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

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Abstract

A recent innovation in equity markets is the introduction of market maker services paid for by the listed companies themselves. We investigate what motivates the issuing firms to pay a cost to improve the secondary market liquidity of their listed shares. By studying the timing of market maker hirings relative to corporate events we show that a contributing factor in this decision is the likelihood that the firm will interact with the capital markets in the near future. The typical firm employing a designated market maker is more likely to raise capital, repurchase shares or experience an exit by insiders.

Keywords: Stock market liquidity, corporate finance, designated market makers, affirmative obligations, equity issuance, share repurchases.

JEL Codes: G10; G20; G30

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Abstract

A recent innovation in equity markets is the introduction of market maker services paid for by the listed companies themselves. We investigate what motivates the issuing firms to pay a cost to improve the secondary market liquidity of their listed shares. By studying the timing of market maker hirings relative to corporate events we show that a contributing factor in this decision is the likelihood that the firm will interact with the capital markets in the near future. The 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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The world's equity markets are changing rapidly. Over the last decade trading has become increasingly fragmented, due to the entry of new trading venues, offering fierce competition to the traditional listing exchanges. These new trading venues offer both high speed (low latency) market access and very low transaction fees. Another significant development is the high fraction of order and trading volume due to algorithmic trading, combined with the gradual disappearance of market participants with positive obligations to provide liquidity. The passing of the NYSE specialist in 2008 is the most visible example,[1] but this has been a global trend, as more and more markets have moved to fully electronic limit order books.

It is commonly argued that we do not need the traditional market makers in today's markets because a large proportion of liquidity supply is provided by High Frequency Traders (HFTs), a subset of algorithmic traders, who act as market makers. The HFTs rapidly update their limit orders and maintain a continuous bid ask spread, a spread much tighter and presumably at more efficient prices than could be achieved under the old specialist system. However, there are also concerns about these "new market makers." While some High Frequency Traders are clearly specialized in *providing* liquidity and earning the bid/ask spread (see e.g. Menkveld (2013)), it is not clear that these traders will continue to do so in times of market stress. A well known example is the US "flash crash" where the results in e.g. Kirilenko, Kyle, Samadi, and Tuzun (2011) suggest that, while the HFTs initially were supplying liquidity, they eventually became net *consumers* of liquidity and contributed to the crash.

One response to the flash crash has been to question the utility of continuous trading with nanosecond precision. A political response has been to call for a transaction tax or the

[1] The specialists at the NYSE were in October 2008 transformed into Designated Market Makers (DMM), see `www.nyse.com/pdfs/fact_sheet_dmm.pdf`. Note, however, that an important distinction between the DMMs studied in this paper and the NYSE DMMs is that there is no payment from the firms for the market making services provided by the DMMs at the NYSE. Instead the NYSE DMMs receive benefits such as being entitled to parity with incoming orders (as opposed to the old specialists' obligation to yield to public orders) and other benefits that result in better access to capital and risk management tools which make their operations more cost effective. In addition to the NYSE Designated Market Makers, two other important liquidity providers are Trading Floor Brokers and Supplemental Liquidity Providers (SLPs).

introduction of other frictions to slow down the trading process (e.g. a minimum resting period for limit orders and other delays). Financial economists on the other hand typically ask whether it is possible to change the trading mechanism to level the playing field. An often mentioned example of such a mechanism is to replace continuous trading with frequent call auctions. Most market participants, such as the exchanges, would however prefer to stay within the continuous trading paradigm, but are looking into different ways of introducing agents with positive market maker obligations into the electronic limit order book structure.

The markets that introduced continuous limit order markets in the 1980s and 1990s, such as most of the European exchanges, faced this problem of "no positive liquidity provision" earlier than the US. Their response was the introduction of what is called a *Designated Market Maker* (DMM). This is a market participant who provides liquidity by continuously maintaining bid and ask quotes in the electronic limit order book. The novel feature of the way this is implemented in these markets is that the *issuing firms* pay the cost of this liquidity provision. In addition to listing fees paid to the exchange, listed firms enter into separate contracts where they pay financial intermediaries to provide a "liquidity service" for their stocks.

The viability of this type arrangement is analyzed theoretically by Bessembinder, Hao, and Zheng (2012) (BHZ). They conclude that "The DMM contract increases trading volume, and enhances allocative efficiency, price discovery and firm value." The starting point of their analysis is an IPO, where a firm is considering listing on an exchange. In an IPO, the value of the firm increases with the issue price. Ellul and Pagano (2006) show both theoretically and empirically that IPO underpricing is lower (IPO price is higher) if the after-issue stock is more liquid. Thus, if the firm can guarantee that a stock will be more liquid down the road, they can support a higher IPO price. BHZ shows the feasibility of an equilibrium where the firm hires a DMM to support the after-listing liquidity against a fee. This allows the firm to charge a higher price in their IPO.

The BHZ model specifically discusses IPO situations, but it clearly generalizes to other cases where the liquidity of the company's stock affects the terms in corporate actions. In such cases firms may want to improve liquidity *before* the corporate actions. Our paper is an investigation of this potential link between corporate actions and the firm's decision to hire a DMM. While earlier research has investigated the effect on liquidity and trading costs of corporate hires of Designated Market Makers,[2] less attention has been paid to the corporate motivations for firms to pay this out-of-pocket cost. In our work we concentrate on this issue by studying a sample of Norwegian firms that hire or terminate a DMM arrangement. We consider various corporate

[2]DMMs have appeared in several countries such as the Netherlands, France, Germany and Sweden, to mention a few, and there are several studies that empirically examine whether and how the hiring of a DMM affects market quality and price discovery. A consensus finding in this literature is that DMM contracts improve 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 (see e.g. Nimalendran and Petrella (2003), Venkataraman and Waisburd (2007), Anand, Tanggaard, and Weaver (2009), Anand and Venkataraman (2013) and Menkveld and Wang (2013)).

actions whose terms may be affected by market liquidity, and test if the likelihood of such actions affects the firm's decision to hire a DMM.

We investigate three possible corporate actions; Seasoned Equity Offers (SEOs), Open Market Stock Repurchases and Exchange Listings (IPOs). Our main finding is that all of these actions are linked to the use of DMMs. Firms in need of new capital, and therefore planning on raising new capital through a SEO, are more likely to hire a DMM. Similarly, firms planning to perform open market repurchases are more likely to hire a DMM. In addition, firms that hire a DMM are more likely to experience an exit by insiders. When modeling the decision to terminate a DMM arrangement, we find that the main determinant of continuing a DMM arrangement is whether the firm continues to repurchase shares or not. Firms that continue to repurchase have a significantly lower probability of terminating their DMM contract.

The structure of the paper is as follows. We first give a short discussion of the relevant theory and hypothesis tested in the paper, before, in Section 2, discussing the data and providing some descriptive statistics for the DMM contracts at the Oslo Stock Exchange. In Section 3 we show what happens to the stock around the DMM hiring, before, in Section 4, examining the main research question of the paper; when do issuers choose to hire (or fire) a DMM? Section 5 offers a brief conclusion.

1 Theory

In this section we will discuss the theoretical background of the decision we are evaluating; corporate hirings of DMMs. To motivate our main hypothesis it is useful to start by thinking about the market for DMM services as having a supply side and a demand side.

The supply side concerns the financial intermediary offering the DMM services. This intermediary can vary the fee it charges for the service from the firm, and the terms of the contract, such as the minimum spread and the minimum quantity. Such a contract may require the DMM to keep the minimum spread to a contractual number of e.g. four percent. The way the DMM would implement this is to maintain bid and ask quotes by submitting and updating limit orders to buy and sell, with a maximal price difference of four percent relative to the bid/ask midpoint. Theoretically, Glosten and Milgrom (1985) show that the equilibrium competitive spread will align a liquidity providers' expected loss to informed traders with the expected gain from uninformed traders, such that the liquidity provider breaks even. Any spread lower than the competitive spread would result in an expected loss for the liquidity providers. For a DMM to be willing to keep the spread below the competitive spread, the spread that would naturally arise with competitive market making, the DMM will need a subsidy that covers the DMM's expected loss from trades with informed traders in excess of what the DMM will earn from the spread when trading with uninformed traders. In the DMM contracts we will be studying, this subsidy is paid for by the firm.

The tighter the contractual spread, the less the DMM can be expected to earn from the spread, particularly with lots of trading, since the DMM will have to compete with many other limit order submitters to be first in the queue and on both sides of the trades. But as the competitive spread gets wider and trading activity decreases, the DMM may expect to be on both sides of a considerable fraction of the trades at the lower (than competitive) contractual spread at which he will be supplying liquidity. On the other hand, at this lower spread the DMM is also facing a higher risk of being picked off by informed traders. There is also the issue of trading frequency. The presence of a DMM may also increase the *frequency* of trading. If so, the DMM's revenue from earning the spread will increase. The contracted liquidity level may actually become "self-sustaining" with a sufficient amount of new trading interest in the stock.

We therefore think of the DMM as offering a menu of prices and contractual terms. It is likely that the fee the DMM requires for the service will be related both to the absolute level of the contractual spread and the implied spread improvement relative to the current level of the spread. When setting the menu, the DMM will also have to form expectations about any changes in trade frequency as a result of the improved liquidity.

The demand side is the firm which has issued the stock. The firm needs to trade off the offered price(s) it will be paying to the intermediary against the perceived benefits to the firm of the improved liquidity in the secondary markets. The argument used in the theoretical model

of BHZ is that the terms of corporate actions are affected by secondary market liquidity of the company's stock. There are various corporate actions for which liquidity may matter.

First, we have the case used directly in the BHZ model: listings (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. It is also shown both theoretically and empirically by Ellul and Pagano (2006) that firms with higher ex post stock market liquidity have lower underpricing in the IPO (i.e. higher price).

This type of argument carries over to the second type of corporate actions we consider: issues of new equity (Seasoned Equity Offers - SEOs). SEOs may be affected by liquidity either through the probability of actually getting capital, or the price at which capital is raised, i.e. underpricing of the issue. If we look at underpricing, there is international empirical evidence that liquidity affects the underpricing in a SEO (Ginglinger, Matsoukis, and Riva, 2013; Stulz, Vagias, and van Dijk, 2012). The presence of a DMM may therefore result in better terms (less underpricing) in the SEO. If we alternatively look at the probability of raising the desired equity, there is empirical evidence that higher liquidity in the stock allows for more equity in the capital structure, see e.g. Lipson and Mortal (2009).

The third corporate action we investigate is share repurchases. Here the BHZ argument does not carry over as readily, due to the 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 for repurchases is that they are cost effective ways of distributing free cash to the firm's owners, potentially catering to different clienteles. The clienteles may for example be tax-induced. For such a motivation for repurchases, clearly the firm wants the liquidity to be as good as possible, because it lowers trading costs when repurchasing. There is however an alternative theory of repurchases, that firms strategically repurchase stock when it is underpriced. In such cases, the firm is presumably acting in the interests of its long-term owners. With such a motivation for repurchases, the firm would *not* want to hire a DMM, because improved liquidity also entails better *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 that the firm's stock is trading at and ask whether the costs of having a DMM is outweighed by the potential improvements in the terms of corporate actions. Clearly, for the most liquid firms on the exchange, there is no need to pay anything for liquidity improvement, liquidity is good enough anyway. But as the current liquidity level gets larger, the benefits of paying the cost may start outweighing the costs and hiring a DMM is a feasible option. For the least liquid shares, however, the costs will be too large for the firms to pay. Such reasoning would argue for a nonlinear relationship between the current level of liquidity and the likelihood of using a DMM.[3]

[3]Such a nonlinearity, where the firms with most liquid and least liquid stocks do not hire a DMM, also

One thing the theory so far is silent on is dynamics. As time passes, most firms' circumstances change. This can come from the dynamics in the firm's product markets, or more generally, market-wide shocks such as financial crises. In our work we will look at the decision to hire a DMM as one that is continually updated to reflect changing circumstances. The horizon at which one evaluates these circumstances will vary. First, at the Oslo Stock Exchange (OSE) the DMM contract is valid for at least one quarter, with a fixed fee up front. The financial markets know this pre-commitment. However, from the perspective of a longer term investor participating in the SEO, there is an question of whether the promised improvement in liquidity from hiring a DMM after e.g. a SEO is a credible commitment. In other words, what guarantee does the investors have that the DMM will be kept for longer than the minimum 3 month period after the SEO? While there are no explicit commitment from the firm to keep the DMM going after a corporate action, there are potential reputation costs associated with discontinuing the DMM just after capital has been raised. For most firms, raising capital or conducting repurchases is not a one shot event, but rather a recurring activity. Thus, for a firm that is likely to also interact with the capital markets in the future, it would be important to keep the DMM long enough after the SEO to be able to use a DMM to improve terms also in future corporate actions. Later in the analysis we examine the typical length of DMM arrangements and document that most DMM arrangements lasts significantly longer than the minimum possible commitment of 3 months. This also relates to the investment horizon for equity owners. Using evidence from Næs and Ødegaard (2009), the median holding period for an equity owner at the Oslo Stock Exchange is less than half a year. Financial market participants will typically have shorter horizons than the firm's investments, which for example in the oil industry may be commitments for several decades.

follows from arguments in BHZ. In their model, what is driving the demand for DMMs is the relative degreee of informational asymmetry relevant for setting the spread. An implication is then that the firms with the least liquid stocks will not have a DMM because the inventory costs will dominate any informational asymmetries.

2 Institutional details and descriptive statistics

Our sample consists of stocks listed at the Oslo Stock Exchange (OSE) in Norway. The OSE is a medium-sized stock exchange by European standards, and has stayed relatively independent.[4] The current trading structure is an electronic limit order book, where orders always need to specify a price and are subject to a strict price-time priority rule. To illustrate the evolution of market liquidity at the OSE over the period 2000-2012, Figure 1 shows 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 in 2004 they reached their lowest level. Spreads increased markedly during the 2008 financial crisis, and have not yet come back to that historical low. The spreads for groups of stocks with different market capitalization show clear differences in liquidity. 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 had 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 (DMMs) 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 a liquid and illiquid segment. 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.[5]

The design of the contract is such that the DMM contracts to maintain a specified maximal 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 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.[6]

When a DMM contract is entered into the first time, it needs to be announced through the

[4] See Bøhren and Ødegaard (2001), Næs, Skjeltorp, and Ødegaard (2008) and Næs, Skjeltorp, and Ødegaard (2009) for some discussion of the structure of the exchange and descriptive statistics for trading at the OSE.

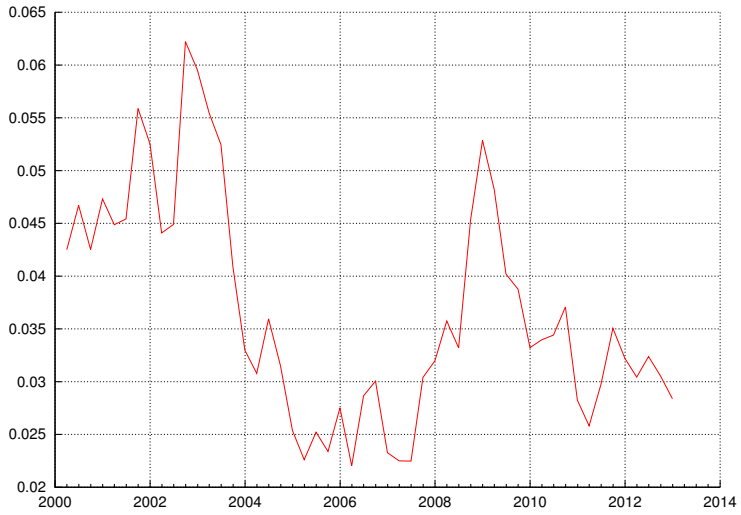
[5] The exchange will typically receive a copy of the contract, but this is privileged information, only used by the surveillance department at the exchange to track DMM activity in these stocks, ensuring that the DMMs are fulfilling their obligations in accordance with the contract.

[6] We do unfortunately 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 4, which typically amount to 400 shares.

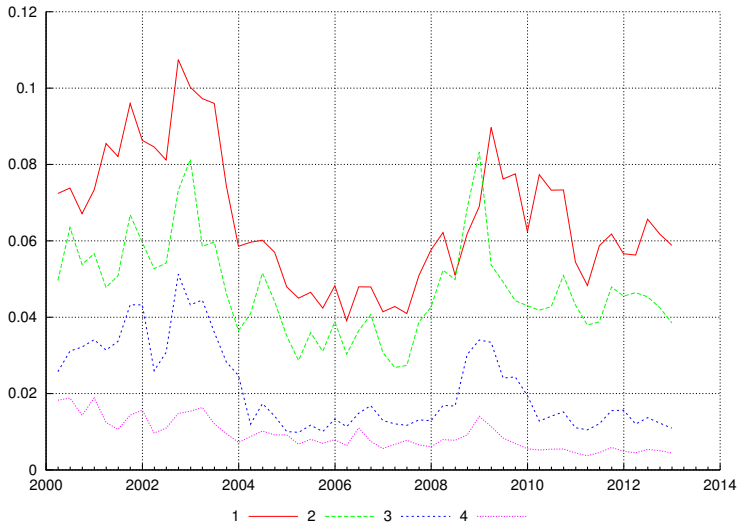
Figure 1 Time series of relative spreads at the OSE

The figures show time series of relative spreads for market aggregates at the Oslo Stock Exchange. The relative spread is the difference between the best closing bid and offer, divided by the quote midpoint. We calculate the relative spread for each stock traded at the OSE on each date. In the figures we use the quarterly average of the daily relative spreads. In Panel A we show the time series of the average quarterly relative spread for all firms at the Oslo Stock Exchange. In Panel B we first group the firms into quartiles sorted by the market value of equity of each firm, and then take the average relative spread for each of the four quartiles. All averages are equally weighted. Data for 2000–2012.

Panel A: Average relative spread for whole market



Panel B: Average relative spreads for four size groups



official notice board of the exchange. To generate the sample of DMM contracts, we have collected all announcements of new DMM contracts from the OSE. In most cases discontinuations will also be announced, but not always. We have therefore used some additional information to identify discontinuations, such as movements from the most liquid OSE index to the least liquid. Any firms in this least liquid index will not have a DMM. While we believe we have caught most discontinuations, the timing of the discontinuations are less certain than the first hires.[7] In addition to the announcements, we use additional data from the OSE data services, which provides daily price quotes, announcements, accounting data, etc.

Table 1 shows some details about the introduction of DMMs at the OSE. For each year we list the number of new DMM deals, the total number of stocks with active DMMs and the fraction (in percent) of listed stocks with a DMM. The number of DMM contracts is small relative to the total number of listed firms. At the most (in 2010) there were 58 firms with a DMM, which was 22% of the firms listed on the exchange. The firms with DMMs are typically smaller, as can be seen from the split into four size quartiles. In total over the sample period, we observe 143 cases where firms hire DMMs, but some of these are cases where the same firm switches DMM or rehires a DMM after a pause. Panel B of Table 1 shows the industry distribution of firms with a DMM.[8] The industry distribution is typical for the OSE, with many firms in the Energy and Industry categories, which typically are oil-related firms.

Table 2 provides various summary statistics comparing firms with a DMM in a given year to firms that do not have a DMM in the same year (*other*).[9] The first set of statistics measure *firm magnitude*, using both asset values and accounting figures. We also look at measures that capture firm health (sales growth and Q). The typical firm that has an ongoing DMM agreement is smaller than the average OSE firm. This is particularly apparent when looking at the averages. However, the averages are pushed up by a very skewed size distribution at the OSE, where the largest three firms constitute between 35% and 50% of the total market capitalization of the OSE in the 2005-2011 period. It is therefore more informative to focus on the medians, which confirm that the firms with DMMs are among the smaller ones on the exchange. Tobin's Q for the firms with DMMs is higher than that of the average firm without a DMM, across all but the last year, while for sales growth there are no systematic differences between the two groups of firms.

We are also interested in the behavior of the firm's owners, and show the trading by firm insiders. Of particular interest is the exit by individual insiders. We measure insider trading by

[7] There are some cases where the liquidity provider terminates its services, the most prominent being the Icelandic bank Kaupthing, which left the Norwegian equity markets as a result of the Icelandic Banking Crisis. However, most customers of Kaupthing either had already obtained another DMM provider before Kaupthing left the OSE, or just after. We don't view this as termination.

[8] The firms are classified using the Global Industry Classification Standard (GICS), an industry taxonomy developed by MSCI and S&P.

[9] We do not include data for 2004 in the table. The OSE first allowed DMM agreements in October 2004. This means that the number of firms in the DMM group for 2004 is low (seven firms), and statistics for the DMM group would only measure the difference for the last three months of 2004.

Table 1 Describing DMM deals at the OSE

The table in panel A describes the activity of DMMs at the OSE by listing the total number of firms on the exchange during the year, together with the number of new DMM deals and the number of active DMM deals. We also show the number of DMMs in four size quartiles, which are constructed by splitting the firms into four groups based on the total value of the equity in the firm at the previous year-end. Firms in size quartile 1 are the 25% smallest firms, and firms in size quartile 4 are the 25% largest firms. Panel B shows the distribution across the 10 GICS industries for the DMM-using firms. Global Industry Classification Standard (GICS) is an industry taxonomy developed by MSCI and S&P. Data for 2004–2012.

Panel A: Year-by-year number of firms with a DMM

	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

Panel B: Industry distribution of firms with a DMM

GICS		Number of firms
10	Energy	12
15	Material	6
20	Industry	17
25	ConsDisc	4
30	ConsStapl	10
35	Health	14
40	Finan	18
45	IT	22
50	Telecom	0
55	Util	2

Table 2 Summary statistics

The table in panel A shows various statistics for firms having a DMM and firms without a DMM. Each year, the first column shows the average for all firms *with* a DMM at some point during that year, while the second column shows the average for all the firms without a DMM (*other*) in the respective year. We split the statistics into four main types. The first set of statistics shows variables that capture *firm magnitude*. *Firm size* is 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. *N inside trades* is the number of trades (large sales) by corporate insiders. The third set of statistics measures the firms' *equity market activity* where *Fraction equity issuers* is the percentage fraction of companies that issues equity in a given year, and *Fraction planned repurchasers* is the percentage fraction of companies that have an active repurchasing plan at yearend, *Fraction actual repurchasers* is the percentage fraction of companies that repurchases stock at least once during the year. The last set of statistics measures the secondary market liquidity of the stocks where, *Spread* is the difference (in Norwegian kroner, NOK) between the best closing bid and ask price, the *Relative spread* is the NOK spread divided by the closing stock price, *LOT* is the Lesmond, Ogden, and Trzcinka (1999) estimate of transaction costs, *Amihud* is the Amihud (2002) illiquidity measure, *Turnover* is the average fraction of the firms outstanding stock that is traded over the year, and *Frac trading year* is the fraction of the trading year with trades in the stock. Panel B shows (contemporaneous) correlations between annual observations of many of the same variables. It includes the additional variables *Issue equity*, a dummy variable equal to one if the firm issues equity during the year, *Actual Repurchase*, a dummy variable equal to one if the firm repurchases shares during the year, *Announced repurchases*, a dummy variable equal to one if the firm has an announced repurchase program at year-end, *Have DMM*, a dummy variable equal to one if the firm has a DMM sometime during the year, *Hire DMM*, a dummy variable equal to one if firm hires a DMM sometime during the year, and *Listed within 2 years*, a dummy variable equal to one if the time since the firm was listed is less than 2 years. Correlations in bold indicate statistical significance below 5%.

Panel A - Firms with DMM vs firms without DMM

	2005		2006		2007		2008		2009		2010		2011	
	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other
Firm magnitude														
-Firm Size (mill)														
Average	2339	9896	1865	12533	1627	12381	1094	7486	1589	9845	2046	11913	1189	7740
Median	640	1446	707	2058	694	2193	307	1116	1168	1400	980	1745	332	975
-Operating Income (mill)														
Average	1543	7225	1268	9507	996	7543	1267	8603	1438	8057	1925	8767	496	9607
Median	485	568	249	838	305	986	360	956	443	1160	306	1028	373	1279
-Q	1.96	1.61	2.01	1.51	1.85	1.29	0.99	0.69	1.50	0.84	1.31	0.96	0.33	0.61
-Sales growth(%)	36.4	21.4	19.2	52.4	23.4	42.0	29.8	35.0	8.6	15.7	18.5	6.5	-11.2	-5.8
Individual owners														
-N inside trades	1.4	1.8	2.2	1.6	1.0	1.0	0.3	0.4	1.1	0.7	0.6	0.9	0.7	0.6
Equity market activity														
-Fraction equity issuers(%)	25.8	38.3	37.2	32.3	37.3	34.2	27.6	25.2	39.6	30.5	29.3	30.1	19.6	26.9
-Fraction planned repurchasers(%)	51.6	40.2	25.6	20.3	19.6	19.8	17.2	20.1	22.9	19.0	17.2	17.0	14.3	13.2
-Fraction actual repurchasers(%)	48.4	33.0	48.8	34.6	39.2	31.3	32.8	35.9	29.2	25.2	31.0	26.2	26.8	27.4
Stock liquidity measures														
-Spread (NOK)	0.8	2.4	0.8	2.5	0.8	2.5	0.7	2.7	0.7	1.4	1.1	1.1	1.1	1.1
-Relative spread(%)	1.91	2.31	2.18	2.31	2.15	2.62	3.43	4.21	3.98	4.36	3.45	3.21	3.65	3.49
-LOT(%)	3.19	3.68	3.01	3.58	3.08	3.43	5.46	5.49	5.88	7.14	4.27	4.54	4.62	4.30
-Amihud	0.172	0.219	0.199	0.227	0.223	0.266	0.534	0.840	0.583	1.015	1.460	3.524	4.116	4.831
-Annual -Turnover(%)	72.66	134.89	70.60	130.73	89.73	97.59	51.11	172.72	46.01	195.57	50.43	151.02	31.18	125.59
-Frac trading year(%)	85.29	83.76	80.71	83.38	85.41	81.82	76.99	74.23	73.54	74.58	75.60	82.92	71.96	80.39

Panel B - Correlations

	Relative Spread	Firm Size	Q	Inside sales	Issue Equity	Repurchases Announced	Repurchases Actual	Sales Growth	Have DMM	Hire DMM	Frac trad days
Firm size	**-0.59**										
Q	**-0.14**	-0.03									
No inside trades	**-0.14**	**0.14**	**0.21**								
Issue equity next year	**-0.05**	**-0.19**	**0.14**	0.01							
Announced repurchases	**-0.17**	**0.20**	**0.07**	**0.14**	**-0.17**						
Repurchase next year	**-0.16**	**0.27**	**0.09**	**0.12**	**-0.17**	**0.31**					
Sales growth	**-0.05**	0.00	0.02	-0.00	**0.06**	**-0.08**	-0.04				
Have DMM	0.01	**-0.23**	**0.07**	-0.01	-0.03	-0.03	0.03	-0.02			
Hire DMM	0.02	**-0.16**	**0.09**	0.03	0.02	0.00	-0.01	0.01	**0.58**		
Frac trading days	**-0.85**	**0.40**	**0.11**	**0.10**	**0.16**	**0.05**	0.02	**0.06**	**-0.07**	-0.04	
Listed within 2 years	**0.10**	**-0.15**	**0.05**	-0.00	**0.11**	**-0.19**	**-0.12**	**0.08**	**0.06**	**0.11**	**-0.07**

counting the number of relatively large insider sales (*N inside trades*). The average number of insider trades does not reveal any systematic differences between the two groups of firms.

As a third set of statistics, we also look at the extent to which firms are active in the capital markets. To this end we show the fraction of firms that issue new equity or repurchase stocks in each year. With regard to repurchases we look at two definitions. First, we count the number of firms that have announced a repurchase plan.[10] We also count the number of firms that ex post actually conduct repurchases. For all these variables, there are some differences between firms with DMMs and firms without a DMM (others), but there are few clear systematic patterns, the differences are small, and the relative sizes may change across years.

Panel B of Table 2 shows the correlations between the variables. Note that these are contemporaneous correlations of annual aggregates. When we later study the determinants of the decision to hire a DMM, we need to be more careful about timing. With that qualification in mind, it is still important to note that many of the potential explanatory variables are correlated.

2.1 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.

Let us therefore look specifically at liquidity differences between firms with and without a DMM. The last set of statistics in Panel A of Table 2 shows statistics on some common measures of stock liquidity: Quoted and relative spreads, LOT (an estimate of transaction costs introduced by Lesmond et al. (1999)) and ILR (the measure of price elasticity introduced by Amihud (2002)). We also consider two liquidity measures providing information about the trading activity in a given stock. The first activity measure is turnover, the fraction of a given stock's outstanding shares traded in a year. The second statistic is the number of trading days within a year in which a stock is traded.[11] 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 count the number of days that the stock is traded. To normalize this number, we relate the number of trading days to the number of potential trading days (business days), and measure the fraction of the trading year a given stock trades. Across all firms traded on the OSE, this average varies between 70% and 90%. At the OSE there is a set of internationally well known stocks (e.g. Statoil, Hydro and Telenor) traded actively, and

[10] At the OSE, firms have to get an approval of the annual meeting before they can repurchase shares. This approval is valid for a maximum of 15 months before it has to be renewed by the annual meeting. We therefore count as a planned repurchase when the firm has an approval by the annual meeting that allows it to repurchase.

[11] This measure is closely related to the *Zero* measure examined in Lesmond et al. (1999), who propose that a count of the number of zero return days can be used as a simple proxy for the number of non-trading days. We calculate the number of days traded directly.

certainly every day. Hence, this low number suggests that there is quite a number of stocks that trade infrequently.

We see some differences in average liquidity across firms with and without a DMM, but these averages do not provide the pertinent information about how liquidity differences affect the DMM hiring decision. A bottom line in the previous theory discussion was that we expect to see a nonlinear relation between current liquidity and the hiring of a DMM. The firms choosing to hire a DMM will not be the firms with *very liquid* or *very illiquid* stocks, but rather firms with medium liquidity.[12] We investigate this in more detail by looking at the cross-sectional frequency distributions of liquidity and DMM activity. In Figure 2 we show the distribution of relative spread and fraction of year traded for stocks that never hire a DMM (in Panels A and C), and stocks that at some point hire a DMM (in Panels B and D). The statistics for firms that hire a DMM (in Panels B and D) use observations *before* these firms hire a DMM. For the non-users we note that the distributions are highly skewed, concentrated towards good liquidity (low relative spread, high fraction of the year traded). For companies in the region with the best liquidity there is little need for a DMM. If a stock trades every day, with a very low average relative spread (e.g below 2%), it is unlikely that a firm would want to pay for a DMM to keep the spread much lower. We see that the distributions for firms that hire a DMM at some point later (in panel B and D) are less skewed, and that these firms on average are less liquid and have lower trading activity. For example, none of the firms in panel B have a relative spread lower than one percent before they hire a DMM, while in panel A we see that there is a large number of observations of relative spreads (for non-users) below this. Comparing the spread figures in Panel A (stocks without DMM) and Panel B (stocks that will hire DMM), we see that while the firms without a DMM are even more concentrated towards the very liquid stocks, there are still a number of firms that are very illiquid (high spreads, low fraction of the year traded), and that choose *not* to hire a DMM. Hence, the typical DMM stocks are neither the most liquid nor the least liquid ones.

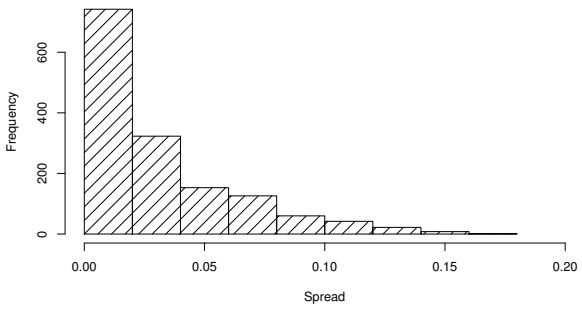
[12] This nonlinear relationship was also shown in (Anand et al., 2009, pg. 1429).

Figure 2 Distribution of liquidity for DMM and non-DMM stocks

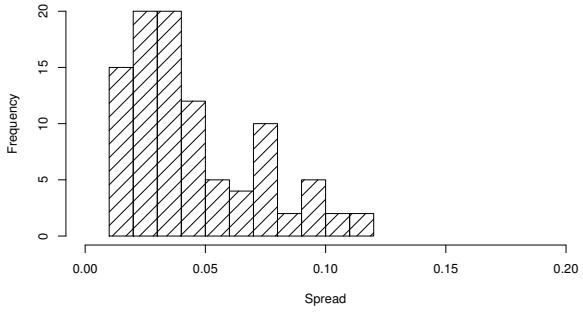
The figures show histograms of the distribution of two measures of stock liquidity, average annual relative spread and fraction of year traded. The panels shows empirical probability distributions for two groups of firms. The left-hand panels (A and C) only use the firms on the exchange that do not have a DMM. The basis for the figure is firm years and for each year we check whether the firm has had a DMM at some point during the year. If it has, this stock is in the group of DMM users and removed from the sample. In right-hand panels we instead only consider the firms which hire a DMM. For this sample we show the distribution of the liquidity using data for the one year period before the firm hired the DMM. We use the same x axis for the two pictures to make them more easily comparable. Data for 2004–2012.

Distributions of Relative Spread

Panel A: Stocks without DMM

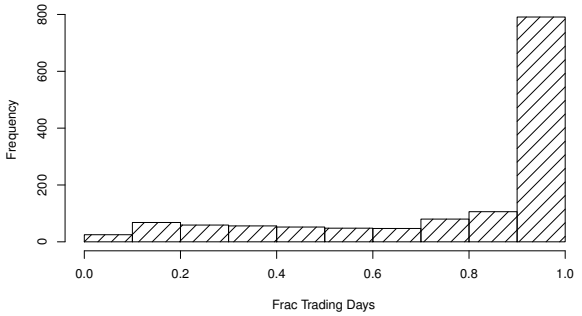


Panel B: DMM hirers (before hiring)

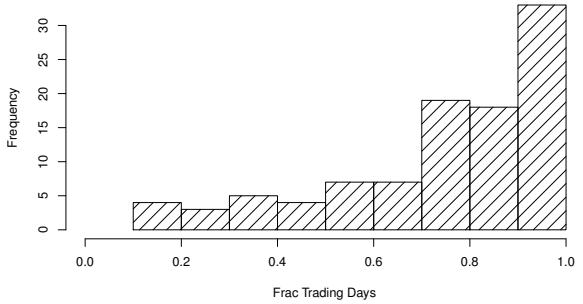


Distributions of Fraction of year traded

Panel C: Stocks without DMM



Panel D: DMM hirers (before hiring)



3 What happens when a firm hires a DMM?

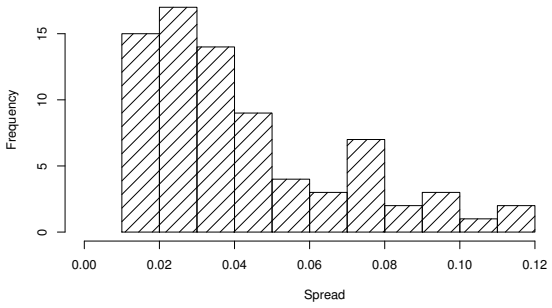
In this section, we examine what happens to liquidity and trading activity in the secondary market for firms that hire a DMM. We look at measures of liquidity and activity in the period around hirings of DMMs. Given that the firm is paying for a liquidity improvement, we expect to see such an improvement. Figure 3 gives a visual illustration and shows histograms of the distribution of relative spread and fraction of year traded, one year before and one year after the start of the DMM contract.

Figure 3 Changes in liquidity and trading activity around DMM hires

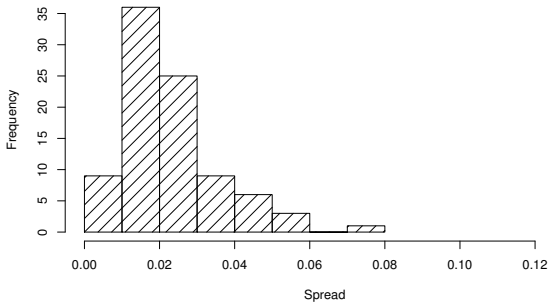
The figures show histograms illustrating the distribution of two liquidity measures: Relative spread and fraction of year traded. Panels A and C show the distribution one year before the DMM contract starts running, while panels B and D show the corresponding liquidity measure for the year after the initiation. In the sample we only use the first time the firm hires a DMM. In the calculation of the year after DMM initiation, we remove periods without a DMM if the DMM services stop within that year.

Distributions of Relative Spread

Panel A: Year before DMM start

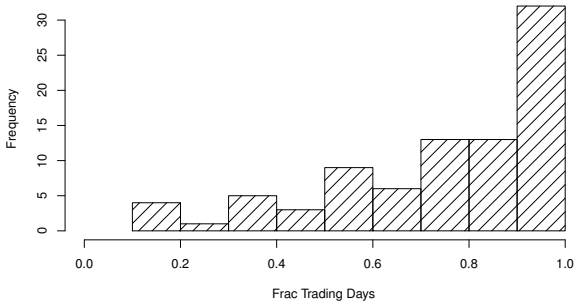


Panel B: Year after DMM start

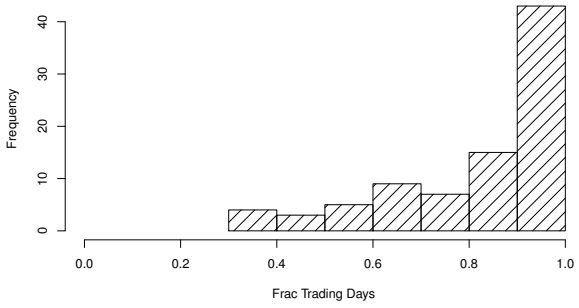


Distributions of Fraction of year traded

Panel C: Year before DMM start



Panel D: Year after DMM start



The two figures on the right (Panel B and D) show the frequency distributions of the liquidity measures for the year *after* the hiring of a DMM. Comparing this to the figures in panels A and B, which show the liquidity of the same firms in the year before the DMM hiring, we see that in both cases there is a clear shift towards improved liquidity. The spread distribution shifts towards zero, and the fraction of year traded shifts towards 1, after the DMM has been hired. While the change in spreads is what one would expect from the contractual terms, the increase in trading activity is interesting since it points to a positive externality associated with having a DMM.

To examine more formally how liquidity changes around DMM hirings, Table 3 shows the change in five different liquidity and activity measures for a one-year and six-month period before and after the initiation of the DMM contract, with a test for whether the change is significant. For the six-month period, we see that the relative spread, LOT and Amihud measures decrease significantly after the DMM start. For the one-year window, the reduction in relative spread and the Amihud measure remain significant, while the change in the LOT measure is rendered insignificant. Interestingly, turnover increases significantly for the one-year horizon, and the fraction of the trading year with trades increases, both over the six-month and 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.[13]

Table 3 Liquidity measures before and after DMM agreements

We describe what happens after the market maker deals, by showing liquidity measures calculated using data for one year and six months before and after the market maker starts. In these calculations we only include stocks where we have observations for the whole period and leave out those cases where the DMM is hired at the same time that the stock is listed. 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 and *Amihud* is the Amihud (2002) measure. *Fraction of year traded* is the number of days that the stock trades, divided by the number of days it is listed. *Monthly Turnover* is the fraction of the firm's stock that is traded in a month. 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. Data for 2004–2012.

	Period before		Period after		t-test diff				n
	1 year	6 months	6 months	one year	6 months		1 year		
Rel 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 dynamics is to look at this on a company-by-company basis,

[13]This test for difference in means assumes that there are no systematic market-wide changes in liquidity over the same period. This would particularly be a worry if there is a trend towards improved liquidity for the whole market in this period. However, as we saw in the time series of spreads shown in Figure 1, there is no such long-time trend at the OSE in the period we are investigating. 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, which soon went back towards the earlier levels.

and illustrate the changes in liquidity due to the hiring or discontinuation of a DMM. In Figure 4 we illustrate time series of monthly average relative spreads for four selected firms. In each figure the time(s) where the firms have a DMM are marked by grey shaded areas. The four examples are chosen to illustrate different outcomes related to the hiring or termination of DMM arrangements.

The first two figures show that the presence of a DMM affects liquidity. The left figure in Panel A shows how the spread decreases after the hiring of a DMM in early 2010 (by the company Copenica). The second figure in Panel A shows the pattern for a company (IM Skaugen), which 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 in the end of 2009 when the firm was without a DMM for just a few days. The last two figures, in panel B, are chosen to illustrate different outcomes when firms terminate a DMM service. The first, Imarex, hired a DMM in 2007. At 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, we know that the stock had no DMM after December of 2011. Liquidity gradually worsened during 2012, with an average relative spread going from about 2% to above 10% during the year. This suggest that the competitive spread was significantly higher than the contractual DMM spread. In this case we have no information about why the DMM service was discontinued. However, given the huge increase in spread during 2012, we can speculate that the price that the DMM charged increased to reflect lower trading interest in the stock, and that this price became higher than the company was willing to pay. The final example is chosen to illustrate the opposite outcome at the termination of the DMM contract. The company Bionor Pharma[14] ended its DMM agreement in 2012 without any apparent effect on the relative spread. When the DMM arrangement was terminated, the firm issued a press statement[15] which included the following formulation

> *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, the company does not see any need to pay for DMM services, as the liquidity and activity is so high that the company's stocks will continue to be traded actively even without a DMM. The time series of the spread bears this presumption out, where the competitive spread remains at the same level as the DMM spread after the discontinuation of the DMM arrangement.

As the last two examples show, companies will sometimes end their DMM contracts. It is therefore interesting to look at how long they typically employ a DMM. In Figure 5 we describe

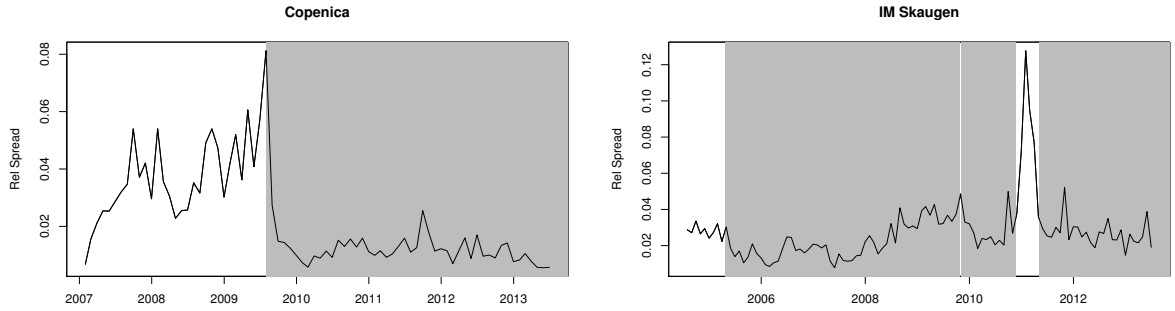
[14] The company changed its name from Nutri Pharma in 2010.

[15] Taken from the Oslo Stock Exchange Newsweb, press statement at 14:00 on 16 May 2012.

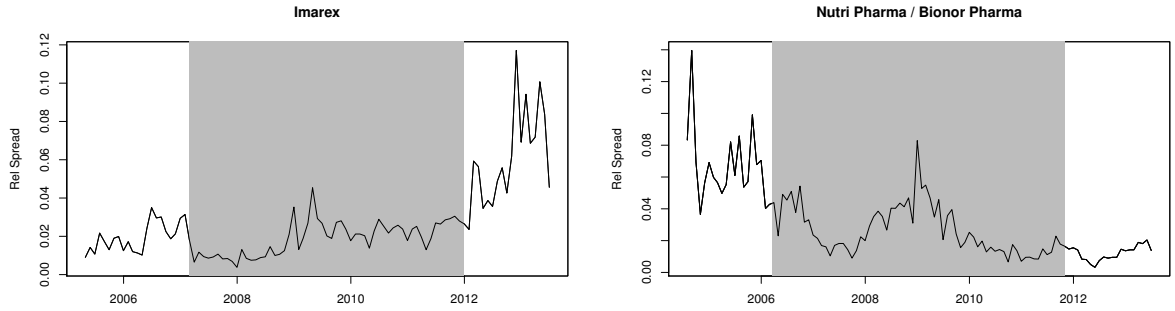
Figure 4 Time series of liquidity for selected individual companies

The figures show time series of liquidity for four example companies (Copenica, IM Skaugen, Imarex and Bionor Pharma. For each company we calculate the average relative spread across the month, and show this time series. The time periods indicated by the shaded areas are times where the firm has had an active DMM.

Panel A



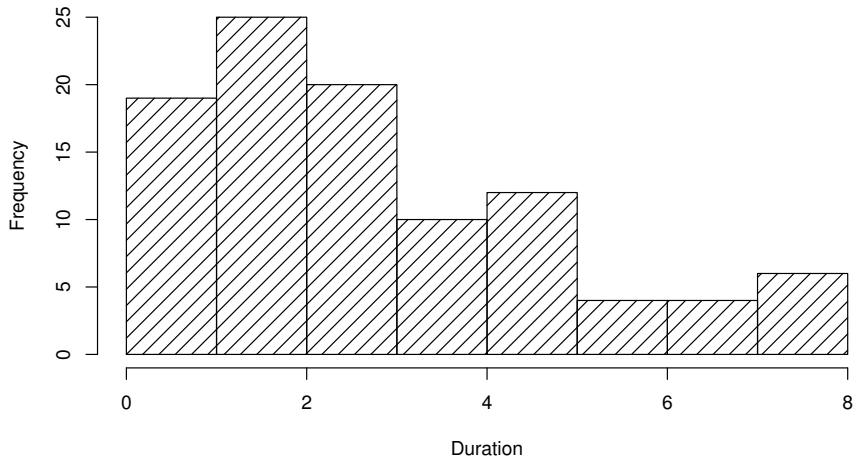
Panel B



the empirical duration of the DMM contracts in the sample. As the figure shows, the use of a DMM is relatively long-term; only a small fraction of the companies employ a DMM for less than a year.

Figure 5 Duration of DMM contracts

The histogram shows the distribution of duration of DMM contracts, how long a company maintains a DMM. For each of the companies that has had a DMM, we measure the time (in years) starting at the first hiring of a DMM and ending in either the discontinuation of DMM services, delisting, or the end of the sample period (December 2012).



To summarize, regarding the question of the effect of DMM initiations on liquidity, we see that there is an improvement in all liquidity measures around the DMM introduction, which is consistent with prior research on other markets. This is however a result which we *should* observe: the DMMs seem to do what they are paid to do, i.e. improve liquidity. The more interesting observation is that the DMM initiation is also associated with an increase in trading activity, as measured by fraction of trading days and turnover. Thus, there may be liquidity externalities associated with having a DMM in the sense that "liquidity attracts liquidity."

4 The corporate decision to hire a Designated Market Maker

Let us now turn to the main question of the paper; *When do issuers choose to pay for a DMM?* The hypothesis we want to test is whether firms that are about to effectuate capital market actions for which liquidity matters are more likely to hire a DMM to improve secondary market liquidity, a liquidity improvement which will improve the terms at which they can execute their corporate actions.

In our empirical specification, we look at calendar years. For each year we ask whether the firm hired a DMM within the year. We view this annual split into calendar years as natural since most of the corporate decisions we examine, such as exchange listing, repurchases and large capital issues, need approval from the annual meeting, which normally happens only once a year. We implement the actual analyses as a binomial choice model, using a Probit regression with the DMM hire as the dependent variable and measures related to capital market events as explanatory variables.[16]

In the theory section we listed three corporate actions we want to investigate. These were Seasoned Equity Offering (SEO), Repurchases, and Listing (IPO). In our empirical design, we specify empirical proxies related to these three actions, and test 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 explanatory variables that are observable at the point when the decision to hire a DMM is made. The second approach is an *ex-post* analysis, where we look at what actions the firm makes after it has hired a DMM.

First, when constructing ex-ante proxies for SEOs, we take the view that the likelihood of an SEO 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, as ex-ante proxies for capital needs we use two variables. The first is the firm's growth opportunities, measured by Tobin's Q, where we assume that capital needs increase with growth opportunities. This implies that the probability of hiring a DMM increases with Q. As an alternative to Q, which has the problem that it may be open to other interpretations than growth potential,[17] we also consider recent growth in the sales of the firm. We assume that a firm that is currently experiencing high growth in sales is more likely to need more capital for investments further on.

An alternative to Q and growth opportunities is to look at the firm's actions ex-post. *Do*

[16] An alternative would have been a hazard model, which is the specification used in Anand et al. (2009). We choose the binomial choice specification also because a hazard model would be problematic to implement. We are interested in corporate motivations, such as growth prospects, when the firm makes the decision to hire a DMM. If we were to apply a hazard specification, we would need to continuously update a measure of the firm's growth prospects as input to the hazard estimation. This is not feasible, since such data is only estimable from accounting numbers, which are only available at annual frequencies. The use of a hazard model was more natural in Anand et al. since their research were more focused on aspects of trading in the market. Such trading data is continuously updated.

[17] Q is typically estimated as stock market values divided by book values. For example would over-valuation of the stock push up Q. Another issue is that the book values rely on accounting choices that may be tax motivated. Accounting choices may also be systematically different across industries.

firms with a DMM actually perform an SEO after it has engaged 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.

Secondly, we also construct proxies for 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 of how repurchases must be performed by Norwegian firms. Before a firm can repurchase shares, it must have approval from the annual meeting of shareholders to repurchase up to a given percentage (maximum 10%) of the firm's shares. This approval is valid for up to a maximum of fifteen months and has to be renewed at the annual meeting. Our ex-ante measure of "planned" repurchases is whether, in the year we analyze, the firm has obtained approval for a repurchase program.[18] As our ex-post measure we use a dummy for whether the firm actually repurchases shares within three years after the DMM hire.

Thirdly, 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 having been listed for less than two years at a given point in time. A second proxy related to IPOs is the exit of the original owners. Among the motivations for IPOs, the desire for the original owners to lower their stake, for diversification or consumption purposes, is typically included. The original owners often have a holdup period before they can start divesting their stakes. Improved liquidity of the firm's shares would lower the price impact associated with insider sales after the expiry of the holdup. Most such cases would be registered as insider trades, which we have access to. We therefore use the number of insider trades in the period after the DMM initiation to measure such cases. To proxy for the *exit* decision by insiders, we count the number of large[19] sales by insiders. This is an ex-post measure.[20]

There are, however, 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. If the stock is already liquid, there is little benefit to be gained from hiring a DMM to improve liquidity. This feature of the data was discussed earlier and is illustrated by the histograms in Figure 2, where we saw that for the firms traded every day, or with very low spreads, there were few DMM contracts. Intuitively, one would not expect very liquid and actively traded firms to be willing to pay a cost to improve liquidity in cases where the competitive spread is already very tight, as these firms would see little or no added benefit from hiring a DMM. To account for this in our empirical specification, we exclude firms which 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 before the one we are considering, traded on more than 90% of the days, we remove the firm from the sample.

[18] Data on these approvals are from the minutes of the annual meetings.

[19] We use insider transactions larger than NOK 50 000 (About USD 10 000) in value.

[20] Note that our insider data does not distinguish the holding period of the insiders, so this *could* be divestures of owners other than the original founders.

In the following sub-sections, we show results from Probit estimations for the various specifications discussed above. In subsection 4.1 we only look at the *first-time* hiring of a DMM. Each year, we use the sample of firms on the OSE without DMMs, and ask why firms hire a DMM (for the first time) during the year. In subsection 4.2, we look at the problem as an ongoing decision, and also include those firms already employing a DMM, asking when they want to continue using a DMM. Finally, in subsection 4.3, we look directly at the terminations of DMM arrangements.

4.1 First-time hires

We are interested in understanding the timing of the decision to hire a DMM for the first time. Table 4 shows the estimation results for the sample containing only these 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 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 availability of some proxies, such as sales growth, for which we need accounting numbers over at least the two previous years. We choose to include the maximal number of observations in each Probit estimation.

In Panel A of Table 4, we summarize the results from the ex-ante specifications. Starting on the left, we have a specification with most of the possible explanatory variables, with the less comprehensive specifications as we move to the right. Looking first at the proxies related to future capital needs, Q, these are always positive and highly significant. 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. We also consider sales growth in the year of the DMM initiation. While the coefficient on this proxy is also positive, 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 to have at least two years of sales history to calculate sales growth. Second, sales growth is a more noisy variable, since it is based on year-to-year accounts.

Let us next consider the alternative way of looking at capital needs, using ex-post data. These results are shown in Panel B of Table 4. With respect to actual capital issuance, we see that the coefficient is always positive and significant.[21] The positive coefficient supports our

[21] This ex-post result corresponds to a result in (Anand et al., 2009, page 1438), 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 only with a 10% p-value.

Table 4 Hiring a Designated Market Maker

The tables report the results from Probit regressions. The dependent variable in each regression is whether the firm hires a DMM in a given calendar year. Success in the Probit is hiring of a DMM. For each specification we show the coefficient estimates and standard errors (in parenthesis). Significance is indicated by stars. In the tables, each column gives results for a different Probit regression. The regressions are grouped into two panels where those in panel A only use explanatory variables that are observable at the time the DMM contract is announced. We call this the *ex-ante* specification. In panel B the explanatory variables include corporate events after the hiring of a DMM. We term this the *ex-post* specification. The "ex-ante" specification includes the following explanatory variables: Q – The current estimate of Q (market/book value of firm), *Sales Growth* – Growth in accounting income previous two years, *Repurchase Program* – Whether the firm has a repurchase program in place and *Listed < 2 years* – Dummy variable equal to one if it is 2 years or less since the firm was listed. For some of the accounting variables (Q and sales growth) we lose observations because the firm has not been listed long enough. In the sample we remove all firms with an already existing DMM contract. Also, we only consider firms that traded less than 90% of the available days the year before. The *ex-post* specification which includes the explanatory variables: *Issue Equity* - Dummy variable equal to one if the firm issues equity the next three years, *Actual Repurchase* - Dummy variable equal to one if the firm actually repurchases equity the next three years, *Insider sales)* - Number of cases with large insiders sales during the next three years. In both specifications we also control for *Liquidity (RelSpread)* - The relative spread last year. In the sample we remove all firms with an already existing DMM contract. Also, we only consider firms that traded less than 90% of the available days the year before.

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)
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

hypothesis that firms that hire a DMM are also more likely to raise additional equity capital in the following years, compared to the firms that do not employ a DMM. Hence, capital needs seems to be an important determinant in the decision to hire a DMM.

For the case of stock repurchases, we see that the coefficients are positive, indicating that repurchasing firms are more likely to hire a DMM. The significance is however lower than for capital needs. In particular the ex-ante variable, that the firm has a repurchase program in place, is never a significant determinant in the first-time hiring decision. The results are more significant for the ex-post variable, where we use actual repurchases. This can be due to the ex-ante variable being 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 actually executing any repurchases. The actual repurchases are therefore a better proxy. Overall, we do find supportive evidence 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, is never significant, although it is consistently positive. Similar to repurchases, the ex-ante proxy in this case is rougher than the ex-post one. Only using a firm's age has no information about the actual ownership structure at the first listing. Here the actual ex-post insider sales should be a better indication. When we look at the results for this ex-post variable in Panel B, we find that it is always positive and highly significant in both specifications.

Let us finally comment on the control variable, liquidity, measured as the relative bid/ask spread. Although it is only significant in one out of three case, it is still useful to explain why the coefficient on this is negative, implying that firms with higher spreads are less likely to hire a DMM. While this might seem counterintuitive, the reason is that we have removed the most liquid stocks from the sample. Therefore, the firms with relatively better liquidity *in the truncated sample* are those for which a DMM arrangement is a relevant option. The fee required by a DMM to be a market maker in the most illiquid firms would probably be prohibitive.

4.1.1 Robustness

The main result in the previous analysis suggested that the likelihood of corporate actions, such as capital issues and repurchases, is a determinant in the first-time decision to hire a DMM. To verify the results of this analysis, we have performed additional robustness checks. One issue not addressed thus far is time variation. In particular, the fact that we have had a financial crisis in the middle of the sample period may raise concerns about time variation potentially unrelated to the relationship of interest. We examine two alternative specifications that aim at controlling for such time variation. The first specification is meant to capture time variation in the *dependent* variable (hiring DMM) not directly related to the explanatory variables. We include fixed annual effects to account for this. The results from this specification are shown in

Table 5.[22] The results show a clear effect of the financial crisis. The dummy for 2009, the first post-crisis year, is highly significantly negative, which is due to a cutback in hiring of DMMs just after the crisis. Similar to all other stock markets the Norwegian market fell significantly during 2009. However, for the Norwegian economy, the crisis was was not as deep and as long as that for the rest of Europe. This is shown by the lack of significance in the dummy for the next year, 2010. However, the important result in this table 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 do not affect our earlier conclusions.

Another concern ist 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 account for such effects by subtracting the cross-sectional time series means of e.g. Q, and using this difference as the explanatory variable. This *Relative Q* will then better identify the firms with high Q in a given cross-section. The results from these specifications are included in an internet appendix, but including these alternative explanatory variables do not affect our conclusions.

4.2 Hiring and maintaining a DMM

As discussed earlier, the theory is silent about the dynamics of the DMM decision. If we believe that the firm is continuously evaluating whether to continue to pay for the DMM service, we should look into empirical specifications that also let us evaluate this decision. We will now consider two such specifications. In the first we look at cases where a firm continues the DMM arrangement for one more period. We implement this by increasing the sample used in the previous Probit regressions, where we only looked at the first hirings, to include continuations. So, in addition to the firms that do not hire a DMM, we now also include firms that had a DMM at the beginning of the year and redefine the 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 6.

The results confirm the earlier results regarding capital issuance. Both the ex-ante (Q) and ex-post measures (Issue Equity) remain highly significant. Regarding repurchases, the results are stronger than in the previous analysis. The ex-ante measure (repurchase program) is now also significant in the specifications where we do not include liquidity. This can 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.[23]

[22] To save space we only show the results for the ex-post specification. The ex-ante specification can be found in an Internet Appendix.

[23] In an Internet Appendix we show robustness results for this specification, particularly specifications robust to time variation.

Table 5 Hiring a Designated Market Maker (ex-post specification) - with fixed annual effects

The table reports the results from Probit regressions with fixed annual effects. The dependent variable in each regression is whether the firm hires a DMM in a given calendar year. Success in the Probit is hiring of a DMM. For each specification we show the coefficient estimates and the number of firm-year observations. Each column gives results for a different Probit regression. The explanatory variables include corporate events after the hiring of a DMM. This "ex-post" specification includes the explanatory variables: *Liquidity (RelSpread)* - The relative spread last year, *Issue Equity* - Dummy variable equal to one if the firm issues equity the next three years, *Actual Repurchase* - Dummy variable equal to one if the firm actually repurchases equity the next three years, and *Insider sales* - Number of cases with large insiders sales during the next three years. We also include fixed annual effects, shown by the variables 2007–2011. In the sample we remove all firms with an already existing DMM contract. Also, we only consider firms that traded less than 90% of the available days the year before.

	Dependent variable: Hire DMM		
	(1)	(2)	(3)
Liquidity (rel.spread)	−1.74		
	(3.07)		
Issue Equity	0.48***	0.50***	0.50***
	(0.17)	(0.17)	(0.15)
Repurchase	0.23	0.23	0.30*
	(0.17)	(0.17)	(0.16)
Insider sales	0.06**	0.07***	
	(0.02)	(0.02)	
2007	0.02	−0.01	−0.07
	(0.25)	(0.25)	(0.23)
2008	−0.11	−0.18	−0.28
	(0.26)	(0.26)	(0.24)
2009	−0.84**	−0.95***	−1.07***
	(0.35)	(0.34)	(0.33)
2010	0.21	0.10	−0.005
	(0.25)	(0.23)	(0.21)
2011	−0.47	−0.55	−0.49*
	(0.38)	(0.37)	(0.29)
Constant	−1.44***	−1.51***	−1.36***
	(0.27)	(0.21)	(0.18)
Observations	462	490	547
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 6 Hiring and maintaining a Designated Market Maker

The table reports the results from Probit regressions. The dependent variable in each regression is whether the firm has a DMM in a given calendar year. Success in the Probit is presence of a DMM. For each specification we show the coefficient estimates and standard errors in parenthesis. Significance is indicated by stars. In the tables, each column gives results for a different Probit regression. The regressions are grouped into two panels, where the ones in panel A only use explanatory variables that are observable at the time the DMM contract is announced. We call this the *ex-ante* specification. In panel B the explanatory variables include corporate events after the hiring of a DMM. We term this the *ex-post* specification. The "ex ante" specification include the following explanatory variables: *Q* – The current estimate of Q (market/book value of firm), *Sales Growth* – Growth in accounting income previous two years, *Repurchase Program* – Whether the firm has a repurchase program in place and *Listed < 2 years* – A dummy variable equal to one if it is 2 years or less since the firm was listed. For some of the accounting variables (Q and sales growth) we lose observations because the firms has not been listed long enough. We only consider firms that traded less than 90% of the available days the year before the DMM hire. The *ex-post* specification includes the explanatory variables: *Issue Equity* – Dummy variable equal to one if the firm issues equity the next three years, *Actual Repurchase* – Dummy variable equal to one if the firm actually repurchases equity the next three years, and *Insider sales* – Number of cases with large insider sales during the next three years. In both specifications we also control for *Liquidity (RelSpread)* – The relative spread last year. In the sample we only consider firms that traded less than 90% of the available days the year before.

Panel A: "Ex-Ante" specification

	Dependent variable: Have DMM			
	(1)	(2)	(3)	(4)
Liquidity (Rel.Spread)	−14.275***	−22.278***		
	(2.228)	(2.936)		
Q	0.196***		0.219***	0.224***
	(0.046)		(0.045)	(0.045)
Sales Growth		−0.042		
		(0.097)		
Repurchase Program	0.208	0.207	0.285**	0.280**
	(0.141)	(0.160)	(0.136)	(0.136)
Listed < 2 years	0.101	0.022	0.102	
	(0.127)	(0.171)	(0.120)	
Constant	−0.128	0.584***	−0.910***	−0.887***
	(0.139)	(0.168)	(0.081)	(0.076)
Observations	622	437	653	653

Panel B: "Ex-Post" specification

	(1)	(2)	(3)
Liquidity (rel.spread)	−15.662***		
	(2.304)		
Issue Equity	0.270**	0.258**	0.296***
	(0.117)	(0.111)	(0.106)
Repurchase	0.094	0.187*	0.288***
	(0.114)	(0.107)	(0.103)
Insider sales	0.022	0.045**	
	(0.020)	(0.019)	
Constant	0.085	−0.785***	−0.799***
	(0.147)	(0.089)	(0.081)
Observations	603	633	696
Note:			*p<0.1; **p<0.05; ***p<0.01

4.3 Discontinuations

Our final approach to understanding firms' use of DMM arrangements is to study cases where firms discontinue their DMM contract. In this specification we change the explanatory variables slightly. The reason for this is that, while we still investigate equity issues and repurchases, we now want to look at the timing of the terminations of the DMM contracts. We therefore include variables that look at issuing activity and repurchase activity just *before* the decision to discontinue the DMM arrangement, as well as the ex-post variables used before. Take for example the stock issuance case. If a company has recently issued equity, it is less likely to need new capital in the near future. The potential benefits of retaining a DMM may therefore be lower, leading to a discontinuation. We therefore include both equity issuance and repurchase activity before and after the decision to hire a DMM.

The results are shown in Table 7. One cautionary note is necessary here. The number of observations is much lower than in the previous analysis since we only use the sample of firms *with* a DMM at some point. If we first look at the coefficients on the equity issuance, there is a positive coefficient on the "recently issued" variable, and negative coefficient on the "will issue" variable. The interpretations of the signs are the following. A positive coefficient means that it is *more* likely that a firm will *discontinue* the DMM service, and vice versa. These signs are what we would expect, since a recent equity issue means that the firm has less need for a liquid secondary market going forward. Conversely, if the firm has *not* issued yet, and will 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 is highly significant and negative, which suggests that if the firm is planning to repurchase shares going forward, they are less likely to terminate the DMM contract.

To summarize the main results of our empirical analysis of the decision to hire (or discontinue) a DMM, our results suggest that corporate hirings of DMM services occur when firms are planning to perform capital market actions such as a stock issuance (SEOs) and stock repurchases. The documentation of this link is the main contribution of our paper. Let us finally mention another interesting implication of our results, concerning the literature on repurchases. In our analysis we find that firms planning to repurchase are more likely to hire a DMM. This is, however, inconsistent with the underpricing hypothesis aiming to explain why firms repurchase shares. The improved liquidity brought by the DMM will make under-valuation less likely. As argued by Bessembinder, Hao, and Lemmon (2011), a restriction on spread widths by having a DMM encourages more traders to become informed, which speeds the rate at which market prices move toward true asset values. Hence, if under-valuation is the main reasons for why firms repurchase shares, it is less likely that the management would engage a DMM, since improving liquidity is likely to improve price discovery and reduce any mispricing.

Table 7 Discontinuing a Designated Market Maker

The table reports the results from Probit regressions. The dependent variable in each regression is whether the firm discontinues a DMM in a given calendar year. Success in the Probit is discontinuation of a DMM. The sample of firm and years only includes firms which currently have a DMM. For each specification we show the coefficient estimates and the number of firm-year observations. In the tables, each column gives results for a different Probit regression. The explanatory variables are *Liquidity (RelSpread)* - The relative spread last year, *Issued Equity Recently* – Dummy variable equal to one if the firm has issued equity this and/or the previous two years, *Repurchased Recently* – Dummy variable equal to one if the firm has carried out repurchases this and/or the previous two years, *Issue Equity Later* – Dummy variable equal to one if the firm issues equity within the next three years, *Repurchase Later* – Dummy variable equal to one if the firm actually repurchases equity within the next three years, and *Insider sales* – Number of cases with large insiders sales within the next three years.

	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

5 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 issuer to improve secondary market liquidity in the firm's stock. The starting point of our analysis is that this cost needs to be offset by some benefits at the corporate level. The main hypothesis motivated and tested in the 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 cost of having a DMM should be offset by the expected benefits when the firm interacts with the capital market in the near future.

The basic question in the paper rests on the theoretical insights by Bessembinder et al. (2012), who show that firms in some cases 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.

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

The contribution of our paper is to confirm our main hypothesis. Across various economietric specifications, where we also perform a number of robustness exercises, we find strong evidence that ex-ante measures relevant for the likelihood that the firm needs to access the capital markets in the near future are significant determinants in firms' decisions to hire a DMM. While this result is consistent with earlier literature showing that secondary market liquidity is important for corporate finance decisions, our results suggest that firms themselves can improve the terms at which they e.g. 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 planning to perform repurchases are more likely to hire a DMM to improve liquidity *before* they execute repurchases. This makes underpricing explanations for why firms initiate repurchases less likely, since the liquidity improvement will lower the probability that the stock is mispriced in the first place. Explanations for repurchases are therefore more likely to involve rational theories, such as a cost-effective way of getting cash to a firm's owners.

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