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What Happens When a Stock Is Added to the Nasdaq-100 Index? What Doesn't Happen?

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What Happens When a Stock Is Added to the Nasdaq-100 Index? What *Doesn't* Happen?

August 26, 2014

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What Happens When a Stock Is Added to the Nasdaq-100 Index?
What *Doesn't* Happen?

Additions to the Nasdaq-100 Index are based primarily on market capitalization rather than on judgments about a firm's stature in its industry. We analyze abnormal returns upon announcement that a stock will be added to the Nasdaq-100 Index in a multivariate analysis that incorporates several possible alternative factors. We find that only liquidity variables are significant, but that factors representing feedback effects on the firm's operations and level of managerial effort are not. This evidence suggests that additions to the Nasdaq-100 Index are associated with liquidity benefits but not with certification effects of the type associated with additions to the S&P indexes.

When it is announced that a new stock will be added to the S&P 500 Index, the market responds positively. There is great interest in finance to understand exactly why the effect is positive, and explanations examined in past research include temporary buying pressure on the part of indexed mutual funds, increased investor and analyst interest, enhanced stock liquidity, enhanced managerial effort, and improved firm performance after the addition. Evidence of enhanced managerial effort and improved firm performance are associated with the certification effect of inclusion in the S&P Index because firms to be included are selected by a committee that judges them to be "leading companies in leading industries."

Recent research has focused on evaluating these effects jointly in a multivariate setting because many of the observed effects are not necessarily mutually exclusive. Elliott, Van Ness, Walker, & Warr (2006) examine additions to the S&P 500 and find that increased investor awareness is the dominant factor behind the cross section of abnormal announcement period returns. Interestingly, they do not find that improvement in liquidity, as measured by trading volume or bid-ask spreads, proves to be significant when included with investor awareness. This is intriguing since a substantial body of prior empirical evidence has documented a positive association between announcement period returns and increased liquidity. It is interesting to note that Becker-Blease & Paul (2006) examine additions to two smaller S&P indexes, the MidCap 400 and SmallCap 600, in a similar multivariate setting. Similar to Elliott el al. (2006), they find that investor awareness is significantly associated with positive abnormal announcement period returns. However, they also find that improvements in liquidity are significantly associated with positive abnormal returns even in the presence of increased investor awareness.

The contrasting results in these studies motivate our research on additions to the Nasdaq-100 Index. Although it is similar to the S&P 500 index in that it includes large stocks, it has

several unique features. The Nasdaq-100 Index is based primarily on market capitalization rather than individual selection, as in the S&P indexes. Also, since the Nasdaq-100 Index includes the 100 non-financial stocks with the largest market capitalization traded in the Nasdaq market, including stocks like Apple and Microsoft, investor awareness is already high for them. The inclusion rule is well-publicized, and market participants may be able to anticipate stocks likely to be added to the index, and when. For this reason, it may be that certification effects associated with addition to one of the S&P indexes will not apply to stocks added to the Nasdaq-100 Index.

A second unique feature of the Nasdaq-100 Index is its reformulation procedure. It is reformed once a year,[1] and there is a special procedure for replacing stocks that are removed during the year.[2] This dual system provides a unique opportunity to assess the impact of changes of two different types: regular changes made at the end of each year that are fully anticipated by market participants, and unscheduled ones made at other times during the year that may not be as fully anticipated.

To understand the potential implications of index inclusion more fully, it is of value to determine how common or varied these effects are across different indexes. The objective of this paper is to analyze the effects of inclusion to the Nasdaq-100 index. Its ruled-based selection approach may mean that conclusions regarding explanations of price effects for the S&P indexes may not apply to additions to the Nasdaq-100.

In our empirical analysis, we first document that the announcement that a stock will be added to the Nasdaq-100 Index is associated with significant positive abnormal returns. The effects are not reversed afterward, and appear to be permanent. We also find that the announcement effects are significantly stronger for the stocks that are added during the year rather than for those added in the regular year-end process.

We supplement these findings with analysis based on regression discontinuity analysis. Described more fully below, this methodology enables us to test for causality and to develop

[1]The Nasdaq-100 is reformed annually according to a well-publicized procedure. Eligible securities are ranked by market value (using closing prices at the end of October) and publicly available total shares outstanding (as of the end of November). Member stocks already in the Index are retained if they continue to meet eligibility criteria and are ranked in a list of the top 125 eligible securities. Any security not meeting these criteria is replaced with the next largest eligible security. The list of annual additions and deletions is generally announced to the public via a press release by Nasdaq in early December, and changes are usually effective after the close of trading on the third Friday in December.

[2] Unscheduled, or interim, evaluations are made whenever a member security is no longer traded mainly on the NSM or when Nasdaq has determined that a security has become ineligible for continuing inclusion. In these cases, the security is replaced with the largest eligible non-member security.

very clean estimates the additions' effects on returns. We find that the added stocks have significantly higher, positive abnormal returns than the control stocks, and somewhat higher than the more familiar event study results. This verifies that the effects are directly related to the announcements.

We next turn to measures of liquidity. We find that the average bid/ask spreads of stocks added to the Nasdaq-100 index are lower after the addition. We examine analyst and investor interest, focusing on changes in analyst coverage. We find that the number of analysts following a stock increases significantly after addition, verifying increased analyst interest. Both forms of evidence are consistent with the hypothesis that the additions are associated with enhanced liquidity for the stocks.

To test for effects on underlying firms themselves, we examine revisions in analysts' forecasts. We find no significant change in average analyst forecasts of EPS after the addition. This provides no evidence that the additions have any discernable effects on the operating results of the underlying firms, nor by inference, on the level of managerial effort.

Finally, we employ multivariate regression procedures to explain the cross section of abnormal returns around announcement of additions to the Nasdaq-100 Index, controlling for different possible factors. These include measures of liquidity as well as several variables associated with other explanations, including ones related to arbitrage risk, operating performance, investor interest and awareness. We find that liquidity factors are the most responsible for explaining the cross-section of abnormal returns of firms added to the Nasdaq-100 index. This suggests that additions to the Nasdaq-100 Index are positive events because they are associated with improved liquidity rather than enhanced performance and managerial effort, as in the case of additions to the S&P indexes. We conclude that what does happen to a Nasdaq stock when it is announced that it will be added to the Nasdaq-100 Index is that more analysts are drawn to it and its market liquidity is enhanced. In contrast, we find no evidence that there are significant effects of enhanced managerial effort or operating performance associated with the inclusion. In other words, this appears to be what doesn't happen. This difference is noteworthy because it suggests that any certification effects of additions to the S&P indexes through S&P's selection process do not apply to the Nasdaq-100 Index additions based primarily on market cap.

Our paper makes several contributions to research on index additions. First, we analyze the effects of addition to a major index that has not been studied previously. Second, we identify

the ways in which this index is unique, and adapt our research methodology accordingly. Importantly, the use of market value rank as a key criterion for inclusion enables us to employ regression discontinuity analysis to clearly establish that positive announcement period returns are caused by inclusion. Third, we build on prior research on index additions to analyze the sources of the positive effects of inclusion in a multivariate setting. We find no evidence of increased operating performance on the underlying firms, indicating that the certification effect associated with additions to the S&P indexes are not present in additions to the Nasdaq-100. This distinction is notable because it serves to enhance the significance of the certification effect of addition to the S&P 500, absent from additions to the Nasdaq-100 based on market capitalization alone.

The remainder of this paper is organized as follows: Section I reviews the closely-related literature and develops our testable hypotheses. Section II describes our data and sample. The empirical results on announcement period abnormal stock returns are presented in Section III. We apply the regression discontinuity analysis in Section IV. In preparation for the multivariate cross-sectional analysis, we provide detailed analyses of the bid/ask spread, analyst coverage and earnings forecasts around index inclusion in Sections V, VI, and VII, respectively. Our multivariate analysis is outlined in section VIII, and Section IX concludes.

I. Literature on Index Additions

In recent years, the focus of literature on index inclusion has shifted from direct price and volume effects on the underlying stocks to information signaling and real effects on the underlying firms.

General overview. Many of the earlier studies on index additions focused on price and liquidity effects on the underlying stocks. According to the price pressure hypothesis, a stock that is newly added to an index is subject to heavy purchases by index funds and investors who become increasingly aware of the stock. If this represents a one-time adjustment, then the price effect should be temporary rather than permanent. Harris & Gurel (1986) examine the price and volume effects surrounding changes in the S&P 500 components, and find support for the price-pressure hypothesis. Although this may cause stock prices to increase temporarily, additions do not convey any information about the future prospects of these firms. However, Shleifer (1986) finds more persistent positive abnormal returns at announcements of additions to the S&P 500. Woolridge & Ghosh (1986) conclude that stock prices of the new S&P 500 firms increase

significantly on announcement day and trading volume of securities increases both absolutely and relative to the market during the event month. Jain (1987) suggests that the positive price effect of the S&P 500 index addition announcement is a result of more favorable investor perception of the stock in question.[3,4]

Chen, Noronha, & Singal (2004) investigate changes in the S&P 500 and find an asymmetric price effect. While additions cause permanent price changes, the abnormal returns associated with deletions are reversed.[5] In a later paper, Chen et al (2006) find that abnormal returns around index additions are significantly related to Merton's (1987) measure of incomplete investor awareness.

Others have examined index additions of smaller U.S. firms. Madhavan (2003) finds positive price effect for new members in the Russell 2000 and 3000 indexes on reconstitution days. Biktimirov, Cowan, & Jordan (2004) compare the price movement prior to and after the Russell 2000 index reconstitution and find a full reversal after the reconstitution. Shankar & Miller (2006) document significant increases in price, trading volume, and institutional ownership at announcement for newly added small-cap S&P 600 firms , especially for firms that are new to the S&P universe but these price and volume effects are fully reversed within weeks following the announcement. These results are consistent with the price-pressure hypothesis.[6]

Based on these studies, we hypothesize that the announcement of an addition to the Nasdaq-100 Index should be associated with significant abnormal returns, whether it is in the regular year-end or the unscheduled process. Expressed in null form:

H_{1A}: The announcement that a stock will be included in the Nasdaq-100 Index is associated with no price response or abnormal returns.

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[3]See also Lamoureux & Wansley (1987) document that stocks of index addition firms experience positive abnormal returns on announcement days. Pruitt & Wei (1989) document a positive relationship between changes in institutional holdings and price effect in response to additions or deletions from the S&P 500 Index. Lynch & Mendenhall (1997) document significantly positive (negative) post-announcement abnormal returns that are only partially reversed following additions (deletions).

[4]Additional related research focuses on issues of co-movement of included firms. See, for example, Vijh (1994), Barberis, Shleifer, & Wurgler (2005), and Coakley & Kougoulis (2004).

[5]In particular, they argue that changing investor awareness is the most likely explanation, given that deletion from an index is unlikely to affect investor awareness of a firm negatively and index inclusion brings increased market scrutiny and reduces unsystematic risk which, in turn, leads to permanent higher prices.

[6]Indexes of stocks in several major international markets have also been studied, including Kaul, Mehrotra, & Morck (2000), who examine the Canadian TSE 300 Index. Although TSE announces its changes in advance, the authors still detect significant price effect in the effective week, an indication of delayed market reaction. Chan & Howard (2002) examine changes in the Australian All Ordinaries Index (AOI) and document an increase in trading activities well before actual addition announcements. Mase (2007) studies the impact of changes in the FTSE 100 Index and finds that the significant price effects at both inclusion and deletion are subsequently reversed, indicating a short-term downward sloping demand curve for stocks. .

We next apply regression discontinuity design analysis to the additions in order to test true causality. Also in null form:

H_{1B}: Positive price effects on average observed following index addition are coincidental with the addition and not caused by it.

Prior research also identifies increased analyst and investor attention as factors that may help explain the cross-section of abnormal returns. Our second hypothesis deals with this, and again is expressed in null form.

H_2: There is no change in analyst coverage of stocks that are added to the Nasdaq-100 Index.

Improved operating performance and changes in earnings expectations. Another line of research looks more broadly at the effects of index inclusion on the underlying firms. Denis *et al.* (2003) argue that addition to the S&P 500 Index can be informative if it leads to an improved operating performance. They hypothesize that index membership brings greater scrutiny and "cost of reputation" and the managers respond with greater effort. As a result, newly added firms experience significant increases in median analysts' EPS forecasts, and their actual earnings miss analysts' forecasts by a smaller margin than comparable control companies. They conclude that S&P Index inclusion is not an information-free event. However, they are unable to determine the causal relation between the information and the addition decision. That is, it is unclear whether it is favorable information that causes Standard and Poor's to add the firm to the index, or whether the inclusion itself causes improved performance.

Dahya (2006) focuses on this last question: are post-inclusion effects due to information that lead to inclusion, or directly to the inclusion itself? He analyzes additions and deletions to the FTSE 100 Index. Since this index is reformed on a regular quarterly basis using publicly-available data, additions should convey no new information. He finds evidence that price effects of index additions and deletions are explained by changes in earnings expectations, information production, and investor awareness. He concludes that the post-inclusion effects are attributable to the inclusion itself rather than to the information that led to the inclusion, so that index changes are not "information free" events.

If the announcement and subsequent addition to the Nasdaq-100 have effects on analysts' earnings estimates or actual earnings post-addition, these factors may help explain the cross-section of announcement period abnormal returns. Also in null form:

H_3: There is no change in the operating performance of firms of stocks that are added to the Nasdaq-100 Index.

Last we briefly review two additional factors that prior research has identified as having significant effects on the abnormal returns of stocks added to the S&P 500.

Investor awareness. Merton (1987) hypothesizes that the difference between the return on an investor's undiversified portfolio and the return on a fully diversified portfolio represents the "shadow cost" of incomplete information. When a stock is added to an index, one effect is that index mutual funds must buy it. Another is the increased visibility of the stock and awareness of the stock by more investors. As investors add the stock to their portfolios, the shadow cost declines.

Arbitrage risk. Wurgler & Zhurabskaya (2002) argue that arbitrage between stocks that are perfect substitutes for each other will insure that demand curves for stocks will be flat. They note, however, that different stocks are not generally perfect substitutes for each other, and question how often true arbitrage – simultaneous sales and purchases of different stocks, with no net investment and no risk – is possible in real markets. They use additions to the S&P 500 index as examples of shocks to demand curves that are unlikely to be associated with new information about the underlying stock or firm. Since the demand shock is temporary, it can thus be used to test for the existence of arbitrage opportunities. They employ two measures of arbitrage risk. The first is based on the stock's residual variance relative to the market portfolio of all stocks, and the second is based on the variance of a long-short portfolio of the stock added to the index and three close substitutes. Empirically these measures are highly correlated with each other. They conclude that both measures of arbitrage risk are positively correlated with the price effects experienced by stocks added to the S&P 500 Index.

In summary, several factors have been identified in prior research as having significant association with announcement period returns. The question we address is which ones, if any, are dominant when Nasdaq-100 Index additions are examined in a multivariate context.

II. Data and Sample

Our initial sample includes all the additions to the Nasdaq-100 Index between 1994 and 2009, and is based on data provided by the Nasdaq Stock Market, Inc. Among the 256 additions in these years, 157 (or 61.3%) are regular year-end additions, and the other 99 are unscheduled replacements during the year. The sample is summarized by year in Table 1.

The list does not include the announcement dates for many of the additions. In these cases, we search the LexisNexis database prior to the listing day and obtain the date of the press

release or Nasdaq's announcement (carried by *Business Wire* or *PR Newswire*). However, information on announcement dates is sparse prior to 1998, and so our final sample of announcements begins in that year. We have announcement dates for 182 additions over 1998-2009, of which 118 (or 64.8%) are regular year-end additions. On average, there are about ten calendar days between the announcement and effective dates for the regular year-end additions, and about six days for the unscheduled ones.

Daily stock returns, prices, and trading volumes are from the Center for Research in Security Prices (CRSP) database. Analysts' earnings forecasts, numbers of analysts issuing earnings forecasts, and analysts' recommendations are from Institutional Brokers' Estimates System International, Inc. (I/B/E/S). All financial statement data used to estimate total and discretionary accruals are from Compustat. We match the additions sample to Compustat on the basis of 9-digit Cusip numbers. Bid and ask prices are from the TAQ database.

In our tests, we employ a control sample that includes all stocks already in the Nasdaq-100 Index. By definition, these stocks are well matched to the new additions on the basis of size and trading venue. They serve as a control in that they are similar stocks which are not subject to a change in index membership, and we refer to them as "incumbent" members of the Index.

III. Effects on Stock Returns

We estimate abnormal returns (AR) in the announcement period (including the announcement and the following days), and on the effective day of the Nasdaq-100 additions using three measures:

1. The market-adjusted return, equal to the difference between the stock return and the Nasdaq-100 Index return.

2. Abnormal returns based on the market model, with the CRSP value-weighted market index as the market proxy.

$$R_{i,t} - RF_t = \alpha + \beta*(RM_t - RF_t) + \varepsilon_{i,t} \qquad (1)$$

where for day *t*,
$R_{i,t}$ = return of stock *i*
RF_t = risk free rate
RM_t = return of the CRSP value-weighted market index

The parameters are estimated separately over each of two time periods:
t + 31 to t + 211 where *t* is the announcement date (see Denis, *et al.* (2003))
t - 240 to t - 61 where *t* is the announcement date (see Shankar & Miller (2006)).

3. The alpha coefficient (α) in the Fama & French (1993) three-factor model:

$$R_{i,t} - RF_t = \alpha_i + b_i(RM_t - RF_t) + s_i(SMB_t) + h_i(HML_t) + \varepsilon_{i,t} \quad (2)$$

where, for day *t*,

$R_{i,t}$ = return on security *i*
RF_t = risk free rate
RM_t = market return
SMB_t = difference between the returns of portfolios of small and large stocks
HML_t = difference between the returns of portfolios of value and growth stocks

The parameters are estimated using ordinary least squares from *t-240 to t-61* or from *t+31 to t+211*, where *t* is the announcement date, using a two-tailed test of their statistical significance.

Announcement period ARs. Results for the 2-day announcement period ARs of the Nasdaq-100 Index additions in 1998-2009 are summarized in Table 2, Panel A.[7] For the whole sample, the average ARs are all positive, ranging from 0.73 to 1.69%, with four of them statistically significant. The average ARs of the unscheduled additions are larger in magnitude, ranging from 2.46% to 3.03%, all statistically significant. The average ARs of the regular year-end additions are much smaller, and only one is significant at the 0.05 level of confidence. The differences in means between the two groups (shown in the final columns of the Table 2) range from 1.85% to 2.83%, and all are statistically significant. Overall, the market responds more strongly to the unscheduled Nasdaq-100 addition announcements than to the regular year-end additions. The fact that the abnormal returns for the year-end regular additions are on average not significant does not allow us to reject a null hypothesis of no price effect for these stocks.

Post-announcement performance. To test whether the price effects are completed within a short period of time, we examine the cumulative abnormal returns (CARs) following the 2-day announcement period. We calculate the CARs for these stocks over the 20, 40, and 60 trading days immediately following the announcement using the market model parameters between *t+31* to *t+211* (see Table 2, Panel B). All the three average CARs are statistically insignificant, suggesting that any price effects associated with the index addition are fully realized upon announcement only.

[7]Although our sample of additions begins in 1994, we limit this analysis to additions beginning in 1998 because we do not have announcement dates for the additions before 1998.

Permanence or reversal of announcement effects. To test for reversal of abnormal returns after the announcement, we estimate the following cross-sectional regression, similar to Kaul, Mehrotra, and Morck (2000):

$$CAR_{j,\,t+2,\,t+k} = \alpha + \beta * AR_{j\,,\,t,\,t+1} + \varepsilon_j \qquad (3)$$

where

$AR_{j,\,t,\,t+1}$ = abnormal return, AR, in the announcement period, days (0, +1)
$CAR_{j,\,t+2,\,t+k}$ = cumulative abnormal return, CAR, after the announcement period, days (+2, (+2 + k)), where k = 21, 41, or 61

A significantly negative slope coefficient would indicate the reversal of any price effects of Nasdaq-100 addition announcements. The results are summarized in Panel C of Table 2. No significant negative estimated slope coefficients are found for any of the Nasdaq-100 addition announcements during the three periods tested, leading us to conclude that any significant abnormal returns of stocks added to the Nasdaq-100 Index are permanent rather than temporary. This enables us to reject H_{1A}, the null hypothesis that the announcement has no price effect on the stock that is added to the Nasdaq-100 Index.

IV. Regression Discontinuity Design Test of Causality

The earliest application of the regression discontinuity design (RDD) is a test of the impact of merit awards on subsequent academic success (see Lee and Lemieux (2010)). A key characteristic is that the award is based on a test score that is observable and not subject to manipulation by the test takers. The idea is that at the cutoff point between students who won the award and the ones who did not, the key difference between them is the award itself. In other words, the last student who won an award is not much different than the first one who did not win one, based on the test score measure. The student who did not receive an award can be viewed as a control or benchmark for comparison. Since the key difference between them is the existence of the award, it is then possible to estimate the causal effect of the award. An important strength of RDD is that causal inferences are potentially clearer and stronger than inferences based on control samples that are formed in many research analyses, such as matching on the basis of SIC code, market value decile, stock price, and other economic and financial variables.

More formally, RDD provides a way of estimating the effects of treatments in non-experimental settings. In the example above, the treatment is the award, and the observed test score provides the cut-off point. The RDD technique has been widely used in education research

to analyze questions such as the effects of financial aid or class size on subsequent educational success. It has recently been adopted in finance research, as in Cunat et al. (2010), who use it to evaluate the impact on stock returns of passing a proposal associated with improved corporate governance.

This is an appropriate technique for use in tests of additions of stocks to the Nasdaq-100 Index because the primary basis for inclusion is the rank of firm size as measured by the market value of equity. For each addition to the index, we need to determine which stock was added, and which is the next stock that would have been added. The essential difference between them is that one is added, and the next one is not.

Nasdaq's current description of the criteria for inclusion in the Nasdaq-100 Index are presented in Appendix 1. Among other criteria, the stock must be traded in the Nasdaq system, be issued by a non-financial firm, and have a certain minimum trading volume. In our implementation, for each announcement date, we form a list, using CRSP data, of non-financial stocks traded on Nasdaq, and sort from highest to lowest market capitalization. From this, we eliminate stocks that are already in the index. For example**,** a listing of stocks added to the Nasdaq-100 Index on December 24, 2001 is shown in Appendix 2. For the year-end additions, the ranking is made at the end of October (and may be revised in late November.) The intention is to replace stocks that are currently in the index if they no longer are in the top 125 eligible stocks by market value. Nasdaq's process is to rank all stocks that it deems eligible for the index at the end of October, and then to add stocks with highest market values. (Once a stock is on the list, it will be retained if its market value rank is at least 125.) The listing by market value in the Appendix shows the stocks added and the next ones in line based on market value. Thirteen stocks were added on December 24, and one was added on December 17 in an unscheduled replacement. It also shows stocks in the top 100 that are not already in the index. Three stocks meet the market value requirements with rankings that are high enough, but are not included in the index for other reasons: Costco, ASLM Holdings and AT&T Canada. These stocks were not added because they did not meet one or more of the additional requirements for eligibility in the Index.

Additional considerations for inclusion in the index include whether the stock is an ADR and has options traded on it, the length of time the stock has traded, whether its audited financial statements show an audit opinion that is currently withdrawn, and whether Nasdaq officials have any reason to believe that a given stock may not meet eligibility requirements in the near future –

if for example, the stock may soon be delisted or move to the NYSE. Aside from such considerations, the next stocks in line for addition on that day would be Marvell Technology and Lincare Holdings. In our case, the last stock added for this date was Synopsis, and the next one not added was Marvell. Marvell was actually later added on December 22, 2003, and Lincare on July 2, 2002.

Since the year-end reformulations are the major ones and usually involve the additions of several stocks, the size of our resulting sample is much smaller than the sample analyzed by announcement dates as in Table 2, or the larger sample analyzed by addition dates as in Tables 6-8. Abnormal returns are summarized in Table 3. For the subset of 71 addition stocks, the average CAR in the announcement period (0, +1) is 2.23%, based on estimation period (-240, -61) with the CRSP value-weighted index. Whether estimated with the CRSP equally-weighted index or with data after the announcement, the CAR is positive and significant at a high level. We also report the same analysis on the control stocks, and find that their announcement period returns are negative, but not significant. Finally, we perform a long/short analysis, in which for each stock added, we form a portfolio of it and its control stock, with a long position in the additions stock and short position in the control stock. The CARs for these announcements are summarized in the last three columns of Table 3. When based on the CRSP value-weighted index and the estimation period is prior to the announcement, the CAR is +0.77%, significant at the 0.0661 level. The estimates based on the equal-weighted index are a bit higher, 1.10% and 1.29%, at the 0.0334 and 0.0103 levels of confidence. These estimates indicate that on average, after adjustment for both movements in the market index and in effects of control stocks, the announcement that a stock will be included in the Nasdaq-100 Index has a positive abnormal return in the two-day period (0, +1) of 0.67 to 1.29%.

The regression discontinuity regression takes this form:

$$AR_{j,t} = \alpha + \theta(INDICATOR_{j,t}) + \varepsilon_{j,t} \qquad (4)$$

Where

$AR_{j,t}$ = Estimated abnormal returns of stock j on day t

$INDICATOR_{j,t}$ = Indicator dummy variable with a value of 1 for stocks added to the index, and 0 for the control stocks

$\varepsilon_{j,t}$ = random error term

The parameter θ represents the effect of index addition on stock return on the announcement day, and the random error term reflects all other determinants of the addition. As long as

$INDICATOR_{j,t}$ is independent of any other factors, the estimate of θ will be consistent. To have a consistent estimate, the addition needs to be (in effect) a randomly assigned variable. This is assured in the RDD approach because as long as the stocks included are those just above and just below the cutoff point, the assignment (or addition) is essentially random.

The results are summarized in Table 4. The estimated coefficient on the indicator dummy variable is positive and significant for the announcement day (day 0), day +1, and days (0, +1). The coefficient on the indicator variable is 0.03657, or 3.657%, for the announcement period (0, +1) and is statistically, significant. This estimate is slightly different than the mean CAR of 0.67 to 1.29% from the event analysis above because, in the regression context, the estimated coefficient provides a measure of best fit. For this reason, the 3.657% can be considered a better estimate of the announcement effect that a stock will be added to the index. This enables us to reject H_{1B}, the null hypothesis that any abnormal returns associated with the announcement are not caused by the addition of the stock to the Nasdaq-100 Index

The regression discontinuity design analysis provides a valuable addition to the analysis of index addition announcement effects because it is based on a uniquely formed control sample, and enables researchers to interpret observed effects as causal in nature. The drawback is that in the case of the Nasdaq additions, the sample is limited to the number of addition dates. For this reason, our multivariate analysis that follows below is based on the entire sample of additions rather than the limited sample in the RDD analysis.

V. Effects on the Bid/Ask Spread

We consider changes in relative bid/ask spreads around additions to the Nasdaq-100 Index as one measure of liquidity. We use TAQ data to compare average daily relative proportional bid-ask spreads before and after addition to the Nasdaq-100 Index, on the basis of each stock's 50-day pre-event (t-55, t-6) and post-event (t+6, t+55) periods. Only bid-ask pairs issued on Nasdaq exchange are included because of the multiple exchanges included in TAQ database. We calculate the average daily bid/ask spread as follows:

$$\begin{pmatrix} Average\ Daily \\ Bid/Ask\ \ Spread \end{pmatrix} = \frac{\left(Average\ Ask\ -\ Average\ Bid\right)}{\left(\frac{Average\ Ask\ +\ Average\ Bid}{2}\right)}$$

Our general sample period is from 1994-2009. In terms of bid/ask estimates, this period covers major changes in markets, including, among others, decimalization in 2001. We first limit our

analysis to changes in the bid/ask spreads for additions after 1998 because of limitations on quote data in TAQ before that. We also report the data separately for data after 2001, when decimalization was introduced. The results are summarized in Table 5.

As summarized in Table 5, panel A, the average relative bid/ask spread of all additions since 1998 was 0.33% before the addition, and 0.21% after. The decrease of 0.10% is significant, with a t-value of -2.6126. The change for the year-end additions alone is a reduction of 0.07% for the year-end additions, also significant with a t-statistic of -2.3027. The change for the mid-year additions was negative, as expected, with a t-statistic of -1.6036. Very interesting in this case is the reduction in volatility of the bid/ask spreads from 0.68% before the addition to 0.21% afterward.

When we limit the sample to the post-decimalization period after 2001, we find similar patterns: the spreads are significantly lower afterward for the whole sample. The reduction is of 0.13%, significant at with a t-statistic of -2.1266. As in the larger sample, the volatility of the spreads also fell significantly after the stocks were added to the Nasdaq-100 Index.

Overall, this evidence is consistent with the hypothesis that stocks added to the Nasdaq-100 Index experience enhanced liquidity following the addition. We next examine additional aspects of investor interest and stock liquidity.

VI. Effects on Analyst Coverage and Investor Interest

In this section we consider possible effects of inclusion on analyst coverage. For each stock in our sample, we obtain the numbers of analysts covering it six months before and after the announcement month from IBES. We find the average numbers of analysts reporting EPS forecasts for the current and next fiscal years (FY1 and FY2) over different time periods around the announcement month: (–6, -1), (– 3, -1), (1, 3), and (1, 6). To control for general changes in the numbers of analysts over time, we adjust by using the incumbent Nasdaq-100 firms as a benchmark.

We estimate three measures of analyst coverage for each stock. These are the average numbers of analysts that issue earnings estimates for the current fiscal year (FY1), the next fiscal year (FY2), and buy-sell recommendation ratings. We calculate changes in the average numbers of analysts in the three and six months following the event month for each measure and compare them to the contemporaneous changes in the control group.

Table 6 indicates that significantly more analysts are attracted to the new Nasdaq-100 members after the addition announcements. Panel A shows changes in the number of analysts that submit current fiscal year earnings estimates after the announcement. Row 1 shows increases in the numbers of analysts in the three months after the announcement relative to the three months before. For the total sample of 240 additions, the average increase in the three months after the announcement is 2.78 analysts (or a 39.57% increase) from the three months before. This increase and the percentage change are statistically significant. These numbers are reduced slightly to 2.09 analysts (or a 28.61% increase) after controlling for general trends in coverage evidenced by the control group, but the increases are still significant.

The average increases are stronger for the unscheduled additions than for the regular ones at year-end. The differences between the two groups are statistically significant at the 0.056 level of significance (or higher). The number of analysts submitting estimates of next fiscal year (FY2) earnings (Panel B) and recommendations (Panel C) are essentially the same. We conclude that the announcement of an addition to the Nasdaq-100 Index attracts significantly more analysts to the stock, especially the unscheduled announcements.

This significant increase in analyst coverage supports the conclusion that the addition of a stock to the Nasdaq-100 Index is associated with an increase in investor interest for both the year-end scheduled additions as well as the unscheduled ones. This enables us to reject hypothesis H_2, the null hypothesis that the announcement has no effect on analyst coverage of stocks that are added to the Nasdaq-100 Index.

VII. Analysts' Forecast Revisions

We next examine whether analysts modify their forecasts of newly-added target firms' earnings, as Denis *et al.* (2003) find for additions to the S&P 500. We compute the change in median estimate of the current fiscal-year EPS (FY1) from the month before the announcement to the median estimate in the month after the announcement. If an addition occurs within three months of the end of the firm's fiscal year, we use the change in median estimates for the next fiscal year EPS (FY2) instead.

Our first measure of estimate revision is the difference between the two median estimates:

$$ER_{j,\,t} = FY1_{j,\,t} - FY1_{j,\,t-1} \qquad (5)$$

where

$ER_{j,t}$ = Estimate revision, $ per share
$FY1_{j,t}$ = Median estimate in period *t* of firm *j*'s earnings for the current fiscal year
$FY1_{j,t-1}$ = Median estimate in period *t-1* of firm *j*'s earnings for the current fiscal year,

We standardize the revisions by stock price. Thus our second measure of estimate revision is the difference between two median estimates, scaled by the corresponding stock price prior to the announcement:

$$ER\_P_{j,t} = 100 * (FY1_{j,t} - FY1_{j,t-1}) / Price_{j,t-1} \quad (6)$$

where

$ER\_P_{j,t}$ = Estimate revision as percent of pre-announcement stock price
$Price_{j,t-1}$ = Stock price in period *t-1*

We use incumbent Nasdaq-100 stocks as our control stocks for their similarity to the newly added stocks in size and trading venue.[8]

The results are summarized in Table 7, Panel A. The first row shows that for the 248 additions, the average change in current fiscal year EPS estimates (standardized by price) is a decrease of $0.29 per share, although 55% of the changes are positive.

Similar to Denis *et al.* (2003), we adjust these changes for control stocks by subtracting their contemporaneous changes from those of the Nasdaq-100 additions. The results for the EPS estimate changes are summarized in Rows 3 and 4 of Table 7. The adjusted changes (standardized by the pre-addition stock price) are not statistically significant. This contrasts with Denis *et al.* (2003)'s results of a significant difference for stocks added to the S&P 500, which are robust across both standardizations and in each of their control samples. Our results for Nasdaq additions do not show a consistent and robust positive difference, and therefore do not provide clear evidence of an information effect.

We repeat these tests for each of the two sub-groups of stocks added to the Nasdaq-100: those added in the regular year-end process, and those added during the year in the unscheduled process. None of the changes in EPS forecasts for the regular year-end process are significant,

[8]This is similar to Denis *et al.* (2003)'s main control sample of all other firms with EPS forecasts in the Institutional Brokers' Estimate Service (IBES) that are contemporaneous with the EPS forecasts of the newly added stocks in S&P index. Their second control sample includes firms with contemporaneous EPS forecasts in IBES that are in the same Fama/French 12 industry portfolios and have the same size and liquidity as the new S&P 500 additions (their "ISL-matched firms"). In their results, the differences between the EPS forecast revisions of the S&P additions and the main control sample are in most cases larger and more significant than those from the control stocks based on the ISL matching.

leading us to conclude that these additions do not provide any information to the analysts, and therefore fail to provide any robust support for the existence of an information effect.

We next focus on changes in analyst recommendations around announcements of Nasdaq additions (Table 7, Panel B). For the whole sample, the mean change is zero. After adjusting for control stocks, the average change is just \$0.01 or \$0.02 per share but not statistically significant, for the three- and six-month post-announcement period. In only one case is there a significant result in this panel, the case for the unscheduled additions in the six months post announcement. We conclude that there is no clear evidence of consistent effects of index addition on the firms' performance, and therefore we cannot reject hypothesis H_3, that the addition has no effect on analysts' expectations of the firm's underlying operating performance.

VIII. Multivariate Analysis

In this section we investigate whether the changes in arbitrage risk, liquidity, investor interest and awareness, and earnings expectations explain permanent price effects in a multivariate setting. Each of these variables has been shown in prior research to have a significant relation in a univariate sense to the cross-section of abnormal returns upon announcement that a stock is being added to a major index. Our key focus here is to determine which, if any, may be dominant in the presence of the others. The dependent variable is the market-adjusted CARs from announcement date (AD) to 60 trading days following the effective date (ED). CARs are market-adjusted returns based on the Nasdaq-100 Index for abnormal returns. The following independent variables are included in the multivariate regression:[9]

Number of analysts. We compare the number of analysts who submit earnings estimates (both FQ1 and FY1) one month prior to announcement date (month AM-1) to the number submitting estimates up to 3 months after the effective date (month ED+3). We adjust the change to the median change in the overall index. The expected sign of this variable is positive because the listing is likely to attract new analyst interest in the stock.

[9]We do not include some control variables that prior researchers have used. We do not include a NYSE/Amex indicator variable because all of our stocks are traded in Nasdaq. Another indicator variable used has a value of 1if the firm was not previously listed on the S&P 400 or the S&P500 index. We omit this because Nasdaq has no other indexes similar to Nasdaq-100 with smaller market capitalizations. Finally, we are unable to include a measure of the percentage of the firm's shares held by index funds because we do not have similar data for the Nasdaq-100.

Trading volume. We add this variable to capture liquidity effects aside from any directly associated with analyst coverage. Our variable for trading volume is calculated as the natural logarithm of the average of daily number of shares traded times closing price. Post-addition abnormal change is relative to the median change in the overall Nasdaq-100 Index during the same period for each measure. Measurement of pre-addition dollar volume includes the 252 days before announcement date and measurement of the post-addition dollar volume includes the 252 days after effective day, starting from 61 days after the effective day. The expected sign of this variable is positive.

Change in current EPS forecast. This variable measures the change in average earnings forecasts adjusted for contemporaneous changes for the Nasdaq-100 stocks. Median EPS forecasts preceding the month of index addition announcement are compared to the EPS forecasts following the effective month to calculate the change in EPS forecasts. The change in EPS forecast is calculated for current-year EPS forecasts.

1. Changes in EPS forecasts for all Nasdaq-100 firms reported in I/B/E/S with the EPS forecasts of the newly added stocks are used as the benchmark.

2. EPS forecast change is standardized by the stock's pre-announcement price.

3. We compute a 3-month change in FY1 (standardized by price) according to the month after effective date (month) (EM), or $(FY1_{EM+1} - FY1_{EM-2}) / PRICE_{EM-2}$. The raw change is adjusted for price, and the median Nasdaq-100 raw change is adjusted similarly.

Shadow cost. This variable measures investor awareness. It is based on Merton's analysis, and is calculated as in Elliott et al. (2006):

$$Shadow\ cost = \left(\frac{Residual\ \sigma}{Index\ Market\ Cap}\right) * \left(\frac{Firm\ Size}{No.of\ Shareholders}\right) * 10^4 \qquad (8)$$

1. 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 Nasdaq-100. We measure this difference over the 252 days before the announcement (pre-inclusion), and the 252 days following the inclusion day (post-inclusion).

2. Firm size is the market value of equity, and the Nasdaq-100 market capitalization is measured as of the announcement date.

3. For the pre-inclusion measure we use the number of shareholders before, and as close as possible to, the announcement date. We measure the post-inclusion number of shareholders at least nine months after inclusion, which allows investors time to alter their holdings. The source of these data is Compustat.

The expected sign of this variable is positive.

Arbitrage risk. This variable is based on Wurgler & Zhuravskaya's (2002) measure of arbitrage-risk A_l . It is calculated as the variance of the residuals of the model

$$R_{it} - R_{ft} = \beta_{it}(R_{mt} - R_{ft}), \quad (7)$$

where R_{mt} is the return on CRSP's value-weighted AMEX / NASDAQ / NYSE index and R_{ft} is the T-bill return. A_l 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. It is scaled by a factor of 1,000 for readability. This variable reflects the difficulty of arbitrage for the stock. The more difficult it is to arbitrage, the larger is the expected response of stock price to a demand shock due to index inclusion. The sign of this variable, thus, is expected to be positive.

Market-to-book ratio. This variable is intended to control for growth opportunities as reflected in market assessments. It is based on Compustat's quarterly item Common/Ordinary Equity - Total (CEQQ) to market value of equity before announcement date.

Natural log of total assets. This variable is intended to control for size effects. It is based on Compustat's quarterly item Assets–Total (or ATQ) before the announcement date.

Table 8 summarizes the multivariate regression results for our sample of additions to the Nasdaq-100 index. We run the multivariate regression separately on the whole sample of 256 additions, as well as the 99 additions made in mid-year and also for the 157 additions made at year-end in the regular rebalancing process. The adjusted R-squared statistics range from 0.3308 for the additions during the year to 0.4169 for the year-end additions.

For our whole sample of additions to the Nasdaq-100, only one variable is significant at the 0.05 level of confidence: trading volume (coefficient of +0.2279 and significant), adjusted for contemporaneous changes in control stocks. The coefficient on change in number of analysts is positive, but not significant. This suggests that though analyst attention is increased (Table 6), the increases do not contribute to an explanation of announcement day abnormal returns once trading volume is controlled for. The coefficient on change in adjusted analysts' current year EPS estimates is also not significant. Thi are no significant changes in these estimates even if they are adjusted for control stocks. Finally, the sign on arbitrage risk is insignificant.

When we turn to the regression results for the two sub-samples, the results are generally similar to those for the whole sample. Again, only one variable is significant in all three regressions: trading volume. This variable captures positive liquidity effects of the additions, and is consistent with the hypothesis that addition of a stock to the Nasdaq-100 Index is more closely

attributable to enhanced trading liquidity than to any other factors examined. In particular, the variable on shadow cost is not significant and does not have the expected negative sign, as in Elliott el al.'s (2006) results for additions to the S&P 500 Index. Although some variables have significant coefficients, none have the same sign and significance in each of the subsamples. For example, the natural log of total assets is -0.0303 (p-value 0.0744) for the unscheduled additions, and positive but not significant for the year end ones (0.0117, p-value 0.4741).

Finally, to account for possible correlation among the explanatory variables and for apparent insignificance of some variables, in Panel B we report results of the stepwise procedure on the multivariate regression in Panel A. The results are essentially unchanged: the sole variable that is significant in all three cases is trading volume.

IX. Summary and Conclusions

In this paper we analyze abnormal returns upon announcement that a stock will be added to the Nasdaq-100 Index, a major index that has not been studied previously. We explain the ways in which this index is unique. Because additions are made primarily on the basis of market capitalization, we are able to employ a regression discontinuity analysis to test for causality. We document positive returns upon announcement of the addition, and the RDD analysis supports the conclusion that the announcement abnormal returns are clearly causal in nature. We find that the bid/ask spreads of added stocks are narrower, that more analysts are drawn to cover the stocks that are added, but that on average they do not change their EPS forecasts, evidence that they do not expect the firm's operations to increase or decrease in values. We consider several possible sources of the positive price effects in a multivariate setting that controls simultaneously for measures of liquidity, arbitrage risk, operating performance, and investor interest and awareness. Only the liquidity variable, based on trading volume, is significant, irrespective of whether the additions are unscheduled during the year or are made in the regular process at year-end.

We conclude that what does happen to a Nasdaq stock when it is announced that it will be added to the Nasdaq-100 Index is that more analysts are drawn to it, and its market liquidity is enhanced. We conclude that what doesn't happen is that there is no evidence of significant effects of enhanced managerial effort or operating performance associated with the inclusion. This difference is noteworthy because it suggests that a certification effect of additions to the S&P indexes associated with S&P's selection process are unique to it and do not apply to the

Nasdaq-100 Index additions based on market cap alone. Our results provide indirect evidence on the existence and significance of the certification effect associated with additions to the S&P indexes.

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Appendix: Eligibility for initial inclusion in the Nasdaq-100 Index,

To be eligible for initial inclusion in the Nasdaq-100 Index. A security must be listed on the Nasdaq Stock Market and meet the following criteria:

- the security's U.S. listing must be exclusively on the Nasdaq National Market (unless the security was dually listed on another U.S. market prior to January 1, 2004 and has continuously maintained such listing);
- the security must be of a non-financial company;
- the security may not be issued by an issuer currently in bankruptcy proceedings;
- the security must have average daily trading volume of at least 200,000 shares;
- if the issuer of the security is organized under the laws of a jurisdiction outside the U.S., then such security must have listed options on a recognized options market in the U.S. or be eligible for listed-options trading on a recognized options market in the U.S.;
- only one class of security per issuer is allowed;
- the issuer of the security may not have entered into a definitive agreement or other arrangement which would likely result in the security no longer being Index eligible;
- the issuer of the security may not have annual financial statements with an audit opinion that is currently withdrawn;
- the issuer of the security must have "seasoned" on NASDAQ or another recognized market (generally, a company is considered to be seasoned if it has been listed on a market for at least two years; in the case of spin-offs, the operating history of the spin-off will be considered); and
- if the security would otherwise qualify to be in the top 25% of the securities included in the Index by market capitalization for the six prior consecutive month-ends, then a one-year "seasoning" criterion would apply.

Source: http://www.nasdaq.com/markets/indices/nasdaq-100.aspx. Download date: April 12, 2012

Appendix 2: Example of Rankings by Market Capitalization

Sample Rankings of Nasdaq Stocks for the Regular Year-end Reformation on December 24, 2001
Ranking Date Is October 31, 2001

Rank by Market Value	Company	Mar-ket Value	Indicator for Additions (2 = addition, 0 = not added)	Date Added	Average Trading Volume (Prior 6 months)	Seasoning at Time of Ranking (Time Listed in Database, No. of Trading Days)	Time Stock Remained on CRSP (No. of Trading Days)	Share Code (11 = Comm on, 12 = ADR)
12	COSTCO WHOLESALE CORP NEW	17,090	0	0	5364964	4021	2561	11
51	A S M L HOLDING N V	5,953	0	0	3031698	1672	2561	12
62	APOLLO GROUP INC	4,644	2	20011217	1088371	1740	2561	11
64	IMCLONE SYSTEMS INC	4,427	2	20011224	1445810	2510	1780	11
67	CHARTER COMMUNICATIONS INC	4,163	2	20011224	4667440	496	1870	11
70	C D W COMPUTER CENTERS INC	3,931	2	20011224	961871	2126	1498	11
71	SYMANTEC CORP	3,832	2	20011224	1891236	3119	2561	11
74	SEPRACOR INC	3,696	2	20011224	1337095	2552	2007	11
82	INVITROGEN CORP	3,243	2	20011224	997072	674	2561	11
83	EXPRESS SCRIPTS INC	3,241	2	20011224	1096322	2371	2561	11
84	CEPHALON INC	3,178	2	20011224	995350	2655	2507	11
87	I C O S CORP	3,119	2	20011224	559179	2626	1319	11
88	CYTYC CORP	3,040	2	20011224	1355313	1423	1504	11
89	PROTEIN DESIGN LABS INC	2,903	2	20011224	1972336	2462	2561	11
90	INTEGRATED DEVICE TECHNOLOGY	2,902	2	20011224	3479492	4470	2561	11
91	A T & T CANADA INC	2,874	0	0	360773	981	236	12
93	SYNOPSYS INC	2,846	2	20011224	1375813	2443	2561	11
94	MARVELL TECHNOLOGY GROUP LTD	2,842	0	0	1140335	337	2561	12
95	LINCARE HOLDINGS INC	2,768	0	0	842264	2427	2561	11
96	PEREGRINE SYSTEMS INC	2,756	0	0	3688493	1149	209	11
97	SIGMA ALDRICH CORP	2,752	0	0	584119	6626	2561	11
98	POLYCOM INC	2,698	0	0	1718506	1387	2561	11
100	SEMTECH CORP	2,659	0	0	1300015	7898	2561	11

Table 1
Additions to the Nasdaq-100 Index by Year

This table shows the number of stocks added to the Nasdaq-100 Index by year, broken out between those that were regularly scheduled year-end changes and those that were unscheduled replacements during the year.

	Total Number of Stocks Added	Added in the Unscheduled Replacement Process	Added in the Regular Annual Replacement Process
1994	10	6	4
1995	22	13	9
1996	22	7	15
1997	8	8	0
1998	26	6	20
1999	30	15	15
2000	17	5	12
2001	19	6	13
2002	21	6	15
2003	9	1	8
2004	10	2	8
2005	14	2	12
2006	10	7	3
2007	13	8	5
2008	15	4	11
2009	10	3	7
Total	256	99	157

Table 2
Abnormal Returns of Stocks Added to the Nasdaq-100 Index

This table shows abnormal returns around announcements of additions to the Nasdaq-100 Index. Average and cumulative abnormal returns are shown for all additions in our sample, and separately for scheduled and unscheduled additions.
Panel A: Abnormal returns in a two-day announcement period are calculated from the Nasdaq-100 Index, the market model (CRSP value-weighted index), and the Fama-French 3-factor model, using two estimate periods -- t-240 to t-61 and t+31 to t+211, where t stands for the announcement day.
Panel B: Cumulative abnormal returns based on market model are calculated over three post-announcement period: t+2 to t+21, t+2 to t+41 and t+2 to t+61.
Panel C: Cumulative abnormal returns are regressed on the abnormal returns of the two-day announcement period.
All p-values are based on two-tailed tests.

	All Nasdaq-100 Additions				Unscheduled Additions				Year-end Re-ranking Additions				Difference	
	# Obs.	% Pos	AR	p-value	# Obs.	% Pos	AR	p-value	# Obs.	% Pos	AR	p-value	AR	p-value
Panel A: Average Abnormal Returns in Announcement Period (2 days: t and t+1)														
Versus Nasdaq-100 Index	182	66.5%	1.69%	0.000	65	72.3%	3.03%	0.000	118	62.7%	0.94%	0.035	2.09%	0.017
Market Model (est. prd.: -240, -61)	182	60.4%	1.13%	0.004	65	72.3%	2.47%	0.001	118	53.4%	0.39%	0.388	2.08%	0.015
Market Model (est. prd.: +31, +211)	182	63.7%	1.43%	0.000	65	70.8%	2.61%	0.000	118	59.3%	0.76%	0.095	1.85%	0.029
FF Model (est. period: -240, -61)	182	56.0%	0.73%	0.071	65	72.3%	2.46%	0.001	118	46.6%	-0.23%	0.618	2.68%	0.002
FF Model (est. period: +31, +211)	182	60.4%	1.13%	0.005	65	73.8%	2.95%	0.000	118	52.5%	0.12%	0.802	2.83%	0.001
Panel B: Average Cumulative Abnormal Returns (Market Model Estimates)														
20 days after announcement (+2, +21)	182	40.7%	-1.60%	0.173	65	38.5%	-1.8%	0.413	118	41.5%	-1.47%	0.278	-0.34%	0.895
40 days after announcement (+2, +41)	182	42.3%	-0.72%	0.679	65	35.4%	-3.4%	0.265	118	45.8%	0.76%	0.720	-4.15%	0.259
60 days after announcement (+2, +61)	182	47.3%	0.92%	0.685	65	43.1%	-3.6%	0.281	118	49.2%	3.42%	0.253	-7.03%	0.115

Panel C: Regression Study - Cumulative Abnormal Returns versus Abnormal Returns in Announcement Period

	# Obs.	b	p-val(b)	# Obs.	b	p-val(b)	# Obs.	b	p-val(b)
20 days after announcement (+2, +21)	182	0.241	0.276	64	0.641	0.092	118	-0.049	0.862
40 days after announcement (+2, +41)	182	0.306	0.351	64	1.026	0.049	118	-0.112	0.797
60 days after announcement (+2, +61)	182	0.360	0.402	64	1.000	0.083	118	0.101	0.870

Table 3
Abnormal Returns of Stocks Added to the Nasdaq-100 Index for which There Are RDD Control Stocks

This table shows abnormal returns around announcements of additions to the Nasdaq-100 Index. Average cumulative abnormal returns for the period (0, +1) around are shown for the subset of the additions in our sample for which we could define a control stock based on market value as needed for the regression discontinuity design analysis.
Abnormal returns in a two-day announcement period (0, +1) are market model residuals based on the CRSP value- and equal-weighted indexes, using two estimate periods -- t-240 to t-61 and t+31 to t+211, where t represents the announcement day.
All p-values are based on two-tailed tests.

		Nasdaq-100 Additions with Control Stocks			Control Stocks			Long/Short		
	# Obs.	% Pos	AR	p-value	% Pos	AR	p-value	% Pos	AR	p-value
Average Abnormal Returns in Announcement Period (2 days: t and t+1) -- All Additions -- Market Model										
Value Wtd Index										
(est. prd.: -240, -61)	71	67.6%	2.23%	<0.0001	45.0%	-1.43%	0.0246	60.6	0.77%	0.0661
(est. prd.: +31, +211)	71	67.6%	2.41%	<0.0001	49.3%	-0.90%	0.1420	63.4	1.10%	0.0334
Equal Wtd Index										
(est. prd.: -240, -61)	71	69.0%	2.02%	<0.0001	47.9%	-1.45%	0.0329	60.6	0.67%	0.0504
(est. prd.: +31, +211)	71	70.4%	2.53%	<0.0001	45.1%	-0.64%	0.2744	66.2	1.29%	0.0103

Table 4
The Regression Discontinuity Analysis

This table summarizes the results of the regression discontinuity design tests, based on this regression:

$CAR_{j,t} = \alpha + \beta * Indicator_{j,t} + \epsilon_{j,t}$

where the Indicator variable has a value of 1 for stocks added to the Nasdaq index, and zero otherwise.

The abnormal returns are around announcements of additions to the Nasdaq-100 Index. Average cumulative abnormal returns for the period (0, +1) around are shown for the subset of all of the additions in our sample. This subset is the additions for which we could define a control stock based on market value as needed for the regression discontinuity design analysis. Abnormal returns in a two-day announcement period (0, +1) are market model residuals based on the CRSP value-weighted indexes, based on the estimation period t-240 to t-61, where t represents the announcement day.

	AR for Event day 0		**AR for Event day +1**		**CAR for Event period (0, +1)**
Intercept	-0.00321		-0.01107		-0.01428
t-statistic	-0.69		-2.07		-2.26
p-value	0.4929		0.0404		0.0252
Slope coefficient	0.01312		0.02345		0.03657
t-statistic	1.99		3.10		4.10
p-value	0.0489		0.0023		<0.0001
F ratio	3.9500		9.6000		16.7800
p-value	0.0489		0.0023		<0.0001

Table 5
Changes in the Bid/Ask Spread Before and After Addition to the Nasdaq-100 Index

We use TAQ data to compare the average daily relative proportional bid-ask spreads before and after addition to the Nasdaq-100 Index, on the basis of each stock's 50-day pre-event (t-55, t-6) and post-event (t+6, t+55) periods. Only bid-ask pairs issued on Nasdaq exchange are included because of the multiple exchanges included in TAQ database.
The Average Daily Bid/Ask Spread is defined and calculated as (average ask - average bid) / ((average ask + average bid)/2)

	Count	Average Pre-event Bid/Ask Spread	Standard Deviation Pre-event	Average Post-event	Standard Deviation Post-event Bid/Ask Spread	Diff in average, Post - Pre	t-value
Panel A: Since 1998 (due to incomplete quote data in TAQ databases)							
All	193	0.33%	0.46%	0.23%	0.21%	-0.10%	-2.6126
Non-year-end rebalancings	68	0.38%	0.68%	0.24%	0.21%	-0.14%	-1.6036
Year-end rebalancings	125	0.30%	0.27%	0.23%	0.21%	-0.07%	-2.3027
Panel B: Since 2002 (after 4/9/2001 decimalization)							
All	112	0.35%	0.59%	0.22%	0.25%	-0.13%	-2.1266
Non-year-end rebalancings	36	0.47%	0.92%	0.24%	0.26%	-0.22%	-1.3776
Year-end rebalancings	76	0.30%	0.33%	0.21%	0.25%	-0.08%	-1.7859

Table 6
Change in Analyst Coverage after a Stock is Added to the Nasdaq-100 Index

This table shows changes in IBES analyst coverage of stocks added to the Nasdaq 100 Index. Data are included for all additions in our sample, and separately for scheduled and unscheduled additions. AnFY1 (AnFY2) is the number of analysts that contribute to the IBES's average EPS estimate of current (next) fiscal-year's earnings in a given month. AnREC is the number of analysts that contribute to the IBES's average buy-hold-sell recommendation in a given month. For a Nasdaq-100 addition, its event month (m = 0) is defined as the month of the effective day of the addition. The average numbers of analysts in the 3-month (m = 1, 3) and the 6-month (m = 1, 6) post-event periods are compared to the average number of analysts one year earlier (YOY) for both new Nasdaq-100 members and the incumbent control group. Additional tests between all Nasdaq-100 additions, unscheduled additions, and year-end re-ranking additions are performed for comparison. All p-values are based on two-tailed tests.

	All Additions to the Nasdaq-100				Unscheduled Additions				Year-End Re-Ranking Additions				Difference	
	# Obs.	% Pos	Value	p-val	# Obs.	% Pos	Value	p-val	# Obs.	% Pos	Value	p-val	Value	p-val
Panel A: The number of analysts making current year EPS estimates (AnFY1)														
(A): # change: (+1, +3) vs. (-1, -3)	240	73%	2.78	0.000	99	76%	3.28	0.000	157	64%	2.18	0.000	1.10	0.056
(B): % change: (+1, +3) vs. (-1, -3)	240	73%	39.57	0.000	99	76%	47.78	0.000	157	64%	30.36	0.000	17.42	0.046
(C): # change: (+1, +6) vs. (-1, -6)	240	79%	2.82	0.000	99	81%	3.29	0.000	157	69%	2.23	0.000	1.06	0.053
(D): % change: (+1, +6) vs. (-1, -6)	240	79%	36.29	0.000	99	81%	45.89	0.000	157	69%	26.55	0.000	19.34	0.015
(A) versus control group (+1, +3)	240	65%	2.09	0.000	92	73%	3.00	0.000	148	61%	1.51	0.000	1.49	0.014
(B) versus control group (+1, +3)	240	63%	28.61	0.000	92	72%	41.89	0.000	148	57%	20.35	0.000	21.53	0.018
(C) versus control group (+1, +6)	240	69%	2.22	0.000	92	82%	3.12	0.000	148	61%	1.66	0.000	1.46	0.012
(D) versus control group (+1, +6)	240	67%	27.15	0.000	92	78%	41.74	0.000	148	60%	18.08	0.000	23.66	0.005
Panel B: The number of analysts making EPS estimates for the next fiscal year (AnFY2)														
(A): # change: (+1, +3) vs. (-1, -3)	239	73%	2.28	0.000	99	78%	2.99	0.000	157	62%	1.58	0.000	1.41	0.004
(B): % change: (+1, +3) vs. (-1, -3)	239	73%	38.33	0.000	99	78%	46.14	0.000	157	62%	29.25	0.000	16.88	0.057
(C): # change: (+1, +6) vs. (-1, -6)	240	79%	2.38	0.000	99	81%	2.91	0.000	157	69%	1.80	0.000	1.11	0.016
(D): % change: (+1, +6) vs. (-1, -6)	240	79%	36.47	0.000	99	81%	45.58	0.000	157	69%	27.01	0.000	18.57	0.022
(A) versus control group (+1, +3)	239	62%	1.51	0.000	92	75%	2.63	0.000	147	54%	0.81	0.008	1.82	0.001
(B) versus control group (+1, +3)	239	57%	24.04	0.000	92	70%	37.11	0.000	147	50%	15.86	0.002	21.25	0.021
(C) versus control group (+1, +6)	240	64%	1.71	0.000	92	80%	2.63	0.000	148	54%	1.14	0.000	1.49	0.003
(D) versus control group (+1, +6)	240	63%	25.69	0.000	92	75%	39.52	0.000	148	56%	17.09	0.000	22.42	0.008
Panel C: The number of analysts making buy-hold-sell recommendations (AnREC)														
(A): # change: (+1, +3) vs. (-1, -3)	239	79%	2.97	0.000	99	78%	3.16	0.000	157	71%	2.52	0.000	0.64	0.251
(B): % change: (+1, +3) vs. (-1, -3)	239	79%	40.87	0.000	99	78%	50.18	0.000	157	71%	30.58	0.000	19.60	0.032
(C): # change: (+1, +6) vs. (-1, -6)	240	83%	2.99	0.000	99	79%	3.12	0.000	157	76%	2.60	0.000	0.53	0.328
(D): % change: (+1, +6) vs. (-1, -6)	240	83%	37.35	0.000	99	79%	45.17	0.000	157	76%	28.61	0.000	16.57	0.031
(A) versus control group (+1, +3)	239	62%	1.74	0.000	91	70%	2.21	0.000	148	57%	1.45	0.000	0.76	0.181
(B) versus control group (+1, +3)	239	61%	26.32	0.000	91	71%	38.69	0.000	148	55%	18.72	0.000	19.97	0.022
(C) versus control group (+1, +6)	240	65%	1.84	0.000	92	73%	2.25	0.000	148	60%	1.59	0.000	0.66	0.230
(D) versus control group (+1, +6)	240	63%	24.87	0.000	92	71%	35.77	0.000	148	57%	18.09	0.000	17.67	0.021

Table 7
Change in Analysts' Earnings Forecasts and Stock Recommendations after Nasdaq-100 Additions, 1994-2009

This table shows monthly changes in analysts' forecasts for current fiscal year earnings per share, EPS. It is computed as a percentage of the prior month's stock price. The analysts' estimates and price data are from IBES. Monthly changes in analysts' average recommendations are also computed. The event month (m = 0) for a stock newly added to the Nadsaq-100 index is the month containing the effective day. The total changes in the 3-month (m = 1, 3) and the 6-month (m = 1, 6) post-event periods are computed for the new Nasdaq-100 members and the incumbent control group. Additional tests between all Nasdaq-100 additions, unscheduled additions, and year-end re-ranking additions are performed for comparison.

The methodology is based on that of Dennis, McConnell, Ovtchinnikov, and Yu (2003) to compute the change in median estimate for the current fiscal-year EPS (or FY1) from before to after the Nasdaq-100 addition for each newly added Nasdaq-100 stock. If an addition occurs within three months of the end of a firm's fiscal year, we use the change in median estimate for the next fiscal-year EPS (or FY2) instead. Raw changes are then standardized by either stock price per share or the median FY1 before the addition. We use incumbent Nasdaq-100 stocks our control stocks for their similarity to the newly added stocks in size, industry, and trading venue. Forecast errors are calculated as the difference between actual EPS and the median FY1 estimate at Nasdaq-100 additions.

All p-values are based on two-tailed tests.

	All Nasdaq-100 Additions				Unscheduled Additions				Year-end Re-ranking Additions				Difference	
	# Obs.	% Pos	Value	p-val	# Obs.	% Pos	Value	p-val	# Obs.	% Pos	Value	p-val	Value	p-val
Panel A: Change in FY1 EPS Estimate As a Percentage of Stock														
(1): % Change in 3 months (+1, +3)	248	55%	-0.29	0.139	99	54%	-0.66	0.150	157	54%	-0.04	0.718	-0.62	0.181
(2): % Change in 6 months (+1, +6)	248	58%	-0.57	0.036	99	55%	-0.76	0.125	157	57%	-0.42	0.158	-0.34	0.553
(3): (1) versus control group (+1, +3)	248	75%	0.03	0.887	97	78%	-0.24	0.609	151	74%	0.20	0.048	-0.45	0.358
(4): (2) versus control group (+1, +6)	248	76%	-0.02	0.952	97	75%	-0.15	0.767	151	76%	0.07	0.825	-0.22	0.712
Panel B: Change in Analyst Recommendation (Rating) (Positive change: Upgrade; Negative change: Downgrade)														
(1): Rating Change in 3 months (+1, +3)	248	47%	0.00	0.998	99	48%	0.01	0.678	157	43%	-0.01	0.758	0.02	0.604
(2): Rating Change in 6 months (+1, +6)	248	50%	0.00	0.874	99	54%	0.02	0.473	157	45%	-0.02	0.494	0.04	0.319
(3): (1) versus control group (+1, +3)	248	56%	0.01	0.441	97	61%	0.03	0.191	151	53%	0.00	0.992	0.03	0.318
(4): (2) versus control group (+1, +6)	248	58%	0.02	0.185	97	64%	0.05	0.038	151	54%	0.01	0.818	0.05	0.187

Table 8

Multivariate Regressions on Announcement Period Abnormal Returns

The dependent variable is the market-adjusted CARs from announcement date (AD) to 60 trading days following the effective date (ED). CARs are market-adjusted returns based on the Nasdaq 100 index for abnormal returns.

Independent variables:

1. Arbitrage-risk Al is the variance of the residuals of the model Rit – Rft = βit(Rmt – Rft) where Rmt is the return on CRSP's value-weighted AMEX / NASDAQ / NYSE index and Rft is the T-bill return. The period is (-250, -1) relative to the announcement. It is scaled by a factor of 1,000
2. Trading volume is the natural log of the average of daily number of shares traded times closing price. Post-addition abnormal change is relative to the median change in the overall Nasdaq-100 index during the same period for each measure. The pre announcemene period is (-252, -1) relative to the announcement day, and the post announcement period is (+61, +313) relative to the effective day.
3. Change in the number of analysts who make earnings estimates (both FQ1 and FY1) one month prior to announcement date (month AM-1) and the number submitting earnings estimates 3 months after the effective date (month ED+3). We adjust the change to the median change in the overall index.
4. Change in current EPS forecast is the change in average earnings forecasts adjusted for contemporaneous changes in that for the Nasdaq 100 stocks. Median EPS forecasts preceding the month of announcement that a company will be added to the Index are compared with EPS forecasts following the effective month to calculate the change in EPS forecasts. The change in EPS forecast is calculated for current-year EPS forecasts.
5. Shadow cost is based on Merton's analysis, and is calculated as:

Shadow cost = ((Residual σ)/(Index Market Cap))*((Firm Size)/(No.of Shareholders))* 10^4

6. Market-to-book ratio is based on Compustat's quarterly item Common/Ordinary Equity - Total (CEQQ) to market value of equity before announcement date.
7. Natural log of total assets is based on total assets are the Compustat's quarterly item Assets – Total (or ATQ) before the announcement date.

Panel A summarizes the regression including all variables jointly, and Panel B summarizes the results for a stepwise procedure.

Panel A: All variables

Variable	All Additions	Additions Made During the Year	Year-end Additions
	Coefficient (p-value)	*Coefficient (p-value)*	*Coefficient (p-value)*
Intercept	0.0120	0.1549	-0.1633
	0.8965	0.2189	0.1995
Arbitrage risk	-0.0220	-0.0343	-0.0106
	0.0932	0.0488	0.5580
Change in volume, adjusted for contemporaneous	0.2279	0.1729	0.2902
changes in control stocks	0.0000	0.0000	0.0000
Change in no. of analysts submitting EPS estimates	0.0009	0.0067	-0.0038
for the current fiscal year, adjusted for	0.8662	0.3664	0.6293
Change in analysts' current year EPS estimates,	1.0363	1.3799	-1.4587
adjusted for contemporaneous changes in control	0.5123	0.4880	0.5377
Change in shadow cost, adjusted for	0.0096	-0.0008	0.0215
contemporaneous changes in control stocks	0.2482	0.9448	0.0550
Ratio of market to book values	0.0000	0.0001	-0.0002
	0.7031	0.4411	0.1451
Natural log of total assets	-0.0112	-0.0303	0.0117
	0.3543	0.0744	0.4741
Summary statistics			
Adjusted R Square	0.3505	0.3308	0.4169
Standard Error	0.2177	0.1825	0.2263
No. of observations	256	99	157

Panel B: Stepwise regression						
Variable		All Additions		Additions Made During the Year		Year-end Additions
		Coefficient (p-value)		*Coefficient (p-value)*		*Coefficient (p-value)*
Intercept		-0.0888		0.2117		-0.0782
		<0.0001		0.0814		0.0012
Arbitrage risk				-0.0321		
				0.0266		
Change in volume, adjusted for contemporaneous		0.2336		0.1735		0.2759
changes in control stocks		<0.0001		<0.0001		<0.0001
Change in shadow cost, adjusted for						0.0184
contemporaneous changes in control stocks						0.0698
Ratio of market to book values						-0.0011
						0.1308
Natural log of total assets				-0.0377		
				0.0207		
Summary statistics						
Adjusted R Square		0.4277		0.367782		0.4243
Standard Error		0.5723		0.1825		0.2251
No. of observations		256		99		157

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