable equal to one if the firm has issued equity in this and/or the previous two years), *Repurchased Recently* (dummy variable equal to one if the firm has carried out repurchases in this and/or the previous two years), *Issue Equity Later* (dummy for whether the firm issues equity within the next three years), *Repurchase Later* (dummy for whether the firm actually repurchases equity within the next three years), and *Insider Sales* (number of cases with large insider sales within the next three years). The numbers in parentheses are the standard errors associated with each coefficient.

	Dependent variable: Quit DMM		
	(1)	(2)	(3)
Liquidity (Rel.Spread)	3.02		
	(4.78)		
Issued Equity Recently	0.31	0.31	0.35
	(0.24)	(0.24)	(0.24)
Repurchased Recently	−0.01	−0.01	−0.003
	(0.19)	(0.19)	(0.19)
Issue Equity Later	−0.24	−0.23	−0.27
	(0.24)	(0.24)	(0.23)
Repurchase Later	−0.61***	−0.65***	−0.66***
	(0.20)	(0.19)	(0.19)
Insider Sales	0.02	0.01	
	(0.04)	(0.04)	
Constant	−0.64**	−0.54***	−0.52***
	(0.26)	(0.20)	(0.19)
Observations	251	253	263
Note:			*p<0.1; **p<0.05; ***p<0.01

Another concern is that time variation may affect the explanatory variables, which will distort the estimated relationship between these variables and the choice of hiring a DMM. We have also estimated a specification that accounts for these effects by subtracting the cross-sectional time series means of Q and using this difference as the explanatory variable. This *Relative Q* will then better identify firms with high Q in a given cross-section. Use of these alternative explanatory variables does not alter our conclusions regarding the importance of investment opportunities, proxied by Q, as a determinant of the decision to hire a DMM.

V. Conclusion

In this paper, we have examined when issuing firms decide to enter, retain, or terminate a Designated Market Maker (DMM) arrangement. In the contracts we are studying, the DMM is paid directly by the issuing firm to improve secondary market liquidity in the firm's stock.

The starting point of our analysis is that this cost must be offset by some benefits at the corporate level. The main hypothesis examined in this paper is that these benefits are associated with improved terms in future corporate actions, such as equity issuance and stock repurchases. From a corporate finance view, the costs of having a DMM are offset by the expected benefits when the firm interacts with the capital markets in the near future.

The basic question in the paper rests on the theoretical insights in Bessembinder et al. (2013), who find that firms can improve the terms in IPOs by paying a designated market maker to reduce the bid/ask spread below the competitive spread. While we also examine corporate actions other than IPOs, we assume that the basic mechanism and motivation for hiring a DMM is the same as in Bessembinder et al. (2013).

In our main analysis, we examine three empirical specifications. The first considers only the determinants of first-time hirings of DMMs, the second case considers continuations of DMM arrangements, while the third case examines the decision to terminate the DMM arrangement.

The contribution of our paper is to demonstrate, across various econometric specifications where we also perform a number of robustness exercises, strong evidence that ex-ante measures relevant to the likelihood that a firm will access the capital markets in the near future are significant determinants in their decision to hire a DMM. While this result is consistent with the earlier literature indicating that secondary market liquidity is important for corporate financing decisions, our results suggest that the firms themselves can improve the terms at which they raise capital by entering into a DMM contract before they interact with the capital markets.

We also make a contribution to the literature on stock repurchases by showing that firms who plan to repurchase shares are more likely to hire a DMM to improve liquidity before they execute the repurchases. This makes underpricing explanations as to why firms initiate repurchases less plausible since liquidity improvement will lower the probability that the stock is mispriced in the first place. Thus, explanations for repurchases are more likely to involve rational theories, such as a cost effective way of getting cash to a firm's owners.

An important and immediate application of our results is to the ongoing policy debate regarding the FINRA Rule where firms are not allowed to pay a third party for market making services. However, the SEC has recently granted participants in NASDAQ's pilot Market Quality Program an exemption to this rule. As discussed in the introduction, NASDAQ claims that their Market Quality Program benefits listed firms. Our results support that claim.

However, on a cautionary note, the design of the NASDAQ Market Quality Program is somewhat different from the DMM contracts observed elsewhere, including the Norwegian contracts studied in this paper. Instead of contracting on the absolute spread level, the NASDAQ contract links the payment to whether the MQP provider is at the NBBO, both on the bid and ask side, a significant fraction of the trading day. This provision may be designed to improve

NASDAQ's competitive position by causing more trades to be executed at the NASDAQ quotes, rather than in the interest of the DMM hirers. On the other hand, by providing incentives for market participants to quote at the NBBO, the depth and stability of the NBBO quotes may improve.

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