

Stock Exchange Listings, Firm Value, and Security Market Efficiency: The Impact of NASDAQ

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Abstract

This paper is an event-time study of OTC stocks that listed on the New York Stock Exchange (NYSE) over the period 1966-1977. This period was chosen because it spans the introduction of the National Association of Securities Dealers Automatic Quotation (NASDAQ) communications system in the OTC market. In the pre-NASDAQ period, stocks, on average, earn significant positive abnormal returns in response to listing announcements. In the post-NASDAQ period, abnormal returns in response to listing announcements are statistically significantly lower than those for the pre-NASDAQ period. These results are consistent with the hypothesis that NASDAQ has reduced the benefits associated with listing on a major stock exchange. Additionally, in both the pre- and post-NASDAQ periods, stocks, on average, earn significant positive abnormal returns following the initial announcement of listing before listing actually occurs, and they earn significant negative returns immediately after listing. These anomalies are explored and the results are shown to be insensitive to variations in empirical methodology.

I. Introduction

The general purpose of this study¹ is to examine the behavior of common stock prices for a sample of over-the-counter (OTC) firms that obtained listings on the NYSE over the period of January 1966 through December 1977. The primary methodology employed is an event-time analysis of stock returns surrounding dates on which information regarding listings is likely to have been released to market participants.

The analysis provides direct evidence regarding the effect of a major stock exchange listing upon shareholders' wealth. The results also contain indirect implications regarding the economics of the trading process and market liquidity.

The most frequently encountered hypothesis regarding the value of a major stock exchange listing argues that improved liquidity provided by exchange trad-

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¹ This paper extends and expands upon work by Sanger [26].

ing stimulates demand for a firm's stock, which, in turn, gives rise to a permanent increase in stock price. An opportunity to test the liquidity hypothesis was provided by the introduction of the National Association of Securities Dealers Automatic Quotation (NASDAQ) communications system in the OTC market in February 1971.

The primary contribution that the NASDAQ system has made to the OTC market is in providing a more complete and timely method for communicating information about OTC dealers' quotations. As a consequence, it is argued by the National Association of Securities Dealers (NASD), among others, that the OTC market has now evolved to the point at which the benefits of an exchange listing have been greatly reduced.²

By examining new listings before and after the introduction of NASDAQ, we should be able to discern any effect that the system has had on the value of an exchange listing.

We also present a test of the market's efficiency in reacting to announcements of NYSE listings. This test is motivated, in part, by several empirical investigations that have documented stock return anomalies surrounding exchange listings prior to the introduction of NASDAQ. These earlier studies have reported stock price increases following public announcements of listings before actual listing, and subsequent decreases after listing occurs. Because these price movements occur after information regarding listings is released to market participants, these results are inconsistent with the concept of an efficient capital market. Thus our examination of listings prior to the introduction of NASDAQ not only provides a benchmark against which to compare post-NASDAQ results, it also allows us to determine whether the anomalous results reported by earlier investigators were due to the methodologies used or to the time periods covered. In addition, the study indicates the extent to which the anomalous stock price behavior observed prior to NASDAQ has persisted in the post-NASDAQ period.

The remainder of the paper is structured as follows. The next section contains a discussion of the listing procedure. This background discussion is useful for identifying precise dates on which information regarding impending exchange listings can be considered to be in the public domain. In Section III, previous empirical examinations of new listings are reviewed. This review motivates our reexamination of new listings in the pre-NASDAQ period. Section IV describes the way in which transactions take place on the organized exchanges and in the OTC market. This description includes a discussion of the way in which the NASDAQ system has altered the OTC market. Based upon this discussion, a plausible argument is constructed to support the claim that the introduction of NASDAQ has reduced the source of any value that results from an NYSE listing. In Section V, we describe our sample selection procedures and data. Section VI contains a description of the methodologies to be used in the analysis, and Section VII presents the results. The final section consists of a summary and concluding remarks.

² See, for example, "Securities Markets Battle to Attract and Maintain Listed Corporations," *Wall Street Journal* (December 18, 1980), p. 31.

II. Procedure for Listing on the NYSE

A detailed sequence of procedures must be followed by a company to obtain a listing on the NYSE. First, a firm must meet certain exchange standards that include a minimum net income, a minimum market value for shares outstanding, and a minimum number of owners of round lots of shares. These requirements serve as proxies for the anticipated volume of transactions, which determines whether trading on the NYSE will be cost effective relative to the OTC market.³

Next, a formal application must be filed with the Division of Stock List. The corporation must also register all securities to be listed with the Securities and Exchange Commission (SEC) under Section 12 of the Securities Exchange Act of 1934. The listing application provides exchange officials with the information necessary to determine the suitability of the security for trading on the Exchange. However, prior to filing a formal application, virtually all firms undertake a confidential preliminary review by the Exchange. This insures that all firms that eventually file a formal application are successful in obtaining a listing. The first official public announcement concerning a formal listing application appears in the *Weekly Bulletin* published every Friday by the Exchange.

Approximately four weeks after the firm has filed its formal application for listing, either the Marketing Division or the Board of Directors of the Exchange renders a decision. The shares become eligible for trading 30 days after the NYSE notifies the SEC that it has received the registration statement and has approved the firm's listing application. An admission date is then agreed upon by the firm in question and the Exchange.

The first official public announcement by the Exchange that an application has been approved also is published in the *Weekly Bulletin* in the week in which approval is granted, and a subsequent issue indicates the date on which trading in an approved stock is to begin. Finally, all firms that are approved for listing must enter into a listing agreement with the Exchange and pay both initial and continuing annual fees.⁴

The steps involved in the listing procedure suggest three dates around which security returns should be examined: (1) the official *announcement* by the Exchange that a formal application has been filed, (2) the date on which *approval* is granted, and (3) the actual *listing* date.

³ West and Tinic [37] and Hamilton [9] provide theoretical and empirical evidence that trading in a single double auction market, such as the NYSE, has a cost advantage relative to a dispersed dealership market, such as the OTC, when the rate of transactions is high.

⁴ Initial listing fees include a fixed charge of \$25,000, plus a variable fee that is a decreasing function of the number of shares listed. Continuing annual fees are also a variable function of the number of shares listed and are payable for the first 15 years after listing, but terminate if the firm ceases to trade on the Exchange for any reason. The total present value of all listing fees, using a 2-percent real discount rate and two million shares priced at \$25 per share, amounts to 0.29 percent of total equity value. The figures used for this calculation approximate the average size and share price of the new issues listed over the period covered by this study. A 2-percent real discount rate was used to calculate the present value of the continuing annual fees because the fee schedule is rarely changed. For additional details concerning the listing procedure, see [17].

III. Previous Studies of New Listings on the Organized Exchanges

In earlier empirical studies of the reaction of stock prices to listings on the organized exchanges, Ule [32] examined the price behavior of 29 stocks that listed on either the NYSE or the New York Curb Exchange over the period 1934 through 1937 and Merjos ([19], [20], and [21]), in a series of *Barron's* articles, examined the price behavior of stocks that became newly listed on the NYSE or the AMEX during three nonoverlapping time intervals covering the early- and mid-1960s. Both authors report that stocks generally rise in price relative to a chosen market index prior to listing and subsequently suffer relative price declines.

Ule and Merjos centered their examinations around the actual listing date rather than the original announcement date of a new listing. Therefore, it is not possible, based upon their results, to determine whether firms that recently have done well subsequently decide to list, or whether the news of an impending listing triggered the price increase. Nor is it possible to determine whether market participants immediately responded to information contained in the listing announcement. Beyond that, the systematic and apparently persistent decline in prices following listing is puzzling.⁵

In a more careful documentation of price reactions surrounding listing announcements, Ying, Lewellen, Schlarbaum, and Lease (hereafter, YLSL) [38] examined stocks that became listed on the NYSE or the AMEX during the period January 1966 through December 1968. In computing abnormal returns, YLSL use the Fama-MacBeth [5] procedure to generate cross-sectional estimates of monthly market parameters to control for market movements and differences in securities' risks. The firms in their sample earned an average abnormal return of +7.54 percent in the month in which listing was applied for. In the following month, before actual listing, the stocks earned an average abnormal return of +5.0 percent.

Finally, an abnormal return of -1.87 percent was observed in the month following listing. All of these returns differed significantly from 0 at the 0.05 level or greater. The positive abnormal return in the month of application is consistent with the hypothesis that listing increases the firm's value.

Because firms that formally apply for listing are virtually never rejected, the positive abnormal return in the month between application and listing and the negative abnormal return in the month following listing are inconsistent with the semi-strong form of the efficient markets hypothesis.⁶ The results are, however, consistent with the findings of Ule and Merjos.

Because of the questions raised by previous studies of new listings, the time period chosen for this study includes the interval examined by YLSL [38]. The

⁵ In another study, Van Horne [33] examined a sample of NYSE and AMEX listings over the period 1960-67 and discovered stock price reactions to listing announcements consistent with those of Ule and Merjos. Additionally, in a study of the post-listing price behavior of stocks that listed on the AMEX between January 1968 and September 1970, Goulet [8] found that 68 percent of the stocks declined in price relative to their respective S&P Industry Indices over the 12 months following listing.

⁶ A search of the *Weekly Bulletin* over the period 1966 through 1977 revealed no cases in which a formal application to list on the NYSE was rejected by the Exchange.

sensitivity of results to variations in methodology is examined, and we have attempted to determine more carefully the dates on which information regarding listings may have been released.⁷

IV. Security Market Structure and Market Liquidity

To the extent that listing enhances a security's value, the gain generally is attributed to the superior liquidity services that the organized exchanges are presumed to supply in comparison with the OTC market.⁸ Typically, a market is said to provide superior liquidity services if the cost of immediately trading a given quantity of a security in that market is lower than in the comparison market. For empirical purposes, this cost is frequently, though imperfectly, measured by the spread between the bid and ask quotations for stocks traded in the market. Differences between the cost of liquidity services provided by the organized exchanges and those provided by the OTC market could result from the dissimilar structures and means of transacting in the markets.

In contrast to the organized exchanges, which rely upon a specialist, liquidity is provided in the OTC market by a group of geographically separated dealers who are said to "make a market" in particular stocks. Since the number of dealers per stock is unregulated, competitive forces determine the number of dealers who actively trade in each issue. In a series of papers, Stoll [29] and Ho and Stoll ([11], [12], and [13]) develop an explicit model of a dealer's cost function in both monopolistic and competitive markets. Their results include a determination of the optimal scale of a dealership and, hence, the equilibrium number of dealers in a given security. Stoll [30] provides empirical support for the model.

Prior to the introduction of NASDAQ, the bid and ask quotations of all dealers in a particular stock were disseminated through publication of the daily NASD "pink sheets." Because of the time lag in updating quotations, costs had to be incurred both by dealers to discover up-to-date information about aggregate market conditions and by brokers wishing to find the best possible transaction prices for their customers. If either search costs were sufficiently high or demand conditions changed sufficiently rapidly to prevent an exhaustive search of the market, a dispersion of quotes among dealers would have existed.⁹ The costs of

⁷ YLSL [38] used S&P's *Security Owners Stock Guide* as the source of the announcement dates for the listings in their sample. Because announcements typically appear in the *Stock Guide* several weeks after they are published in the *Weekly Bulletin*, the announcement dates used by YLSL frequently lag the true date by up to one month.

⁸ Three alternative explanations that have been offered are: (1) holders of listed shares have greater access to information about the firm, (2) holders of listed shares are protected by more effective regulation against unreasonable commissions and fraudulent business practices, and (3) a stock exchange listing signals management's confidence in the future prospects of the firm. The first two explanations appear to be less likely candidates to explain the increase in value that accompanies listing. First, at least since the passage of the Securities Acts Amendments of 1964, the same disclosure requirements that apply to listed firms have applied to stocks traded in the OTC market. Second, because the By-Laws, Rules of Fair Practice, and enforcement mechanisms of the NASD constitute a self-regulatory framework equivalent to that of the organized exchanges, any differential regulatory protection is likely to be slight. Finally, although managerial signalling remains a viable alternative, we do not provide a direct test of this hypothesis.

⁹ Stigler [28], Kohn and Shavell [15], and Rothschild [25] develop models of optimal search

obtaining transactions services in a multidealer market would then have included the costs of searching for an acceptable trading price.¹⁰

In February 1971, the NASDAQ system was implemented. This system allows instantaneous communication of bid and ask quotations among OTC dealers and brokers. Because the system also allows dealers to update quickly their quotations in response to changes in information, it has imparted some of the qualities of a central market to the OTC.

Two lines of reasoning support the contention that the introduction of NASDAQ improved the liquidity of OTC stocks. First, as Kohn and Shavell [15] have demonstrated, a reduction in search costs initially stimulates additional search by market participants. In turn, this forces dealers to provide more uniform quotes in order to attract demand, and results in a more compact distribution of price quotations among dealers. The new equilibrium is then characterized by lower total search costs and, thus, a lower cost of trading.

Second, NASDAQ provides each dealer with up-to-date information about the quotations of competing dealers. Because a single dealer in isolation observes only a fraction of the total trading volume in a particular stock, interdealer communication allows each dealer to more easily distinguish random fluctuations in supply and demand from shifts in equilibrium conditions and also facilitates the process of trading among dealers to balance inventories. Each of these factors decreases the risks and costs of making a market in OTC stocks, thus reducing dealer spreads.¹¹

In support of the arguments regarding the impact of NASDAQ, Hamilton [10] has provided evidence that the differences between the NYSE and the OTC market, in the costs of providing liquidity services that prevailed in the pre-NASDAQ period, largely were dissipated by the introduction of NASDAQ. Holding constant the factors that influence bid-ask spreads, Hamilton observed significantly lower spreads for stocks traded on the NYSE than for those traded in the OTC market prior to NASDAQ. However, he found that the difference in spreads was significantly reduced in the post-NASDAQ period.¹²

It is not unreasonable to presume that the introduction of NASDAQ has reduced the gain in value that previously may have come about as a result of any liquidity benefits provided by listing. If NASDAQ has improved the liquidity of the OTC market sufficiently, then we should not observe positive stock price reactions to new listing announcements in the post-NASDAQ period.

behavior for market participants in this environment. In general, a sale (purchase) will take place when a trader discovers a price quote exceeding (falling below) an optimally determined reservation price. The optimal reservation price, in turn, is a function of both the cost of searching and the perceived distribution of price quotations.

¹⁰ Garbade and Silber [7] provide a discussion and empirical test of these points in the market for U.S. treasury securities.

¹¹ Ho and Stoll ([11] and [13]) present a model of the interaction among competing dealers, and determine an equilibrium bid-ask spread under the assumption of perfect information.

¹² Additional evidence consistent with this argument is provided by Tinic and West [31], who demonstrate that liquidity costs are higher *ceteris paribus* on the Toronto Stock Exchange than on the NYSE and that the differential is at least partially responsible for increased trading by Canadian investors in NYSE stocks.

V. Sample Selection and Data

The initial sample included all 444 OTC firms that applied for an original listing on the NYSE over the twelve-year period January 1966 through December 1977. To be included in the final sample, bid and ask quotations must have been available for a stock for at least 26 weeks prior to the announcement of its formal application, and also for a total of at least 52 weeks either before or after the announcement date. The final sample consists of the 319 firms for which sufficient data were available. Of this total, 153 firms were listed in the pre-NASDAQ period (1966-1970) and 166 were listed following the introduction of NASDAQ (1971-1977). Table 1 presents the calendar time distribution of listing dates.

TABLE 1
Frequency Distribution, by Year, of Total OTC Firms
that Listed on the NYSE and Firms in the Final Sample, 1966-1977

Year	Total OTC-NYSE Listings	Firms in the Final Sample
1966	36	29
1967	34	28
1968	46	30
1969	57	42
1970	37	24
1971	58	34
1972	51	41
1973	53	32
1974	15	12
1975	11	10
1976	20	20
1977	26	17
	Total 444	Total 319

Application, approval, and listing dates were obtained from the NYSE's *Weekly Bulletin*. Each Friday's *Bulletin* contains applications received by the Exchange and approvals rendered during that week. To verify that the *Bulletin* was indeed the first published source of news regarding each listing, the *Wall Street Journal Index* was checked for such announcements. For each of the firms in the sample, announcement in the *Bulletin* preceded any announcement in the *Wall Street Journal*.

For each stock in the sample, Friday's bid and ask quotations were collected from the *I.S.L. Daily Stock Price Record* for 52 weeks prior to the official announcement that a company had filed an application up through the week prior to listing. In those cases in which Friday was a holiday, Thursday's bid and ask price quotations were substituted. Any apparent errors in the data were checked against quotes in either *Barron's* or the *Wall Street Journal*.¹³ Returns for the 104 weeks following the week of listing were computed from the *CRSP* daily return files. Over the time period before actual listing, weekly rates of return

¹³ Cross-checking of an observation was performed: (1) if the bid quote were higher than the ask, (2) if either a quotation were missing or could not be read clearly, (3) if the bid-ask spread appeared to be out-of-line with previous or subsequent spreads, or (4) if the quoted prices changed by more than 25 percent in a single week after adjusting for stock dividends and splits.

were alternatively computed for each security using bid, ask, and the average of the bid and ask quotations.¹⁴ For all return computations, cash dividends, stock dividends and splits, and other changes in capitalization were taken into account. Additionally, weekly rates of return were computed for the Standard and Poor's (S&P) 500 Stock Index and for the value-weighted index consisting of all AMEX and NYSE stocks for the period 1965 through 1978.

Because the distributional properties of securities' returns are important in testing for significant abnormal performance, several descriptive statistics for the pre- and post-NASDAQ samples were computed. These are reported in Table 2 along with the 95th and 99th fractiles of the skewness, kurtosis, and studentized-range coefficients of samples drawn from a normal distribution.

TABLE 2
Summary Statistics for Weekly Returns of Stocks Initially Listed on the NYSE
in the Pre- (1966-1970) and Post-NASDAQ (1971-1977) Periods

	Pre-NASDAQ Listings (N=153) ^a	Post-NASDAQ Listings (N=166) ^a
Mean Return per Week:		
Before Listing	0.0057	0.0047
After Listing	0.0013	-0.0007
Combined Before and After Listing	0.0037	0.0020
Standard Deviation of Return	0.0513	0.0578
Skewness	0.508	0.504
Kurtosis	4.742	5.324
Studentized Range	6.016	6.237

Fractiles of Random Samples of Size 100 Drawn from a Normal Population					
Skewness		Kurtosis		Studentized Range	
0.95	0.99	0.95	0.99	0.95	0.99
±0.389	±0.567	3.77	4.39	5.90	6.36

^aStatistics are averages for each sample of securities based on the 105 weekly returns surrounding the week of listing.

The distributions of returns for the listing securities are significantly positively skewed and leptokurtic, relative to the normal distribution. Based on the raw returns, it appears that many firms decide to list after a period in which they have performed exceptionally well. Specifically, in the pre-NASDAQ period, the average weekly return was 0.0057 over the 52 weeks before listing, versus 0.0013 over the 52-week period after listing. Corresponding pre- and post-listing average weekly returns for the post-NASDAQ period were 0.0047 and -0.0007, respectively.¹⁵

¹⁴ OTC bid and ask quotations are reported to the financial news services by the NASD. The published bid and ask quotations are termed "representative" quotes. Actually, bids are the median of the quotations of all participating market makers, while asks are equal to the median bid quotation plus the median bid-ask spread for the security.

¹⁵ Interestingly, when sample statistics were computed separately for returns before versus after listing, the average kurtosis and studentized-range values fell below the 95th fractile of random samples drawn from a normal distribution. Thus, the time series of returns surrounding the event of listing appear to deviate from normality partly because they are drawn from a mixture of distributions.

VI. Methodology

The primary methodology employed to measure the average magnitude and timing of security price adjustments to announcements surrounding an NYSE listing is the now standard abnormal returns technique based upon the market model.¹⁶ The model is implemented by computing *ex post* abnormal returns for each security as

$$(1) \quad AR_{jt} = R_{jt} - (\hat{\alpha}_j + \hat{\beta}_j R_{mt}),$$

where $R_{jt} = R_{mt}$ are the observed returns for security j and the market portfolio, respectively, in time t , relative to the event date of interest. The security specific parameters $\hat{\alpha}_j$ and $\hat{\beta}_j$ are computed over an estimation period that adjoins the event in question, but excludes those time periods in which information concerning the event is likely to influence security returns.

Event period average abnormal returns are computed as

$$(2) \quad \overline{AR}_t = \sum_{j=1}^N \frac{AR_{jt}}{N},$$

where N is the number of securities in the portfolio on event date t . The event time period examined below begins 52 weeks before the event date of interest (time 0) and ends 52 weeks after the event. Cumulative average abnormal returns also will be examined and are computed as

$$(3) \quad CAR_t = \sum_{k=-52}^t \overline{AR}_k.$$

To determine statistical significance, each security's abnormal return in event week t is first standardized by its estimated prediction error

$$(4) \quad \widehat{AR}_{jt} = AR_{jt} / S_t(AR_j),$$

where

$$S_t(AR_j) = \left\{ S_j^2 \left(1 + \frac{1}{T} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{\tau=1}^T (R_{m\tau} - \bar{R}_m)^2} \right) \right\}^{1/2},$$

S_j^2 = the residual variance from the ordinary least squares estimation of the market model for security j ,

\bar{R}_m = the average return on the market portfolio over the estimation period for security j , and

T = the total number of weeks in the estimation period.

¹⁶ Because the statistical techniques applied here are widely used in stock market studies, we provide only a brief description of the key statistics reported below. For a fuller discussion of the methodology and underlying assumptions see, for example, [16].

Then, the test statistic for the null hypothesis of a 0 abnormal return in event week t is computed as

$$(5) \quad Z_t = \overline{AR}_t / S(\overline{AR}),$$

where

$$\overline{AR}_t = \frac{1}{N} \left(\sum_{j=1}^N \widehat{AR}_{jt} \right), \text{ and } S(\overline{AR}) = \left(\frac{T-2}{T-4} \right)^{1/2} \frac{1}{\sqrt{N}}.$$

VII. Empirical Results

The discussion of empirical results addresses three issues. First, does listing have a positive impact on stock price? Second, does the "listing effect" differ between the pre- and post-NASDAQ periods? Third, are our results (and, by implication, the results of earlier investigators) sensitive to the empirical methodology employed? To accomplish these objectives, we first discuss abnormal returns for new listings in the pre-NASDAQ period around three event dates: (1) the week of publication in the *Weekly Bulletin* of a firm's formal application to list, (2) the week in which approval of the formal application by the NYSE's Board of Directors is published, and (3) the week in which listing actually takes place.

We then discuss abnormal returns around the same three event dates for new listings in the post-NASDAQ period. Following these discussions, we conduct a statistical test to determine whether the listing effect differs between the pre- and post-NASDAQ periods. Constructing this test turns out to be a subtle undertaking in itself because of certain anomalies in the data. Finally, we conduct a number of experiments to determine the extent to which the results of the study are sensitive to variations in the empirical methodology applied.

In reporting the results, we initially focus upon those generated using the S&P 500 Index as a proxy for the market portfolio and the pre-listing returns series based on the average of OTC bid and ask quotations. The parameters of the market model were estimated for each security over weeks +15 through +104, following the week in which the firm's application to list is published in the *Bulletin*. The period from week +1 through +14 is excluded to avoid any delayed announcement effects that may be reflected in securities' returns following week 0. Additionally, the period from week -52 through week -1 is excluded because of the apparent selection bias in the data. That is, from the data, it appears that firms typically apply for listing following a period during which their stocks have earned unusually high returns (see Table 2).¹⁷

In the tables below, column 1 identifies the event week relative to week 0, column 2 presents the average abnormal return, and column 3 reports the test statistic described in equation (5) for each event-related week. Column 4 presents the cumulative average abnormal return and column 5 reports the percentage of

¹⁷ Because these criteria are admittedly arbitrary, the analyses below were repeated using other periods to estimate market model parameters. In all cases, the results closely parallel those reported in the paper.

firms having nonnegative abnormal returns in each event-related week. This statistic is reported to indicate the degree of uniformity of the observed pricing effects, and also to serve as the basis for a nonparametric test of significance. Because listing securities' return distributions are asymmetric as well as thick-tailed, a generalized sign test is used to determine the statistical significance of the percentage of securities having nonnegative abnormal returns.¹⁸

To implement the sign test, we determine the proportion of stocks in the sample that should have nonnegative abnormal returns under the null hypothesis of no abnormal performance. Call this proportion p_o . If the null hypothesis is true, the number of nonnegative values of AR_{jt} , in a sample of size n at time t , will have the binomial distribution with parameter p_o . The proportion of securities having nonnegative abnormal returns under the null hypothesis was estimated as the average fraction of those stocks with nonnegative abnormal returns over the control period of weeks +15 through +104, relative to the announcement week.

A. New Listings in the Pre-NASDAQ Period (1966-1970)

1. Application to List on the Exchange

Table 3 reports results surrounding the week in which the announcement of a formal application to list initially appeared in the *Bulletin*. Examination of the results indicates that firms experience predominantly positive abnormal returns over the year prior to the listing announcement. The CAR rises to 21.76 percent by the week of announcement and, in fact, continues to drift upward through week +8, where it reaches a maximum of 26.63 percent.

For the period beginning 10 weeks prior to the announcement, and ending 8 weeks after the week of announcement, only three abnormal returns are negative, while several are positive and significant at either the 0.01 or 0.05 level. Additionally, abnormal returns in the week prior to the announcement and in the actual week of announcement are both statistically significant ($z = 2.73$ and 2.44 , respectively). Surprisingly, 4 of the 8 weeks immediately following the announcement date exhibit significant positive abnormal returns. After week +8, returns exhibit no particular abnormal behavior and the CAR ends up at 25.68 percent 52 weeks after the week of announcement.

The sign test of the percentage of firms having nonnegative abnormal returns in any event-related week supports the same general conclusions as the z -test, although the results are somewhat less significant.¹⁹ Specifically, the percentage of nonnegative abnormal returns over the control period (weeks +15 through +104) is 0.46. In weeks closely surrounding the announcement date,

¹⁸ When the data under analysis deviate from normality, the sign test is more powerful at detecting a false null hypothesis than is the t -test, and it also ensures that the stated significance of the test is achieved. The generalized sign test is described in [2], pp. 167-170. This test avoids the problems associated with applying standard nonparametric tests to asymmetric data observed by Brown and Warner [3], pp. 218-222.

¹⁹ Although the sign test performs well when the data deviate markedly from normality, it has low power relative to the t -test when the data are approximately normal. In the present case (due to the Central Limit Theorem), event-time portfolio returns appear to be closer to normally distributed than do individual securities' returns. The skewness, kurtosis, and studentized-range statistics for portfolio returns are -0.09 , 3.01 , and 4.31 , respectively (compare to Table 2).

TABLE 3
 Summary of Abnormal Returns Analysis of 153 OTC Stocks that Listed
 on the NYSE over the Period 1966-1970 for the 105 Event Weeks Surrounding
 the Week of Announcement

Event ^a Week	Average Abnormal ^b Return	Z-Statistic ^c	Cumulative Average ^d Abnormal Return	Percent ^e Nonnegative
-52	0.0066	1.58	0.0066	0.53*
-40	0.0055	1.29	0.0497	0.47
-30	0.0035	0.96	0.0685	0.44
-20	0.0074	2.16*	0.1153	0.52
-10	-0.0050	-1.10	0.1531	0.45
-9	0.0108	3.01**	0.1639	0.58**
-8	0.0087	2.52*	0.1725	0.56**
-7	0.0079	2.15*	0.1804	0.52
-6	0.0079	2.06*	0.1883	0.51
-5	-0.0018	-0.62	0.1865	0.42
-4	0.0060	1.70	0.1925	0.54*
-3	0.0003	0.30	0.1928	0.46
-2	0.0056	1.50	0.1984	0.53*
-1	0.0104	2.73**	0.2088	0.51
0	0.0088	2.44*	0.2176	0.52
1	0.0088	2.32*	0.2263	0.52
2	0.0012	0.52	0.2275	0.45
3	0.0031	0.78	0.2306	0.49
4	0.0098	2.76**	0.2404	0.52
5	0.0116	2.55*	0.2520	0.52
6	-0.0003	-0.31	0.2517	0.48
7	0.0064	2.19*	0.2581	0.48
8	0.0082	1.62	0.2663	0.51
9	-0.0030	-1.06	0.2633	0.39*
10	-0.0080	-1.42	0.2554	0.45
20	-0.0029	-0.80	0.2388	0.41
30	-0.0049	-0.84	0.2481	0.41
40	-0.0067	-1.38	0.2442	0.41
52	0.0015	0.61	0.2568	0.51

*Significant at the 0.05 level.

**Significant at the 0.01 level.

^aWeek relative to the initial published announcement of a listing application in the *Weekly Bulletin*.

^bComputed by equation (2).

^cTest statistic as computed by equation (5).

^dComputed by equation (3).

^eCross-sectional percentage of stocks having nonnegative abnormal returns.

the percentage of nonnegative abnormal returns is consistently and sometimes significantly above this level.

The foregoing results are interpreted in the following way. The large positive abnormal returns in weeks -1 and 0, relative to the announcement of a formal listing application, indicate that, over the period 1966 through 1970, a listing on the NYSE was viewed as a valuable commodity by the capital market.²⁰

²⁰ We have defined week -1 to end on the Friday on which the announcement is published in the *Weekly Bulletin*. Each Friday's *Bulletin* contains applications received by the Exchange during the week. The *Bulletin* is then mailed to subscribers and would normally be received in week 0. However, some firms also announce their formal applications to the financial news services on the day the application is filed. For this reason, it is appropriate to measure the market's initial reaction to the listing announcement as the abnormal returns that occur in weeks -1 and 0.

The predominance of positive abnormal returns in the weeks prior to the announcement of a formal application could have at least three explanations: (1) the result of actions by "insiders" who have access to the news of a formal application before the official public announcement, (2) firms decide to list only after a period in which they have performed exceptionally well, and (3) misspecifications of the test procedure. This final possibility will be addressed in Section VII.C.

The behavior of securities' returns after the public announcement date is more puzzling, though it is certainly consistent with the results of YLSL, Merjos, and other earlier listing studies. The CAR increases by 4.77 percent between the announcement week and week +8 before leveling off. This change in the CAR has a significant *z*-value of 4.39.²¹ The existence of significant positive abnormal returns in weeks following the initial public announcement of a listing application is inconsistent with the concept of an efficient capital market, unless some uncertainty as to the outcome of the event remains after the announcement date.

The positive abnormal returns following the initial announcement could be due to the fact that approval by the Exchange follows the initial application with an average lag of four weeks. Given the listing procedure, it seems unlikely that the announcement of the formal approval contains any further information. However, this possibility was tested by computing abnormal returns surrounding the week in which the application for listing is approved by the NYSE's Board of Directors. Though not reported here, the general behavior of the CAR is similar to that observed surrounding application dates, however, there is no significant reaction in the week of approval, or in the closely surrounding weeks. Apparently, on average, no new information is provided to the market by the formal announcement of an approval to list. However, even though approval follows application by an average of four weeks, positive abnormal returns continue to accrue after the approval week. Specifically, in the four weeks following the week of approval, the CAR increases by 2.83 percent and two of the weekly abnormal returns differ significantly from 0 at the 5 percent level.

2. Listing on the Exchange

Our interest in examining returns surrounding the week in which trading begins is motivated by the anomalous returns surrounding listing that have been

²¹ The test statistic for the null hypothesis that the cumulative abnormal return is equal to 0 over the period t_1 through t_2 is computed as

$$Z = \overline{\text{CAR}} / \frac{S(\overline{\text{AR}})}{\sqrt{L}}$$

where

$$\overline{\text{CAR}} = \frac{1}{L} \left(\sum_{t=t_1}^{t_2} \overline{\text{AR}}_t \right), \quad L = t_2 - t_1 + 1.$$

Serial correlations of the average abnormal returns of up to lag 5 were computed to verify conformance with the test assumption of independence. In all cases, the serial correlations were below 0.10 and, thus, statistically insignificant.

documented by earlier studies. Specifically, past studies report that abnormal returns tend to be positive during the interval between application and listing, and then become significantly negative immediately after listing. Results centered on the listing week are reported in Table 4.

TABLE 4
Summary of Abnormal Returns Analysis of 153 OTC Stocks that Listed
on the NYSE over the Period 1966-1970 for the 105 Event Weeks Surrounding
the Week of Listing

Event ^a Week	Average Abnormal ^b Return	Z-Statistic ^c	Cumulative Average ^d Abnormal Return	Percent ^e Nonnegative
-52	0.0009	0.03	0.0009	0.41
-40	0.0069	1.67	0.0276	0.46
-30	0.0048	1.15	0.0684	0.51
-20	0.0056	1.67	0.1215	0.54*
-10	0.0073	1.51	0.1589	0.52
-9	0.0074	1.80	0.1663	0.51
-8	0.0075	2.05*	0.1738	0.52
-7	0.0080	2.37*	0.1818	0.48
-6	0.0040	1.03	0.1858	0.50
-5	-0.0001	-0.21	0.1857	0.41
-4	0.0065	1.82	0.1922	0.54*
-3	0.0119	2.99**	0.2042	0.55**
-2	0.0064	1.27	0.2106	0.44
-1	0.0125	3.49**	0.2231	0.57**
0	0.0093	2.18*	0.2323	0.50
1	-0.0165	-4.40**	0.2158	0.33**
2	-0.0058	-1.54	0.2099	0.42
3	-0.0068	-2.07*	0.2031	0.33**
4	0.0066	1.67	0.2097	0.48
5	-0.0050	-0.95	0.2047	0.43
6	-0.0015	-0.28	0.2032	0.50
7	0.0029	0.16	0.2060	0.48
8	-0.0017	-0.68	0.2044	0.44
9	0.0001	0.02	0.2044	0.44
10	-0.0000	-0.12	0.2044	0.48
20	-0.0022	-0.80	0.2009	0.42
30	0.0012	0.73	0.2059	0.51
40	-0.0023	-0.43	0.2067	0.46
52	-0.0053	-1.36	0.2198	0.40

*Significant at the 0.05 level.

**Significant at the 0.01 level.

^aWeek relative to the week of listing on the NYSE.

^bComputed by equation (2).

^cTest statistic as computed by equation (5).

^dComputed by equation (3).

^eCross-sectional percentage of stocks having nonnegative abnormal returns.

Because trading on the Exchange begins, on average, 9 weeks after the initial application date, the 52-week pre-application and pre-listing periods have several weeks in common, hence, we observe a similar pattern of positive abnormal returns prior to the week of listing. The average abnormal returns in weeks -1 and 0 are positive and significant at the 0.01 and 0.05 levels, respectively.²²

²² We replicated all tests using returns series based on bid and ask quotations. In only one instance did these results differ from those based on the average of bid and ask quotations. In the week of listing, when bid quotations were used, a positive abnormal return of 2.12 percent with a z-statistic

These security returns are curious in view of the fact that the listing date becomes known shortly after a listing application is approved by the Exchange. It also is evident that the persistent positive abnormal performance observed following the initial announcement and approval dates terminates abruptly in the week of listing.

In sharp contrast to the results thus far, the firms in our sample, on average, experience significant negative abnormal returns immediately following listing. Specifically, the average abnormal returns in the first and third weeks after listing are negative and significant at the 0.01 and 0.05 levels, respectively. Additionally, in each of these weeks a full 67 percent of all firms have negative abnormal returns. Newly listed firms lose, on average, approximately 3 percent of their value, relative to the market model benchmark, over the three-week period following listing. This change in the CAR is significant at the 0.01 level, with a z -value of -4.87 . Over the ten-week period following listing, seven abnormal returns are negative. Furthermore, these results cannot be explained by peculiarities of the quotes used to compute returns, since NYSE closing prices are used from the listing week onward.

The significant negative returns immediately following listing are consistent with studies of new listings conducted over a thirty-five-year period prior to NASDAQ, but they are inconsistent with the semi-strong form of the efficient markets hypothesis. In the next section, we examine whether the anomalous behavior of firms' returns surrounding listing persist in the post-NASDAQ period.

B. New Listings in the Post-NASDAQ Period (1971-1977)

1. Application to List on the Exchange

Table 5 contains results centered on the week in which the announcement of an application to list initially appeared in the *Bulletin*. As in the pre-NASDAQ period, listing firms, on average, earn positive abnormal returns over the 52-week period prior to the listing announcement. The CAR rises to 19.57 percent by the week of announcement and continues upward to reach a maximum of 21.85 percent in week +4.

Although the general pattern of returns is similar to the previous results, there are important differences. The abnormal returns in weeks -1 and 0 are smaller in magnitude than those in the pre-NASDAQ period, and they are statistically insignificant. Also, the percentage of firms with nonnegative abnormal returns in these two weeks is nearly identical to the control sample percentage of 0.47. Apart from the "good news" that appears to be reflected in listing firms' returns over the year prior to the announcement week, the market's specific response to news of impending listings has diminished, on average, in the post-NASDAQ period. An alternative explanation is that leakage of information prior to the announcement date was sufficient to preclude any further reaction of stock prices in weeks -1 and 0 . However, it is not clear why there would be

of 5.55 was obtained; with ask quotations, a negative abnormal return of -0.23 percent with a z -statistic of -1.09 was obtained. These results occurred because the closing prices on the first Friday after listing typically fell between the bid and ask quotes on the last Friday prior to listing. In no other event related week were the results materially altered by the choice of price quotations.

TABLE 5
 Summary of Abnormal Returns Analysis of 166 OTC Stocks that Listed
 on the NYSE over the Period 1971-1977 for the 105 Event Weeks Surrounding
 the Week of Announcement

Event ^a Week	Average Abnormal ^b Return	Z-Statistic ^c	Cumulative Average ^d Abnormal Return	Percent ^e Nonnegative
-52	0.0042	0.93	0.0042	0.46
-40	-0.0006	-0.33	0.0606	0.46
-30	0.0057	0.83	0.1009	0.59**
-20	0.0063	0.84	0.1263	0.49
-10	0.0013	0.20	0.1632	0.53
-9	0.0038	0.81	0.1670	0.52
-8	0.0075	1.40	0.1745	0.51
-7	0.0073	2.24*	0.1818	0.51
-6	-0.0052	-1.75	0.1766	0.41
-5	0.0004	0.20	0.1770	0.45
-4	-0.0016	-0.23	0.1754	0.49
-3	0.0080	1.97*	0.1834	0.58**
-2	0.0060	1.43	0.1894	0.51
-1	0.0038	1.34	0.1932	0.48
0	0.0025	0.26	0.1957	0.47
1	0.0090	2.43*	0.2047	0.56**
2	0.0081	2.51*	0.2129	0.54*
3	0.0013	0.33	0.2141	0.53
4	0.0044	1.61	0.2185	0.50
5	-0.0007	-0.01	0.2178	0.48
6	-0.0108	-1.82	0.2070	0.45
7	0.0050	1.60	0.2119	0.54*
8	-0.0060	-2.05*	0.2060	0.44
9	0.0042	0.41	0.2102	0.46
10	-0.0024	-0.97	0.2077	0.46
20	0.0086	1.33	0.2024	0.53
30	-0.0017	-0.02	0.1771	0.42
40	0.0020	0.27	0.2086	0.50
52	-0.0048	-0.56	0.2039	0.46

*Significant at the 0.05 level.

**Significant at the 0.01 level.

^aWeek relative to the initial published announcement of a listing application in the *Weekly Bulletin*.

^bComputed by equation (2).

^cTest statistic as computed by equation (5).

^dComputed by equation (3).

^eCross-sectional percentage of stocks having nonnegative abnormal returns.

relatively more leakage of information in the post-NASDAQ period than in the pre-NASDAQ period.

In view of the reduced announcement effect in this later time period, it is surprising to observe positive abnormal returns after week 0. The abnormal returns in weeks +1 and +2 are statistically significant by both the z-test and the sign test. Also, the increase in the CAR over weeks +1 through +4 is significant at the 0.01 level with a z-value of 3.45.

These results provide some support for the contention that improved liquidity was at least partially responsible for the favorable reaction of stock prices to listing announcements in the pre-NASDAQ period, and that the introduction of NASDAQ has reduced the advantage associated with listing on a major stock exchange.

2. Listing on the Exchange

Because securities' returns are not significantly different from 0 on the approval date they are not presented here. Instead, we turn to a discussion of the results centered on the week of listing presented in Table 6.

TABLE 6
Summary of Abnormal Returns Analysis of 166 OTC Stocks that Listed
on the NYSE over the Period 1971-1977 for the 105 Event Weeks Surrounding
the Week of Listing

Event ^a Week	Average Abnormal ^b Return	Z-Statistic ^c	Cumulative Average ^d Abnormal Return	Percent ^e Nonnegative
-52	-0.0015	-0.22	-0.0015	0.45
-40	-0.0060	-1.44	0.0435	0.46
-30	0.0019	0.20	0.0706	0.46
-20	0.0025	0.95	0.1175	0.52
-10	-0.0016	-0.23	0.1391	0.46
-9	0.0091	2.31*	0.1482	0.53
-8	0.0033	0.60	0.1515	0.48
-7	0.0075	1.98*	0.1590	0.52
-6	0.0097	2.20*	0.1688	0.51
-5	0.0089	2.46*	0.1777	0.55*
-4	-0.0044	-0.80	0.1732	0.48
-3	0.0045	1.64	0.1777	0.53
-2	0.0036	1.44	0.1813	0.50
-1	0.0049	1.66	0.1862	0.55*
0	0.0122	2.09*	0.1984	0.57**
1	-0.0200	-4.60**	0.1783	0.34**
2	-0.0126	-2.51*	0.1658	0.40*
3	0.0095	1.40	0.1753	0.52
4	-0.0009	-0.04	0.1744	0.44
5	-0.0053	-1.21	0.1691	0.45
6	-0.0068	-1.18	0.1623	0.43
7	0.0020	1.42	0.1643	0.56**
8	0.0007	0.28	0.1651	0.48
9	0.0006	0.84	0.1657	0.49
10	0.0010	0.16	0.1667	0.48
20	-0.0089	-2.13*	0.1459	0.41
30	0.0074	1.11	0.1676	0.49
40	0.0005	0.24	0.1804	0.51
52	-0.0051	-0.68	0.1646	0.45

*Significant at the 0.05 level.

**Significant at the 0.01 level.

^aWeek relative to the week of listing on the NYSE.

^bComputed by equation (2).

^cTest statistic as computed by equation (5).

^dComputed by equation (3).

^eCross-sectional percentage of stocks having nonnegative abnormal returns.

As before, positive abnormal returns are observed through the week of listing. However, the most important result is that the anomalous returns observed immediately following the listing date in the pre-NASDAQ period persist in this later time period. Specifically, the average abnormal return in the first week after listing is negative and significant at the 0.01 level with a z-value of -4.60 . This result also is significant according to the sign test with 66 percent of the listing firms having negative abnormal returns. The abnormal return of -1.26 percent

in week +2 also is negative and statistically significant. Relative to the market model benchmark, listing firms lose, on average, over 3 percent in value in this two-week period. Also, as in the pre-NASDAQ period, abnormal returns are close to zero following the first two weeks immediately after listing. Fifty-two weeks after listing, the CAR of +16.5 percent is almost identical to its level of +16.6 percent two weeks after listing. Interestingly, the anomalous returns following both the announcement and listing weeks persist in the post-NASDAQ period, even though the initial market reaction to the news of an exchange listing has diminished.

A possible explanation of the consistent negative abnormal returns immediately following listing may lie in the market-making process and exchange rules governing the dealership function. Because the majority of transactions in a listed stock are channeled through the exchange specialist, it is quite likely that OTC dealers would discontinue making a market in a stock once it achieves listed status. In fact, over the period covered by this and all previous studies, NYSE rules prohibited member firms that made a market in an OTC stock from continuing to do so after the stock became listed. As a consequence, we would anticipate that OTC market makers would liquidate their inventories of newly listed stocks. If so, it is possible that the liquidation of dealer inventories has a depressing impact on the stock's price.

Unfortunately, this line of reasoning is not entirely compelling. First, the predictable negative returns following listing are still incompatible with capital market efficiency. Second, the explanation (contrary to Scholes [27]) implies that market participants are unable to recognize that the liquidation of inventories by OTC dealers conveys no negative information about the securities in question.²³

3. Comparing Returns in the Pre- and Post-NASDAQ Periods

The preceding tests indicate that there is a significant initial announcement effect associated with listing in the pre-NASDAQ period, but not in the post-NASDAQ period. However, the question of whether the announcement effects in the two periods differ significantly from each other still remains. Furthermore, given the peculiar abnormal returns observed following listing announcements, the precise way to construct an appropriate test is not entirely clear.

If the traditional hypothesis of market efficiency is accepted, then the proper test is to compare securities' returns in the announcement period only. However, if it is argued that the data suggest that the event of listing has an impact on securities' returns that persists beyond the announcement period, then the test period should be extended to include returns following the immediate announcement period. Because the choice is largely a matter of taste, we perform tests over several different time intervals.

Specifically, CARs are computed for both the pre- and post-NASDAQ periods over time intervals encompassing the application week through the following week (weeks -1 and 0), the application week through the listing week, and the

²³ Interestingly, since July 1980, NYSE member firms have been permitted (by S.E.C. Rule 19c-3) to make a market in stocks listed after April 26, 1979. An examination of new listings following July 1980 would permit a test of our conjecture.

application week through two weeks after the listing week. For convenience, we refer to cross-sectional average CARs computed over these three intervals as the initial listing effect, the gross listing effect, and the net listing effect, respectively (i.e., the net listing effect is the gross effect minus the negative effect that occurs in the two weeks immediately after listing). Because the number of weeks between the announcement and listing dates differs among securities, the latter two tests are conducted with cross-sectional averages of CARs computed for individual securities over intervals of different lengths.

Two types of tests are performed with each set of data. The results are summarized in Table 7. First, single sample tests are performed to determine whether each of the individual pre- and post-NASDAQ CARs differs significantly from 0 (columns 2 and 3). Then, two sample tests are performed to determine whether each of the various CARs from the pre-NASDAQ period differs significantly from the corresponding post-NASDAQ CARs (column 4).²⁴

For the pre-NASDAQ period, the initial listing effect, the gross listing effect, and the net listing effect are 1.92 percent ($z = 3.65$), 7.67 percent ($z = 6.34$), and 5.44 percent ($z = 4.04$), respectively. Each of these CARs differs significantly from 0 at the 0.01 level. Although the negative abnormal returns following listing reduce the gross listing effect, a significant positive listing effect is observed in the pre-NASDAQ period, regardless of the interval over which abnormal returns are measured.

By contrast, for the post-NASDAQ period, the initial, gross, and net listing effects are 0.64 percent ($z = 1.13$), 4.44 percent ($z = 4.10$), and 1.18 percent ($z = 1.43$), respectively.

Thus, for the post-NASDAQ period, the initial market reaction to the news of an exchange listing is not significantly different from 0. However, statistically significant gains do accrue to firms between the application and listing dates as the gross listing effect is positive and significant at the 0.01 level. The fact the increase in value that occurs after the initial listing announcement is not permanent is demonstrated by the insignificant value for the net listing effect.

Turning to the two sample tests, the z -statistics for the initial, gross, and net listing effects are 1.83, 2.44, and 2.72, respectively. Each of these values exceeds the critical level for significance at the 0.05 level or greater. Thus, despite certain peculiarities in the data, the results and conclusions drawn from the two sample tests are insensitive to the test period considered. These test results are consistent with the hypothesis that listing had a positive impact on firms' stock prices in the pre-NASDAQ period, and that the introduction of NASDAQ diminished significantly the valuation effect that was previously associated with listing on the NYSE.

C. Further Tests

To determine the extent to which the tests could be biased by the specifics of the methodology employed, the sensitivity of the results to variations in test implementation were considered.

²⁴ In performing the two sample tests, we assume that the average standardized abnormal returns for the pre- and post-NASDAQ periods have equal standard deviations. The computed sample standard deviations for the two periods are 0.082 and 0.079, respectively.

TABLE 7
Two Sample Tests for Differences in Listing Securities' Returns between the Pre- and Post-NASDAQ Periods

Time Interval	Cross-Sectional Average CARs ^a		Test Statistic ^b
	Pre-NASDAQ	Post-NASDAQ	H ₀ : Average CARs Are Equal
Initial Listing Effect (application week through following week)	0.0192 (3.65)	0.0064 (1.13)	1.83 (0.0336)
Gross Listing Effect (application week through listing week)	0.0767 (6.34)	0.0444 (4.10)	2.44 (0.0073)
Net Listing Effect (application week through two weeks after listing week)	0.0544 (4.04)	0.0118 (1.43)	2.72 (0.0033)

^a Single sample z-statistics are in parentheses. The average number of weeks in the application through listing interval for the pre- and post-NASDAQ periods are 10.0 weeks and 8.6 weeks, respectively.

^b p-values are in parentheses. The test statistic for time interval *i* is defined as follows

$$Z_i = \frac{\overline{CAR}_{1i} - \overline{CAR}_{2i}}{\left(\frac{N_1 S^2(\overline{AR}_1) + N_2 S^2(\overline{AR}_2)}{N_1 + N_2 - 2} \right)^{1/2}}$$

where

$$\overline{CAR}_{1i} = \frac{1}{N_1} \sum_{j=1}^{N_1} \sum_{t=r_j}^{s_j} \frac{\widehat{AR}_{1jt}}{\sqrt{L_{ij}}}, \quad \overline{CAR}_{2i} = \frac{1}{N_2} \sum_{j=1}^{N_2} \sum_{t=r_j}^{s_j} \frac{\widehat{AR}_{2jt}}{\sqrt{L_{ij}}}$$

$\widehat{AR}_{1jt}, \widehat{AR}_{2jt}$ are defined by equation (4) where

1 = pre-NASDAQ firms, 2 = post-NASDAQ firms

L_{ij} = number of weeks in test interval *i* for security *j*.

r_j, s_j = beginning and end points of the test interval for security *j*.

$S(\overline{AR}_1), S(\overline{AR}_2)$ are defined by equation (5), and

$N_1 = 153, N_2 = 166$.

First, as an alternative to the market model, we measured abnormal returns by the mean-adjusted returns model discussed by Brown and Warner [3]. A particular attraction of the mean-adjusted returns model is that the need to estimate securities' betas and select a proxy for the market portfolio is avoided. Also, the expected returns implied by both the market model and the mean-adjusted returns model will be equivalent, if the expected return for the market factor is stationary over the sample period.

The results obtained using the mean-adjusted returns model are nearly identical to those generated with the market model and, hence, are not reported.²⁵ Apparently, the market model results are not seriously biased by potential errors in estimating either securities' betas or returns on the market portfolio.

²⁵ Copies of all results described but not reported in this section are available from the authors upon request.

Second, biases in the results could occur if significant shifts in the process that generates equilibrium expected returns occur systematically in event time. Such shifts might be expected to occur if listing typically takes place in close proximity to other economically significant changes in the firm's activities.

To test for stationarity of the return-generating process, the market model was reestimated to allow for shifts in both α and β coefficients as follows

$$(6) \quad \tilde{R}_{jt} = \alpha_j + \alpha'_j D_j + \beta_j \tilde{R}_{mt} + \beta'_j D_j \tilde{R}_{mt} + \tilde{e}_{jt}$$

where
$$D_j = \begin{cases} 0 & \text{prior to listing of firm } j \\ 1 & \text{after listing of firm } j \end{cases}$$

Here α_j and β_j are firm j 's market model coefficients prior to listing, while α'_j and β'_j represent the changes in the coefficients that occur after listing.

In the pre-NASDAQ period, there were six (zero) decreases (increases) in α and six (five) decreases (increases) in β following listing that are significant at the 5-percent level. In the post-NASDAQ period, there were (was) seven (one) decreases (increase) in α and fifteen (thirteen) decreases in β following listing that were significant at the 5-percent level. Although the number of significant changes is greater than would be expected due to chance, especially in the post-NASDAQ period, the parameters of the market model are stable for the majority of firms in the sample. Also, the number of increases in systematic risk roughly equals the number of decreases in both periods. The results obtained after omitting stocks having significant changes in parameters were indistinguishable from those reported earlier.²⁶

In both the pre- and post-NASDAQ periods, significant positive abnormal returns were observed after the publication of listing announcements in the NYSE's *Weekly Bulletin*. One possible explanation for this effect is that the *Bulletin* is less widely circulated than other financial publications that typically report listing applications with various lags. To examine this possibility, announcement dates were collected from the *Wall Street Journal* and the tests were repeated. For the pre-NASDAQ period, three of eight weekly abnormal returns immediately following the announcement week are significant at the 0.05 level, and the CAR increased by 6.05 percent by the ninth week following the announcement. For the post-NASDAQ period, two of four weekly abnormal returns immediately following the announcement week are significant at the 0.05 level and the CAR increased by 2.25 percent by the fourth week following the announcement. Thus, especially in the pre-NASDAQ period, some degree of market inefficiency is documented even with respect to *Wall Street Journal* announcements—announcements that occur relatively late in the overall listing process.²⁷

²⁶ An alternative approach would be to compute abnormal returns using separate market model benchmarks for returns before versus after listing. However, a large fraction of the firms in the sample do not have sufficient pre-listing returns to both obtain reliable parameter estimates and allow for an omission period prior to the public announcement date.

²⁷ Several other checks as to the robustness of the results were also performed. First, the above analyses were replicated using alternative stock indexes as proxies for the market portfolio. As representative of the OTC market, the National Quotation Bureau's index of thirty-five industrial stocks was used for the period 1966-1970, and the NASDAQ composite index was used for the period 1971-

VIII. Summary and Conclusions

This paper examines the behavior of common stock returns for samples of OTC firms that were newly listed on the NYSE both before and after the introduction to the NASDAQ communications system in the OTC market. In the pre-NASDAQ period, we document a positive and significant reaction by the capital market to the news of a major stock exchange listing. This result is consistent with a number of earlier studies conducted over long periods of time prior to the introduction of NASDAQ. In the post-NASDAQ period, we observe a reduced and statistically insignificant capital market reaction to initial announcements of impending exchange listings. Additionally, despite some peculiarities in the stock return data surrounding listing announcements, the market's response to the news of new listing differs significantly between these two periods. This result is consistent with the joint hypothesis that the primary source of increases in value associated with exchange listings in the pre-NASDAQ period resulted from the superior liquidity services provided by the NYSE and that the introduction of NASDAQ in the OTC market has reduced the liquidity advantage provided by the NYSE.²⁸

However, care must be exercised in interpreting these results. We must admit the possibility that leakage of information to market participants prior to the public announcement date may have obscured any announcement effect in the post-NASDAQ period. Additionally, we are unable to explain the significant positive abnormal returns observed in weeks immediately following listing announcements in the post-NASDAQ period. Finally, we cannot rule out the possibility that firms' stock prices could be enhanced by a major stock exchange listing due to factors other than improvements in liquidity.

A second hypothesis concerning the valuation implications of listing concerns managerial signalling. Although the exact meaning of a particular signal may be ambiguous, YLSL [38] suggest that listing serves as an expression of managers' confidence in the future prospects of the firm. One possibility is that managers who expect significant growth in the firm's assets obtain a listing to facilitate the issuance of new equity. In this respect, Goulet [8] finds an unusually high frequency of new equity issues by recently listed companies over the period 1968 through 1970. Alternatively, managers who feel that their firm's stock is currently undervalued may obtain a listing to attract increased scrutiny

1977. Additionally, the value-weighted index of all NYSE and AMEX stocks was also used for both periods. In all cases, the results were nearly identical to those previously reported. In particular, there were no changes in the significance of individual weekly abnormal returns. Our conclusions are not altered by the choice of a market proxy.

Second, an attempt was made to determine whether the 125 firms that were deleted from the original exhaustive sample of 444 listings over the period 1966-1977 differed in any material way from the firms remaining in the final sample. All of the missing firms were deleted due to insufficient bid-ask data preceding the application date. However, a check of post-listing abnormal returns revealed behavior very similar to that reported above. Specifically, average abnormal returns for the first four weeks following listing were -0.0211 , -0.0059 , -0.0089 , and -0.0012 , with z -statistics of -4.77 , -1.67 , -2.04 , and -0.26 , respectively.

²⁸ The introduction of NASDAQ has not been the only recent change to affect the operation of U.S. securities markets. Two notable changes were the increased trading of listed securities in the "third market" and the gradual abolition of fixed minimum commissions on organized exchanges. Because both of these changes should have improved the liquidity of listed stocks, they serve to reinforce our conclusions.

by the market.²⁹ The possibility that stock exchange listings may signal other positive information about firms deserves further study.

Certain aspects of our results are puzzling. First, significant positive abnormal returns are observed following public announcements of listing applications. This is true even in the post-NASDAQ period in which we fail to observe an initial statistically significant announcement effect. This anomaly is measurable even when *Wall Street Journal* announcement dates are used, and, hence, is evidence inconsistent with capital market efficiency.

Second, listing securities in both the pre-and post-NASDAQ eras incurs significant negative abnormal returns immediately following listing. This phenomenon, which has been observed in virtually all previous studies of newly listed securities, is predictable conditional upon the prior public announcement of listing applications, and, hence, is inconsistent with the semi-strong form of the efficient markets hypothesis. Both of these anomalies were found to be insensitive to several variations in the empirical methodologies applied, and both have persisted over relatively long periods of time.

The implication of these results for holders of soon-to-be-listed OTC stocks is to sell them in the week of actual listing. Depending upon the magnitude of transactions costs, a strategy of buying a stock when a listing announcement appears in the *Weekly Bulletin* and then short selling in the week of listings may be profitable as well.³⁰

Although our results and analysis may provide the beginnings of a more complete understanding of the puzzling returns of common stocks surrounding stock exchange listings, the phenomenon deserves further investigation.

²⁹ Because the listing process is not costless (listing fees, disclosure requirements, management's time), we would not expect to observe that firms with poor future prospects seek to become listed.

³⁰ For further discussion of this point, see [18].

References

- [1] *Barron's*. New York: Dow-Jones, Inc. (1965-78).
- [2] Bradley, J. *Distribution-Free Statistical Tests*. Princeton, NJ: Prentice Hall (1968).
- [3] Brown, S. J., and J. B. Warner. "Measuring Security Price Performance." *Journal of Financial Economics*, Vol. 8 (September 1980), pp. 205-258.
- [4] Fabozzi, F. J., and R. A. Hershkoff. "The Effect of the Decision to List on a Stock's Systematic Risk." *Review of Business and Economic Research*, Vol. 14 (Fall 1979), pp. 77-82.
- [5] Fama, E., and J. MacBeth. "Risk, Return and Equilibrium: Empirical Tests." *Journal of Political Economy*, Vol. 81 (May-June 1973), pp. 607-636.
- [6] Furst, R. "Does Listing Increase the Price of Common Stocks?" *Journal of Business*, Vol. 49 (April 1970), pp. 174-180.
- [7] Garbade, K. D., and W. L. Silber. "Price Dispersion in the Government Securities Market." *Journal of Political Economy*, Vol. 84 (August 1976), pp. 721-741.
- [8] Goulet, W. M. "Price Changes, Managerial Actions and Insider Trading at the Time of Listing." *Financial Management*, Vol. 3 (Spring 1974), pp. 30-36.
- [9] Hamilton, J. L. "Competition, Scale Economies, and Transaction Cost in the Stock Market." *Journal of Financial and Quantitative Analysis*, Vol. 11 (December 1976), pp. 779-802.
- [10] _____. "Marketplace Organization and Marketability: NASDAQ, the Stock Exchange, and the National Market System." *Journal of Finance*, Vol. 33 (May 1978), pp. 487-503.
- [11] Ho, T., and H. Stoll. "On Dealer Markets under Competition." *Journal of Finance*, Vol. 35 (May 1980), pp. 259-267.
- [12] _____. "Optimal Dealer Pricing under Transactions and Return Uncertainty." *Journal of Financial Economics*, Vol. 9 (March 1981), pp. 47-73.
- [13] _____. "The Dynamics of Dealer Markets under Competition." *Journal of Finance*, Vol. 38 (September 1983), pp. 1053-1074.
- [14] *I.S.L. Daily Stock Price Record*. New York: Standard and Poor's Corporation (1968-78).
- [15] Kohn, M. G., and S. Shavell. "The Theory of Search." *Journal of Economic Theory*, Vol. 9 (October 1974), pp. 93-123.
- [16] Linn, S. C., and J. J. McConnell. "An Empirical Investigation of the Impact of Antitakeover Amendments on Common Stock Prices." *Journal of Financial Economics*, Vol. 11 (April 1983), pp. 361-400.
- [17] *Listing Procedure*. New York: New York Stock Exchange (1976).
- [18] McConnell, J. J., and G. C. Sanger. "A Trading Strategy for New Listings on the NYSE." *Financial Analysts Journal*, Vol. 40 (January-February 1984), pp. 34-38.
- [19] Merjos, A. "Going on the Big Board: Stocks Act Better before Listing than Right Afterward." *Barron's*, Vol. 43 (January 29, 1962), 5ff.
- [20] _____. "Like Money in the Bank: Big Board Listing, the Record Suggests, Is a Valuable Asset." *Barron's*, Vol. 43 (July 8, 1963), 9ff.
- [21] _____. "Up on the Curb." *Barron's*, Vol. 47 (May 1, 1967), 9ff.
- [22] *NASDAQ/OTC Securities Fact Book*. Washington, D.C.: National Association of Securities Dealers, Inc. (1978).
- [23] O'Donnell, J. L. "Case Evidence on the Value of a New Stock Exchange Listing." *Michigan State University Business Topics*, Vol. 17 (August 1969), pp. 15-21.
- [24] Reints, W. W., and P. A. Vandenberg. "The Impact of Changes in Trading Location on a Security's Systematic Risk." *Journal of Financial and Quantitative Analysis*, Vol. 10 (December 1975), pp. 881-890.
- [25] Rothschild, M. "Searching for the Lowest Price when the Distribution of Prices is Unknown." *Journal of Political Economy*, Vol. 82 (July-August 1974), pp. 689-711.
- [26] Sanger, G. "Stock Exchange Listings, Firm Value and Security Market Efficiency." Ph.D. Dissertation, Purdue University, Ann Arbor, MI: University Microfilms International.
- [27] Scholes, M. S. "The Market for Securities: Substitution Effects versus Price Pressure and the Effects of Information on Share Prices." *Journal of Business*, Vol. 45 (April 1972), pp. 179-211.

- [28] Stigler, G. J. "The Economics of Information." *Journal of Political Economy*, Vol. 69 (June 1961), pp. 213-225.
- [29] Stoll, H. "The Supply of Dealer Services in Securities Markets." *Journal of Finance*, Vol. 33 (September 1978), pp. 1133-1151.
- [30] _____. "Pricing of Security Dealer Services: An Empirical Study of NASDAQ Stocks." *Journal of Finance*, Vol 33 (September 1978), pp. 1153-1172.
- [31] Tinic, S. M., and R. R. West. "Marketability of Common Stocks in Canada and the U.S.A.: A Comparison of Agent versus Dealer Dominated Markets." *Journal of Finance*, Vol. 29 (June 1974), pp. 729-748.
- [32] Ule, M. G. "Price Movements of Newly-Listed Common Stocks." *Journal of Business*, Vol. 10 (October 1937), pp. 346-369.
- [33] Van Horne, J. "New Listings and Their Price Behavior." *Journal of Finance*, Vol. 25 (September 1970), pp. 783-794.
- [34] *Wall Street Journal*. N.Y.: Dow-Jones, Inc. (1965-78).
- [35] *Wall Street Journal Index*. N.Y.: Dow-Jones, Inc. (1966-77).
- [36] *Weekly Bulletin*. N.Y.: New York Exchange (1966-77).
- [37] West, R., and S. Tinic. *The Economics of the Stock Market*. New York: Praeger (1971).
- [38] Ying, L. K. W.; W. G. Lewellen; G. G. Schlarbaum; and R. C. Lease. "Stock Exchange Listings and Securities Returns." *Journal of Financial and Quantitative Analysis*, Vol. 12 (September 1977), pp. 415-432.

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