Why 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 why firms are willing to pay a cost to improve the secondary market liquidity of their shares. 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, either because they have capital needs, or that they are planning to repurchase shares. We also find a significant reduction in liquidity risk and cost of capital for firms that hire a market maker. Firms that prior to hiring a market maker has a high loading on a liquidity risk factor, experience a significant reduction in liquidity risk to a level similar to that of the larger and more liquid stocks on the exchange.

Keywords: Stock market liquidity, corporate finance, designated market makers, equity issuance

JEL Codes: G10; G20

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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 why firms are willing to pay a cost to improve the secondary market liquidity of their shares. 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, either because they have capital needs, or that they are planning to repurchase shares. We also find a significant reduction in liquidity risk and cost of capital for firms that hire a market maker. Firms that prior to hiring a market maker has a high loading on a liquidity risk factor, experience a significant reduction in liquidity risk to a level similar to that of the larger and more liquid stocks on the exchange.

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Introduction

Historically, the typical trading structure for equities involved market makers with responsibility for maintaining an orderly market in a stock, such as the specialist at the NYSE. With the evolution of market structures towards electronic limit order markets, where participants provide liquidity themselves, the market maker seemed destined for the scrap heap. Recently, though, markets makers have been reappearing. In several electronic limit order markets, market participants have appeared with promises to maintain an orderly market in a particular stock, for example by keeping the spread at or below some agreed upon maximum. The innovation of these Designated Market Makers (hereafter DMMs) is that they charge a fee to the firm that has issued the equity to keep an orderly market in the firm's stock.

DMMs have appeared in several countries such as the Netherlands, France, Germany and Sweden. The DMM introductions have been studied for all these markets, where the main question examined is whether liquidity improves following the initiation of DMM agreements. A consensus finding in this research is that liquidity improves, and that the improvement in liquidity is particularly large for small illiquid stocks. While these results are interesting, they are not particularly surprising. A DMM have a contractual agreement with the firm to improve its secondary market liquidity against a fee, so if this agreement is not honored they may have problems justifying the fee.

In this paper we look at the hiring of DMMs from a different perspective. We investigate the motives for corporations to pay this cost for improving the secondary market liquidity. While improved market liquidity clearly is beneficial to short term traders, on the face of it, this seems to be a cost with little benefit to the firm. After all, the firm has paid the cost of becoming listed at the IPO, after that what happens on the exchange is just trading between different owners of the firm, of interest to the owners, not the firm. But, there are occasions when the firm returns to the stock market. The most obvious one is when a firm wants to raise more capital through a SEO. Another occasion is when the firm wants to buy back some of its shares through open market repurchases. At both these occasions it is beneficial to the firm to have a liquid secondary market for its stock. Both the SEO price and the repurchase price will better reflect realities if the stock is more liquid. If firms are rationally balancing a cost of maintaining a liquid market against its benefits, we should see that firms that are more likely to interact with the capital market in the future are more willing to pay the cost of hiring a DMM.

To look at this question we use data from the introduction of DMM's at the Oslo Stock Exchange (OSE). The possibility of hiring a designated market maker was introduced at the OSE in 2004, following the example of the Stockholm Stock Exchange. Since then, around a hundred firms have hired (or rehired) designated market makers at the Oslo Stock Exchange.

In the first part of the paper we show that, similarly to other markets, the liquidity of a company's shares improves following the hiring of a DMM. Consistent with what is found in other markets, we also find that there is a positive announcement effect associated with firms announcing DMM agreements.

Having established that both the liquidity and price effects associated with DMM agreements is similar in our sample to what is found at other exchanges, we next ask the more novel question of why firms enter into DMM agreements in the first place. We argue that from the firm's point of view, this must be because the firm's value is potentially affected by either changes in future cashflows or changes in the discount rate. Looking first at the cash flow channel, we relate the likelihood of hiring a DMM with measures of planned repurchases and capital needs, proxied by Q and sales growth. We also relate hiring a DMM to whether firms ex post issue capital or repurchase shares. Using various regression specifications we find that measures of capital needs and later interactions with the capital markets all predict a higher likelihood of hiring a DMM.

Secondly, looking at the discount rate channel, we examine, in an asset pricing framework, the effect of hiring a DMM on liquidity risk. Since the DMM is paid by the firm to keep the spread below an agreed maximum, the DMM can not regain any losses to informed traders by increasing the spread above the agreed maximum. This means that the DMM potentially takes on some of the liquidity risk that otherwise would have been reflected in wider spreads. The presence of a DMM may thus cause a reduction in the stock's liquidity risk. This is exactly what we find. In the sample of firms that hire a DMM, we find a significant drop in the loading on the liquidity risk factor in a two-factor asset pricing model. Firms that hire a DMM experience a drop in liquidity risk to a level that is close to that of the largest and most liquid stocks on the exchange. To illustrate the economic significance of this result, we show that the reduction in liquidity risk reduces the expected returns by about 2.5% on an annual basis, which suggest that hiring a DMM reduces the cost of raising capital significantly.

The structure of the paper is as follows. We first discuss the relevant literature, and place our questions in context. In section 2 we provide some descriptive statistics for the DMM contracts at the Oslo Stock Exchange. We then look at the effects on the market of DMM introductions in section 3. In section 4 we examine the central question of the paper, what affect the firm's decision to hire a DMM. In section 5 we examine the effect of DMMs on liquidity risk to provide an estimate of the effect on firms cost of capital, before we conduct a brief discussion and conclude.

1 The problem

A *market maker* is a participant at the stock exchange which assumes a special obligation to *maintain a market* in the trading of a given stock. What is implied in this varies across markets. At the NYSE the market maker is called a *specialist*, and is assigned which stocks to maintain the market in by the stock exchange. One of the obligations of a NYSE specialist is to continuously quote bid and ask prices valid for a minimal quantity. However, the NYSE is a hybrid market structure. In a pure limit order market there is no such market maker, all that is available for trade is trading interest put in by market participants. A limit order market can have *effective* market makers if there are market participants that continuously put in buy and sell orders for given quantities, orders which are updated as trading evolves. As long as the same market participant simultaneously submits buy and sell orders with a spread between them this market participant behaves as a market maker. A *Designated Market Maker* (DMM) is such a market participant, which charges a fee to the company which has issued a stock, to continuously maintain the possibility to trade small orders within a specified spread.

In the theoretical market microstructure literature, the market maker faces costs associated with keeping inventory (see e.g. Garman (1976), Amihud and Mendelson (1980)) as well as a risk of being picked off by informed traders (Glosten and Milgrom, 1985). To adjust his inventory and to regain expected losses to informed traders, the market maker adjusts quoted bid and ask prices and hence the spread. Intuitively, the market maker has two dimensions to play with: moving the price, and widening/narrowing the spread. Relative to the typical market maker a DMM does not have the same flexibility to widen the spread in times of adverse information shocks, due the contractual obligation to keep the bid-ask spread below an agreed maximum.[1] To minimize the costs of the DMM obligation, it becomes more important for the DMM to set the right price. One effect of a firm having a DMM may thus be more informative prices, since the market maker needs to spend more energy on moving the price in response to new information. In other words, the DMM is taking on costs and risks that otherwise would have been passed on to the traders in the secondary market by widening of the spread. Instead, these costs are now covered by the firm through the fee charged by the DMM.

We want to investigate why listed firms want to hire a DMM. As we discussed above, the function of a DMM is to improve the quality of trading the firm's shares in the secondary market. On the face of it, this does not affect the firm's operations in any way. Why should then the firm do it? It may here be instructive to do the discussion from a corporate valuation perspective. What determines firm value? Let us take the simplest such case, and let current firm value V be the result of a perpetuity of future annual cash flows X discounted at the cost of capital r:

$$V = \frac{X}{r} \tag{1}$$

With this perspective, for any corporate action to affect firm value it will have to affect either future cash flows (X) or the discount rate (r). Now, a firm which pays for DMM services has a known cash outflow, the cost of DMM services. By that token

$$V = \frac{X - \text{ Cost of DMM services}}{r}$$

would indicate a *lowering* of firm value. However, all empirical studies of introduction of DMM's have found a positive stock price reaction at the time of announcement of DMM hiring,[2] which imply an *increase* in firm value. To explain an increase in firm value we therefore have to look for either other cash flow consequences or a change in the cost of

[1]At most exchanges, a DMM has an option to suspend the contractual obligation to maintain a minimum spread if there are special circumstances, such as news releases from the company, but this needs to be justified, and may be reputationally costly for the DMM.

[2]Such empirical investigations have been carried out by Anand, Tanggaard, and Weaver (2009) which looks at the Swedish case, Menkveld and Wang (2009) for Euronext, Hengelbrock (2008) for the German market, and Venkataraman and Waisburd (2007) for the Paris Bourse. The focus of these papers is the impact of DMM introductions on liquidity. A general finding is that liquidity improves following the DMM introduction, and that there is an increase in the stock price of DMM firms around the hiring date.

capital (or both):

$$V = \frac{X - \text{ Cost of DMM services} + \text{ Other cash flow consequences}}{r + \text{Change in cost of capital}}.$$

This basic corporate finance perspective is a useful way of structuring our analysis.

Let us start by asking how can the hiring of a DMM to improve the liquidity in the trading in the secondary market affect future cashflows. If the firm never need to go back to the capital market this liquidity will not affect the firms cash flow in any material way. We therefore have to look at occasions with interactions between the firm and capital markets. The obvious ones are times when the firm issue new equity capital or repurchases equity, but there may be others.

What are the potential cash flows related to the firm's raising of new capital (Seasoned Equity Offer - SEO)? There is a direct channel, the direct cost of issuing new equity, either as a private placement or as a general issue to the firm's owners. In the more recent literature on SEO's stock liquidity is found to affect the terms of issuance.[3] Firms with more liquid stock can therefore expect to have a lower cost of raising new equity capital. There are also a number of more indirect effects related to capital structure. The choice between debt and equity is affected if the terms of raising equity changes. In fact Butler and Wan (2010) links debt issuance directly with stock liquidity. It may also indirectly affect decisions related to dividends (Banerjee, Gatchev, and Spindt, 2007). Since the expected costs today are a product of the *probability* of the future capital event times the costs, when they occur, we would expect the firms that are more likely to need capital in the near future (higher probability) to care more about the liquidity of the firm's stock. Hiring of DMM's should be positively related to the likelihood that the firm will need capital.

Another case where the firm interacts with the capital market is the opposite of raising equity, namely stock repurchases, occasions when corporations buys back some of its own shares. There is a large literature on buybacks, we refer to Vermaelen (2005) for a survey. The question of motivations for buybacks is still somewhat open, but there are two popular explanations. First, if the firm's shares are undervalued, it benefits the firm's long term owners if the firm buys the undervalued shares. Second, share repurchases may be preferred to paying out cash as dividends, for example it may be tax advantageous for the owners if capital gains are taxed differently from dividends. No matter what the motivation for repurchases, improving secondary liquidity in the stock will lower a potential price impact when the firm buys back stock. Brockman, Howe, and Mortal (2008) argue that managers compare the tax and flexibility advantages of a

[3]See for example Ginglinger, Koenig-Matsoukis, and Riva (2009) and the references in that paper.

repurchase to the liquidity cost. All else equal, higher market liquidity lowers the cost of repurchasing relative to paying cash dividends. In line with this, they find evidence that managers condition their repurchase decision on the level of market liquidity. Thus, if a firm is planning to initiate a repurchase program, this could be a potential motivation for improving the liquidity of its shares.

The theoretical discussion above argues that the more likely that a firm plans to interact with capital markets in the near future, the more likely they are to care about the future negative cash flows (costs), and therefore more likely to employ DMM's. In our empirical work we test this prediction, by asking whether DMM hirings are are linked to factors that we argued above are related to future cash flows.

Let us next turn to the second channel through which firm valuc can be affected, the discount rate. It is by now well accepted in the asset pricing literature that there is a priced liquidity component in the cross-section of stock returns. An improvement in liquidity brought on by the DMM may therefore affect the required return of the stock, and therefore the discount rate.[4] We also investigate this issue in our work, by testing if the risk premium related to liquidity changes as a result of the DMM introduction, and investigate the implications of such changes for the cost of capital.

A final issue we introduce concerns the preferences of individual owners of a firm. The standard valuation equation (1) calculates the value as the consensus value of the firm in a world without transaction costs. It can be thought of as the value to an owner planning to keep her shares indefinitely. The picture is different for an owner that wants to sell (or buy) shares. Such an owner will have to adjust for transaction costs

$$\text{Value to trader} = \frac{X}{r} \times \text{fraction of company traded} - \text{transaction costs.}$$

The transaction cost is influenced by the liquidity of the stock: The better the liquidity, the lower the transaction costs (Harris, 2002). So, an owner planning to transact in the near future would clearly want the firm to do its best to improve liquidity. However, is not clear that the firm should do this on the owner's behalf. Why should the firm make it easier for your random owner to vote with his feet? There are however some owners for whom this may be a valid concern. In a recent study of the motivations for why firms want to pay the cost of becoming listed, Brau and Fawcett (2006) uses surveys to ask CFOs about these corporate motivations. According to their survey, the most important factor for becoming listed is to facilitate takeovers, either as a target or as an acquirer. For our purposes, though, the more interesting such motivation is their second

[4]For the asset pricing argument see the survey by Amihud, Mendelson, and Pedersen (2005). For the link to the firm's cost of capital see the literature following Easley and O'Hara (2004).

most important one, that an IPO provides an exit for the founders, employees, venture capitalists, and other investors in the firm. This second motivation is clearly relevant for the DMM decision. If the firm wants to facilitate the exit by e.g. founding shareholders, they would want the stock to be as liquid as possible. In our empirical work we will also evaluate this explanation.

Let us finally summarize the empirical implications of the above discussion. We have shown that when we view the firm as a whole, if we want to justify a change in firm value we have to either identify a change in future cashflows, a change in the cost of capital, or both. As potential cash flow items we identified costs of future equity and other capital issuance, and stock repurchases. A potential factor affecting the cost of capital is the liquidity premium in asset returns. Finally, if we move away from the "whole firm" view, and instead look at individual owners, these will naturally prefer to have the highest possible degree of liquidity. More specifically, we argued that exit for the original inside owners could be a motivation for the firm to improve liquidity, but not necessarily so as a general rule, due to the public good nature of the improved liquidity.

2 The Oslo Stock Exchange and the data

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

In 2004 the OSE introduced the possibility for financial intermediaries to declare themselves as Designated Market Makers for a firm's stock, where the firm pays the DMM for the market making service. Formally, the exchange does not oversee these DMM agreements, and have no say in them, but typically receive copies of the contracts.[6] When such a contract is entered into it needs to be announced through the official notice board of the exchange, and the announcement is required to give some detail about the purposes of the contract. OSE provides a standardized contract. Although there may be other contractual features, we are told that the standard contract is the typical one. The DMM obligations in the standard contract is that the bid and ask quotes should be

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

[6] All firms that have a DMM agreement is included in the OB Match index, which is an index containing the most liquid stocks at the exchange. Due to this, the surveillance department at the exchange track the DMM activity in these stocks to ensure that the DMMs are fulfilling their obligations in accordance with the contract.

available at least 85% of the trading day, the minimum volume at both the bid and ask quotes should equal 4 lots, and finally that the relative spread should not exceed 4%.

In the paper we are using data from the Oslo Stock Exchange data services, from where we have access to daily price quotes, the announcements, the accounts, and so on. The announcements also contain details about trades by corporate insiders.

In Table 1 we show some details about the introduction of DMMs at the OSE. We show the number of new DMM deals and the total number of DMMs active in a given year. We see that the number of DMM contracts is small relative to the total number of listed firms, at the most (in 2008) there were 57 firms that had a DMM, out of 286 stocks on the OSE in total, or about a fifth of the firms on the exchange.[7] The firms with DMM are typically smaller, as can be seen from the split into four size quartiles also shown in the table. In total over the sample we observe 111 cases where firms hire DMMs, but some of these are cases where the same firm switches DMM or rehires a DMM after a pause.[8]

Table 1
Describing DMM deals at the OSE

The table 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.

	2004	2005	2006	2007	2008	2009	2010
Total active stocks at OSE	207	238	258	292	286	263	235
New DMM contracts	7	23	17	20	16	15	11
Active DMM contracts	7	30	42	50	57	47	48
of which in firm size quartile 1	0	4	11	17	24	32	32
of which in firm size quartile 2	2	16	19	15	18	9	8
of which in firm size quartile 3	3	5	8	14	11	6	6
of which in firm size quartile 4	2	5	4	4	4	0	2

To give some further perspectives on the firms that employ DMMs, in Table 2 we provide a number of summary statistics where we compare firms with a DMM in a given year with those that does not have a DMM. We first show a number of common liquidity measures: Quoted and relative spreads, LOT (an estimate of transaction costs introduced by Lesmond, Ogden, and Trzcinka (1999)), and ILR (the measure of price

[7] There were 14 financial institutions that were offering DMM contracts over the period.

[8] Some of the switches are due to choices by the company, and some are due to financial firms stopping providing DMM services. One example is the Icelandic bank Kaupthing, which had quite a number of DMM contracts, but closed down as a result of the Icelandic banking crisis. Also, SEB Enskilda ASA, quit all their DMM engagements in the beginning of 2009.

elasticity introduced by Amihud (2002)).[9] We also calculate two other measures of trading activity: Fraction of the trading year with trades, and monthly turnover.

We additionally compare the size of the firms, measured in both asset values and accounting income, sales growth, estimated Q, and the number of trades by corporate insiders during a year. Finally, we estimate what fraction of the firms in the two groups issue new equity or repurchase stocks in the given 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 performed repurchases.

Note that 2004 is atypical, we concentrate on the later years.[11] Comparing the liquidity of the two groups, we observe that there are some systematic differences. All of the quoted spread, relative spread (where we standardize the spread to the price level), LOT, and the Amihud measures are systematically smaller for the DMM group.[12] These measures all look at the cost of trading stocks. Two other measures also look at trading *activity*, which is another aspect of liquidity. DMM stocks are traded about as often as the average non-DMM firm, but with less turnover.

With respect to the firm characteristics, the typical DMM firm is much smaller than the other OSE firms. Interestingly, Tobin's Q for the DMM firms are higher than the average non-DMM firm across all years except for 2004. This is consistent with an explanation where firms that hire a DMM have higher growth opportunities, and are more likely to need capital to finance new projects. The fraction of equity issuers for the two groups also conforms to such a hypothesis, as we see that there is, for most years, a larger fraction of firms within the DMM group that actually issue equity compared to the non-DMM group. Finally, we see that there is also a larger fraction of firms that repurchase shares in the DMM group.

Note that many of the firms on the OSE are not trading every day. Let us show some details on this. In figure 1 we show the distribution of *fraction of year traded*, which is

[9] All the liquidity measures we use here are calculated from daily (closing) observations. We do unfortunately not have transactions level data for this recent period at the OSE, otherwise we would have looked at more detailed microstructure measures of liquidity. For details about how the liquidity measures are calculated see Næs et al. (2008) or Næs, Skjeltorp, and Ødegaard (2011).

[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] The OSE first allowed DMM agreements in October of 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.

[12] Comparing the quoted spread (NOK) and the relative spread, a notable feature is that the difference in quoted spread seem much larger in magnitude between DMM and non-DMM stocks than the comparable difference for relative spread. This is likely to be mainly due to the lower price level of the DMM stocks.

Table 2

Summary statistics, DMM firms vs Non-DMM firms

This table compares DMM firms with non-DMM firms, by calculating a number of descriptive statistics, and comparing their averages across the two groups. Each year, the column titled “with DMMs” shows the average for all firms *with* a DMM at some point during that year, the other column, titled “other”, shows the average for all the remaining stocks that did not have a DMM in the respective year. *Spread* is the difference (in Norwegian kroner, NOK) between the closing bid and ask price at the exchange. The *Relative spread* is the NOK spread divided by the closing stock price. *LOT* is the Lesmond et al. (1999) estimate of transaction costs, *Amihud* is the Amihud (2002) illiquidity measure, *Frac trading year* is the fraction of the trading year with trades in the stock, *Turnover* is the average fraction of the firms outstanding stock that is traded over the year, the *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, *N inside trades* is the number of trades (large sales) by corporate insiders, *Fraction equity issuers* is the fraction of companies within each group that issues equity in a given year, *Fraction planned repurchasers* is the fraction of companies that have an active repurchasing plan at yearend, *Fraction actual repurchasers* is the fraction of companies that repurchases stock during the year, and *Sales growth* is the percentage change in operating income.

	2004		2005		2006		2007		2008		2009		2010	
	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other	with DMMs	other
Spread (NOK)	0.7	2.2	0.9	2.5	0.8	2.5	0.8	2.5	0.7	2.8	0.7	1.4	1.0	1.2
Relative spread	0.031	0.029	0.019	0.023	0.022	0.023	0.022	0.026	0.034	0.043	0.040	0.045	0.033	0.033
LOT	0.047	0.045	0.032	0.037	0.030	0.036	0.031	0.034	0.051	0.058	0.060	0.072	0.049	0.047
Amihud	0.412	0.415	0.172	0.216	0.202	0.227	0.227	0.267	0.537	0.856	0.592	1.040	1.517	3.504
Annual Turnover	0.533	1.087	0.722	1.348	0.689	1.282	0.852	0.954	0.531	0.904	0.477	0.881	0.525	0.838
Frac trading year	0.757	0.801	0.851	0.841	0.803	0.835	0.851	0.818	0.766	0.741	0.730	0.740	0.794	0.812
Average Firm size (mill)	2544	8843	2259	9654	1908	12467	1571	11964	1098	7359	1570	9798	581	1401
Median Firm size (mill)	850	1039	640	1450	723	1985	676	2111	307	1116	1168	1396	149	367
Average Operating Income (mill)	1601	6824	1515	7304	1301	9389	980	7361	1179	8622	1362	8016	283	768
Median Operating Income (mill)	537	710	507	656	281	811	314	974	360	1014	367	1160	283	38
Q	2.04	1.65	1.97	1.58	2.02	1.52	1.84	1.30	0.97	0.69	1.53	0.84	0.32	0.51
Sales growth(%)	6.9	13.6	32.1	22.2	22.7	52.7	19.9	38.6	24.1	36.7	8.8	7.7	-1.7	-17.4
No inside trades	2.8	2.0	2.1	2.6	2.6	2.1	1.1	1.2	0.1	0.2	0.0	0.0	0.1	0.5
Fraction equity issuers(%)	57.1	31.5	26.7	37.5	38.1	31.0	36.0	33.9	21.1	20.5	38.3	28.1	31.2	27.6
Fraction planned repurchasers(%)	71.4	52.0	50.0	40.9	26.2	20.8	22.0	19.4	17.5	20.5	25.5	19.5	20.8	17.1
Fraction actual repurchasers(%)	42.9	31.0	50.0	33.2	50.0	34.3	40.0	31.4	29.8	32.8	29.8	25.8	27.1	27.6

simply the number of days in the year that a stock is traded divided by the number of days the stock is listed. We see that this variable is highly skewed. Most stocks is traded almost every day, but there is a large group which is traded less often. It is for firms in this latter group that it makes sense to hire a DMM. If your stock has enough trading activity that it trades every day, there is no need to hire a DMM to keep the spreads below 4%, there is enough trading interest to keep the spreads low anyway. This point is illustrated in panel B of the figure, where we show the distribution of fraction of the year with trading for the firms which have hired a DMM. Note that most of these firms are trading much less than every day. We also show the difference one year before and one year after the DMM introduction. Note the shift to the right in the figure.[13]

In figure 2 we use histograms of relative spreads to illustrate in more detail the distribution of liquidity. The histogram in Panel A shows the distribution of relative spread for the companies that *do not* have a DMM in a given year. In Panel B we look at firms that enter a DMM agreement. On the left we show the distribution of relative spread for the year before the date the DMM contract is initiated, on the right we show the distribution for the year after the DMM initiation. An important observation from these histogram is that the DMM users are not the most liquid firms. Rather, it is the group of firms with low to medium spreads which seem to want hire a DMM to improve their liquidity. A plausible cause of this is that for the most liquid firms there is no need for a DMM, the spreads are kept low anyway by the amount of trade interest. We also note from the histogram in panel A that there are firms with very high spreads that do not hire a DMM.

A final descriptive exercise is to calculate the correlations between some of these variables, shown in Table 3. 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 careful about timing, so these numbers are not exactly the same as those used in the regressions. With that qualification in mind, it is still important to note that many of the potential explanatory variables are correlated, such as Q and equity issuance.

3 The effect of hiring a DMM

In this section, we take a look at DMM introductions and their effects on liquidity and other properties of the market. The main purpose is to examine whether the results found for DMM introductions in other markets also holds in our sample for the OSE. First, we examine whether different measures of liquidity improve after DMM introductions, and

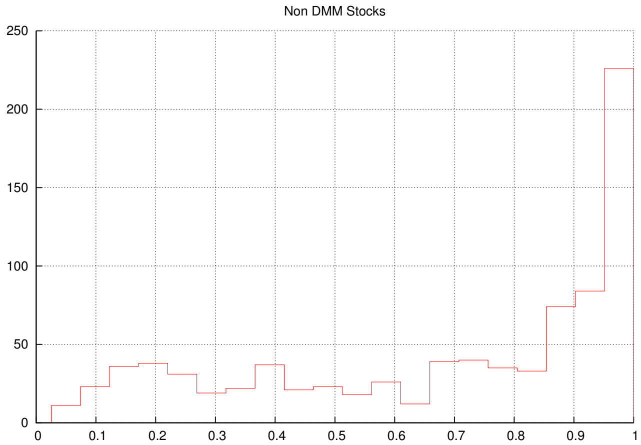
[13]Actually, when we in our empirical analysis look at the decision to hire a DMM, we will exclude those firms that trade almost every day.

Figure 1

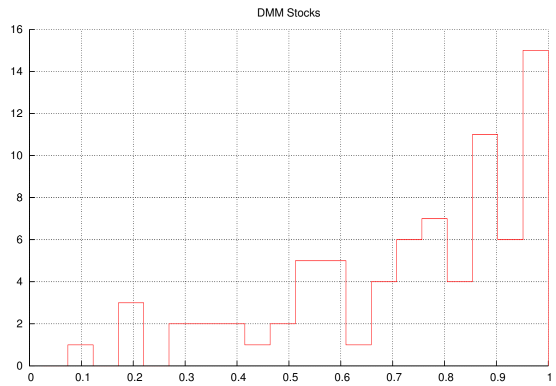
Distribution of fraction of year traded for DMM and non-DMM stocks

The figures show histograms of the distribution of fraction of year traded. We calculate the fraction of year traded as the number of days in a year that a firm's stock actually traded, divided by the number of days that the stock was listed. If the stock traded every day, the number is one. Panel A shows the distribution for all firms on the exchange that do not have a DMM. The basis for the figure is firm years, 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. Panel B shows the distribution of fraction of year traded for firms initiating a DMM. We look at the fraction one year before the DMM contract starts running (the histogram on the left) and one year after the initiation (the histogram on the right). In the sample we only use the first time the firm hires a DMM.

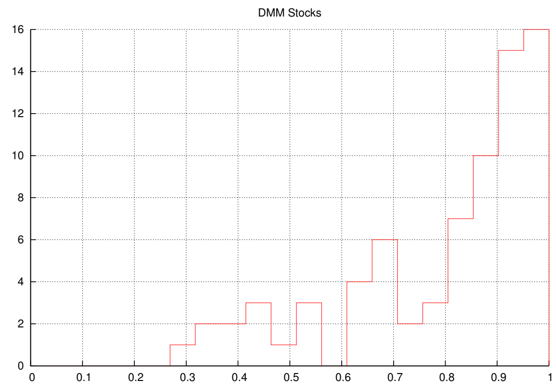
Panel A: Stocks without DMM



Panel B: Stocks with DMM



Year before DMM start



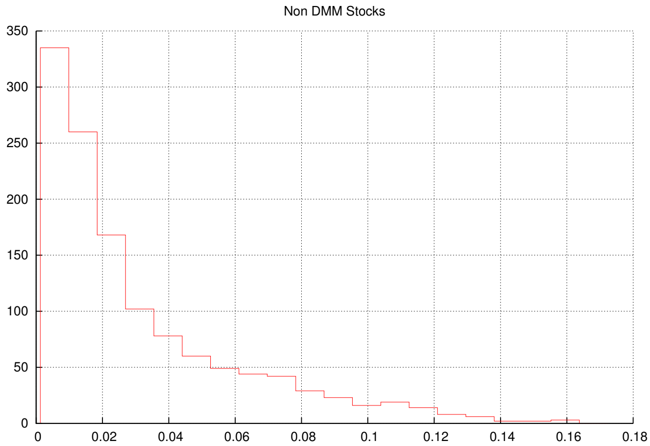
Year after DMM start

Figure 2

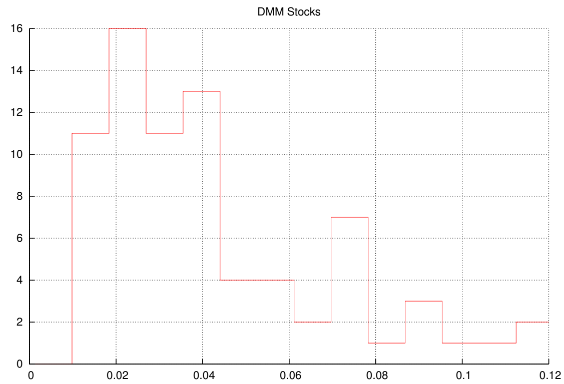
Distribution of relative spread for DMM and non-DMM stocks

The figures show histograms of the distribution of average annual relative spread for two group of firms. Panel A shows the distribution of relative spreads for all firms on the exchange that do not have a DMM. The basis for the figure is firm years, 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. Panel B shows the distribution of relative spreads for firms initiating a DMM. We look at the average spreads one year before the DMM contract starts running (the histogram on the left) and one year after the initiation (the histogram on the right). In the sample we only use the first time the firm hires a DMM.

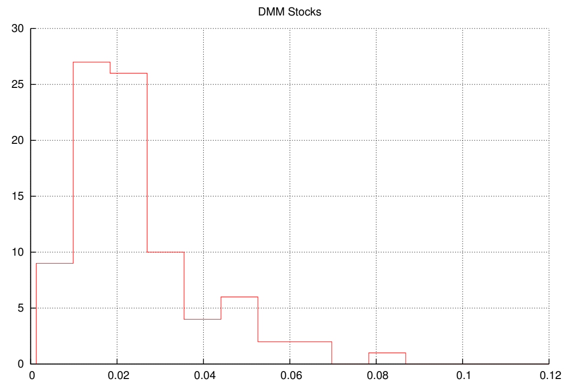
Panel A: Stocks without DMM



Panel B: Stocks with DMM



Year before DMM start



Year after DMM start

Table 3

Correlations

The table shows (contemporaneous) correlations between annual observations of the following variables: *Relative Spread* is the difference between the best bid and ask price on each date with trades, divided by the last trade price, averaged over a year. *Firm size* is the value of the firm's assets, *Q* is Tobin's Q calculated as the market value to book value of firms assets, *Inside Trades* is the number of large inside sales during the year. *Issue equity this year* is a dummy variable equal to one if the firm issues equity during the next year, and similarly *Actual Repurchase* is a dummy variable equal to one if the firm repurchases shares during the next year. *Announced repurchases* is a dummy variable equal to one if the firm has an announced repurchase program. *Sales growth* is the percentage change in operating income. *Have DMM* is a dummy variable equal to one if firm has a DMM sometime during the year and *Hire DMM* is a dummy variable equal to one if firm hires a DMM sometime during the year. *Frac trading days* is the number of days that the stock is traded divided by the days the stock is listed and *Listed within 2 years* is a dummy variable equal to one if the time since the firm was listed is less than 2 years.

	Relative	Firm		Inside	Issue	Repurchases		Sales	Have	Hire	Frac
	Spread	Size	Q	sales	Equity	Announce	Actual	Growth	DMM	DMM	trad days
Firm size	0.05										
Q	0.04	0.06									
No inside trades	0.06	0.17	0.26								
Issue equity next year	0.02	-0.08	0.13	0.07							
Announced repurchases	0.06	0.17	0.09	0.32	-0.07						
Repurchase next year	-0.02	0.13	0.08	0.19	-0.15	0.27					
Sales growth	0.07	0.07	0.04	0.33	0.11	0.33	0.08				
Have DMM	0.10	0.02	0.13	0.29	0.06	0.45	0.15	0.73			
Hire DMM	0.10	0.06	0.14	0.32	0.08	0.47	0.14	0.78	0.94		
Frac trading days	0.74	0.37	0.16	0.13	0.09	0.11	-0.03	0.13	0.13	0.15	
listed within 2 years	-0.09	-0.13	0.06	-0.02	0.13	-0.20	-0.09	-0.11	-0.14	-0.14	-0.11

then we look at the market reaction to DMM announcements using an event study.

3.1 Does liquidity change?

We answer this question in a very simple manner, by comparing the liquidity before and after the introduction of DMMs. In Table 4 we look at the five different liquidity measures for the year, and six month period, before and after the initiation of the DMM agreement.

Table 4
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 start. 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 at the end of the trading day divided by the stock price at the close. 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 firms stock that is traded in a month. Numbers in parenthesis represent p-values from a test of whether the change in liquidity is significantly different from zero.

	Period before		Period after		t-test diff				n
	1 year	6 months	6 months	one year	6 months		1 year		
Rel Spread	0.039	0.039	0.024	0.026	-0.015	(0.00)	-0.013	(0.00)	100
LOT	0.045	0.044	0.034	0.038	-0.009	(0.02)	-0.006	(0.07)	100
Amihud	0.570	0.615	0.406	0.436	-0.186	(0.05)	-0.106	(0.19)	100
Monthly Turnover	0.042	0.043	0.051	0.058	0.007	(0.15)	0.015	(0.02)	100
Fraction of year traded	0.753	0.756	0.824	0.817	0.073	(0.00)	0.071	(0.00)	100

For the six month period, we see that both the relative spread, the LOT and Amihud measures fall significantly after the DMM agreement has been initiated. This point was also illustrated in panel B of figure 2, which showed the distribution of relative spread before and after the DMM initiation. In the picture we clearly saw that the distribution of relative spread shifted left after DMMs were introduced. For the one year window, the reduction in relative spread and Amihud measure remains significant, while the change in the LOT measure is rendered insignificant. Interestingly, trading activity seem to increase. The fraction of the trading year with trades increases, both over the six month and one year horizon, and the increase in turnover becomes significant at the one year horizon. This may indicate that the reduction in transaction costs due to the introduction of a DMM attracts traders to the stock causing trading activity to increase.

Another interesting observation is that the average relative spread *before* DMM contracts are initiated is 3.9% for the year before. This is actually lower than the default contractual obligation to keep the spread below 4%. This may suggest that the cost to the Designated Market Maker of maintaining a spread of 4% may be relatively low.

Overall, regarding the question of the effect of DMM initiations on liquidity, we see that there is a significant improvement in all liquidity measures around the DMM introduction, which is consistent with research on other markets. This is however a result which we *should* observe; i.e. it looks like the DMMs do what they are paid to do, improve liquidity. The more interesting observation is that the DMM initiation is also associated with an increase in trading days and turnover. Thus, there may be an externality from hiring a DMM in the sense that "liquidity attracts liquidity".

3.2 Market reaction

A more open question is whether the market values the DMM contracts. To answer this question we perform an event study, where the date when the firm announces a DMM is the "event date". The market reaction is measured by the cumulative abnormal return at the date when the DMM agreements are announced to the market. We exclude stocks that started trading simultaneously with the DMM initiation,[14] and stocks where we can not identify with certainty the announcement date.

In figure 3 and panel A of Table 5 we show the results of this event study, where we start 5 trading days before the event date and plot the aggregate CAR for the next ten trading days. In aggregate there is a positive reaction of about 1% just around the announcement date. The reaction is significant, as shown by the tests in panel A of Table 5.

This positive market reaction is consistent with other research. For example, Anand et al. (2009) find a CAR around liquidity provider introduction of about 7% in their Swedish sample, and Menkveld and Wang (2009) find a CAR of 3.5% at Euronext. We thus confirm the effects on the market found in other studies, liquidity improves, and the market reacts positively to DMM introductions.

To further investigate these results we look at whether the size of the CAR is related to properties of the firms hiring DMM's. In panel B of Table 5 we regress the magnitude of the CAR on the liquidity, measured by the spread, of the stock before the DMM start, also controlling for the firm size. The regression shows a positive relationship between the spread and CAR. This means that the larger the spread before the DMM start, the bigger the reaction. So the positive market reaction is largest for the least liquid stocks.

[14] There are quite a few cases where the firm hires a DMM at the same time as the firm's IPO. In several cases the DMM agreement is likely to be part of the IPO "package" where the underwriter also acts as a market maker to keep a liquidity market for the stock after the IPO.

Figure 3

Event study, announcement date of DMM

The event study is done using the standard methods, as for example exposited in Campbell, Lo, and MacKinlay (1997). The figure plots the average cumulative abnormal return (CAR), where CAR is calculated relative to the market model. Specifically, for each stock i and date t we calculate $AR_t = r_{it} - (\widehat{\alpha}_i + \widehat{\beta}_i(r_{mt} - r_{ft}))$, where AR is the abnormal return, r_{mt} the market return, and $\widehat{\alpha}_i$ and $\widehat{\beta}_i$ the estimated parameters. We use an equally weighted stock market index for the market. The figure shows the cumulative abnormal return (CAR) from 5 days before the DMM announcement (at t=0) to 5 days after the DMM announcement. We only use stocks for which we can identify the announcement date from the OSE news feed.

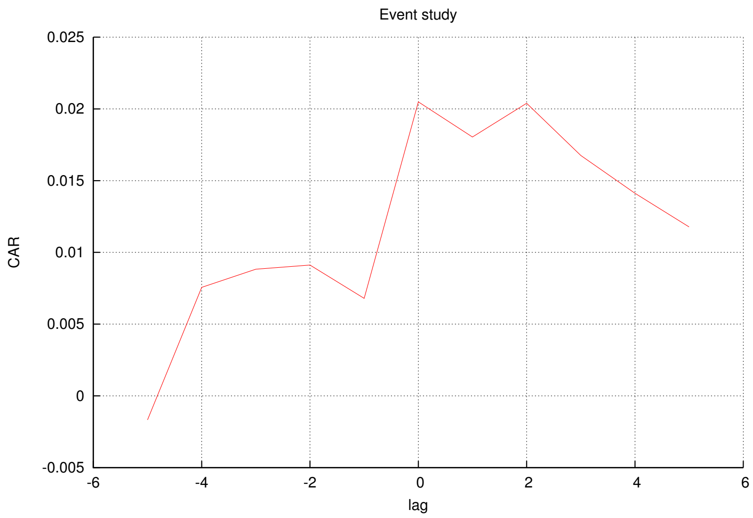


Table 5

Event study

The tables provide further information about the event study. In Panel A we test the significance of the CAR's for the event study. The second column lists the average cumulative abnormal return (CAR) for the given lag, where CAR is calculated relative to the market model. Specifically, for each stock i and date t we calculate $AR_t = r_{it} - (\widehat{\alpha}_i + \widehat{\beta}_i(r_{mt} - r_{ft}))$, where AR is the abnormal return, r_{mt} the market return, and $\widehat{\alpha}_i$ and $\widehat{\beta}_i$ the estimated parameters. We use an equally weighted stock market index for the market. For each stock, CAR_i is the sum of abnormal returns, and the table lists the average of CAR_i for each lag. The next two columns provides the two standard tests for significance of the average CAR being different from zero, J_1 and J_2, as exposited in Campbell et al. (1997). These test statistics follow a t-distribution.

In Panel B we show results of a regression where the CAR at a 10 day horizon is the dependent variable. In these regressions we look at two explanatory variables: Liquidity, measured by relative spread one year before the DMM initialization, and firm size, proxied by the log of operating income.

Panel A: Significance test of CAR's in event study

lag	$\bar{CAR}$	J_1	J_2
0	0.0205	7.337	8.310
1	0.0180	5.982	6.669
2	0.0204	6.324	6.631
3	0.0168	4.899	4.527
4	0.0141	3.917	3.650
5	0.0118	3.115	2.791

Panel B: Determinants of CAR.

	coeff	(serr)	[pvalue]
Constant	-0.1637	(0.1163)	[0.16]
liqudity(rel spread)	1.5662	(0.9221)	[0.09]
ln(operating income)	0.0086	(0.0088)	[0.33]
n	62		
$\bar{R}^2$	0.06		

4 The decision to hire a DMM – Is cash flow relevant?

We now want to look for a link between expected future cash flows and the hiring of DMM's. We do this indirectly, by asking whether the factors we indicated earlier, capital needs and repurchases, are relevant for the DMM decision. In the empirical implementation we also consider the possibility of exit by large shareholders, and control for other factors which affect the DMM decision, such as stock liquidity.

Specifically, we model the decision to hire a DMM as a probit regression.[15] In a probit we differentiate between two possible outcomes, and model the determinants of this choice. We choose to look at each calendar year as a primitive, and count as success if the firm has a DMM at some point during the year. We thus lump both firms having decided to hire a DMM during the year, and those firms which had a DMM before, and just decides to keep the DMM agreement going. We view this annual split into calendar year as natural since most of the corporate decisions we look at here, such as repurchasing and large capital issues, need approval from the annual meeting, which normally happens only once a year. The sample is thus all combinations of firm and year in the 2004-2009 period. If a firm have a DMM at some point in a given year that is viewed as success in the probit.

The explanatory variables of interest are related to the probability of the firm directly interacting with the capital markets in the near future, either due to capital needs, or repurchasing stocks. As proxies for capital needs we use several variables. One is the firm's growth opportunities, measured by Tobin's Q. We assume that capital needs are increasing in growth opportunities, which implies that the probability of hiring a DMM is increasing in Q. In addition to Q, which has the problem that it may be open to other interpretations than growth potential, 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 growth opportunities is to look at this ex post: *Do* firms with a DMM raise new capital in the near future? To test it this way we use a dummy for whether the firm issues equity in the next three years. Under the hypothesis that firms want to improve liquidity before they raise capital we expect the probability of hiring a DMM to be increasing in this dummy variable.

We also look at repurchases. If a firm wants to do a repurchase of the company's stock in the near future, improved liquidity in the firm's stock will reduce the price

[15] We have in unreported estimations also considered a logit formulation. The overall conclusions from those regressions are similar to the ones with a probit formulation.

impact when the stock's are bought in the market, and hence lower the costs of executing the repurchases. We use two different measures of repurchases, one ex ante and one ex post. The ex ante measure comes from the regulation of how repurchases must be performed by Norwegian firms. Before a given firm can repurchase shares, it must have approval by the annual meeting of shareholders to repurchase up to a given percentage 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. The ex ante measure we use is whether, in the year we analyze, the firm has gotten approval for a repurchase program. As our ex post measure we use a dummy for whether the firm actually repurchase shares within three years of the DMM hire.

As mentioned in the theoretical discussion, we also include a potential third explanation for why a firm would want to hire a DMM; exit for the original owners. In motivations for IPO's one often mentions the desire for the original owners to lower their stakes, for diversification or consumption purposes. These original owners often have a period before they can start divesting their stakes. Improved liquidity of the firm's shares would lower the price impact at the time of such sales. These cases would be registered as insider trades, which we have access to. We therefore look at 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 inside sales by insiders.[16] This is an ex post measure. As an ex ante measure we believe that this explanation is most likely to be valid for recently listed firms, and use a dummy for whether the firm listed less than two years before.

There are however a number of additional factors that are likely to influence whether a firm hires a DMM. One is the current liquidity of the stock. If it is already liquid, there is no need to hire a DMM to improve liquidity.

This feature of the data was illustrated in the histograms in figures 1 and 2, where we saw that for the firms that were traded every day, or had very low spreads, there were few DMM's. We therefore want to exclude these firms which already have liquid stocks, and only consider those for whom DMM is a relevant option. We choose to base the selection on the number of trading days: If the firm, in the year before the one we are considering, traded more than 90% of the days, we choose to remove the firm's from the sample.[17]

In table 6 we show the results from a number of probit regression specifications. In the table, each column contains the results for one specification. Starting on the left, we

[16]By large we use insider transactions larger than 50 thousand NOK (About 10 thousand USD) in value.

[17]We could alternatively have based the exclusion on the relative spread, but we chose the number of trading days as less endogenous than the spread, which is the criterion the contract is written on. We have in unreported analysis also looked at a sample selection where we remove stocks with low spreads, and find similar results.

have a specification with most of the possible explanatory variables, and then have less comprehensive versions moving to the right. In doing the analysis it is useful to group the explanatory variable 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). We split the results into separate panels for the ex ante and ex post proxies.

In this probit formulation a positive coefficient should be interpreted as increased probability of hiring a DMM. So, for example, a positive coefficient on the Q variable should be interpreted as firms with higher Q have a higher probability of having a DMM. We see that the data is supportive of our theoretical arguments, although there is some variation across model specification. If we first look at the ex ante specifications, Q is always positive and highly significant. If we think of Q as a measure of growth opportunities, this is supportive of our argument that firms that are more likely to need capital are those that hire a DMM. However, Q is a variable with many interpretations, so this is not unambiguous support. We therefore should also look at the other proxies for this, sales growth and (ex post) actual equity issues. Here we see that sales growth is not significant, which can be due to the noise in this accounting figure. It is thefore more interesting to look at ex post capital issuance. While the more comprehensive specifications are not significant, when we look at just equity issuance and repurchases, equity issuance is a significant determinant of the decision to hire a DMM. Again the coefficient is positive. Regarding repurchases, we observe that there is strong evidence that firms that plan to repurchase hire a DMM. Both the ex ante and the ex post proxies for the likelihood of repurchasing are significant in a majority of cases. There is almost no evidence suggesting that exit for the original owners is significant, insider trades is never significant, but there is one case where the dummy for a young firm is a significant determinant.

Now, the above specification treats new DMM contracts and continuing an already existing DMM contract equally. However, these decisions may not be equal. We therefore do a second probit formulation where we remove all the firms with existing DMM contracts, and only contrast firms that hire a DMM *this year* (success in the probit) with firms without a DMM. The specification may get more cleanly at the tradeoff. The results of this specification is shown in table 7. Comparing these results with the previous ones, we find that also here Q is significant in all specifications. In the ex post case, issuing equity is now significant in all specifications. So there is even stronger evidence that capital needs is an important determinant of DMM hires.

To conclude, in our indirect analysis we find evidence consistent with a cash flow explanation, that firms evaluate the potential future cashflows, specifically future costs of interacting with the capital markets, before deciding to hire (or rehire) a DMM.

Table 6

Having a Designated Market Maker

The tables report results from probit regressions, where the dependent variable is success if the firm has had a DMM at some point during a year. The explanatory variables are: Liquidity (average relative bid/ask spread last year), Q (end of last year), planned repurchases, the time the firm has been listed, whether the firm actually repurchases shares, whether the firm issues equity and the number of large inside sales, all over a three year period, and the accounting sales growth the previous year. The table reports the results for a number of different specifications. Each set of two columns show the result of a given specification. For each specification we show the coefficient estimates, the *p*-values, the number of observations (N) and the Pseudo R^2. In the sample we only consider firms that traded less than 90% of the available days the year before.

Panel A: Ex ante eplanatory variables

Model	1	2	3	4
Liquidity (RelSpread)	-17.417***	-26.47***	.	.
	(0.00)	(0.00)	.	.
Q last year	0.293***	.	0.308***	0.311***
	(0.00)	.	(0.00)	(0.00)
Sales growth	.	0.01	.	.
	.	(0.94)	.	.
Repurchase program	0.257	0.022	0.358**	0.332**
	(0.13)	(0.91)	(0.02)	(0.04)
Listed < 2 years	0.368***	0.180	0.183	.
	(0.01)	(0.32)	(0.17)	.
Constant	-0.411**	0.680***	-1.255***	-1.180***
	(0.02)	(0.00)	(0.00)	(0.00)
N	437	311	494	494
Pseudo R^2	0.17	0.17	0.09	0.09

Panel B: Ex post explanatory variables

Model	1	2	3
Liquidity (RelSpread)	-16.729***	.	.
	(0.00)	.	.
Issue equity	0.229	0.18	0.238**
	(0.12)	(0.17)	(0.04)
Actual repurchase	0.358***	0.442***	0.398***
	(0.01)	(0.00)	(0.00)
Insider trades (sells)	-0.015	0.002	.
	(0.46)	(0.89)	.
Constant	-0.137	-1.010***	-1.069***
	(0.45)	(0.00)	(0.00
N	392	482	633
Pseudo R^2	0.10	0.02	0.02

Table 7

Decision to hire a Designated Market Maker

The tables reports the results from probit regressions, where the dependent variable is the decision to hire a DMM in this year. The explanatory variables are: Liquidity (relative bid/ask spread last year), Q (end of last year), whether the firm actually repurchases shares this or next year, whether the firm issues equity within the same period, the number of inside transactions over the same period, and the accounting sales growth the year of the DMM initiation. The tables reports the results for a number of different specifications. For each specification we show the coefficient estimates, the *p*-values(in parenthesis), the number of observations (n) and the Pseudo R^2. 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 eplanatory variables

Model	1	2	3	4
Liquidity (RelSpread)	-7.402**	-15.916***	.	.
	(0.03)	(0.00)	.	.
Q last year	0.30***	.	0.29***	0.30***
	(0.00)	.	(0.00)	(0.00)
Sales growth	.	-0.011	.	.
	.	(0.95)	.	.
Repurchase program	0.152	-0.079	0.201	0.146
	(0.49)	(0.75)	(0.35)	(0.49)
Listed < 2 years	0.40**	0.181	0.319*	.
	(0.03)	(0.43)	(0.06)	.
Constant	-1.33***	-0.29**	-1.77***	-1.62***
	(0.00)	(0.27)	(0.00)	(0.00)
N	368	248	425	425
Pseudo R^2	0.12	0.08	0.09	0.08

Panel B: Ex post explanatory variables

Model	1	2	3
Liquidity (RelSpread)	-6.731*	.	.
	(0.06)	.	.
Issue equity	0.412**	0.35**	0.358***
	(0.03)	(0.04)	(0.01)
Actual repurchase	0.419**	0.469***	0.350**
	(0.03)	(0.01)	(0.02)
Insider trades (sells)	0.021	0.030	.
	(0.34)	(0.12)	.
Constant	-1.259***	-1.526***	-1.544***
	(0.00)	(0.00)	(0.00
N	329	419	559
Pseudo R^2	0.07	0.05	0.03

5 Does hiring a DMM affect the firm's cost of capital?

Let us now look at the second potential channel through which the hiring of a DMM may affect firm value, cost of capital. We start by looking at asset pricing theory, how can changes in liquidity affect expected returns? In asset pricing terms, we need to look at whether liquidity is a priced risk factor in the expected returns of the firm.

5.1 Changes in liquidity risk

In our setting, if the presence of a DMM reduces the liquidity risk, we would expect the liquidity risk in the stocks of firms that hire a DMM to decrease after the DMM starts market making. As mentioned earlier, liquidity externalities from hiring a DMM may help improve liquidity over and above what is provided by the DMM. To examine this conjecture we start by considering the following two-factor asset pricing model,

$$er_{it} = a_i + \beta_i^m er_{mt} + \beta_i^{liq} LIQ_t + e_t \tag{2}$$

where er_{it} is the excess return of stock i on day t, a_i is a constant term, er_{mt} is the excess return on the market on day t, and β_i^m is stock i's loading on the market factor. LIQ_t is a liquidity factor similar to the Fama and French size and book/market factors,[18] and β_i^{liq} is stock i's loading on the liquidity risk factor. In general, a large positive β_i^{liq} coefficient means that the stock has high liquidity risk, while a low (or negative) coefficient means that the stock has low liquidity risk. If the presence of a DMM reduces the liquidity risk this would manifest in changes of the estimates of β^{liq}. This is what we investigate.

Panel A in Table 8 shows the average and median liquidity beta (β^{liq}) estimated using data one year before the firm hires a DMM ("Pre DMM"), and one year after the firm has hired a DMM ("post DMM"). Both the mean and median liquidity beta before the DMM contract is positive and is reduced after the DMM hiring. This drop in liquidity beta is highly significant both with respect to the mean as well as the median. Thus, in support of our conjecture, the stocks of firms that hire a DMM experience a significant reduction in liquidity risk.

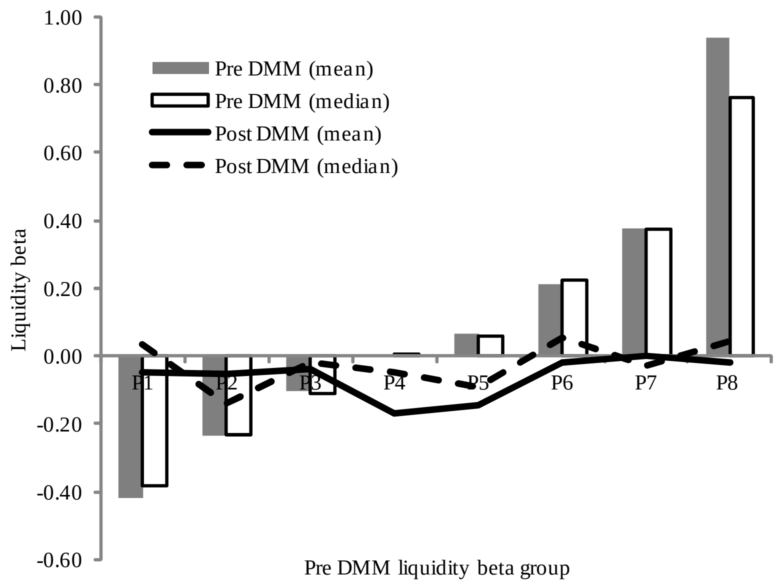
To further investigate how the liquidity risk changes, in panel B of Table 8 we construct 8 portfolios of stocks based on their pre-DMM liquidity beta, with P1 being the portfolio with the lowest pre-DMM liquidity beta and P8 containing stocks with the highest pre-

[18]The construction of the liquidity factor is detailed in Næs et al. (2009), essentially the LIQ_t factor portfolio is calculated as a return difference between a portfolio of the least liquid stocks at the OSE and a portfolio with the most liquid stocks at the OSE.

DMM liquidity beta. The liquidity betas of these portfolios vary in magnitude between −0.42 to +0.94. After the DMM hire we observe liquidity betas much more similar, both with respect to sign and size, across all groups. Interestingly, we also find that stocks that had the lowest pre-DMM liquidity beta (stocks in P1), experience a significant increase in liquidity risk. We do not have any good explanation for why we observe this, however, one reason may be that we are we underestimate the pre-DMM liquidity beta for these stocks. With respect to the portfolios with higher pre-DMM liquidity risk, we see that the stocks in portfolios 4 to 8 experience a significant decline in liquidity risk.

Figure 4
Pre- versus post-DMM liquidity beta

The figure shows the average and median liquidity beta before and after the firm having a DMM. We group stocks into eight portfolios based on their pre-DMM liquidity beta. The average pre-DMM beta grey bars and the pre-DMM median liquidity beta are the white bars. The lines show the mean (solid) and median (dotted) post-DMM liquidity betas for the same groups of stocks.



To show that the results are robust also for the median firm, Figure 4 plots the pre-DMM (grey and white bars) average and median liquidity beta across stock groups and the post-DMM liquidity betas (solid and dotted lines). Overall, there seems to be strong support for the conjecture that hiring a designated market maker with a contractual obligation to keep the spread at or below a maximum level reduces the liquidity risk loading for these stocks.

Table 8

DMM impact on liquidity risk

Panel A of the table shows the average and median liquidity beta (β^{liq}) across DMM stocks before (pre) and after (post) the DMM agreement. The liquidity beta is estimated using 1 year of daily data before and after the DMM contract is established as,

$$er_{it} = a_i + \beta_i^m er_{mt} + \beta_i^{liq} LIQ_t + e_t$$

The difference in liquidity beta is the difference between the post- and pre estimates. The last two columns show the change in beta with the associated p-value from a t-test for the difference being significant. In the second row of Panel A, we report the medians of the distribution of liquidity betas estimated for the pre-DMM and post-DMM periods. We perform a Wilcoxon/Mann-Whitney test for the equality of medians between the pre-DMM and post-DMM distributions. Also, ** and * indicate a significant difference between the post- and pre-DMM liquidity beta at the 1% and 5% level, respectively. The last column provides the p-values from a test of whether the change in the average (median) liquidity beta is significantly different from zero.

Panel B of the table shows the average liquidity beta for subgroups of firms grouped on their pre-DMM liquidity beta.

		Liquidity beta (β^{liq})		Test for difference	
	n	Pre DMM	Post DMM	Post-Pre	p-value
Panel A: All stocks					
All stocks, mean	89	0.114	-0.062	-0.176***	0.002
All stocks, median	89	0.044	-0.022	-0.157**	0.014
Panel B: Groups of stocks based on pre-DMM β^{liq}					
P1 (Low β^{liq})	11	-0.420	-0.049	0.371***	0.012
P2	11	-0.235	-0.055	0.181	0.111
P3	11	-0.105	-0.039	0.066	0.328
P4	11	0.004	-0.169	-0.174**	0.053
P5	11	0.065	-0.146	-0.211***	0.001
P6	11	0.211	-0.020	-0.231**	0.038
P7	11	0.378	0.000	-0.378***	0.000
P8 (High β^{liq})	12	0.940	-0.019	-0.959***	0.001

5.2 Liquidity risk premium

Looking at the risk loadings does not let us evaluate the economic significance associated with the reduction in liquidity risk for DMM stocks. To measure this significance we look at the pricing implications of the reduction in liquidity risk.

To do so, we first need estimates of the general risk premium associated with liquidity in the Norwegian stock market. The estimate of a liquidity risk premium will make it possible to gauge the economic significance of the reduction in liquidity risk and indirectly say something about the potential effect on the cost of raising capital. In addition, it is useful to see where in the distribution the liquidity beta for the DMM stocks fall relative to the full cross-section of stocks.

A comprehensive crossectional analysis of asset pricing at the OSE was done in Næs et al. (2009). Among their analyzes was an estimation of this two factor model, with market and liquidity factors. Their analysis was performed using data for 1980-2008. We extend their analysis to also include 2009. The analysis reported in Table 9 corresponds to table 11 on page 30 in Næs et al. (2009), and we refer to that paper for details about the methods and data employed.

First, in panel A we report estimates of the factor model (2) for liquidity-sorted portfolios for the whole exchange, not just the DMM firms we used in Table 8. Since the final purpose of this estimation is to obtain an estimate of the unconditional liquidity risk premium, we use a long sample period covering the period from 1980 through 2009. Comparing the liquidity beta estimates at the right of the table, we see that for these portfolios the liquidity premium range from -0.40 to $+0.68$, a range that is actually similar to what we saw for the DMM firms in panel B of Table 8, although the DMM estimates are presumably more noisy as they are just using one year of daily data.

Comparing the liquidity risk loadings for all stocks in Panel A of Table 9 with the loadings on the liquidity factor before and after the DMM hiring in Table 8, we see that the average pre-DMM liquidity beta (0.114) is similar to the loading for stocks in the upper range (portfolio 7 and 8) of liquidity portfolios in Table 9. However, after the firm has hired the DMM, the liquidity beta is closer to what we find for the more liquid stocks on the exchange (portfolio 4 and 5). This suggest that hiring a DMM reduces the market liquidity risk of these firms.

To gauge the economic significance of the liquidity risk, we need estimates of the risk premia associated with the various factors. To estimate this we add the crossectional pricing restriction given by equation (3):

$$E[er_i] = \lambda_0 + \lambda_m \beta_i^m + \lambda_{liq} \beta_i^{liq} \tag{3}$$

The estimate of λ_{liq} is found by estimating a system where one imposes both equations (2) and (3) jointly. In panel B of Table 9 we present the risk premia estimates both for the CAPM as well as the two factor model where we add the liquidity risk factor.[19] First off, in the CAPM estimation we estimate an unconditional market risk premium of 0.014 (1.4%) per month, which annualized is about 18%.[20] In the two last columns in panel B of the table, we present the risk premia estimates associated with the factors in the two factor model. When adding the liquidity factor to the model we see that the market risk premium drops slightly. More importantly, we see that the risk premium associated with the liquidity factor is highly significant and is of the similar magnitude to the premium on the market factor. Furthermore, we see that the J-test rejects the null that the CAPM is able to accurately price the liquidity portfolios, while we are unable to reject the null for the two-factor model.

To get a measure of the economic magnitude of the liquidity effect, we can use the estimated risk premium $\hat{\lambda}_{liq} = 0.0119$ to calculate the annual reduction in expected returns due to the hiring of a DMM. Combining the premium with the reduction of 0.176 in the loading on liquidity risk found in Table 8, we would calculate the change in required return as $(1 + (0.0119 \cdot 0.176))^{12} - 1 = 0.0254$. In other words, the required returns for firms that hire a DMM is reduced by about 2.5% in annualized terms. This suggest that the hiring of a DMM has a significant impact on the firms cost of raising equity capital and is potentially large enough to justify the fee that the firm pays to the DMM.

6 The economics of the results

Let us now take stock of our results, and again look at them in terms of our original question. How can a firm justify paying a cash fee just to improve liquidity?

First, we have identified what looks like a link between future capital markets operations and the hiring of a DMM, but we did it in an indirect manner. One way to evaluate the reasonableness of this conclusion is to ask whether it makes sense in terms of the economic magnitudes involved. Simply asked, are the potential cost savings large enough? Let us look at one of these capital market events, issuing equity. How large are the potential cost savings? While these are not observable, we can do some back-of the envelope calculations of expected annual costs for a typical company at the Oslo Stock Exchange. First, given that a firm issues equity, what is the cost? We have some evidence on these costs in the Norwegian market, in Kvaal and Ødegaard (2011). If we for

[19] The risk premia are estimated by GMM, see Næs et al. (2009) for details.

[20] While this is a very high equity premium compared to e.g. the US, the average realized returns on equity in Norway has been very high over the period 1980-2009.

Table 9

Liquidity risk at the Oslo Stock Exchange (1980-2009)

The table shows results from a two factor model estimated for ten portfolios sorted by liquidity (relative spread). The estimation uses monthly data for the period 1980-2009.
Panel A shows the factor loading estimates from a Black, Jensen, and Scholes (1972) analysis where we estimate the two-factor model

$$er_{it} = a_i + \beta_i^m er_{mt} + \beta_i^{liq} LIQ_t + e_t$$

Panel B shows the factor loading estimates from a GMM analysis where we estimate the two-factor jointly with a cross-section pricing restriction, specified by:

$$E[er_{it}] = a_i + \beta_i^m er_{mt} + \beta_i^{liq} LIQ_t$$

$$E[er_i] = \lambda_0 + \lambda_m \beta_i^m + \lambda_{liq} \beta_i^{liq}$$

Here er_{it} is the excess return of portfolio i, a_i is a constant term, er_{mt} is the excess return on the market, β_i^m is portfolio i's loading on the market factor, LIQ_t is the liquidity factor, and β_i^{liq} is portfolio i's loading on the liquidity risk factor.The risk premia are λ_m and λ_{liq}. numbers in parenthesis are p-values associated with the coefficients.
Panel B shows the (monthly) factor risk premia estimated by GMM with the associated t-values. We both estimate and test whether the regular CAPM is able to accurately price the 10 liquidity portfolios, and similarly for the two factor model. The two last rows report the χ^2 and the associated p-value from a J-test for over-identifying restrictions for the CAPM and the two factor model, respectively.

Panel A: Market and liquidity risk loadings

Portfolio	a_i		β_i^m		β_i^{liq}	
1 (low spread)	-0.003	(0.36)	1.06	(0.00)	-0.40	(0.00)
2	-0.003	(0.41)	0.98	(0.00)	-0.37	(0.00)
3	-0.002	(0.64)	1.08	(0.00)	-0.24	(0.00)
4	-0.001	(0.70)	0.90	(0.00)	-0.19	(0.00)
5	-0.001	(0.87)	0.95	(0.00)	-0.09	(0.26)
6	-0.001	(0.79)	0.88	(0.00)	-0.13	(0.01)
7	0.000	(0.93)	0.89	(0.00)	0.04	(0.58)
8	0.003	(0.57)	0.93	(0.00)	0.32	(0.00)
9	0.004	(0.40)	1.00	(0.00)	0.44	(0.00)
10 (high spread)	0.006	(0.18)	1.06	(0.00)	0.68	(0.00)

Panel B: Risk premia estimates

	CAPM		Two factor model	
Factor	$\lambda[k]$	p-val.	$\lambda[k]$	p-val.
er_m	0.014	(0.00)	0.0113	(0.00)
liq	-	-	0.0119	(0.00)
GMM J-test	$J(\chi^2(8))$	p-val.	$J(\chi^2(7))$	p-val.
	24.47	(0.00)	9.26	(0.16)

example look at targeted equity issues[21] in the 2000-2010 period, the typical equity issue is a 10% increase in the firm's equity capital. From the firm's point of view, the most important component of the costs of issuing equity is underpricing, new equity is issued at a lower price than the current stock price. For the period in question, the median underpricing was 7.2%. We do not know by how much this underpricing is lowered by having a DMM, but we can use the difference in underpricing between small and large companies to give an indication. For the same period, the median underpricing for the smallest half of companies at the OSE was 9.1%, while the number for the largest half of OSE companies was 5.3%. If we use the difference between these two as an estimate, a firm can lower the underpricing by 3.8 percentage points by hiring a DMM. What is this number in NOK terms? From table 2 we see that the median firm with DMM's have a value of 850 million NOK. The potential cost saving is in other words of the magnitude of NOK 850 mill $\times$ 10% $\times$ 3.8% = 3.23 mill.[22]

Now, this is the cost once the decision to issue has been made, but any given firm will only have expectations about whether it needs capital, and the expected cost in any given year is the probability of capital issue times the 3.2 million we just estimated. We can estimate this probability too from the record of equity issuance at the OSE. In the ten year period we are looking at there were a total of 933 targeted equity issues at the OSE, or 93 issues a year. If we use the frequency of equity issuance as an estimate of the probability, we need to divide this number by the number of firms at the exchange each year. The typical crossection at the OSE has about 250 listed shares, giving an estimated probability of a targeted equity issue of $\frac{93.3}{250} = 37\%$. With this probability we would estimate the expected annual cost of a new issue as NOK 2.3 mill $\times$ 37% = 1.2 million NOK. When we compare this number with annual costs of keeping a DMM in the three hundred thousand region, the potential costs savings from having a DMM are clearly large enough to be of first order importance in the decision to hire a DMM.

Let us next look at the implications of our estimates of how improved liquidity changes the cost of capital. In fact, these seem to be too good to be true. Let us go back to the valuation equation before. If we ignore the annual costs we would calculate the new value as,

$$V = \frac{X}{r - \text{liquidity premium decrease}}.$$

If for example the current cost of the capital r is 10%, a 2.5% lowering of the liquidity premium would indicate an increase in firm value by a third. Even though the typical

[21] We do not include the rights issues, as the underpricing is not as clearly a cost, in a rights issue the underpricing is part of the compensation to the current shareholders.

[22] This is about half a million USD, the exhange rates in december 2010 were NOK/USD=6.15 and NOK/EUR=8.06.

cost of capital for these firms is higher than 10%, it still seems like a large valuation effect from a simple increase in the liquidity of the firm's equity. It also seem to run counter to the typical Miller Modigliani intuition that one needs to affect the firm's operations. Now, one way that a lowering of cost of capital is actually going to affect the firm's operations is that a lower cost of capital will make more positive NPV projects feasible, so it will change the firm's operations that way.

If we take this result as given, a significant lowering in the liquidity premium, it would indicate that there are significant public benefits from improving liquidity, much above the costs paid by the firm. In fact, given the public goods nature of liquidity, our results indicate that it may be desirable to subsidize liquidity provision in equity markets.

7 Conclusion

We have investigated what motivates firms to spend cash hiring "Designated Market Makers" for the trading of the firm's stock. We argue that from a corporate finance view, this should primary be influenced by whether the firm expects to interact with the capital markets in the near future. Using data from the Oslo Stock Exchange we confirm this hypothesis, we show that measures relevant for the likelihood of the firm to go to the capital markets in the near future are significant determinants of firm's decisions to hire DMM's.

Liquidity in the trading of the firms stock is thus mainly valuable *to the firm* because of the stock markets primary role for the stock issuers, raising of new capital. Phrasing the result this way also show why the result of this paper has wider implications. If we go back to the literature on the interaction of corporate finance and the liquidity of a company's stock, the liquidity is shown to interact with the cost of capital of the firm. But this literature still have not faced the disconnect between the liquidity of trading in the secondary market (the stock market) – to the firm, all that happens is the replacing of one owner by another – and internal investment decisions in the firm, where the cost of capital is influenced by the liquidity of the stock. Our results points to the economic channel giving such results. What matters is the *potential* for raising capital through equity markets. Liquidity matters because it affects the terms at which new capital is raised.

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