Testing for Liquidity Gains in the Market Reaction to Nasdaq National Market System Phase-Ins

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This study examines whether the market reaction to stock movements from the regular Nasdaq to the Nasdaq National Market System (NMS) is explained by changes in liquidity costs (i.e., spreads) and whether the relationship between pre-NMS spreads and market reaction to NMS transfers is consistent with realized liquidity cost changes. The study also tests whether the number of market makers affects the predictive power of the pre-NMS spreads on the price reaction to NMS phase-ins. Comprehensive tests are conducted on a sample of 672 stocks that were phased in from 1983 to 1991. This study finds new evidence that the market reaction to NMS phase-ins is directly related to the reductions in spreads and that the price reaction is positively related to the potential for liquidity gains. The pre-NMS number of market makers does not impact adversely the pre-NMS spread and market reaction relationship.

INTRODUCTION

Previous studies by Ying, Lewellen, Schlarbaum, and Lease (1977), Fabozzi (1981), Grammatikos and Papaioannou (1986a), and Sanger and McConnell (1986) report a positive market reaction to announcements about the movement of stocks from the over-the-counter (OTC) market to an organized exchange such as the New York Stock Exchange (NYSE) or the American Stock Exchange (Amex). These value gains have been attributed to greater liquidity or marketability, increased visibility and information flow, stricter trading rules, and positive signaling effects.

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Grammatikos and Papaioannou (1986b) and Edelman and Baker (1990) show that the price effects associated with switching to another marketplace are directly related to the size of the spread the stocks had in their original marketplace. None of the above studies, however, presents evidence that associates listing-induced price effects to changes in the spread after listing on the new trading place.

This study addresses this issue in the particular case of Nasdaq stocks that moved into the Nasdaq National Market System (NMS), now called the Nasdaq National Market. The first two objectives of the study are to examine whether the market reaction to NMS phase-ins is explained by changes in liquidity (i.e., bid-ask spreads) and whether the relationship between pre-NMS spreads and the market reaction to NMS transfers is consistent with the realized liquidity changes. Baker and Edelman (1990) provide evidence that generally supports both questions. Their findings show that although most low spread stocks experience spread declines in the post-NMS period, these stocks have insignificant market reaction. This finding suggests that the evidence of liquidity-driven value gains is not conclusive. Seguin (1991) finds that the pre-NMS number of market makers is a significant predictor of spread changes induced by the NMS transfer. Therefore, the third objective of the study is to test whether the pre-NMS spread remains a consistent predictor of market reaction to the phase-in news after accounting for the pre-NMS number of market makers.

Our findings suggest that market reaction is related to spread changes resulting from NMS phase-ins and that the pre-NMS level of the spread is a reliable predictor of market reaction even after accounting for the number of market makers. The findings are unaffected by such factors as voluntary versus mandatory phase-ins, the measurement interval of the spreads, and the January effect on the spread-to-expected-returns relationship.

This study complements the extant empirical evidence on spreads and price effects induced by NMS phase-ins. It extends the validity of the Baker and Edelman (1990) study by using a larger sample over a longer period, by examining market reaction to both mandatory and voluntary switches to the NMS, and affirming the robustness of the results under several alternative test specifications. Thus, this study provides more conclusive evidence on the relation between liquidity changes and market reaction in the case of NMS phase-ins.

NMS PHASE-INS, LIQUIDITY, AND PRICE EFFECTS

An NMS phase-in occurs when Nasdaq upgrades a stock from the regular Nasdaq listings to the NMS. To qualify for the NMS phase-in, a stock must meet the higher standards of that segment. From its introduction in April 1982 until 1989 listing on the NMS was both mandatory and voluntary depending on whether Nasdaq or the firm initiated the decision to transfer the stock to the NMS. After 1989 only voluntary listings occur.

There are several possible benefits and costs associated with listing on the NMS as opposed to the regular Nasdaq. NMS listing entails exemption from blue sky registration, more information on newspaper listings, and automatic margin eligibility (although regular Nasdaq stocks also may qualify for the latter).[1] NMS listing fees were initially the

[1] See Seguin (1990) for more details on margin eligibility and its impact on price volatility.

same as for regular Nasdaq listing, but they have been increased since 1990. Although these and a few minor differences in corporate governance and reporting standards could impact the relative valuation of NMS versus Nasdaq stocks, this study focuses on the changes in liquidity costs (spreads in particular) and their impact on the price reaction to the phase-in news.

Since its inception and until June 15, 1992, the major difference in favor of NMS listings was the requirement to report last sale information on NMS stocks to dealers within 90 seconds. The speedier and fuller access to last trade price and volume data by all dealers should improve the price discovery process, decrease the adverse selection problem dealers face versus informed traders (Seguin, 1991), and thus lead to narrowing market spreads. (See Hasbrouck, 1988; Glosten and Harris, 1988; and Stoll, 1989.) Using a large sample of NMS phase-ins from 1982 to 1987 Seguin reports evidence of significant spread reduction following the NMS transfer. Moreover, Seguin finds the spread reduction to be directly related to the pre-NMS number of market makers. This spread reduction is justified by the reduction of the fragmentation of transaction information across dealers in the post-NMS period which would benefit mostly stocks traded by many dealers on the regular Nasdaq.

Amihud and Mendelson (1986, 1988) have shown that liquidity costs (i.e., bid-ask spreads) are inversely related to the equilibrium required rate of return and , therefore, that such costs can impact asset values.[2] Baker and Edelman (1990), analyzing a sample of 278 stocks that transferred to NMS from 1982 to 1987, find that the group of stocks with high pre-NMS spreads realized positive average abnormal returns around the phase-in day and registered significant declines in their spreads in the post-NMS period. Baker and Edelman also show that most of the low spread stocks, which had insignificant average price reaction, experienced spread declines.

The less-than-conclusive findings reported in Baker and Edelman and the evidence (see Eleswarapu and Reinganum, 1993) of a January effect in the spread-to-average-returns relationship suggest that the relationship of liquidity costs and value effects merits further examination.

Seguin's evidence on the explanatory power of the pre-NMS number of market makers on spread reduction also implies that the market reaction, due to anticipated liquidity improvement, may be less systematically related to the level of the pre-NMS spread. It is possible that the market can better infer the scope for spread reduction from the cross-sectional variation of the number of market makers than the spread level. Therefore, after accounting for the number of market makers, the pre-NMS spread may not be a significant predictor of market reaction with respect to the potential for liquidity gains.

SAMPLE AND DATA

The sample of 672 stocks is drawn from the total population of phase-ins in the 1983-1991 period provided by Nasdaq. The main criterion responsible for reducing the total number of phased-in stocks from 3797 to 672 is the availability of trades and, hence, valid return and bid and ask price data on each day in the time interval of -100 to +100

[2] Kadlec and McConnell (1994) provide empirical support that narrowing of spreads following New York Stock Exchange listings leads to value gains.

Table 1—Total Number of NMS Phase-Ins and Sample Size Per Year, 1983 to 1991

Year	NMS Phase-ins	Sample Size
1983	601	265
1984	557	169
1985	1137	107
1986	589	49
1987	450	41
1988	200	9
1989	96	12
1990	88	10
1991	79	10
Total	3797	672

days around the phase-in day (day 0). Table 1 shows both the number of phase-ins and those included in the sample on a per year basis in the 1983 to 1991 period. Most stocks qualified for inclusion in NMS immediately after its establishment in 1982 which explains the declining numbers in recent years.

The source of the bid and ask prices and the number of market makers is the CRSP/Nasdaq tapes. To avoid mixing returns estimated from bid and ask prices (for the Nasdaq period) with returns estimated from closing transaction prices (for the NMS period), we use the bid and ask prices, defined as the best (highest) bid and (lowest) ask prices recorded for Nasdaq and NMS stocks at the end of each trading session. Thus, we use the bid-ask midpoint (average of the bid and ask prices) at the start and end of each interval in estimating returns. We also calculate the daily percentage bid-ask spread in relation to the average bid-ask price for each stock. Average percentage spreads are computed for the pre-NMS period (day -100 to day -51) and the post-NMS period (day +51 to day +100).

Table 2 presents additional descriptive statistics of average daily volume of traded shares, market prices (bid-ask midpoints), and market capitalization values. These data are reported for the portfolio of 672 stocks and for two portfolios of low and high spread stocks, respectively. We follow Grammatikos and Papaioannou (1986a) and use the median average percentage spreads of all stocks in the pre-NMS period to form the two portfolios of stocks with below-the-median and above-the-median percentage spreads. The data in Table 2 suggest that low spread stocks have higher average market price and market capitalization than their do high spread counterparts, and the differences are statistically significant. The difference in daily trading volume between the two groups, however, is not statistically significant.

TESTS AND FINDINGS

MARKET REACTION TO ANTICIPATED BID-ASK SPREAD CHANGES

We first analyze the price reaction to NMS phase-ins in relation to anticipated changes in the bid-ask spreads. In accordance with Seguin's (1991) evidence of narrower post-NMS spreads and the Amihud and Mendelson (1986, 1988) hypothesis of a positive relationship between bid-ask spreads and expected returns, the market response is predicted to be related directly to the anticipated liquidity gains (i.e., spread reduction).

Table 2—Mean Values for Selected Variables for the Different Portfolios of Stocks

Average volume is the average number of shares traded each day for days -100 to +100. Market price is the average of the bid-ask midpoints for days -100 to +100. Market capitalization is the average of the total market values of the firms (computed as bid-ask midpoint multiplied by the number of shares outstanding) as of the phase-in date

Variables	Average Volume (daily)	Market Price (in $)	Market Capitalization (in $ million)
Entire Portfolio (n = 672)	32,214	15.22	155.34
Low Spread Portfolio (n = 336)	30,330	20.74	227.24
High Spread Portfolio (n = 336)	34,098	9.70	83.44
Difference Between High and Low Spread Portfolios (t-test)	3,768 (0.58)	-11.04*** (-14.72)	-143.80*** (-2.78)

* Significant at the 10 percent level for a two tailed test
** Significant at the 5 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

To test this prediction, we employ standard event study methodology to estimate abnormal returns (ARs) and cumulative abnormal returns (CARs) following the Brown and Warner (1985) approach under the assumption of cross dependence of abnormal returns. We use the mean-adjusted model for an estimation period that includes the return interval (-99, -30) and (+30, +99). The use of other estimation periods that include the intervals (-99, -30) and (+30, +99), respectively, as well as the application of the market model produced qualitatively similar results. According to Nasdaq practice, phase-in dates become known to dealers in the two week period preceding the day of the phase-in. A search in the *Wall Street Journal Index* and the *Dow Jones ABI-Inform* reveals no mention of the NMS phase-ins for any of the 672 stocks in the three month period before the switch. Given this practice, the market reaction may occur over several days before the phase-in day, which is designated as event day 0. Consequently, abnormal returns are studied over several different event windows.

For the analysis of the market reaction to anticipated gains in liquidity, the abnormal returns are examined in relation to the pre-NMS percentage spreads. The marketability gains hypothesis (Grammatikos and Papaioannou, 1986a) suggests that if improvement in liquidity is a perceived benefit of switching to a different marketplace, the potential for liquidity gains is directly related to the spread size in the original marketplace. Consequently, high spread stocks are predicted to have greater value gains than low spread stocks have.

Table 3 reports the cumulative average returns of several event intervals for the entire sample and for the two portfolios of high and low spread stocks, respectively. The differences in the results obtained from the two respective stock portfolios are striking. The findings suggest that only the high spread stocks realize positive value gains from switching to the NMS. In Table 3 the CARs of the high spread portfolio are positive and significant (at the 1 percent level) in the intervals (-29, -1), (-20, -1), and (-10, -1). Also, the interval (0, 0), i.e., day 0, average abnormal return of 0.70 percent is positive and signifi-

Table 3—Abnormal Returns of NMS Phased-In Stocks for Selected Intervals

These are the percentage mean-adjusted abnormal returns for the entire portfolio and the two portfolios of low spread and high spread stocks using an estimation period that combines the prephase-in days -99 to -30 and the postphase-in days +30 to +99

Interval	Entire Portfoilo (N = 672) CAR[1]	Low-Spread Portfolio (N = 336) CAR[1]	High-Spread Portfolio (N = 336) CAR[1]	Difference Between High and Low Spread
(-29,-1)	2.14	-2.28	6.55***	8.83***
	(1.44)	(-1.20)	(3.99)	(3.75)
(-20,-1)	1.36	-1.82	4.54***	6.36***
	(1.10)	(-1.15)	(3.32)	(3.23)
(-10,-1)	0.46	-1.49	2.40**	3.89***
	(0.52)	(-1.34)	(2.49)	(2.92)
(-5,-1)	0.23	-0.66	1.11	1.77**
	(0.37)	(-0.83)	(1.63)	(2.35)
(0,0)	0.52*	0.33	0.70**	0.37*
	(1.87)	(0.94)	(2.30)	(1.68)
(0,+5)	0.04	-0.62	0.69	1.31*
	(0.06)	(-0.71)	(0.93)	(1.96)
(0,+10)	-0.47	-1.26	0.31	1.57
	(-0.52)	(-1.08)	(0.31)	(1.54)
(0,+20)	-0.20	-1.75	1.35	3.10**
	(-0.16)	(-1.09)	(0.97)	(2.28)
(0,+29)	-2.44	-4.17**	-0.71	3.46*
	(-1.61)	(-2.16)	(-0.43)	(2.07)
(-29,+29)	-0.30	-6.45**	5.84**	12.29***
	(-0.14)	(-2.38)	(2.49)	(4.01)

[1]CAR is the cumulative average daily abnormal returns. Numbers in parentheses are t-values
* Significant at the 10 percent level for a two tailed test
** Significant at the 5 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

cant at the 5 percent level. By contrast, the low spread stocks experience insignificant negative cumulative abnormal returns in the intervals preceding the phase-in day and insignificant positive average daily abnormal return on day 0. Furthermore, the differences of CARs between the high and low spread groups are positive and significant in all event windows except the (0, +10) window. This evidence is consistent with the findings reported in Baker and Edelman (1990) concerning their samples of high and low spread stocks, respectively.

The CARs of the high spread group are significantly higher than the CARs of the low spread group (except for the (0, +10) interval). The positive (negative) and significant CAR of the interval (-29, +29) reveals that the NMS listing is, on average, value-increasing(decreasing) for the stocks with high (low) pre-NMS spreads. The negative return performance of the low spread stocks in the interval (-29, +29) results from the significantly negative CAR of these stocks in the interval (0, +29). This evidence differs from that of Baker and Edelman (1990), who find no significant CARs in the postswitching period.[3]

[3] To examine the January effect on the spread-expected return relationship reported in Eleswarapu and Reinganum (1993), the tests are repeated after excluding the 35 stocks that were phased in in the month of January. Because the results (not reported here) remain qualitatively the same, our conclusion is that there is no evidence of a January effect on the findings of this study.

Table 4—Tests for Changes in Average Spreads for the Entire Portfolio (N = 672) and the Two Portfolios of Low Spread (N = 336) and High Spread (N = 336) Stocks

Pre-NMS average spread is the mean percentage spread in the prephase-in period -100 to -51. Post-NMS average spread is the mean percentage spread in the postphase-in period +51 to +100. Spread change is the pre-NMS average spread minus the post-NMS average spread

Portfolio	Pre-NMS Average Spread (percent)	Post-NMS Average Spread (percent)	Spread Change (percent)	Percent Positive
All Stocks	2.82	2.89	-0.07	46.9
Binomial t-test				(-1.61)
Matched pair t-test			(-1.08)	
Wilcoxon signs test			(p = 0.0251)	
Low Spread Stocks	1.65	2.00	-0.35***	37.5***
Binomial t-test				(-2.80)
Matched pair t-test			(-6.68)	
Wilcoxon signs test			(p = 0.0001)	
High Spread Stocks	3.98	3.78	0.20	56.3*
Binomial t-test				(1.72)
Matched pair t-test			(1.61)	
Wilcoxon signs test			(p = 0.0937)	

* Significant at the 10 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

The portfolio-based findings also are confirmed by regressing cross-sectionally the interval-specific CARs of all stocks against the continuous values of their respective average pre-NMS relative spreads.[4] The positive and significant coefficients of the average pre-NMS spread variable provide additional evidence in support of the positive relationship between the potential for liquidity gains and market reaction. Consistent with market efficiency, the regression results show no evidence of significant relationship between the cumulative abnormal returns from post-NMS intervals and the pre-NMS spreads.

The above findings do not prove that the market reaction is related to changes of spreads following phase-ins. An indirect way to examine whether abnormal returns are justified by changes in spreads is to compare the pre- and post-NMS spreads of the phased-in stocks. Both matched pairs t-tests and Wilcoxon signs tests are used to test the null hypothesis of no change in spreads. Table 4 reports the average values of the pre-NMS and post-NMS spreads of the entire sample and the two portfolios of low and high spread stocks, respectively. Also reported in Table 4 are the average changes in the spreads, estimated as the mean difference of the pre- and post-NMS spreads. The post-NMS spread for each stock is the average of the bid-ask percentage spreads in the period from day +51 to day +100. To check the robustness of the tests to the choice of the measurement interval, spread changes are compared from the intervals (-50, -1) to (+1, +50) and from day -1 to day +1. The results are qualitatively similar to those reported.

The stocks with low pre-NMS spreads experience, on average, an increase in their spreads (from 1.65 percent to 2.00 percent) which is statistically significant at the 1 percent level. On the contrary, the stocks with high pre-NMS spreads experience a decline (from 3.98 percent to 3.78 percent) which is statistically insignificant. Similar evidence

[4] The results are available from the authors.

is provided by the Wilcoxon signs tests. Consistent with these results, the respective percentages of stocks with positive differences (i.e., decreases) in spreads are 37.5 percent for the low spread stocks and 56.3 percent for the high spread stocks, both statistically significantly different from the *a priori* expectation of a 50 percent proportion. Although not reported here, for both portfolios of stocks the spreads before and after inclusion in the NMS are highly and significantly correlated (Pearson correlation coefficient of 0.63 and Spearman rank order correlation coefficient of 0.69) which implies that, on average, stocks with high (low) pre-NMS spreads continue to have high (low) post-NMS spreads. Nonetheless, the spread changes reported in Table 4 indicate that the high spread stocks realize significant liquidity gains.

These findings are consistent with the prediction that high spread stocks have greater potential for liquidity gains as a result of their inclusion in the NMS. The findings are mixed regarding the association between price reaction and pre-NMS spreads. The significant positive price gains of the high spread stocks are consistent with the average spread declines of these stocks. The insignificant, but negative, price reaction for low spread stocks coupled with a significant average increase of their spreads implies that market reaction is not driven entirely by anticipated changes in liquidity costs for this group of stocks. Yet the significant positive relationship between abnormal returns and the pre-NMS spread (according to the cross-sectional regression results) suggests that the less than consistent market reaction found in the portfolio approach may be due more to the dichotomous classification of stocks into portfolios of low and high pre-NMS liquidity than to the pre-NMS spread as predictor of liquidity gains and price reaction.

For a more direct test of the relationship between price reaction and the changes in liquidity costs (identified by spread changes), the CARs of various intervals are regressed cross-sectionally against the relative spread changes. The relative spread change of a stock is estimated as the log of the ratio of the post-NMS to the pre-NMS spread. If the market correctly anticipates the changes in spreads, the CARs should be negatively related to the relative spread changes.

As Table 5 shows, the regression coefficient of the spread variable is negative and significant for the intervals (-29, -1), (-20, -1), and (-10, -1) which confirms the prediction that announcements of NMS phase-ins are associated with a positive market reaction. Investors apparently anticipate the reduced liquidity costs from trading on the NMS segment of Nasdaq. These regression results strengthen the evidence obtained from the portfolio-based tests of this study and Baker and Edelman (1990).

The evidence from the preceding results supports four conclusions. First, the market anticipates stocks to realize differential liquidity gains from NMS trading and reacts according to the expected change in the bid-ask spread. Second, value gains from NMS phase-ins are positively related to the potential for liquidity gains which is proxied by the level of the pre-NMS relative spread. Third, the stocks with the high pre-NMS spreads are those that experienced spread declines as opposed to the low spread stocks which experience significant spread increases. Fourth, the price reaction is consistent with the actual changes in spreads following the NMS phase-in.

Table 5—Results of the Regression CAR = b_0 + b_1 SPREADIFF

CAR is the cumulative average daily abnormal return estimated by the mean-adjusted method and using an estimation period that combines the pre-phase-in days -99 to -30 and the post-phase-in days +30 to +99. SPREADIFF is the log of the post-NMS average spread to the pre-NMS average spread. The post-NMS average spread is the mean percentage spread of days +51 to +100, and the pre-NMS average spread is the mean percentage spread of days -100 to -51. Number of stocks in regression: 672. Numbers in parentheses are t-values

Interval	b_0	b_1	R^2
(-29,-1)	0.0223*	-0.0013***	0.0321
	(1.90)	(-4.71)	
(-20,-1)	0.0156	-0.0009***	0.0229
	(1.59)	(-3.96)	
(-10,-1)	0.0056	-0.0005***	0.0138
	(0.84)	(-3.07)	
(-5,-1)	0.0025	-0.0001	0.0024
	(0.67)	(-1.26)	
(0,0)	0.0052***	-0.0000	0.0024
	(4.74)	(-1.28)	

* Significant at the 10 percent level for a two tailed test
** Significant at the 5 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

MARKET REACTION TO THE PRE-NMS NUMBER OF MARKET MAKERS AND THE PRE-NMS SPREAD

An implication of Seguin's (1991) findings is that the market may infer the expected change in spreads from the pre-NMS number of market makers. In particular, the stock price reaction should be positively related to the number of market makers. Therefore, the previously reported regression of CARs against the pre-NMS spreads is re-estimated by including the number of market makers as an alternative predictor of spread changes.

Table 6 reports the relevant test results. No evidence of a significant relationship exists when regressing cumulative abnormal returns against the log of the number of market makers only. Therefore, the pre-NMS number of market makers alone has no predictive power regarding the price reaction to phase-ins. When the cumulative returns are regressed against both the spread and the number of market makers (log form), both explanatory variables have positive and significant coefficients for the intervals (-29, -1), (-20, -1), and (-10, -1). These results do not necessarily refute Seguin's evidence that the number of market makers is negatively related to the spread change (i.e., the more market makers, the greater the spread reduction). Nonetheless, they suggest that the pre-NMS spread is a consistent predictor of the market reaction to anticipated marketability gains.

ADDITIONAL TESTS AND EVIDENCE

The findings show that the pre-NMS spread remains a significant predictor of market reaction to NMS listings even after accounting for the number of market makers. In this connection, it is interesting to investigate whether market reaction to potential liquidity gains is related to other observable determinants of the spread or the unexplained portion of the pre-NMS spread.[5]

[5] The authors thank an anonymous reviewer for suggesting this line of reasoning.

Table 6—Results of the Regression CAR = c_0 + c_1 LOGMM + c_2 SPREADBEF

CAR is the cumulative average daily abnormal return estimated by the mean-adjusted method and using an estimation period that combines the prephase-in days -99 to -30 and the postphase-in days +30 to +99. LOGMM is the log of the average number of market makers in the prephase-in period. SPREADBEF is the mean percentage spread of days -100 to -51. The number of stocks in the regression is 672. Numbers in parentheses are t-values

Interval	c_0	c_1	c_2	R^2
(-29,-1)	-0.0623	0.0378		0.0035
	(-1.14)	(1.53)		
(-29,-1)	-0.2769***	0.0770***	4.6141***	0.1133
	(-4.88)	(3.25)	(9.10)	
(-20,-1)	-0.0440	0.0267		0.0025
	(-0.97)	(1.30)		
(-20,-1)	-0.2200***	0.0588***	3.7837***	0.1093
	(-4.65)	(2.98)	(8.96)	
(-10,-1)	-0.0230	0.0128		0.0013
	(-0.75)	(0.92)		
(-10,-1)	-0.1374***	0.0336**	2.4577***	0.0997
	(-4.27)	(2.50)	(8.55)	

* Significant at the 10 percent level for a two tailed test
** Significant at the 5 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

To examine this conjecture, two regressions are estimated using pre-NMS data. The first is a cross-sectional regression of the relative spread on the following variables: the inverse of the share price, the inverse of the share price squared, the daily price variance, the number of shares outstanding, and the number of market makers. The second is a cross-sectional regression of the variable SPREADIFF on the same variables. SPREADIFF measures the change in spread as the log of the ratio of the post- to the pre-NMS average relative spread. All variables are measured as averages over the interval (-100, -51).

The market reaction to the potential for spread reduction is tested by constructing the following four models. The first model regresses the CAR (-10, -1) against the fitted value of the spread regression and the residuals of that regression. The second model regresses the same CAR against the independent variables of the spread regression and the residuals of that regression. The third and fourth models regress the CAR (-10, -1) against the fitted values and the residuals and the independent variables and the residuals, respectively, from the SPREADIFF regression specified above.[6] Using CARs from other windows in the pre-NMS period produces qualitatively similar results.

In Table 7 the CARs are regressed against the fitted values and the residuals of the spread and SPREADIFF models in equations (1) and (3), respectively. In both regressions only the fitted value variable is significantly related to the CARs. In equations (2) and (4) the CARs are regressed against the individual determinants of the spread and the residuals. The results in equations (2) and (4) suggest that only the inverse of the price and the squared value of that variable ar significantly related to the CARs which implies that the

[6] For each stock the fitted value of the relative spread or SPREADIFF is estimated from the parameter estimates of the corresponding regression and the stock-specific values of the independent variables.

Table 7—Results of the Regression of CARs on Spread Determinants

CAR is the cumulative average daily abnormal return of the interval -10 to -1,estimated by the mean-adjusted method and using an estimation period that combines prephase-in days -99 to -30 and post-phase-in days +30 to +99.

Model 1: $CAR = a_0 + a_1Z + a_2RESID$
Model 2: $CAR = a_0 + a_1RESID + a_2PRC + a_3PRC2 + a_4PRCVAR + a_5SHARE + a_6NMM$
Model 3: $CAR = a_0 + a_1Z + a_2RESID$
Model 4: $CAR = a_0 + a_1RESID + a_2PRC + a_3PRC2 + a_4PRCVAR + a_5SHARE + a_6NMM$

Models 1 and 2 use fitted values and residuals from regressing the mean percentage spread (SPREAD) of days -100 to -51 against the inverse of the share price (PRC), the square of the inverse of the share price (PRC2), the variance of the share price (PRCVAR), the number of shares outstanding (SHARE), and the pre-NMS number of market makers (NMM). Models 3 and 4 use fitted values and residuals from regressing the log of the post-NMS average spread to the pre-NMS average spread (SPREADIFF) of days -100 to -51 against the inverse of the share price (PRC), the square of the inverse of the share price (PRC2), the variance of the share price (PRCVAR), the number of shares outstanding (SHARE), and the pre-NMS number of market makers (NMM). The number of stocks in each regression is 672. Numbers in parentheses are t-values

Variables	Model 1	Model 2	Model 3	Model 4
Intercept	-0.0719***	-0.0388**	0.0172**	-0.0388**
	(-6.08)	(-2.28)	(2.40)	(-2.28)
Fitted Value (Z)	2.7563***		-0.0061***	
	(8.21)		(-8.77)	
RESID	1.0010	1.0010	-0.0002	-0.0002
	(1.50)	(1.55)	(-1.12)	(-1.15)
PRC		0.3885***		0.3885***
		(10.46)		(10.46)
PRC2		-0.0328***		-0.0328***
		(-8.64)		(-8.64)
PRCVAR		0.0003		0.0003
		(1.18)		(1.18)
SHARE		-0.0000		-0.0000
		(-1.06)		(-1.06)
NMM		-0.0007		-0.0007
		(-0.41)		(-0.41)
F-value	34.78***	20.30***	39.04***	20.08***
Adjusted R-square	0.1026	0.1638	0.1140	0.1623

** Significant at the 5 percent level for a two tailed test
*** Significant at the 1 percent level for a two tailed test

statistical significance of the fitted value variable in equations (1) and (3) is derived from the significant effects of the two price-related variables on market reaction. The inverse relationship between price and CARs implied by the positive sign of the regression coefficient of that variable suggests that low price stocks experience greater CARs than do high price stocks. In Table 2 the high spread stocks have a significantly lower average share price than do low spread stocks. Stoll (1978) also shows that relative spread is inversely related to price. Consequently, the positive relationship of market reaction to pre-NMS share price is consistent with the prediction that high spread stocks experience a more favorable market reaction to the NMS listing news because of their potential to realize liquidity gains.

Because an NMS listing could be either mandatory or voluntary until 1989, spread changes and market reaction may have been affected by the initiation procedure. Thirty-four mandatory and 201 voluntary listings are identified from the sample of 672 stocks. T-tests of the difference of spread changes (from the pre-NMS to the post-NMS period) between the samples of mandatory and voluntary phase-ins could not reject the null

hypothesis of zero difference. This finding also holds for tests of differences in spread changes between mandatory and voluntary phase-ins within each portfolio of low and high spread stocks. The findings suggest no relationship between the spread behavior following phase-ins and the type of listing, i.e., mandatory versus voluntary.

Although the bid-ask spread is the most direct indicator of the cost (price) of liquidity, another measure of liquidity is the AMIVEST ratio, the dollar trading volume necessary to move the price 1.0 percent. The less the price moves as dollar trading volume increases, the greater the liquidity is considered to be. Changes in the AMIVEST ratio are investigated by computing the pre-NMS and post-NMS average AMIVEST ratios from day -100 to -51 and day +51 to +100, respectively. Results of the matched pair t-test and the Wilcoxon signed-ranks test (not reported here) show that both portfolios of stocks realize significant improvements in their average AMIVEST ratios, as reported also in Baker and Edelman (1990). The insignificant abnormal returns reported for the high spread stocks in Table 3, however, indicates that price reaction is consistent with the limited potential of these stocks for spread reduction despite improvement in their AMIVEST ratio.

SUMMARY AND CONCLUSIONS

This study examines whether price reaction to news of stock switching to the NMS is associated with liquidity benefits, i.e., a reduction of the bid-ask spread. Tests confirm that the market reaction to NMS transfers is directly related to reductions in spreads. The paper also examines whether the relationship between pre-NMS spreads and the market reaction is consistent with liquidity gains of transferred stocks. The findings confirm the previously reported evidence that price reaction is positively related to the potential for liquidity gains as measured by the level of the pre-NMS bid-ask spread. Moreover, the comparison of the spreads before and after the NMS phase-in shows that the stocks with high pre-NMS spreads experience significant declines in the spreads, but stocks with low pre-NMS spreads had significant increases in their spreads. Overall, our findings confirm that the price reaction to the news of NMS phase-ins is related to anticipated improved liquidity gains, as reported in previous studies.

The third objective of the study is to examine whether the pre-NMS spread maintains its significant relationship to the price reaction to NMS transfers after accounting for the pre-NMS number of market makers. The findings show that the pre-NMS level of the spread remains a significant predictor of market reaction to anticipated liquidity gains even after accounting for the impact of the number of market makers. This conclusion is further supported by the finding that the market reaction to NMS listings is significantly (and inversely) related to only one of the observable determinants of the spread: the share price which has been shown to be inversely related to the relative spread.

Several additional tests reveal that the above findings are robust to various sources of bias, including the estimation periods for the spreads, the January anomaly, and the type of phase-in (mandatory versus voluntary).

This study is important in two respects. First, it confirms earlier evidence that stocks derive differential benefits when they move to another marketplace which investors perceive to afford superior liquidity. A reliable predictor of this postlisting liquidity performance is the level of the prelisting spread. A policy implication of these findings is that

low spread stocks mandatorily transferred to the NMS realized, on average, value losses. Under the present practice of voluntary transfers, the findings suggest that the NMS listing is value-enhancing only for high spread Nasdaq stocks.

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