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Minimum obligations of market makers

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Minimum obligations of market makers

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1. Objective

The business model of market makers is to buy securities from sellers and then to resell them at a higher price to buyers. Market makers can be officially recognized as such or operate in that capacity on a de-facto basis. The latter is the case for many high frequency trading firms. Without minimum obligations market makers are free to enter and exit markets at will or set buy and sell prices at any level. The objective of this measure is to examine the efficacy of imposing minimum obligations on market makers. These obligations can take the form of maximum spread width, minimum quoted volume, location of the market makers spread width relative to the best bid and offer, minimum percentage of the day the market maker must quote, and minimum time in force for market maker quotes.

We will discuss these obligations in the context of equity markets and attempt to identify whether the minimum obligations should be applied universally or to a specific set of stocks. The welfare implications of imposing these obligations will be examined for individual firms as well as society.

2. Background

What is a market maker? She is not much different than a grocer except she buys and sells stocks instead of vegetables. Without grocers, consumers of vegetables would have to buy directly from farmers. What if the farmer isn't selling when consumers are buying or vice versa? If there are lots of consumers and farmers in an area then the timing problem is mitigated. Otherwise a grocer can solve the timing problem by providing immediacy for both the farmer and consumer. Similar to a grocer a stock market maker buys stock from sellers by bidding for them and sells to buyer by offering to sell to them. As with vegetables, if there are lots of buyers and sellers of stocks then a market maker is not necessary.

Market makers have existed for as long as stocks have been continuously traded. The business model was simple – buy low then quickly sell high or vice versa. If a market maker stopped earning sufficient profits in one stock he would switch to another. If things became too volatile, the market maker walked away altogether and waited for things to return to normal.

In London, market makers (known as jobbers) can be traced back to the late 1700s.[1] Over time, exchanges began to assign affirmative obligations to market makers – most commonly requiring that they provide quotes of a certain magnitude and for a certain amount of time each day. Some exchanges, such as London and NASDAQ, developed as competing market maker (dealer) systems. Others, like the New York Stock Exchange, developed as a monopolist market maker (specialist) system.[2]

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[1] See Attard (2000.)

[2] Beginning in 1871, in a switch from call market to continuous market, the NYSE created the post system whereby brokers and market makers who wanted to trade a particular stock stood at a certain location. This was a multiple market maker system with brokers and market makers moving in and out of stocks. As the story goes one of the

Charitou and Panayides (2009) examine the method of liquidity provision in 30 stock markets in 29 countries. They find that only the Tokyo Stock Exchange relies completely on public order flow for liquidity. The remaining 29 markets rely on market makers to provide liquidity beyond that supplied by the public. They find that, at least in major markets, that these market makers have affirmative obligations. The most common affirmative obligation for market makers in these markets is a rule on maximum spread width.

2.1. Background – traditional market makers

Can designating someone to provide liquidity and charging them with affirmative obligations improve social welfare? That is the question examined by Bessembinder, Hao and M. Lemmon (2006). The authors model a trading world composed of investors who trade either based on private information they have (informed traders) or for liquidity purposes (uninformed traders) as well as competing market makers without any affirmative obligations. To create benchmarks, the authors examine spreads and outcomes for varying sets of parameter values assuming that due to competition expected profits are zero. The resulting spread is termed the competitive spread – or the spread that would naturally arise in a market without a market maker with affirmative obligations. They then introduce a market maker with an affirmative obligation to either set a fixed or maximum spread. A fixed spread is one that is set as a percentage of the value of the stock.[3] A maximum spread allows the market maker to post a spread that is the maximum of either the fixed spread or the competitive spread. Since market makers, by assumption, earn no profits at the competitive spread, whenever the constrained spread is less than the competitive spread market markers suffer losses. Since no one would ever voluntarily lose money, the authors point out that the designated market maker will need a side payment to compensate for her losses.

Bessembinder, Hao and M. Lemmon (2006) argue that the cost of this side payment improves social welfare and therefore can be seen as a transfer by society. The authors explain further that the narrower spreads arising from a designated market maker with an affirmative obligation to set a maximum or fixed spread, will induce both uninformed and informed traders to trade more. This in turn leads to increased price efficiency and faster price discovery. It is also pointed in the paper that the narrowness of the spread cannot be less than the social welfare cost of trading. A number of papers have empirically examined the impact of a market maker with affirmative obligations on market quality. We will now turn to those papers to try and quantify any benefits.

Anand and Weaver (2006) examine the 1987 adoption of Designated Primary Market Makers (DPMs), on the Chicago Board Options Exchange's (CBOE) competing market maker system. The CBOE's DPMs are similar in privileges and obligations to specialists in that DPMs had exclusive knowledge of the limit order book. Saar (2001) predicts that a specialist system will

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participants broke his leg and being immobile sat at a particular post so that he could earn at least something. Other participants starting giving him limit orders with prices away from the current market price. They offered to share their commission with him in return for freeing them up to trade elsewhere. The limit orders left with him became known as his "book" and he became the first specialist.

[3] For example designated liquidity providers on the Stockholm Stock Exchange are required to set spreads that at most 4% of the asking price of the stock. See Anand, Tanggaard, and Weaver (2010) for a discussion of the contracts in Sweden and Skjeltorp and Ødegaard (2011) for those in Norway.

have lower spreads because the specialist's knowledge of the limit order book reduces uncertainty about investor demand. Anand and Weaver find results consistent with the predictions of Saar. In particular they find statistically significant decreases in quoted, current, and effective spreads following the trading system change. They estimate that investors save more than $200 million annually.

Also of interest to this paper is that fact that during the period of Anand and Weaver's study, the options markets were fragmented with multiple markets trading the same options. Therefore, benefits of DPMs accrued in a fragmented market structure similar to equity markets today.

While Anand and Weaver (2006) examine the imposition of a market maker with affirmative obligations on a competing market maker system, Nimalendran and Petrella (2003) compare the voluntary imposition of a market maker with affirmative obligations on a public order driven system on the Italian Stock Exchange. Consistent with Anand and Weaver they find that spreads narrow and depth increases following the listed firm's election of a market maker with affirmative obligations. In a related paper, Menkveld and Wang (2011) find that the introduction of a market maker with affirmative obligations for small firm stocks traded on Euronext-Amsterdam increases the probability that trades will be completed quickly.

Anand, Tanggaard, Weaver (2009) examine the unique method of compensating market makers on the Stockholm Stock Exchange (SSE). During the period of their study (2003–2004), listed firms on the SSE could choose a Designated Liquidity Provider to set a maximum spread less than or equal to an exchange established maximum. The listed firm then pays the Designated Liquidity Provider a negotiated specified payment based on a fixed monthly component (average about SEK16,000) and a variable trade based component (average about SEK9,000) up to a monthly maximum payment which averages about SEK23,000. The listing company may also provide the Designated Liquidity Provider with shares of company stock to create an inventory. The authors go on to examine the determinants of the choice by the listing firm to contract for liquidity. They find that firms with low volumes, wide spreads, and higher information asymmetry are more likely to contract for liquidity provision. However, firms with very wide spreads do not contract for liquidity provision, perhaps due to the higher cost Designated Liquidity Providers would charge. The authors find that the cost of the affirmative obligation is directly related to the expected spread improvement but was mitigated by existing financial relationships. Finally, they also find that listed firms are more likely to contract with Designated Liquidity Providers around equity offers. This suggests that Designated Liquidity Providers view the financial gain from the relationship to be greater than that implied by the terms of the contract.

The fact that firms with very wide spreads refrain from contracting for liquidity suggests that firms perform an explicit or implicit cost/benefit analysis in determining the feasibility of contracting for liquidity provision. Anand, Tanggaard, and Weaver (2009) address the benefits of contracting for liquidity provision by estimating the change in the value of firms after the beginning of liquidity provision. They find that the average firm increases in value by SEK12.36 million. The authors find a statistically significant improvement in market quality for firms contracting for liquidity provision. In particular it is found that percentage quoted spreads reduce by more than half, that the contracted liquidity attracts more trading volume, and (consistent with the predictions of Bessembinder, Hao, and Lemmon (2009) price discovery improves.

Anand, Tanggaard, and Weaver (2009) also examine how liquidity providers provide liquidity. They find that the liquidity providers trade passively against incoming marketable orders and that this action increases as the spread widens beyond the contracted maximum.[4]

A recent paper by Skjeltorp and Ødegaard (2011) examines the institution of DPMs on the Oslo Stock Exchange. Their findings are similar to those of Anand, Tanggaard, Weaver (2009). They report an average annual cost of contracting with a DMM as NOK300,000. Interestingly they suggest that "given the public goods nature of liquidity, our results indicate that it may be desirable to subsidize liquidity provision in equity markets." Recall that Anand, Tanggaard, and Weaver (2009) found that firms with very wide spreads do not contract for liquidity provision, perhaps due to the high cost. Subsidizing such firms to make liquidity provision more attractive is one option open to regulators.

Hengelbrock (2008) examines market makers on Deutsche Börse's Xetra system. On Xetra firms below an exchange determined liquidity level are required to contract with at least one market maker called a designated sponsor. They can be a bank or a brokerage house. These market makers are required to set maximum spread widths of 4% as well as minimum quote sizes. In addition they have a maximum time before they must respond to a request for a quote. Hengelbrock finds that firms with multiple sponsors have lower spreads. He also finds that on average brokers provide lower spreads than banks. This last finding is consistent with the findings of Anand, Tanggaard, Weaver (2009) that other financial relationships can lower the contract payment (or in this case result in a lower spread for the same contract price.)

The documented benefits of market makers with affirmative obligations go beyond an improvement in market quality for continuously traded stocks. Venkataraman and Waisburd (2007) find that market makers with affirmative obligations prevents market failure in call auctions on Euronext-Paris and that this decreased probability of market failure is associated with statistically significant positive returns. The benefits also accrue beyond the listed stocks. For example Cao, Choe, and Hatheway (1997) find that market makers with affirmative obligations use the profits from more liquid stocks to subsidize trading in less liquid stocks.

Finally Bessembinder, Hao and M. Lemmon (2006) demonstrate that affirmative obligations are costly to market makers. Panayides (2007) compares the losses incurred by a monopolistic market maker to their profits. In particular he examines the losses incurred by NYSE specialists from their obligation to trade in the opposite direction of supply and demand for a stock.[5] He shows that this obligation results in average daily losses to specialists of $938 per day. However this is offset by a daily average profit of $14,878 per stock from trading on their monopolistic informational advantage. He further shows that this affirmative obligation lowers volatility and spreads.

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[4] The contracts examined do not call for strict adherence to the maximum spread but rather typically call for the spread in the market to be no wider than the contract maximum at least 85% of the trading day.

[5] On the NYSE this is known as the price continuity rule and it requires the specialist to assure that price movements are no larger than the minimum price change (the tick). As an illustration assume that the price of a stock should drop from $5.00 to $4.80 a share and that the tick is $0.05. The price continuity rule requires the specialist to buy at least a minimum number of shares at $4.95, $4.90, and $ 4.85. The net effect of this is to slow down price movements to give markets a chance to assess information.

2.2. Background – high frequency traders as market makers

A number of authors view high frequency traders as "new" market makers. Brogaard, (2011a) examines high frequency trading in the U.S. market. He estimates that high frequency traders are involved in almost 70% of the dollar trading of U.S. stocks. They are most active in large liquid stocks and tend to engage in trading strategies that are correlated with other high frequency traders. Brogaard estimates that U.S. high frequency traders earn between $0.075 and $0.09 per $100 traded which is about 1/7 that of traditional market makers.

In an appendix to his paper Brogaard (2011a) provides a good overview of how high frequency trading developed. As he points out high frequency trading is similar to algorithmic trading in that they are both based on computerized trading. They differ though in their holding period, with algorithmic traders willing to hold a position for days or weeks, while the length of time high frequency traders hold positions can be measured in milliseconds.

Do these high frequency traders provide liquidity or remove it? Menkveld (2011) examines high frequency trading on a European multilateral trading facility, Chi-X. In particular he examines the entry of a large high frequency trader to Chi-X in September 2007. He employs a long data series from September 2007 through June 2008. For the purposes of this paper, Menkveld's key finding is that 78% of the high frequency trader's quotes are passive market maker quotes. He concludes that high frequency traders, provide liquidity, and are the new market makers. As such Menkveld estimates that the trading firm studied is estimated to earn an average €1,416 a day per stock. Thus they are profitable.

Whereas, traditional market making occurs in a single stock, Gerig and Michayluk (2010) show that automated market makers can make money by trading in similar stocks in a way that traditional market makers do in a single stock. They consider a model whereby an automated market maker is confronted by two traders in different but similar stocks. They argue that if one trader is selling and the other buying then at least one of them must be is uninformed. This lowers the losses automated market makers incur to informed traders.

The growth in high frequency trading has been facilitated by exchange efforts to attract liquidity through rebate programs. In particular numerous exchanges have established business models where they give a rebate to limit orders posted on their system that get executed. They also charge a *larger* fee to traders for executing against the limit orders called a taker fee. For example an exchange may give a rebate of $0.0015 for supplying liquidity and a fee of $0.0023 for taking liquidity. The exchange then earns $0.0008 per share. [6] Although the rebates can be earned by any trader, they represent additional profit for a market maker who routinely posts bids and offers. For example, given the above rebate structure, a market maker with a bid of $15.05 and offer of $15.06 will earn $15.06-$15.05 = $0.01 per share on the spread and an additional $0.0015 x 2 = $0.003 in rebates for a total of $0.013 per share in profit. High frequency traders use the scalability of their computers to trade large volumes of stocks earning these small profits per share. Trading 100,000 shares of stock will earn the firm $1,300. This strategy works best in stocks which are stable and naturally trade large numbers

[6] This business model could lead to much higher fees for long term investors accessing liquidity as exchanges increase the rebates to attract more liquidity. To limit costs to long term investors, the U.S. SEC has placed a $0.003 cap on liquidity taking fees on all venues.

of shares. Therefore, the market making activity of high frequency traders is concentrated in very liquid large capitalization listed firms.

Not all high frequency trading strategies involve passive market making. Indeed there are strategies that are viewed as predatory by regulators and other market participants. Some commentators have called for measures to curtail the non-market making activities of high frequency traders. To distinguish them from market making we will now discuss the non market making strategies of high frequency traders. Key to some of these strategies is the high frequency trading concept of latency. Brogaard (2011a) describes in his appendix latency arbitrage whereby high frequency traders use their speed advantage to profit through what he terms quote stuffing. In this strategy high frequency trading firms generate a large amount of message traffic which other firms must process. While the other firms process the data, the originating high frequency firm can trade ahead of them.

Brogaard, (2011b) examines the relationship between high frequency trading and volatility in a companion paper to his earlier cited paper. He finds that high frequency trading activity is correlated with volatility. But does trading cause the volatility or does the volatility attract the trading? To disentangle the two he performs statistical tests called Granger causality tests to try and determine the direction of the cause. The results of the tests support both possibilities. That is, volatility is Granger caused by volatility and volatility is Granger caused by high frequency trading. Brogaard uses the September 2008 U.S. ban on the short sale of financial stocks as a further test of the causal relationship between volatility and high frequency trading. He compares the 13 financial stocks that had high frequency trading in his sample with a matched sample of stocks not included in the ban. He observes a significant increase in volatility in the 13 short sale banned stocks and offers that finding as evidence that high frequency traders do not cause volatility.

As a further investigation into the relationship between high frequency trading and volatility Brogaard (2011b) examines the propensity for high frequency traders to either provide or take liquidity around news events. He finds that the well-documented increased volatility surrounding stock specific news is related to an increase in the frequency with which high frequency traders provide liquidity and a reduction in the frequency of taking liquidity. Brogaard finds the reverse for macro-economic news events. The results can be explained by considering the high frequency trading strategy of pairs trading. In this strategy, high frequency traders extrapolate movements in one stock to another correlated stock. Stock specific news fits within the pairs strategy as traders use the information released in the news to trade the stock's correlated pairs. In macro-economic news all stocks are likely affected simultaneously rendering the strategy less effective.

3. Risk assessment

In this section we describe the current state of market making in North America and Europe and discuss the risks associated with not changing the current structure. In a recent speech, U.S. Securities and Exchange Commission Chairman Mary L. Schapiro stated

> ...five years ago, the great majority of the capitalization of U.S. equities was traded on a listing market – the New York Stock Exchange – that executed nearly 80 percent of volume in those stocks. Today, the NYSE executes approximately 26 percent of the volume in its listed stocks. The remaining volume is split among

more than 10 public exchanges, more than 30 dark pools, and more than 200 internalizing broker-dealers.[7]

This increased fragmentation and the trading venue competition that accompanies it have caused traditional exchanges to change their models of liquidity provision. In addition, markets that were primarily public limit order driven came to the realization that liquidity would not endogenously appear for illiquid stocks and that formal structures were necessary.

As a result of these changes, the NYSE abandoned traditional specialists shortly after it merged with Euronext. Today, for trading occurring on their NYSE and NYSE/AMEX equity units, they call their market makers Designated Market Makers (DMMs) and they are very far removed from their specialist roots. DMMs are required to maintain a continuous bid and offer of at least 100 shares. They are further required to quote at the national best bid or national best offer at least 15% (10%) of the trading day for securities trading over (under) 1,000,000 shares per day. For those times that they are not at the NBBO their quotes cannot be more than 8% away from the NBBO for stocks in the S&P 500 or Russell 1000 indexes. For other stocks the maximum amount their quotes may be away from the NBBO is 28% for stocks trading at or over $1 and 30% otherwise. In addition to DMMs, the NYSE also allows for another class of market maker called a Supplemental Liquidity Provider (SLP) with lesser quoting requirements. SLPs are required to quote at the inside 10% of the day and must add liquidity of at least 10 million shares a day. DMMs and SLPs receive larger rebates than other traders for providing liquidity.

In contrast to the NYSE, NASDAQ OMX's U.S. market makers are required to maintain continuous two sided quotes of at least 100 shares but are not required to be at the NBBO any portion of the day. Like the NYSE they have the same three tiers and definitions for the maximum percentages they are allowed to be away from the NBBO. On NASDAQ only registered market makers are allowed to transmit bids and offers to be displayed on the NASDAQ system. However, one benefit of being a market maker in the US is the ability to short stocks without locating the physical shares.

Of the remaining U.S. stock exchanges: BATS, Boston Stock Exchange (BX), Chicago Stock Exchange, Direct Edge, National Stock Exchange, NYSE ARCA, and Philadelphia Stock Exchange (PSX) all but PSX have market makers with quoting requirements similar to those described for NASDAQ.[8] PSX specifically states that they do not have market makers and is therefore a limit order driven market. Of interest is the fact that the Chicago Stock Exchange specifically does not allow their market makers to trade as agent – only principal.[9] None of these arrangements involve any exchange-based compensation or privileges.

The other major North American exchange is The Toronto Stock Exchange (TSX.) The TSX refers to their market makers as Responsible Designated Traders (RDTs). RDTs are required

[7] See Shapiro (2010)

[8] DirectEdge has applied to the SEC to allow them to have market makers. The other markets listed already have obtained approval.

[9] Market makers trade as agents when they execute a customer's order. They trade as principal when they trade for their own account.

to maintain a goal (average) spread for minimum sizes and be willing to fill any incoming order up to the minimum guaranteed fill.[10] RDTs are compensated through time priority in that they are allowed to participate in any incoming marketable order up to 40% of the minimum guaranteed fill.

Turning to Europe, the London Stock Exchange has stocks that are primarily order driven and others that are quote driven.[11] It requires market makers in order driven markets to maintain quotes that can be electronically executed 90% of the day. In quote driven markets, the market maker is required to post a firm quote but there is no stated minimum percentage of the day and the quotes are not required to be electronically executable.[12] The LSE has maximum spread widths of 5% or 10% depending on the stock.[13] LSE market makers are also required to quote minimum depths based on the stock's average daily turnover.

Borsa Italiana refers to market makers in its STAR segment as specialists. They are required to continuously quote for an exchange-specified number of shares. Maximum spread widths are set at between 1% and 4.5% depending on the average daily currency turnover in the stock. Interestingly, STAR specialists are required to provide at least two research reports each year for each company they trade.[14]

On the European markets operated by NYSE/Euronext, there are two types of market makers – auction or permanent. The former add liquidity for stocks only traded through call auctions and the latter for stocks traded continuously. In the case of auction market makers they are required to maintain a spread during the order collection phase of each call auction. the maximum spread width for both types of market makers are between 2% and 5% (€0.10 and €0.25) for stocks trading above (at or less than) €5. Euronext LPs obtain a reduction in fees and may receive side payments from the companies they trade.

Deutsche Börse has two different models for market makers. In their continuous trading segment they require less liquid companies to have at least one market maker called a Designated Sponsor (DS.) The maximum spreads DSs can post ranges from 1.5% to 10% for an exchange-specified number of shares. DSs are required to post bids and offers at least 50% of the trading day and participate in at least 80% of all call auctions for their stocks. Designated Sponsors on Deutsche Börse receive an exchange set annual fee of €34,000 from each listed firm. In addition if DSs participate in at least 90% of all call auctions for their stocks (minimum is 80%) they then receive reimbursement from the exchange for transaction costs.

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[10] TSX goal spreads are not publically available.

[11] Order driven securities are those in which there are sufficient public orders arriving to create a two-sided quote without a dealer supplying one. A quote driven market is one in which dealer quotes make up the inside quote.

[12] A firm quote is one in which the market maker is contacted via phone or electronically about his posted quotes. There is the possibility that the market maker may be in the process of updating their quote at the time they are contacted in which case they would not be required to trade at the firm quote.

[13] The maximum spread rule only applies to the more active stock on the LSE SETS. Smaller stocks traded on SETSqx and SEAQ do not have maximum spread widths.

[14] See Perotti and Rindi (2010) for a discussion of the value of this information producing obligation.

In 2009 Deutsche Börse established a specialist model for stocks whose liquidity level relegated them to only have a daily call auction. The program is a throwback to the traditional NYSE specialist. In the Deutsche Börse program, the specialist has exclusive access to a closed book where public limit orders are held. He is allowed to use this monopolistic power to set whatever spread he sees fit. Just as the traditional NYSE specialist, his compensation is his trading profits from using this monopolistic information advantage.

Chi-X rules provide for a market maker called a Designated Liquidity Provider for stocks included in the STOXX 50 index. DLPs are required to quote within 0.25% of the Chi-X inside quotes for their lit market at least 80% of the trading day.

For the European exchanges operated by NASDAQ OMX, the Oslo Stock Exchange, and Euronext exchanges allow listed companies to directly contract with a market maker. The listed firm and market maker decide on the maximum spread width as long as it is less than or equal to the exchanged mandated maximum of 4%. The same applies to the quotation size whose minimum is dependent on the trading activity of the stock. Market makers on NASDAQ OMX's European exchanges as well as those from the Oslo Stock Exchange and Euronext receive compensation directly from the listed companies they trade in. Although many of the contracts are not publically available, those available for Swedish firms indicate an average payment to market makers of SEK276,000 while those on Norwegian firms indicate an average of NOK300,000.

From the above, it can be seen that the application of minimum obligations for market makers, as well as the mode of compensation, is uneven across markets on both sides of the Atlantic. Some markets impose minimum obligations on market makers for all listed stocks (e.g. the NYSE and LSE) while others only require minimum obligations on less liquid stocks (e.g. Deutsche Börse.) Some markets require their markets makers to quote at the best bid or offer at least a portion of the day (e.g. NYSE) while others do not impose any constraint on market maker quotes relative to the best bid and offer (e.g. NASDAQ OMX's U.S. market and the LSE.) Still other markets focus on setting maximum market maker spread widths (e.g. the Oslo Stock Exchange, and Euronext.)

As mentioned earlier in this section markets on both sides of the Atlantic are facing an increasing amount of fragmentation. What importance does this have for a system of market makers with affirmative obligations? The most common affirmative obligation for market makers is to maintain a maximum spread width. Market makers will agree to the maximum width as long as they can earn at least a reasonable profit. But not all trades are profitable. If the trader is more informed than the market maker, then the market maker will buy stock just before it falls in price or sell it just before it rises. In consolidated (non-fragmented) markets, market makers compensate for these losing trades by charging a higher spread to all traders. It is similar to the problem grocery markets have with spoiled milk. If you maintain an inventory of milk for your customers' convenience, some will spoil. Grocery markets charge everyone a higher price to make up for the losses due to spoiled milk.

In a fragmented market, there is the possibility that trades not containing information can be siphoned off by other venues before they are sent to the market maker. This is the case in internalization (see Weaver 2011.) If the uninformed trades are siphoned off then market makers will face an order flow containing a higher proportion of losing trades. If the market maker is compensated for providing liquidity then she will need higher compensation to offset her higher losses. Therefore, any scheme to require market makers to have affirmative

obligations will need to take into consideration the higher informed trader losses faced by market makers in a fragmented market structure. Higher losses will necessitate higher compensation for market makers.

Finally, there is an increasing incidence of trades involving high frequency traders which some authors refer as the new market makers. Although they may engage in strategies that resemble market making only some have chosen to officially be recognized as market makers. Traders without affirmative obligations may stop trading in a stock that becomes too volatile (as in the May 6 Flash Crash), leaving the market maker with affirmative obligations as the sole source of liquidity. This eventuality will lead market makers to demand higher compensation than in a market where they are not the sole source of liquidity due to higher losses.

Therefore, both increasing fragmentation in the markets and an increased presence of high frequency traders will continue to erode market maker profits. Without additional compensation (especially for those market makers with costly affirmative obligations,) some existing market makers will cease making markets. Given the positive benefits of assigning market makers with affirmative obligations found by all empirical studies of the subject, there is a real risk that the exit of existing market makers will result in wider spreads for affected firms. This in turn will lead to higher costs of capital for listed firms, which leads to lower firm valuations and fewer projects accepted. The end result is slower economic growth.

In addition to a reduction in the number of market makers with affirmative obligations, the current uneven application of which stocks are assigned market makers with affirmative obligations bears risks as well. It has been shown that not all stocks benefit from market makers with affirmative obligations. For example, requiring market makers to have quotes that are electronically accessible (the LSE) will not benefit small firms whose spreads are wider than they would be if an obligation to set a maximum spread width was imposed on market makers. Failure to enact obligations that will lower spreads will stifle economic growth in the same manner described above.

4. Options

Based on the minimum obligations of market makers employed by markets the following options appear to be best suited for imposing minimum obligations on officially recognized market makers:

- Maximum spread width as a percentage of the bid
- Quoting at the inside a specified percentage of the trading day
- Quotes cannot exceed a specified percentage away from the best bid and offer
- Minimum quoted size
- Minimum time in force

4.1. Maximum spread width as a percentage of the bid

In this option market makers are obligated to keep their quoted offer price at most x% above their bid. For example if the maximum is set at 4% a market maker who bids €8.00 per share

must have an offer that is no higher than €8 * 1.04 = €8.32. Since the market maker's bid (offer) cannot be above (below) anyone's offer (bid) without triggering a trade this rule ensures that the market maker will be quoting at or very near the best bid and offer.

4.2. Quoting at the inside a specified percentage of the trading day

In this option market makers are required to have a bid or offer that is at the best bid or offer at least for a specified portion of the trading day. For example if the best bid is $50.10 and the best offer $50.12, if the market makers offer is $50.12 then their bid can be a significant amount below the best bid – say $50.01.

4.3. Quotes cannot exceed a specified percentage away from the best bid and offer

Market makers' quotes must lie within a certain band of the best bid and offer. For example with an 8% band if the best bid and offer are €15.20 and €15.30 then the market maker must have quotes within the band €15.20 * (1-.08) = €13.98 and €15.30 * (1+.08) = €16.52.

4.4. Minimum quoted size

Market maker quotes must be for at least a specified number of shares

4.5. Minimum time in force

Quotes must stand for a minimum amount of time before they are either traded against or canceled by the market maker.

5. Cost, risks, and benefits

As pointed out by academic authors, affirmative obligations can improve social welfare. In particular, narrower spreads will induce both informed and uninformed traders to trade which in turn increases price efficiency and quickens price discovery. Every one of the empirical papers on the subject concludes that the affirmative obligations improve market quality. The following benefits are found in various studies:

- Lower transaction costs
- Improved price discovery
- Increased volume
- Lower volatility
- Higher depth
- Lower cost of capital

For affected firms it has been shown that affirmative obligations are associated with lower costs of capital and a commensurate increase in firm valuation. However it is also shown in the papers examined that not all companies will benefit from liquidity provision with affirmative obligations. The main beneficiaries are smaller illiquid firms. In exchanges that provide for

liquidity provision with affirmative obligations for all stocks, the market makers are far more active in illiquid stocks than in liquid ones.[15]

The options listed in Section 4 derive different benefits to markets and have different risks. Therefore each option will be discussed in turn, after which the costs of implementing minimum obligations will be discussed.

5.1. Maximum spread width as a percentage of the bid

The main benefit of this option is that the maximum spread width with a market maker can be set to be narrower than the current average spread of the firm. This will result in a lower cost of capital for these firms. Their values should increase and the number of projects that they accept should increase spurring economic growth. The beneficiaries of this will be firms with less capitalization and less trading activity. There are no particular business sectors that will benefit over another. If applied across all stocks then there is the risk that some stocks will see no benefit. This is true for liquid stocks that already have very narrow spreads.

5.2. Quoting at the inside a specified percentage of the trading day

The benefit derived from this option is that the market sets the appropriate spread for a stock and then market makers are required to set their spreads to provide additional liquidity. In order for this option to be viable the stock should have sufficient trading to set a competitive spread. While this is the case for large liquid stocks it is not the case for illiquid stocks. Therefore, the risk is that costs of capital may not decline and thus economic growth may not be significantly impacted. However, supplying additional liquidity will result in lower volatility.

5.3. Quotes cannot exceed a specified percentage away from the best bid and offer

As with the previously discussed option, this option will have benefits if there is sufficient competition to set a lower spread. Otherwise, the main benefit is that there will be additional liquidity and hence lower volatility. The risk is that the full potential benefit of lower transaction costs will not be realized for a large number of less liquid stocks. The benefits here will largely accrue to large liquid stocks.

Some commentators believe that imposing minimum obligations on market makers can prevent market crashes. We call attention to the fact that there were specialists on the NYSE, AMEX, and regional stock exchanges in 1987, as well as market makers on NASDAQ. There were no high frequency traders. Yet the market crashed. Market makers with affirmative obligations do not prevent markets from running away. They are most akin to fire marshals that make sure everyone walks and doesn't run out of a burning building. The building still burns down but more people got out than would have otherwise.

5.4. Minimum quoted size

In order for any minimum obligation related to spread width to be successful market makers must be willing to buy and sell a non-trivial number of shares. Therefore the benefit of this option is that it makes the spread options meaningful. The risk of setting this option too high is that it may discourage other traders from trading.

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[15] See Madhavan and Sofianos (1998)

5.5.Minimum time in force

Kirilenko, et al. (2011) examine the role of high frequency traders in the U.S. flash crash of May 6, 2010. They conclude that high frequency traders exacerbated the downward movement in the affected stocks. It was widely reported that high frequency traders slowed or stopped quoting during the flash crash. As a result a minimum time if force has been suggested as a minimum obligation of the new market makers – high frequency traders. The argument of proponents of this approach is that it will slow down price changes by not allowing high frequency trader quotes to be quickly cancelled. All this will do is postpone a price decline by the amount of the minimum time-in-force. However, it would greatly reduce the occurrence of the predatory high frequency trading practices of spoofing and smoking, discussed earlier in this study. Both practices depend on the ability to quickly cancel phantom quotes. To the extent regulators want to stop these practices, minimum time-in-force for all quotes is appropriate. But the cost of these predatory practices must be weighed against the benefits of high frequency trading demonstrated in papers to date.[16]

For completeness we also put forwards another suggested fix to reign in the harmful practices of high frequency traders. Some commentators have recommended taxes as a method to curtail the perceived harmful effects of HFTs. A security transaction tax is being considered on both sides of the Atlantic as a way to “throw sand into the wheels of speculation” and thereby reduce volatility. In a recent paper Pomeranets and Weaver (2011) examine nine changes in the level of a New York State imposed security transaction tax as well as review the existing empirical literature on the subject. They conclude that they could find no evidence of a consistent statistically significant relationship between a security transaction tax and volatility. This suggests that a tax will not have the intended impact on volatility.

Thus far we have ignored the issue of the cost of each option because the costs will vary depending upon the exact parameters involved (e.g. what maximum spread width is set) and what other factors are impacting the implementation (e.g., how much order flow is fragmented and siphoned off for a stock.) Regulators can control who pays for the listed options: governments; exchanges; or listed firms. We will focus on this issue. First though it is important to point out that not all market makers receive compensation beyond their profits (including rebates.) For example, as described earlier, most U.S. exchanges have official market makers with affirmative obligations but do not compensate them directly. In addition, at least some high frequency traders have business models as unofficial market makers. This suggests that market making is inherently profitable, although not in all stocks at all times. Panayides (2007) shows that affirmative obligations can be established that benefit markets without greatly impacting the profits of market makers. Regulators could use this fact to require minimum obligations of unofficial market makers. There is support for affirmative obligations for unofficial market makers among industry firms. For example Moyer (2010) quotes the U.S. arms of high frequency trading firms GETCO, KNIGHT and Virtu Finance as urging the SEC to require all market makers to have minimum quoting obligations.

[16] Related to minimum time-in-force is a suggested some have made to "tax" excessive quoting. This approach assumes that it is the number of quotes that is the problem and not the fact that the quotes disappear before investors can trade against them. Taxing excessive quoting will limit the strategy of some HFT firms to enter a large number of quotes to tie up competitors' computers while they trade ahead of them.

Given that minimum obligations imposed on market makers, such as maximum spread width, are costly – who then should bear this cost. Skjeltorp and Ødegaard (2011) state "given the public goods nature of liquidity, our results indicate that it may be desirable to subsidize liquidity provision in equity markets." Therefore, they would support government subsidizing of minimum obligations.

Exchanges earn revenue from listing and trading fees and therefore they may be in a position to compensate market makers for the cost of imposed minimum obligations. This is already done through higher rebates for market makers on some exchanges (e.g., NYSE.) Past implementations of minimum obligations for market makers funded by exchanges have tended to apply a lower level of obligation across all stocks. For example the NYSE requires market makers be at the NBBO only 10% to 15% of the day. Another factor in seeking exchange funding is the increased competition in today's markets which has eroded the profitability of listing exchanges.

The final potential source of funding for implementing costly minimum obligations on market makers is the listed firms themselves. A number of European markets have taken this route and allow listed firms to contract directly with market makers to provide maximum spread widths and minimum quoted volumes. Since not all firms will benefit from a market maker with minimum obligations (e.g., large liquid firms) and the listed firms are the direct beneficiaries of the obligations this approach seems to make the most sense. The costs to listed firms in Sweden are around €35,000 a year and is found to increase the value of these firms by over €1,400,000.

Market makers need trading profits to make the loses from affirmative obligations palatable. A recent trend in markets is reducing those profits which will in turn reduce the ability of exchanges and/or regulators to require costly affirmative obligations. Weaver (2011) documents that over 30% of U.S. order flow is internalized by brokers and never gets to markets to interact with market makers.[17] He further shows that internalization is most prevalent in small company stocks which are the main beneficiaries of liquidity provision with affirmative obligations. In Europe under MiFID this is less of an issue since Systematic Internalizers must publish executable quotes and thus become market makers.

6. Future

There have been a number of programs which have instituted market makers with affirmative obligations. They have either been targeted for small illiquid stocks or the market makers were most active in these stocks. The Stockholm Stock Exchange approach was to first determine the exchange imposed affirmative obligation limits (maximum spread width, minimum depth, percentage of time quotes would be available, etc.) They then approached potential market maker firms. After several financial firms agreed to be market makers they approached listed companies and marketed the program to them. They had a pilot program of 23 listed firms. The firms negotiated with the liquidity providing firms and contracts were signed. They then began publicizing the program to the public. Based on the results of a study performed a few months

[17] The percentage internalized ranges from 3% to 62% of a firm's order flow with the larger numbers attributed to smaller stocks.

after the start of the pilot, the exchange concluded that the pilot program was a success and began marketing it widely.[18]

The above pilot program was voluntary and targeted a subset of listed firms. In the case of a market wide affirmative obligation such as maximum quote widths or minimum quoting times a different approach to a pilot program would be appropriate. When NASDAQ implemented their Order Handling Rule in January 1997, they selected a set of 50 stocks chosen at random from different firm size bins. They also selected 50 companies that would not be part of the pilot for comparison purposes. The program was extended to December 1997 and expanded in April 1997. As with the Stockholm Stock Exchange pilot program, academics performed an empirical analysis of the pilot and deemed it a success in that it narrowed spreads by about 2/3. The program was then expanded to all stocks.

In summary, we have presented two historically successful methods for implementing a pilot program on affirmative obligations – one for a targeted obligation and one for a market wide obligation.

As shown, continental European exchanges are adopting liquidity provision with affirmative obligations for exactly the stocks that will benefit – smaller less liquid stocks. There is no reason to expect this expanding trend of increased liquidity provision for smaller illiquid firms to not continue. Should regulators impose minimum obligations on market makers, beyond that required by exchanges, the pace of expansion of obligations will quicken.

The major differences in the approaches across exchange seem to be in the method of compensating the market makers. These differences may unleash a new form of competition between exchanges – market maker compensation. Some may give information advantages (Deutsche Börse), others greater rebates/lower fees (NYSE), others time priority (Toronto), and others direct payments from listed firms (NASDAQ OMX Nordic and Euronext.)[19]

7. Summary and recommendation

Most markets around the world employ market makers with affirmative obligations. It has been shown that these obligations can improve social welfare. For example, narrower spreads induce investors to trade which increases price efficiency and improves price discovery. Every one of the empirical papers on the subject concludes that the affirmative obligations improve market quality. The following improvements are found in various studies:

- Lower transaction costs

[18] As pointed out by Anand, Tanggaard, Weaver (2009) other financial relationships between the market maker and listed firm may impact the level of compensation. Therefore, that possibility must be taken into account when attempting to determine if the results of any pilot study can be generalized to other listed firms.

[19] In addition to the listed forms of compensation the BATS Exchange has asked permission from the SEC to award financial incentives to market makers who quote at the best bid and offer for a certain percentage of the day. The form of the financial incentive has not yet been revealed but a reading of the application suggests that it will be similar to the NYSE program.

- Improved price discovery
- Increased volume
- Lower volatility
- Higher depth
- Lower cost of capital

The main beneficiaries of these improvements in market quality are small illiquid firms. Several options are examined as to what affirmative obligations to impose. The option that will have the biggest impact is to impose a maximum spread width and minimum quote size on market makers. Several options for paying for these obligations are explored. The option that stands out is to allow listed firms to directly contract with market makers and negotiate the spread width, volume, and payment. This is the model employed in a number of European markets today.

The role of high frequency traders is examined by papers we review. It is found that 72% of the quotes of these traders are passive market maker quotes. Given that they are involved in over 70% of U.S. trades they are an important addition to the ranks of market makers. There is support within the investment community to impose minimum obligations on these unofficial market makers as well.

Not all trades are profitable for market makers. As with any business, market makers absorb the losses from unprofitable trades as long as there are sufficient profitable trades. Some academic papers suggest that profitable trades are being siphoned off by brokers who execute the trades themselves thereby depriving market makers of profits. This happens most frequently in small illiquid stocks – exactly those which benefit most from affirmative obligations. This in turn will result in market makers demanding greater compensation for agreeing to minimum obligations. To the extent that regulators can reduce this internalization, listed firms will benefit.

In summary, the preferred minimum obligation options are (both to be applied):

- Maximum spread width as a percentage of the bid
- Minimum quoted size

The preferred option for method of payment is that companies should negotiate with market makers directly and pay the negotiated fee.

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