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, at 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 relate the likelihood of hiring a DMM with measures of 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.

As a final exercise we look more closely at the mechanism by which these changes in liquidity affect the market (and the firm). 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. Finally, 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 conclude.

1 Literature

This paper intersects a number of somewhat disjoint literatures. The first is the market microstructure literature. In theoretical market microstructure, the role of the market maker has always been central, from the models of Glosten and Milgrom (1985), Kyle (1985) and onwards. In these models the market maker has an informational and price-setting role. Typically, the market maker uses his informational advantage to generate revenue (Harris and Panchapagesan, 2005). Empirically, however, in the world's stock markets we have seen a move away from markets with market making, towards (electronic) limit order markets. This lead Glosten (1994) to theoretically discuss the inevitability of limit order markets, and the development in market structure seemed to bear out this prediction. Recently, though, several stock markets have introduced the possibility of so-called "Designated Market Makers," financial intermediaries which have a special role in maintaining an orderly market in the trading of the company's stock, and charge the listed firm for these services. The appearance of such intermediaries has lead to theoretical reappraisal of the role of market making in electronic limit order markets.[1] 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

[1] See for example Nimalendran and Petrella (2003), Bessembinder, Hao, and Lemmon (2007) and Anand and Subrahmanyam (2008).

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.[2] 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.

Separately from the theoretical literature there has been a number of empirical investigations of the actual cases where firms hire a DMM. 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.[3]

Another strand of the literature we intersect is the literature on listings, Initial Public Offers (IPOs). While the IPO literature is large, (See e.g. Eckbo, Masulis, and Norli (2007) for a recent survey of this literature), much of it concerns the underpricing phenomenon on the listing date, and the mechanisms of the listing process. The literature often takes the wish to become listed as given, and go from there. A much smaller portion of the IPO literature looks at why firms want to pay the cost of becoming listed. A recent paper by Brau and Fawcett (2006) is a useful starting point. The paper uses surveys to ask CFOs about the corporate motivations to become listed. Interestingly, according to their survey, the most important factor for becoming listed is to facilitate takeovers, either as a target or as an aquirer. A second important motivation is that an IPO provides an exit for the founders, employees, venture capitalists, and other investors in the firm. Typical textbook explanations for being listed, such as lowering the cost of raising capital, comes much further down on the list of potential motivations for becoming listed.

[2]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.

[3]There are two likely reasons for this price increase. First, a level effect where the liquidity improvement due to the DMM introduction reduces the implicit costs of trading the stock, and hence increases the price. Second, an improvement in liquidity also potentially lowers the liquidity risk (Pastor and Stambaugh, 2003), which also cause the price to increase. In the last section of the paper we investigate this.

This result is a useful starting point for our research. Improving secondary market liquidity should have some of the same motivations as the decision to list on an exchange, but the claimed most important reason for listing, acquisitions, should not be a particular important reason for a slight improvement in secondary liquidity. The more traditional "textbook" reasons for becoming listed, such as lowering the cost of capital, are likely to be more prominent motivating factors. Improving liquidity does lower the cost of exit for the original investors, and may be a contributing factor, but this issue should be of declining importance the further from the IPO date one gets.

Let us therefore look at the cost of capital and its link to stock market liquidity. An important early contribution to this literature is Easley and O'Hara (2004), which points out that liquidity should be relevant for the firm's cost of capital. The driving feature of their model is the degree of private information about the firm. The lower the private information, the lower the cost of capital. A logical conclusion of this result is that actions that lower the degree of private information about a corporations value will lower its cost of capital and increase the value of the firm.

These arguments have been used as a basis for empirical investigations of links between liquidity and corporate finance decisions. For example, Lipson and Mortal (2009) examine whether market liquidity affect firms' capital structure, and find that the least liquid firms have higher debt to equity ratios. Their results suggest that firms with a more liquid secondary market in their stock rely more on equity financing. Similarly, Banerjee, Gatchev, and Spindt (2007) find that owners of less liquid common stock are more likely to receive cash dividends. Also, Eckbo and Norli (2005) find that IPO stocks are significantly more liquid (proxied by turnover), and have lower leverage ratios, compared to non-issuing firms matched on various characteristics. As opposed to equity issuance, Butler and Wan (2010) examine the long-run under-performance of debt issuers found by Spiess and Affleck-Graves (1995). Butler and Wan (2010) find that the stocks of debt issuers are significantly more liquid than matched size and book-to-market counterparts. They show that once they control for liquidity in their matching procedure as well as for liquidity risk in their multi-factor model for expected returns, the underperformance disappears. In addition, they find that more liquid firms are more likely to issue public debt, suggesting that higher stock market liquidity reduces the cost of debt issuance. Butler and Wan (2010) propose several explanations for their result, including information spillover effects between stocks and bonds (Sunder, 2006), and that firms credit ratings (and hence financing costs) is related to their stock liquidity (Odders-White and Ready, 2006).

A problematic feature of the literature that builds on the Easley and O'Hara (2004) intuition, is that the underlying uncertainty of the stock is *exogenous*. An improvement in liquidity may reduce the asymmetric information about the stock, but the underlying properties of the stock remains the same. We argue that this view of the link between corporate finance and liquidity is too narrow. It ignores that changes in liquidity may actually change the properties of the underlying firm. Recall the typical issues in Miller and Modigliani type discussions. Here, one distinguishes between changes that affect the real operations of the firm, such as its investments, and changes to the other side of the balance sheet, such as the debt/equity mix. If the basis for the link between liquidity and corporate finance is an exogenous property of the firms equity, this would imply that we are *only* looking at the right hand side of the balance sheet, without thinking about the asset side. If, in such a setting, we argue that changing the liquidity of the stock affects firm value, this seems to run counter to the typical Miller-Modigliani intuition; i.e. that we need to affect the firm's investments to affect its value.

We argue that one way we can reconcile these conflicting arguments is by simply allowing liquidity to affect the firms cash flows. An obvious channel is by saying that if the cost of capital of the firm changes, the firm's investment opportunities will change. If the cost of capital is lower, the firm may be able to produce more positive NPV projects. The same argument holds if one lowers the *direct* costs of raising new capital. If one has access to cheaper capital, one can sustain more positive NPV projects.

We are not the first to point out the endogenous nature of liquidity and corporate finance decisions. In a study that looks at the link between capital structure and the market liquidity of a firms stock, Frieder and Martell (2006) study the causal relation between the two and considers a joint determination of these two variables.

The innovation of our study is that it looks at cases which are close to perfect laboratories for studying the possible interrelationship between the firm's financing and liquidity, cases with *endogenous* decisions by firms to change the liquidity of the firm's stock. In our study we posit a number of plausible factors that may affect this decision, and perform an analysis of the decision to hire a DMM, asking whether the posited factors are relevant for this decision.

We argue that paying for DMM services only makes sense if the firm is planning to interact with the capital market in the near future. Two obvious times when a firm interacts with capital markets is when it *raises new capital* or performs *open market repurchases*. There is a limited literature which looks at capital issuing and repurchases and relate them to secondary market liquidity. For example, with respect to the cost of raising capital, Butler, Grullon, and Weston (2005) find a strong relationship between investment banks' fees, for facilitating seasoned equity offerings, and stock liquidity. They argue that their results suggest that firms have an incentive to promote the market liquidity of their equity. In relation to the question of raising new capital, Ginglinger, Koenig-Matsoukis, and Riva (2009) provide two main findings. First, they confirm the relationship between flotation costs and market liquidity in Butler et al. (2005). In addition, they show that stock market liquidity is an important determinant of the choice of flotation method when comparing uninsured rights, standby rights and public offerings. Finally, Lipson and Mortal (2009) show that firms with more liquid equity have lower leverage and prefer equity financing when raising capital. The results in these studies provides one potential motivation for why firms would want to hire a DMM.

In our work we also look at corporate 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 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 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.

To summarize, we argue that if the firm's management acts to maximize firm value, they should look at the costs of maintaining a DMM relationship, and ask whether this cost is lower than the expected cost savings of future interactions with the capital market, be it repurchases or capital issuance.

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.[4] 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

[4]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.

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.[5] 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 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.[6] 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.[7]

[Table 1 about here.]

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)), ILR (the measure of price elasticity introduced

[5] 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.

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

[7] 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.

by Amihud (2002)), and finally monthly turnover.[8] We also 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.

[Table 2 about here.]

Note that 2004 is atypical, we concentrate on the later years.[9] 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.[10] These measures all look at the cost of trading stocks. Another measure that is also used to investigate liquidity, turnover, tells an opposite story. The DMM firms have lower turnover than the non-DMM firms. 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.

The averages shown above does not give a full picture of how liquidity covary with the decision to hire a DMM, let us therefore give some further detail on this. In figure 1 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

[8] 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).

[9] 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.

[10] 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.

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. One reason may be that the cost of a DMM contract would be very high for these firms, another reason is that raising equity capital would be very expensive for these firms also with a DMM in place. Thus, for the most illiquid firms on the exchange hiring a DMM may be too costly relative to what they would gain from doing so.

[Figure 1 about here.]

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.

[Table 3 about here.]

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

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 four different liquidity measures for the year, and six month period, before and after the initiation of the DMM agreement.

[Table 4 about here.]

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 is also illustrated in panel B of figure 1, which shows the distribution of relative spread before and after the DMM initiation. In the picture we clearly see that the distribution of relative spread shifts left after DMMs were introduced. With respect to turnover, we find that it increases, although not significantly. 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, 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 turnover to increase.

One 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 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,[11] and stocks where we can not identify with certainty the announcement date.

In figure 2 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.

[11]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.

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 show 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.

[Figure 2 about here.]

[Table 5 about here.]

4 The decision to hire a DMM

We now turn to the corporate finance aspects of this study, and shift focus from the effects on the trading in the secondary market to the links between the firm and the microstructure of trading. What affects the decisions by firms to hire DMM's? This is the central question we investigate in this paper. If, as we argued before, a source of the value of liquidity to the firm is that it makes it cheaper to raise new capital, or cheaper to repurchase stock, we would expect measures of future capital needs, or likelihood of repurchases, to affect the decision to hire a DMM.

Specifically, we model the decision to hire a DMM as a probit regression.[12] The variables of interest in this paper 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 should be increasing in Q. In addition to Q, which has the problem that it may be open to other interpretations than growth potential, we look at 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.

[12]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.

An alternative to growth opportunities is to look at this ex post: *Does* firms hiring 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 impact, and hence lower the implicit costs of executing the repurchases. We use a dummy for whether the firm actually repurchases within three years of the start of the DMM. Note that, similarly to the dummy for whether the firm issues capital or not, this is an ex post measure, not observable when the decision to hire a DMM is made.

As mentioned in the theoretical discussion, we also point to 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.[13]

There are however a number of additional factors that are likely to influence whether a firm is likely to hire 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 Figure 1, where we saw that for the firms with lowest 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. To implement such a selection procedure we remove those stocks from the sample with an average spread *before* considering DMM to be less than 3%.

4.1 Hiring a DMM

We first look at results where a firm enters into a *new* DMM contract. In Table 6 we list results from a number of probit regression specifications. In the table, each column contains the results for a regression specification. Starting on the left, we have a specification with all the possible explanatory variables. Here we see that Q is the most significant explanatory variable. It has a positive sign, which is consistent with

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

an explanation based on Q as a proxy for growth. Of the others, only issue capital is (marginally) significant. However, this extensive probit regression may be problematical, as we saw in Table 3 many of these explanatory variables are correlated. We therefore investigate specifications with only some of these explanatory variables. These alternative specifications are listed in the next columns. We see that in any regression where Q is not included as an explanatory variable, issuing capital is a significant determinant of the decision to issue new equity. The coefficient is positive, which has the interpretation that an increase in equity issuance induces a higher probability of hiring a DMM. The repurchasing variable is positive in most specification but only significant in specification 6. With respect to sales growth, this variable is never significant, although it is of the expected sign (higher sales growth increases the probability of hiring a DMM.)

[Table 6 about here.]

4.2 Maintaining a DMM

We have also investigated a similar formulation, but where we look at the "hire or keep" decision. Instead of only viewing the decision about hiring a market maker when one currently do not have one, we also look at the dependent variable: "Have a market maker in the current year." In other words, we do not *only* look at the time when the firm starts a DMM relationship, we also look at cases where the firm keeps their existing DMM relationship going one more year. The estimation results when using all stocks on the exchange with this definition of the dependent variable are shown in Table 7. The patterns are similar to those of the first-time decision, but there is less significance.

[Table 7 about here.]

5 Does hiring a DMM affect liquidity risk?

As we see, the firm's decision to have a DMM seems to be at lease partly motivated by future interactions with the capital market. To gain further understanding of the mechanism of the liquidity effects, we return to the market microstructure perspective, and investigate how the introduction of a DMM changes properties of the trading process, and how this changes the liquidity for stocks.

5.1 Changes in liquidity risk

We therefore look more closely at the liquidity risk component of the expected stock return for the owner of a stock. 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,

$$er_{it} = a_i + \beta_i^m er_{mt} + \beta_i^{liq} LIQ_t + e_t \qquad (1)$$

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,[14] 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-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 see that stocks that had the lowest pre-DMM liquidity beta (stocks in P1), actually experience a significant increase in liquidity risk. While we do not have any good explanation for why we observe this, 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.

[Table 8 about here.]

[Figure 3 about here.]

[14]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 most illiquid stocks at the OSE and a portfolio with the least liquid stocks at the OSE.

To show that the results are robust also for the median firm, Figure 3 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.

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 (1) 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 (2):

$$E[er_i] = \lambda_0 + \lambda_m \beta_i^m + \lambda_{liq} \beta_i^{liq} \tag{2}$$

The estimate of λ_{liq} is found by estimating a system where one imposes both equations (1) and (2) 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.[15] 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%.[16] 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.

[Table 9 about here.]

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 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

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

[16] 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.

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 issue capital 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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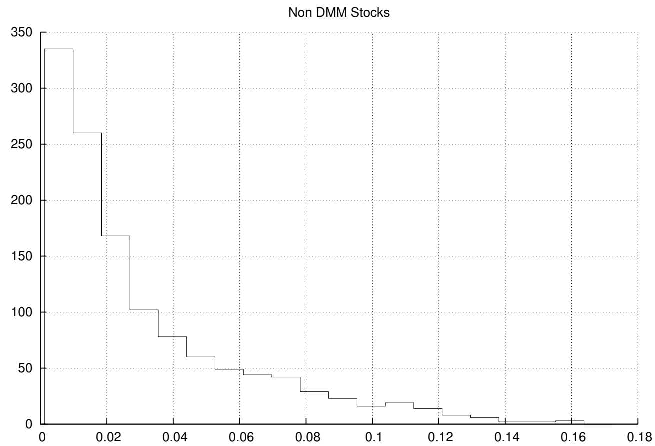
Figure 1

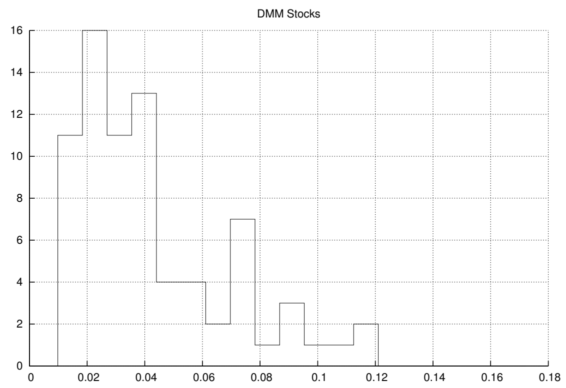
Distribution of relative spread for DMM and non-DMM stocks

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.

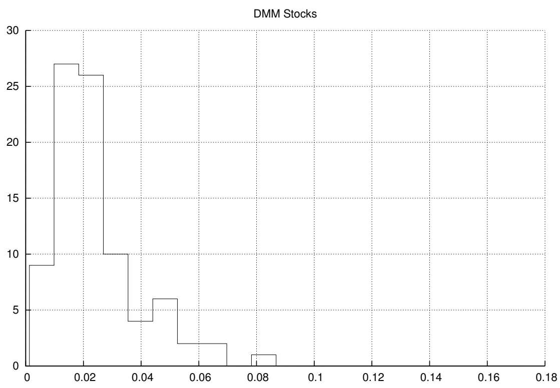
Panel A: Stocks without DMM



Panel B: Stocks with DMM



Year before DMM start



Year after DMM start

Figure 2

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.

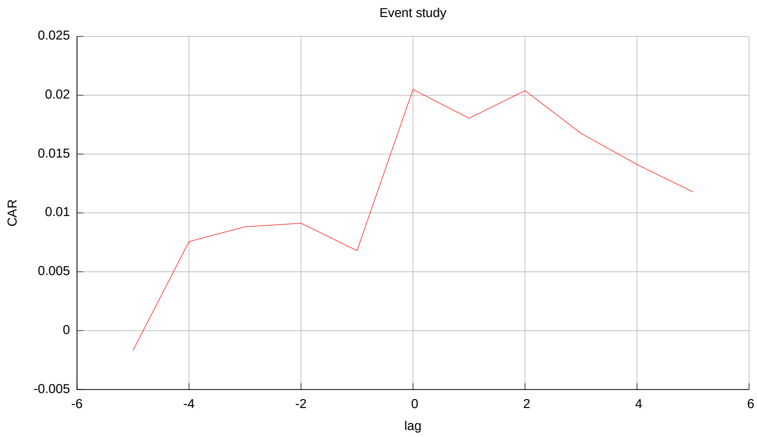


Figure 3
Pre- versus post-DMM liquidity beta

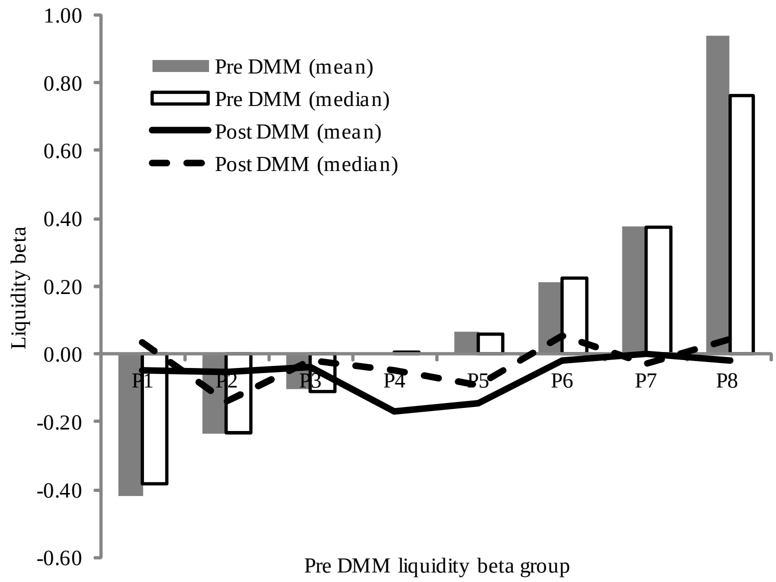


Table 1

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

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, *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 by corporate insiders, *Fraction equity issuers* is the fraction of companies within each group that issues equity in a given year, *Fraction 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	
	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
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
LOT	0.047	0.045	0.032	0.037	0.030	0.036	0.031	0.034	0.051	0.058	0.060	0.073
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
Annual Turnover	0.533	1.230	0.722	1.482	0.689	1.275	0.851	0.946	0.531	0.896	0.477	0.803
Average Firm size (mill)	2544	8843	2193	9571	1871	12420	1623	11964	1118	7359	1613	9921
Median Firm size (mill)	850	1039	597	1450	707	2022	694	2111	309	1116	1265	1388
Average Operating Income (mill)	1601	6824	1515	7274	1301	9350	1035	7361	1185	8622	1457	8065
Median Operating Income (mill)	537	710	507	664	281	825	320	974	360	1014	389	1160
Q	2.04	1.65	1.97	1.58	2.02	1.52	1.81	1.30	0.95	0.69	1.51	0.85
Sales growth(%)	6.9	13.6	32.1	22.2	22.7	52.4	19.6	38.6	22.2	36.7	15.3	7.7
No inside trades	2.8	2.1	2.1	2.7	2.9	2.2	1.2	1.3	0.3	0.5	0.0	0.0
Fraction equity issuers(%)	57.1	31.5	26.7	37.5	38.1	31.5	36.0	33.9	21.1	20.5	40.4	28.5
Fraction repurchasers(%)	42.9	31.0	50.0	33.2	50.0	34.7	40.0	31.4	29.8	32.8	29.8	25.8

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 year, and similarly *Repurchase(Repu)* is a dummy variable equal to one if the firm repurchases shares during the year. *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.

	Relative Spread	Firm Size	Q	Inside trades	Issue equity	Repu	Sales growth	Have DMM
Firm size	-0.57							
Q	-0.25	0.20						
Insider trades	-0.13	0.16	0.17					
Issue equity this year	-0.14	-0.00	0.12	0.02				
Repurchase this year	-0.12	0.21	0.06	0.05	-0.14			
Sales growth	-0.03	-0.02	-0.07	0.01	0.08	-0.10		
Have DMM	-0.03	-0.17	0.04	-0.02	0.01	0.05	-0.02	
Hire DMM	-0.01	-0.13	0.06	-0.00	0.05	0.02	-0.02	0.59

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, *Amihud* is the Amihud (2002) measure, and *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)	-0.012	(0.00)	99
LOT	0.043	0.041	0.031	0.037	-0.011	(0.00)	-0.005	(0.06)	99
Amihud	0.574	0.621	0.382	0.414	-0.217	(0.02)	-0.130	(0.13)	99
Monthly Turnover	0.042	0.043	0.049	0.055	0.006	(0.27)	0.010	(0.04)	99

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	$C\bar{A}R$	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		

Table 6

Decision to hire a Designated Market Maker - all stocks

The table 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 table reports the results for a number of different specifications. For each specification we show the coefficient estimates, the *p*-values, the number of observations (n) and the Pseudo R^2.

Model	1	2	3	4	5	6	7
Liquidity (RelSpread)	-5.42	-7.71*	.	-7.42*	.	.	.
	(0.20)	(0.06)	.	(0.06)	.	.	.
Q last year	0.19**	0.21***	0.21***	.	.	.	0.20***
	(0.03)	(0.01)	(0.00)	.	.	.	(0.01)
Issue capital later	0.38*	.	.	0.48***	0.43***	0.40**	.
	(0.09)	.	.	(0.01)	(0.01)	(0.05)	.
Repurchase later	0.04	-0.06	0.01	0.16	0.20	0.34*	0.17
	(0.86)	(0.75)	(0.95)	(0.42)	(0.24)	(0.09)	(0.41)
N inside trades later	0.02	0.04*	0.05**	0.05*	0.04**	.	.
	(0.40)	(0.09)	(0.02)	(0.06)	(0.05)	.	.
Sales growth	0.16	.	.	.	.	0.03	0.09
	(0.31)	.	.	.	.	(0.82)	(0.53)
Constant	-1.55***	-1.17***	-1.62***	-1.19***	-1.64***	-1.66***	-1.70***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
N	261	312	354	322	426	321	319
Pseudo R^2	0.08	0.08	0.06	0.08	0.04	0.03	0.04

Table 7

Decision to hire or keep a Designated Market Maker - all stocks

The table reports the results from probit regressions, where the dependent variable is the decision to hire or keep 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 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.

Model	1	2	3	4	5	6	7
Liquidity (RelSpread)	-9.53***	-16.67***	.	-16.60***	.	.	.
	(0.01)	(0.00)	.	(0.00)	.	.	.
Q last year	0.10	0.11*	0.15**	.	.	.	0.14**
	(0.22)	(0.10)	(0.02)	.	.	.	(0.05)
Issue capital later	0.20	.	.	0.23	0.23	0.32**	
	(0.28)	.	.	(0.16)	(0.11)	(0.05)	
Repurchase later	-0.20	-0.05	0.03	0.06	0.15	-0.02	-0.15
	(0.30)	(0.79)	(0.87)	(0.71)	(0.29)	(0.35)	(0.36)
N inside trades later	0.01	0.03	0.04*	0.03	0.03	.	.
	(0.57)	(0.26)	(0.09)	(0.22)	(0.15)	.	.
Sales growth	0.07	.	.	.	.	-0.02	0.11
	(0.62)	.	.	.	.	(0.84)	(0.92)
Constant	-0.45	-0.07	-1.04***	-0.06	-1.24***	-0.91***	-0.91***
	(0.07)	(0.76)	(0.00)	(0.80)	(0.00)	(0.00)	(0.00)
N	261	312	354	322	426	321	319
Pseudo R^2	0.06	0.10	0.03	0.10	0.01	0.01	0.02

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

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)