

What Drives the S&P 500 Inclusion Effect? An Analytical Survey

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Abstract

We present an analytical survey of the explanations — price pressure, downward-sloping demand curves, improved liquidity, improved operating performance, and increased investor awareness — for the increase in stock value associated with inclusion in the S&P 500 Index. We find that increased investor awareness is the primary factor behind the cross-section of abnormal announcement returns. We also find some evidence of temporary price pressure around the inclusion date. We find no evidence that long-run downward-sloping demand curves for stocks, anticipated improvements in operating performance, or increased liquidity are related to the cross-section of announcement or inclusion returns.

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On average, when stocks are added to the Standard and Poor's 500 Index, they earn positive abnormal returns on both the announcement date and the date they are actually included. In an early study of this phenomenon, Shleifer (1986) presents evidence that stocks that are included in the S&P 500 Index (the "Index") between 1976 and 1983 increase in value by nearly 3%. He argues that inclusion in the Index is an information-free event, and this value increase reflects a rightward shift of the downward-sloping demand curve due to demand from index tracking funds.

In this paper, we examine S&P 500 Index inclusion effects by conducting an analytical survey of the explanations for this phenomenon: price pressure, downward-sloping demand curves, improved liquidity, improved operating performance, and increased investor awareness. We state each hypothesis in turn, and then compare them with each other.

Although our univariate findings support the results of previous work, our multivariate tests indicate that the investor awareness hypothesis is the primary explanation for the observed cross-section of announcement day price effects. We also find evidence of short-run price pressure in the pattern of post-inclusion day returns. In our multivariate tests, we find no evidence that proxies for long-run downward-sloping demand curves or anticipated improvements in operating performance or liquidity are related to the cross-section of abnormal returns associated with inclusion in the Index.

The paper proceeds as follows: in Section I we provide institutional details on Index additions and document the abnormal returns with this event. In Section II we discuss each of the competing hypotheses and present univariate evidence for the particular hypothesis in our own data set. In Section III we present the results of the competition among the theories. We discuss our findings in Section IV and conclude in Section V.

I. The S&P 500 Index Effect

Before we examine the competing hypotheses that seek to explain the S&P 500 Index inclusion effect, we briefly discuss the institutional details regarding Index changes and then document price effects associated with inclusion.

A. Institutional Details

There are a many reasons why Standard and Poor's may choose to change the composition of the Index. Often, changes are needed because of corporate events such as mergers, acquisitions, or financial distress. S&P evaluates events such as recapitalizations, spin-offs, and other restructurings on a case-by-case basis. S&P also makes changes to make the Index more representative of the overall market. S&P selects replacement stocks from an undisclosed pool of firms based on industry representation, firm size, number of shareholders, trading volume, and financial soundness. Standard and Poor's states that it uses the financial soundness requirement to ensure stability of the Index and that this requirement is based solely on publicly available information.

Before October 1989, the announcement of an addition to the Index and the actual inclusion in the Index occurred on the same day. But in October 1989, S&P began announcing Index changes ahead of the inclusion date. On average, S&P announces changes about five days prior to the actual inclusion date in the Index, although there is some variation in this time frame.

B. Announcement- and Inclusion-Day Returns

We start our analysis in 1993, since that is when TAQ data for our liquidity measures becomes available. We end our analysis in 2000 to avoid contamination of our results by the

effect of decimalization that occurred in 2001, and which brought about market-wide liquidity improvements. During the 1993-2001 period, S&P added a total of 268 firms to the Index.

Where there is a merger and one firm is already a member of the Index, we exclude additions. We also exclude firms that are new to the Index due to a spin-off, corporate restructuring, or name change. After deleting these observations, we are left with 147 Index additions.¹

[Insert Table I about here]

In Table I, we present the abnormal returns associated with Standard and Poor's announcement that a firm will be included in the Index, as well as the abnormal returns surrounding the actual inclusion day. We compute abnormal returns using a one-factor market model with the CRSP equally weighted index as the market proxy. Column 1 presents the abnormal returns and the *t*-statistics associated with announcement for the entire sample. We define Day 0 as the first trading day after the announcement, since the announcement generally occurs after the close of trading. The mean abnormal announcement-day return for the full sample is a positive and statistically significant 5.67%. Two recent papers that examine similar periods are Chen, Noronha, and Singal (2004) who find a 5.45% abnormal announcement return over 1989-2000, and Denis, McConnell, Ovtchinnikov, and Yu (2003) who report a 4.65% abnormal announcement return over 1987-1999.

In column 2 we limit the sample to those additions for which there are at least two days separating the announcement day and the inclusion day. This limited sample provides a more precise measure of the announcement effect, since we separate out any inclusion day effects. As column 2 shows, the abnormal returns on Day 0 is a statistically significant 4.74%.

¹ Our choices of which firms to exclude reflect those made by Denis, McConnell, Ovtchinnikov, and Yu (2003), and Chen, Noronha, and Singal (2003), who kindly provided us with their respective samples.

Column 3 presents the abnormal returns for the inclusion date. The mean abnormal inclusion-date return is 2.24%. After excluding the firms with an announcement date within two days of the inclusion date (column 4), the abnormal return drops to 1.31%. In aggregate, virtually all of the inclusion-date abnormal returns are reversed as the abnormal returns are -1.2% on the day after inclusion.

II. Theories on the S&P 500 Index Effect

Here, we examine each of the main competing hypotheses for the S&P 500 Index inclusion effect. For each hypothesis, we use our data set to replicate and compare some of the key results of these studies. These hypotheses are not necessarily mutually exclusive, and it is this potential for overlap that motivates our multivariate tests in Section III.

A. Price Pressure

We begin by noting that previous studies use different terminology to describe similar effects. Scholes (1972) uses the term “price pressure” in his study to describe the effect of investor preferences (i.e., downward-sloping demand curves). Chen, Noronha, and Singal (2004) describe short-run price deviations in response to S&P additions as “short-term downward -sloping demand curve[s]”. In recent studies, the term “price pressure” is the term most often used to describe the short-run effect of market liquidity constraints. Current studies also use the term "downward-sloping demand curves" to describe the longer run price effect due to investor preferences. We follow this terminology.

Market frictions can create short-run liquidity constraints, resulting in a price pressure effect. For example, if an investor submits a buy or sell order that is small relative to the float,

we expect that trade to have little to no price impact. However, for large block trades, market frictions can cause short-run deviations from a stock's equilibrium price. Kraus and Stoll (1972) describe the effect of a large block buy or sell order as creating a "distribution effect due to short-run liquidity constraints." The cause of this distribution effect, or price pressure, can come from several sources. First, the market maker may incur a search cost to find the other side of the transaction for a large order. Second, the market maker may bear an inventory cost that causes his or her inventory to deviate from an optimum level. The market maker will attempt to recoup this cost by moving the bid-ask spread. Empirical support for the price pressure effect is provided by Keim and Madhavan (1998) who document significant temporary price impacts from large block trades.

1. Previous Work

Harris and Gurel (1986) find a 3.13% abnormal return associated with inclusion to the S&P 500 and find a reversal of this initial price increase. They interpret this reversal as evidence of temporary price pressure. Subsequent research by Dhillon and Johnson (1991) and Lynch and Mendenhall (1997) generally supports a temporary component to the price increase, but a portion of the increase remains permanent, and unexplained by price pressure. Elliott and Warr (2003) provide evidence that the structure of the market matters. They find that, for stocks being added to the Index, the size of the short-run price deviation from equilibrium is greater in dealer markets (NASDAQ) compared to specialist markets (NYSE and Amex). Madhavan (2003) finds evidence of both a temporary and permanent return component associated with index reconstitution of the Russell 2000 and 3000 indices. Madhavan interprets the temporary effect as

evidence of price pressure. In a study of 53 deletions to the Index, Dash (2002) finds that short term price reactions for stocks that are deleted from the Index are reversed within six days.

2. Our Tests

In Table I, for firms that have at least two days separating the announcement and inclusion (column 4) dates, the positive inclusion-day return (Day 0), and the negative return on the day following the inclusion (Day +1) provide evidence indicating temporary price pressure. Since any potential effect of new information associated with inclusion occurs on the announcement date, we assume that the price changes associated with the inclusion date are the direct result of the demand shock from passive index funds.

If the price reversal is strictly due to short-run price pressure, then the magnitude of the reversal should be related to the magnitude of the initial price shock. To test this conjecture, we regress the Day +1 abnormal returns on the Day 0 abnormal returns. If the cross-sectional variation in price pressure is correlated with the price shock, then the coefficient should be close to negative one. We present the results of this regression in Equation (1):

$$AR_1 = -0.012 - 0.0024AR_0$$

$$(t = -2.99) \quad (t = -0.03) \quad (1)$$

$$n = 112, R^2 = 0.00$$

where AR_1 is the abnormal return for one day after inclusion and AR_0 is the abnormal return for the inclusion day. Excluding firms with negative inclusion day returns (since these are inconsistent with price pressure and may represent information contamination) yields the following coefficient estimates:

$$AR_1 = -0.004 - 0.179AR_0$$

$(t = -0.53)$
 $(t = -1.40)$
(2)

$n = 63, R^2 = 0.03$

Although the evidence presented in Table I suggests that there appears to be a price pressure, there does not appear to be a statistically significant relation between the price reversal and the initial price shock. However, it is plausible that the price pressure effect is similar across firms and thus the effect of price pressure is not visible in cross-sectional tests.

B. Downward-Sloping Demand Curves for Stocks

In a classical CAPM world, demand curves for equities are horizontal, because prices reflect the market's perceptions of risk and expected return. In this framework, as long as no new information accompanies the shock, a demand or supply shock will have no impact on the stock price. Investors can alter their portfolios using near-perfect substitutes in the form of other securities or combinations of securities. These substitutes allow an investor to occupy the same, or a similar, risk-return state space, resulting in horizontal demand curves for any individual security. If perfect substitutes for a stock are not available, then investor reaction to a large block trade can influence the price of an individual security, as investors will demand compensation to adjust their portfolios (Kraus and Stoll, 1972). In the case of Index inclusion, if there are downward-sloping demand curves for stocks, to induce a sell to a passive index fund, individual investors will require a price above the previous equilibrium price. Therefore, the slope of the demand curve is a function of the availability of close substitutes.

1. Previous Work

One of the earliest studies of equity demand curves comes in a study of block trades conducted by Scholes (1972). Scholes does not find evidence of a permanent price decline around block trades and concludes that acceptable substitutes are available for individual securities, implying horizontal demand curves for stocks.

Shleifer (1986) argues that studies of block trades may not represent clean tests of stock price elasticity because of information contained in the trade. Instead of block trades, he suggests that S&P 500 Index additions represent a cleaner test of demand curve slopes because inclusion in the Index is an information-free event. In contrast to Scholes (1972), Shleifer finds evidence that downward sloping demand curves explain the price effect of a 2.79% abnormal return on the announcement/inclusion day during a period when index funds hold approximately 3% of each firm in the Index.

Shleifer's findings are supported by Lynch and Mendenhall (1997) and Wurgler and Zhuravskaya (2002). Wurgler and Zhuravskaya measure the difficulty to arbitrage a stock added to the Index and examine the announcement returns relative to this arbitrage measure. They find that perfect substitutes do not exist for stocks added to the Index and investors that engage in index arbitrage bear some risk. This arbitrage risk reduces the arbitrageur's ability to return the added stock to the price associated with its risk-return relation. Further evidence of downward sloping demand curves comes from Kaul, Mehrotra, and Morck (2000) who find that stock values change in response to the re-weighting of the Toronto Stock Exchange 300 Index in 1996. As we will detail in Sections II C, II D, and II E, Index inclusion might be associated with new information. However, re-weighting of an index is much more likely to be a pure information-free event.

Beneish and Whaley (1996) show that both trading volume and stock values increase around the announcement of impending inclusion, and they argue that this increased activity is evidence of short-term investors front-running index funds. Therefore, any potential effect of downward sloping demand curves should be present on the announcement date due to investor arbitrage.

In addition to predictions regarding the importance of substitute stocks, the presence of downward sloping demand curves also implies that the price change in a stock should be correlated with the size of the demand shock. The magnitude of the demand shock should be directly proportional to the percentage of the S&P 500 held by index funds. Because index fund managers attempt to minimize tracking error, they are unlikely to try to front run Index changes and instead they tend to purchase the stock on the inclusion day (Blume and Edelen, 2004).²

2. Our Tests

To test for the presence of a downward-sloping demand curve, we replicate three of the measures used in Wurgler and Zhuravskaya (2002). The first variable measures the expected demand-curve shift associated with overall index fund demand for the added stock. Since the S&P 500 is a value-weighted index, all index funds should hold the stocks of the Index in the same proportion as they appear in the Index. This variable, which we call Shock Pct, is the percentage of the Index held by index mutual funds. Over the sample period, Shock Pct ranges from about 10% in 1993 to a high of 12% in 1998, and then 9.3% in 2000. Unfortunately, because it is reported annually, the Shock Pct variable lacks precision.

² Pruitt and Wei (1989) show that institutional holdings are correlated with changes in the index, potentially increasing the degree of the demand shock, and Blume and Edelen (2004) report that most index funds follow a full replication strategy and hold at least 499 of the stocks in the Index.

As our proxy for arbitrage risk, we compute Wurgler and Zhuravskaya's (2002) variables, A1 and A2. A1 is the variance of the error term from a regression of the added stock's excess returns on the market's excess returns for the 250 days prior to the announcement. A2 is the variance of the error term from Equation (3) of the added stock's excess returns on a portfolio of three substitute stocks, again for the 250 days prior to the announcement:

$$(R_{added} - R_{rf}) = \beta_1 (R_{sub1} - R_{rf}) + \beta_2 (R_{sub2} - R_{rf}) + \beta_3 (R_{sub3} - R_{rf}) + \varepsilon, \quad (3)$$

where R_{added} is the daily return for the added stock, R_{rf} is the daily risk-free rate, and R_{sub1-3} represents the daily returns for the substitute stocks. We draw our substitute stocks from stocks that have the same Fama and French (1997) industry classification as the added stock. We then place these stocks into quintiles according to the absolute value of the difference between their market value and that of the added stock, and also by the difference between their book-to-market ratios and that of the added stock. If there is a tie, we select the lowest market value difference quintile of stocks, and of those, select the three with the lowest book-to-market difference. Wurgler and Zhuravskaya (2002) argue that the ease with which arbitrageurs can earn arbitrage profits on a firm's shares is decreasing in A1 and A2. In other words, a stock with a high A1 or A2 does not have close substitutes available and, as a result, is more difficult to arbitrage. Wurgler and Zhuravskaya (2002) study additions to the Index prior to 1989, (when securities were not pre-announced) in order to avoid the potential contamination of arbitrageurs front running the Index change.

[Insert Table II about here]

In Table II, Panel A, we present correlations between A1 and A2 and the abnormal returns, and between Shock Pct and the abnormal returns. We measure abnormal announcement returns over a three-day window that we center on the announcement day (Day 0) in order to

fully capture any price effect of Index inclusion. To examine the demand shock that occurs before any reversal, we measure inclusion-day returns only on the inclusion (Day 0). Both arbitrage risk measures, A1 and A2, have a positive, significant correlation with the announcement-day abnormal returns. A1's correlation is also significant on the inclusion day. These correlations are consistent with Wurgler and Zhuravskaya's (2002) findings. We do not find the predicted relation for Shock Pct and announcement returns. We suspect that this lack of a positive, significant relation is driven by the lack of variation and precision in the Shock Pct variable through our sample period.

C. Improved Liquidity

An increase in ownership by institutional investors (i.e., mutual funds, in the case of Index changes) may increase the liquidity of the stock, which would be reflected in a lower bid-ask spread. Furthermore, an increase in monitoring can result from increased institutional ownership, leading to lower asymmetric information (although index funds themselves are passive investors). Lower asymmetric information should also result in lower bid-ask spreads. Conversely, increased ownership by mutual funds may cause a reduction in liquidity (as index funds are buy-and-hold investors). Amihud and Mendelson, (1986) argue that if liquidity is priced, an increase in liquidity will result in lower expected returns and hence, a positive price reaction to the addition of the stock to the Index.

1. Previous Work

Beneish and Whaley (1996) find a transitory liquidity effect using quoted spreads as an estimate of trading costs. Erwin and Miller (1998) find a decline in bid-ask spreads, which they

attribute to increased information production, since only the stocks with no options trading maintain the decline beyond the inclusion period. They argue that firms with traded options already benefit from greater information production and thus, inclusion in the Index provides no incremental information production. Hegde and McDermott (2003) find that inclusion in the Index reduces both actual and relative bid-ask spreads and the reduction is not temporary. Madhavan (2003) finds a permanent price effect associated with changes in the Russell indices which he attributes to changes in liquidity as measured by increased trading volume.³

2. Our Tests

To measure the change in liquidity surrounding Index additions, we closely follow the approach of Hegde and McDermott (2003) and compute the Percentage Spread, the Percentage Effective Spread, the Volume, and the Number of Trades for the stocks added to the Index. We use the NYSE TAQ data set to compute these variables, and precondition the data in several ways. We omit trades and quotes if they are flagged as out of time sequence or involve either an error or a correction. We omit quotes if either the ask or the bid price is equal to or less than zero, and we omit trades if the price or volume is not greater than zero. In addition, as in Huang and Stoll (1996), we omit the following observations to further minimize data errors: quotes when the spread is greater than \$4 or less than zero; trades and quotes made before-the-open and after-the-close; trades when $(p_t - p_{t-1})/p_{t-1} > 0.10$, where p_t is the trade price; ask quotes, a_t , when $(a_t - a_{t-1})/a_{t-1} > 0.10$; and bid quotes, b_t , when $(b_t - b_{t-1})/b_{t-1} > 0.10$. We define the quoted

³ Becker-Blease and Paul (2006) use liquidity changes associated with S&P 500 inclusions to test whether improved liquidity affects the firm's investment behavior.

Percentage Spread as the difference in the ask price and the bid price, for each firm, divided by the midpoint of the spread:

$$\text{Percentage Spread} = \frac{\text{Ask Price} - \text{Bid Price}}{\text{Midpoint}} \quad (4)$$

where we define the midpoint of the spread is the mean of the ask price and the bid price, for each firm:

$$\text{Midpoint} = \frac{(\text{Ask Price} + \text{Bid Price})}{2} \quad (5)$$

To measure spreads when trades occur inside the bid and ask quotes, we compute the Percentage Effective Spread as:

$$\text{Percentage Effective Spread} = \frac{2D(\text{Trade Price} - \text{Midpoint})}{\text{Midpoint}} \quad (6)$$

Trade Price is the transaction price, and D is a binary variable which equals +1 for a customer buy order and -1 for customer sell orders (as in Lee and Ready, 1991). We compute Volume as the product of the daily average number of trades and the daily average trade size.

Panel B of Table II presents the percentage change in liquidity variables over two time horizons. We measure the base case for the liquidity variables over the Day -60 to Day -10 day window before the inclusion. We measure the short-run, post-inclusion window over Day 1 to Day 4, and the long-run post-inclusion window over Day 10 to Day 60.

Over the short run, post-inclusion window we find a statistically significant decrease in the Percentage Spread and Percentage Effective Spread. We also find a significant increase in volume and the number of trades. All these changes suggest an improvement in market quality immediately after the inclusion. This liquidity improvement is present, although lower in magnitude, over the long-run, post-inclusion window. These results suggest that some of the

immediate improvements in liquidity are due to greater trading activity associated with inclusion and a portion of the increase in liquidity appears permanent.

D. Improved Operating Performance

Many researchers who study the S&P inclusion effect assume that inclusion in the Index is an information-free event. For example, Shleifer (1986), Harris and Gurel (1986), and Wurgler and Zhuravskaya (2002) all theorize that inclusion in the Index is an ideal setting for their respective studies, since inclusion in the Index is unlikely to be accompanied by additional information. Standard and Poor's explicitly states that "...the decision to include a company in the S&P 500 Index is not an opinion on that company's investment potential."⁴

1. Previous Work

The hypotheses listed above imply that the only potential source of information comes from Standard and Poor's selection criteria. However, being in the Index may facilitate greater information production about the stock. In a paper looking at five stocks that were dropped from the Index and replaced by the "Baby Bells" following the AT&T breakup, Goetzmann and Garry (1986) document persistent negative returns. They ascribe these returns to uncertainty about "the future quality of information about a company."⁵ Denis, McConnell, Ovtchinnikov, and Yu (2003) show that inclusion in the Index is associated with higher analyst estimates of post inclusion operating performance. They also find that firms that are added to the Index outperform peer firms in realized EPS. They argue that one explanation for their results is that the expected higher operating performance reflects greater monitoring since the firm is more visible. Another explanation is that the reputation costs and benefits for poor or good

⁴ "S&P 500 Index Methodology," Section 3, Criteria of Index Company Changes, page 32.

⁵ Jain (1987) also finds evidence that supports information content in index additions.

performance are greater for firms that are in the Index relative to firms that are not. Denis *et al.*'s (2003) evidence supports Dhillon and Johnson's (1991) finding that the value of bonds also increases after the firm's stock is included in the Index.

2. Our Tests

To test the improved operating performance hypothesis of Denis *et al.* (2003), we use their method to calculate the change in earnings expectations for the current year and the year-ahead forecast, standardized by EPS. (We use First Call data rather than the IBES data.)

The change in forecast earnings measures the change in the market's expectation of future profitability due to inclusion in the Index. Denis *et al.* hypothesize that if inclusion in the Index results in real improvements in firm profitability, then rational analysts will revise their earnings forecasts to reflect this increase in profitability when firms are added to the Index.

We use pre- and post-listing earnings forecasts as follows. If the inclusion date is more than three months prior to the fiscal year-end, we use that year's forecast for the current year forecast. If inclusion in the Index occurs within three months of the fiscal year-end, then we use the forecast for the following year as the current-year forecast. Thus, if a firm's fiscal year-end is December 31, 1999 and the addition announcement occurs before October 1, 1999, we use estimates for 1999 as the current year forecasts and estimates for 2000 as one-year-ahead forecasts. If the announcement occurs after October 1, 1999, then we use estimates for 2000 as the current year and estimates for 2001 become the one-year-ahead forecasts.

In Panel C of Table II, we report the change in the mean and median earnings estimate from the pre- inclusion period to the post-inclusion period. Consistent with Denis *et al.* (2003), we find that expected earnings after inclusion in the Index do not decline. This finding contrasts

with the Richardson, Teoh, and Wysocki (2004) hypothesis that for the average firm, expected earnings decline as the forecasted period end approaches. If being included in the Index is to have a positive value effect for a firm, then the change in EPS should be positive relative to investor expectations. If investors rationally anticipate a decline, on average, in earnings forecasts, then these univariate results support the improved operating performance hypothesis.

E. Increased Investor Awareness

In his presidential address to the American Finance Association, Merton (1987) presented an extension of the CAPM, which includes the possibility that investors do not have complete information about all stocks. The CAPM states that investors will hold each stock in the same proportion as that stock's weight in the market portfolio, and in doing so will fully diversify away any idiosyncratic risk. Under Merton's theory, since investors only invest in stocks that they are aware of, some stocks are only held in a subset of investors' portfolios. Because they are not fully diversified, investors who hold these stocks are overweighted in these stocks and thus hold suboptimal portfolios. To be induced to hold the lesser known stocks, these investors demand higher returns in exchange for bearing the idiosyncratic risk. The difference between this return due to suboptimal diversification and the return predicted by the CAPM is the shadow cost of incomplete information.

1. Previous Work

Chen, Noronha, and Singal (2004) hypothesize that under Merton's (1987) framework, being added to the S&P 500 increases investor awareness and will reduce the shadow cost associated with that stock. Although closely related, the demand curves and investor awareness

hypotheses have different predictions for a stock that is removed from the Index. A downward-sloping demand curve implies that the removal of the stock and its subsequent selling by index funds will result in a decline in the price of the stock. In contrast, the investor awareness hypothesis implies no price effect associated with removal from the Index, since once investors are aware of the stock, they do not become unaware of it after it has been removed from the Index. Chen, Noronha, and Singal (2004) find evidence of this asymmetric price response for additions and deletions to the Index.

2. Our Tests

Our proxy for the investor awareness hypothesis is the change in Merton's (1987) shadow cost. We compute the shadow cost by following Kadlec and McConnell (1994) and Chen, Noronha, and Singal (2004) for both pre- and post-index inclusion periods as:

$$Shadow\ Cost = \frac{Residual\ standard\ deviation}{S\ \&\ P\ 500\ Market\ Cap} \times \frac{Firm\ Size}{Number\ of\ Shareholders} \quad (7)$$

The residual standard deviation measures the stock's idiosyncratic risk and is the standard deviation of the difference between the return on the firm's stock and the return on the S&P 500. For the pre-inclusion period we measure this difference over the 252 days before the announcement, and for the post-inclusion period we use the 252 days following the inclusion day. We measure firm size, which we measure as the market value of equity, and the S&P 500 market capitalization as of the announcement date. As in Chen, Noronha, and Singal (2004), for the pre-inclusion measure we measure the number of shareholders before, and as close as possible to, the announcement date. We take the post-inclusion number of shareholders at least nine months after inclusion, which allows investors time to alter their holdings. Our primary

source for the number of shareholders is Compustat. If the data are unavailable there, we move to the Moody's manuals, and finally, we consult the S&P Market Encyclopedia.

Equation (7), the shadow cost formula, shows the intuition behind Merton's (1987) model of incomplete information. The two key components of the model are the idiosyncratic risk of the stock, which we measure by the residual standard deviation, and the average size of a shareholder investment, which we measure by firm size divided by the number of shareholders. We scale by the overall size of the market. For full-information stocks, investor ownership is widespread and average shareholder investment is small. Firms that suffer from incomplete information have few shareholders relative to their market capitalization, and therefore those shareholders have suboptimally large holdings in the stock. The magnitude of the shadow cost increases for these firms if they also have more idiosyncratic risk. As stocks are added to the Index, the number of shareholders increases and the shadow cost declines, resulting in a positive price reaction.

Table II, Panel D, shows that the proxy for shadow costs declines after announcement. This finding is consistent with the results documented by Chen, Noronha, and Singal (2004).⁶ Other proxies for shadow costs, such as number of shareholders and number of analysts that follow the stock, also increase, which is consistent with an increase in investor awareness.

III. Comparing the Theories

⁶ We thank Vijay Singal for providing us with the number of shareholders data from their sample. We have supplemented his data as necessary to accommodate our sample. By supplementing his data set, we are able to include some data points not included in Chen *et al.*'s (2004) sample. Our mean decline in shadow cost is greater than that reported in Table 5 of Chen *et al.* (46.29% as compared to 31%).

All five explanations for the Index inclusion effect are empirically supported in other studies and by our univariate tests. However, these tests do not control for the effects of the other explanations, and thus it is not clear which, if any, of the hypothesized effects dominate. In Tables III and IV we analyze the various hypotheses in a multivariate setting to observe their relative contributions.

In Table III, the dependent variable is the three-day abnormal return announcement, which we compute by using the market model, from Day -1 to Day +1. We exclude all firms that do not have at least one clear trading day between the announcement day and the inclusion day. Doing so allows us to isolate the announcement effects. The observations used in Table III start with the 112 firms used in columns (3) and (4) of Table I, and have the necessary data for the independent variables.

To allow for different measures of liquidity, Table III presents three versions of the regression, all of which we estimate over the short window. To mitigate the influence of confounding events we exclude five observations that have a change in EPS forecasts of more than 20%. In unreported tests, when we include the five observations with a change greater than 20% in EPS forecasts, the coefficients for the change in EPS forecast are negative and significant in some of the models.

In all three models the only significant coefficient is on the change in the shadow costs variable. The coefficients have the predicted negative sign for the investor awareness hypothesis and the magnitudes of the coefficients are similar across models. We consider this finding to be the major finding of our paper: that when we include all the hypothesized effects in a single regression, it is only the investor awareness variable that is significant. Our regression results are robust to substituting A2 for A1 as the measure of arbitrage risk, using market-adjusted

returns as the dependent variable, and using the liquidity change variables measured over the long window.

In Table IV, we investigate the effects on the inclusion date. To minimize tracking error, we follow Blume and Edelen (2004) by using as the inclusion date the date when index fund managers adjust their portfolios. We investigate the inclusion day effects in order to examine whether, even in the presence of arbitrage activity, the demand for stock on this day alters stock prices due to downward-sloping demand curves for stocks.

[Insert Table IV about here]

The dependent variable is the abnormal return on the inclusion date. In all three regressions (again, we allow for different liquidity measures), we find that all of the variables, with the exception of the NYSE/Amex dummy variable, are nonsignificant. For some of the variables, this lack of significance is to be expected, because any information pertaining to the Index change should be incorporated in prices on the announcement day. Therefore, we do not expect to find any significant effect on the operating performance variable, change in forecast EPS, nor on the awareness variable, or change in shadow cost. The lack of any relation for the arbitrage risk measure A1 and Shock Pct does not support the conjecture that downward-sloping demand curves play a role in the Index effect.⁷ The significance of the NYSE/Amex dummy is consistent with the findings of Elliott and Warr (2003), and supports the interpretation that specialist markets are better able to mitigate the price effects of a demand shock. We interpret this variable as providing indirect evidence of price pressure.

IV. Discussion

⁷ In unreported results substituting A2, using market-adjusted returns for the dependent variable or substituting the long windows for the liquidity variables does not result in any significant coefficients.

The nonsignificant coefficients in Tables III and IV do not necessarily mean that these variables are not changing in a significant way around the addition. In fact, Table II suggests that most of the variables that we study change significantly. However, in a multivariate setting, the cross-sectional change in shadow costs is the only variable that appears to be related to the cross-sectional variation in abnormal returns. There are several possible explanations that could reconcile the univariate results reported in Table II with the multivariate results reported in Table III.

First, there may be errors in how we measure the variables we use as proxies for their respective hypotheses. Thus, our results might reflect a type 1 error.

Second, it is possible that the relations reported in Table II could be spurious. Firms that are improving in liquidity and operating performance may be more likely to be selected as new members of the Index. The positive relation between A1 and A2 and abnormal returns in the univariate correlations may also be spurious. Both A1 and A2 are significant and negatively correlated with the change in shadow costs ($\rho = -0.30$ and $\rho = -0.29$, respectively) and significant and positively related to the pre-inclusion shadow costs ($\rho = 0.44$). Since these variables reflect the residuals of return regressions, firms with high A1 and A2 values could be the same stocks that have high shadow costs, and will be the stocks that benefit the most from an improvement in shadow costs associated with inclusion in the Index. The multivariate regressions reported in Table III are consistent with this view.

However, it is possible that the true impact of the coefficients in the regressions in Tables III and IV are obscured by multicollinearity. Typically, multicollinearity has the effect of increasing the standard errors of the independent variables. We use Chatterjee and Price's (1991)

method to explore this possibility by calculating the variance inflation factors (VIFs) for the regression coefficients in these tables. The VIF for variable x_j is given by:

$$VIF(x_j) = 1/(1-R_j^2) \quad (8)$$

where R_j^2 is the square of the multiple correlation coefficient that results when we regress x_j against all the other explanatory variables. There is no definitive threshold for the presence of multicollinearity, but as a rule of thumb, a VIF greater than ten implies a potential multicollinearity problem. For tables III and IV, none of the individual VIFs rise above two, which suggests that multicollinearity is not an issue in these regressions.

A third explanation is that the lack of significance of the liquidity and earnings forecast coefficients illustrates the potential overlap of the various S&P inclusion theories. If inclusion increases awareness of the newly added stock, then we expect to see improved operating performance and increased liquidity as a result of the increased investor awareness. Consistent with this explanation, Hegde and McDermott (2003) find that the asymmetric information component of the bid-ask spread declines subsequent to inclusion. If an increase in investor awareness is related to a decline in asymmetric information, then it is plausible that the improvements in liquidity are partly the result of the increase in investor awareness. We could use a similar argument to the Denis *et al.* (2003) finding of improvements in operating performance, in that the improvements in operating performance could be a second-order effect of an increase in investor awareness.

V. Conclusion

We conduct an analytical survey of the various hypotheses that have been proposed to explain the increase in stock value associated with inclusion in the S&P 500 Index. These

hypotheses deal with price pressure, downward-sloping demand curves, improved liquidity, improved operating performance, and increased investor awareness.

The most important find in our study is that increased investor awareness is the primary factor that explains the cross-section of abnormal returns associated with inclusion in the Index. The investor awareness hypothesis is an application of Merton's (1987) theory of capital market equilibrium with incomplete information, under which an increase in investor awareness results in a decline in the stock's required rate of return.

When we examine all the hypotheses simultaneously, we find no significant relation between the cross-section of abnormal returns and proxies for downward-sloping demand curves, anticipated improvements in operating performance, and improvements in liquidity. However, we do find evidence of temporary price pressure associated with trading on the inclusion date.

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Table I. Abnormal Returns Around Announcement and Inclusion Days

Our sample comprises firms added to the S&P 500 Index from 1993-2000. For each day relative to either the announcement (or inclusion) date, we report abnormal returns by using a one-factor market model with the CRSP equal-weighted index as the proxy for the market portfolio. We estimate the market model parameters over the -250 to -50 day window prior to the announcement. Columns 1 and 2 show abnormal returns for the announcement day. Column 1 shows the full sample. Column 2 shows the subsample in which the announcement day and the inclusion day are separated by at least one clear trading day (i.e., the inclusion date is two or more days after the announcement). Columns 3 and 4 show abnormal returns for the inclusion day. Column 3 shows the full sample. Column 4 shows the subsample in which the announcement day and the inclusion date are separated by at least one clear trading day (i.e., the inclusion date is two or more days after the announcement). We report *t*-statistics using a one-tail test.

Days	Announcement Day = Day 0				Inclusion Day = Day 0				
	Full Sample (n=147)		Minimum 2 day gap (n=112)		Full Sample (n=147)		Minimum 2 day gap (n=112)		
	(1)	(2)	(3)	(4)	(3)	(4)	(3)	(4)	
	AR	<i>t</i> -stat	AR	<i>t</i> -stat	Days	AR	<i>t</i> -stat	AR	<i>t</i> -stat
-5	0.53%	2.053**	0.77%	2.399***	-5	0.08%	0.320	0.20%	0.657
-4	0.69%	2.663***	0.73%	2.263**	-4	1.24%	4.788***	1.63%	5.367***
-3	0.31%	1.212	0.52%	1.623*	-3	1.13%	4.361***	1.53%	5.040***
-2	-0.09%	-0.352	-0.07%	-0.212	-2	1.10%	4.240***	1.38%	4.558***
-1	0.10%	0.390	0.11%	0.339	-1	1.68%	6.484***	1.17%	3.862***
0	5.67%	21.880***	4.74%	14.687***	0	2.24%	8.628***	1.31%	4.308***
+1	0.07%	0.263	0.37%	1.151	+1	-1.16%	-4.463***	-1.20%	-3.960***
+2	0.74%	2.855***	0.99%	3.078***	+2	-0.30%	-1.163	-0.34%	-1.114
+3	-0.10%	-0.393	-0.07%	-0.230	+3	-0.69%	-2.671***	-0.80%	-2.639***
+4	0.26%	1.015	0.35%	1.080	+4	0.01%	0.023	0.02%	0.067
+5	0.01%	0.057	0.15%	0.472	+5	0.02%	0.089	0.06%	0.200

*** Significant at the 0.01 level.

** Significant at the 0.05 level.

* Significant at the 0.1 level.

Table II. Univariate Results

Our sample comprises firms added to the S&P 500 Index from 1993-2000 that have data available. (We note the number of observations that have the data for each statistic in parentheses.) Panel A shows correlation coefficients between demand curve proxies and abnormal returns. A1 is the variance of the error term from a regression of the added stock's excess returns on the market's excess returns for the 250 days prior to the announcement. A2 is the variance of the error term from the following regression of the added stock's excess returns on a portfolio of three substitute stocks, again for the 250 days prior to the announcement: $(R_{added} - R_{rf}) = \beta_1(R_{sub1} - R_{rf}) + \beta_2(R_{sub2} - R_{rf}) + \beta_3(R_{sub3} - R_{rf}) + \varepsilon$ where R_{added} is the daily return for the added stock, R_{rf} is the daily risk-free rate, and R_{sub1-3} represents the daily returns for the substitute stocks. Shock Pct is the percentage of equity that is required by index funds at the time of inclusion in the Index. Panel B shows changes in liquidity proxies. Percentage Spread is the difference in the best ask price and the best bid price for each firm, divided by the midpoint of the spread. We define the midpoint of the spread as the mean of the best ask price and the best bid price for each firm. Percentage Effective Spread is $2(\text{Trade Price} - \text{Midpoint})/\text{Midpoint}$, where Trade Price is the transaction price, and D is a binary variable that equals +1 for a customer buy order and -1 for customer sell orders. We calculate volume as the product of the daily average number of trades and the daily average trade size. We calculate trade variables as daily averages per stock over the -60 to -10 day window. The short window compares the mean of the liquidity variables over the -60 to -10 days with +1 to +4 days relative to the inclusion day. The long window compares the mean of the liquidity variables over the -60 to -10 days with +10 to +60 days relative to the inclusion day. Panel C shows changes in operating performance proxies. The Mean % Δ in Current Year forecast is the change in the median analyst forecast from the month prior to inclusion relative to the month after inclusion for the current year, standardized by EPS. The Mean % Δ in One-Year-Ahead Forecast is the change in the median analyst forecast from the month prior to inclusion relative to the month after inclusion for one year ahead, standardized by EPS. Panel D shows changes in investor awareness proxies. The Mean % Δ in Shareholders equals (number of shareholders for the year post index inclusion minus number of shareholders pre-inclusion)/number of shareholders pre-inclusion. The Mean % Δ in number of Analysts' Following equals (number of analysts for the year after Index inclusion minus number of analysts pre-inclusion)/number of analysts pre-inclusion. The Mean Δ in Shadow Costs equals shadow costs post inclusion minus shadow costs pre-inclusion where
$$\text{Shadow Cost} = \frac{\text{Residual standard deviation}}{\text{S \& P 500 Market Cap}} \times \frac{\text{Firm Size}}{\text{Number of Shareholders}}$$

The residual standard deviation measures the stock's idiosyncratic risk and is the standard deviation of the difference between the return on the firm's stock and the return on the S&P 500. For the pre-inclusion period we measure this difference over the 252 days before the announcement, and for the post-inclusion period we use the 252 days following the inclusion day. We measure firm size, which we measure as the market value of equity, and the S&P 500 market capitalization as of the announcement date.

Panel A. Price Pressure and Demand Curves		
	Announcement AR (Day -1 to +1)	Inclusion AR (Day 0)
A1 correlation with: (n=112)	0.290 ***	0.157 *
A2 correlation with: (n=112)	0.255 ***	0.094
Shock Pct correlation with: (n=112)	-0.212	-0.106
Panel B. Liquidity		
	Short-Run Post-Inclusion Window +1 to +4	Long-Run Post-Inclusion Window +10 to +60
% Δ in Percentage Spread (n=147)	-20.11% ***	-8.97% ***
% Δ in Percentage Effective Spread (n=147)	-16.64% ***	-8.75% ***
% Δ in Volume (n=147)	155.61% ***	35.20% ***
% Δ in Number of Trades (n=147)	86.08% ***	44.82% ***
Panel C. Operating Performance		
	Mean Forecast	Median Forecast
Mean % Δ in Current Year forecast (n=145)	0.59%	0.86%
Mean % Δ in One-Year-Ahead Forecast (n=125)	-0.71%	-0.02%
Panel D. Investor Awareness		
Mean % Δ in Shareholders (n=140)	28.00% ***	
Mean % Δ in number of Analysts' Following (n=142)	11.00% ***	
Mean % Δ in Shadow Costs (n=140)	-46.29% **	

*** Significant at the 0.01 level.

** Significant at the 0.05 level.

* Significant at the 0.01 level.

Table III. Regressions on Announcement-Day Abnormal Returns

Our sample comprises firms added to the S&P 500 Index from 1993-2000 that have data available and at least one clear trading day between announcement and inclusion in the Index. The dependent variable is the abnormal return over the three day window surrounding the announcement day computed using a one-factor market model with the CRSP equal-weighted index as the proxy for the market portfolio. We estimate the market model parameters over the -250 to -50 day window prior to the announcement. Announcement day is the first trading day after announcement that the firm is added to the Index. A1 is the residual variance for the firm in a regression of the firm's daily returns on the returns of the market. Shock Pct is the percentage of equity that is required by index funds at the time of inclusion in the Index. NYSE/Amex dummy is one if stock is on NYSE or Amex, and zero otherwise. The Δ Percent Effective Spread is $2D(\text{Trade Price} - \text{Midpoint})/\text{Midpoint}$ where Trade Price is the transaction price, and D is a binary variable which equals +1 for a customer buy order and -1 for customer sell orders. Volume is the product of the daily average number of trades and the daily average trade size, which we then divide by 1,000,000 for readability. Trade variables are daily averages per stock over the -60 to -10 day window. We divide the Number of Trades by 1,000 for readability. The Mean Δ in Curr. Yr. EPS forecast is the change in the median analyst forecast for the month prior to inclusion relative to the month after inclusion for the current year standardized by EPS. The Mean Δ in Shadow Costs equals shadow costs post inclusion minus shadow costs

$$\text{Shadow Cost} = \frac{\text{Residual standard deviation}}{\text{S \& P 500 Market Cap}} \times \frac{\text{Firm Size}}{\text{Number of Shareholders}}$$

pre-inclusion where measures the stock's idiosyncratic risk and is the standard deviation of the difference between the return on the firm's stock and the return on the S&P 500. For the pre-inclusion period we measure this difference over the 252 days before the announcement, and for the post-inclusion period we use the 252 days following the inclusion day. We measure firm size, which we measure as the market value of equity, and the S&P 500 market capitalization as of the announcement date. Robust p values are in parenthesis.

	Dependent Variable MM CAR (Announcement Day -1, +1)		
	(1)	(2)	(3)
Constant	8.154 (0.150)	7.816 (0.161)	7.460 (0.176)
<i>Price Pressure and Demand Curves</i>			
A1	2.993 (0.750)	2.887 (0.762)	2.194 (0.817)
Shock Pct	-28.898 (0.512)	-28.904 (0.512)	-27.605 (0.523)
NYSE/Amex Dummy	-0.505 (0.663)	-0.329 (0.794)	-0.007 (0.996)
<i>Liquidity</i>			
Δ Percent Effective Spread	3.156 (0.799)	-	-
Δ Volume	-	0.137 (0.621)	-
Δ Number of Trades	-	-	-0.027 (0.213)
<i>Operating Performance</i>			
Δ in Curr Yr EPS forecast	-10.637 (0.238)	-11.378 (0.177)	-13.599 (0.108)
<i>Investor Awareness</i>			
Δ in Shadow Costs	-27.783*** (<0.001)	-25.725*** (<0.001)	-23.238*** (<0.001)
N	99	99	99
Adj. R-squared	0.230	0.232	0.246

*** Significant at the 0.01 level.

** Significant at the 0.05 level.

* Significant at the 0.1 level.

Table IV. Regressions on Inclusion-Day Abnormal Returns

Our sample comprises firms added to the S&P 500 Index from 1993-2000 with data available and at least one clear trading day between announcement and inclusion. The dependent variable is the abnormal return on the inclusion day computed using a one-factor market model with the CRSP equal-weighted index as the proxy for the market portfolio. We estimate the market model parameters over the -250 to -50 day window prior to the announcement. The announcement day is the first trading day after announcement that the firm is being added to the Index. A1 is the residual variance for the firm in a regression of the firm's daily returns on the returns of the market. Shock pct is the percentage of equity that is required by index funds at the time of inclusion in the Index. The NYSE/Amex dummy is one if stock is on NYSE or Amex, and zero otherwise. The Δ Percent Effective Spread is $2D(\text{Trade Price} - \text{Midpoint})/\text{Midpoint}$ where Trade Price is the transaction price, and D is a binary variable that equals +1 for a customer buy order and -1 for customer sell orders. Volume is the product of the daily average number of trades and the daily average trade size, which we then divide by 1,000,000 for readability. Trade variables are daily averages per stock over the -60 to -10 day window. We divide the Number of Trades by 1,000 for readability. The Mean Δ in Curr Yr EPS forecast is the change in the median analyst forecast from the month prior to inclusion relative to the month after inclusion for the current year, standardized by EPS. The Mean Δ in Shadow Costs equals shadow costs post inclusion minus shadow costs pre-inclusion. The Mean Δ in Shadow Costs equals shadow costs post inclusion minus shadow costs pre-inclusion where $\text{Shadow Cost} = \frac{\text{Residual standard deviation}}{\text{S \& P 500 Market Cap}} \times \frac{\text{Firm Size}}{\text{Number of Shareholders}}$. The residual standard deviation measures the

stock's idiosyncratic risk and is the standard deviation of the difference between the return on the firm's stock and the return on the S&P 500. For the pre-inclusion period we measure this difference over the 252 days before the announcement, and for the post-inclusion period we use the 252 days following the inclusion day. We measure firm size, which we measure as the market value of equity, and the S&P 500 market capitalization as of the announcement date. Robust p values are in parentheses.

	Dependent Variable MM CAR (Inclusion Day 0)		
	(1)	(2)	(3)
Constant	1.876 (0.716)	1.959 (0.705)	1.842 (0.725)
<i>Price Pressure and Demand Curves</i>			
A1	-2.215 (0.818)	-2.129 (0.821)	-2.231 (0.810)
Shock pct	7.756 (0.846)	7.984 (0.841)	7.828 (0.845)
NYSE/Amex Dummy	-2.237* (0.055)	-2.342* (0.075)	-2.225* (0.074)
<i>Liquidity</i>			
Δ Percent Effective Spread	0.438 (0.967)	-	-
Δ Volume	-	-0.073 (0.821)	-
Δ Number of Trades	-	-	0.007 (0.980)
<i>Operating Performance</i>			
Δ in Curr Yr EPS forecast	3.996 (0.640)	4.185 (0.598)	3.884 (0.591)
<i>Investor Awareness</i>			
Δ in Shadow Costs	-4.338 (0.322)	-5.284 (0.437)	-4.194 (0.474)
N	99	99	99
Adj. R-squared	0.054	0.055	0.054

*** Significant at the 0.01 level.

** Significant at the 0.05 level.

* Significant at the 0.10 level.