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Firm Size and Turn-of-the-Year Effects in the OTC/NASDAQ Market

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ABSTRACT

This paper examines the turn-of-the-year effect, the firm size effect, and the relation between these two effects for a sample of OTC stocks traded via the NASDAQ reporting system over the period 1973–1985. We find results similar to those based solely on listed stocks. The importance of these findings stems from the existence of nontrivial differences between the characteristics of the OTC/NASDAQ sample and the samples of listed firms examined previously in the literature. We also find that NASDAQ quoted bid-ask spreads are highly negatively correlated with firm size, are not highly seasonal, and are large enough to preclude trading profits based upon a knowledge of the seasonality of small firms' returns.

BOTH THE "SIZE EFFECT" and the "turn-of-the-year effect" have received much recent attention in the finance literature. Wachtel (1942), Rozeff and Kinney (1976), Branch (1977), and Dyl (1977) have all documented calendar time seasonalities in U.S. stock returns. Particularly striking are the large, regularly observed January returns. Banz (1981) and Reinganum (1981) found that, on average, small capitalization firms experience significantly higher risk-adjusted (vis à vis CAPM) returns than large firms. Keim (1983) showed that the two effects are related. A large part of the annual excess risk-adjusted return earned by small firms accrues in January, and in particular during the first few trading days in January.[1] Conversely, large firms earn significantly negative excess risk-adjusted returns in January.

Numerous other papers have further characterized these effects and investigated possible causes of the apparent anomalies.[2] Although several hypotheses concerning the size and turn-of-the-year effects have been investigated, no completely satisfactory explanation has been discovered.[3] This paper extends the

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[1] Roll (1983a) showed that the series of positive excess risk-adjusted returns actually begins on the last trading day of December.

[2] See, for example, Schneeweis and Woolridge (1979), Park and Reinganum (1986), Chan, Chen, and Hsieh (1985), Chang and Pinegar (1986), Officer (1975), Brown, Keim, Kleidon, and Marsh (1983), Berges, McConnell, and Schlarbaum (1984), and Gultekin and Gultekin (1983).

[3] Efforts to explain the observed effects have focused on the following possibilities: tax-loss selling (see Reinganum (1983), Rozeff (1985a,b), Schultz (1985), Chan (1986), and Jones, Pearce, and Wilson (1987)), transactions costs (see Stoll and Whaley (1983), James and Edmister (1983), and Schultz

effort to understand these empirical regularities by examining a sample of stocks traded in the over-the-counter (OTC) market via the NASDAQ quotation system.

The study of OTC securities is illuminating for several reasons. First, the OTC data allow us to study a large sample of firms that are much smaller than those examined by previous researchers.

Second, the characteristics of OTC firms that are small by exchange standards differ in important ways from those of small listed firms. In particular, at any given point in time, a portfolio of small NYSE firms will contain primarily firms that have recently performed poorly. This can be explained by noting that, due to NYSE listing standards, very few newly listed firms enter the NYSE population as small firms.[4] Subsequent to listing, firms that perform poorly (well) over time become small (large) by NYSE standards. Similar logic applies to AMEX firms. By contrast, OTC firms that are small by exchange standards are much less likely to have been recent losers. This is the case for two reasons. First, NASDAQ inclusion criteria are minimal in comparison with exchange listing requirements.[5] Approximately 80 percent of all stocks added to the NASDAQ list over the period 1973–1985 (the sample period covered by this study) would be ranked among the smallest 20 percent of all NYSE-AMEX stocks. Second, firms that perform poorly enough to be delisted from one of the major exchanges represent a trivial proportion of the NASDAQ market.[6] The implications that these differences in characteristics may have for the size and turn-of-the-year effects are of interest, especially in light of recent work concerning the relative performance of winners versus losers. (See DeBondt and Thaler (1985, 1987) and Chan (1988).)

A third motivation for this study is to test the robustness of the observed effects to institutional differences in market structure. The most notable distinction between the two market types is the structure of the market making system (i.e., competitive market makers versus a monopoly specialist). Among other differences between the two markets are the absence of an uptick rule and the inability to place limit orders in the OTC market. Also, many (especially small) OTC firms do not qualify for margin purchases and, thus, cannot be sold short.

Fourth, the available data for OTC stocks include information on bid-ask spreads and partial information on trading volume. These variables allow additional cross-sectional analyses of the size and turn-of-the-year effects.

Finally, returns on (non-NMS) OTC stocks are computed from successive midpoints of bid and ask prices rather than from closing transaction prices.

(1983)), information effects (see Rozeff and Kinney (1976)), statistical and/or data problems (see Roll (1981, 1983b), and Blume and Stambaugh (1983)), and misspecification of systematic risk factors (see Chan, Chen, and Hsieh (1985) and Chan and Chen (1988a,b)).

[4] For direct evidence on this point, see McConnell and Sanger (1987) and Chan and Chen (1988b).

[5] Through 1983, NASDAQ inclusion criteria required a firm to have at least two market makers, 300 round lot holders, 100,000 shares of public float, at least $1 million book value of total assets, and at least $0.5 million book value of equity. In 1984, the assets and equity requirements were raised to $2 million and $1 million, respectively. No market value requirements are imposed. See NASDAQ Fact Book (1984).

[6] Sanger and Peterson (1988) found only 121 NYSE and AMEX firms that were delisted to the NASDAQ market over the period 1973–1985. The delisted firms had an average market value of equity of $14.2 million, placing them approximately at the midpoint of the NASDAQ size distribution.

Unlike previous studies of exchange listed firms, this permits us to rule out measurement error caused by a shift in order flow from trades at the bid price to trades at the ask price as a possible explanation for any observed effects.

The next section of the paper describes the data set and methodology employed in our analysis. Section II presents evidence on the size effect for NASDAQ stocks. Section III examines the interaction between firm size and seasonality of returns. For purposes of comparison, Sections II and III also present parallel results for NYSE-AMEX stocks over the same sample period and using the same methodology. Section IV considers daily returns and trading characteristics surrounding the turn of the year. The interrelationships among firm size, returns, and bid-ask spreads are explored in Section V. Finally, Section VI concludes the paper.

I. Data and Methodology

A. The Data

The CRSP NASDAQ files provide the OTC data used in this study. These files contain daily closing prices, returns, and other periodic data (such as number of shares outstanding) for 7659 stocks that were traded in the OTC market and quoted on the NASDAQ system over the period December 14, 1972 through December 31, 1985. NASDAQ daily returns are computed from the midpoints of successive closing bid and ask quotes and include all distributions to shareholders. Prior to July 7, 1980, reported closing bid and ask quotes are medians of all quotes submitted by market makers. Afterward, closing bid and ask quotes are "inside" quotes (i.e., highest bid and lowest ask). Beginning on October 1, 1982, closing prices for National Market System (NMS) stocks are last trade prices rather than bid-ask averages. Hence, daily returns for this segment of the NASDAQ market, like those for all listed stocks, are computed from successive closing (last trade) prices.[7] Daily trading volume data are also available from November 1, 1982 through December 31, 1985. Finally, the CRSP files contain daily returns and other information on value-weighted and equally weighted indices of all NASDAQ stocks, both with and without distributions. The NASDAQ composite index and industry subindices are also available.

The NYSE-AMEX data used in this study are taken from the 1986 CRSP Daily Returns and Daily Master Files. Over the 1973–1985 period, data are available for a total of 4170 NYSE and AMEX stocks. Information on bid-ask spreads and trading volume is not available for NYSE and AMEX stocks.

B. Computing Excess Returns

In the sections that follow, we perform tests that examine the returns on various portfolios formed on the basis of size. We examine both raw returns and

[7] NMS firms are typically larger and are more actively traded than non-NMS firms. This segment of the NASDAQ market is growing rapidly. The number of NMS and the total number of all NASDAQ stocks on November 1, 1982 through 1985 are as follows: (45/3101), (487/3559), (941/3816), (2272/3846). NMS stocks automatically qualify for margin purchases.

returns adjusted for risk. Risk-adjusted returns are defined using a procedure analogous to the CRSP excess returns technique described in Keim (1983).

For each year from 1973 through 1985, a set of control portfolios for the NASDAQ sample is formed by the following procedure. In each calendar year, all NASDAQ securities with at least 100 contiguous valid daily returns are ranked by their Scholes-Williams (1977) betas. Betas are computed initially using an equally weighted index of all NASDAQ stocks including distributions. Each year, all available securities are divided equally into ten portfolios on the basis of beta, with portfolio 1 containing the lowest beta stocks and portfolio 10 containing the highest beta stocks. The number of securities in each portfolio varies from a low of approximately 220 to a high of approximately 380. Monthly control portfolio returns are then computed by first compounding individual security returns and then averaging across securities in each portfolio. Hence, control portfolio returns are equally weighted averages of individual securities' returns. This procedure assumes a monthly buy and hold strategy and, as such, avoids the bias inherent in a daily rebalancing strategy described by Roll (1981, 1983b) and Blume and Stambaugh (1983). Monthly excess returns for each individual security are also computed by first compounding daily returns to obtain monthly returns and then subtracting the monthly returns of the control portfolio of which the security is a member.

For the NYSE-AMEX sample, control portfolio construction is analogous to that of the NASDAQ case. Scholes-Williams betas are computed initially using an equally weighted index of all NYSE-AMEX stocks including distributions. The number of securities in each NYSE-AMEX control portfolio varies from a low of approximately 220 to a high of approximately 260.

Finally, to examine the sensitivity of our results to the choice of an index, and also to allow direct comparisons between the NASDAQ and NYSE-AMEX results, we reformed the control portfolios using all stocks from the combined universe of all NASDAQ, AMEX, and NYSE stocks. To achieve this, Scholes-Williams betas were computed annually for all stocks in the combined sample using an equally weighted "market" index constructed using stocks from all three markets.

II. The Size Effect in the NASDAQ Market

A. Formation of Size-Ranked Portfolios

In order to focus on the relation between firm size and stock returns, we examine monthly excess returns of portfolios formed on the basis of size. Specifically, in each year from 1973 through 1985, we rank all NASDAQ firms by market value of outstanding equity as of the end of the previous year.[8] Securities are then placed into 20 portfolios, with portfolio 1 containing the

[8] For a given security in a given year, market value of equity is computed by multiplying the number of shares outstanding by closing price on the last trading day of the previous year. If either variable is missing on the last day of the previous year, we checked the previous nine trading days for valid data. If closing price and/or shares outstanding are missing for all days checked, the security is dropped from the sample for that year.

smallest five percent of all firms and portfolio 20 containing the largest five percent. The ranking and portfolio formation procedure is repeated for each calendar year in the sample period. Monthly raw returns and excess returns for each size-ranked portfolio are computed by averaging across individual securities within the portfolio.[9] The number of firms in each size-ranked portfolio varies through time from a low of approximately 110 to a high of approximately 190. The same procedure was used to obtain 20 size-ranked portfolios of NYSE-AMEX firms, each containing between 110 and 130 stocks.

B. NASDAQ Results

Average monthly raw returns and excess returns for the twenty size-ranked portfolios of NASDAQ stocks are reported in Table I. The results are based on 13 years of monthly returns for each portfolio, beginning in January 1973 and ending in December 1985. Table I also provides several additional descriptive statistics for the NASDAQ data. Included are mean values for each portfolio's Scholes-Williams beta, market value of equity, stock price, and relative bid-ask spread.[10] Mean values are obtained by first averaging across securities within a given portfolio each year and then averaging these values over the 13-year sample period. Finally, the monthly time series standard deviation of each portfolio's excess returns is reported.

The mean market value of equity figures indicate that the NASDAQ data provide a relatively large sample (approximately 150 firms, on average, per portfolio) of very small firms. The smallest portfolio in our sample has an average market value over the sample period of $920,060. By comparison, the median market value for the smallest size-ranked portfolio reported by Keim (1983) ($4.4 million) is larger than the average market value of our first *five* portfolios. Also, note that the largest firms in the NASDAQ sample, with an average market value of slightly over $413 million dollars, would not be considered "small" by absolute standards.[11] There is a perfect positive monotonic relation between average firm size and average share price. The smallest portfolio contains stocks with an average share price of only $1.36, while the average share price of the largest portfolio is $39.64.

There is also a perfectly monotonic, negative relation between firm size and relative bid-ask spread. This relationship is predicted by both theory and evidence concerning the determinants of the bid-ask spread.[12] For the smallest stocks in

[9] Note that, for a security to be included in a size-ranked portfolio in a given year, we require that at least 100 contiguous daily returns be available so that Scholes-Williams betas, and hence excess returns, can be computed. This procedure excludes fewer firms than that used, for example, by Keim (1983), who required each sample firm to be included in the CRSP files at the beginning and end of a given calendar year.

[10] The relative bid-ask spread is defined as (ask−bid)/[(bid+ask)/2]. Henceforth, all references to the spread should be interpreted to mean relative spread.

[11] ADRs were not included in the average market value calculations because their reported outstanding shares values are unreliable.

[12] The stocks of small firms are likely to be thinly traded and subject to a greater proportion of trades by insiders relative to outsiders. Thus, both the inventory cost and the adverse selection cost components of the spread will tend to be larger for small firms. See Demsetz (1968), Benston and Hagerman (1974), Stoll (1978), Glosten and Milgrom (1985), and Copeland and Galai (1983).

Table I

Descriptive Statistics for NASDAQ Firms

This table reports mean monthly raw returns, excess returns, beta estimates, time series standard deviations, mean market value of equity, mean stock price, and mean relative spread for twenty size-ranked portfolios of NASDAQ firms over the period 1973–1985.

		Index and Control Portfolios Formed with NASDAQ Stocks				Index and Control Portfolios Formed with NASDAQ, AMEX, and NYSE Stocks					
Portfolio	Mean Monthly Raw Return (t-statistic)	Mean Monthly Excess Return (t-statistic)	Mean Scholes-Williams Beta	Mean Monthly Beta	Time Series Standard Deviation	Mean Monthly Excess Return (t-statistic)	Mean Scholes-Williams Beta	Time Series Standard Deviation	Mean Market Value of Equity (000's)	Mean Share Price	Mean Relative Bid-Ask Spread
1	0.030	0.016	0.69	1.07	0.0348	0.016	0.55	0.0400	920.06	1.36	0.356
(smallest)	(5.01)[a]	(5.60)				(5.14)					
2	0.025	0.011	0.75	1.09	0.0312	0.012	0.61	0.0356	1719.45	2.12	0.263
	(4.44)	(4.44)				(4.32)					
3	0.021	0.006	0.83	1.10	0.0274	0.007	0.68	0.0323	2459.02	2.69	0.221
	(3.61)	(2.73)				(2.76)					
4	0.019	0.005	0.88	1.11	0.0228	0.006	0.73	0.0279	3274.28	3.22	0.196
	(3.48)	(2.69)				(2.58)					
5	0.017	0.003	0.87	1.10	0.0227	0.004	0.73	0.0274	4162.85	3.90	0.173
	(3.12)	(1.57)				(1.67)					
6	0.015	−0.000	0.96	1.11	0.0184	0.001	0.82	0.0225	5167.05	4.86	0.151
	(2.72)	(−0.12)				(0.52)					
7	0.014	−0.000	0.96	1.10	0.0166	0.001	0.82	0.0204	6332.07	5.40	0.135
	(2.72)	(−0.05)				(0.39)					
8	0.014	−0.001	1.01	1.13	0.0155	−0.000	0.87	0.0189	7669.87	5.96	0.124

	(2.67)	(−0.71)				(−0.06)					
9	0.013	−0.002	0.99	1.11	0.0140	−0.001	0.85	0.0178	9236.68	7.09	0.113
	(2.38)	(−1.86)				(−0.83)					
10	0.013	−0.002	1.06	1.10	0.0131	−0.001	0.91	0.0150	11221.62	7.90	0.101
	(2.62)	(−1.78)				(−0.70)					
11	0.013	−0.002	1.05	1.09	0.0123	−0.001	0.92	0.0147	13637.70	8.89	0.092
	(2.54)	(−2.08)				(−1.03)					
12	0.012	−0.002	1.06	1.11	0.0129	−0.002	0.93	0.0142	16683.45	10.29	0.084
	(2.44)	(−2.37)				(−1.59)					
13	0.012	−0.002	1.09	1.10	0.0128	−0.002	0.96	0.0144	20436.59	11.49	0.076
	(2.35)	(−2.34)				(−1.38)					
14	0.013	−0.002	1.10	1.06	0.0144	−0.002	0.97	0.0139	25186.97	12.80	0.068
	(2.46)	(−2.08)				(−1.35)					
15	0.011	−0.002	1.08	1.08	0.0147	−0.002	0.95	0.0130	31763.80	14.72	0.063
	(2.34)	(−2.10)				(−1.91)					
16	0.012	−0.003	1.10	1.07	0.0148	−0.002	0.98	0.0130	40917.93	17.13	0.058
	(2.38)	(−2.40)				(−2.15)					
17	0.011	−0.003	1.10	1.03	0.0172	−0.003	0.99	0.0145	54690.62	18.87	0.051
	(2.27)	(−2.41)				(−2.36)					
18	0.011	−0.002	1.04	0.97	0.0178	−0.002	0.94	0.0147	80006.06	21.79	0.044
	(2.48)	(−1.73)				(−1.82)					
19	0.010	−0.003	1.08	0.95	0.0232	−0.002	0.98	0.0190	130260.37	25.39	0.038
	(2.34)	(−1.41)				(−1.43)					
20	0.010	−0.003	1.00	0.93	0.0280	−0.003	0.92	0.0257	413443.06	39.64	0.031
(largest)	(2.24)	(−1.28)				(−1.25)					

NASDAQ market standard deviation: 0.0636
NASDAQ-AMEX-NYSE market standard deviation: 0.0626

[a] t-Statistics are based upon time series standard deviations.

our sample, the difference between the quoted bid and ask prices is nearly 36 percent of the share price itself. As we shall see, the largest portfolio that exhibits a significant size effect (portfolio 4) has a relative bid-ask spread of nearly 20 percent. The largest firms in our sample have quoted spreads of approximately three percent.

Turning to the returns data, Table I provides clear evidence of a significant size effect for NASDAQ securities. Mean monthly raw returns decline almost monotonically from 3.0 percent for the smallest size-ranked portfolio to 1.0 percent for the largest size-ranked portfolio. The smallest four size-ranked portfolios exhibit significant positive monthly excess returns (t-statistics are reported in parentheses below the excess returns). For example, portfolio 1 has a mean monthly excess return of 1.6 percent with a t-statistic of 5.60. This is equivalent to an annual size effect of 20.98% ($1.016^{12}-1$) for the smallest firms in our sample. Excess returns decline (weakly) monotonically as size increases through the ninth size portfolio, for which the mean monthly excess return reaches −0.2 percent per month. As size increases further, excess returns stabilize in the range of −0.2 percent to −0.3 percent per month. Excess returns for portfolios 11 through 17 are negative and significant at the five percent level. Although the excess returns for the largest firms in our sample, contained in portfolios 18 through 20, are approximately of the same magnitude as those for portfolios 11 through 17, they are not significantly negative. This occurs because the time-series standard deviations of portfolio excess returns, upon which the t-statistics are based, increase somewhat for the largest size-ranked portfolios.[13]

Finally, note that broadening the index that defines excess returns to include NYSE and AMEX stocks has almost no effect on the results. Average Scholes-Williams betas are slightly lower and time-series standard deviations of excess returns are slightly higher, but mean monthly excess returns are nearly identical to results obtained using the NASDAQ-only index.

Average Scholes-Williams betas are less than one for the smallest five size-ranked portfolios. Portfolios 6 through 20 have average betas very close to one. The relatively low average betas for the smaller NASDAQ firms are likely due to non-trading. If a firm's shares do not trade for a period longer than a day, Scholes-Williams betas will understate true betas. To estimate the magnitude of any potential non-trading biases, we also computed OLS betas, using monthly returns, for each size-ranked portfolio. Each security's beta was computed using monthly returns over its entire NASDAQ trading history, along with corresponding monthly (buy and hold) returns on the equally weighted NASDAQ index.[14]

Relative to the daily Scholes-Williams betas, the monthly betas (also presented in Table I) are somewhat higher for the smaller size-ranked portfolios and conversely are somewhat lower for the larger size-ranked portfolios. This is precisely the pattern expected if small (large) NASDAQ stocks trade less (more) frequently than average.[15]

[13] The t-statistics in Table I are computed using the monthly time series standard deviations of portfolio excess returns over the 156 months from January 1973 through December 1985.

[14] This procedure does not allow for possible nonstationarity in betas. However, the average trading history for firms in the NASDAQ sample is only 60.3 months. Also, 2602 of the 7659 NASDAQ stocks in our sample had less than 25 total monthly returns and, hence, were excluded from the calculations.

[15] We present direct evidence later in the paper that small NASDAQ stocks trade much less

C. NYSE-AMEX Results

Table II presents results for the NYSE-AMEX sample over the same time period covered by the NASDAQ data. First, note that the smallest size-ranked NYSE-AMEX portfolio contains firms that are closest in size to the fourth NASDAQ portfolio, while NYSE-AMEX portfolio 17 is closest in average firm size to NASDAQ portfolio 20. As expected, the largest NYSE-AMEX firms are much greater in size than the largest NASDAQ firms.

As in the NASDAQ case, mean monthly raw returns decline almost monotonically as firm size increases. The smallest NYSE-AMEX firms have average raw returns of 2.5 percent per month, and the largest firms have average raw returns of 0.8 percent per month. Excess returns are computed using both the NYSE-AMEX index and the broader NASDAQ-AMEX-NYSE index. Over the 1973–1985 period, listed securities exhibit an annual size effect that is less pronounced than that of the NASDAQ sample. Only the smallest size-ranked portfolio displays a (marginally) significant annual size effect, while none of the large firm portfolios experiences significant negative effects. Unfortunately, direct comparisons of these results with those of earlier studies are difficult due to differences in sample periods and the nonstationarity of the annual effect.

Note that, as in the NASDAQ case, broadening the index by which benchmark returns are defined has a negligible effect upon the results. This is somewhat more surprising than in the NASDAQ case. Because of the relative numbers of firms, an equally weighted index of NASDAQ, AMEX, and NYSE firms is dominated by the NASDAQ component. The percentages of NYSE, AMEX, and NASDAQ firms that make up the broad index, averaged over the 1973–1985 period, are 29.8 percent, 17.9 percent, and 52.3 percent, respectively. Despite the increased weight assigned to small firms in the broader index, the annual NYSE-AMEX size effect is relatively unchanged.[16]

The average Scholes-Williams betas are close to one for all but the largest NYSE-AMEX size-ranked portfolios. Again, for comparison, we computed monthly OLS betas for the NYSE-AMEX sample using the same procedure as reported earlier for the NASDAQ sample.[17] An equally weighted monthly buy and hold NYSE-AMEX index was constructed from the CRSP monthly indices.

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frequently than large NASDAQ stocks. Also, despite some apparent biases, we continue to compute excess returns using the daily Scholes-Williams betas. In most cases, the magnitude of the bias is small, and the alternative choice of using 60 monthly returns to compute betas would introduce a survivorship bias of unknown magnitude and would reduce the usable sample period from 13 years to eight.

[16] To better understand the relative size distribution of firms across markets, we ranked all firms in the NYSE, AMEX, and NASDAQ markets by size into 20 portfolios each year from 1973 through 1985. The average percentages of NYSE, AMEX, and NASDAQ firms in the smallest (largest) size-ranked portfolio are 0.2 percent (89.9 percent), 13.2 percent (2.9 percent), and 86.6 percent (7.2 percent), respectively. The proportion of NYSE (NASDAQ) firms increases (decreases) perfectly monotonically from portfolio 1 through portfolio 20. The relative proportion of AMEX firms is largest in the intermediate size range.

[17] Of a total of 4170 NYSE and AMEX stocks with returns over the 1973–1985 sample period, 705 firms with less than 25 total monthly returns were dropped from the calculations.

Table II

Descriptive Statistics for NYSE-AMEX Firms

This table reports mean monthly raw returns, excess returns, beta estimates, time series standard deviations, mean market value of equity, and mean stock price for twenty size-ranked portfolios of NYSE-AMEX firms over the period 1973–1985.

		Index and Control Portfolios Formed with NYSE-AMEX Stocks				Index and Control Portfolios Formed with NASDAQ, AMEX, and NYSE Stocks				
Portfolio	Mean Monthly Raw Return (t-statistic)	Mean Monthly Excess Return (t-statistic)	Mean Scholes-Williams Beta	Mean Monthly Beta	Time Series Standard Deviation	Mean Monthly Excess Return (t-statistic)	Mean Scholes-Williams Beta	Time Series Standard Deviation	Mean Market Value of Equity (000's)	Mean Share Price
1	0.025	0.008	0.95	1.31	0.0537	0.008	1.12	0.0501	2896.88	3.02
(smallest)	(2.94)[a]	(1.97)				(1.99)				
2	0.020	0.004	1.00	1.26	0.0332	0.003	1.16	0.0305	5982.26	4.71
	(2.78)	(1.44)				(1.37)				
3	0.018	0.002	0.97	1.21	0.0247	0.002	1.12	0.0218	9109.31	6.22
	(2.65)	(1.00)				(0.88)				
4	0.018	0.002	0.97	1.18	0.0235	0.002	1.13	0.0214	12928.85	7.44
	(2.73)	(1.08)				(0.98)				
5	0.018	0.002	1.00	1.14	0.0176	0.001	1.15	0.0155	17600.19	8.94
	(2.85)	(1.38)				(1.14)				
6	0.017	0.001	0.99	1.12	0.0128	0.001	1.13	0.0140	23363.94	10.33
	(2.98)	(1.22)				(0.72)				
7	0.016	0.001	1.02	1.11	0.0129	0.000	1.16	0.0139	30734.63	11.45
	(2.78)	(0.75)				(0.27)				

8	0.017	0.002	1.03	1.10	0.0118	0.001	1.17	0.0146	39452.66	13.10
	(3.00)	(1.82)				(0.97)				
9	0.016	0.000	1.04	1.09	0.0102	−0.000	1.19	0.0134	49443.28	14.44
	(2.77)	(0.24)				(−0.37)				
10	0.014	−0.001	1.09	1.08	0.0099	−0.002	1.23	0.0142	63136.41	16.14
	(2.65)	(−1.65)				(−1.63)				
11	0.014	−0.001	1.05	1.05	0.0112	−0.001	1.19	0.0165	82243.44	17.76
	(2.65)	(−0.99)				(−0.53)				
12	0.014	−0.000	1.04	1.02	0.0119	−0.001	1.17	0.0172	107529.00	18.93
	(2.81)	(−0.39)				(−0.61)				
13	0.014	−0.001	1.02	0.98	0.0123	−0.001	1.15	0.0177	139876.69	20.81
	(2.70)	(−1.09)				(−1.02)				
14	0.013	−0.001	0.99	0.92	0.0126	−0.001	1.11	0.0180	185299.75	22.48
	(2.81)	(−0.52)				(−0.73)				
15	0.013	−0.001	0.99	0.89	0.0160	−0.002	1.10	0.0219	249116.81	24.47
	(2.79)	(−0.94)				(−1.14)				
16	0.012	−0.002	1.00	0.86	0.0188	−0.002	1.11	0.0242	344239.44	27.00
	(2.51)	(−1.27)				(−1.14)				
17	0.012	−0.001	0.98	0.81	0.0185	−0.001	1.08	0.0236	488712.87	29.26
	(2.68)	(−0.62)				(−0.67)				
18	0.011	−0.002	0.96	0.76	0.0219	−0.003	1.06	0.0270	726218.44	31.56
	(2.42)	(−1.30)				(−1.21)				
19	0.010	−0.002	0.93	0.69	0.0254	−0.003	1.02	0.0304	1153564.00	36.66
	(2.59)	(−1.11)				(−1.04)				
20	0.008	−0.004	0.91	0.59	0.0309	−0.004	0.99	0.0350	4402423.00	50.08
(largest)	(2.12)	(−1.67)				(−1.48)				

NYSE-AMEX market standard deviation: 0.0658

[a] t-Statistics are based upon time series standard deviations.

An interesting pattern emerges within the monthly betas. Again, when compared with the daily betas, there is evidence of a difference in trading frequencies between small and large firms. More important is the perfect inverse monotonic relation between firm size and beta. The monthly betas range from 1.31 for the smallest NYSE-AMEX firms to 0.59 for the largest.[18]

When compared with the absence of such a pattern for the NASDAQ sample, these results lend support to the argument that small NASDAQ firms differ in important ways from small exchange-listed firms. If small (large) NYSE-AMEX firms have, on average, recently underperformed (overperformed) the market, a simple leverage effect can explain the observed pattern in beta values (Chan and Chen (1988b)). The fact that such a pattern is not present in the NASDAQ sample supports the notion that relative firm size is not determined by recent relative performance in the OTC market. Again, this is due to the fact that new firms enter the NASDAQ universe more evenly over the size spectrum than exchange-listed firms. An implication of these results is that a study of the size effect in the OTC market is less likely to suffer from a performance-related selection bias than a similar study using exchange-listed firms.

Finally, it is interesting to note that average raw returns for NYSE-AMEX firms are larger than those of similarly sized NASDAQ firms by approximately 0.4 to 0.6 percent per month. For example, compare NYSE-AMEX portfolios 3, 8, and 13 with NASDAQ portfolios 9, 16, and 19, respectively. Also, note that this differential is somewhat reduced for the largest NASDAQ stocks. (Compare NASDAQ portfolio 20 with NYSE-AMEX portfolio 17.)

III. Seasonality and the Size Effect in the NASDAQ Market

In this section we first examine the seasonality of both raw and excess returns for certain size-ranked portfolios of NASDAQ stocks. Then, the NYSE-AMEX sample is analyzed for comparison. Finally, the seasonal variation of relative bid-ask spreads is examined.

A. Monthly Variation in Returns

To formally test the null hypothesis of equal monthly expected raw or excess returns for various size-ranked portfolios, we initially employed a month-by-month dummy variable regression (as in Keim (1983), Table 3). There is little variation in February through December returns for any of the NASDAQ or NYSE-AMEX size-ranked portfolios. Thus, to conserve space, we report results based on a regression of portfolio returns on an intercept (to capture January's return) and a single dummy variable to capture the average difference of February–December returns from January. Table III presents estimates of the dummy variable regressions for ten size-ranked portfolios of NASDAQ firms and NYSE-AMEX firms. To facilitate direct comparisons between results for NASDAQ

[18] The patterns observed in the monthly betas of the NASDAQ versus NYSE-AMEX samples are very similar to those obtained when monthly raw returns of the size-ranked portfolios are themselves regressed on the appropriate monthly equally weighted market index over the 1973–1985 period. The NYSE-AMEX results are also very similar to those of Chan and Chen (1988a).

firms and NYSE-AMEX firms, all excess returns are defined vis-à-vis the combined NASDAQ-AMEX-NYSE universe.

Because of the possibility that monthly excess returns may be both heteroskedastic and autocorrelated (see, for example, Rozeff and Kinney (1976) and Keim (1983)), we present t-statistics (in parentheses below the parameter estimates) based upon the procedure of Newey and West (1987). This generalized method-of-moments (GMM) procedure allows the estimation of a heteroskedasticity- and autocorrelation-consistent (positive semi-definite) variance-covariance matrix and provides consistent t-statistics.[19]

The NASDAQ results appearing in Table III follow a familiar pattern. First, average raw January returns decline monotonically from 13.3 per cent for the smallest NASDAQ firms to 3.1 percent for the largest. For all size categories, January's return exceeds the returns in all other months of the year.

There is also a perfect (inverse) monotonic relation between firm size and excess return in January. Excess January returns for the first six size-ranked portfolios are positive and significant at the five percent level. The sixth size-ranked portfolio in Table III contains the same firms as in portfolios 11 and 12 in Table I and thus includes firms with average market values of approximately $15.2 million (($13.64 million + $16.68 million)/2). As size increases, average excess returns in January continue to decrease. Average excess returns for portfolio 7 are close to zero and are insignificant. Portfolios 8 through 10 display significant negative average excess returns in January.

The pattern observed in January is reversed for February through December. There is an almost perfect positive monotonic relation between firm size and excess return for the last eleven months of the year. The model F-statistics allow us to reject (at the five percent level) the null hypothesis of equal excess returns across all months for both small (portfolios 1–5) and large (portfolios 8–10) NASDAQ firms.[20]

Turning to the NYSE-AMEX results, the overall patterns in the data are very similar to those found in the NASDAQ sample. Note, however, that the range of January returns is much wider than in the NASDAQ data. The smallest NYSE-AMEX firms have average January returns of 18.4 percent, while the largest firms' average January return is 1.7 percent. January returns are significantly higher than February through December returns for the first four deciles, with the significance of the differences declining thereafter. Turning to the excess returns, the smallest three deciles exhibit typical small-firm behavior—i.e., positive significant excess returns in January and negative, significant excess returns in February through December. Note that the third decile (which contains

[19] The Newey-West (1987) procedure is an extension of White (1980). We allow for the possibility of up to twelfth-order autocorrelation in estimating the covariance matrix. Reported F-statistics are based upon the classical Gauss-Markov assumptions.

[20] We also performed the regressions of Table III using excess returns defined solely from the NASDAQ universe. In this case, excess returns in January are positive and significant only through the fourth size-ranked portfolio, insignificant for portfolios 5 and 6, and significantly negative for portfolios 7 through 10. February through December returns follow the reverse pattern. Portfolio 4 contains firms with an average market value of $7.0 million (portfolios 7 and 8 from Table I). Thus, the "market" which is used to define excess returns does have some effect upon the measurement of the turn-of-the-year effect for NASDAQ stocks.

Table III

Test of the Seasonality of the Size Effect in the NASDAQ and NYSE-AMEX Markets

These tests use monthly raw returns and excess returns on ten size-ranked portfolios of stocks over the period 1973–1985. Excess returns are based on all NASDAQ-AMEX-NYSE stocks. For each portfolio the first row contains parameter estimates of the regression of returns on a constant and a February–December dummy variable; the second row contains GMM t-statistics.[a]

	NASDAQ Raw Returns			NASDAQ Excess Returns			NYSE-AMEX Raw Returns			NYSE-AMEX Excess Returns		
Portfolio	Jan	Feb–Dec	R^2 F-statistic	Jan	Feb–Dec	R^2 F-statistic	Jan	Feb–Dec	R^2 F-statistic	Jan	Feb–Dec	R^2 F-statistic
1	0.133	−0.115	0.21	0.068	−0.059	0.24	0.184	−0.176	0.24	0.087	−0.088	0.36
(smallest)	(4.55)	(−3.79)	40.11	(4.93)	(−4.16)	47.65	(3.98)	(−3.62)	49.98	(5.14)	(−4.92)	85.54
2	0.107	−0.095	0.15	0.042	−0.039	0.16	0.128	−0.120	0.17	0.036	−0.037	0.26
	(4.40)	(−3.90)	27.63	(4.34)	(−4.31)	29.29	(3.47)	(−3.07)	30.85	(5.38)	(−5.04)	55.11
3	0.100	−0.092	0.15	0.034	−0.035	0.19	0.103	−0.094	0.12	0.012	−0.012	0.07
	(4.37)	(−3.79)	26.28	(5.77)	(−5.55)	36.02	(3.04)	(−2.62)	21.74	(2.55)	(−2.42)	11.38
4	0.088	−0.081	0.12	0.018	−0.019	0.10	0.093	−0.083	0.10	0.002	−0.001	0.00
	(3.77)	(−3.26)	20.45	(3.74)	(−3.78)	17.39	(2.88)	(−2.43)	17.56	(0.44)	(−0.15)	0.02
5	0.085	−0.078	0.11	0.014	−0.017	0.10	0.079	−0.070	0.08	−0.012	0.013	0.08
	(3.61)	(−3.12)	19.77	(2.96)	(−3.30)	16.98	(2.54)	(−2.12)	12.63	(−3.22)	(3.19)	14.38
6	0.079	−0.072	0.10	0.006	−0.008	0.04	0.065	−0.055	0.06	−0.024	0.025	0.20
	(3.47)	(−3.07)	17.09	(2.15)	(−2.80)	6.43	(2.32)	(−1.87)	8.95	(−6.18)	(6.52)	38.31
7	0.069	−0.062	0.07	−0.004	0.002	0.00	0.056	−0.046	0.04	−0.027	0.029	0.22
	(2.95)	(−2.58)	12.32	(−1.08)	(0.75)	0.53	(2.18)	(−1.72)	7.05	(−6.22)	(6.28)	43.52
8	0.060	−0.053	0.06	−0.012	0.010	0.08	0.040	−0.031	0.02	−0.042	0.044	0.31
	(2.80)	(−2.34)	9.71	(−3.22)	(2.97)	13.42	(1.66)	(−1.23)	3.49	(−6.73)	(6.34)	68.40
9	0.051	−0.043	0.04	−0.021	0.020	0.19	0.034	−0.024	0.01	−0.044	0.046	0.27
	(2.42)	(−1.97)	7.08	(−5.07)	(5.11)	37.19	(1.48)	(−1.05)	2.30	(−6.05)	(5.73)	56.72
10	0.031	−0.023	0.01	−0.036	0.037	0.24	0.017	−0.009	0.00	−0.054	0.056	0.23
(largest)	(1.78)	(−1.25)	2.26	(−5.93)	(6.12)	49.65	(0.99)	(−0.51)	0.41	(−4.73)	(4.49)	46.32

[a] Each regression has (1,154) degrees of freedom. Critical values are $F_{5\%}(1,154) = 3.91$ and $F_{1\%}(1,154) = 6.81$.

the fifth and sixth size-ranked portfolios from Table II) has an average firm size of approximately $20.5 million. Recall that the NASDAQ sample exhibits the analogous classical small firm effect through the sixth decile (average firm size of $15.1 million).

Listed firms exhibit the typical large firm effect—i.e., negative, significant excess returns in January and positive significant excess returns in all other months, for firms in the fifth through tenth deciles (average size of $56.3 million and larger). By comparison (Table III), NASDAQ portfolios, composed of firms with market values of $35.3 million and larger (deciles 8 through 10) exhibit the "large firm effect."[21] Hence, the results for listed versus OTC stocks do not differ dramatically when measured by the same benchmark.

B. Monthly Variation in Bid-Ask Spreads

It has been suggested that high transactions costs (Stoll and Whaley (1983)) and/or low liquidity (Amihud and Mendelson (1986)) might be responsible for the excess risk-adjusted returns earned by small firm stocks. However, as Keim (1983) and Schultz (1983) have pointed out, to explain the observed seasonality of the size effect, transactions costs must also exhibit seasonal behavior.

To examine the seasonal behavior of transactions costs in the NASDAQ market, average monthly relative bid-ask spreads were regressed on monthly dummy variables for ten size-ranked portfolios over the period 1973–1985.[22] Estimates of the regression coefficients are presented in Table IV. As before, t-statistics are based upon the GMM procedure.

As reported in Table I, there is a strong negative relation between relative bid-ask spread and firm size. Average spreads in January decrease from 33.1 percent for the smallest firms to 3.2 percent for the largest. However, there is little significant month-to-month variability in relative spreads. For the smallest firms in our sample (portfolio 1), spreads are slightly lower in February through December than in January (significantly so in July, August, and September). For all sizes of firms, spreads are slightly (though insignificantly so) lower in February than in January. As firm size increases, there is a notable tendency for spreads to be larger in September through December (relative to January). Thus, small NASDAQ firms are most costly to trade in January and least costly to trade in August, while large firms are most costly to trade in December and least costly to trade in February. It is unclear whether any of the observed patterns is of any real economic significance. However, dramatic changes in liquidity or transactions costs throughout the year, to the extent that they are reflected in reported

[21] The regressions were also performed on excess returns defined using only firms in the NYSE-AMEX universe. Again, there was a slight but noticeable effect upon the results. January excess returns were positive and significant through the fourth decile, insignificant for the fifth decile, and significantly negative for the sixth through tenth deciles. The converse was true of February through December returns.

[22] Schultz (1983) examined the seasonality of transactions costs of small (primarily) AMEX stocks over the period 1962–1979. He compared transactions costs for one day in June with one day in December for a randomly selected (subject to the requirement that each firm does not trade on at least one day of the month) sample of 40 stocks each year. No evidence of June–December seasonality was discovered.

Table IV

Test of the Month-to-Month Variability of Average Monthly Relative Bid-Ask Spreads

These tests are for ten size-ranked portfolios of NASDAQ securities over the period 1973–1985. For each portfolio the first row contains parameter estimates from the regression of monthly average relative bid-ask spread on monthly dummy variables; the second row contains GMM t-statistics.[a]

Portfolio	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	R^2 F-statistic
1	0.331	−0.016	−0.019	−0.020	−0.019	−0.022	−0.034	−0.037	−0.035	−0.031	−0.027	−0.022	0.03
(smallest)	(15.44)	(−1.80)	(−1.53)	(−1.33)	(−1.14)	(−1.23)	(−2.11)	(−2.26)	(−2.10)	(−1.94)	(−1.80)	(−1.44)	0.36
2	0.211	−0.006	−0.007	−0.007	−0.003	−0.001	−0.007	−0.007	−0.004	−0.001	0.003	0.008	0.02
	(16.91)	(−1.20)	(−0.84)	(−0.69)	(−0.31)	(−0.09)	(−0.66)	(−0.69)	(−0.43)	(−0.08)	(0.36)	(0.96)	0.20
3	0.160	−0.005	−0.003	−0.001	−0.001	0.002	−0.001	0.000	0.004	0.009	0.014	0.019	0.04
	(14.63)	(−1.10)	(−0.51)	(−0.18)	(−0.10)	(0.23)	(−0.13)	(0.00)	(0.45)	(1.24)	(1.95)	(2.53)	0.58
4	0.124	−0.002	0.000	0.001	0.002	0.006	0.003	0.004	0.008	0.013	0.016	0.022	0.05
	(13.28)	(−0.46)	(0.02)	(0.15)	(0.25)	(0.72)	(0.45)	(0.60)	(1.15)	(1.86)	(2.50)	(3.06)	0.68
5	0.103	−0.003	−0.002	0.000	0.000	0.003	0.002	0.005	0.008	0.011	0.015	0.019	0.06
	(12.98)	(−0.86)	(−0.36)	(0.08)	(0.03)	(0.47)	(0.34)	(0.82)	(1.38)	(2.16)	(3.11)	(3.36)	0.87
6	0.084	−0.001	0.000	0.001	0.003	0.005	0.003	0.005	0.008	0.010	0.013	0.018	0.05
	(12.36)	(−0.54)	(0.10)	(0.27)	(0.60)	(1.03)	(0.72)	(0.93)	(1.45)	(1.97)	(2.77)	(3.54)	0.71
7	0.068	−0.001	0.000	0.001	0.002	0.004	0.002	0.004	0.007	0.010	0.013	0.016	0.06
	(12.06)	(−0.24)	(0.08)	(0.29)	(0.47)	(0.80)	(0.57)	(1.00)	(1.47)	(2.13)	(2.93)	(3.41)	0.84
8	0.059	−0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.005	0.006	0.008	0.011	0.04
	(12.18)	(−0.61)	(0.09)	(0.36)	(0.37)	(0.38)	(0.24)	(0.65)	(1.33)	(1.81)	(2.42)	(2.90)	0.58
9	0.045	−0.001	0.001	0.002	0.002	0.004	0.003	0.004	0.006	0.008	0.010	0.012	0.07
	(10.64)	(−0.77)	(0.34)	(0.70)	(0.77)	(1.26)	(1.08)	(1.34)	(1.96)	(2.61)	(3.24)	(3.57)	1.00
10	0.032	−0.001	0.000	0.001	0.001	0.003	0.002	0.004	0.006	0.007	0.009	0.010	0.15
(largest)	(12.53)	(−0.72)	(0.22)	(0.31)	(0.71)	(1.27)	(1.14)	(1.77)	(2.03)	(2.76)	(3.44)	(3.79)	2.23

[a] Each regression has (11,144) degrees of freedom. Critical values are $F_{5\%}(11,144) = 1.86$ and $F_{1\%}(11,144) = 2.38$.

NASDAQ spreads, appear to be an unlikely explanation for the previously described returns anomalies.

Finally, the magnitude of the bid-ask spreads observed for small NASDAQ stocks suggests that public investors could not profit from a trading strategy designed to exploit the predictable seasonality in small firms' returns. Previous evidence provided on this issue by Stoll and Whaley (1983) and by Schultz (1983) for exchange-listed stocks is mixed. Stoll and Whaley (1983) conclude that, after accounting for transactions costs, the (long horizon) returns for NYSE firms do not differ significantly from CAPM predictions. Schultz (1983) examined smaller AMEX firms along with NYSE firms and concluded that excess returns could be earned over holding periods as short as one month if a January were included.

We simulated a trading strategy of buying small firms' stocks at the ask price and then selling them at the bid price over various holding periods surrounding the turn of the year. The strategy assumes that all securities within a given size-ranked portfolio are purchased at the close on day −4 relative to the first day of the year (day 0) and sold at the close on either days +17, +37, or +57. In all cases the strategy produced negative average *raw* returns for portfolios of small NASDAQ stocks. Adjustments for risk, market movements, and brokerage commissions would produce even lower returns. Hence, although the magnitude of the bid-ask spread cannot explain the seasonalities in small firm returns, it may explain why the actions of public traders have not tended to eliminate the effects over time.

IV. Daily Returns and Trading Characteristics

Previous studies of AMEX and NYSE firms have revealed systematic patterns in daily returns and other trading characteristics such as volume of trades around the turn of the year. Keim (1983) found that small AMEX and NYSE firms earn significantly higher returns than larger listed firms over the first five trading days in January. Roll (1983a) reported that the last trading day in December is actually the first of a series of unusually high daily returns for small firms. Finally, Lakonishok and Smidt (1984) discovered an increase in trading volume for small firms at the turn of the year. Table V contains average daily returns for ten size-ranked portfolios of NASDAQ stocks surrounding the first trading day of the year over the period 1973–1985. Because the expected daily return is close to zero, the difference between raw returns and excess returns on a daily basis will be small. For simplicity's sake, we report raw returns here. Also reported for each size-ranked portfolio are the average relative bid-ask spread, average trading volume (in shares), and average percentage of stocks that traded each day. Since volume data are available only for the period November 1, 1982 through December 31, 1985, the number of shares traded and the percentage of stocks trading each day are averaged over the final three years of the sample period. Finally, the last row of the table presents averages and time-series standard deviations of each variable over a control period defined to include trading days +30 through +55 relative to the turn of the year.

Each of the size-ranked portfolios exhibits an unusually high return on the last trading day of the year (day −1). The last trading day return exceeds one percent for the first four size-ranked portfolios, and then it falls monotonically to 0.72 percent for the largest portfolio. Each of these returns exceeds its respective control period mean by at least four standard deviations. Returns prior to day −1 typically do not differ significantly from their control period means. The return on the first trading day of the new year (day 0) again exceeds one percent for the portfolio of smallest firms. Portfolios 2 through 9 all have day 0 returns that are at least two standard deviations above their control period means. Returns over subsequent days also tend to be high, especially for the smaller firm portfolios. Returns on days +1 through +5 for portfolio 1 are three to four standard deviations above the control period mean return. The first six size-ranked portfolios have returns over days +6 through +15 that exceed their respective control period mean returns by at least two standard deviations. Recall that these results, unlike those for listed stocks, cannot be due to a shift in order flow from sell orders (executed at the bid) to buy orders (executed at the ask).

Next, we examine the daily behavior of average bid-ask spreads surrounding the turn of the year. Table V reveals clearly that, except for the first four size-ranked portfolios, quoted spreads remain virtually unchanged over the period immediately surrounding the turn of the year. For the smaller NASDAQ stocks, there is some tendency for quoted spreads to be somewhat higher surrounding the turn of the year than in the control period. Although the differences are statistically significant, it is not clear that they are economically significant.[23]

It should be noted that, on July 7, 1980, NASDAQ began reporting inside (i.e., highest bid and lowest ask among all participating market makers) closing quotes. Prior to that date, closing bid and ask prices were medians of all submitted quotes. To examine the effect of this change we computed the average relative bid-ask spread for size-ranked portfolios 1, 10, and 20 over the two 50-day periods immediately before and immediately after the change in reporting. In each case there was a significant reduction in relative spread. For portfolios 1, 10, and 20 respectively, average relative spreads before and after the change were 0.5002/0.2997 (t-statistic on the difference = 67.5); 0.1168/0.0676 (t-statistic = 94.3); 0.0431/0.0218 (t-statistic = 73.5). The average spreads reported in Tables I, IV, and V should be interpreted as mixtures of these two regimes. Because spreads were reduced for all size groups, the general patterns reported in these tables are valid both before and after the change in reporting.[24]

An additional measure of the liquidity of a stock is the frequency at which it trades. As measures of trading frequency, Table V reports average daily trading volume and the average percentage of stocks that trade each day. As would be expected, the table reveals that the volume of trading and the percentage of stocks that trade each day both increase as firm size increases. The smallest

[23] For example, portfolio 1 has an average relative spread of 35 percent just prior to the turn of the year compared with a control period average of 31 percent. This difference is 80 times the time-series standard deviation of the mean relative spread over the control period.

[24] Because computed returns are based upon bid-ask averages, the change in reporting could affect returns if median quotes are not symmetric about inside quotes. We computed the average of bid and ask prices for size-ranked portfolios 1, 10, and 20 for the day before and the day after the change in reporting. The before and after average prices were \$1.76/\$1.75 for portfolio 1, \$9.45/9.40 for portfolio 10, and \$37.67/\$38.05 for portfolio 20. Thus, the change in quotes had, on average, little effect upon the midpoints of bid-ask spreads.

stocks in our sample (portfolio 1) trade an average of 7030 shares per day over the control period, and, on average, a sizable 47 percent do not trade each day. The largest stocks in our sample trade an average of 55,030 shares per day, and only four percent, on average, do not trade each day.

For the small firms in our sample, trading activity begins to increase on day −3. The last trading day of the year (day −1) is by far the most active day reported in terms of both shares traded and percentage of stocks trading. These values reach 12,969 shares traded and 23 percent non-trading for portfolio 1 on day −1. Both differ from their control period means by more than five standard deviations. By contrast, the first two days of the new year are characterized by extremely low trading activity for small firms. The average number of shares traded and percentage not trading on the first day of the year are 4501 and 51 percent, respectively, for portfolio 1. Again, both figures differ from their respective control period means by more than two standard deviations. Despite these dramatic differences in trading activity, the returns for portfolio 1 on days −1 and 0 are nearly identical.

As firm size increases, the above reported patterns in trading activity tend to diminish. For the largest firms in our sample (portfolio 10), trading activity, measured by either shares traded or percentage of stocks trading, is actually lower before the turn of the year than afterward.

Although one should keep in mind that only three year-end periods of trading activity data were available for analysis here, the daily returns and trading activity patterns observed in the NASDAQ data match fairly closely the results previously obtained for listed securities. We also find that, except for the smallest NASDAQ firms, quoted relative bid-ask spreads are virtually constant over the turn-of-the-year period.

V. Firm Size, Returns, and the Bid-Ask Spread

Table I revealed strong relations among firm size, returns, and the bid-ask spread. To provide a more detailed description of these relations, we cross-classified firms at the end of each year, first into deciles based upon bid-ask spreads and then within each spread decile into firm size quintiles. Several descriptive statistics for these classifications over the 1981–1985 period are reported in Table VI. We exclude the 1973–1980 time period over which median spreads are reported. Each cell of the table contains the average relative bid-ask spread (averaged over all trading days in December of each year), average market value of equity (in thousands of dollars), average excess return in January, average excess return over all other months of the year, and average number of market makers. The cells contain approximately equal numbers of firms each year. The average number of observations in each cell over the sample period is 340 (68 firms × 5 years). Averages of all values across spread deciles, across size quintiles, and over all cells are also presented.

There is a large range of liquidity and firm size within the data. The smallest, least liquid firms have an average relative spread of 54.44 percent and average market value of equity of $737,380. By comparison, the largest, most liquid firms

Table V

Daily Returns and Trading Characteristics Surrounding the First Trading Day of the Year

These data are for ten size-ranked portfolios of NASDAQ stocks averaged over the period 1973–1985. For each cell the first number is the daily portfolio return; the second number is the relative bid-ask spread; the third number is daily trading volume in shares; and the fourth number is the percentage of stocks traded. Returns and spreads are averaged over the period 1973–1985. Volume and percent traded are averaged over 1983–1985.

	Portfolio									
Day[a]	1 (smallest)	2	3	4	5	6	7	8	9	10 (largest)
−5	0.0001	0.0023	0.0035	0.0033	0.0028	0.0047	0.0043	0.0037	0.0036	0.0035
	0.36	0.22	0.17	0.13	0.10	0.08	0.07	0.06	0.04	0.03
	7400	9015	7201	7843	5941	7933	11078	10119	13253	29447
	0.62	0.71	0.75	0.81	0.83	0.86	0.89	0.90	0.94	0.94
−4	−0.0004	0.0024	0.0026	0.0027	0.0026	0.0029	0.0024	0.0029	0.0028	0.0043
	0.35	0.22	0.17	0.13	0.10	0.08	0.07	0.06	0.04	0.03
	7404	10108	9992	9319	9095	9717	10535	11409	14320	35580
	0.68	0.75	0.79	0.85	0.85	0.88	0.88	0.91	0.94	0.95
−3	0.0004	−0.0006	0.0001	0.0005	0.0010	−0.0002	0.0003	0.0001	−0.0000	0.0002
	0.35	0.22	0.16	0.13	0.10	0.08	0.07	0.06	0.04	0.03
	8487	12480	11101	12213	10225	11942	13162	13025	16860	38866
	0.73	0.77	0.81	0.87	0.87	0.90	0.92	0.92	0.95	0.96
−2	0.0019	0.0008	0.0033	0.0024	0.0023	0.0023	0.0025	0.0024	0.0025	0.0024
	0.35	0.22	0.16	0.13	0.10	0.08	0.07	0.06	0.04	0.03
	9495	14638	13229	13725	11040	12959	14973	15678	18374	40624
	0.75	0.78	0.84	0.87	0.89	0.90	0.92	0.93	0.94	0.96
−1	0.0119	0.0110	0.0105	0.0104	0.0093	0.0080	0.0094	0.0089	0.0079	0.0072
	0.35	0.22	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	12969	20892	16101	14287	13308	14179	16589	17415	21729	39746
	0.77	0.82	0.85	0.87	0.88	0.91	0.92	0.90	0.97	0.96
0	0.0108	0.0058	0.0040	0.0035	0.0022	0.0027	0.006	0.0012	0.0002	−0.0000
	0.34	0.22	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	4501	8909	9157	9669	8180	8545	10694	11470	15922	37122
	0.49	0.67	0.72	0.80	0.84	0.88	0.92	0.90	0.96	0.96

+1	0.0055	0.0042	0.0038	0.0042	0.0038	0.0048	0.0039	0.0050	0.0036	0.0023
	0.34	0.21	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	4598	9307	8747	9910	8886	12929	10823	14456	18358	46776
	0.48	0.66	0.74	0.82	0.86	0.89	0.90	0.92	0.95	0.96
+2	0.0076	0.0072	0.0063	0.0072	0.0064	0.0074	0.0069	0.0055	0.0055	0.0035
	0.34	0.21	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	7246	10834	12153	10602	11017	11976	13585	16291	22121	58684
	0.47	0.68	0.77	0.81	0.84	0.89	0.91	0.92	0.96	0.96
+3	0.0068	0.0058	0.0053	0.0046	0.0036	0.0035	0.0030	0.0027	0.0020	0.0008
	0.34	0.21	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	7048	11756	13533	12095	12769	11781	14406	17746	23118	54256
	0.52	0.67	0.76	0.84	0.86	0.89	0.92	0.92	0.96	0.96
+4	0.0057	0.0055	0.0048	0.0058	0.0041	0.0043	0.0038	0.0028	0.0024	0.0005
	0.34	0.21	0.16	0.12	0.10	0.08	0.07	0.06	0.04	0.03
	7544	13447	13312	12897	10229	13175	15172	16968	23261	56185
	0.51	0.69	0.77	0.84	0.90	0.90	0.92	0.91	0.97	0.97
+5	0.0068	0.0046	0.0056	0.0032	0.0032	0.0035	0.0030	0.0022	0.0019	0.0014
	0.34	0.21	0.16	0.12	0.10	0.08	0.06	0.05	0.04	0.03
	8101	13589	11660	12063	10099	12987	14561	16726	21361	55440
	0.52	0.70	0.77	0.84	0.87	0.90	0.92	0.92	0.96	0.96
Average over days +6–+15	0.0050	0.0042	0.0037	0.0028	0.0031	0.0028	0.0023	0.0023	0.0016	0.0009
	0.33	0.21	0.16	0.12	0.10	0.08	0.06	0.05	0.04	0.03
	7084	15154	12909	12642	11253	13696	16245	19229	23664	61520
	0.53	0.71	0.78	0.84	0.87	0.90	0.92	0.93	0.96	0.96
Average and standard deviation)[b] over control period days +30–+55	0.0016 (0.0013)	0.0011 (0.0009)	0.0005 (0.0010)	0.0004 (0.0011)	0.0003 (0.0009)	0.0002 (0.0013)	0.0001 (0.0012)	0.0001 (0.0013)	−0.0001 (0.0013)	0.0001 (0.0014)
	0.31 (0.0005)	0.20 (0.0007)	0.15 (0.0010)	0.12 (0.0006)	0.10 (0.0003)	0.08 (0.0003)	0.06 (0.0004)	0.06 (0.0004)	0.04 (0.0006)	0.03 (0.0002)
	7030 (951)	13397 (1189)	13570 (2100)	12097 (1163)	12303 (1934)	13067 (1474)	15288 (1099)	15855 (2828)	21658 (2534)	55030 (5721)
	0.53 (0.014)	0.70 (0.016)	0.77 (0.016)	0.83 (0.013)	0.86 (0.010)	0.89 (0.011)	0.91 (0.009)	0.92 (0.008)	0.95 (0.008)	0.96 (0.005)

[a] Day 0 is the first trading day in January.
[b] Time series standard deviations are in parentheses below averages.

Table VI

NASDAQ Firms Classified by Bid-Ask Spread and Then Ranked by Size over the Period 1981–1985

For each cell the first number is the relative bid-ask spread; the second number is the market value of equity in thousands of dollars; the third number is the excess return in January; the fourth number is the excess return in all other months; and the fifth number is the number of market makers. All numbers are averages across firms within the cell and across time from 1981 through 1985.[a]

	Spread Decile										
Size Quintile	1 (Most Liquid)	2	3	4	5	6	7	8	9	10 (Least Liquid)	Average across Spread Deciles
1	0.0139	0.0021	0.0309	0.0416	0.0546	0.0702	0.0940	0.1307	0.1992	0.5444	0.1146
(Smallest)	57472.52	22982.47	14601.25	9813.94	7018.91	5005.84	3548.51	2448.17	1599.13	737.38	12977.52
	−0.0251	−0.0072	−0.0019	0.0057	0.0198	0.0281	0.0184	0.0399	0.0453	0.1003	0.0209
	−0.0003	−0.0034	−0.0026	0.0001	−0.0007	0.0026	−0.0005	0.0074	0.0075	0.0106	0.0017
	12.3	9.9	9.2	8.7	7.8	7.1	7.5	6.9	6.6	4.8	8.2
2	0.0128	0.0214	0.0306	0.0409	0.0536	0.0700	0.0929	0.1308	0.1942	0.4416	0.1032
	113179.00	42855.01	25569.98	16963.76	11759.11	8768.61	6082.95	4355.66	2809.74	1440.40	24620.65
	−0.0252	−0.0124	0.0001	0.0108	0.0023	0.0069	0.0217	0.0093	0.0457	0.0971	0.0141
	0.0069	−0.0015	−0.0023	−0.0015	0.0008	−0.0059	−0.0093	0.0004	−0.0048	−0.0034	−0.0019
	12.1	10.9	9.2	9.0	8.1	7.8	7.4	7.6	7.1	6.1	8.7

3	0.0115	0.0211	0.0304	0.0408	0.0530	0.0694	0.0931	0.1281	0.1929	0.4201	0.1006
	175294.00	65807.31	38542.48	25598.73	17369.42	12944.53	8726.60	6415.53	4144.28	2270.70	37792.70
	−0.0267	−0.0076	0.0005	−0.0077	0.0108	0.0086	0.0025	0.0228	0.0256	0.0542	0.0072
	0.0024	−0.0010	−0.0009	−0.0053	−0.0078	−0.0046	−0.0055	−0.0106	−0.0028	0.0048	−0.0031
	12.6	10.7	9.7	9.5	8.6	8.0	7.3	7.4	7.4	7.2	9.0
4	0.0103	0.0207	0.0303	0.0402	0.0529	0.0690	0.0920	0.1253	0.1901	0.4165	0.0991
	284012.62	100615.94	59703.57	37908.42	26481.92	20505.25	13149.19	9613.83	6435.29	3571.57	59130.77
	−0.0394	−0.0220	−0.0037	0.0056	−0.0144	0.0010	0.0066	0.0237	0.0255	0.0480	0.0019
	0.0072	0.0028	−0.0002	−0.0041	−0.0064	−0.0071	−0.0130	−0.0106	−0.0094	−0.0053	−0.0043
	14.6	10.7	8.7	8.8	8.1	7.5	7.7	6.8	7.2	8.1	8.9
5	0.0086	0.0198	0.0298	0.0405	0.0526	0.0685	0.0909	0.1259	0.1864	0.3663	0.0974
(largest)	730682.75	213447.50	135048.50	84438.00	58858.00	45833.06	38664.86	27542.40	15398.69	8878.06	128035.19
	−0.0509	−0.0310	−0.0169	0.0000	−0.0176	0.0032	0.0056	0.0146	−0.0078	0.0177	−0.0080
	0.0013	0.0024	0.0012	−0.0071	−0.0024	−0.0055	−0.0054	−0.0118	−0.0130	−0.0193	−0.0058
	16.3	11.1	8.7	8.3	6.7	6.5	5.7	6.7	7.4	8.9	8.6
Average across	0.0115	0.0210	0.0304	0.0408	0.0533	0.0694	0.0926	0.1282	0.1925	0.4372	0.1029
size quintiles	253710.75	88780.75	54194.66	35207.02	24338.79	18776.36	14163.64	10167.67	6116.61	3420.38	52396.02
	−0.0328	−0.0159	−0.0042	0.0028	0.0002	0.0095	0.0109	0.0220	0.0267	0.0632	0.0072
	0.0036	−0.0002	−0.0010	−0.0036	−0.0033	−0.0041	−0.0067	−0.0052	−0.0046	−0.0029	−0.0027
	13.5	10.7	9.1	8.8	7.9	7.4	7.1	7.1	7.2	7.1	8.7

[a] Each cell contains approximately equal numbers of firms each year. The average number of observations in each cell over the sample period is 340 (68 firms × 5 years).

have an average relative spread of 0.86 percent and average market value of equity of $730.7 million.

Visual inspection of the data corroborates the strong inverse relation between firm size and bid-ask spread, where firms are now ranked first by spread. The average number of market makers is also closely related, in the manner expected, to both spread and firm size.

The correlation between firm size and bid-ask spread, computed across the 50 cell values in Table VI, is −0.30. When the natural logarithm of firm size is used, the correlation becomes −0.70. The Spearman rank correlation between spread and firm size is −0.88. Looking either across rows or down columns, the average excess return in January tends to increase with the bid-ask spread and decrease with firm size. In contrast, no clear pattern emerges for average excess returns across other months.

Despite the high degree of association between firm size and relative bid-ask spread, we wish to determine whether either variable has marginal power to explain excess returns once the other has been accounted for. To achieve this, we regress average excess returns, first separately and then jointly, on the natural logarithm of average firm size and average relative bid-ask spread. The use of the log of firm size is motivated by earlier studies (Amihud and Mendelson (1986)) which found this specification to provide greater explanatory power for excess returns (in comparison with absolute firm size). The tests are performed using the cross-section of five-year average values of each variable reported in Table VI. Nearly identical results are obtained when the data are disaggregated across years (e.g., using five annual average values for each variable). The results of the regressions are reported in Table VII. OLS t-statistics are reported in parentheses, and GMM t-statistics are reported in brackets below the coefficient estimates. Adjusted R^2 and p-values are also reported. Taken separately, both firm size and relative spread are highly significant in explaining cross-sectional variation in average excess January returns. The results indicate that each variable also contributes significantly at the margin to the explanation of excess January returns. Both variables enter with highly significant t-statistics of the expected sign. Jointly the log of firm size and relative bid-ask explain 88 percent of the cross-sectional variation in average excess January returns.[25]

Similar regressions were performed using average excess returns for all months except January as the dependent variable. Neither the log of firm size nor relative bid-ask spread had significant explanatory power over the months February through December. Finally, nearly identical results obtain when the tests are performed with firms ranked first into size deciles and then into spread quintiles.

VI. Conclusions

This study examines a comprehensive data set of OTC/NASDAQ securities for evidence of returns anomalies known as the size effect and the turn-of-the-year

[25] However, this result should be interpreted with caution. Because there is no well developed theory concerning the relationships among excess returns, firm size, and bid-ask spread, there is no sound reason to use any one functional form. Given the high degree of correlation between firm size and spread, it is possible that different nonlinear transformations of the variables may yield different conclusions regarding the marginal explanatory power of either variable.

Table VII

Cross-Sectional Regressions of Average Excess January Return on the Natural Log of Firm Size and Relative Bid-Ask Spread

Each regression is performed using the five-year average values of each variable reported in Table VI.

Parameter Estimates				
Intercept	Log (Firm Size)	Relative Spread	Adjusted R^2	p-Value[a]
0.180	−0.018	—	0.80	<0.0001
	(−14.02)[b]			
	[−10.47][c]			
−0.013	—	0.195	0.69	<0.0001
		(10.48)		
		[8.52]		
0.116	−0.012	0.094	0.88	<0.0001
	(−8.80)	(5.77)		
	[−10.59]	[4.09]		

[a] p-Values test the significance of the overall regression. Degrees of freedom for the first two regressions are (1,49) and, for the third regression, (2,48).

[b] OLS t-statistics are in parentheses.

[c] GMM t-statistics are in brackets.

effect. As in previous studies of exchange-traded securities, we document evidence of both effects over the period January 1973 through December 1985. Our results strongly confirm earlier studies based solely on listed stocks. Small firms tend to earn significant, positive abnormal returns in January, and conversely for large firms. These general results are not sensitive to changes in the composition of the market index.

We feel that the findings presented here are important for several reasons. First, most of the truly small publicly traded firms in the U.S. trade "over the counter." Second, this study introduces additional degrees of freedom to extant tests of the anomalies.[26] These tests are bolstered by increasing the size of the stock universe employed by some 200%. Third, despite nontrivial institutional differences between the major organized exchanges and the OTC/NASDAQ market, the size and seasonality patterns of listed stocks are clearly evident in nonlisted, publicly traded stocks. Fourth, the manner in which NASDAQ returns are calculated enables us to rule out shifts in order flow as the cause of the observed effects. Finally, small NASDAQ firms do not suffer from the same selection bias, based upon past performance, that small exchange-listed firms do.

The available bid-ask spread data allow us to draw some additional conclusions. Quoted bid-ask spread is highly correlated cross-sectionally with firm size. Both variables appear to be significant in explaining average excess returns in January. Average relative bid-ask spreads are stationary over the period immediately surrounding the turn of the year and across calendar months. If spreads accurately reflect liquidity, explanations of the observed anomalies that are based upon seasonal differences in transactions costs are ruled out. Finally, the quoted inside

[26] For more on this point, see Merton (1987, pp. 106–108).

spreads of small NASDAQ firms are too large to allow public traders to earn profits based upon a knowledge of the anomalies.

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