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Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures

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ABSTRACT

Attempts to identify price pressures caused by large transactions may be inconclusive if the transactions convey new information to the market. This problem is addressed in an examination of prices and volume surrounding changes in the composition of the S&P 500. Since these changes cause some investors to adjust their holdings of the affected securities and since it is unlikely that the changes convey information about the future prospects of these securities, they provide an excellent opportunity to study price pressures. The results are consistent with the price-pressure hypothesis: immediately after an addition is announced, prices increase by more than 3 percent. This increase is nearly fully reversed after 2 weeks.

THE EFFICIENT MARKET HYPOTHESIS (EMH) predicts that security prices reflect all publicly available information. Therefore, one corollary of the EMH is that "you can sell (or buy) large blocks of stock at close to the market price as long as you can convince other investors that you have no private information."[1] This statement assumes that securities are near perfect substitutes for each other. If so, the excess demand for a single security will be very elastic, and the sale or purchase of a large number of shares will have no impact on price.

In contrast to the EMH, Scholes [8], Kraus and Stoll [5], Hess and Frost [4], and others propose two hypotheses which predict that a large stock sale (purchase) will cause the price to decrease (increase) even if no new information is associated with the transaction.

The imperfect substitutes hypothesis (ISH), also known as the distribution effect hypothesis, assumes that securities are not close substitutes for each other, and hence, that long-term demand is less than perfectly elastic. Under this hypothesis, equilibrium prices change when demand curves shift to eliminate excess demand. Price reversals are not expected because the new price reflects a new equilibrium distribution of security holders.

The price-pressure hypothesis (PPH) assumes that investors who accommodate demand shifts must be compensated for the transaction costs and portfolio risks that they bear when they agree to immediately buy or sell securities which they otherwise would not trade. These passive suppliers of liquidity are attracted by immediate price drops (rises) associated with large sales (purchases). They are compensated for their liquidity service when prices rise (drop) to their full-information levels. The PPH, like the EMH, assumes that long-run demand is

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[1] Brealey and Myers [1, p. 279].

perfectly elastic at the full-information price. It differs in that it recognizes that immediate information about non-information-motivated demand shifts may be costly, and hence that short-term demand curves may be less than perfectly elastic.

The effect on price of large stock sales is studied by Scholes [8] and Mikkelson and Partch [6] in the case of secondary distributions, by Kraus and Stoll [5], Dann, Mayers, and Raab [2], and others in the case of block sales, and by Hess and Frost [4] in the case of new issues of seasoned securities. These authors all find an immediate significant price drop following large sales. Without further analysis, however, this evidence cannot be used to discriminate among the various price response hypotheses because secondary distributions, block sales, and new issues are all often associated with negative information about future security prospects. These large sales may depress the price because rational investors (acting under any of the three hypotheses) infer adverse information from the sale. Without controlling for the information effects of these sales, these events cannot be used to make inferences about short- and long-run elasticities of demand.

Two approaches to testing the various price response hypotheses might be considered. The informational price effect of information-bearing transactions might be measured, or attention might be focused on events which, by their very nature, are unlikely to convey new information to the market. The former approach is quite difficult since it requires an empirical model of the information price effect. The latter approach has been taken by several authors. Scholes [8] finds that absolute price drops are smaller on average (but still non-zero) when the seller is an estate or trust, both of which are presumed to trade most often for liquidity reasons, than when the seller is a corporation, which is presumed to trade more often for informational reasons. Mikkelson and Partch [6] and Hess and Frost [4], in their respective studies of secondary and primary distributions, both analyze separately the price effects found on announcement dates from those effects found on distribution dates. They associate the former with information effects and presume that the latter are information free. Both studies show that the distribution day price effect is small. They note, however, that substantial underwriting spreads are evidence of liquidity costs (price pressures) in their data.

This article presents tests for the presence of price pressures which we believe are not confounded by informational problems. The events studied here are changes in the composition of Standard and Poor's (S&P) list of 500 stocks. Also presented will be arguments and empirical evidence suggesting that these events do not convey new information to the market about future return distributions. However, since these events cause shifts in demand, primarily by index funds, a study of their effect on prices and volume will enable a more certain determination of whether price pressures exist.

The remainder of the article is organized as follows. Section I explains why changes in the composition of the S&P 500 list are not expected to convey new information, but are expected to cause changes in demand. Section II describes the empirical results, including those which support the no-information assertion. Section III contains a summary and some conclusions.

I. Causes and Effects of Changes in the S&P 500 List

Changes in the S&P 500 list are usually made when a listed company is involved in a bankruptcy, a merger, or a tender offer. The company is removed and is often replaced by the largest company in the same industry which is not yet on the list. Other changes are made when an included company becomes too small or when S&P wants the list to more nearly reflect the industrial and geographical composition of the U.S. stock market as a whole.[2] Between 1973–1983, approximately 20 firms per year have been routinely added to the list. In addition, on June 30, 1976, an extraordinary change added 53 mostly financial firms to the list.

The key aspect of S&P's selection mechanism for this study is that the composition of their list does not depend on forecast security returns. (S&P explicitly states that, "Judgements as to the investment appeal of the stocks do not enter into the selection process."[3]) Since changes are based only on publicly available information and on well-known criteria, they should not reveal new information about future return distributions. This assertion is further discussed and tested in the next section.

Although it is unlikely that changes in the composition of the S&P 500 list convey new information, they do shift demand. Many very large index funds try to replicate the performance of the S&P 500 Index by holding a portfolio of the 500 stocks employing the same weights used to compute the Index. Since the S&P 500 Index is a market value-weighted index, these portfolios do not need to be actively managed. Transactions occur only when the funds experience net cash inflows or outflows or when the composition of the S&P 500 list changes. In the latter case, the index funds frequently purchase the added security and sell the deleted security (if necessary) within a few days of the announcement. The potential shift in demand can be quite large. At the end of 1983, there were $35.7 billion invested in public index funds (2.96 percent of the total market value of the S&P 500 List) and probably an amount equal to that in privately managed (in-house) index funds.[4] If all public and private index funds bought an added (sold a deleted) security, demand for that security would increase (decrease) by 5.92 percent.[5]

Since changes in the composition of the S&P 500 list cause demands to shift, and since it is unlikely that the change announcements convey new information to the market about future return distributions, a study of their effects on prices and volume may identify price pressures in the absence of new information. The next section examines and interprets these effects.

[2] The criteria are published in S&P's *Security Price Index Record* [9] p. 1.

[3] S&P's *Security Price Index Record* (p. 1). In addition, in private conversation, the staff at Standard and Poors have strongly affirmed the stated selection criteria.

[4] *Pensions and Investment Age* (Vol. 13, No. 7, p. 1, April 1, 1985). The total market value of the S&P 500 at the end of 1983 was $1.207 billion.

[5] This figure probably overstates the change in demand since some index funds hold a stratified sample of the 500 stocks. These funds, which track nearly as well as the full-sample funds, will not necessarily respond to change announcements. On the other hand, there may be many portfolio managers, in particular those whose decisions must meet fiduciary standards, who prefer to invest only in S&P 500 stocks. When a stock is added to the list, they may buy it where previously they would not.

II. Empirical Results

All changes in the S&P 500 list for the period 1973–1983 were obtained. There were 228 additions during this period and an equal number of deletions. Since most deletions were the result of mergers, tender offers, or bankruptcies which caused listed securities to cease to exist, attention is focused primarily on the additions. Of these, 34 were excluded from the study because they involved a merger with a deleted firm (21 cases) or because the added stocks trade on the OTC markets (13 cases).

In order to study the price and volume effects associated with these changes, the exact date on which they became public knowledge must be known. Prior to September 1976, changes were first publicly announced in Standard and Poor's *The Outlook* on an irregular basis (about four times a year). Since this newsletter was always mailed so that it would arrive on a Monday for New York subscribers, the Monday arrival date is assumed to be the date of first public announcement for changes which occurred before September 1976. On September 22, 1976, S&P began a Notification Service which announced changes in the S&P 500 list to subscribers on the day of the change (always a Wednesday), after the close of trading. This date is taken as the first public announcement date for the second half of the sample.[6]

A. Immediate Post-announcement Volume and Price Changes

To determine whether trading activity increases after a firm is added to the S&P 500 list, trading volumes, adjusted for market volume, are analyzed in event-time.[7] Cross-sectional means are computed as follows:

$$\mathrm{MVR}_t = \frac{1}{N} \sum_i VR_{it}$$

where

$$VR_{it} = \frac{V_{it}}{V_{mt}} \cdot \frac{V_{m.}}{V_{i.}}, \tag{1}$$

where V_{it} and V_{mt} are the trading volumes of security i and of the total NYSE in event-time period t, respectively, and $V_{i.}$ and $V_{m.}$ are the average trading volumes of the security and of the total NYSE in the 8 weeks preceding the announcement week. The volume ratio, VR_{it}, is a standardized measure of period t trading volume in security i, adjusted for market variation. Its expected value is 1 if there is no change in volume during event-period t relative to the prior 8 weeks.

After the announcement of an addition, volume increases as predicted (Table

[6] During the entire sample period, changes were reported in the *Wall Street Journal* only two times. On July 1, 1976, the *Journal* reported the extraordinary change made on June 30, 1976. This report named only four firms used in this sample (four OTC firms were also named). Accordingly, the announcement dates for these firms were taken to be July 1, 1976. The second report on December 1, 1983 announced that all seven of the Bell operating firms were added to the S&P 500 list. This announcement was concurrent with the Notification Service announcement.

[7] The volume data were collected from S&P's *Daily Stock Price Record*. When a stock experienced a split, all subsequent volume data were divided by the split factor.

Table 1

Mean Post-Announcement Increases in Trading Volumes for Securities Added to the S&P 500 List

		Day 1[a]				Days 1 to 5			
Period	N	MVR[b]	STD[c]	t[d]	Percent >1	MVR	STD	t	Percent >1
1973–83	194	1.89	2.63	4.65	55	1.29	0.88	4.56	54
1973–77	110	1.21	2.69	0.81	33	1.01	0.81	0.18	36
1978–83	84	2.81	2.27	7.16	86	1.66	0.84	7.14	77
1978–80	34	1.87	1.11	4.51	82	1.47	0.74	3.71	68
1981–83	50	3.45	2.63	6.46	90	1.79	0.88	6.23	83
1973	20	1.00	0.84	−0.00	35	0.96	0.51	−0.37	35
1974	12	1.22	1.90	0.41	25	0.83	0.85	−0.68	17
1975	18	1.15	6.31	0.77	17	1.45	1.61	1.19	44
1976	52	0.95	0.67	−0.59	38	0.90	0.39	−1.89	35
1977	8	1.28	1.32	0.60	38	1.19	0.53	0.98	63
1978	11	1.76	0.84	2.85	80	1.65	0.91	2.37	64
1979	14	1.92	1.43	2.42	79	1.31	0.70	1.64	64
1980	9	1.92	0.89	3.08	89	1.52	0.50	2.62	78
1981	19	4.72	2.99	5.42	89	2.12	1.09	4.50	89
1982	22	2.28	1.93	3.04	86	1.52	0.69	3.41	71
1983	9	3.51	2.04	3.48	100	1.73	0.53	3.94	100

[a] Day 1 is the first day after announcement of the change.

[b] Mean volume ratio. The cross-security mean of the ratio of volume in security i on day 1 to the average volume in that security in the 8 weeks preceding the week of the addition announcement, adjusted for splits and market volume. The expected value of this ratio will be equal to 1 if the announcement has no effect on volume.

[c] The sample standard deviation of the volume ratios.

[d] t-statistic for testing whether the mean of the volume ratios is different from 1.

I, line 1).[8] On average, volume on day 1 (the first day on which trading is possible) is 1.89 times as large as the daily mean volume over the 8 weeks prior to the announcement. The summed volume for days 1 to 5 is 1.29 times as large as the previous weekly mean. Tests of whether these mean volume ratios are equal to 1 reject equality in both cases ($t = 4.65$ and $t = 4.56$, respectively). Moreover, the large mean volume ratios are not caused by only a few firms; the individual volume ratios are greater than 1 in 55 and 54 percent of the cross-section, respectively. These percentages are large since trading volume is skewed to the right. About 30 percent of these firms have volume ratios greater than 1 on any day chosen at random.

[8] Volume data for the individual securities are adjusted for splits whereas the market volume data are not. This causes the mean volume ratios to be biased downwards. Therefore, the large mean volume ratios presented in Table I are more significant than they would otherwise appear. Volume ratios were also examined without adjustment for splits and without adjustment for the market. The results in both cases are qualitatively the same. Market adjustment produces stronger tests by controlling for market variation.

Table II

Assets of Two Public Index Funds (By Year)

Year	Vanguard ($million)	Wells Fargo ($million)
1974	—[a]	170
1975	—[a]	152
1976	14	439
1977	21	1,049
1978	66	1,718
1979	78	2,686
1980	98	4,200
1981	91	4,344
1982	110	5,100
1983	234	6,130

Note: The Vanguard Index Trust is a publicly traded mutual fund, the Wells Fargo S&P Fund is managed by the trust department of that bank.

[a] The Vanguard Index Trust was founded in August 1976.

When the sample years are analyzed separately, it is apparent that the volume effect has grown over time (Table I). Most of the volume increase observed for the whole sample occurs in its second half. The mean day 1 volume ratio in 1973–1977 is only 1.21 ($t = 0.81$ with 33 percent greater than 1) versus 2.81 ($t = 7.16$ with 86 percent greater than 1) in 1978–1983. This result is consistent with the tremendous growth which index funds have experienced over the sample period.[9]

The volume data suggest a change in demand for the added securities but do not indicate in which direction prices move, if at all. Using event-study methodology, the evidence shows that prices immediately increase. The cross-sectional mean of the excess returns is 1.52 percent on day 1 (71 percent positive) and 1.62 percent (64 percent positive) for days 1 to 5 (Table III, line 1).[10] The t-statistics for testing whether these means are equal to zero are 8.99 and 4.73, respectively.[11]

[9] The total assets in public index funds grew from an insignificantly small total in 1973, to $9 billion by 1980 and to more than $35.7 billion by the end of 1983. These figures would probably double if assets under privately managed index funds were added in. As an illustration of the tremendous growth experienced by index funds, the assets of two public index funds are tabulated by year in Table II.

[10] Excess returns were computed using standard event study methodology as first developed by Fama, Fisher, Jensen, and Roll [3]. The market regressions were computed using data (obtained from the CRSP Daily Stock Return File) from 250 days before the announced change to 40 days after it, with days 0 to 10 excluded. Both the CRSP value-weighted and the CRSP equal-weighted market indices were used as proxies for the market return. The results are nearly identical. Only the value-weighted results are presented.

Note that although all of the event days occur only on Mondays or Wednesdays, the use of returns measured relative to the market eliminates biases that may result from the day-of-the-week effect.

News reports for each of the sample securities were collected from the *Wall Street Journal Index* to ensure that the event study results are affected by events which systematically coincided with the S&P announcements. No systematic patterns in reports are apparent.

[11] To control for heteroskedasticity, the t-statistics were computed from excess returns, standard-

Table III

Mean Excess Returns on the First Day Following an Announcement of an Addition to the S&P 500 List

		Day 1				Days 1 to 5			
Period	N^a	Mean[b]	STD	t^c	Percent > 0	Mean[b]	STD	t^c	Percent > 0
1973–83	194	1.52	2.41	8.99	71	1.62	4.69	4.73	64
1973–77	110	0.21	1.89	0.99	53	0.69	4.85	1.45	53
1978–83	84	3.13	1.96	13.95	96	2.77	4.23	6.00	77
1978–80	34	2.97	1.79	8.84	97	2.74	3.40	4.69	85
1981–83	50	3.25	2.07	10.65	96	2.79	4.75	4.16	72
1973	20	0.82	2.93	1.58	65	1.08	7.35	0.66	50
1974	12	0.19	1.87	0.15	50	0.25	2.69	0.32	58
1975	18	−0.02	1.82	0.03	50	3.20	6.21	2.19	72
1976	52	−0.07	1.27	−0.28	40	−0.43	2.70	−1.09	46
1977	8	0.89	1.75	1.20	75	1.15	4.66	0.70	50
1978	11	2.91	1.72	5.18	91	3.15	4.04	2.59	91
1979	14	2.30	1.56	4.32	100	1.82	3.22	2.11	71
1980	9	4.07	1.85	6.70	100	3.66	2.79	3.94	100
1981	19	3.89	1.28	11.98	100	2.59	4.57	2.47	74
1982	22	2.59	2.40	4.97	91	2.99	5.66	2.48	68
1983	9	3.52	2.32	5.58	100	2.74	2.59	3.17	78

[a] The number of securities in this table differs slightly from Table I because of data availability.

[b] Mean excess return on day 1 in percent. The CRSP value-weighted index was used as the market proxy.

[c] t-statistic for testing whether the mean of the excess returns on day 1 is different from zero. These t-statistics were computed after the excess returns were divided by the root-mean-squared error of the market model regression to adjust for heteroskedasticity.

The subsample evidence concerning the price effect closely resembles the volume effect. The positive post-announcement price effect is found only in the second half of the sample, as might be expected given the growth of index funds. During the subperiod 1973–1977, the cross-sectional mean excess return on the first day after the announcement is only 0.21 percent (t = 0.99 with 53 percent positive) while it is 3.13 percent (t = 13.95 with 96 percent positive) for 1978–1983.[12]

ized by the standard error of the market model regression. This procedure yields t-statistics which are slightly greater in value than those computed without standardization.

t-statistics were also calculated to determine whether the mean excess return on day 1 is different from the mean return observed on days −10 to 40, excluding days 0 to 6. This test is more robust than the former test, since it permits a degree of misspecification in the regression model. The results of this test are qualitatively identical to those presented in the text.

[12] Opening price data for the 14-month period December 1981–January 1983 were examined to determine whether the day 1 effect occurred before the start of trading (as would be expected if traders anticipated the post-announcement price rise) or during the trading period. (The sample period corresponds to a transactions data set which was readily available to us.) The mean returns

Conditional on the no-information assertion, the price data do not support the EMH. Rather, the significantly positive post-announcement price change appears to be evidence of price pressures or imperfect substitution among securities as new demanders purchase the added securities.

B. The No-information Assertion

The no-information assertion is essential to any interpretation of the post-announcement price change. Although S&P explicitly states that the selection decision does not depend on information about the future prospects of the stock, it is still important to examine the assertion critically. This subsection presents three empirical arguments in favor of the no-information assertion.

The first argument assumes that any information about the future prospects of the stock which might be associated with S&P 500 listing is valuable. Although this simple assumption seems almost definitional, it yields a useful test. If listing information were valuable, information-motivated investors would attempt to obtain it as quickly as possible. Before the Notification Service began in September 1976, this information could be obtained on demand (after the change was made but before it was published in the *S&P Outlook*) by calling Ron Anderson, the Director of Index Services at S&P. However, he reports (in private conversation) that only 5 to 10 such requests were made each year, primarily from index fund managers. After the Notification Services started, this patronage pattern persisted; almost all the initial subscribers were index fund managers, not information-motivated investors. If the listing information reveals information about the future returns prospects of the stocks, more interest in it might have been expressed.

The second argument in favor of the no-information assertion assumes that any information which might be associated with S&P 500 listing is independent of the total size or behavior of index funds. Since index funds grew tremendously over the sample period, this prediction can be tested by comparing mean post-announcement price changes for the first half (1973–1977) versus the second half (1978–1983) of the sample. If the announcement of an addition conveys new information about the future prospects of the stock, post-announcement prices should increase in both halves of the sample. However, as noted in the previous subsection, prices increase only in the second half of the sample (Table III, lines 2 and 3). This result is, therefore, inconsistent with the information hypothesis.

The third argument in favor of the no-information assertion may be the strongest. It assumes that any information which might be associated with S&P 500 listing will permanently affect prices. In particular, under the information hypothesis, there should be no reversal of the observed post-announcement price rise, as would be expected if the price change were due to price pressures. To test this prediction, mean cumulative (geometric) excess returns were computed for 30 event days following the announcement. Since the large post-announcement price change is found only in the second half of the sample, only that subperiod

for the 18 firms added to the S&P 500 list in this period are 1.45 percent ($t = 6.14$) from day 0 close to day 1 open and 1.01 percent ($t = 1.90$) from open to close on day 1. Although these results are based on a small sample, it appears that much of the first-day price increase accrues between the announcement and the opening of trading.

is analyzed. The results show a cumulative reversal of the 3.13 percent day 1 price rise (Table IV). The mean cumulative excess return from day 2 to day 11 is −1.74 percent, and from day 2 to day 21, it is −2.49 percent. Both cumulatives are individually significantly different from zero ($t = -3.01$ and $t = -3.07$, respectively). Moreover, it does not appear that only a few outliers cause the reversal. The cumulative price change is negative for 63 percent of the securities by day 11 and for 68 percent by day 21. Systematic reversal of the initial price effect is inconsistent with its interpretation as an information effect.

The t-tests of the previous paragraph only allow inference about the direction, but not the magnitude, of the reversal. Since the PPH predicts that the reversal will be complete while both the EMH (assuming information) and the ISH (assuming no information) predict that there will be no reversal, it is interesting to compare these two simple alternatives. Two tests are presented. The first is a t-test of whether the mean of the cumulative excess return from day 2 to day T is equal to the negative of the mean of the excess return on day 1. The second test uses a Bayesian approach and calculates the posterior odds ratio for discriminating between the two alternative hypotheses nested in the following model:

$$\begin{aligned} ER_{i1} &= \mu_i + \varepsilon_i \\ CER_{iT} &= \phi_i + \eta_i \\ \text{with} \quad \varepsilon_i &\sim N(0, \sigma^2) \\ \eta_i &\sim N(0, (T-1)\sigma^2), \quad \text{independently of } \varepsilon_i \end{aligned} \tag{2}$$

where ER_{i1} is the excess return on security i for day 1, CER_{iT} is the cumulative excess return on security i from day 2 to day T, and σ^2 is a variance parameter. The two hypotheses compared are:

$$\begin{aligned} &H_0\text{: } \phi_i = 0 \text{ for all } i && \text{(no reversal)} \\ &H_a\text{: } \phi_i = -\mu_i \text{ for all } i && \text{(full reversal).} \end{aligned} \tag{3}$$

This specification allows the variance securities to have different price responses to the announcement. The odds ratio is computed by forming the ratio of the sample likelihood of the data under H_0 to that under H_a, after σ^2 is integrated out of each using a diffuse prior.

The results of both tests favor full reversal (Table IV). Prices tend to return to their pre-announcement levels after about 3 weeks. For every day after day 10, the t-test cannot reject (at the 5 percent level) full reversal. Likewise, the posterior odds of no correction, measured relative to full correction, are less than 0.07 for all $T > 15$. (Prior odds are assumed to be equal to 1.) The data thus favor the PPH over either the EMH or the ISH.[13,14]

[13] Since the cumulatives for the various days overlap, the test statistics are not independent across event time. Simultaneous inferences cannot be made from these statistics. Note, however, that the results are stable through time; when the analysis is repeated for 1978–1980 and 1981–1983 separately, the results in both periods are qualitatively the same as for the whole sample.

[14] Bayesian odds ratios were also computed to discriminate between the following two hypotheses:

$$\begin{aligned} &H_0\text{: } \phi_i = 0 \text{ for all } i && \text{(no reversal)} \\ &H_a\text{: } \phi_i = -\mu_i = -\mu \text{ for all } i && \text{(modified full reversal).} \end{aligned}$$

Table IV

Mean Cumulative Excess Returns From Day 2 to Day T for the 84 Securities Added to the S&P 500 List in 1978–1983, and Two Tests of Whether the Negative of the Mean of the Cumulative is Equal to the Mean of the Day 1 Excess Return

			t-Test[c]			Percent > 0	
Day 2 to Day T	Mean Cum.[a]	STD[b]	t	p-Value	Posterior Odds Ratio[d]	Day 2 to Day T	Day 1 to Day T
2	0.09	1.76	11.10	0.0001	2.22×10^{32}	49	90
3	−0.11	2.99	7.63	0.0001	1.42×10^{17}	50	86
4	−0.09	3.45	6.88	0.0001	6.91×10^{13}	44	86
5	−0.36	3.80	5.75	0.0001	3.44×10^{9}	43	77
6	−0.69	3.89	4.91	0.0001	3.28×10^{6}	39	75
7	−0.64	4.34	4.55	0.0001	1.32×10^{5}	39	74
8	−0.66	4.49	4.32	0.0001	2.12×10^{4}	48	73
9	−0.97	4.58	3.64	0.0004	1.48×10^{4}	39	68
10	−1.18	4.75	3.17	0.0020	6.29×10^{2}	37	60
11	−1.74	5.29	1.95	0.0537	6.1576	37	56
12	−2.10	5.50	1.31	0.1933	1.7909	36	55
13	−2.26	5.70	1.01	0.3160	0.3207	36	58
14	−2.25	5.74	1.00	0.3213	0.5907	36	62
15	−2.25	5.96	0.95	0.3424	0.1910	32	57
16	−2.26	6.53	0.85	0.3947	0.0396	36	60
17	−2.60	6.53	0.38	0.7041	0.0092	32	56
18	−2.86	6.93	0.05	0.9575	0.0034	30	49
19	−2.83	6.88	0.09	0.9280	0.0020	31	50
20	−2.43	7.55	0.54	0.5910	0.0479	39	50
21	−2.49	7.43	0.48	0.6354	0.0222	32	54
22	−2.47	7.93	0.46	0.6444	0.0657	35	49
23	−2.61	7.82	0.32	0.7521	0.0552	37	50
24	−2.46	7.88	0.46	0.6484	0.0490	35	51
25	−2.52	7.36	0.41	0.6812	0.0539	35	55
26	−2.72	7.34	0.19	0.8475	0.0144	35	49
27	−2.63	7.79	0.29	0.7754	0.0120	32	46
28	−2.34	8.04	0.57	0.5702	0.0351	39	51
29	−2.39	8.20	0.50	0.6175	0.0415	37	50
30	−2.49	8.48	0.40	0.6935	0.0307	33	48

[a] Mean cumulative excess return, in percent, from day 2 to the day indicated.

[b] Sample standard deviation of the cumulative excess returns.

[c] t-test for the equality of the means of two samples. The two samples are the day 1 excess returns of the added securities and the negative of the corresponding day 2 to day T cumulative excess returns. This test assumes that the two samples have different variances. Satterthwaite's [7] approximation for the degrees of freedom was used. In all cases, it was greater than ninety. The p-level presented is for a two-sided test. Note that the various t-statistics are not independent.

[d] The posterior odds ratio for discriminating between

H_0: $\phi_i = 0$ for all i (no reversal)
H_a: $\phi_i = -\mu_i$ for all i (full reversal)

in the following model:

$$ER_{i1} = \mu_i + \varepsilon_i$$
$$CER_{iT} = \phi_i + \eta_i$$
$$\text{with } \varepsilon_i \sim N(0, \sigma^2)$$
$$\eta_i \sim N(0, (T-1)\sigma^2), \text{ independently of } \varepsilon_i$$

where ER_{i1} is the excess return for the i^{th} security on day 1, and CER_{iT} is the cumulative excess return in the i^{th} security from day 2 to day T. A low odds ratio favors the full-correction hypothesis. Note that the various odds ratios are not independent across T.

The above three arguments, together with S&P's stated denial, strongly suggest that little if any information about future returns is conveyed by the listing announcement. Given this conclusion, the large positive post-announcement price change found in the second half of the sample contradicts the EMH. As an alternative explanation, the PPH can explain the immediate price rise, its subsequent reversal, and the fact that these phenomena are only found when trading volume is above average.

C. Other Volume and Price Effects Around the Announcement

The results of the previous subsection provide evidence of price pressures on the day after the announcement of a change in the S&P 500 list. This subsection examines volume and price changes in event-time around the announcement date to determine whether the announcement is anticipated. Since the price and volume effects are strongest in the latter half of the sample, attention is focused on the years 1978–1983.

The pre-announcement volume and price data indicate that announcements are not anticipated by the market. The mean volume ratios for days −2 to 0 are insignificantly different from 1 (Table V), and only one (day −10) of the mean excess returns for days −10 to 0 is significantly different from zero (Table VI). The result is interesting because had there been evidence that the announcements were anticipated, the importance of the day 1 results would have diminished.

Post-announcement volume data were analyzed to determine how long trading volume remained above normal. After the large day 1 increase in trading, the daily volume declined quickly to near normal levels (Table V). By day 7, the mean volume ratio had declined to 1.20. From then until week 8, the mean volume ratios ranged between 0.98 to 1.18. To determine whether there was a permanent increase in trading activity, volume for one quarter (a year after the announcement) was analyzed. These data indicate that inclusion on the S&P 500 list permanently increases a security's trading volume; the mean volume ratio was 1.26, which is significantly different from 1 ($t = 2.32$). Permanently increased volume is consistent with the presence of funds, not necessarily index funds, which only invest in securities on the S&P 500 list.[15]

D. Deletions from the S&P 500 List

An analysis of the deletions from the S&P 500 list could provide important additional evidence for the existence of price pressures since another prediction of the PPH (the announcement of a deletion should be followed by a drop in price) could be examined. Unfortunately, there were only 13 deletions in the

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This specification corresponds more closely to the sampling theory t-tests in that it restricts the price response to the announcement to be the same for all securities. The posterior odds ratios for this comparison are very similar to those presented in Table IV and discussed in the text.

[15] It can be argued that increased volume makes the added stock more liquid and that expectations of this benefit can account for the day 1 price rise. Although this theoretical argument is valid, it cannot explain the price reversal documented in the previous subsection.

Table V

Mean Increases in Daily and Weekly Trading Volumes Around the Announcement Date of the 84 Additions to the S&P 500 List in 1978–1983

Period	MVR[a]	STD	t[b]	Percent > 1
		Days		
Day −2	0.86	0.80	−1.51	31
Day −1	0.89	0.74	−1.36	35
Day 0 (Wed.)	0.95	0.94	−0.53	26
Day 1	2.81	2.27	7.16	86
Day 2	1.63	1.66	3.44	54
Day 3	1.50	1.35	3.33	57
Day 4	1.21	0.88	2.13	46
Day 5	1.16	0.81	1.73	48
Day 6	1.23	1.23	1.67	38
Day 7	1.20	1.44	1.25	37
Days 1 to 5 (Thurs. to Wed.)	1.66	0.84	7.14	77
		Monday to Friday Weeks		
Week 8	0.98	0.44	−0.44	38
Week 7	0.96	0.43	−0.78	40
Week 6	1.02	0.46	0.46	51
Week 5	1.04	0.49	0.68	44
Week 4	1.06	0.52	1.14	49
Week 3	1.09	0.57	1.52	52
Week 2	0.94	0.37	−1.42	40
Week 1	0.90	0.40	−2.33	33
Week 0[c]	1.46	0.76	5.57	75
Week 1	1.25	0.65	3.57	60
Week 2	1.15	0.82	1.72	46
Week 3	1.14	0.67	1.95	49
Week 4	1.14	1.06	1.18	44
Week 5	0.98	0.53	−0.40	39
Week 6	1.06	0.67	0.86	43
Week 7	1.18	0.98	1.70	50
Week 8	1.14	0.70	1.85	51

[a] Mean volume ratio. The cross-security mean of the ratio of volume in security i to the average volume in that security in the 8 weeks preceding the week of the addition announcement, adjusted for splits and market volume. The expected value of this ratio will be equal to 1 if the announcement has no effect on volume.

[b] t-statistic for testing whether the mean of the volume ratios is different from 1.

[c] The weekly data are measured from Monday to Friday. Since announcements of changes in the S&P 500 are always made after trading closes on Wednesday, week 0 is composed of three pre-announcement days (days −2 to 0) and 2 post-announcement days (days 1 and 2). Week 1 is composed of days 3 to 7.

Table VI

Mean Excess Returns Around the Announcement Date for the 84 Securities Added to the S&P 500 List in 1978–1983

Event Day	Mean[a]	STD	t^b	Percent > 0
−10	−0.73	2.23	−3.10	35
−9	−0.04	2.12	−0.44	44
−8	−0.15	1.54	−0.99	44
−7	−0.17	1.58	−1.12	37
−6	−0.06	1.90	−0.25	44
−5	−0.31	2.19	−1.05	49
−4	0.21	2.05	1.15	50
−3	0.11	1.50	0.42	44
−2	0.01	1.76	0.12	46
−1	−0.13	1.42	−0.39	45
0	0.01	2.15	0.53	46
1	3.13	1.96	13.95	96
2	0.09	1.77	0.84	49
3	−0.21	2.21	−0.39	45
4	0.02	1.95	0.14	46
5	−0.27	1.83	−1.10	42
6	−0.33	1.94	−1.58	40
7	0.04	1.74	0.24	56
8	−0.01	1.81	0.23	43
9	−0.31	1.72	−1.49	38
10	−0.19	2.00	−1.03	45
11	−0.59	1.62	−3.29	36
12	−0.36	1.81	−2.09	45
13	−0.17	1.81	−0.93	44
14	0.01	1.87	0.21	46
15	−0.00	1.93	0.22	46
16	−0.03	2.31	−0.07	50
17	−0.35	1.50	−2.05	38
18	−0.27	1.80	−0.86	39
19	0.05	1.91	0.12	46
20	0.39	2.44	0.77	48
21	−0.03	1.89	0.23	43
22	0.00	2.10	0.14	39
23	−0.12	2.13	−0.62	48
24	0.16	1.81	0.89	46
25	−0.01	1.85	−0.16	45
26	−0.19	1.75	−0.39	44
27	0.09	2.26	−0.05	49
28	0.29	1.84	1.83	61
29	−0.05	1.97	−0.24	48
30	−0.10	21.7	−0.04	42

[a] Mean excess return in percent. The CRSP value-weighted index was used as the market proxy. Cumulatives are presented in Table IV.

[b] t-statistic for testing whether the mean of the excess returns on day t was different from zero. These t-statistics were computed after the excess returns were divided by the root-mean-squared error of the market model regression to adjust for heteroskedasticity.

1978–1983 sample which were not caused by a merger, bankruptcy, or tender offer. Moreover, since six of these deletions took place on November 30, 1983 to make room for the new firms formed by the breakup of AT&T, and since all six firms are utilities, an event study of the deletions sample may suffer from the clustering problem; factors specific to utilities will affect the results. Therefore, only the most basic results are presented.

These results are consistent with the presence of price pressures. Trading volume increased after the announcement date, which is suggestive of a shift in demand. The mean volume ratio for day 1 is 4.92, and 3.59 for days 1 to 5. The t-statistics for testing whether these means are equal to 1 are 3.00 and 2.08, respectively. The price response on day 1 was negative (1.4 percent), and significantly different from zero ($t = 2.75$), suggesting that demand decreased, as expected. During the next several days, there was no immediate increase in price. Unfortunately, since the variance of the cumulatives is large and the sample size is small, it is impossible to make any meaningful inferences about the pattern of prices over the following several weeks.

Because the data are scarce, the deletions evidence, by itself, cannot strongly support or contradict the hypotheses presented in this study. However, these results are important because they add breadth to the strong evidence obtained from studying the additions. The two sets of results, taken together, indicate that large shifts in demand affect the prices of stocks, even in the absence of new information about future return distributions.

III. Conclusions

This study examines prices and volume surrounding announcements of S&P 500 list changes. Since these changes cause some investors to trade the affected securities and since the changes do not appear to convey new information about the future prospects of these securities, they provide an excellent opportunity to study price pressures.

The results support the PPH. On the first trading day after an addition to the list is announced, there is a large increase in volume, which is suggestive of a shift in demand. On that day, there is also an economically and statistically significant increase in price. Since the volume and price effects are not present in the first years of the sample (when index funds were small), it is unlikely that the announcements, by themselves, cause the price changes observed in the latter years. Moreover, since the price increase is consistently reversed, it is unlikely that new information is the cause of the initial increase. Rather, it appears that an immediate increase in price (price pressure) is necessary to induce passive demanders to offer their shares, while the subsequent decrease allows them to reestablish their position (if desired) at a net profit.

It is interesting to note that although the post-announcement volume effect grew during the period 1978–1983, the price effect strengthened only slightly, if at all. Perhaps market forces limit the magnitude of the price-pressure effect. In particular, a 3 percent price change, in the absence of new information, may be sufficiently large so that otherwise passive investors will be willing to trade as many shares as are demanded.

REFERENCES

1. R. Brealey and S. Mayers. *Principles of Corporate Finance*, second edition. New York: McGraw-Hill, 1984.
2. L. Y. Dann, D. Mayers, and R. J. Raab. "Trading Rules, Large Block Trades and the Speed of Price Adjustment." *Journal of Financial Economics* 4 (January 1977), 3–22.
3. E. Fama, L. Fisher, M. Jensen, and R. Roll. "The Adjustment of Stock Prices to New Information." *International Economic Review* 10 (February 1969), 1–21.
4. A. C. Hess and P. A. Frost. "Tests for Price Effects of New Issues of Seasoned Securities." *Journal of Finance* 36 (March 1982), 11–25.
5. A. Kraus and H. R. Stoll. "Price Impacts of Block Trading on the New York Stock Exchange." *Journal of Finance* 27 (June 1972), 569–88.
6. W. H. Mikkelson and M. M. Partch. "Stock Price Effects and Costs of Secondary Distributions." *Journal of Financial Economics* 14 (June 1985), 165–94.
7. F. W. Satterthwaite. "An Approximate Distribution of Estimates of Variance Components." *Biometrics Bulletin* 2 (January 1946), 110–14.
8. M. S. Scholes. "The Market for Securities: Substitution versus Price Pressure and the Effect of Information on Share Prices." *Journal of Business* 45 (April 1972), 179–211.
9. Standard and Poor's Statistical Service. *Security Price Index Record*, New York, 1973.