Stock Liquidity and the Value of a Designated Liquidity Provider: Evidence

from Euronext Paris $^{\infty}$

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Current Draft: October 2002

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 ∞ We thank Venkatesh Panchapagesan, Christopher Barry, and Rex Thompson for valuable comments and discussion. We are grateful to Loic Choquet, Socheat Chhay and Lourent Fournier of Euronext Paris for information on market structure in Paris, and to Pascal Samaran for providing us with the data. Mann and Waisburd thank the Charles Tandy American Enterprise Center, and the Luther King Center for Research in Financial Economics.

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Abstract

This paper studies the value of a designated liquidity provider (DLP) in an electronic limit order book. We conduct a natural controlled experiment by examining a sample of Euronext Paris securities that trades both with and without the assistance of a market maker. We find that less liquid stocks experience a statistically significant cumulative abnormal return of four percent around the introduction of the DLP. For this sample, the DLP enhances market quality by reducing the frequency of market failure, providing strong empirical support for Glosten (1989). Liquid stocks are generally unaffected. Overall, these findings support the joint hypothesis that liquidity is priced and that the services of the designated liquidity provider are an important factor in this premium. We thus present compelling evidence of a link between market microstructure and asset pricing.

Key Words: Liquidity provider; Market maker; Trading cost; Electronic limit order book

1. Introduction

The worldwide proliferation of automated trading systems has spurred a debate over the role of financial intermediaries in the trading process. Although recent advances in technology have significantly reduced the intermediation needs for mundane tasks such as order submission or information dissemination, the role of a designated liquidity provider (DLP), such as the NYSE specialist, as the central pillar of an order-driven market remains contentious. The liquidity provider is most easily understood as a provider of immediacy. However, it is argued that public limit orders can be stored in an electronic limit order book and can supply immediacy. Glosten (1989) emphasizes an alternate rationale that the DLP may prevent market failures by supplying liquidity during periods when the limit order book is thin.¹ This paper measures the value of introducing a designated liquidity provider for a sample of stocks in the Paris Bourse, an automated order driven market, and adds to our understanding on this debate.

Several empirical papers have documented the beneficial role of a DLP.² For example, studies of the NYSE show that the specialist helps maintain narrow spreads and plays a beneficial role in price formation by anticipating future order imbalances and reducing transitory volatility. However, extant literature has mainly focused on traditional floor-based order driven markets, such as the NYSE. This paper provides insight regarding the previously unstudied value of a DLP in an automated order driven market.

The trading protocols in floor-based and automated markets differ considerably. More specifically, the specialist at the NYSE has a privileged position vis-à-vis the market, due to

¹ Theoretical expositions on the relative merits of order driven markets are also provided in Benveniste et al. (1992), Glosten (1994), and Seppi (1997), besides others.

² See, for example, Hasbrouck and Sofianos (1993), Madhavan and Smidt (1993), Madhavan and Sofianos (1998), Kavajecz (1999), and Madhavan and Panchapegesan (2000) for evidence at the NYSE, Kehr et al. (2001) at the Frankfurt Stock Exchange, and Mayhew (2002) and Anand and Weaver (2002) at the CBOE.

monopolistic access to order flow information. Given informational advantages, the specialist may discern better than most traders time-variations in the composition of order flow and use this information to enhance price discovery. NYSE regulations, in turn, require the specialist to maintain a fair and orderly market and stabilize prices more often that he would on his own. In contrast, the privileges and obligations of the DLP are more modest in automated trading systems. The DLP has no informational advantage over other traders and passively provides liquidity by posting limit orders in the book.³ In turn, he has no obligation to stabilize the market, though he is required to maintain market presence by quoting prices. Given these differences and the global trend towards automated order driven markets, an important question is whether a DLP adds value in such a market structure?

To address this question, we study a sample of 19 firms of medium-to-high liquidity ("Liquid") and 37 firms of low liquidity ("Illiquid") for which a DLP was introduced by the Paris Bourse between 1995 and 1998. First, we conduct an event study to analyze cumulative abnormal returns around the introduction of the DLP. The *liquidity premium hypothesis* (see Amihud and Mendelson (1986)) predicts that improvements in market liquidity lower the risk-adjusted return required by investors.⁴ Therefore, if the DLP enhances market quality, then we expect an increase in stock price around the event. Further, theoretical models (e.g., Grossman and Miller (1988), Glosten (1989)) predict that the DLP's role assumes greater prominence for less liquid stocks. As less liquid stocks suffer from higher information asymmetry (see Easley et

³ Madhavan and Sofianos (1997) say "Besides occasionally acting as a dealer, the (NYSE) specialists also supervise the trading process, match buyers and sellers, act as agents for other brokers, and exercise crowd control to ensure price and time priority and efficient order representation." In automated trading systems, all the above functions are either unnecessary or have been assigned to the central computer.

⁴ Brennan and Subrahmanyam (1996), Eleswarapu (1997), and Brennan et al. (1998), among others, present evidence of cross-sectional relationship between expected returns and firm liquidity. Amihud et al. (1997), Muscarella and Piwowar (2001), and Kalay et al. (2002)) examine stocks that transferred from call to continuous markets and also find empirical support for the liquidity hypothesis.

al (1996)), the ability of the DLP to average profits across trades, consistently provide liquidity, and prevent market failure becomes more valuable. In support of these predictions, we find that the introduction of the DLP has created positive value, on average, for our sample of Illiquid firms but not for our sample of Liquid firms. We estimate cumulative abnormal returns (CAR) over an event window that begins five days before the DLP announcement date and ends 10 days after the stocks started trading with a DLP. For the Illiquid sample, we find a statistically significant CAR of 4.4% during the event window; however, for the liquid sample, the CAR is not different from zero.

Next, in order to identify those attributes that are enhanced by DLP participation, our investigation examines changes in various measures of market quality. The DLP does not enhance traditional market quality measures such as trading volume, market depth or executions cost. However, DLP introduction is associated with significant reductions in the likelihood of market failure for the Illiquid sample, providing strong empirical support for Glosten (1989). Finally, in support of the liquidity premium hypothesis, our cross-sectional analysis finds that firms that experienced a larger improvement in market quality after DLP introduction also experienced larger CARs.

This study is also particularly well suited to test theoretical predictions on the differential value of a DLP in electronic call and continuous markets. The Liquid sample in our study trade in a continuous, electronic limit order market (ELOB), while the Illiquid sample trade in a twice-daily electronic call market. Glosten (1994) predicts that a continuous ELOB inherently has the ability to handle extreme adverse selection and prevent market failures – the benefit of a DLP, therefore, is likely to be modest. Furthermore, Economides and Schwartz (1995) propose that an

electronic call market is the only suitable type of market in which substantial capital can be committed to enhancing liquidity. Our results find strong support for both these predictions.

In summary, this paper's contribution is threefold. First, we perform a controlled experiment to present the first empirical evidence regarding valuation and liquidity benefits of introducing a DLP in an automated trading system. Second, we test several theoretical predictions regarding the value of a DLP using data from the Paris Bourse, which closely resembles the markets envisioned by theorists. Third, and most notably, we present evidence of another unique and important link between market microstructure and asset pricing.

The remainder of the paper proceeds as follows. The next section reviews the relevant institutional features of the Paris Bourse and describes the data. Event study results reported in section 3 document the marginal value of designated liquidity provision. In section 4, we examine the liquidity provider's impact on market quality. Section 5 analyzes the cross-sectional correlation between changes in stock price and liquidity. We conclude with a discussion of the implications and limitations of the analysis.

2. Institutional background and sample selection

A. Market structure

The Paris Bourse is an automated order driven market.⁵ Limit orders supply liquidity to immediacy demanding market orders, both of which are submitted, processed, and displayed through a transparent ELOB. Generally, trade takes place continuously for the more liquid

⁵ See Biais et al. (1995,1999), Harris (1996), Demarchi and Foucault (1999), Venkataraman (2001), Muscarella and Piwowar (2001), and Pagano and Schwartz (2002) for detailed descriptions of the Paris Bourse market structure. On September 22, 2000, the Paris Bourse, the Amsterdam Stock Exchange, and the Brussels Stock Exchange merged to form Euronext. In this section, we document the institutional details in place during our sample period (Source: The Paris Bourse Users Guide).

securities and via twice-daily call auctions for less actively traded stocks.⁶ During the continuous trading session, orders are executed according to strict price, exposure and time priority. Executions in the call auction are based on the single price that maximizes the trading volume.

In 1992, the Paris Bourse implemented a program to allow designated liquidity providers, known as animateurs, to facilitate trade in certain less liquid firms. In 1994, the program was extended such that more actively traded securities were also eligible. According to exchange officials, the introduction decision is made solely by the Paris Bourse and is not influenced by the firm's management or by the firm's future prospects, which mitigates the self-selection bias that is inherent in this type of analysis.

In Paris, the DLP's primary function is to maintain a regular market presence: to quote a maximum bid-ask spread and a minimum depth, and to execute, up to a certain extent, orders partially or totally unmatched at the opening price. A Paris Bourse surveillance team monitors the market maker's performance and may terminate the DLP's contract should he fail to meet his obligations. In return for his liquidity services, the market maker receives free access to the trading facilities; he is recognized as an exclusive dealer for the security and as the focal point for block trades. The DLP also benefits indirectly from his market-making role, as he is often the executor of the listed firm's investment banking business. In contrast to the NYSE specialist, the Paris DLP does not possess an informational advantage over public orders nor does he have the opportunity to condition his price schedule on the arriving order flow. In turn, he is charged with

⁶ All continuously traded stocks, which fall into trading categories *Continu A* and *Continu B*, open with a call auction at 10 a.m., and medium-activity continuously traded stocks, *Continu B*, close with a call auction at 5 p.m. Less active stocks are classified as *Fixing A* and trade in a twice per day call auction at 11:30 a.m. and 4 p.m.

fewer responsibilities. In particular, he is not obliged to maintain price continuity or to trade in a stabilizing manner.⁷

B. Data and sample selection

The trade, order and quote data used in this study are obtained from the Paris Bourse BDM database (1995-1998). The exchange provided a list of firms for which a DLP was introduced, the member firm acting as the DLP, and the date of introduction. Between January 1, 1995 and December 31, 1998, DLPs were introduced for 155 securities. We verify the introduction dates on Avis, an official publication of the exchange, and we designate the announcement date of the LP introduction as the date of the Avis notification. The DLP may be introduced shortly after a security is listed. To avoid misclassifying any unusual activity around the security's listing as being caused by the introduction of a liquidity provider, we exclude the ten trade days immediately subsequent to stock listing. To remain in our sample, securities must meet the following criteria: (1) the security must be an exchange traded French common stock in the BDM database (eliminates 16 securities); (2) the DLP announcement must be available in Avis (eliminates 1 stock); (3) intraday data must be available prior to the introduction of the DLP (eliminates 37 stocks) (4) there must be no mention of a DLP in Avis prior to the official announcement (eliminates 37 stocks) (5) the stock must trade exclusively in either the continuous or the call auction throughout the analysis period (eliminates 8 stocks). The final sample consists of 56 stocks. Of these, 37 are less liquid issues that trade in the call auction, and 19 are more liquid securities that trade continuously. We refer to these two subsamples as the 'Illiquid' sample and as the 'Liquid' sample, respectively.

⁷ Hasbrouck and Sofianos (1993) and Cao, Choe, Hatheway (1997) offer a detailed discussion of the NYSE specialist performance criteria. The stabilization role of the specialist is analyzed in Goldstein and Kavacejz (2002).

For the Liquid stocks, we analyze activity during the continuous trading session only. During this time, a large marketable limit order to buy (sell) may exhaust the depth on the inside quote and walk up (down) the limit order book. Such orders are reported in the BDM database as multiple trades occurring at the same time. We classify these simultaneous trades as a single transaction. For the less liquid stocks that trade in a call auction, we analyze orders in addition to trades and quotes. The order data suffers from two drawbacks for the purposes of this study. First, it is not possible to observe when orders are executed. Therefore, we classify a buy (sell) order as having been executed during the auction for which it was submitted if the order price is greater (less) than or equal to the price at which the auction cleared. Second, it is not possible to observe when orders are cancelled. Although we are unable to correct explicitly for this in our analysis, Biais, Hillion, and Spatt (1999) find that relatively few orders are cancelled in the precall-auction.

Summary statistics are presented in Table 1. DLPs are typically introduced on a stockby-stock basis. However, as many as four firms begin facilitated trading on the same day. On average, liquidity providers are introduced approximately two trading days after their pending introductions are announced. These results are generally consistent for both the Liquid and Illiquid firms. As implied by our subsample nomenclature, differences in liquidity between the two subsamples are pronounced. For the more liquid stocks, the median daily volume is 767,000 French francs (FF), eight times that of the less liquid sample. Additionally, Liquid firms tend to be much larger. The median market capitalization of the illiquid sample is 202 million FF. The median firm size for the more liquid stocks is nearly 1.3 billion FF. Differences in firm size, trading activity and price are statistically significant at reasonable levels.

3. Event Study

We conduct an event study to analyze the extent to which the presence of a designated liquidity provider increases firm value and, more specifically, whether the marginal benefit of the DLP is greater for the Illiquid sample. We denote the DLP introduction day by 'I' and the announcement day by 'A'. The event window extends from A-5 to I+10. The days between announcement and introduction, which varied, were combined. The market model is estimated from I+23 through I+154 employing Scholes-Williams betas to adjust for infrequent trading and using the value-weighted SBF120 Index as a proxy for the market portfolio. Since DLPs may be announced for multiple securities on a single calendar date, cross-sectional correlation in returns could bias the results. Therefore, we form equally weighted portfolios of securities that have identical announcement dates and treat the portfolio returns as those of a single security. Test statistics are calculated as in Brown and Warner (1985).

Figure 1 reveals distinct patterns in the cumulative average abnormal returns (CAARs) for the Liquid and Illiquid subsamples. For the less liquid stocks, the announcement that a DLP is to be introduced yields an immediate and positive average increase in price of more than three percent. The effect persists over the next 10 trading days during which time prices drift upward by an additional one percent. In contrast, the announcement appears to have little price effect for more liquid securities. For trade days A-5 through I+10, the CAARs hover about zero.

Table 2 provides statistical tests of the results presented in Figure 1. For the less liquid sample, the CAAR of 3.06 percent just prior to the announcement is statistically significant at the one percent level. The price increase is driven, in large part, by the average abnormal returns of 1.25 percent (t-statistic=2.80) and 1.09 percent (t-statistic=2.44) on the days immediately prior to the announcement. The CAAR at day t+10 of 4.43 percent is also significant at the one percent

level. The results strongly support the existence of a positive price effect due to the introduction of the DLP that is permanent and economically meaningful. Statistical tests confirm the absence of an observable price effect for the Liquid sample. The CAARs of –0.60 percent just prior to announcement and 0.33 percent on the announcement day are not significantly different from zero. The CAAR continues to remain insignificant on day I+10. For both subsamples, similar results are obtained when we test the hypothesis that the proportion of firms with positive returns is greater than one half. Statistical results are robust when measured over longer event windows.

These results offer strong support for the joint hypothesis that liquidity is priced [Amihud and Mendelson (1986)] and that the services provided by the DLP are an important source of liquidity. The findings are consistent with economic arguments that DLPs are more valuable for less liquid stocks [Grossman and Miller (1988) and Glosten (1989)] and for stocks that trade in a call auction [Economides and Schwartz (1995)], and are less valuable for stocks that trade in a continuous ELOB [Glosten(1994)].

4. Market Quality

A. Stock liquidity and transactions costs

In this section, we examine changes in market quality around the introduction of the designated liquidity provider. The pre-DLP period is defined as day A-6 through A-35 and the post-DLP period is defined as day I+6 through I+35. We consider several measures of market quality. For both the Liquid and Illiquid samples, we compute the change in activity as the difference in the average daily number of trades and the average daily trading volume. We compute the log difference of two additional measures presented in Amihud et al. (1997). The average daily relative trading volume (RV) is the ratio of the average daily trading volume for a

given stock relative to the market. The liquidity ratio measures the number of shares that can be traded for a unit change in stock price:

$$LR_i = \sum V_{it} / \sum |R_{it}|,\tag{1}$$

where V_{it} and R_{it} are, respectively, the volume and return for stock *i* on day *t*, and the summation is over the days in the event period. An increase in the LR ratio is consistent with an increase in market depth. The results presented in Table 3 suggest that the DLP does not increase trading volume or market depth for either sample.

For the liquid sample, we examine the changes in the quoted bid-ask spread and the quoted depth. If the DLP enhances liquidity by placing buy (sell) limit orders that are above (below) the best bid (ask) price, or by placing additional orders at the inside quote, then we expect a decrease in percentage quoted spreads and/or an increase in the quoted depth after DLP introduction. Studies of the NYSE have typically found that the NYSE specialist narrows the inside spreads and improves on the best prices. In contrast, we find no statistically significant change in time-weighted quoted spreads and depths, suggesting that the DLP in Paris does not improve this dimension of market quality.

Additionally, for the Liquid sample, we estimate the change in effective spreads and price impact. As the Paris Bourse is an automated market, the DLP cannot offer price improvement like the NYSE specialist. However, the effective spread also captures the effect of large orders that walk up the ELOB or upstairs trades that execute within the quotes. The price impact of trades measures the degree of asymmetric information. Evidence on the NYSE suggests that the specialist has the ability to identify the informed order flow and reduce information asymmetry [see Benveniste et al. (1992) for theory and Chakravarty (2001) for empirical evidence].

Following Huang and Stoll (1996) and Bessembinder and Kaufman (1997), we measure percentage effective spreads and percentage price impacts as follows:

Percentage effective spread_{it} =
$$200*D_{it}*(Price_{it} - Mid_{it}) / Mid_{it}$$
 and (2)

Percentage price impact_{it} =
$$200 * D_{it} * (V_{i(,t+30)} - Mid_{it}) / Mid_{it},$$
 (3)

where $Price_{it}$ is the transaction price for security *i* at time *t*, Mid_{it} is the mid-point of the quoted ask and bid prices, D_{it} is a binary variable that equals 1 for buyer-initiated trades and -1 for seller-initiated trades, and $V_{i,(t+30)}$ is the mid-point of the first quote reported at least 30 minutes after the trade. In contrast to studies of the NYSE, we find no change in effective spreads or price impact, suggesting that the DLP neither reduces execution costs nor resolves information asymmetry. These findings are consistent, however, with the lack of discretion granted to the DLP on the Paris Bourse.

B. Market Failure

The preceding results are consistent with the absence of price effects for the Liquid sample. However, we also fail to observe an improvement in market quality that is implied by the event study results for the Illiquid sample. The latter finding may be explained in two ways. First, the semi-strong form of the efficient market hypothesis is violated. More likely, volume and depth measures may not capture the benefit of designated liquidity provision. In this section, we explore an alternative. In particular, Glosten (1989) argues that, when the level of adverse selection risk is substantial, stocks may experience market failure in the absence of a DLP. The less liquid sample may be predisposed to such breakdown as it is composed of relatively small firms for which information asymmetries may be extreme [see Easley et al. (1996)].

One observable measure of market failure is the extent to which auctions do not clear. Auction clearing frequency is calculated as the proportion of sessions for which a transaction

price is realized. For each stock, the clearing frequency is computed before and after the introduction of the liquidity provider. Figure 2 plots the cross-sectional distribution of clearing frequencies in each period. The mass of the pre-DLP distribution is weighted more heavily in the left tail. In the presence of the market maker, the distribution shifts right. In fact, based on cumulative frequency plots, it is clear that the post-DLP distribution first order dominates. In this sense, the presence of the DLP is beneficial.

Panel A of Table 4 reports auction clearing frequency statistics. Adverse selection risk is potentially greatest in the morning due to the accumulation of information during the non-trading period. Therefore, statistics are computed for all sessions, as well as by morning and afternoon sessions. On average, 79.2 percent of all auctions clear prior to the introduction of the liquidity provider. Once DLPs begin to trade, the clearing frequency increases significantly (p-value = 0.01) to more than 85 percent. The pattern persists for both morning and afternoon sessions. The average morning auction clearing frequency increases from 86.5 percent to 93.5 percent (p-value=0.00). In the afternoon, clearing increases by 5.2 percent, but is insignificant.

The decline in auction failures may reflect non-DLP-related changes in market conditions. In particular, the market may clear more frequently because there is greater interest to trade or because the interest to trade is more evenly distributed among buyers and sellers.⁸ To control for such factors, we estimate the following logit regression model with pooled time series, cross section data:

$$Pr(Clear_{i,t}) = A \begin{bmatrix} \beta_0 + \beta_1 DLP_{i,t} + \beta_2 Morning_{i,t} + \beta_3 (DLP_{i,t} \times Morning_{i,t}) + \\ \beta_4 TotalOrderFlow_{i,t} + \beta_5 |NetOrderFlow_{i,t}| + \sum_{i=1}^{36} \beta_{i+5} F_{i,t} \end{bmatrix},$$
(4)

⁸ The DLP may produce information (e.g., analyst reports) and increase trading interest in a stock. To the extent that this is true, this analysis understates the value of a DLP.

where Λ is the logistic cumulative distribution function, $Clear_{i,t}$ equals 1 if auction t for firm i clears and 0 otherwise, $DLP_{i,t}$ equals 1 if auction t for firm i occurs in the presence of a market maker and 0 otherwise, $Morning_{i,t}$ equals 1 if auction t for firm i occurs in the morning and 0 otherwise, $TotalOrderFlow_{i,t}$ is the total quantity of new shares submitted for stock i during session t (in 1000's), $NetOrderFlow_{i,t}$ is the total signed quantity of new shares submitted for stock i during session t (in 1000's), and $F_{i,t}$ equals 1 if auction t is for firm i and 0 otherwise.

Regression results for full and reduced forms of the model are presented in Panel B of Table 4 (firm dummies are omitted for brevity). Coefficients are significant at reasonable levels. Intuitively, clearing frequency is positively correlated with the level of order flow and inversely related to demand asymmetry. Controlling for these factors, DLPs increase the likelihood that the market clears. For instance, in specification (1), the DLP coefficient equals 0.42 (p-value=0.00). Significantly positive β_1 and β_3 coefficients in specifications (2) and (3) indicate that the benefits of designated liquidity provision are evident in both morning and afternoon sessions but are more pronounced at the open. Consistent with the notion that information asymmetry is more extreme in the morning, the market maker seems best able to reduce the likelihood of market failure at the open.

As an alternative measure of (inverse) market failure, we consider order execution. We estimate the following logit regression model with pooled time series, cross section data:

$$Pr(Execute_{i,t}) = A \begin{vmatrix} \beta_0 + \beta_1 DLP_{i,t} + \beta_2 Morning_{i,t} + \beta_3 (DLP_{i,t} \times Morning_{i,t}) + \\ \beta_4 TimetoAuction_{i,t} + \beta_5 Imbalance_{i,t} + \\ \beta_6 Aggressiveness_{i,t} + \sum_{i=1}^{36} \beta_{i+6} F_{i,t} \end{vmatrix},$$
(5)

where $Execute_{i,t}$ equals 1 if order t for firm *i* executes in the auction in which it is submitted and 0 otherwise. $TimetoAuction_{i,t}$ is the number of trade hours between order submission and auction time.⁹ Im balance_{i,t}</sup> measures the extent to which an order competes for execution. It equals the signed ratio of $|NetOrderFlow_{i,t}|$ to $TotalOrderFlow_{i,t}$, where the ratio's sign is positive if order direction is the same sign as $NetOrderFlow_{i,t}$ and is negative otherwise. $Aggressiveness_{i,t}$ is an indicator variable that reflects the relative aggressiveness of the order submission price. For a buy (sell) order, $Aggressiveness_{i,t}$ equals 1 if the order price is more than one percent lower (higher) than the previous auction price, equals 2 if the order price is within one percent of the prior auction price, and equals 3 if the order price is more than one percent higher (lower) than the previous auction price. All other variables are as defined earlier.

Panel C reports the results. Observations are share weighted such that the regression coefficients reflect the likelihood that a given share executes. All coefficients are significant at reasonable levels. *Imbalance_{i,t}* and *Aggressiveness_{i,t}* coefficients are intuitive. A share is more likely to execute if submitted as part of a more aggressive order, and it is less likely to execute as the competition for liquidity increases. Biais, Hillion, and Spatt (1999) document time variation in order execution rates for Paris Bourse call auctions. Consistent with this possibility, a share is more likely to execute in the call auction as the order submission time approaches auction clearing time. Most importantly, the DLP coefficient for specification (1) is significantly positive. A share is more likely to execute when submitted in the presence of a market maker. Consistent with expectations, specifications (2) and (3) indicate that designated liquidity providers increase the likelihood that a share submitted in the morning executes. As

⁹ If the auction does not clear, the scheduled auction time is used.

 $(DLP_{i,t} \times Morning_{i,t})$ coefficients are positive (0.29 and 0.40), we reject the null hypothesis that $\beta_1 + \beta_3 = 0$ (tests are not reported). However, post-LP, a share submitted in the afternoon is less likely to execute; $DLP_{i,t}$ coefficients for the two models are -0.08 and -0.29, respectively. One potential explanation is that the increase in the morning execution rate reduces the available supply of public limit orders on the ELOB in the afternoon such that the likelihood of execution later in the day declines. On the whole, these findings suggest that a given share is more likely to execute in the presence of a DLP.

5. Cross-sectional tests

The results thus far suggest that the introduction of the DLP has no effect for the Liquid sample. In contrast, the event has created positive value for our sample of Illiquid stocks by reducing the likelihood of market failure. It is likely that the impact of the DLP varied across stocks in both samples. The liquidity premium hypothesis predicts that, assuming market efficiency, firms that experience larger improvement in market quality due to DLP introduction should also experience larger cumulative abnormal return. To test this proposition, we estimate the following cross-sectional model:

$$CAR_i = \alpha + \beta * DMQ_i + \varepsilon_i, \tag{6}$$

where CAR_i is the cumulative abnormal return on stock *i* from day A-5 to day I+5, and DMQ_i is the change in market quality. Change in market quality is either measured as the change in market liquidity (RV or LR), or as the change in execution costs for the Liquid sample and the extent of market failure for the Illiquid sample.

Table 5 presents the results. For the Liquid sample (Panel A), we find that the coefficients for average daily trading volume (1) and relative trading volume (2) are 0.047 (p-

value=0.02) and 0.053 (p-value=0.01), respectively. Despite the small sample size (N=18), the adjusted- R^2 statistics are 28 percent and 26 percent, respectively, which suggests that substantial cross-sectional variation in the CAR can be explained by changes in trading volume. The relationship is weaker for DLR (3): the regression coefficient is 0.028 (p-value=0.08) and the adjusted- R^2 drops to 12 percent. Finally, execution costs coefficients ((4) and (5)) are insignificant and the adjusted- R^2 s are negative.

For the Illiquid sample (Panel A), the findings are consistent with the results in Table 3: changes in trading volume ((1) and (2)) and market depth (3) do not explain the cross-sectional variations in the CAR. In contrast, we find (in Panel B) that the market views the reduction in auction failures favorably. The cross-sectional variation in the change in morning session clearing (6) and afternoon session clearing (7) explain 7 percent and 9 percent of the variation in CARs, respectively. Across all sessions (8), the coefficient is 0.002 (p-value=0.02), with a corresponding increase in adjusted-R² to 12 percent. Finally, if we proxy the benefit of DLP introduction for each stock as the logit regression coefficient from the call auction clearing specification (see model 1 in Panel B of Table 4) estimated on a stock-by-stock basis, the coefficient of DMQ is highly significant at 0.036 (p-value=0.00). These cross-sectional results are consistent with the liquidity premium hypothesis for both samples: firms that experienced a larger improvement in market quality after DLP introduction also experienced larger cumulative abnormal returns. The results also provide strong empirical support for the Glosten (1989) prediction that a DLP may enhance liquidity by preventing market failures, rather than by increasing overall trading volume or by reducing executions costs in the traditional sense.

6. Conclusions

This paper studies the value of a non-strategic specialist. We conduct a natural controlled experiment examining a sample of Paris Bourse securities that trades both with and without the assistance of a market maker. Following the introduction of a designated liquidity provider into a purely order driven market, less liquid stocks experience a statistically significant increase in price that is permanent and economically meaningful; actively traded issues are generally unaffected. These findings are consistent with a liquidity premium in asset prices.

Results are obtained despite the fact that the Paris Bourse liquidity provider is a passive player in the market who simply quotes a maximum spread and a minimum depth. The more complex role of the NYSE specialist often requires active intervention in the trading process. Assessing the value of such discretion is beyond the scope of this analysis. Here, the more modest objective is an improved understanding of the benefits (if any) to maintaining a regular market presence, the single responsibility shared by agents of the NYSE and the Paris Bourse. The evidence suggests that, while patient limit order traders may provide an adequate supply of liquidity for actively traded securities, participation by a market maker reduces the likelihood of market failure for less liquid stocks. Market presence alone neither reduces execution costs nor increases market depth. The fact that the NYSE specialist is able to improve these dimensions of market quality suggests that granting the designated liquidity provider some powers to direct the trading process may further improve the terms of trade in an electronic order driven market.

Selection bias is an inherent problem in this analysis. Since market makers tend to be assigned to stocks that are likely to benefit from their presence, our findings may overstate the advantages of designated liquidity provision for a randomly selected firm. At least for the event study, this problem may largely resolve itself. If market makers are more likely to be introduced

for certain issues, it follows that an efficient market should anticipate their arrival. As a result, announcement abnormal returns are attenuated and the upward bias is, at least in part, offset.

A second important limitation of this study concerns the interpretation of the results. We emphasize that the value of the specialist tends to be greater for more thinly traded assets. This explanation is consistent with both economic theory and extant empirical research. However, an alternative interpretation may be that the benefits to delegated market making vary by trading mechanism. Consistent with the data, Glosten (1994) suggests that augmenting the limit order book with the services of a designated liquidity provider will not improve the terms of trade in an automated continuous market, and Economides and Schwartz (1995) suggest that a market maker can only enhance liquidity in an electronic call market. Our results may therefore reflect both the liquidity properties of the sample stocks and the mechanisms in which they are exchanged, as these alternatives are not mutually exclusive. Unfortunately, the data do not easily lend themselves to disentanglement of the two effects. Future research may continue to explore why some stocks benefit from professional liquidity services while others do not.

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Table 1: Sample summary statistics

Reported are summary statistics of the sample of 19 firms of medium-to-high liquidity (Liquid sample) and 37 firms of low liquidity (Illiquid sample) on Euronext Paris where a liquidity provider (LP) was introduced between 1995 to 1998. Stocks per introduction represent the total number of stocks introduced on each LP introduction day. Days until introduction represent the number of trading days between the LP announcement date (A) and the LP introduction date (I). Market capitalization is the market size in FF millions on the LP introduction day. Daily trading volume is the average daily trading volume (in 000's of FF) in the pre-LP period (Days[A-35,A-5]) while stock price is the first market price in the pre-LP period. All sample measures are cross sectional averages across sample firms within liquidity groups.

	Mean	Median	Std. Dev	Min	Max
Panel A: Liquid Sample (N=19)					
Stocks per introduction	1.06	1.00	0.24	1.00	2.00
Days until introduction	1.53	2.00	0.61	0.00	2.00
Market Capitalization (in millions)	1,550	1,273	1,183	220	4,751
Daily trading volume (in 000's of FF)	981	767	1,070	15	5,077
Price	315	265	186	129	898
Panel B: Illiquid Sample (N=37)					
Stocks per introduction	1.23	1.00	0.68	1.00	4.00
Days until introduction	1.70	2.00	0.66	1.00	4.00
Market Capitalization (in millions)	253	202	229	63	1,423
Daily trading volume (in 000's of FF)	205	92	254	0	1,301
Price	211	198	110	65	600

Table 2: Cumulative abnormal returns around introduction of the Liquidity Provider

Average abnormal returns (AAR) and cumulative average abnormal returns (CAAR) around the introduction of a Liquidity Provider (LP) of 19 firms of medium-to-high liquidity (Liquid sample) and 37 firms of low liquidity (Illiquid sample) on Euronext Paris from 1995 to 1998. The event window extends from five days before the announcement day (A) to 10 days after the LP introduction day (I). Event day I aggregates the period through A to I (the number of days in this period varies). The market model is estimated over a 132 days period that begins 23 days after the introduction date. Scholes-Williams betas are computed using the value-weighted SBF120 Index as a proxy for the market. Daily returns are calculated from closing prices (adjusted for dividends, splits, and other corporate actions). Stocks with identical introduction dates are formed into equally weighted portfolios.

	Lic	Liquid Sample (N=19 firms)			I1	Illiquid Sample (N=37 firms)			
Day	AAR	t	CAAR	t	AAR	t	CAAR	t	
-5	0.08	0.14	0.08	0.14	-0.02	-0.04	-0.02	-0.04	
-4	0.04	0.06	0.12	0.14	0.33	0.75	0.32	0.50	
-3	-0.63	-1.11	-0.51	-0.52	0.59	1.33 *	0.88	1.14	
-2	0.08	0.14	-0.43	-0.38	1.25	2.80 ***	2.05	2.29 **	
-1	-0.17	-0.31	-0.60	-0.48	1.09	2.44 ***	3.06	3.07 ***	
А	0.33	0.58	-0.28	-0.20	0.25	0.55	3.29	3.01 ***	
Ι	-0.22	-0.39	-0.50	-0.33	-0.44	-1.00	2.88	2.44 ***	
1	0.21	0.38	-0.29	-0.18	-0.75	-1.67 **	2.21	1.75 **	
2	0.51	0.91	0.22	0.13	-0.24	-0.53	1.98	1.48 *	
3	-0.17	-0.29	0.06	0.03	0.62	1.40 *	2.61	1.85 **	
4	0.09	0.16	0.15	0.08	0.22	0.50	2.83	1.91 **	
5	-1.05	-1.86 **	-0.84	-0.43	0.29	0.65	3.11	2.01 **	
6	-0.67	-1.19	-1.47	-0.72	-0.05	-0.12	3.06	1.90 **	
7	0.11	0.20	-1.36	-0.64	1.08	2.42 ***	4.14	2.48 ***	
8	0.62	1.10	-0.74	-0.34	0.51	1.15	4.65	2.69 ***	
9	0.50	0.89	-0.26	-0.12	0.28	0.62	4.93	2.76 ***	
10	0.29	0.51	0.01	0.00	-0.51	-1.15	4.43	2.41 ***	

****, ***, and *: Significant at the 1, 5, and 10 percent respectively (one-tailed)

Table 3: Changes in Market Quality with introduction of a Liquidity Provider

Reported are trading volume and transactions cost measures around the introduction of a Liquidity Provider (LP) for 19 firms of medium-to-high liquidity (Liquid sample) and 36 firms of low liquidity (Illiquid sample) on Euronext Paris from 1995 to 1998. Market quality measures are obtained using trade and quote data from the BDM database. Relative trading volume is the logarithm of the average trading volume of stock normalized by the average daily trading volume of the market. The market depth (LR) measures the trading volume associated with a unit change in the stock price. Percentage quoted spread is computed as [200*(Ask-Bid)/mid], where mid is the midpoint of the bid-ask quotes. Percentage effective spread is computed as [200×dummy×(Price-mid)/mid], where the dummy equals one for a market buy and negative one for a market sell, price is the transaction price. Percentage price impact is computed as [200×dummy× (Qmid30 - mid)/mid], where Qmid30 is the midpoint of the first quote observed after 30 minutes. All market quality measures are cross sectional averages across sample firms during 30 day trading window in the pre-LP period (Days[A-35,A-5]) and post-LP period (Days[I+5,I+35], where A is the LP announcement date and I is the LP introduction date. The p-value tests the null that market quality measures are equal.

		Mean			Median		
	Pre-LP	Post-LP p-	val of Diff.	Pre-LP	Post-LP p	-val of Diff.	
Panel A: Liquid Sample							
Trading Volume							
Daily number of trades	17	21	(0.42)	14	15	(0.80)	
Daily trading volume	1,504,900	3,485,400	(0.41)	901,900	1,245,100	(0.25)	
Relative trading volume	-9.04	-8.98	(0.67)	-8.93	-8.95	(0.86)	
Market depth (LR ratio)	1,287,500	2,476,200	(0.66)	663,351	752,358	(0.28)	
Quotations							
Quoted spreads (%)	0.74	0.82	(0.46)	0.59	0.62	(0.77)	
Quoted depth (Ask)	194	198	(0.25)	160	177	(0.51)	
Quoted depth (Bid)	190	184	(0.54)	144	138	(0.49)	
Transactions Cost							
Effective spreads (%)	1.45	1.60	(0.47)	1.33	1.25	(0.89)	
Price impact (%)	0.36	0.35	(0.53)	0.31	0.35	(0.82)	
Panel B: Illiquid Sample							
Trading Volume							
Daily trading volume	210,600	198,800	(0.73)	318,800	349,800	(0.88)	
Relative trading volume	-10.77	-10.82	(0.81)	-10.62	-10.84	(0.47)	
Market depth (LR ratio)	269,400	263,800	(0.87)	167,000	148,500	(0.71)	

Table 4: Changes in Call Auction Market Quality with introduction of a Liquidity Provider

Reported are call auction market quality measures around the introduction of a Liquidity Provider (LP) for 36 firms of low liquidity (Illiquid sample) on Euronext Paris from 1995 to 1998. Market quality measures are obtained using trade, quote and order data from the BDM database during a 30 day trading window in the pre-LP period and post-LP period. Panel A presents the average proportion of morning, afternoon and overall sessions that cleared before and after the introduction of the LP. The p-value tests the null that market quality measures are equal. Panel B presents MLE estimates of a pooled logit regression of the likelihood that a session clears. The dependent variable is dummy variable that takes the value of one when the session clears and zero otherwise. The LP variable takes the value of one in the Post-LP period and zero in the Pre-LP period. Morning variable takes the value of one for morning sessions and zero otherwise. Total order flow is the total number of new shares submitted during the session (in 1000s). Net order flow is the total signed quantity of new shares submitted during the session (in 1000s). Also included are 36 firm dummy variables that take on a value of one for the firm in question and zero otherwise. Panel C presents the MLE estimates of a pooled logit regression of the likelihood that an order executes. The dependent variable is one when the order executes and zero otherwise. Time-toauction variable measures the number of hours between the time when an order is submitted and the next scheduled auction. Imbalance is the signed ratio of Net order flow to Total order flow. The ratio's sign is positive if the direction of the order equals the sign of the Net order flow. Aggressiveness is one for the least aggressive orders, two for the more aggressive orders, and three for the most aggressive orders.

		N	<i>l</i> ean			Median	
	Pre	e-LP	Post-LP	p-val	Pre-LP	Post-LP	p-va
Morning sessions (%)	86	6.50	93.50	(0.00)	90.00	96.70	(0.00)
Afternoon sessions (%)	7	1.90	77.10	(0.16)	73.03	80.00	(0.14)
Overall sessions (%)	79	9.20	85.30	(0.01)	81.30	85.80	(0.02)
	(1)			(2)		(3)	
Panel B: Logistical analysis of like		or oun	adolion		9	(0)	
Intercept	1.34	(0.00)	0.89	(0.00)	0.10	(0.65)
LP		(0.00) (0.00)		0.89 0.32	(0.00)	0.10 0.29	(0.65) (0.01)
LP Morning	1.34			0.89 0.32 1.08	(0.00) (0.00)	0.10 0.29 1.02	(0.01) (0.00)
LP	1.34			0.89 0.32	(0.00)	0.10 0.29	(0.01)
LP Morning LP * Morning	1.34			0.89 0.32 1.08	(0.00) (0.00)	0.10 0.29 1.02 0.35	(0.01) (0.00) (0.07)

	(1)		(2)		(3)	
Intercept	-0.08	(0.00)	0.46	(0.00)	-1.25	(0.00)
LP	0.13	(0.00)	-0.08	(0.00)	-0.29	(0.00)
Morning			-0.86	(0.00)	-0.82	(0.00)
LP * Morning			0.29	(0.00)	0.40	(0.00)
Time to auction					-0.23	(0.00)
Imbalance					-1.07	(0.00)
Aggressiveness					1.70	(0.00)
Firm Dummies					Yes	

Table 5: Cross-sectional regressions of CAR on changes in market quality

Reported are coefficients of cross-sectional regressions of CAR on changes in market quality around the introduction of a Liquidity Provider (LP) for 19 firms of medium-to-high liquidity (Liquid sample) and 36 firms of low liquidity (Illiquid sample) on Euronext Paris from 1995 to 1998. Market quality measures are obtained using trade, quote and order data from the BDM database during a 30 day trading window in the pre-LP period and post-LP period. In Panel A, relative trading volume is the logarithm of the average trading volume of stock normalized by the average daily trading volume of the market. The market depth (LR) measures the trading volume associated with a unit change in the stock price. Percentage quoted spread is computed as [200*(Ask-Bid)/mid], where mid is the midpoint of the bid-ask quotes. Percentage price impact is computed as [200×dummy× (Qmid30 - mid)/mid], where Qmid30 is the midpoint of the first quote observed after 30 minutes. In Panel B, call auction market quality is measures by the change in the average proportion of morning, afternoon and overall sessions that cleared. In Model (9), the CARs are regressed on the LP coefficient of the firm-specific logit analysis of model (1) in Panel B of Table 4.

Panel A: Regression o	f CAR [-5,+5] on cha (1) Diff. in Trading Volume	ange in market quality (2) Diff. in relative trading volume	(3) Diff. in market depth	(4) Diff. In quoted spread	(5) Diff. In price impact
iquid Sample (N=18).					
Intercept	-0.016 <i>(0.21)</i>	-0.012 <i>(0.32)</i>	-0.012 <i>(0.39)</i>	-0.008 <i>(0.61)</i>	-0.011 <i>(0.47)</i>
Slope	0.047 <i>(0.02)</i>	0.053 <i>(0.01)</i>	0.028 <i>(0.08)</i>	-0.019 <i>(0.53)</i>	0.009 <i>(0.68)</i>
Adjusted R ²	28%	26%	12%	-4%	-5%
lliquid Sample (N=35)					
Intercept	0.028 (0.07)	0.028 <i>(0.07)</i>	0.028 (0.07)		
Slope	0.001 <i>(0.92)</i>	0.001 <i>(0</i> .93)	0.002 <i>(0.85)</i>		
Adjusted R ²	-3%	-3%	-3%		

	(6)	(7)	(8)	(9)
	Diff. in morning	Diff. in afternoon	Diff. in overall	LP coefficient - Table 4
	session clearing	session clearing	session clearing	Panel B - Model (1)
Intercept	0.011	0.021	0.014	0.005
	<i>(0.51)</i>	<i>(0.16)</i>	<i>(</i> 0.37)	<i>(0.70)</i>
Slope	0.002	0.001	0.002	0.036
	<i>(0.06)</i>	<i>(0.04)</i>	<i>(0.02)</i>	<i>(0.00)</i>
Adjusted R ²	7%	9%	26 12%	20%



Figure 1: Cumulative abnormal returns around the introduction of a Liquidity Provider (LP) of 37 firms of low liquidity (Illiquid firms) and 19 firms of medium-to-high liquidity (Liquid firms) on Euronext Paris from 1995 to 1998. The event window extends from five days before the announcement day (A) to 10 days after the LP introduction day (I). Event day I aggregates the period through A to I (the number of days in this period varies). The market model is estimated over a 132 days period that begins 23 days after the introduction date. Scholes-Williams betas are computed using the value-weighted SBF120 Index as a proxy for the market. Daily returns are calculated from closing prices (adjusted for dividends, splits, and other corporate actions). Stocks with identical introduction dates are formed into equally weighted portfolios.

5 40 4.5 35 4 30 **Cumulative Frequency** 3.5 25 3 Frequency 2.5 20 2 15 1.5 10 1 5 0.5 0 + 0.0 17.0 33.0 56.7 68.3 76.7 81.5 86.8 92.9 98.3 **Proportion of Call Auctions Clearing** Pre-LP Post-LP -x-Post-LP_Cum

Call Auction Clearing Frequency

Figure 2: Reported are the average proportion of call auctions that clear around the introduction of a Liquidity Provider (LP) for 36 firms of low liquidity (Illiquid sample) on Euronext Paris from 1995 to 1998. Market quality measures are obtained using trade, quote and order data from the BDM database during a 30 day trading window in the pre-LP period (Days[A-35,A-5]) and post-LP period (Days[I+5,I+35], where A is the LP announcement date and I is the LP introduction date. The left axis and right axis represent the number of firms and the cumulative number of firms in each call clearing frequency.