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One for the Money, Two for the Show? The Number of Designated Market Makers and Liquidity

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One for the Money, Two for the Show? The Number of Designated Market Makers and Liquidity

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Abstract

Prior research has established that the presence of designated market makers (DMMs) in an electronic open limit order book increases liquidity. We analyze whether the presence of *additional* DMMs results in a further improvement in liquidity. Using data from Deutsche Börse's Xetra system we find that increases in the number of DMMs significantly improve liquidity, and vice versa for decreases in the number of DMMs. Our results are confirmed when we use an instrumental variables approach to overcome potential endogeneity issues.

Keywords: Designated market makers, Liquidity

JEL classification: G10, G14

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1 Introduction

The electronic open limit order book has become the standard trading protocol for equities. While it achieves high liquidity for large stocks, liquidity of small caps is often deemed insufficient. Therefore, many exchanges have introduced designated market makers (DMMs) to improve liquidity for small caps. In a typical arrangement the listed firm contracts with a marker maker and pays an annual fee. The market maker, in turn, commits to register as a DMM in the stock of the firm and to comply with the requirements set by the exchange. These may include minimum quotation time, minimum depth and maximum spread requirements.

This paper contributes to the literature on the impact of DMMs on liquidity. Prior empirical evidence suggests that stocks with a DMM are indeed more liquid.[1]. We ask whether additional liquidity improvements can be achieved by hiring more than one DMM. Biais et al. (2000) and Rust and Hall (2003) derive models in which an increase in the number of market makers increases liquidity. Wahal (1997) provides empirical evidence from Nasdaq which is consistent with this prediction. However, he analyzes a pure market maker market in which market makers do not face competition from a limit order book. Bellia et al. (2021) analyze competition between DMMs which operate within an electronic open limit order book. They consider a change (in 2013) of the trading protocol of Euronext Paris that increased competition among DMMs. However, their sample consists of highly liquid stocks (the constituents of the CAC40 index). In contrast, we analyze a sample of small caps. The difference in the samples is highlighted by the average quoted spread which is about 2 basis points in their sample and more than 300 basis points in ours. We use data from the German stock market where it is common that a stock has several DMMs and analyze how changes in the number of DMMs affect (quoted and effective) spreads and depth.

We find that a decrease in the number of DMMs results in a significant increase

[1] See, e.g., Anand et al. (2009), Bessembinder et al. (2020), Clark-Joseph et al. (2017), Comerton-Forde et al. (2010), Declerck and Hazart (2002), Eldor et al. (2006), Hengelbrock (2012), Menkveld and Wang (2013), Nimalendran and Petrella (2003), Skjeltorp and Ødegaard (2015), Perotti and Rindi (2010).

in both quoted and effective spreads and a significant decrease in quoted depth. Increases in the number of DMMs result in a significant decrease in quoted and effective spread. Depth increases, but not significantly so.

DMMs decide endogenously which stocks they cover. It is conceivable that they withdraw from a stock when they predict that market making will become less profitable in the future. In this case our regressions might suffer from an endogeneity problem. We use an instrumental variables approach to address this concern. The results confirm the finding that a decrease in the number of DMMs is associated with a decrease in liquidity.

Our results suggest that competition between DMMs improves liquidity, and that it can be advantageous for a firm to hire more than one DMM. This, in turn, implies that exchange operators should allow for multiple market making arrangements.

2 Institutional Background

Xetra, the dominant market for German stocks operated by Deutsche Börse, has three trading modes, call auction-only, continuous trading with DMM support, and continuous trading without DMM support. Stocks are sorted into two categories based on execution costs (measured by the cost of a roundtrip trade of size 25,000 Euros) and daily turnover. Stocks in the low-liquidity category are, by default, traded in the call-auction-only mode. They are traded continuously when the firm hires a DMM. Stocks in the high-liquidity category are traded continuously. The issuer may hire a DMM but is not obliged to do so.

We only consider continuously traded stocks with at least one DMM. Therefore we only describe the trading mode "continuous trading with DMM support". Trading opens and closes with a call auction. Between the auctions stocks are traded continuously in an electronic open limit order book, interrupted by an intraday call auction at 1 pm. DMMs are required to supply liquidity by submitting buy and sell orders to the call auctions and by quoting bid and ask prices during the

continuous trading session. Specific performance requirements apply.[2] In return for their services DMMs receive a fee from the issuer.[3] Details are specified in an (undisclosed) contract between DMM and issuer. DMMs also benefit from reduced exchange fees.

A substantial number of firms have two or more DMMs. There are two possible reasons. First, a firm can voluntarily contract with several DMMs. Second, a market making firm can register as a DMM for a stock without entering into a contract with the issuer. In this case the market making firm is subject to the full set of obligations but does not receive a fee from the issuer. Because the existence of a contract between the market making firm and the issuer is not disclosed we cannot distinguish between these two cases.

3 Data and Descriptive Statistics

Our sample contains a total of 611 different stocks. The number of stocks per quarter ranges between 409 and 443. The median (first and third quartile) market capitalization is 110 (40, 524) million euros, implying that our sample is dominated by small caps.[4] Deutsche Börse provides us with data on the assignment of DMMs to each stock at the beginning of each quarter between 2007 and 2012.

Table 1 shows descriptive statistics. On average there are 36.5 different market

[2]The obligations of DMMs are described in the exchange's Designated Sponsor Guide (Deutsche Börse (2012)). They comprise a minimum participation rate in the call auctions and a minimum participation rate in the continuous trading session. Quotes only count towards these requirements when they meet maximum spread and minimum depth conditions. These conditions depend on the liquidity of the stock. Specifically, stocks are sorted into four liquidity classes with maximum spread requirements ranging from 2.5% to 5% and minimum depth ranging from 10,000 to 20,000 euros. We note that the presence of additional DMMs does not result in higher liquidity mechanically. Our spread and depth measures will only be affected by DMM activity when the DMMs quote at the best bid or ask. Because there is no requirement to establish a minimum presence at the best bid and ask, DMM activity will not mechanically affect our liquidity measures. Exceptions may be those occasions where the maximum spread requirement for DMMs are binding. In these cases the DMM quotes are likely to establish the market spread. When, in such a situation, several DMMs quote the same bid and ask price, the depth they provide adds up. Even in these cases we don't expect a mechanical effect on the quoted spread, though, because in the scenario described the DMMs will not typically quote a spread below the maximum spread set by the exchange.

[3]This is the rule. For an exception see below.

[4]To check whether our results are driven by the very smallest sample stocks we-re-estimate our baseline regression after excluding the 20% least actively traded stocks. The results (not tabulated) are similar to those for the full sample.

making firms active at the beginning of a quarter. This number varies over time, ranging from 27 to 43. There are also large differences in the breadth of activity of different firms. The least [most] active firm makes a market in one [in 123] stocks. The majority of stocks has only one DMM. However, more than 25% of the firms have two or more DMMs. The maximum number is five.

[Table 1 about here.]

We obtain daily data on (time-weighted) average percentage quoted spreads, (volume-weighted) average percentage effective spreads, and (time-weighted) average depth at the top of the order book from the Market Microstructure Database Xetra.[5] For all three measures we then obtain quarterly values as unweighted averages of the daily values.

Table 2 shows summary statistics on liquidity. The average quoted and effective spreads amount to 339 [323.7] basis points (bps), equivalent to 3.39% [3.24%]. There is huge variation in the data. The 5% [95%] quantile across all stock-quarter observations is 7.14 [1,112.3] bps for the quoted spread and 7.65 [937] bps for the effective spread. The average depth at the best quotes amounts to 12,943 Euros. The values at the 5% and 95% quantiles are 857 [38,582] Euros, respectively. The last line shows the standard deviation of minute-by-minute midpoint returns. It averages 0.69 bps. All four variables shown in Table 2 are highly skewed. In our regressions we use logs because relative changes are more meaningful than absolute changes. Otherwise our results might be dominated by large absolute changes observed for the least liquid sample stocks.

[Table 2 about here.]

4 Results

We proceed in two steps. In section 4.1 we analyze the effect of changes in the number of DMMs on liquidity. We address endogeneity concerns in section 4.2.

[5] https://www.bwl.uni-mannheim.de/en/theissen/research/#c33344

4.1 Baseline Results

To analyze how changes in the number of DMMs affect liquidity, we estimate first-differences panel regressions. The dependent variables are the changes in the log of the quoted spread, effective spread, and depth, respectively. Dummy variables identify quarters in which the number of DMMs in a stock increases or decreases. Because volatility is an important determinant of liquidity we include changes in the log of midpoint volatility as a control variable.[6] We include quarter-fixed effects to account for market-wide changes in liquidity. Standard errors are clustered at the stock level.

Stocks that have exactly one DMM are included in the analysis of increases in the number of market makers but are excluded from the analysis of decreases. The reason is that firms in the low-liquidity category that only have one DMM can increase but cannot reduce the number of DMMs.[7]

As noted in section 3, our data on DMM assignments contains the number of market makers at the start of a quarter. If the data reports one DMM at the beginning of quarter Q and two market makers at the beginning of quarter Q+1 we know that the change became effective during quarter Q. By estimating the changes from quarter Q to quarter Q+1, we implicitly assume that it became effective at the *end* of quarter Q. Violations of this assumption will make it more difficult to find significant effects of changes in the number of DMMs. Consequently, if anything, we underestimate the true effects we seek to identify.[8]

Table 3 contains the results.[9] The coefficients shown are the estimated logarithmic

[6] Volatility itself is likely to depend negatively on liquidity. An event (such as an increase in the number of DMMs) that increases liquidity will thus also reduce volatility. However, the coefficient that we estimate for the increase in the number of DMMs will only capture the direct effect on liquidity, not the indirect effect via the change in volatility. Consequently, we are likely to underestimate the effect on liquidity of a change in the number of DMMs, meaning that our estimates are conservative.

[7] Otherwise the stock would no longer be traded continuously and would, consequently, be excluded from our analysis because of unavailability of post-event data. Note that most sample firms that only have one designated market maker are in the low-liquidity category.

[8] In untabulated robustness checks we estimated changes from quarter Q-1 to Q+1. The results are qualitatively similar to those reported in the paper.

[9] We estimate augmented models where we differentiate between increases from one to two DMMs and those increases where the initial number of DMMs is larger than one. Similarly, we estimate a model where we differentiate between decreases from two to one DMMs and decreases

differences, scaled up by a factor of 100. Panel A shows that a decrease in the number of DMMs leads to a significant decrease in liquidity. Quoted and effective spreads increase by about 5%, and depth decreases by about 7%. All coefficients are significant at the one-percent level. By contrast, increases in the number of market makers increase liquidity. Quoted and effective spreads decrease significantly by about 4% to 5%. Depth increases, but the effect is smaller than in the case of decreases in the number of DMMs and is not statistically significant. The coefficient on the control variable, the change in midpoint volatility, has the expected sign and is highly significant in all regressions. Increases in volatility are thus associated with larger spreads and lower depth.

[Table 3 about here.]

4.2 Addressing endogeneity concerns

One concern is that changes in the number of DMMs assigned to a stock may be endogenous. DMMs may be able to predict how difficult market making in a specific stock will be in the future. The difficulty of market making, in turn, may be positively related to the stock's illiquidity. Thus, a positive relation between a stock's liquidity and the number of its DMMs may arise because of self-selection of DMMs. It is ultimately an empirical question whether this concern is relevant. We address this point but limit the analyses to the case of decreases in the number of DMMs. For this case we have strong and plausibly exogenous instruments, whereas we do not know of similarly good instruments for the case of increases in the number of DMMs.

To control for possible self-selection effects we estimate an endogenous treatment effects model (Heckman, 1978). A first step probit regression explains decreases in the number of DMMs. In the second step the effect of the predicted value

where the initial number of DMMs is larger than two. The results (not tabulated) suggest that there is neither a significant effect when the number of DMMs increases beyond two nor a significant effect when the number of DMMs decreases to a value of two or above. We note, though, that these estimates are based on few observations and should thus be interpreted with care.

of the outcome variable on our three liquidity measures is analyzed in a linear regression.[10]

This approach requires an instrument that affects the change in the number of market makers but does not directly affect changes in liquidity.[11] We use two instruments to predict decreases in the number of DMMs. First, we use a dummy representing a DMM firm's complete exit from its activity, i.e., a drop in the number of stocks covered to zero. Plausible reasons for such exits are the strategic decisions to exit the market making business, or mergers among DMM firms. The implicit assumption of our identification strategy is that the termination of the entire market making business by a market making firm is independent of expectations on the future liquidity of individual stocks. Our second instrument is the current number of market makers active in a stock. The intuition is that the probability of a decrease in the number of market makers active in a given stock is increasing in the number of active DMMs.[12]

Results for the first stage probit model, presented in the bottom panel of Table 4, show that the instruments are strong. The upper panel shows that the findings from the previous subsection still hold. The results for the quoted spread and for depth are of similar magnitude as before and retain their statistical significance. The coefficient for the effective spread becomes somewhat smaller (it drops from 5.2 to 3.1) and loses its statistical significance. Untabulated results further show no evidence for the existence of a selection effect. The correlations between the error terms of the first and second stage are not statistically significant and range between 0.009 and 0.05. Altogether, while statistical significance is lost in one out of three model specifications, the results are generally supportive of those presented in the previous subsection.

[Table 4 about here.]

[10] While we explain the approach as a two-step method for illustrative purposes, we estimate the system simultaneously via maximum likelihood.

[11] Without such an instrument identification of the parameters would rely on the different functional form of the first-stage (probit) and second-stage (linear) models. This is considered to be unadvisable.

[12] Note that, while the number of DMMs may be related to the *level* of liquidity, it is reasonable to assume that it is independent of *changes* in liquidity.

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Table 1: Descriptive statistics for market makers

	Mean	Min	25Pct	Median	75Pct	Max
Active DMMs	36.51	27	34	37	40	43
Mandates per DMM	14.54	1	3	8	22	123
DMM per Stock	1.46	1	1	1	2	5

This table shows summary statistics for designated market makers aggregated over all calendar quarters. The first row provides information on the distribution of the number of distinct designated market makers that are active in at least one of the stocks contained in our sample. The second row summarises the number of assignments for which DMMs are registered. The third row gives information on the number of DMMs assigned to a stock simultaneously.

Table 2: Descriptive statistics of liquidity and volatility

	Mean	5Pct	25Pct	Median	75Pct	95Pct
Quoted Spread	339.00	7.14	40.66	154.28	330.91	1112.30
Effective Spread	323.68	7.65	40.65	148.52	306.96	936.98
Euro Depth	12942.75	856.62	3750.08	6526.15	11257.98	38581.54
Midpoint Volatility	0.69	0.00	0.03	0.06	0.13	0.76

This table shows summary statistics for the liquidity and volatility of our sample stocks. The distribution is computed across stock-month observations. *Quoted Spread* is the time-weighted relative quoted spread measured in basis points. *Effective Spread* is the equally-weighted relative effective spread measured in basis points. *Euro Depth* is the time-weighted average of the euro volume quoted at the top of the book at the bid and the ask sides. *Midpoint Volatility* is the standard deviation of minute-by-minute quote midpoint returns measured in basis points.

Table 3: Effect of changes in the number of designated market makers

Panel A: Decrease in Number of Market Makers			
	(1) Log Quoted Spread	(2) Log Effective Spread	(3) Log Euro Depth
Decrease	5.067***	5.198***	-6.774***
	(3.08)	(3.33)	(-2.72)
D(Log Midpoint Vola)	11.896***	13.665***	-13.459***
	(6.61)	(8.97)	(-4.00)
constant	-6.458***	-7.061***	-0.306
	(-4.11)	(-4.52)	(-0.15)
Quarter FE	Yes	Yes	Yes
Obs	3298	3298	3298
Panel B: Increase in Number of Market Makers			
	(1) Log Quoted Spread	(2) Log Effective Spread	(3) Log Euro Depth
Increase	-5.068***	-4.489***	1.511
	(-4.17)	(-3.79)	(0.91)
D(Log Midpoint Vola)	9.223***	9.851***	-5.021***
	(13.74)	(14.58)	(-5.14)
constant	-3.296***	-4.353***	2.652*
	(-3.01)	(-4.00)	(1.81)
Quarter FE	Yes	Yes	Yes
Obs	9244	9242	9244

This table shows the results of linear regressions of the first differences of stocks' average quarterly liquidity measures on categorical variables indicating a reduced (Panel A) or increased (Panel B) number of designated market makers, respectively, as compared to the observation prior to the change. The dependent variables are the logarithmic changes in the quoted and effective spreads as well as in the euro top of book depth. The logarithmic change in the one-minute midpoint volatility over the same period serves as a control variable. The sample for the analysis of increases [decreases] in the number of market makers is restricted to firms with at least one [two] designated market makers. All regressions contain quarter fixed effects. Standard errors are clustered at the stock level. ***, ** and * denote statistical significance at the 1%, 5% or 10% level.

Table 4: Effect of decrease in number of designated market makers: endogenous treatment regressions

	(1) Log Quoted Spread	(2) Log Effective Spread	(3) Log Euro Depth
Decrease	4.657**	3.086	-7.510**
	(2.16)	(1.09)	(-2.32)
D(Log Midpoint Vola)	11.653***	13.437***	-13.253***
	(6.49)	(8.81)	(-3.95)
constant	-6.481***	-6.966***	-0.213
	(-4.12)	(-4.42)	(-0.11)
First stage marginal effects on probability of decrease in number of market makers			
Market Maker Exit (sign)	0.258***		
	(10.56)		
L(# Market Makers)	0.056***		
	(6.34)		
Quarter FE	Yes	Yes	Yes
Obs	3301	3301	3301

This table shows the results of endogenous treatment regressions of the logarithmic changes of a stock's average quarterly liquidity measures on a categorical variable indicating a reduced number of designated market makers as compared to the observation prior to the change. The dependent variables are the logarithmic changes in the quoted and effective spreads as well as in the euro top of book depth. The logarithmic change in the one-minute midpoint volatility over the same period serves as a control variable. The change in the number of designated market makers is instrumented using the previous-quarter number of market makers of a stock and a dummy variable indicating the exit of a designated market maker from that business. The sample is restricted to stocks with at least two market makers in the respective period. All regressions contain and quarter fixed effects. Standard errors are clustered at the stock level. ***, ** and * denote statistical significance at the 1%, 5% or 10% level.

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