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Transactions Costs and Holding Periods for Common Stocks

ALLEN B. ATKINS and EDWARD A. DYL*

ABSTRACT

Amihud and Mendelson (1986) and Constantinides (1986) provide a theoretical basis for the proposition that assets with higher transactions costs are held by investors for longer holding periods, and vice versa. We examine average holding periods and bid-ask spreads for Nasdaq stocks from 1983 through 1991 and for New York Stock Exchange (NYSE) stocks from 1975 through 1989 and find strong evidence that, as predicted, the length of investors' holding periods is related to bid–ask spreads. We also find that the relation between holding periods and bid–ask spreads is much stronger on Nasdaq, where spreads are larger, than on the NYSE, where spreads are smaller.

EARLY ARTICLES BY Harold Demsetz (1968) and Jack Treynor, writing under the pseudonym Walter Bagehot (1971), examine the importance of transactions costs and, in particular, the bid–ask spread, for investment decisions. These seminal papers gave rise to much research regarding the determinants of the bid–ask spread,[1] the size of bid–ask spreads in various markets,[2] the role of bid–ask spreads in explaining so-called stock market anomalies,[3] and the effect of bid–ask spreads on returns from common stocks.[4] Several of the latter studies also suggest that the bid–ask spread causes a clientele effect. That is, it affects the frequency with which investors trade securities and causes investors with longer (shorter) expected holding periods to hold the assets with the higher (lower) transactions costs. This study investigates whether investors with longer (shorter) investment time horizons hold common stocks with higher (lower) bid–ask spreads.

Amihud and Mendelson (1986) examine the effect of bid–ask spreads on investors' holding periods and present a formal proof of their Proposition I, which states, "Assets with higher spreads are allocated in equilibrium to portfolios with (the same or) longer expected holding periods" (p. 228). That is,

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[1] Tinic (1972), Benston and Hagerman (1974), and Stoll (1978).

[2] Branch and Freed (1977), Hamilton (1976), and Marsh and Rock (1986).

[3] Stoll and Whaley (1983), Keim (1989), and Atkins and Dyl (1990).

[4] Amihud and Mendelson (1986, 1989), Constantinides (1986), Chen and Kan (1989), and Eleswarapu and Reinganum (1993).

in equilibrium, a higher (lower) bid–ask spread results in the underlying security being owned by investors who expect to hold the security for a longer (shorter) time. In a similar vein, Constantinides (1986) investigates the effect of transactions costs on capital market equilibrium and concludes that "... investors accommodate transactions costs by drastically reducing the frequency and volume of trade" (p. 859). Since the bid–ask spread is a transactions cost that varies across securities, the behavior postulated by Constantinides is likely to result in the clienteles hypothesized by Amihud and Mendelson. Amihud and Mendelson provide empirical evidence consistent with their Proposition II, which states, "In equilibrium, the observed market (gross) return is an increasing and concave piecewise-linear function of the (relative) spread." Their Proposition I, however, relating investors' holding periods and bid–ask spreads, remains untested.

The basic proposition that the cost of transacting affects the volume of trade and, ceteris paribus, investors' holding periods, is intuitively appealing and appears to be widely accepted. For example, Bhide (1993) attributes the relatively short holding periods observed for common stocks in the United States to lower transaction costs in United States markets versus foreign stock markets. In a similar vein, both proponents and opponents of a securities transaction tax (STT), designed to reduce "excess speculation" in the United States stock and futures markets, agree that the resulting increase in the cost of transacting will reduce the volume of trading in these markets.[5] The proponents of the STT assume that this reduced trading, with concomitant longer holding periods, will decrease market volatility. Umlauf (1993) presents evidence that the imposition of an STT in Sweden reduced the rate of turnover in Swedish stock markets (although it did not affect volatility). Umlauf notes, however, that his finding is only one data point. Epps (1976) and Jarrell (1984) also document a relation between transactions costs and trading. Epps examines transactions costs and trading volumes for a random sample of 20 common stocks during 1968 and estimates that a 10 percent increase in the cost of transacting would lead to a decline in trading volume of approximately 2.5 percent. Jarrell observes that average brokerage commissions fell by about 30 percent from May 1975 through 1978 and that share turnover from May 1975 through 1981 was 30 percent higher than it was during the period from 1968 through April 1975. These studies provide evidence that trading volume is inversely related to transactions costs.

Additional evidence of an association between transactions costs and trading volume can be found in the literature on bid–ask spreads. Demsetz (1968) finds that spreads (measured in dollars) are inversely related to two proxies for trading volume, the number of transactions per day, and the number of shareholders, and concludes that trading costs decline as trading activity increases. Tinic (1972) finds an inverse relationship between dollar spreads and daily trading volume, and concludes that transactions costs are lower for

[5] Stiglitz (1989), Summers and Summers (1989), Grundfest and Shoven (1991), and Schwert and Seguin (1993).

issues that are traded heavily and continuously. Bentson and Hagerman (1974) find that the scale of trading (measured by the number of shareholders) is negatively related to spreads (again, measured in dollars), and conclude that this finding is evidence of economies of scale in trading. Stoll (1978) similarly reports an inverse relation between spreads and trading volume. Although the findings of these studies are consistent with transactions costs affecting trading behavior in the manner posited by Amihud and Mendelson and Constantinides, these authors all conclude it is trading activity that results in lower spreads rather than vice versa.

This study provides empirical evidence about the relationship between the bid–ask spreads of common stocks and the average length of time that investors hold those stocks. The following section reports empirical findings regarding average holding periods and bid–ask spreads for firms traded on Nasdaq and on the New York Stock Exchange (NYSE). Section II investigates the relationship between changes in holding periods and changes in bid–ask spreads for these firms. Section III examines the issue of the direction of causality (i.e., Granger causality) between holding periods and bid–ask spreads. Our conclusions are summarized in Section IV.

I. Holding Periods and Bid-Ask Spreads

We use two-stage least squares regression to examine the relationship between bid–ask spreads and the average holding period for common stocks trading on Nasdaq from 1983 through 1991 and for stocks trading on the NYSE from 1975 through 1989. The following sections describe this regression model, the data, and the results of the regressions.

A. The Regression Model

The focal point of this study is on the relationship between investors' average holding periods and the bid–ask spread. Factors other than the bid–ask spread, however, may also influence the average holding period observed for investors in a particular firm's common stock. Such factors must also be included in the regression model for the model to be well-specified. We therefore include two additional variables in the regression: the market value of the firm's common stock and the variance of the firm's daily returns over the year. Larger firms are assumed more likely to be considered investment grade than smaller firms, so we may observe longer holding periods for larger firms than for smaller firms. Karpoff (1986) suggests that volume is high when investors' expectations are diverse. Large firms are followed by more analysts, which may reduce the divergence of investors' expectations, resulting in less trading and hence longer holding periods. In addition, studies have shown that larger firms are generally less risky than smaller ones, which may affect holding periods.[6] The stocks of large firms may also have greater stability in the

[6] Stoll and Whaley (1983) document that both total risk, measured as the standard deviation of stock returns, and systematic risk, measured by beta, are a decreasing function of a firm's size.

parameters of their return distributions. If so, investors need to do less portfolio rebalancing with large firms' stocks, and the average holding periods will be longer.

The variance of the firm's daily stock returns is a direct measure of the volatility of the firm's stock. If volatility is a consequence of short-term trading, we would expect to observe an inverse relationship between investors' holding periods and the variance of the firm's returns. Higher volatility indicates greater asymmetry in information, which may induce more trading and shorten holding periods. The variation in volatility from year to year may also capture the effect of omitted variables, such as changing economic conditions, that influence the investors' holding periods.

The periods that we study are relatively long and may encompass events that influence investors' holding periods, such as changes in the tax laws. In addition, both Nasdaq and the NYSE were growing and changing during these periods in various ways. To capture the possible effect of time-specific events on average holding periods, we include a separate dummy variable in our regression model denoting each year in each of the samples.

We estimate the coefficients of the following equation to examine the relation between investors' holding periods and the bid–ask spreads on common stocks:

$$\text{HldPer}_{iT} = \alpha + \beta_1 \text{ Spread}_{iT} + \beta_2 \text{ MktVal}_{iT} + \beta_3 \text{ VarRet}_{iT} + \sum_{j=4}^{k} \beta_j D_T + \varepsilon_{iT} \quad (1)$$

where HldPer_{iT} is the average length of time that investors hold the stock of firm i during year T, Spread_{iT} is an estimate of the average percentage bid–ask spread on firm i's shares during year T, MktVal_{iT} is the average market value of firm i's shares during year T, VarRet_{iT} is the variance of firm i's daily stock returns during year T, the D_Ts are 0, 1 dummy variables denoting year T, α and the βs are parameters of the model, and ε_{iT} is an error term. All of the variables except the D_Ts are expressed as natural logarithms. The use of the natural logarithms for the variables eliminates the severe skewness present in the raw data. After the logarithmic transformation, the distribution of each of the variables is essentially normal.

We cannot use ordinary least squares to estimate these relationships directly because it is likely that the investors' holding period and the bid–ask spread for each stock are simultaneously determined. The use of the bid–ask spread as an exogenous independent variable in regression equation (1) would therefore result in coefficient estimates that are biased and inconsistent.[7]

Lakonishok and Shapiro (1986) also report that beta and the standard deviation of stock returns are a decreasing function of the market value of the firm. In addition, numerous others have reported that beta and firm size are inversely related (i.e., see Keim (1983), Brown, Keim, Kleidon, and Marsh (1983), Basu (1983), and Barry and Brown (1984)).

[7] See Ramanathan (1992, p. 533.)

Two-stage least squares is an appropriate estimation procedure, using an instrumental variable to estimate the bid–ask spread. We employ the bid–ask spread for each firm from the previous year as an instrumental variable, since there is no reason to believe that this year's holding period and last year's bid–ask spread are jointly determined. In addition, the lagged bid–ask spread has the desired property of being an instrumental variable that is highly correlated with this year's spread.[8] We estimate the following first-stage regression:

$$\text{Spread}_{iT} = \alpha + \beta_1 \text{ Spread}_{iT-1} + \beta_2 \text{ MktVal}_{iT} + \beta_3 \text{ VarRet}_{iT} + \varepsilon_{iT} \qquad (2)$$

where Spread_{iT-1} is the natural logarithm of the average percentage bid–ask spread on firm i's shares during year $T - 1$ and the other variables are as defined earlier. Spread_{iT}, estimated from equation (2), is the measure of bid–ask spread employed in equation (1).

B. The Data

B.1. The Nasdaq Sample

The data for Nasdaq stocks are obtained from the *Center for Research in Security Prices* (CRSP) Nasdaq National Market System (NMS) file for the years 1983 through 1991. The original data are all firms with a price of at least one dollar per share for which data are available for bid–ask spread, annual trading volume, and market value. To prevent atypical firms from influencing our results, we delete firms with reported trading volume less than 25,000 shares per year, with fewer than 500,000 shares outstanding, and with average bid–ask spreads less than 0.2 percent or greater than 50 percent. These procedures eliminate extremely small firms and firms that seldom trade. (The relevance of the bid–ask quotes for firms that almost never trade is questionable.)

The percentage bid–ask spreads and market values computed for each firm are an average of daily observations for the year. We compute the average annual bid–ask spread for each stock i for each year T as follows:

$$\text{Spread}_{iT} = \left[\sum_{t=1}^{N} \frac{\text{Ask}_{it} - \text{Bid}_{it}}{(\text{Ask}_{it} + \text{Bid}_{it})/2} \right] \Big/ N \qquad (3)$$

[8] Three stage-least squares can result in asymptotically more efficient estimates than two-stage least squares. In our analysis, however, the three-stage least squares estimation procedure will be the same as the two-staged least squares estimation procedure because the equations in the system are exactly identified. We present only the two-stage results. See Judge, *et al* (1988, p. 646–651).

where Ask_{it} and Bid_{it} are, respectively, the ask and bid prices reported by CRSP for stock i on day t, and N is the total number of trading days for stock i during year T.

The average holding period of each firm's investors for each year is computed by dividing the number of outstanding shares in the firm by the firm's annual trading volume. That is, for each year T the average holding period (in years) for each firm's common stock is computed as follows:

$$\text{Holding Period}_{iT} = \frac{\text{Shares Outstanding in Year } T}{\text{Trading Volume in Year } T}. \tag{4}$$

This average holding period, observed ex post, is a proxy for the average investor's ex ante investment horizon. The computation of investors' average holding periods is only a crude approximation of investors' time horizons, because a particular firm's investors are not likely to all hold the firm's shares for the same length of time; the so-called average investor in the firm is simply a useful hypothetical construct. Nonetheless, as a practical matter, employing estimates of investors' average holding periods is reasonable when investigating the relationship between transactions costs and investors' time horizons. Although Amihud and Mendelson's proposition is stated in terms of investors holding periods, Constantinides' result is simply that higher transactions costs result in lower trading volume. Since trading volume appears in the denominator of equation (4), our investigation of the relationship between holding periods and spreads also provides evidence regarding Constantinides' proposition.

The measure of trading volume used in the denominator of equation (4) is not the raw trading volume reported for Nasdaq NMS common stocks. Nasdaq is a dealer market, and a dealer is either the buyer or the seller in almost every trade. Each trade is reported within 90 seconds of execution for Nasdaq NMS stocks and is included in the total trading volume reported at the end of the day. This procedure greatly overstates the actual number of trades occurring between public investors.[9] For example, consider the situation where Investor A sells 100 shares of stock to Dealer X and then later in the day Investor B purchases this same 100 shares from Dealer X. Nasdaq NMS reports trading volume of 200 shares for the stock, when only 100 shares actually changed hands between public investors.[10] Trading volume reported for Nasdaq NMS stocks must therefore be approximately halved to obtain a measure of actual trading volume comparable to the trading volumes reported for NYSE stocks.[11]

[9] During the period we study, this procedure applied only to the NMS stocks. Trading volume reported for non-NMS stocks was the greater of the dealers' total purchases or sales of stock i for the day, a procedure which may result in less overcounting. Since June 15, 1992, however, trading volumes for all stocks traded on Nasdaq are reported using the NMS procedure.

[10] This problem is of less consequence on the NYSE, which is primarily an auction market where investors are generally the principals on both sides of a trade.

[11] The use of a 50 percent adjustment factor is supported by the findings of Atkins and Dyl (1997), who investigate changes in reported trading volume for firms that switch from being traded

The holding periods we compute for Nasdaq NMS stocks are based on this estimate of the actual volume of trading by public investors rather than on the trading volume reported.

Mean and median bid–ask spreads, holding periods, market values, and the variances of daily returns for Nasdaq firms are shown in Panel A of Table I. The sample comprises more than 2000 firms for each year except 1983 and 1984, which have 680 firms and 1215 firms, respectively. There are fewer firms in 1983 and 1984 because firms were being gradually incorporated into Nasdaq's newly formed National Market System during these years. Table I shows data on an annual basis (Panel A.1) and for the entire nine-year period (Panel A.2). The mean and median bid–ask spreads for the pooled sample of 20,581 firms over nine years are 5.14 percent and 3.75 percent, respectively. The large difference between the mean and median bid–ask spreads indicates that the distribution of spreads for the firms in our sample is highly skewed, so that the median values are more indicative of bid–ask spreads for typical Nasdaq NMS stocks. The median bid–ask spread in our sample increases from 1.90 percent in 1983 to 5.00 percent in 1991. Bid–ask spreads are considerably lower in 1983 than in later years, presumably because Nasdaq initially incorporated larger firms into the NMS; larger firms ordinarily have smaller percentage bid–ask spreads. The relatively large mean and median market values reported for 1983 (i.e., relative to the values for later years) support this conjecture. Investors held these Nasdaq stocks for an average of 6.99 years, with a median holding period of 3.38 years. The annual data reported in Panel A.1 do not exhibit a clear trend in investors' holding periods.

The market value of the firm and the variance of the firm's daily returns are used in the regression analysis as control variables. Table I also shows summary statistics for these variables. The average market value for the firms in the sample is $132 million, with a median market value of $47 million. Market values were relatively constant over the nine-year period, except for the previously mentioned high value in 1983. Daily return variance exhibits an upward trend. The mean and median variances jump in 1987, which may be due to the stock market crash, and they remain high post-1987.

B.2. The NYSE Sample

Annual observations of the bid–ask spread on the last trading day in each year are available for a large sample of NYSE firms for the period from 1975 through 1989. We employ these data to examine the relationship between bid–ask spreads and average holding periods for NYSE firms. The data for the 1975 through 1979 period are obtained from Hans Stoll, and are the data used in Stoll and Whaley (1983). Similar data for the 1980 through 1989 period are obtained from Marc Reinganum and are those used in Eleswarapu and Rein-

on Nasdaq to being traded on the NYSE. They find that, on average, trading volume falls by 50 percent following the change in trading location.

Table I

Bid–Ask Spreads, Holding Periods, Market Values, and Variances

The average bid–ask spread for stocks on Nasdaq for year T is the average of the bid–ask spreads for the year from the Center for Research in Security Prices (CRSP) Nasdaq tape. The average bid–ask spread for stocks on the New York Stock Exchange (NYSE) for year T is the average of the spread on the last trading day in year T and the spread on the last trading day in year $T - 1$. The average holding period for a firm's common stock is computed by dividing the number of shares outstanding by the trading volume for the year. The market value of the firm is the average annual share price times the number of shares outstanding at the end of the year. The variance of return is the variance of the daily common stock return.

		Bid-Ask Spread (Percent)			Holding Period (Years)			Market Value (millions)			Variance of Return (×100) (Percent)		
Year	No. of Observations	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.	Mean	Median	Std.
Panel A: Nasdaq Firms													
Panel A.1: Annual Data													
1983	680	2.31%	1.90%	1.71%	2.92	2.18	2.59	$194	$105	$348	0.095	0.078	0.087
1984	1215	3.28	2.73	2.32	4.38	3.13	4.42	129	62	233	0.118	0.074	0.158
1985	2198	3.85	2.97	3.17	6.30	3.39	12.10	105	45	181	0.112	0.069	0.202
1986	2708	4.15	3.23	3.36	5.67	2.91	12.79	127	50	275	0.139	0.085	0.227
1987	3032	5.06	4.00	4.03	6.08	2.96	13.45	128	46	284	0.236	0.158	0.376
1988	2964	5.49	4.11	4.70	9.06	4.43	18.96	117	39	291	0.183	0.103	0.297
1989	2722	4.79	3.60	4.08	8.10	3.70	20.38	136	44	358	0.157	0.086	0.241
1990	2539	7.06	5.29	6.03	8.46	3.96	16.80	133	40	387	0.313	0.155	0.588
1991	2523	7.15	5.00	6.42	7.33	3.22	16.72	165	49	515	0.292	0.163	0.455
Panel A.2: Overall Sample													
1983–91	20581	5.14%	3.75%	4.71%	6.99	3.38	15.60	$132	$47	$336	0.197	0.108	0.357
Panel B: New York Stock Exchange Firms													
Panel B.1: Annual Data													
1975	493	1.79%	1.30%	1.74%	5.81	4.87	5.61	$834	$283	$1849	0.075	0.049	0.075
1976	551	1.29	0.99	1.21	4.67	3.92	3.95	869	336	1728	0.045	0.029	0.052
1977	565	1.14	0.88	0.98	5.25	4.36	5.77	833	308	1749	0.034	0.022	0.045
1978	581	1.31	1.00	1.12	4.55	3.56	4.55	818	288	1720	0.046	0.030	0.052
1979	642	1.23	1.00	0.90	4.89	3.42	11.75	911	323	1922	0.044	0.028	0.043
1980	692	1.26	1.05	0.87	4.39	2.74	13.44	1067	352	2321	0.059	0.045	0.044
1981	717	1.33	1.07	0.97	4.44	3.06	15.58	1052	359	2427	0.050	0.037	0.041
1982	745	1.33	1.04	1.23	3.56	2.50	7.28	1107	435	2124	0.059	0.047	0.049
1983	778	1.15	0.96	0.86	2.86	2.04	4.60	1319	516	2615	0.046	0.038	0.034
1984	814	1.40	1.04	1.31	3.46	2.23	8.93	1322	451	2605	0.045	0.034	0.045
1985	831	1.27	0.95	1.09	2.88	1.99	5.90	1565	548	2972	0.039	0.028	0.049
1986	896	1.41	1.00	1.57	2.86	1.67	7.37	1794	569	3504	0.053	0.037	0.064
1987	986	1.72	1.25	1.65	2.65	1.49	5.85	1902	487	4559	0.099	0.078	0.083
1988	1027	1.48	1.05	1.49	4.94	2.13	17.05	2060	551	4884	0.045	0.033	0.047
1989	1101	1.48	0.99	1.62	4.62	2.02	15.58	2097	579	4443	0.044	0.026	0.085
Panel B.2: Overall Sample													
1975–89	11419	1.38%	1.03%	1.32%	4.01	2.43	10.46	$1405	$434	$3224	0.053	0.036	0.060

ganum (1993).[12] The Francis Emory Fitch Company provides the bid and ask quotes originally used to compute the bid–ask spreads in both studies. The average annual bid–ask spread for each stock in the sample is estimated by averaging the two observations of bid–ask spreads surrounding each year. That is, the average spread for each stock i for each year T is computed as follows:

$$\text{Spread}_{iT} = \left[\frac{\text{Ask}_{iT} - \text{Bid}_{iT}}{(\text{Ask}_{iT} + \text{Bid}_{iT})/2} + \frac{\text{Ask}_{iT-1} - \text{Bid}_{iT-1}}{(\text{Ask}_{iT-1} + \text{Bid}_{iT-1})/2} \right] \Big/ 2 \qquad (5)$$

where Ask_{iT} and Bid_{iT} are, respectively, the ask and bid prices for the ith stock on the last trading day in year T.

In retrospect, it is unfortunate that these spread data are collected for the last day in December, since this day is perhaps the most unusual trading day of the year.[13] In addition to the onset of the famous turn-of-the-year effect, a noticeable increase in spreads across firms of all sizes occurs during the last week of the year (see Fortin, Grube, and Joy (1989)). The existence of this anomaly is not germane to our study, however, since we are not concerned with the absolute size of the bid–ask spread. Rather, we are interested in the differences in the magnitudes of bid–ask spreads among different firms. These differences are likely to exist in the same rank order on the last trading day in December as during the rest of the year. We investigate this issue by obtaining bid–ask spreads for the last trading day in May from 1975 to 1989 from the Francis Emory Fitch Company. We obtain 9,560 observations that we are able to match with the annual spreads in the Stoll/Whaley data. The Spearman rank correlation between these mid-year spreads and the corresponding Stoll/Whaley spreads is 0.688 (p-value = 0.0001) and the Pearson (common) correlation is 0.709 (p-value = 0.0001). The year-end spreads in the Stoll/Whaley data thus appear to be representative of spreads at other times during the years, at least for our purposes.

Data used to compute the average length of time that investors hold the individual stocks in our sample are from the CRSP monthly master file. We compute the average holding period of each firm's investors for each year by dividing the number of shares each firm had outstanding by the firm's annual trading volume. This is the same procedure used for the sample of Nasdaq firms (see equation 4), except that we use reported trading volume (unadjusted) to compute the average holding period for NYSE stocks. We again measure the average market value of each firm during each year by multiplying the firm's average stock price by the number of shares outstanding.

The availability of data required to compute average annual bid–ask spreads, average annual holding periods, market values, and daily return variances determines the number of observations in each year. The number of

[12] We again thank Stoll and Whaley and Eleswarapu and Reinganum for providing these data.

[13] Eleswarapu and Reinganum (1993) collect data for the last trading day in December because they are updating the Stoll and Whaley data.

firms in the sample range from a low of 493 firms in 1975 to a high of 1,101 firms in 1989. A year-by-year summary of the data, showing the number of firms per year, annual mean and median bid–ask spreads, holding periods, market values, and daily return variances is shown in Panel B.1 of Table I. There are a total of 11,419 observations over the 15-year period from 1975 to 1989. The mean and median bid–ask spreads of 1.38 percent and 1.03 percent, respectively, remain relatively constant over the period. The average time that investors hold the stocks is 4.01 years; the median holding period is 2.43 years. The average length of time that stocks are held varies from year to year without exhibiting any clear trend over the 15-year period, although mean and median holding periods are shorter from 1982 to 1987.

Comparing the data for NYSE stocks with the data for Nasdaq stocks in Table I reveals evidence that is consistent with the hypothesis that holding periods are determined, in part, by the magnitude of the bid–ask spread. We observe a median (mean) holding period of 3.38 (6.99) years for Nasdaq stocks, where the median bid–ask spread is 3.75 percent. For NYSE stocks we observe a median (mean) holding period of only 2.43 (4.01) years and a median spread of only 1.03 percent. The longer holding periods observed in the higher-spread environment of Nasdaq support the Amihud and Mendelson and Constantinides propositions regarding the effect of transactions costs on investors' behavior.

The mean and median market values for the overall sample of NYSE firms are \$1.405 billion and \$434 million, respectively. The average market value of the firms increases from \$834 million in 1975 to over \$2 billion in 1989; the median market value increases from \$283 million in 1975 to \$579 million in 1989. The typical firm in the overall sample of NYSE stocks is roughly ten times as large as the typical firm in the Nasdaq sample. There is also a striking difference between the variance of daily returns for the NYSE and Nasdaq stocks. The median variance of the Nasdaq stocks' daily returns is three times larger than that of the NYSE stocks, and the mean variance is almost four times larger. In summary, NYSE firms and Nasdaq firms differ in many ways.

C. Regression Results

The results of estimating equation (1) for the Nasdaq firms, using two-stage regressions, are as follows:

$$\underset{}{\text{HldPer}_{iT}} = \underset{(-2.60)}{-0.101} + \underset{(89.85)}{2.097\ \text{Spread}_{iT}} + \underset{(44.51)}{0.426\ \text{MktVal}_{iT}} + \underset{(-92.87)}{-0.941\ \text{VarRet}_{iT}}$$

The coefficient on the bid–ask spread variable is positive and significant at the 0.01 level, with a t-statistic of 89.85. This finding provides strong support for the hypothesis that investors' holding periods for common stocks are related to the level of transactions costs in the manner predicted by Amihud and Mendelson (1986) and Constantinides (1986). The regression coefficients on firm size and on the return variance also have the expected signs and are highly significant. Longer holding periods are associated with larger firms, and

shorter holding periods are associated with more volatile firms. The coefficients (not reported) on six of the seven dummy variables denoting particular years are also significant. The adjusted R^2 of the regression is 0.434, indicating that a substantial proportion of the variation in investors' holding periods for Nasdaq common stocks is explained by the variables in our analysis.[14]

The results of the two-stage regression analysis for the NYSE firms are:

$$\underset{}{\text{HldPer}_{iT} =} \underset{(-10.29)}{-1.002} + \underset{(25.13)}{1.168\ \text{Spread}_{iT}} + \underset{(17.60)}{0.240\ \text{MktVal}_{iT}} + \underset{(-47.24)}{-0.693\ \text{VarRet}_{iT}}$$

The coefficient on the bid–ask spread variable is again positive and significant at the 0.01 level, with a *t*-statistic of 25.13. The coefficients on firm size and return variance also have the expected sign and are significant, as are the coefficients (unreported) on 11 of the 13 annual dummy variables.[15] The overall findings regarding NYSE stocks are very similar to the results we report for Nasdaq stocks, although the R^2 of the NYSE regression is only 0.272. A smaller portion of the variation in holding periods for NYSE stocks is explained by the regression model. In addition, both the magnitude and significance of the coefficient on Spread_{iT} is lower for NYSE stocks. These differences between the relationships found for Nasdaq and NYSE firms are not surprising, given the levels of bid–ask spreads in the two markets. Recall that the median (mean) bid–ask spread for the stocks in the Nasdaq sample is 3.75 (5.14) percent, which is more than 3½ times the median (mean) spread of 1.03 (1.38) percent for the stocks in the NYSE sample. Transactions costs do not have as great an influence on investors' behavior when transactions costs are relatively low.

To test whether the relationship between investors' holding periods and bid–ask spreads has been stable over time, we also estimate equation (1) for each year. These results are shown in Table II. The coefficient on the bid–ask spread variable has the expected sign and is significant in each year for both the Nasdaq (Panel A) and NYSE (Panel B) samples. The coefficients on MktVal_{iT} and VarRet_{iT} are also of consistent sign and significant from year to year. The R^2s for the Nasdaq regressions range from 0.270 in 1985 to 0.534 in 1991. The R^2s for the NYSE regressions range from 0.086 in 1986 to 0.580 in 1978, and are generally higher from 1976 to 1980 than in subsequent years. This result may be associated with the longer average holding periods during the earlier period (see Panel B.1 in Table I).

Although market value is included as a variable in equation (1), we also run the regressions for market value deciles (omitting MktVal_{iT}) to determine if

[14] The simple correlation between spread and market value in our raw data is −0.216. The correlation between the variables after the logarithmic transformation is −0.798. These values indicate strong multicollinearity, but although multicollinearity increases standard errors (thereby reducing *t*-statistics) it does not bias the estimates of the coefficients. Multicollinearity, therefore, is not a problem, in view of the magnitude of the *t*-statistics reported for the regressions. See Kennedy (1992, p. 181).

[15] There is again multicollinearity between the spread and market value variables. See footnote 14.

Table II

Annual Holding Period Regressions

This table shows the relationship between holding periods, bid–ask spreads, market values and variances for Nasdaq for 1983–1991 and New York Stock Exchange (NYSE) common stocks for 1976–1989. The results are from the following two-stage least squares regression:

$$\text{HldPer}_{iT} = \alpha + \beta_1 \text{ Spread}_{iT} + \beta_2 \text{ MktVal}_{iT} + \beta_3 \text{ VarRet}_{iT} + \varepsilon_{iT}$$

where HldPer_{iT} is the natural logarithm of the investors' average holding period for firm i during year T, Spread_{iT} is estimated from the first-stage regression, MktVal_{iT} is the natural logarithm of firm i's market value at the end of year T, VarRet_{iT} is the natural logarithm of the variance of the daily return of firm i's common stock, α, β_1, β_2, and β_3 are parameters to be estimated, and ε_{iT} is an error term.

Period	Number of Observations	α (t-value)	β_1 (t-value)	β_2 (t-value)	β_3 (t-value)	Adj. R^2
			Panel A: Nasdaq			
1984	662	−0.224	1.338	0.276	−0.714	0.334
		(−1.55)	(12.61)*	(6.76)*	(−18.13)*	
1985	1120	0.004	1.472	0.315	−0.706	0.270
		(0.03)	(16.83)*	(9.37)*	(−20.27)*	
1986	2032	0.083	1.919	0.428	−0.862	0.413
		(0.81)	(33.21)*	(17.47)*	(−33.23)*	
1987	2472	0.067	1.910	0.492	−0.841	0.482
		(0.76)	(40.45)*	(22.87)*	(−42.31)*	
1988	2706	1.135	2.139	0.463	−0.804	0.404
		(12.13)*	(39.40)*	(21.16)*	(−33.06)*	
1989	2546	0.730	2.229	0.455	−0.894	0.468
		(7.75)*	(41.50)*	(20.62)*	(−40.07)*	
1990	2367	0.203	2.623	0.558	−1.077	0.501
		(2.38)	(39.18)*	(20.93)*	(−43.06)*	
1991	2245	0.392	2.311	0.432	−0.939	0.534
		(4.19)*	(37.42)*	(16.35)*	(−38.12)*	
			Panel B: The NYSE			
1976	486	−1.106	0.526	0.092	−0.537	0.349
		(−4.37)	(7.70)*	(3.42)*	(−14.55)*	
1977	533	−0.919	0.664	0.118	−0.573	0.389
		(−3.50)*	(8.42)*	(4.36)*	(−16.31)*	
1978	543	−2.635	0.584	0.095	−0.743	0.580
		(−10.62)*	(7.42)*	(3.43)*	(−24.43)*	
1979	587	−1.017	0.879	0.165	−0.659	0.422
		(−2.10)	(5.93)*	(3.27)*	(−18.69)*	
1980	640	−1.703	0.957	0.217	−0.754	0.418
		(−3.38)*	(6.97)*	(4.86)*	(−18.88)*	
1981	680	0.014	1.386	0.355	−0.672	0.194
		(0.020)	(5.05)*	(4.29)*	(−12.40)*	
1982	709	0.005	1.186	0.244	−0.630	0.181
		(0.01)	(4.60)*	(3.16)*	(−12.00)*	
1983	744	−0.101	1.292	0.250	−0.671	0.170
		(−0.15)	(4.34)*	(3.16)*	(−11.59)*	
1984	770	−0.595	1.695	0.322	−0.895	0.113
		(−1.35)*	(4.43)*	(3.10)*	(−7.69)*	
1985	795	−0.147	1.327	0.243	−0.668	0.096
		(−0.40)	(5.33)*	(3.51)*	(−8.52)*	
1986	823	−1.284	1.119	0.214	−0.713	0.086
		(−4.35)*	(5.81)*	(4.04)*	(−8.39)*	
1987	907	−1.137	1.254	0.324	−0.707	0.108
		(−3.73)*	(6.74)*	(5.66)*	(−10.37)*	
1988	969	0.029	1.507	0.354	−0.674	0.116
		(0.09)	(8.96)*	(6.82)*	(−11.29)*	
1989	1017	−0.068	1.871	0.481	−0.771	0.117
		(−0.21)	(8.73)*	(7.20)*	(−11.71)*	

* Significant at the 0.01 level (two-tailed test).

the regression coefficients are stable across size groups. Market value deciles for each sample are formed by grouping the data for each year in deciles according to the market value of the firm's stock, and then combining these annual deciles across the years in each sample. The results (not reported) show that the coefficients on Spread_{iT} and VarRet_{iT} for each decile are of the same sign as for the overall samples, are consistent across deciles, and are all highly significant.

D. Summary

The regression results reported above support the hypothesis that investors' average holding periods are an increasing function of the bid–ask spread. Investors on both Nasdaq and NYSE who buy high-spread common stocks exhibit, on average, longer investment time horizons than investors who buy low-spread stocks. The relationship is weaker, however, in the low-spread environment of the NYSE than in the high-spread environment of Nasdaq. The coefficients on the bid–ask spread variable are lower for NYSE stocks than for Nasdaq stocks, and they have lower t-statistics, suggesting that the holding period for NYSE stocks is affected by considerations other than the bid–ask spread to a greater degree than for Nasdaq stocks.

II. Changes in Holding Periods and Changes in Spreads

In this section we investigate the effect of changes in spreads on changes in holding periods. We estimate the following regression equation:

$$\Delta\text{HldPer}_{iT} = \alpha + \beta_1\,\Delta\text{Spread}_{iT} + \beta_2\,\Delta\text{HldPer}_{mT} + \varepsilon_{iT} \qquad (6)$$

where ΔHldPer_{iT} is the change in the average holding period for stock i from year $T-1$ to year T (i.e., HldPer_{iT} minus HldPer_{iT-1}), ΔSpread_{iT} is the change in the bid–ask spread of stock i from year $T-1$ to year T, ΔHldPer_{mt} is the change in the median holding period for all firms in our sample from year $T-1$ to year T, α, β_1 and β_2 are parameters of the model, and ε_{iT} is an error term. The variables are again expressed as natural logarithms. We include the change in the average holding period for the overall market to capture the effect of marketwide changes in average holding periods from year to year on the holding periods observed for the individual firms in our sample. Such changes might be caused by the general market environment, economic conditions, changes in tax laws, or other factors that might have a common effect on investors' holding periods across all securities.

We estimate equation (6) separately for 16,169 Nasdaq firms and 10,854 NYSE firms where there was an observation of the firm's bid–ask spread in both year T and year $T-1$, a necessary condition for measuring a change in the bid–ask spread. The results for the Nasdaq stocks are as follows:

$$\begin{array}{lccc} \Delta\text{HldPer}_{iT} = & -0.029 + & 0.473\ \Delta\text{Spread}_{iT} + & 0.849\ \Delta\text{HldPer}_{mT} \\ & (-5.50) & (37.81) & (29.20) \end{array}$$

where the numbers in parentheses are t-statistics. The regression coefficients are both significant at the 0.01 level. Changes in a firm's bid–ask spread are associated with changes in the average holding period we observe for that firm. Investors' holding periods also appear to be influenced by marketwide factors. The R^2 of this regression is 0.137.

The results for the NYSE firms are as follows:

$$\begin{array}{lccc} \Delta \text{HldPer}_{iT} = & -0.0009 + & 0.083\ \Delta \text{Spread}_{iT} + & 0.963\ \Delta \text{HldPer}_{mT} \\ & (-0.23) & (11.86) & (44.75) \end{array}$$

where numbers in parentheses are t-statistics. As with Nasdaq stocks, changes in the bid–ask spread on NYSE stocks are associated with changes in investors' average holding periods in the manner we hypothesize. The R^2 of this regression is 0.163. The relationship between changes in bid–ask spreads and changes in investors' holding periods for individual Nasdaq and NYSE stocks is consistent with the proposition that holding periods are influenced by transactions costs in the manner hypothesized by Amihud and Mendelson (1986).

III. Causality Between Bid–Ask Spreads and Holding Periods

The empirical analysis presented above documents a relationship between holding periods and bid–ask spreads. We employ two-stage least squares regression analysis because it is likely that investors' holding periods and bid–ask spreads are simultaneously determined. We now examine the direction of causality between holding periods and bid–ask spreads. No perfect tests for causality exist. Nevertheless, causality as defined by Granger (1969) can shed some light on this issue. If past values of the bid–ask spread predict holding periods, then one can say that bid–ask spreads "Granger-cause" holding periods. Conversely, if past values of holding periods explain bid–ask spreads, one can say that holding periods Granger-cause bid–ask spreads. Causality that runs in both directions indicates a feedback effect.

We test to see whether bid–ask spreads Granger-cause holding periods by first running the following unrestricted regression:

$$\text{HldPer}_t = \sum_{k=1}^{3} \alpha_k\ \text{HldPer}_{t-k} + \sum_{k=1}^{3} \beta_k\ \text{Spread}_{t-k} + u_t \tag{7}$$

where k represents the number of years each variable is lagged and the variables are as defined earlier. We then examine the results from the following restricted regression:

$$\text{HldPer}_t = \sum_{k=1}^{3} \alpha_k\ \text{HldPer}_{t-k} + u_t \tag{8}$$

To test for the null hypothesis that past values of the bid–ask spread do not influence holding periods, we use a Wald F-statistic:[16]

$$F_c = \frac{(\text{ESSR} - \text{ESSU})/q}{\text{ESSU}/(N-p-q)} \tag{9}$$

where ESSR is the error sum of the squares for the restricted model and ESSU is the error sum of the squares for the unrestricted model. N is the number of observations used in the unrestricted model, p is the order of the lag for HldPer, and q is the order of lag for Spread. In this case both p and q are three.

For the NYSE data, the test results in an F-statistic of 10.16 with a p-value of 0.0001. The null hypothesis is rejected, implying that past values of the bid–ask spread do affect holding period. That is, bid–ask spreads Granger-cause holding periods. We then run the test in the opposite direction to test the null hypothesis that past values of holding periods affect the bid–ask spread. This test results in an F-statistic of 20.08 and a p-value of 0.0001. Again, we reject the null hypothesis, implying that holding periods also Granger-cause bid–ask spreads. For the Nasdaq NMS data, with HldPer as the dependent variable, the test results in an F-statistic of 69.00 with a p-value of 0.0001. When the test is run in the opposite direction, with Spread as the dependent variable, the F-statistic is 14.32 with a p-value of 0.0001. Granger-causality again runs in both directions, indicating a feedback effect between the bid–ask spread and the holding period.

We repeat these tests for Granger-causality using the yearly changes in the holding period (ΔHldPer) and yearly changes in the bid–ask spread (ΔSpread) from equation (6). For the NYSE data, with ΔHldPer as the dependent variable, the test results in an F-statistic of 21.82 with a p-value of 0.0002. For the Nasdaq NMS data, with ΔHldPer as the dependent variable, the test results in an F-statistic of 15.00 with a p-value of 0.0001. When ΔSpread is the dependent variable, the test results in an F-statistic of 44.36 with a p-value of 0.0001. These results show that Granger-causality again runs in both directions, indicating a feedback effect between changes in bid–ask spreads and changes in investors' holding periods.

These results are consistent with the relationships proposed by Amihud and Mendelson (1986) and Constantinides (1986), which are the result of equilibrium models where holding periods and transactions costs are jointly determined (although their models do not explicitly address the issue of how this equilibrium comes about). The feedback effect from holding periods to spreads is also consistent, however, with the literature on the determinants of bid–ask spreads, where high trading volume is said to cause lower bid–ask spreads.[17] The Granger-causality tests do not resolve the issue of the direction of causality.

[16] See Ramanathan (1992, p. 530).

[17] See Demsetz (1968), Tinic (1972), Benston and Hagerman (1974), and Stoll (1978).

IV. Conclusion

Amihud and Mendelson (1986) and Constantinides (1986) provide a theoretical basis for the proposition that, in equilibrium, assets with higher transactions costs will be held by investors with longer holding periods and vice versa. This study examines average holding periods and bid–ask spreads and annual changes in holding periods and spreads for Nasdaq stocks from 1983 through 1991 and for NYSE stocks from 1975 through 1989 and finds strong support for this proposition. We also find that this bid–ask spread clientele effect is much stronger in the high-spread environment that exists on Nasdaq than in the low spread environment that exists on the NYSE.

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