S&P 500 INDEX RECONSTITUTIONS: AN ANALYSIS OF OUTSTANDING HYPOTHESES

by

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ABSTRACT

LINDSAY CATHERINE BARAN S&P 500 index reconstitutions: an analysis of outstanding hypotheses (Under the direction of DR. TAO-HSIEN DOLLY KING)

The market reaction to announcements of S&P 500 index changes shows a sustained price increase for added firms and a short-term price decline for newly removed firms. We explore the outstanding hypotheses regarding liquidity, certification, and investor awareness using new evidence. We show that the cost of equity declines following inclusion and increases following removal from the index and these changes are related to liquidity improvements and deterioration rather than changes in investor awareness. Secondly, we conclude that information asymmetry declines following addition but does not change significantly following deletion. Specifically, we show that, after controlling for other pertinent factors, stock analyst earnings forecast errors shrink when a firm is added to the S&P 500 index. These findings support the certification hypothesis to explain stock market response to index reconstitution. Finally, we explore changes in bond yields to distinguish between the type of information certified by Standard and Poors, but our results are inconclusive. Taken together, we find additional support for both the liquidity and certification hypotheses proposed in extant literature about S&P 500 index reconstitutions.

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CHAPTER 1: COST OF CAPITAL AND S&P 500 INDEX REVISIONS

Since inception, Standard and Poor's has changed the composition of its S&P 500 Index as companies are selected in and out of the index. Numerous studies examine the price effects of these index changes. Earlier studies such as Harris and Gurel (1986) and Shleifer (1986) document the strong and persistent price increase of newly included firms. On the other hand, Jain (1987) and Lynch and Mendenhall (1997) show that excluded stocks experience a temporary decline in price. In the literature, five outstanding hypotheses seek to explain the market reactions to the S&P 500 Index changes. Standard and Poor's maintains that they do not use information about future prospects when selecting firms to be added or deleted from their index.

The five hypotheses used to explain the price reactions around index changes can be broadly categorized as undermining or supporting the efficient market hypothesis. The ***imperfect substitutes*** hypothesis stands alone against the efficient market theory as the hypothesis suggests a downward-sloping demand curve for the S&P 500 stocks. In particular, the hypothesis states that, with no information in the announcements about future firm performance or risk, stocks that are included in the index are preferred by investors and cannot be easily substituted. Therefore, in the index revision events, the inclusion stocks experience a positive price reaction while the exclusion stocks show a negative price reaction. This implication contradicts with Scholes' (1972) finding that stocks are perfect substitutes and have flat long-run demand curves. In the case of perfect

substitutes and perfect elasticity of demand, shocks to supply or demand that do not convey information to the market should not affect prices. Thus, the increased demand by index funds when a firm is added to the S&P 500 Index should not cause a long-run effect in price unless information transmission occurs in the announcement of the index inclusion.

The *price pressure hypothesis* is consistent with Scholes' (1972) flat demand curves but only holds if price improvements at addition are completely reversed in the short run. Index fund rebalancing might create a temporary imbalance of supply and demand to raise prices, but, barring any information conveyed in the inclusion decision, these price changes should be short-term. The remaining hypotheses propose that information is conveyed when Standard and Poors makes changes to the index, and this information corroborates Scholes' (1972) proposition of long-run flat demand curves. Within these supporters of market efficiency, scholars search for alternative explanations that are consistent with stocks being perfect substitutes. To date, four hypotheses have been proposed in the literature. Proponents of the *liquidity hypothesis* claim that the documented permanent improvements (declines) in liquidity explain the increase (decrease) in stock prices following an addition (deletion) to the S&P 500 Index. The *certification hypothesis* encompasses several types of information about the firms that are included in (excluded from) the Standard and Poor's Index. For inclusion stocks, better future cash flows, a lower level of information asymmetry, and closer monitoring of the firms are forms of positive news that may be conveyed to the markets and support a sustained price increase. For deleted stocks, a price decline following the removal is supported by the negative information conveyed in the index revision. Advocates of the

investor awareness hypothesis assert that investors' attention to newly added index stocks is piqued and that they do not immediately revoke attention when stocks are removed. The asymmetric effect of permanent price increases at additions and temporary price decreases at deletions stem from the asymmetric changes in investor awareness. We discuss these hypotheses and related literature in detail in the following section.

In this paper, we examine the cost of equity capital surrounding index additions and deletions to further explain the price reactions. In particular, our analysis of cost of capital around index revisions provides evidence about the liquidity and investor awareness hypotheses. Our paper is related to studies by Becker-Blease and Paul (2006) and Chen, et al (2004). Becker-Blease and Paul (2006) examine the relationship between increased stock liquidity following S&P 500 Index inclusion and expansion of the investment opportunity set. They find a positive correlation between increases in stock liquidity and proxies for investment opportunities including capital expenditures and research and development expenses. They argue that if stock liquidity increases, then the cost of equity capital, and therefore the overall cost of capital for the firm, would decrease. The decrease in cost of capital expands the set of value-creating investment opportunities for the firm. While Becker-Blease and Paul (2006) document the relation between liquidity and investment opportunities, they do not directly examine the cost of capital around index inclusion events. In addition, they do not examine index deletion firms. On the other hand, our study is also related to that of Chen, et al (2004) who find asymmetric price reactions at additions and deletions that support the investor awareness hypothesis. They claim that the excess returns around index changes are due to either changes in expectations of future cash flows or changes in the required rate of return.

They provide three explanations for a change in the cost of equity capital: shifts in liquidity, information asymmetry, and monitoring.

Both the liquidity and investor awareness hypotheses suggest a link between stock price reactions and cost of capital. Based on the liquidity hypothesis, stock liquidity changes as a result of index changes, explaining the stock price reactions. An increase (decrease) in stock liquidity for inclusion (deletion) stocks can lead to a drop (rise) in cost of equity. We expect to find a decrease in the cost of equity capital for firms added to the S&P 500 and an increase in the cost of equity capital for firms deleted from the index. Finding symmetric changes in cost of equity at addition and deletion supports the liquidity hypothesis. On the other hand, the investor awareness hypothesis suggests that investors require a smaller shadow premium (and therefore a smaller required rate of return) on the stock when the firm is added to the index and do not require a larger shadow premium on the deleted stocks. We expect to find a decrease in the cost of equity for added stocks and an insignificant change in cost of equity for deleted stocks. Thus, asymmetric changes in cost of capital support the investor awareness hypothesis.

In this study, we estimate cost of equity using two methods: buy-and-hold returns and market/four-factor model. From existing literature, we find support for the use of these two methods to measure the cost of equity. Based on the buy-and-hold returns, the returns for firms added to the S&P 500 Index decline significantly after the inclusion events. More importantly, we find that the drop in buy-and-hold returns for the inclusion firms is significantly *larger* than that for their matched firms. For firms deleted from the index, buy-and-hold returns are significantly higher following the removal of the stock from the index. Similarly, the buy-and-hold returns for the deleted firms increase

significantly *more* than those of matched firms. Our second method to estimate changes in the cost of equity uses the market and the four-factor models. Based on this method, our results strongly support the results of the buy-and-hold returns. We find that the estimated cost of equity for added firms decreases significantly after the inclusion events. Similarly, the cost of equity for firms deleted from the index experiences a significant jump after the deletion events. These findings are consistent with liquidity hypothesis rather than the investor awareness hypothesis.

To examine the factors that explain the change in cost of capital for the index addition and deletion firms, we explore several liquidity measures and shadow cost as suggested by Chen, et al (2004). We examine these measures around the index revision events and link them to the changes in cost of capital. First, we test the change in the liquidity and shadow cost proxies, and we find that liquidity increases for newly added stocks and falls for newly removed ones. For the shadow cost proxy, we show an asymmetric change around additions and deletions. Shadow cost declines significantly upon addition but remains relatively constant upon deletion. Using regression analysis, we show that, after controlling for changes in these liquidity and shadow cost variables, cost of capital changes are negatively related to excess returns for addition firms. However, this relationship does not hold for newly removed firms. These results show that cost of capital changes are a significant factor in explaining the price increase of new S&P 500 firms.

In the final component of our analysis, we show that the drop in the cost of equity for added stocks is driven by turnover increases, and the increase in the cost of equity for removed stocks is impacted by the illiquidity ratio and trading volume changes. This

result persists even after controlling for changes in leverage, information asymmetry, and firm risk. To sum up, we find symmetric changes in the cost of equity around index revisions and liquidity proxies, rather than shadow cost changes, are significant in explaining the cost of equity changes, our study supports the liquidity hypothesis over the investor awareness hypothesis.

The remainder of the paper is organized as follows. Section 1.1 discusses the literature related to index inclusion and deletion events. Section 1.2 presents the sample selection process and descriptive statistics of the sample. Section 1.3 discusses the methodology and presents our empirical results. In Section 1.4, we conclude the paper.

1.1 Literature Review

From the extensive literature on the price impacts of the S&P 500 Index changes, we identify five competing hypotheses: imperfect substitutes, liquidity, certification, investor awareness, and price pressure. The imperfect substitutes hypothesis argues against market efficiency as proposed in Scholes (1972), while the remaining four hypotheses support market efficiency. These hypotheses discuss potential sources of information conveyed in index reconstitutions that make observed price patterns consistent with perfect elasticity of demand for stocks. We describe each hypothesis in detail below.

The ***imperfect substitutes*** hypothesis claims that stocks are not perfect substitutes for one another and that investors' demand for S&P 500 stocks exceeds that for non-index stocks. This hypothesis is consistent with a permanent price increase at index additions and a permanent price decline following deletions. Shleifer (1986) and Lynch and Mendenhall (1997) provide support for this hypothesis, while Edmister, et al (1994) and Hrazdil (2007) conclude that the long-run demand curves for stocks are flat. In particular, Shleifer (1986) shows that abnormal returns are positively related to the amount of index fund purchases of a newly included stock and are not correlated with bond ratings. Based on this evidence, he proposes that demand curves for these stocks are downward sloping and rejects the certification hypothesis. Lynch and Mendenhall (1997) look at a sample of index changes following October 1989 when Standard and Poors began pre-announcing index changes. While a portion of the initial price increase is due to temporary price pressure, they conclude that demand curves for stocks are

downward sloping because some of the initial price increase remains. They find opposite price reaction for stocks deleted from the index.

On the other hand, Edmister, et al (1994) argue that previous research supporting the price pressure and imperfect substitutes hypotheses rely upon biased measures of abnormal returns. The re-estimate the abnormal returns using a future estimation period and reject both hypotheses. They reject the price pressure hypothesis because excess returns are not reversed in the short run. They also reject the imperfect substitutes hypothesis because they find no relation between excess returns and variables measuring increased demand for newly added stocks. Hrazdil (2007) studies the change in S&P 500 weighting method from a market-based to a free-float based system. If stocks had downward sloping demand curves, abnormal returns should be correlated with the change in the index weight. However after controlling for other factors, Hrazdil (2007) finds no relation between abnormal returns and index weight changes.

The ***liquidity*** hypothesis is similar to the price pressure hypothesis because it posits that the price increases associated with index inclusions are due to increases in liquidity from more active trading of the index stocks. Amihud and Mendelson's (1986) theoretical model suggests that share price increases as bid-ask spread decreases. In contrast to the price pressure hypothesis, the liquidity benefits can be sustained and this hypothesis suggests a permanent price increase after index additions. Erwin and Miller (1998), Hedge and McDermott (2003), and Becker-Blease and Paul (2006) find support for this hypothesis.

Erwin and Miller (1998) show that liquidity can explain the documented price increase at inclusion events. They examine the bid-ask spreads of stocks that are added

to the index. They find that, for stocks without previously traded options, bid-ask spreads decrease and the increase in price and trading volume for these stocks are sustained. On the contrary, stocks with traded options experience a temporary increase in price and no significant decrease in bid-ask spreads after the inclusion. The presence of traded options mitigates the benefit of liquidity improvements, so stocks with no traded options at the time of the inclusion benefit more from the greater liquidity. Hedge and McDermott (2003) show that the cumulative abnormal returns around index additions are negatively related to the change in bid-ask spreads. They also find that decreases in the spread are permanent benefits of increased liquidity, and that a large portion of the drop in spreads is due to the reduction in the direct costs of transactions rather than in the asymmetric information component. Finally, Becker-Blease and Paul (2006) report that firms added to the S&P 500 Index experience an increase in liquidity and growth opportunities, which supports a permanent price increase associated with additions. They suggest that the link between liquidity and growth opportunities is the cost of capital. In particular, Becker-Blease and Paul (2006) hypothesize that firms have a lower cost of capital due to better liquidity and therefore are able to take on more projects (measured by capital expenditure and R&D expense) after the additions. They did not provide a test on whether the cost of capital for added firms falls as a result of greater liquidity.

The *certification* hypothesis supports a positive and sustained price reaction to index additions because inclusion announcements contain positive information about selected firms. Similarly, deletion firms accrue losses because negative information is conveyed in the announcement. While signalling information about future performance is contrary to the stated practice of Standard and Poor's, work by Dhillon and Johnson

(1991), Denis, et al (2003), Kappou, et al (2007), and Cai (2007) supports this hypothesis. On the other hand, Hrazdil and Scott (2007) provide evidence against this hypothesis. In one of the earlier studies of the certification hypothesis, Dhillon and Johnson (1991) examine the returns to bonds and options to distinguish between the price pressure and certification hypotheses. Assuming no positive information, stock options and bonds are not susceptible to the price pressure or downward-sloping demand due to index rebalancing. However, Dhillon and Johnson find that call option and bond prices both increase at the announcements of index inclusion, while put prices fall. These findings support the certification hypothesis.

In recent studies, Denis, et al (2003) and Kappou, et al (2007) find that earnings per share rise in the period following index inclusion events. In addition, Denis, et al (2003) show that analyst earnings forecasts increase at the same time. Denis, et al (2003) point out that it is unclear as to the source of the increase in earnings per share and analysts forecasts. They suggest that the increased earnings may be due to superior monitoring by the market or the fact that these firms are selected by Standard and Poors for their better earnings potential. Furthermore, Cai (2007) suggests that inclusion events convey positive information about both the industry and selected company. Hrazdil and Scott (2007) refute the findings of Denis, et al (2003) by showing that the increases in earnings per share are due to managerial manipulation of the discretionary accruals. They suggest inclusion announcements convey no real information about company performance.

Chen, et al (2004) find permanent price increases for addition stocks but no permanent decline in prices for deletion stocks. Given this finding, they propose an

alternate explanation regarding the asymmetric effects of index additions and deletions. The *investor awareness* hypothesis stems from the Merton (1987) model of market segmentation where investors demand a shadow premium because they are only aware of and invest in a subset of stocks. When stocks are added to the index, investors become more aware of them and the shadow premium should decrease. Therefore, the required rate of return for the stock falls. When a stock is removed from the index, investors do not remove it from their sphere of awareness so a symmetric decrease in stock prices is not expected.

The *price pressure* hypothesis supports a temporary price increase for added stocks to the index due to heavy buying pressure by index funds. Under this hypothesis, the effect of the increased demand of the selected stocks should dissipate in the short run and thus the positive price effects should be temporary. Similarly, the hypothesis suggests a temporary price drop for stocks that are removed from the index. Harris and Gurel (1986) and Elliott and Warr (2003) find empirical support for this hypothesis. In particular, Harris and Gurel (1986) argue that the price pressure, driven by the rebalancing of index funds, leads to a short-term positive price reaction that is reversed within two weeks of the index change. Since Standard and Poor's states that they do not use forecasts of future performance as a selection criteria for choosing firms for the index, Harris and Gurel's evidence of increased trading volume and price increases supports the price pressure hypothesis. In addition, they document a positive relation between the magnitude of the change in trading volume and prices and the size of index funds in the market. Elliott and Warr (2003) examine the differences in price pressure between the added firms on the NYSE and those on the Nasdaq. They find that Nasdaq

stocks experience a larger and more sustained price impact. They attribute the difference to the greater ability of the auction markets to absorb large increases in demand but conclude that price pressure drives the positive reaction of stocks added to the S&P 500.

Finally, another strand of literature studies the changes in equity betas surrounding S&P 500 Index revisions. Vijh (1994) finds, for the period of 1985 to 1989, the betas of newly included stocks to the S&P 500 increase and shows that some of this increase is due to increased trading volume in index stocks. He concludes that the market beta of S&P 500 stocks is overstated following index inclusion. Barberis, et al (2005) further examine changes to betas of newly added S&P 500 stocks and find increased correlation with other S&P 500 stocks and decreased correlation with non-S&P 500 stocks. A rational view of markets suggests that an increase in market betas would occur with increased co-movement of fundamentals or cash flows of a particular stock. Nevertheless, Barberis, et al (2005) shows that a "sentiment-based" theory of stock movement has support.

1.2 Sample Selection and Descriptive Statistics

Our sample consists of firms that are added to or deleted from the S&P 500 Index from 1990 through 2007. We begin our sample period in 1990 because Standard and Poor's revised their method of announcing index revisions in October 1989. Prior to this revision, Standard and Poor's announced index changes after trading closed on the day immediately prior to the revision. Following the change in 1989, index changes are pre-announced several days prior to the actual revision of index constituents. According to Benish and Whaley (1996), this change alleviates some buying pressure caused by index funds attempting to purchase shares of the newly added stock on the morning of the change. Using a monthly list of S&P 500 Index constituents from Compustat, we identify the months in which the index constituents change. We then verify, using news articles in Lexis-Nexis, the announcement and effective revision dates for all index changes. This process produces 842 total sample firms with 419 index additions and 419 deletions. Panel A of Table 1 provides a breakdown of the number of index revisions by year in our sample. We further exclude those sample firms that are associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm (11 cases involving 11 added and 11 deleted firms), (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index (5 cases involving 5 deleted firms), (3) when two existing index firms merge and the resulting merged firm remains on the index (9 cases involving 9 added and 18 deleted firms), and (4) when an index firm is replaced by a spun-off subsidiary (17 cases involving 17 added and 17 deleted firms). The final sample contains 382 added firms and 368 deleted firms. Panel B presents the sample screening process described above.

TABLE 1: Number of Events by Year

The sample consists of all firms added to or deleted from the S&P 500 during the period of 1990 - 2007. Panel A includes all additions and deletions. Panel B describes the events that were removed from the original sample and provides the final sample. Deals were removed if an outside firm acquires an S&P 500 firm and replaces it on the index, if an S&P firm acquires another S&P firm and the acquired firm is removed from the index, if two S&P 500 firms merged and the merged firm remains on the index, and if an S&P 500 firm spins off a subsidiary and the subsidiary replaces the parent firm.

Panel A: Number of Additions and Deletions by Year

	Additions/Deletions
1990	11
1991	11
1992	7
1993	12
1994	16
1995	31
1996	23
1997	28
1998	42
1999	41
2000	56
2001	28
2002	22
2003	9
2004	19
2005	19
2006	31
2007	13
Total	419

Panel B: Sample Screening Process

Reason for Removal	Additions	Deletions
A non-index firm acquired and replaced an index firm.	11	11
An S&P 500 firm acquires another index firm and the acquired firm is removed from index.	0	5
Two index firms merge and the remaining merged firm remains in index.	9	18
Spun-off subsidiary replaces index firm.	17	17
Final Sample Total	382	368

In addition, we create a sample of matched peers for the sample firms by matching on industry and firm size. For each sample firm, we collect a pool of industry peers in the same three-digit SIC code. We then select the peer with a firm size (measured by total assets) that is closest to that of the sample firm. We require that the selected match has valid data in Compustat for the fiscal year prior to the event date as well as valid stock returns in CRSP for the period of seven months prior to and after the announcement of the index revision. Finally, we require that the matched firm is not a member of the S&P 500 Index in the five years prior to and after the event. Our annual accounting data is from Compustat, daily and monthly stock returns are retrieved from CRSP, and marginal tax rates are the before-interest-expense tax rates from John Graham's website. If these tax rates are missing, tax rate is computed from Compustat data as the tax expense divided by total pretax income. Any remaining missing or negative tax rates are filled in with the median tax rate of the existing inclusion or deletion sample.

Table 2 reports the descriptive statistics for the sample and matched firms for the inclusion sample in Panels A and B, respectively. For the deletion sample, the same statistics are reported in Panels C and D. On average, sample firms are larger in terms of assets, sales, and market value of equity than the matched pairs, and this holds for both the inclusion and deletion samples. Also, both sets of sample firms have lower leverage than their matched counterparts.

TABLE 2: Descriptive Statistics of Sample and Matched Pair Firms

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. We match each sample firm with a matching pair firm in the same 3-digit SIC code and the matched pair is the closest possible match in asset size. Matched firms can not be constituents of the S&P 500 for a period of 10 years surrounding the event. Assets, sales, long-term debt, and short-term debt are the book value of these measures from the fiscal year end immediately prior to the index change. Market value of equity is the value of the target's outstanding equity at the end of the fiscal year prior to the announcement. Assets, sales, and market value of equity are reported in millions of 2007 dollars and were adjusted using the Consumer Price Index. Leverage is the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets, where the market value of assets is estimated as the book value of assets minus the book value of equity plus the market value of equity.

Panel A: Inclusion Firms

	Mean	Median	N	Min	Max	Std. Deviation
Total Assets *(in millions of 2007 dollars)*	16,302.08	4,309.34	379	259.66	360,924.72	39,786.75
Total Sales *(in millions of 2007 dollars)*	5,113.03	2,564.17	379	136.84	58,930.82	7,502.00
M.V. of Equity *(in millions of 2007 dollars)*	8,979.95	6,512.49	332	598.16	129,033.75	10,664.16
Long Term Debt *(in millions of 2007 dollars)*	1,844.11	539.65	369	1,844.11	35,854.57	3,796.67
Short Term Debt *(in millions of 2007 dollars*	2,678.27	33.41	372	0.00	175,345.89	14,464.10
Leverage	0.13	0.08	328	0.00	0.82	0.16

Panel B: Inclusion Matched Pair Firms

	Mean	Median	N	Min	Max	Std. Deviation
Total Assets *(in millions of 2007 dollars)*	11,782.68	2,751.70	379	21.08	347,785.60	30,997.19
Total Sales *(in millions of 2007 dollars)*	2,911.65	1,708.02	377	9.10	31,644.41	3,996.55
M.V. of Equity *(in millions of 2007 dollars)*	2,972.62	1,958.87	363	0.00	45,324.76	3,700.29
Long Term Debt *(in millions of 2007 dollars)*	1,527.68	640.73	378	1,527.68	38,517.59	3,244.52
Short Term Debt *(in millions of 2007 dollars*	1,780.63	39.15	377	0.00	235,024.51	12,973.26
Leverage	0.24	0.19	358	0.00	0.94	0.21

TABLE 2 (continued)

Panel C: Deletion Firms

	Mean	Median	N	Min	Max	Std. Deviation
Total Assets *(in millions of 2007 dollars)*	21,148.25	4,909.08	365	115.38	395,540.71	46,973.00
Total Sales *(in millions of 2007 dollars)*	7,661.41	3,732.01	367	53.73	120,860.82	12,128.07
M.V. of Equity *(in millions of 2007 dollars)*	9,994.89	3,890.84	318	24.11	120,511.31	17,391.82
Long Term Debt *(in millions of 2007 dollars)*	3,683.06	1,045.78	341	3,683.06	64,035.80	7,215.22
Short Term Debt *(in millions of 2007 dollars*	2,999.78	148.55	341	0.00	223,993.49	15,215.45
Leverage	0.20	0.17	317	0.00	0.93	0.16

Panel D: Deletion Matched Pair Firms

	Mean	Median	N	Min	Max	Std. Deviation
Total Assets *(in millions of 2007 dollars)*	12,656.01	2,804.80	362	37.74	330,988.96	33,226.73
Total Sales *(in millions of 2007 dollars)*	4,271.04	2,058.24	360	27.78	43,356.36	6,864.77
M.V. of Equity *(in millions of 2007 dollars)*	4,356.35	1,435.67	344	0.01	113,819.15	10,945.04
Long Term Debt *(in millions of 2007 dollars)*	1,973.56	645.33	361	1,973.56	34,724.00	4,030.63
Short Term Debt *(in millions of 2007 dollars*	773.64	42.51	358	0.00	41,248.95	3,363.60
Leverage	0.24	0.22	337	0.00	0.98	0.19

1.3 Methodology and Empirical Results

According to Becker-Blease and Paul (2006) and Chen, et al (2004), the cost of equity capital should decrease for firms added to the S&P 500 due to increases in liquidity, decreases in information asymmetry, and increases in investor awareness of the firms. The cost of equity capital should increase for deleted firms because of declines in liquidity. In this section, we present the findings of the cost of capital around index revision events and discuss how our results relate to the liquidity and investor awareness hypotheses.

Cost of Equity Before and After Index Revisions: Buy-and-Hold Returns To measure the cost of equity, we use two different methods. First, we follow Errunza and Miller (2000) who use buy-and-hold returns for a period prior to and after the ADR listing of international firms. They use changes in the buy-and-hold returns as a proxy for changes in the cost of equity. We compute buy-and-hold returns for a period of one year and two years prior to and after the announcement date excluding a one month window around the announcement for both the sample and matched group of firms. All buy-and-hold returns are annualized. Table 3 reports the buy-and-hold returns for firms added to and deleted from the S&P 500 Index. We report the returns measured over the following windows: a twelve-month window before (from month -13 to month -2, where month 0 is the announcement month), a twelve-month window after (month +2 to month +13), a 24-month window before (month -25 to month -2), and a 24-month window after (month +2 to month +25). Panel A includes buy-and-hold returns for all added firms and adjusted returns for the same firms. Adjusted buy-and-hold returns are the difference between the sample firm buy-and-hold returns and those of the matched pair firms, and

TABLE 3: Buy and Hold Returns

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. We match each sample firm with a matching pair firm in the same 3-digit SIC code and the matched pair is the closest possible match in asset size. Matched firms cannot be constituents of the S&P 500 for a period of 10 years surrounding the event. Buy and hold returns are calculated for two windows before and after the event date, where month 0 is the announcement month. All buy and hold returns are annualized. For a given window, if the sample firm is missing 25% or less of the total monthly returns, we compute the buy-and-hold return for the shorter window based on valid returns. Panel A contains results for newly included firms to the index before winsorization. Panel B contains results where buy and hold returns are winsorized to remove extreme observations greater [less] than the 99th [1st] percentile. Panel C contains results for firms removed from the index before winsorization, and Panel D includes the same sample with winsorized buy-and-hold returns. The unadjusted mean is the mean for the sample firms. The adjusted mean is the difference between the sample return and that of the matched pair. We measure statistical signficance using a t-test for the difference of each variable from before and after the announcement date. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

Panel A: Inclusion Firms

	[-13, -2]	[+13, +2]	Difference	N
Unadjusted Mean	0.5852 ***	0.1126 ***	-0.4726 ***	298
Adjusted Mean	0.2751 ***	0.0328	-0.2423 ***	

	[-25, -2]	[+25, +2]	Difference	N
Unadjusted Mean	0.4554 ***	0.0784 ***	-0.3770 ***	229
Adjusted Mean	0.2501 ***	0.0264	-0.2237 ***	

Panel B: Inclusion Firms - Winsorized at 1/99% level

	[-13, -2]	[+13, +2]	Difference	N
Unadjusted Mean	0.5625 ***	0.0968 ***	-0.4657 ***	298
Adjusted Mean	0.2824 ***	0.0217	-0.2607 ***	

	[-25, -2]	[+25, +2]	Difference	N
Unadjusted Mean	0.4435 ***	0.0721 ***	-0.3714 ***	229
Adjusted Mean	0.2413 ***	0.0194	-0.2219 ***	

TABLE 3 (continued)

Panel C: Deletion Firms

	[-13, -2]	[+13, +2]	Difference	N
Unadjusted Mean	-0.0910 **	0.3480 ***	0.4390 ***	103
Adjusted Mean	-0.1490 ***	0.1699	0.3190 ***	

	[-25, -2]	[+25, +2]	Difference	N
Unadjusted Mean	-0.0980 ***	0.1339 ***	0.2310 ***	85
Adjusted Mean	-0.0900 **	0.0451	0.1350 **	

Panel D: Deletion Firms - Winsorized at 1/99% level

	[-13, -2]	[+13, +2]	Difference	N
Unadjusted Mean	-0.0900 **	0.2922 ***	0.3820 ***	103
Adjusted Mean	-0.1500 ***	0.1139	0.2640 ***	

	[-25, -2]	[+25, +2]	Difference	N
Unadjusted Mean	-0.0950 ***	0.1307 ***	0.2260 ***	85
Adjusted Mean	-0.0890 **	0.0496	0.1390 **	

Panel B shows the results for these firms when the buy-and-hold returns are winsorized at the 99 and 1% levels. Panels C and D provide the same results for deleted firms. For a given sample firm in the inclusion and deletion samples, the unadjusted return is the raw return measured over the window. The adjusted return is the unadjusted return of the sample firm minus the unadjusted return of the matched pair. The results in Panels A and B suggest that the unadjusted buy-and-hold returns for the inclusion sample firms are consistently higher in the pre-event period and fall during the post-event period. The difference between the pre- and post-event buy-and-hold returns is significantly different at the 1% level for sample firms. For example, Panel A shows that the mean pre-event return for inclusion firms over the 24-month window was 45.54% annually, while the post-event return was 7.84% annually. Similarly, adjusted returns for inclusion firms decline significantly in the post-event period. In the two-year window, the adjusted buy and hold return declined by 22.37% (significant at the 1% level), which indicates that this proxy for the cost of equity of newly included firms decreases more than the matched sample. The winsorized returns in Panel B show similar results. The pre-inclusion returns for added firms are significantly higher than those of the matched firms, but following inclusion to the index no significant difference remains between these returns. Hedge and McDermott (2003) suggest that Standard and Poors often selects firms after periods of positive momentum which may explain this finding of high returns for added firms. In addition, high returns in the pre-inclusion period increase firm value and may cause the added firm to surpass the Standard and Poors' minimum size threshold.

For deleted firms, buy-and-hold returns are significantly higher in the post-deletion period for all but one sample period. In Panel C, deleted firms have a buy-and-

hold return of -9.8% prior to removal and 13.39% following removal for the two-year sample period. The increase in buy-and-hold returns for newly deleted S&P 500 firms is 23.10%, which is significant at the 1% level. The adjusted buy-and-hold returns for the deletion firms also show that this proxy for the cost of equity increases by 13.50% (significant at the 5% level) more for sample firms than matched firms. Similar results are obtained using the winsorized sample shown in Panel D. Consistent with the liquidity hypothesis we find significant increases in the cost of equity for newly deleted firms and decreases in the cost of equity for newly added firms to the S&P 500 Index. Note that it is somewhat difficult to interpret the buy-and-hold returns as the cost of equity when these realized returns are negative for some of the deletion firms. Therefore, we use an alternative method to estimate the cost of equity and report the results next.

Cost of Equity Before and After Index Revisions: Market and Four-Factor Models

We follow Grullon and Michaely (2004) and estimate the market and three-factor models to compute changes in the cost of equity. Since Hedge and McDermott (2003) suggest that companies are often included in the S&P 500 following a period of positive momentum, we estimate the Carhart's (1997) four-factor model to account for the possibility of positive momentum in inclusion stocks and negative momentum in deletion stocks. . Using daily returns for one year prior to and following the announcement date of the index revision, we compute the coefficients for the market model

$$r_{it} - r_{ft} = \alpha_{-i}+\alpha_{\Delta i}D_t+b_{-i}(r_{mt} - r_{ft})+b_{\Delta i}D_t(r_{mt} - r_{ft}) + e_t$$

and the four factor model

$$r_{it} - r_{ft} = \alpha_{-i} + \alpha_{\Delta i}D_t+ b_{-i}(r_{mt} - r_{ft}) + b_{\Delta i}D_t(r_{mt} - r_{ft}) + s_{-i}SMB_t + s_{\Delta i}D_tSMB_t + h_{-i}HML_t +$$

$$h_{\Delta i}D_tHML_t +u_{-i}UMD_t + u_{\Delta i}D_tUMD_t + e_t$$

where r_{it} is the daily return on a stock i, r_{ft} is the daily return on the one-month U.S. Treasury bills, r_{mt} is the daily return on the NYSE/AMEX/Nasdaq value-weighted index, SMB_t is the difference between the daily return on a portfolios of small and large firms, HML_t is the difference between the daily returns of the portfolios of high book-to-market and low book-to-market stocks, UMD_t is the difference between the daily returns of the portfolios of high and low momentum stocks, and D_t is a dummy variable equal to 1 if t is greater than the announcement date of the inclusion or deletion event. To calculate the cost of capital for these models, we compute the average daily risk premium for the market, SMB, HML, and UMD factors over the period from 1990 through 2007 and use these average values to determine the expected annual return. Table 4 reports the change in the cost of capital based on the market and four-factor models, respectively. In particular, we present the change in cost of equity before and after for the inclusion sample in Panels A (no winsorization) and B (1%/99% winsorization). For the inclusion sample, the unadjusted change in cost of capital has a mean of -44.1% (significant at the 1% level) and a median of -19.29% (significant at the 1% level). More importantly, the mean (median) adjusted change in cost of equity is -22.3% (-9.07%) significant at the 5% (1%) level. We find similar results using the four-factor model. In particular, the inclusion firms experience a significant drop in the estimated cost of capital with a mean (median) adjusted change of -15.8% (-3.08%), which is significant at the 5% (10%) level. The winsorized results in Panel B are generally similar to the results in Panel A.

For deletion firms, the results on the change in cost of capital are reported in Panels C and D of Table 4. The results clearly suggest that the deleted firms experience a significant increase in the cost of capital after the deletion events. Panel C shows that the

TABLE 4: Changes in Cost of Capital

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. We match each sample firm with a matching pair firm in the same 3-digit SIC code and the matched pair is the closest possible match in asset size. Matched firms cannot be constituents of the S&P 500 for a period of 10 years surrounding the event. The table reports the mean and median values of the cost of capital measured by the market model

$$r_{it} - r_{ft} = \alpha_{-i} + \alpha_{\Delta i} D_t + b_{-i}(r_{mt} - r_{ft}) + b_{\Delta i} D_t (r_{mt} - r_{ft}) + e_t$$

and the four-factor model

$$r_{it} - r_{ft} = \alpha_{-I} + \alpha_{\Delta i} D_t + b_{-i}(r_{mt} - r_{ft}) + b_{\Delta i} D_t (r_{mt} - r_{ft}) + s_{-i} SMB_t + s_{\Delta i} D_t SMB_t + h_{-i} HML_t + h_{\Delta i} D_t HML_t + u_{-i} UMD_t + u_{\Delta i} D_t UMD_t + e_t$$

where r_{it} is the daily return on a stock i, r_{ft} is the daily return on the one-month U.S. Treasury bills, r_{mt} is the daily return on the NYSE/AMEX/Nasdaq value-weighted index, SMB_t is the difference between the daily return on a portfolios of small and large firms, HML_t is the difference between the daily returns of the portfolios of high book-to-market and low book-to-market stocks, UMD_t is the difference between the daily returns of the portfolios of high and low momentum stocks, D_t is a dummy variable equal to 1 if t is greater than the announcement date of the inclusion or deletion event. We estimate the model using daily returns for one year prior to and following the announcement date. The cost of capital for the market and four-factor models are calculated using the mean daily market, SMB, HML, and UMD risk premia over the period from 1990 through 2007. The adjusted cost of capital is equal to the unadjusted cost of capital for the sample firms minus the estimated cost of capital for the matched firms. We measure statistical signficance using a t-test for means and the Wilcoxon ranked sign test for the medians for before and after the event. We use the mean difference t-test for difference in means and Wilcoxon-Mann-Whitney test for difference in medians. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

Panel A: Inclusion Firms

		Cost of Capital					
Market Model	*N*	Before		Change		After	
Unadjusted Mean	*345*	*0.7862*	***	*-0.4410*	***	*0.3454*	***
Adjusted Mean	*340*	*0.3111*	***	*-0.2230*	**	*0.0881*	*
Unadjusted Median	*345*	*0.4156*	***	*-0.1929*	***	*0.2067*	***
Adjusted Median	*340*	*0.1529*	***	*-0.0907*	***	*0.0350*	**
Four Factor Model	*N*	Before		Change		After	
Unadjusted Mean	*345*	*0.7324*	***	*-0.3490*	***	*0.3835*	***
Adjusted Mean	*340*	*0.2771*	***	*-0.1580*	**	*0.1191*	***
Unadjusted Median	*345*	*0.4224*	***	*-0.2034*	***	*0.2430*	***
Adjusted Median	*340*	*0.1359*	***	*-0.0308*	*	*0.0554*	***

TABLE 4 (continued)

Panel B: Inclusion Firms - Winsorized at 1/99% level

		Cost of Capital					
Market Model	*N*	Before		Change		After	
Unadjusted Mean	*345*	*0.7568*	***	*-0.4360*	***	*0.3208*	***
Adjusted Mean	*340*	*0.3149*	***	*-0.2460*	***	*0.0689*	*
Unadjusted Median	*345*	*0.4156*	***	*-0.1929*	***	*0.2067*	***
Adjusted Median	*340*	*0.1529*	***	*-0.0980*	***	*0.0350*	**
Four Factor Model	*N*	Before		Change		After	
Unadjusted Mean	*345*	*0.7058*	***	*-0.3250*	***	*0.3805*	***
Adjusted Mean	*340*	*0.2673*	***	*-0.1420*	**	*0.1253*	***
Unadjusted Median	*345*	*0.4224*	***	*-0.2034*	***	*0.2430*	***
Adjusted Median	*340*	*0.1359*	***	*-0.0308*	**	*0.0565*	***

Panel C: Deletion Firms

Market Model	*N*	Before		Change		After	
Unadjusted Mean	*141*	*0.0613*		*0.6113*	***	*0.6726*	***
Adjusted Mean	*140*	*-0.1600*	**	*0.4761*	***	*0.3161*	**
Unadjusted Median	*141*	*0.0735*		*0.1369*	***	*0.2325*	***
Adjusted Median	*140*	*-0.0750*	**	*0.1425*	***	*0.0757*	
Four Factor Model	*N*	Before		Change		After	
Unadjusted Mean	*141*	*0.0843*	*	*0.4054*	***	*0.4898*	***
Adjusted Mean	*140*	*-0.1350*	**	*0.3418*	***	*0.2067*	*
Unadjusted Median	*141*	*0.0015*		*0.1888*	***	*0.2159*	***
Adjusted Median	*140*	*-0.0937*	**	*0.1632*	**	*-0.0042*	

Panel D: Deletion Firms - Winsorized at 1/99% level

Market Model	*N*	Before		Change		After	
Unadjusted Mean	*141*	*0.0619*		*0.5910*	***	*0.6529*	***
Adjusted Mean	*140*	*-0.1300*	**	*0.4275*	***	*0.2978*	**
Unadjusted Median	*141*	*0.0735*		*0.1369*	***	*0.2325*	***
Adjusted Median	*140*	*-0.0750*	**	*0.1492*	***	*0.0790*	
Four Factor Model	*N*	Before		Change		After	
Unadjusted Mean	*141*	*0.0848*	*	*0.3847*	***	*0.4695*	***
Adjusted Mean	*140*	*-0.1260*	**	*0.3107*	***	*0.1849*	*
Unadjusted Median	*141*	*0.0015*		*0.1888*	***	*0.2159*	***
Adjusted Median	*140*	*-0.0937*	**	*0.1632*	**	*-0.0042*	

unadjusted change in the cost of capital is significantly positive based on either the market or four-factor models. We observe the same conclusion in the adjusted cost of capital. For example, the adjusted change in cost of capital for deletion firms based on the market model has a mean (median) of 47.61% (14.25%), which is significant at the 1% (1%) level. Based on the four-factor model, the deleted firms experience a significant mean change in cost of capital of 34.18% (16.32%) after their stocks are removed from the index. The winsorized results in Panel D confirm the results in Panel C. Therefore, using the market and four-factor models, we show that the cost of capital for the added (deletion) firm declines (increases) significantly after the index change.

Overall, the buy-and-hold returns and cost of capital based on market and four-factor models indicate a symmetric pattern in the change in cost of capital for added and deleted firms. In other words, we observe a significant decline in the cost of equity for added firms and a significant increase in the cost of equity for deleted firms. These changes are significantly different from those of the matched peers. Thus, the evidence supports the liquidity hypothesis as we observe a symmetric reaction in cost of capital for newly included and removed firms. However, one cannot rule out the investor awareness hypothesis without further examination. If, for example, the decrease in cost of equity following addition is driven by both increases in liquidity and decreases in shadow cost, and the increases in the cost of equity following deletion are driven by declines in liquidity only, this finding would support both the liquidity hypothesis and investor awareness hypothesis simultaneously. To study what drives the changes in cost of capital for the sample firms, we next analyze various liquidity measures and the shadow cost suggested by Chen, et al (2004).

Liquidity and Shadow Cost Changes Based on the liquidity and investor awareness hypotheses, changes in cost of equity for addition and deletion firms can stem from one of two main sources: change in liquidity and change in shadow cost. To examine the two sources of changes in cost of equity, we report the change in three liquidity measures and shadow cost. The three liquidity measures and shadow cost are measured for 12 months preceding the event announcement ending one month prior to the announcement date. Similarly, we measure the liquidity and shadow cost for 12 months following the event beginning one month after the completion date. In particular, the three liquidity measures are illiquidity ratio, trading volume, and turnover. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is further multiplied by 10^7. Volume is the log of the average of the daily dollar amount traded. The dollar amount traded is calculated for each day as the number of shares traded multiplied by the closing price. The turnover ratio is the average of the monthly share volume traded divided by the number of shares outstanding during that month. On the other hand, shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 Index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 Index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the

event, and the number of shareholders after the event is measured a minimum of nine months after the announcement date.

Table 5 reports the unadjusted and adjusted mean (median) of the three liquidity measures and shadow cost for the inclusion and deletion firms, respectively. The unadjusted mean (median) of a given variable is the sample firm average (median). The adjusted mean (median) is the mean (median) difference between the sample firms and their matched pairs. We report the results in this table and for all multivariate regressions with variables winsorized at the 1% and 99% levels. For inclusion firms, we observe a drop in illiquidity ratio and an increase in volume and turnover. This observation is generally significant for the unadjusted and adjusted means (medians). As developed by Amihud (2002), the illiquidity ratio measures the price impact per dollar of trading activity on a particular date, and larger values indicate deteriorating liquidity. Contrarily, increases in turnover and volume signal liquidity improvements. In other words, the results suggest that added firms experience better stock liquidity after the inclusion events, which is consistent with the literature. On the other hand, we also find that the shadow cost is significantly lower after the inclusion events, which suggests that investors are more aware of the added firms after the index revisions.

For deleted firms, we find that the illiquidity ratio is significantly higher and volume drops significantly after their stocks are excluded from the index, which suggests a decrease in liquidity for the deleted stocks. Interestingly, turnover for deleted firms increases after the announcements. The result implies that, although total trading volume decreases after the stock is deleted from the index, the stocks remain relatively active as indicated by an increase in turnover. Since deleted firms experience a large albeit

TABLE 5: Liquidity and Shadow Cost Measures

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. We match each sample firm with a matching pair firm in the same 3-digit SIC code and the matched pair is the closest possible match in asset size. Matched firms cannot be constituents of the S&P 500 for a period of 10 years surrounding the event. The unadjusted mean (median) for each variable is the sample firm average (median) value, and the adjusted mean (median) for each variable is the mean (median) difference between the sample and matched firms. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 107. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE 5 (continued)

Panel A: Inclusion Firms

Illiquidity Ratio								
	N	Before		Change		After		
Unadjusted Mean	*354*	*0.0116*	***	*-0.0050*	***	*0.0071*	***
Adjusted Mean	*350*	*-0.3090*	**	*-0.3370*	**	*-0.6980*	***
Unadjusted Median	*354*	*0.0068*	***	*-0.0021*	***	*0.0039*	***
Adjusted Median	*350*	*-0.0173*	**	*0.0009*	**	*-0.0161*	***

Volume								
	N	Before		Change		After		
Unadjusted Mean	*354*	*14.6840*	***	*0.4592*	***	*15.2590*	***
Adjusted Mean	*350*	*0.9168*	***	*0.2508*	***	*1.1608*	***
Unadjusted Median	*354*	*16.5402*	***	*0.3299*	***	*16.9765*	***
Adjusted Median	*350*	*0.9492*	***	*0.2516*	***	*1.2470*	***

Turnover								
	N	Before		Change		After		
Unadjusted Mean	*354*	*180.2300*	***	*25.7560*	***	*201.8100*	***
Adjusted Mean	*350*	*42.5750*	*	*13.5290*	*	*54.1130*	***
Unadjusted Median	*354*	*107.3501*	***	*16.0793*	***	*134.4867*	***
Adjusted Median	*350*	*22.1346*	**	*8.0131*	**	*32.7602*	***

Shadow Cost								
	N	Before		Change		After		
Unadjusted Mean	*284*	*15.6380*	***	*-5.0230*	***	*10.6290*	***
Adjusted Mean	*242*	*8.8365*	***	*-4.1630*	***	*3.9546*	**
Unadjusted Median	*284*	*4.9310*	***	*-0.1386*	***	*3.5959*	***
Adjusted Median	*242*	*1.8948*	***	*-0.2450*	***	*1.2142*	***

TABLE 5 (continued)

Panel B: Deletion Firms

Illiquidity Ratio								
	N	Before		Change		After	
Unadjusted Mean	*161*	*0.1096*	**	*0.8548*	**	*1.0364*	**
Adjusted Mean	*159*	*-0.8480*		*0.1687*		*-1.2820*	**
Unadjusted Median	*161*	*0.0082*	***	*0.0040*	***	*0.0459*	***
Adjusted Median	*159*	*-0.0175*	**	*0.0085*	**	*-0.0166*	***

Volume							
	N	Before		Change		After	
Unadjusted Mean	*161*	*15.8140*	***	*-0.3520*	***	*14.6080*	***
Adjusted Mean	*159*	*2.0039*	***	*-0.2580*	***	*1.8964*	***
Unadjusted Median	*161*	*16.7373*	***	*-0.1819*	***	*15.1582*	***
Adjusted Median	*159*	*1.3078*	**	*-0.1000*	**	*1.1283*	***

Turnover							
	N	Before		Change		After	
Unadjusted Mean	*161*	*136.0500*	**	*43.4130*	**	*163.3400*	***
Adjusted Mean	*159*	*31.2320*	**	*43.5690*	**	*44.9080*	**
Unadjusted Median	*161*	*103.4638*	***	*8.5867*	***	*95.1455*	***
Adjusted Median	*159*	*29.1191*	***	*11.5839*	***	*18.2102*	**

Shadow Cost							
	N	Before		Change		After	
Unadjusted Mean	*107*	*1.8457*		*-0.3740*		*1.3332*	***
Adjusted Mean	*91*	*-3.4620*		*0.0109*		*-4.3600*	***
Unadjusted Median	*107*	*0.4808*	*	*0.0351*	*	*0.4746*	***
Adjusted Median	*91*	*-0.1684*		*0.0441*		*-0.2297*	***

temporary price decline following removal from the index, the illiquidity ratio and volume, which are both calculated with share price, may not be a clear indicator of liquidity changes. We believe that turnover is a better measure of liquidity changes because it is independent of price changes. Moreover, the shadow cost of deleted stocks is not significantly different before and after the deletion events. Overall, the findings suggest that liquidity of the deleted stocks decreases after the deletion announcements, however, these stocks remain actively traded and their shadow cost does not change significantly.

The findings of the change in liquidity measures and shadow cost for inclusion and deletion firms lend support for both the liquidity and investor awareness hypotheses. In particular, the increase (decrease) in liquidity for inclusion (deletion) stocks is both economically and statistically significant, suggesting a symmetric change in liquidity in the sample firms. This evidence is consistent with the liquidity hypothesis. In addition, we find that both added and deleted firms experience an increase in stock turnover. More importantly, the shadow cost of the added stocks drops significantly while that of the deleted stocks experiences no significant change. These findings support the investor awareness hypothesis that while inclusion stocks are added to the investors' awareness at the index revisions, deleted stocks are not taken out of the investor's awareness when they are excluded from the index.

Relating Cost of Equity Changes to Announcement Returns Our motivation for studying the changes in cost of equity around S&P 500 Index revisions is to account for the price reaction to the reconstitution announcements. In this section, we examine the determinants of excess returns around the event dates. In particular, we explore whether

changes in liquidity and investor awareness are directly related to excess returns or rather if these factors influence the announcement returns indirectly through affecting the cost of capital.

The pattern of decreases in the cost of equity for newly added S&P 500 firms and increases in the cost of equity for newly removed firms is observable to investors. If this information is anticipated and incorporated into the announcement period returns, we should observe a relation between the changes in the firms' cost of equity and returns around index change announcements. Therefore, to analyze whether decreases (increases) in the cost of equity drive the announcement reaction for addition (deletion) firms, we conduct a multivariate regression using the cumulative excess returns as the dependent variable. We measure the cumulative excess returns from the announcement date through the actual completion date to capture the effect of the pre-announced change. The independent variables include the change in cost of equity, change in liquidity proxies, and change in shadow cost measure. In addition, we control for the three variables suggested by Chen, et al (2004) as they may be related to the announcement returns around index revisions. In particular, we control for firm age, whether the firm traded on the NYSE, and relative size. Firm age is measured as the log of the number of months between a firm's first appearance in CRSP and the announcement date. We define a dummy variable equal to 1 if the firm traded on the NYSE prior to index inclusion or removal. Relative size is the log of the ratio of firm size to the S&P 500 Index market capitalization at the announcement date. Lastly, we include the market to book ratio as a control variable. Market to book ratio is the ratio of the market value of assets to the book value of assets, where the market value of assets is estimated as the

book value of assets minus the book value of equity plus the market value of equity. The results of this analysis are presented in Table 6 with the results for inclusion events in Panel A and the results for deletion events in Panel B.

In general, a decline in the cost of equity for inclusion firms is expected to be associated with a positive abnormal return. We perform the regressions based on three models. Model 1 includes the cost of capital changes, liquidity proxy variable changes, and changes in shadow cost. Model 2 includes the above variables plus the three control variables suggested by Chen, et al (2004). In Model 3, we add additional control variables to Model 2. In Models 1 and 2, we confirm the negative relation between cost of capital change and abnormal returns by observing a positive and significant coefficient on the change in cost of capital. The liquidity and shadow cost changes are not directly related to the announcement excess returns. Interestingly, Chen, et al (2004) show that the change in shadow cost is negatively related to abnormal returns, while our results show the impact of shadow cost is negative but insignificant. As Chen, et al (2004) indicate that changes in shadow cost have an impact on the changes in cost of equity, our analysis suggests that the shadow cost change has no significant impact on excess returns once we control for the changes in cost of equity. In other words, changes in shadow costs have an indirect effect on abnormal returns through their impact on the cost of capital. In Model 3, we add the market to book ratio and the interaction between market to book ratio and cost of capital changes. Becker-Blease and Paul (2006) suggest that addition firms benefit from more value-creating investments as a result of a lower cost of capital. Therefore, newly added firms to the S&P 500 will benefit most when their cost of equity falls AND they face opportunities for further growth. Following Adam and

TABLE 6: Multivariate Analysis of Excess Returns

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the excess abnormal return from the index change announcement date through the implementation date. The cost of capital change is estimated from four-factor model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Firm age is the log of the number of months between a firm's first appearance in the CRSP database and the announcement month, and we include a dummy variable equal to 1 if the firm traded on the NYSE prior to the index change. The market/book ratio is the ratio of the market value of assets to the book value of assets, where the market value of assets is estimated as the book value of assets minus the book value of equity plus the market value of equity. Parameter estimates are presented with t-statistics below. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE 6 (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3
Intercept	4.4858 ***	11.4314 *	10.4332 *
	7.77	*1.87*	*1.71*
COC Change	-0.9730 *	-0.9209 *	0.7160
	-1.94	*-1.81*	*1.07*
Illiquidity Ratio Change	-78.9969	-67.3369	-83.0231
	-1.15	*-0.97*	*-1.23*
Volume Change	0.3625	0.4085	0.5094
	0.62	*0.68*	*0.87*
Turnover Change	-0.0011	-0.0017	-0.0023
	-0.21	*-0.33*	*-0.47*
ShadowCost Change	-0.0251	-0.0114	0.0546
	-0.81	*-0.34*	*1.38*
Relative Size		-0.4191	-0.3230
		-0.56	*-0.45*
Firm Age		-0.7101	-0.7557
		-1.34	*-1.44*
NYSE Dummy		-0.7379	-0.2177
		-0.70	*-0.19*
Market/Book Ratio			0.2149
			1.58
COC Change * Market/Book Ratio			-0.1820 ***
			-2.71
N	281	281	278
R-Squared	0.0288	0.0377	0.0861

TABLE 6 (continued)

Panel B: Deletion firms

	Model 1	Model 2	Model 3
Intercept	-8.5180 ***	-16.4203	-20.7934 *
	-6.42	*-1.52*	*-1.80*
COC Change	0.8042	1.6833	2.8643
	0.56	*1.12*	*0.80*
Illiquidity Ratio Change	-0.0120	-0.0278	-0.1332
	-0.06	*-0.13*	*-0.34*
Volume Change	0.7300	0.5304	0.7033
	0.60	*0.43*	*0.54*
Turnover Change	-0.0072	-0.0052	-0.0042
	-1.10	*-0.74*	*-0.59*
ShadowCost Change	-0.2216	-0.1412	0.5705
	-0.22	*-0.13*	*0.45*
Relative Size		1.7106 *	1.4195
		1.70	*1.36*
Firm Age		-0.5698	-0.1243
		-0.32	*-0.07*
NYSE Dummy		3.0498	3.3692
		0.85	*0.94*
Market/Book Ratio			1.6358
			0.76
COC Change * Market/Book Ratio			-0.5597
			-0.22
N	99	99	99
R-Squared	0.0231	0.0626	0.0792

Goyal (2008), we include the market to book ratio to represent the firms' investment opportunity set. We also include an interaction term of the change in cost of capital and market to book ratio. We find that market to book ratio has an insignificant impact on abnormal returns. Interestingly, we find that the coefficient on the interaction term is negative. This indicates that firms with larger investment opportunity sets have larger announcement returns when their cost of capital declines. These firms are able to take better advantage of the reduction in cost of capital because more of these investment opportunities become positive NPV projects, benefiting shareholders. For deletion firms in Panel B, there is no significant relation between the cost of capital changes and the excess returns around announcement[1]. Overall, the results from this section suggest, for inclusion firms, that the cost of capital changes are inversely related to the price increases around S&P 500 index changes. Additionally, newly included firms with larger investment opportunity sets benefit more from the decline in cost of equity than those with smaller investment opportunity sets. The results support the important link between the cost of equity change and the price response of inclusion stocks. Our final analysis explores the factors that explain the cost of equity changes to further distinguish between the investor awareness and liquidity hypotheses.

[1] We conduct the same analysis using the change in the cost of equity using the market model and report these results in Table A of the appendix. Only the results on the interacted term in Model 3 persist using this model to estimate the cost of equity. This model does not account for momentum which may be an important factor in inclusion firms. In Table B of the appendix, we repeat the analysis using all values adjusted by the control firms. The dependent variable is the adjusted change in the cost of equity measured by the four factor model. The results from Table 6 do not remain when we take into account the control firms.

Factors Explaining Cost of Equity Changes To examine if liquidity and/or investor awareness are the main determinants for the change of cost of capital around index revisions, we perform a multivariate regression analysis. We include the change in cost of capital as the dependent variable. We measure the cost of capital using the cost of equity estimated by the market model and the four-factor model. The independent variables include the change in illiquidity ratio, volume, turnover, and shadow cost. We also include the relative size of the sample firm as a control variable. Cost of equity changes may also be driven by the changes in firm's capital structure, so we include the changes in firm leverage. In particular, we measure firm leverage during each fiscal year for three years prior to and following the announcement date. Then we compute the average leverage ratio before and after the event and use the difference in these averages as the change in leverage. Additionally, we include a variable to capture the change in information asymmetry. Chen, et al (2004) suggest that a lower level of information asymmetry may be a cause of cost of capital reduction for inclusions. To control for information asymmetry changes, we measure the cumulative abnormal return on days -1, 0, and +1 surrounding a quarterly earnings announcement. We measure the average of the absolute value of these returns for the 5 years before and after the event date and compute the change in the average reaction. A decline or increase in the average stock reaction to quarterly earnings announcements is a proxy for a decrease or increase in information asymmetry, respectively. Both Lobo and Tung (1997) and Dierkens (1991) use this variable to proxy for information asymmetry. We perform the multivariate regressions for the inclusion firms and deletion firms individually and report the results in Table 7.

TABLE 7: Multivariate Analysis of Cost of Capital Changes

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the change in the cost of capital estimated from the four-factor model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The change in these measures is the difference between the measure before and after the announcement date. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. We measure the average leverage in the three years prior to the announcement date and the three years following the announcement date. The change in leverage is the difference of the average after the announcement and before the announcement date. The abnormal reaction to quarterly earnings announcements is measured for every quarter for days [-1, +1]. We find the average of the abnormal reaction for the 20 quarters preceding and following the announcement date respectively. The change in the quarterly earnings announcement is the difference in the average abnormal reaction following the event and preceding the event. Parameter estimates are presented with t-statistics below. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE 7 (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	-0.1880 ***	1.2315 **	1.2627 **	1.3366 **
	-2.79	*1.98*	*2.03*	*2.17*
Illiquidity Ratio Change	-3.9150	-6.2583	-6.0142	
	-0.61	*-0.96*	*-0.92*	
Volume Change	0.0171	-0.0089	-0.0194	
	0.24	*-0.12*	*-0.27*	
Turnover Change	-0.0039 ***	-0.0043 ***	-0.0043 ***	-0.0043 ***
	-7.00	*-7.31*	*-7.33*	*-7.35*
Shadow Cost Change	0.0100 ***	0.0039	0.0030	0.0027
	2.74	*0.86*	*0.67*	*0.61*
Relative Size		-0.2076 **	-0.2126 **	-0.2219 **
		-2.31	*-2.37*	*-2.49*
Leverage Change		-1.8774 ***	-2.0281 ***	-1.9444 ***
		-2.70	*-2.87*	*-2.84*
Quarterly Earn. Ann.			0.0306	0.0316
Reaction Change			*1.15*	*1.21*
N	281	256	256	256
R-Squared	0.1691	0.2096	0.2138	0.2111

Panel B: Deletion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	0.3738 ***	1.1273 ***	1.2489 ***	2.0755 ***
	4.30	*3.27*	*3.48*	*4.71*
Illiquidity Ratio Change	0.0918 ***	0.0969 ***	0.0991 ***	
	7.50	*7.40*	*7.51*	
Volume Change	-0.1243	-0.1863 **	-0.1853 **	
	-1.43	*-2.16*	*-2.15*	
Turnover Change	-0.0004	-0.0003	-0.0004	-0.0005
	-0.91	*-0.71*	*-0.87*	*-0.83*
Shadow Cost Change	0.0496	0.0309	0.0316	-0.0019
	1.07	*0.63*	*0.65*	*-0.03*
Relative Size		-0.1568 **	-0.1753 **	-0.3189 ***
		-2.26	*-2.47*	*-3.60*
Leverage Change		-0.7325	-0.6025	-1.1265
		-1.06	*-0.86*	*-1.29*
Quarterly Earn. Ann.			-0.0295	-0.0046
Reaction Change			*-1.20*	*-0.15*
N	99	91	91	91
R-Squared	0.3914	0.5204	0.5285	0.1863

For brevity, we present the results using the change in cost of capital based on the four-factor model. The results using the cost of capital based on the market model are similar those based on the four-factor model. These results are available in the Appendix in Table C[2]. The first three models in Table 7 are structured as follows. Model 1 includes the changes in liquidity measures (Illiquidity Ratio Change, Volume Change, Turnover Change) and shadow cost (Shadow Cost Change). In Model 2 we include additional variables to control for firm size (Relative Size) and leverage (Leverage Change), and in Model 3 we consider possible changes in information asymmetry (Quarterly Earn. Ann. Reaction Change). For inclusion firms, we observe in Model 1 that the change in cost of equity is negatively related to the change in turnover and positively related to the change in shadow cost. However, in Models 2 and 3, the impact of shadow cost on the change in cost of equity is insignificantly different from zero. The coefficient on the turnover change, however, remains consistently significant. Interestingly, while illiquidity ratio, volume, and turnover are all proxy variables for liquidity changes, only turnover change is significant in predicting the change in the cost of equity for inclusion firms. We believe this is due to the fact that illiquidity ratio and volume are calculated using the stock price. Thus the decrease in illiquidity ratio and increase in volume are more likely to be driven by the price increases surrounding the events. On the other hand, turnover ratio is not based on share price. For this reason, we

[2] Additionally, we conduct the same analysis on an adjusted basis for the four-factor model. These results are available in the appendix Table D. For the cost of capital change and all independent variables, we compute the adjusted value as the difference between the sample and control firm. The main results persist in these adjusted regressions suggesting that the affect of liquidity and shadow cost on cost of capital changes are not merely due to industry factors.

believe that turnover is the cleaner measure of liquidity for our analysis. To ensure that the effect of turnover changes on the changes in cost of equity exist independent of the other two liquidity proxy variables, we estimate Model 4. This model includes the change in only one liquidity measure, turnover, and we find that the negative effect of turnover on the change in cost of capital remains consistent. Of the control variables, two are significant in predicting the changes in cost of equity for additions. First, larger firms have a larger decline in the cost of equity. This implies that larger firms benefit more from inclusion to the S&P 500 Index in terms of declines in the cost of equity. Secondly, changes in leverage and cost of equity are inversely related. This implies that firms that have an increase in leverage experience a decline in cost of equity.

We implement the same four models for deletion firms, and only the change in the illiquidity ratio and volume are significant in predicting the cost of equity changes for deletion firms in Model 1. This result remains consistent when control variables are added in Models 2 and 3. Interestingly, the coefficients on firm size and leverage have the same sign as those in the inclusion regressions. In particular, large firms enjoy some protection from increases in the cost of equity and firms with larger increases in leverage have smaller increases in the cost of equity. Turnover, the one liquidity proxy variable free from ties to the stock price, is insignificant in predicting the changes in cost of equity for deletions.

To sum up, we find that liquidity increases for added stocks and decreases for deleted stocks. On the other hand, shadow cost decreases for added stocks but remains constant for deleted stocks. This finding supports both the liquidity and investor awareness hypotheses. In our multivariate regression we show that the drop in cost of

equity for added stocks is mainly driven by an increase in turnover, and the increase in cost of equity for deleted stocks can be partially explained by an increase in illiquidity ratio and volume. Shadow cost changes are not a significant predictor of the cost of capital changes for either additions or deletions. Taken together, the results from the multivariate analyses support the liquidity hypothesis.

1.4 Conclusion

Analysis of the cost of capital for newly included and excluded firms to the S&P 500 Index allows us to distinguish between the liquidity and investor awareness hypotheses. Using buy-and-hold returns as a proxy for the cost of equity, we find support for the liquidity hypothesis as the cost of equity increases upon index inclusion and decreases when firms are removed from the index. Results using the market model and four-factor model to estimate the cost of equity further confirm the liquidity hypothesis. The cost of equity decreases after additions and increases following deletions. Further analysis of the liquidity measures and shadow cost imply support for both liquidity and investor awareness hypotheses. In particular, we find that liquidity increases (decreases) for added (deleted) stocks. On the other hand, shadow cost increases for added stocks but remains constant for deleted stocks. Using a multivariate regression framework, we find that the change in cost of equity for addition firms is mainly due to an increase in liquidity, and the change in cost of equity for deleted firms is due to a decrease in liquidity. In examining the determinants of the announcement reaction for index inclusion events, we show that firms with a larger investment opportunity set may be more poised to take advantage of the reduction in the cost of capital.

CHAPTER 2: S&P 500 INDEX RECONSTITUTIONS AND INFORMATION ASYMMETRY

Information asymmetry between management and shareholders is costly to existing shareholders. Theoretical models, such as Diamond and Verrecchia (1991), find that reductions in information asymmetry can lead to decreases in the cost of capital and increases in the value of stock. Similarly, Easley and O'Hara (2004) show that the presence of informed and uniformed traders causes a higher required rate of return for firms with more private information. Krishnaswami and Subramaniam (1998) provide empirical support for this theory. Therefore events that reduce information asymmetry positively impact shareholders.

Several studies of the S&P 500 Index reconstitutions suggest that firms added to the S&P 500 Index may experience a reduction in information asymmetry. In particular, Chen, et al (2004), Hedge and McDermott (2003), and Becker-Blease and Paul (2006) point to reductions in information asymmetry as a possible source of gains to shareholders around S&P 500 Index inclusion. However, there have yet been studies that empirically test the reduction in information asymmetry and the relationship between information asymmetry changes and positive returns to newly included firms. This paper directly tests these propositions by presenting the changes in several measures of information asymmetry. First, we verify that firms added to the index accrue gains around the inclusion, and firms removed from the index have negative abnormal returns. We show that inclusion firms have an increase in firm size and the number of analysts

and a decline in the market to book ratio, analyst forecast error, and forecast dispersion. The findings show a reduction in information asymmetry for added firms. For deletion firms, we observe a decline in firm size, the number of shareholders, and analysts following the firm and increases in earnings announcement reactions, volatility of earnings per share, and volatility of stock returns. In other words for newly removed firms, we find increases in information asymmetry.

To further explore this issue, we link the abnormal announcement reaction the level of information asymmetry by partitioning firms into quartiles based on the pre-inclusion (deletion) level of each information asymmetry proxy variable. We find that inclusion firms with higher levels of information asymmetry measured by R&D, earnings announcement reactions, and analyst forecast error have the highest abnormal return at the announcement, indicating that these firms benefit most from the reduction in information asymmetry following inclusion. The results for deletion firms are inconclusive.

Finally, we focus on a measure of information asymmetry, stock analyst earnings per share (EPS) forecast accuracy, whose change is not endogenous to index reconstitution events. We show that, after controlling for firm characteristics suggested by previous literature to impact forecasting errors, analyst forecast errors decrease significantly following firm inclusion events. In addition, an increased number of analysts following the firm reduces the mean forecast error from all analysts following the firm. The mean forecast is referred to as the consensus forecast of all analysts. We confirm the finding of Aboody and Lev (2000) that research and development is a likely source of information asymmetry because analyst forecast error is positively related to

research and development expense. There is no significant change in analyst forecast error when a firm is removed from the index. One potential criticism of using the consensus-level forecast error in studies of S&P 500 Index changes is that the pool of analysts covering a stock typically increases following addition and decreases following removal from the index. Therefore, consensus forecasts are computed using a pool of analysts that is different before and after the index reconstitution. We suggest further research into the accuracy of analyst forecasts around S&P 500 index changes at the individual analyst level, in addition to the analyses at the consensus level. The focus of this research is to examine whether the accuracy of analyst forecasts improve following index additions exist because of increased monitoring efforts by analyst on index stocks, driven by the high profile nature of the S&P 500 Index or a reduction in information asymmetry. In addition, it is important to study if the reduction in forecast errors is a permanent phenomenon indicating sustained reduction in information asymmetry.

2.1 Literature Review

Previous studies of S&P 500 Index reconstitutions have sought to understand the price reactions surrounding these events. Five hypotheses emerge in this literature to explain the observation of a positive and sustained stock reaction to index additions and a short-term negative stock reaction to index deletions. The *imperfect substitutes* hypothesis is the sole hypothesis to contradict the efficient market hypothesis because proponents of this hypothesis claim that the long-run demand curve for stocks becomes downward sloping upon addition to the S&P 500 Index. A downward-sloping long-run demand curve contradicts the finding that stocks are perfect substitutes with flat long-run demand curves in Scholes (1972). Since Standard and Poors claims that no inside information about firm performance is used to select stocks for the index, the addition of a stock to the index should not change the price of the stock if demand curves are flat. However, if demand curves for S&P 500 stocks are downward sloping, we would expect a permanent price increase at addition and a permanent price decline at deletion from the index. Shleifer (1986) and Lynch and Mendenhall (1997) provide support for this hypothesis, while Edmister, et al (1994) and Hrazdil (2007) conclude that the long-run demand curves for stocks are flat.

The remaining hypotheses are consistent with the Scholes (1972) finding of flat long-run demand curves. The first of these hypotheses that support market efficiency is the *price pressure* hypothesis. When stocks are added to or removed from the S&P 500 index, the initial activity of buying and selling by index funds rebalancing portfolios could cause a temporary price increase surrounding additions and decrease at deletion even if long-run demand curves are flat. Many studies of index additions find long-term

price increases at addition, contradictory to the price pressure hypothesis. However, both Harris and Gurel (1986) and Elliott and Warr (2003) find support for this hypothesis.

Three alternate hypotheses state that index reconstitutions convey some information which causes the positive price shock at addition and negative price shock at deletion. The type of information conveyed in the index change event differs among the four remaining hypotheses. The ***liquidity*** hypothesis purports that price increases upon addition are due to improvements in liquidity, whereas deleted stocks lose value because of declines in liquidity. Since Amihud and Mendelson (1986) show that share price increases with reductions in bid-ask spread and several studies of finds liquidity improvements following index addition, this hypothesis claims that the positive information conveyed in index addition is liquidity improvement for added stocks. Contrary to the temporary price pressure experienced by index fund rebalancing, these liquidity improvements can be sustained over time and help explain the permanent positive reaction. Erwin and Miller (1998), Hedge and McDermott (2003), and Becker-Blease and Paul (2006) all find support for the liquidity hypothesis.

The ***certification*** hypothesis claims that positive price reactions to additions stem from positive information about future performance of firms added to the S&P 500 Index. Similarly, price declines following deletions are due to a negative signal about future firm performance. This hypothesis is contrary to the stated practice of Standard and Poors that firm performance is not a selection criteria for the index. Dhillon and Johnson (1991), Denis, et al (2003), Kappou, et al (2007), and Cai (2007) support this hypothesis. In particular, Dhillon and Johnson (1991) show that bond and option prices, which are not subject to the price pressure or liquidity improvements of stocks, suggest improvements

in future performance. Denis, et al (2003) and Kappou, et al (2007) show that analyst earnings forecasts and earnings per share improve following addition. Cai (2007) shows that positive information about the added firm's industry is conveyed in addition announcements. On the other hand, Hrazdil and Scott (2007) provide evidence against this hypothesis because they show that improvements in earnings are due to management manipulation of discretionary accruals.

Finally, Chen, et al (2004) draw upon the asymmetric reaction of index additions and deletions to develop the *investor awareness* hypothesis. In this framework, prior to addition to the S&P 500 investors demand a shadow premium (Merton, 1987) because of lack of awareness about a stock. Upon addition, investors become more aware of the stock and the required rate of return falls from a declining shadow premium. However, when firms are removed from the index, investors do not revert back to a state of being unaware of the stock. Therefore the shadow premium remains constant after deletions. The hypothesis supports an asymmetric stock price reaction to addition and deletion events.

In order to study the effect of information asymmetry in S&P 500 index changes, we draw upon the existing literature that suggests several proxy variables for the level of information asymmetry of a particular firm. The first set of variables relates to firm policy decisions that lead to an information disparity between firm insiders and outside investors. The level of research and development expenditures and intangible assets capture those aspects of a firm that are more difficult to value by an outsider. Research and development activities, as compared to other firm expenditures, are not transparent because they are unique to a particular firm and have no market prices. Aboody and Lev

(2000) identify research and development as a source of information asymmetry that leads to insider trading gains. Similar to research and development activities, intangible assets are more difficult to value and understand by an outsider. For example, high levels of intangible assets serve as a proxy for information asymmetry in Barth and Kasznick (2002).

The next set of information asymmetry proxy variables includes firm characteristics such as size, number of shareholders, and the market to book ratio. Larger firms typically attract more analyst coverage and investor scrutiny and thus have lower information asymmetry. Small firms, with lower analyst coverage, are considered to have higher information asymmetry. Opler and Titman (1995) and McLaughlin, et al (1998) employ this proxy for information asymmetry. In addition, ownership structure can be a proxy for information asymmetry. O'Neill and Swisher (2003) find that the information asymmetry component of the bid-ask spread is lower for firms with high institutional ownership. Institutional investors who hold larger amounts of a firm's stock can spread out the cost of information gathering over their large investment. There is less motivation to free-ride, and therefore institutional holdings are inversely related to information asymmetry. Similarly, a larger number of shareholders indicate lower concentrated ownership and many minority shareholders. Changes in the number of shareholders may be endogenous to the event of index inclusion. Lastly, the presence of growth opportunities as compared to assets in place allows managers to have more inside information about the investment opportunity set of the firm (Smith and Watts, 1992). The market to book ratio measures the level of growth opportunities relative to assets in place and serves as a proxy for information asymmetry. McLaughlin, et al (1998) use

this proxy in their study of information asymmetry and seasoned equity and debt offerings.

The next set of proxy variables for information asymmetry is associated with variability in a firm's stock and earnings. Dierkens (1991) uses the absolute value of the abnormal return surrounding quarterly earnings announcement dates as a proxy for information asymmetry. This proxy captures the stock response to the unanticipated component of quarterly earnings and should be larger for firms with more information asymmetry. We also employ the EPS volatility and the stock return volatility to proxy for the difficulty in understanding firm performance by an outsider. Lang, et al (2003) use the standard deviation of stock returns to examine the level of information asymmetry around cross-listing events.

The final group of proxy variables relates to the presence of stock analysts and their ability to provide accurate earnings forecasts. These measures include the number of analysts following the firm, analyst forecasting accuracy, and analyst forecast dispersion. Brennan and Subrahmanyam (1995) suggest that an increase in the number of analysts decreases information asymmetry because of the additional attention on a firm. Yu (2008) also uses analyst coverage to measure the prevalence of earnings management which is a practice that occurs more frequently in firms with high information asymmetry. However, Chung, et al (1995) show that the number of analysts following a firm increases with information asymmetry. This positive relationship is due to larger payoff for analysts for the private information gained through their analysis. As Yu (2008) highlights, increases in analyst coverage for S&P 500 index inclusion firms are endogenous. In line with the number of analysts following a firm, the accuracy and

dispersion of analyst forecasts of earnings per share is frequently used as a measure of information asymmetry. Thomas (2002), Krishnaswami and Subramaniam (1998), Gilson, et al (1998), and Clarke and Shastri (2001) use the accuracy and dispersion of analyst forecasts of earnings to proxy for the level of information asymmetry. One potential criticism of this measure is that forecast error may be due to higher firm risk rather than information asymmetry.

Our study is related to studies that examine the factors determining analyst forecast error. Haw, et al (1994) study forecast errors prior to and following mergers and show temporary increases in that forecast errors following the deals. Similarly, Bernard (2008) shows that forecast errors following CEO turnover events shrink due to increased company disclosures related to the turnover event. Finally, Lang, et al (2003) study how the information environment changes for firms that cross-list in the United States and point to improvements in forecast accuracy which link to increases in market value following the cross-listing.

2.2 Sample Selection and Data

Sample firms in our study include those added to or removed from the S&P 500 index from 1990 through 2007. Although a longer history of index changes exists, Standard and Poors modified the announcement procedure for index changes in October 1989. Prior to this change, index reconstitutions were announced and implemented on the same trading day. According to Benish and Whaley (1996), this creates price pressure from index funds rebalancing their portfolios simultaneously. To alleviate this effect, Standard and Poors began preannouncing index changes several days before implementation in October 1989. In our sample, the mean (median) length between the announcement date and actual change date is 5.26 (5) days.

To create the list of index changes, we collect the monthly list of S&P 500 index constituents from Compustat. For each month, we identify firms that have been added or removed. We then use news accounts from Lexis-Nexis to verify the index change announcement and implementation dates. This procedure identifies 838 total sample firms with 419 additions and 419 deletions. We further exclude those sample firms that are associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm (11 cases involving 11 added and 11 deleted firms), (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index (5 cases involving 5 deleted firms), (3) when two existing index firms merge and the resulting merged firm remains on the index (9 cases involving 9 added and 18 deleted firms), and (4) when an index firm is replaced by a spun-off subsidiary (17 cases involving 17 added and 17 deleted firms). The final sample on

which our analysis is conducted contains 382 added firms and 368 deleted firms. Table 8 displays the number of events per year of our sample.

We also create a sample of matching peers for the sample firms. We require that the matched firms have valid Compustat data for the fiscal year prior to the index change as well as CRSP prices for the seven days prior to and after the event date. We exclude matching firms currently in the S&P 500 index and firms that were removed from or added to the index within five years of the event. For each sample firms, we identify all firms with the same three-digit SIC code in Compustat and choose the peer that is closest in size (as measured by sales) to the sample firms. We use cumulative abnormal returns computed in EVENTUS to measure the quarterly earnings announcement reactions, and calculate our proxies for information asymmetry using data from CRSP and Compustat. We use data from I/B/E/S to calculate the analyst earnings forecasts.

TABLE 8: Index Addition and Deletion Frequencies

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm (11 cases involving 11 added and 11 deleted firms), (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index (5 cases involving 5 deleted firms), (3) when two existing index firms merge and the resulting merged firm remains on the index (9 cases involving 9 added and 18 deleted firms), and (4) when an index firm is replaced by a spun-off subsidiary (17 cases involving 17 added and 17 deleted firms). The final sample on which our analysis is conducted contains 382 added firms and 368 deleted firms.

	Number of Additions	Number of Deletions
1990	9	9
1991	9	7
1992	7	7
1993	10	9
1994	14	14
1995	27	25
1996	22	21
1997	24	21
1998	37	34
1999	37	37
2000	53	51
2001	28	28
2002	22	22
2003	8	8
2004	18	18
2005	16	16
2006	29	29
2007	12	12
Total	382	368

2.3 Methodology and Results

In this paper, we employ several methods to examine changes in information asymmetry for the newly included or excluded firms on the S&P 500. We follow the methodology of Krishnaswami and Subramaniam (1999) who test whether information asymmetry motivates spinoffs and if reductions in information asymmetry help explain the gain surrounding spinoffs. Specifically, we first verify that abnormal returns surrounding index inclusion (removal) announcements are positive (negative) and show the changes in our measures of information asymmetry. Next, we use quartile analysis to link abnormal returns to information asymmetry measures. Finally, we focus on the errors in analyst forecasts because changes in these measures are non-endogenous to the inclusion or removal of a firm from the index.

Abnormal Returns Surrounding Index Changes Table 9 shows, for the two sample windows, the cumulative abnormal returns for sample firms, matched pairs, and the difference between these firms. We compute abnormal returns using the market model with the returns to the S&P 500 index as the market return. We calculate the model parameters using daily returns for one year ending 45 days before the event announcement. We then use the model parameters to compute the abnormal returns surrounding the event. The event window is measured as the number of trading days between the announcement date and the implantation date of index change. The maximum length of the event window is 51 days and the minimum is 1 day, with the average (median) length being 5.26 (5) days. We first measure the cumulative abnormal return for the entire event window. In addition, to standardize the abnormal returns, we compute a daily abnormal return by dividing the CAR for the entire event window by the

TABLE 9: Abnormal Returns

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. Any firm that was an S&P 500 constitutent in the 5 years prior to and following the inclusion or deletion announcement cannot be a matched pair. Cumulative abnormal returns are computed in EVENTUS using the standard market model and the CRSP value-weighted index. We report CARS over two event windows. The first event window encompasses the announcement date through the implementation date of the index change. The number of days in this window may vary between events. The second period is a daily abnormal return over the entire event. We divide the CAR over the entire event window by the number of days in that window. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Additions				
		Sample Firms	Matched Pairs	Difference
Event Window Abnormal Return	Mean	5.06% ***	0.46%	4.60% ***
	Median	4.08% ***	0.06%	4.25% ***
	N	343	343	343
Daily Abnormal Return	Mean	0.96% ***	0.08%	0.88% ***
	Median	0.77% ***	0.02%	0.80% ***
	N	343	343	343

Deletions				
		Sample Firms	Matched Pairs	Difference
Event Window Abnormal Return	Mean	-3.44% ***	-0.31%	-3.13% ***
	Median	-0.94% ***	-0.24%	-0.85% ***
	N	340	340	340
Daily Abnormal Return	Mean	-0.65% ***	-0.11%	-0.53% **
	Median	-0.18% ***	-0.04%	-0.17% ***
	N	340	340	340

number of days in the window. Thus, the daily abnormal return measures the average abnormal return per day. Table 9 confirms the previously documented result that abnormal returns for additions, as well as the difference between the addition firms and their matched sample, are significantly positive. The raw return is the return for the sample firms, whereas adjusted returns are the sample firm returns minus the matched peer firm returns. Specifically, the median event window abnormal return for newly added firms is 4.08%, and this is 4.25% higher (difference significant at the 1% level) than that of the matched pairs. For the daily abnormal returns, the addition firms have an average of 0.88% above the matched pair firms (significant at the 1% level). For deletions, the raw and adjusted abnormal returns are significantly negative. The mean deletion sample firm has an event window abnormal return of -3.44% compared to -0.31% for the matched pairs, and the difference is significant at the 1% level. The results confirm the findings of previous research of significant announcement effects for index additions and deletions.

Information Asymmetry Proxy Variable Analysis From the literature on information asymmetry, we include eleven proxy variables to examine the level of information asymmetry surrounding changes to the S&P 500 index. Table 10 provides the definitions of these proxy variables. We present the level of our information asymmetry proxy variables in Table 11. Panel A (C) shows the level of these proxies for the sample addition (deletion) firms and the matched pairs before the index change. Addition firms have more R&D but less intangible assets than their matched counterparts, although only the difference in sample means for R&D is significant (at the 10% level). Sample firms are larger and have a higher market to book ratio than the

TABLE 10: Description of Information Asymmetry Proxy Variables

Firm Policy Factors	
Research and Development	Research and development is the ratio of the research and development expense to total assets. We measure this value in the fiscal year prior to and following the index change.
Intangible Assets	Intangible assets is equal to one minus the ratio of property, plant, and equipment plus current assets to total assets. We measure this value in the fiscal year prior to and following the index change.
Firm Characteristics	
Firm Size	Firm size is the log of the market value of the stock at the end of the fiscal year. We measure this value in the fiscal year prior to and following the index change.
Number of Shareholders	The number of shareholders is measured in thousands in the fiscal year prior to and following the index change.
Market/Book Ratio	The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity.We measure this value in the fiscal year prior to and following the index change.
Variability Factors	
Earnings Announcement Rxn	The earnings announcement reaction measures the abnormal return in the three-day window surrounding the announcement of quarterly earnings. Specifically, we measure the cumulative abnormal return on days [-1, +1] where day 0 is the earnings announcement date. We then average the cumulative abnormal return over the 20 quarters preceding or the 20 quarters following the index change.
Volatility of EPS	The volatility of EPS is the standard deviation of the annual EPS for five years preceding or the five years following the index change.
Volatility of Returns	The volatility of stock returns is the standard deviation of the monthly stock returns for the 60 months preceding or the 60 months following the index change.

TABLE 10 (continued)

Analyst Forecast Factors	
Number of Analysts	The number of analysts is the number of analysts making one fiscal year ahead forecasts in any given year. We average the number of analysts over the five fiscal years prior to or after the index change.
Analyst Error	The consensus forecast is the mean of all individual analyst forecasts. The analyst forecast error is the absolute value of the difference between consensus forecast and the actual EPS scaled by the consensus forecast. In tables 4 and 5, we include analyst forecasts for one fiscal year ahead and average the forecast error over the five years prior to or following the index change. In table 6, we include all analyst forecast errors for both one and two fiscal years ahead for the period of five year before the index change through five years after the index change.
Forecast Dispersion	Forecast dispersion is the standard deviation of all individual analyst forecasts divided by the consensus forecast. We include only the forecasts for one fiscal year ahead and average the forecast dispersion over the five fiscal year prior to and following the index change.

matched pairs (the mean differences are both significant at the 1% level). Standard and Poors selects large firms for the S&P 500 index, thus the result on firm size is consistent with this selection criteria. Hedge and McDermott (2003) highlight that firms are often selected to the index following periods of positive momentum, and this may contribute to higher market to book ratios for sample firms. The mean difference in abnormal stock returns to the quarterly earnings announcements is positive though insignificant, however the median difference between addition firms and matched pairs is negative. Interestingly, both the mean and median volatility of stock returns is lower for newly added firms than their matched pairs. We also show that there are more stock analysts following addition firms, which is consistent with the larger firm size for sample firms as larger firms tend to attract more analysts (Bhushan, 1989, and Barth, et al, 2001). Finally, addition firms have larger analyst forecast errors than their matched pairs with the mean difference significant at the 1% level. Colak (2009) studies the IPO characteristics of firms added to the S&P 500, S&P 400, and S&P 600 indexes. He finds that at the time of the IPO these firms have less uncertainty than other IPO firms indicated by better underwriter reputation and less underpricing. He argues that the Standard and Poors committee exhibits risk aversion in their selection of firms to the index but does not examine whether the difference in information level at the time of the IPO persists to the time of index inclusion. Our analysis indicates that, compared to the matched pairs, newly selected S&P 500 firms have significantly higher information asymmetry measured by research and development, market to book ratio, and analyst forecast error, but less information asymmetry measured by firm size, volatility of returns, and the number of analysts. Thus, our contradictory findings suggest that the hypothesis

TABLE 11: Information Asymmetry Measures

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. Any firm that was an S&P 500 constitutent in the 5 years prior to and following the inclusion or deletion announcement cannot be a matched pair. Research and development is the ratio of research and development expense to total assets. Intangible assets is measured as one minus the sum of property, plant, and equipment plus current assets divided by total assets. Firm size is the log of the market value of equity and the number of shareholders is measured in thousands. The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity. R&D, intangibles, firm size, market to book ratio, and the number of shareholders are calculated for the fiscal year prior to and following the event date. The earnings announcement reaction is the average three day cumulative abnormal return for the 20 quarters preceding or following the announcement date. The volatility of EPS is the standard deviation of quarterly earnings per share for the five year periods preceding and following the announcement date, and we measure the standard deviation of monthly stock returns over the same periods. The analyst forecast error is absolute value of the ratio of the difference between the mean analyst forecast of earnings per share and the actual earnings per share divided by the mean forecast. We measure this error for the forecasts during the five years before or after the event and compute the average over each period. The forecast dispersion is the standard deviation of analyst forecasts divided by the mean forecast. We measure this dispersion for the forecasts during the five years before or after the event and compute the average over each period. We test the sample and matched firms as well as before and after the event for sample firms using the mean difference t-test for difference in means and Wilcoxon-Mann-Whitney test for difference in medians. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively for the t-test for means and Wilcoxon ranked sign test for medians.]

TABLE 11 (continued)

Panel A: Level of before-event information asymmetry for sample and matched firms for index additions

		Sample Firms		Matched Pairs		Difference	
	N	Mean	Median	Mean	Median	Mean	Median
Firm Policy Factors							
Research and Development	116	6.05	4.78	4.71	2.44	1.33 *	0.00
Intangible Assets	237	23.13	16.48	24.70	18.92	-1.57	-3.23
Firm Characteristics							
Firm Size	263	8.58	8.55	7.07	7.15	1.50 ***	1.32
Number of Shareholders	262	43.78	4.26	17.54	2.97	26.24	0.78
Market/Book Ratio	263	3.92	2.32	1.89	1.38	2.03 ***	0.55
Variability Factors							
Earnings Announcement Rxn	324	4.83	4.28	4.75	4.13	0.08	-0.05 ***
Volatility of EPS	254	0.59	0.40	0.63	0.50	-0.05	-0.04
Volatility of Returns	295	0.11	0.10	0.12	0.11	-0.01 **	-0.01 ***
Analyst Forecast Factors							
Number of Analysts	266	13.82	13.20	9.94	8.40	3.89 ***	4.45
Analyst Error	230	3.16	1.47	1.31	0.73	1.85 ***	0.56
Forecast Dispersion	252	3.03	2.50	3.86	3.00	-0.83	-0.87

TABLE 11 (continued)

Panel B: Level of information asymmetry for sample firms before and after index addition

Variable	N	Before Index Change Mean	Before Index Change Median	After Index Change Mean	After Index Change Median	Difference Mean	Difference Median
Firm Policy Factors							
Research and Development	171	5.93	4.49	6.09	4.52	0.17	0.00
Intangible Assets	271	23.31	16.48	27.10	23.21	3.80 ***	1.36 ***
Firm Characteristics							
Firm Size	328	8.57	8.55	8.80	8.80	0.23 ***	0.28 ***
Number of Shareholders	318	40.95	4.26	53.57	7.60	12.62	0.44 ***
Market/Book Ratio	328	3.67	2.10	2.52	1.73	-1.15 ***	-0.05
Variability Factors							
Earnings Announcement Rxn	338	4.83	4.27	5.12	4.78	0.29 **	0.30 ***
Volatility of EPS	313	0.58	0.39	0.62	0.40	0.04	-0.02
Volatility of Returns	325	0.12	0.10	0.12	0.11	0.01 **	0.01 ***
Analyst Forecast Factors							
Number of Analysts	311	13.63	13.00	17.04	16.60	3.41 ***	3.20 ***
Analyst Error	304	2.96	1.26	0.79	0.32	-2.17 ***	-0.89 ***
Forecast Dispersion	308	5.71	2.48	2.65	1.76	-3.06	-0.39 ***

TABLE 11 (continued)

Panel C: Level of before-event information asymmetry for sample and matched firms for index deletions

Variable		Sample Firms		Matched Pairs		Difference	
	N	Mean	Median	Mean	Median	Mean	Median
Firm Policy Factors							
Research and Development	49	4.14	2.03	2.98	1.29	1.16 *	0.34
Intangible Assets	119	25.99	23.15	21.86	16.75	4.12 **	2.89
Size Factors							
Firm Size	102	6.80	6.88	6.38	6.51	0.42 ***	0.29
Number of Shareholders	110	24.52	7.93	13.34	2.23	11.18	3.76
Market/Book Ratio	101	1.52	1.19	1.64	1.37	-0.12	-0.07
Variability Factors							
Earnings Announcement Rxn	130	4.48	3.99	5.11	4.42	-0.62 **	-0.35 ***
Volatility of EPS	102	0.86	0.94	0.75	0.70	0.11	0.12
Volatility of Returns	99	0.12	0.11	0.13	0.12	-0.01	0.00 ***
Analyst Forecast Factors							
Number of Analysts	115	12.10	10.20	8.82	7.00	3.28 ***	2.65
Analyst Error	87	0.64	0.61	1.22	0.64	-0.58	-0.09
Forecast Dispersion	100	3.74	3.39	2.77	3.49	0.97	-0.46

TABLE 11 (continued)

Panel D: Level of information asymmetry for sample firms before and after index deletion

Variable	N	Before Index Change Mean	Before Index Change Median	After Index Change Mean	After Index Change Median	Difference Mean	Difference Median
Firm Policy Factors							
Research and Development	81	3.92	1.70	3.77	1.54	-0.15	0.00
Intangible Assets	140	25.33	22.79	26.30	21.93	0.97	0.35
Size Factors							
Firm Size	131	6.85	6.90	6.18	6.37	-0.67 ***	-0.19 ***
Number of Shareholders	134	24.32	8.16	19.70	5.49	-4.62 **	-0.75 ***
Market/Book Ratio	130	1.46	1.18	1.44	1.22	-0.02	0.03
Variability Factors							
Earnings Announcement Rxn	135	4.46	3.97	5.44	4.99	0.99 ***	0.88 ***
Volatility of EPS	130	0.87	0.97	1.04	1.08	0.17 ***	0.12 ***
Volatility of Returns	112	0.12	0.11	0.15	0.12	0.03 ***	0.02 ***
Analyst Forecast Factors							
Number of Analysts	138	11.99	10.20	7.68	4.90	-4.32 ***	-4.20 ***
Analyst Error	117	0.22	0.54	1.50	0.47	1.28	0.05
Forecast Dispersion	129	0.50	3.21	-0.09	3.33	-0.59	0.30

proposed by Colak (2009) should be further investigated to see if the Standard and Poors selection committee exhibits bias against firms with high levels of information asymmetry. Additionally, it is important to examine whether other firm characteristics, aside from the stated selection criteria of size and liquidity, can be used as predictors of committee selection of new index firms.

Panel C of Table 11 shows a similar comparison between the information asymmetry proxy variables of deletion firms and their matched pairs. Deletion sample firms have significantly higher mean values of R&D (significant at the 10% level) and intangible assets (significant at the 5% level). Deletion firms are also larger than the matched pairs. Since we require that matched firms are not included in the S&P 500 Index during the five years preceding or following the deletion, matched pair firms are likely to be smaller than the index firms. Notably, in the period prior to the event, deletion firms have significantly smaller abnormal returns to earnings announcements than their matched pairs, and the mean and median differences are both significant (at the 5% and 1% levels respectively). Not surprisingly, deletion firms also have a larger number of analysts following the firms. These results indicate that while the deletion firms are in the S&P 500 index, they have lower information asymmetry than the matched pair firms immediately before the events.

Panel B (D) of Table 11 displays the levels of the information asymmetry proxies before and after the index inclusion (removal) as well as the difference between these periods. For addition firms, we observe no significant changes in research and development expense but a mean (median) increase of 3.80% (1.36%) in intangible assets with both the mean and median differences significant at the 1% level. The firm policy

factors, research and development expense and intangible assets, are more useful in cross-sectional analysis to compare levels of information asymmetry across firms rather than across time for a single firm. Thus, we do not conclude from the increase in intangible assets that addition firms have higher information asymmetry following inclusions. This finding may be due to a shift in firm policy. In the second group of proxy variables about firm characteristics, we show that firm size increases upon addition and that the number of shareholders increases. Both the mean and median increases in firm size and the median increase in the number of shareholders are significant at the 1% level. If we observe a group of firms cross-sectionally, larger firm size and number of shareholders typically indicate less information asymmetry. In our analysis, however, the increase in firm size and number of shareholders following additions to the S&P 500 index is endogenous because of the pre-event positive momentum in stock returns and the post-event increased demand of index funds. We observe a decline in the market to book ratio from a mean of 3.67 before inclusion to 2.52 afterwards, with the difference significant at the 1% level. This decline in the market to book ratio is less likely to be endogenous than firm size and number of shareholders and provides the first evidence that information asymmetry declines following index inclusion.

The findings from the next group of factors pertaining to firm variability show increases in the abnormal reaction to quarterly earnings announcements and the volatility of returns. In fact, the median increase in abnormal returns to earnings announcements is 0.30% (significant at the 1% level), and the median increase in volatility of stock returns is 0.89% (significant at the 1% level). The mean change in EPS volatility is positive while the median difference is negative, and neither value is statistically significant. The

significant increases in abnormal returns to earnings announcement and stock volatility may be attributable to the following reasons. First, these firms may experience an increase in information asymmetry following index inclusion. Second, inclusion firms may have an increase in firm risk from changes in their capital structure. Kappou, et al (2007) and Chen, et al (2004) claim that new S&P 500 index members may be able to attract more capital because of the reputation of the index. If these firms increase their leverage ratios, risk to stockholders increases. To further explore this second explanation, we compute the change in leverage around inclusion events and test the correlation between the leverage change and the change in abnormal returns to earnings announcements and the change in stock volatility. Index inclusion firms have an average (median) leverage ratio of 0.1489 (0.0971) prior to inclusion and 0.1576 (0.1038) after. The mean difference in leverage is significant at the 5% level. The correlation between the change in leverage and the change in earnings announcement reaction is 0.1566 (significant at the 1%) level. The correlation between the leverage change and change in stock return volatility is 0.2254 (significant at the 1% level). For a robustness check, we also compute the correlation between the change in analyst forecast accuracy (a measure of information asymmetry) and the changes in the two volatility variables (abnormal returns to earnings announcements and stock return volatility), and we find that these correlations are both negative but insignificant. Therefore, the evidence supports the latter explanation for the increases in earnings announcement reaction and volatility of stock returns. Namely, increases in firm risk due to leverage increases explain the rise in the firm volatility variables rather than increases in information asymmetry.

Our final set of information asymmetry proxy variables relates to analyst forecasts of earnings per share. We show that the mean and median number of analysts following newly added firms increases by 3.41 and 3.20 analysts respectively, and both of these increases are significant at the 1% level. As highlighted in Yu (2008), this increase is endogenous to the addition events and is not necessarily evidence of changes in information asymmetry. However, the error in analyst forecasts and the dispersion of these forecasts are less likely to be endogenous to the index changes. Both analyst forecast error and forecast dispersion decline after inclusions, which indicates a reduction in information asymmetry. In particular, the mean (median) change in forecast error is -2.17% (-0.89%), and both of these changes are significant at the 1% level. The mean change in forecast dispersion is -3.06%, and the median decline in forecast dispersion is -0.39% (significant at the 1% level). The overall evidence for inclusion firms supports a decline in information asymmetry following the index reconstitution. Our proxy variables unrelated to firm policy and changes in leverage, the market/book ratio and analyst forecast errors and dispersion indicate that information asymmetry falls.

Panel D of Table 11 shows the level and changes in the information asymmetry proxy variables before and after removal from the S&P 500 index. We observe no significant change in the firm policy factors including research and development and intangible assets. For firm characteristics, the mean and median changes in firm size and number of shareholders are all negative and significant. The mean (median) decline in firm size is -0.67 (-0.19), and both changes are significant at the 1% level. Additionally, the number of shareholders falls by an average of 4,620 (significant at the 5% level)

people. These changes, however, are endogenous to the deletion events and are not necessarily indicative of increases in information asymmetry.

For the variability measures, we bserve increases in the mean and median for all three variables: earnings announcement reaction, volatility of EPS, and volatility of stock returns. The absolute value of the abnormal stock return surrounding quarterly earnings announcements increases by an average of 0.99% (significant at the 1% level) following removal events, and the median increase is 0.88% (significant at the 1% level). The mean changes in the volatility of EPS and stock returns are 0.17 and 0.03 (both significant at the 1% level) respectively, and the median changes are similarly positive and statistically significant. This result is similar to that of addition firms because we observe increases in these factors, but the changes in these proxy variables are uncorrelated with changes in leverage as we observed for inclusion firms. Thus, the increases in earnings announcement reaction, volatility of EPS, and volatility of stock returns suggest an increase in information asymmetry following removal from the index.

In the final set of proxy variables, the only significant change is in the number of analysts following the firm, a measure endogenous to the removal of the firm from the index. The mean (median) change in analyst following is -4.32 (-4.20) people and both of these values are significant at the 1% level. Both analyst forecast error and forecast dispersion increase following index removal, but these changes are insignificantly different from zero. Therefore, for deletion firms, we observe some evidence of information asymmetry increases following index removal.

Information Asymmetry and Abnormal Returns: Quartile Analysis We study information asymmetry changes around index reconstitutions to explain the abnormal

returns surrounding these events. In Table 12, we partition the sample firms into quartiles based on the level of the information asymmetry proxy variable prior to the index change and evaluate the median abnormal return in each quartile. We refer to these quartiles as Q1, Q2, Q3, and Q4 in this section, and firms in Q1 (Q4) have the lowest (highest) values for each proxy. Then, we compute the median difference in the abnormal return between the Q1 and Q4. We expect that addition firms with higher pre-inclusion information asymmetry will have higher abnormal returns because these firms benefit most from the reduction in information asymmetry. For deletion firms whose information asymmetry may increase, those with lower pre-removal information asymmetry may have larger losses at announcement.

We present the results for addition firms in Panel A of Table 12. Inclusion firms in Q4, with the highest levels of R&D, have an abnormal return of 1.21% and firms in Q1 have an abnormal return of 0.36%. The difference between these quartiles is significantly different at the 1% level, and the abnormal returns increase monotonically with the increases in R&D. Because R&D is a firm policy decision and often related to a firm's industry (Aboody and Lev, 2000), we did not see a change in R&D after inclusion. However, abnormal returns are related to the level of R&D indicating that firms with high R&D benefit most from the decrease in information asymmetry caused by other factors. The median abnormal returns in the quartiles based on intangible asset levels are neither monotonically increasing across quartiles nor significantly different between Q1 and Q4.

We next observe the abnormal returns for the quartiles by firm characteristic proxy variables. The difference in median abnormal return between Q4 and Q1 is -0.67%

TABLE 12: Abnormal Return Breakdown by Information Asymmetry Proxy Variables

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. Research and development is the ratio of research and development expense to total assets. Intangible assets is measured as one minus the sum of property, plant, and equipment plus current assets divided by total assets. Firm size is the log of the market value of equity and the number of shareholders is measured in thousands. The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity. R&D, intangibles, firm size, market to book ratio, and the number of shareholders are calculated for the fiscal year prior to the event date. The earnings announcement reaction is the average three day cumulative abnormal return for the 20 quarters preceding the announcement date. The volatility of EPS is the standard deviation of quarterly earnings per share for the five year periods preceding the announcement date, and we measure the standard deviation of monthly stock returns over the same period. The analyst forecast error is absolute value of the ratio of the difference between the mean analyst forecast of earnings per share and the actual earnings per share divided by the mean forecast. We measure this error for the forecasts during the five years before the event and compute the average. The forecast dispersion is the standard deviation of analyst forecasts divided by the mean forecast. We measure this dispersion for the forecasts during the five years before the event and compute the average over each period. The quartiles indicate the level of the proxy variable. The variable measured is the daily average cumulative abnormal return between the announcement and completion dates of the index change. The last column is the difference between the first and fourth quartiles abnormal returns. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

TABLE 12 (continued)

Panel A: Addition Sample					
	Quartile				Difference
	1	2	3	4	Q4 - Q1
Firm Policy Factors					
Research and Development	0.36	0.57	0.67	1.21	0.85 ***
Intangible Assets	0.84	0.62	0.65	0.81	-0.03
Firm Characteristics					
Firm Size	1.19	0.80	0.60	0.52	-0.67 *
Number of Shareholders	0.62	0.65	0.86	0.72	0.10
Market/Book Ratio	0.70	0.79	0.76	0.91	0.21
Variability Factors					
Earnings Announcement Rxn	0.73	0.76	0.37	1.12	0.39 *
Volatility of EPS	0.75	0.77	0.74	0.84	0.09
Volatility of Returns	0.68	0.65	0.66	1.07	0.39
Analyst Forecast Factors					
Number of Analysts	0.63	0.62	0.90	0.92	0.29
Analyst Error	0.44	0.85	1.05	1.06	0.62 **
Forecast Dispersion	0.73	0.88	1.13	0.86	0.13
Panel B: Deletion Sample					
	Quartile				Difference
	1	2	3	4	Q4 - Q1
Firm Policy Factors					
Research and Development	-0.86	-0.77	-0.85	-0.65	-0.19
Intangible Assets	-1.10	-0.63	-1.09	-0.58	-0.12 *
Firm Characteristics					
Firm Size	-1.72	-1.05	-0.79	-0.64	0.12 **
Number of Shareholders	-0.87	-1.07	-0.56	-0.72	1.09
Market/Book Ratio	-2.02	-0.90	-0.72	-0.77	1.77 ***
Variability Factors					
Earnings Announcement Rxn	-0.52	-0.58	-1.15	-0.81	-0.32
Volatility of EPS	-0.76	-0.88	-1.60	-1.12	-0.03
Volatility of Returns	-0.49	-0.90	-1.33	-0.97	-0.73
Analyst Forecast Factors					
Number of Analysts	-1.02	-1.07	-0.79	-0.55	0.65 **
Analyst Error	-1.27	-0.94	-0.98	-0.82	0.57 *
Forecast Dispersion	-1.11	-0.56	-0.62	-1.07	0.48

for the breakdown using firm size and the abnormal returns are monotonically decreasing across the quartiles. The result supports that firms with the highest information asymmetry (small firm size) benefit most from the inclusions. For the number of shareholders and market to book quartiles, the differences in abnormal returns between Q4 and Q1 are insignificant, but the Q4 abnormal return for the market to book breakdown is the highest of all quartiles. For the firm variability variables, firms with the highest levels of earnings announcement reactions, volatility of EPS, and volatility of stock returns all have the highest abnormal returns around announcement. Only the difference between Q4 and Q1 for the earnings announcement reactions is significant. In particular, the Q1 median abnormal return is 0.73%, the Q4 abnormal return is 1.12%, and the difference of 0.39% is significant at the 10% level. In general, firms with higher variability have larger abnormal returns.

The final set of proxy variables for inclusion firms deals with analyst forecasts. For the breakdown by analyst forecast error, the Q4 abnormal return is 1.06% and the Q1 abnormal return is 0.44%. The difference between these values is significant at the 5% level, indicating that firms with larger forecast error and higher information asymmetry prior to inclusion have stronger announcement returns. Interestingly, firms with the largest number of analysts in Q4 have the highest median announcement abnormal return. This finding contradicts our hypothesis that firms with higher information asymmetry have larger abnormal returns. Chung, et al (1995) presents an explanation for this finding because they show that more analysts follow firms with higher information asymmetry because the value of private information in these firms is higher. So, firms with higher information asymmetry may have more analyst coverage prior to inclusion.

Panel B of Table 12 reports a similar analysis by quartiles for firms removed from the index. Partitioning firms into quartiles by the level of R&D and intangible assets shows no significant differences between firms with high and low pre-removal levels of these variables. However, we show interesting results when we partition firms by firm size and market to book ratio. Firms in Q1 of firm size (smallest firms) and of market to book ratio (lowest ratio) incur the largest announcement period losses. This result on firm size is contradictory in terms of information asymmetry because firm size is inversely related to information asymmetry. This finding may be related to firm performance factors because firms that are removed from the index due to low market capitalization[3] could be performing poorly leading to a decline in market value. In this case, the announcement by Standard and Poors that these firms will be removed from the index leads to larger losses than for firms removed for other reasons.

Partitioning deletion firms based on the firm variability factors leads to insignificant differences in abnormal return between the quartiles. However, we find significant differences in abnormal returns by analyst forecast variables. Firms with the lowest analyst coverage (Q1) have lower abnormal returns than those with higher analyst coverage (Q4). In particular, the Q1 abnormal return is -1.02%, whereas the Q4 abnormal return is -0.55%. The difference is significant at the 5% level. The difference between the Q4 and Q1 abnormal returns for analyst forecast error partitioning is 0.57%

[3] Sometimes Standard and Poors cites firm size as a reason for removal. Twenty-five firms in our sample were removed for this reason.

(significant at the 10% level). From this section, we observe mixed results in terms of the relationship between information asymmetry and announcement returns for deletions[4].

Overall the evidence suggests that inclusion firms with more information asymmetry prior to inclusion accrue larger abnormal gains upon addition. Specifically, firms with higher R&D expense, smaller firm size, larger earnings announcement reaction, and larger forecast errors have higher gains. The results for deletion firms were mixed and mostly insignificant, so we conclude that there is little relation between the pre-deletion level of information asymmetry and the losses at the announcement of removal from the S&P 500 index.

Multivariate Analysis of Analyst Forecast Errors Among the information asymmetry proxy variables examined above, stock analyst forecast errors should not change simply as a result of the index reconstitutions, i.e. they are not endogenous to the events. Therefore, we conduct a more in-depth analysis of the changes in forecast errors using regressions and present the results in Table 13. As the dependent variable in these regressions, we include analyst forecast measured by the errors of annual EPS forecasts for the five years prior to the event and the five years following the event. These are forecast errors for forecasts made for one and two fiscal years ahead in the month directly preceding the fiscal-year end for the firm. We follow Haw, et al (1994), and define the

[4] In Panel B of Appendix Table E, we present similar results by partitioning firms into groups either above or below the median value of the information asymmetry proxy. The results on firm size and market/book ratio remain consistent for the deletion firms, but there is no significant difference in abnormal returns when partitioning into two groups by the number of analysts and forecast error. However, firms with larger earnings announcement reactions and volatility of returns have larger abnormal returns. The wide variety in results based upon the number of groups in partitioning also supports the conclusion that information asymmetry is less related to announcement returns for deletion firms.

TABLE 13: Analyst Forecast Error Regression Results

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. The dependent variable in the regressions is the scaled analyst forecast error. The scaled analyst forecast error is absolute value of the ratio of the difference between the mean analyst forecast of earnings per share and the actual earnings per share divided by the mean forecast. We include the one-year and two-year ahead forecast errors from the five years before and after the event. We include a dummy variable to indicate observations occuring after the event announcement date, and a one year lag of the scaled forecast error. The scaled forecast dispersion is the standard deviation of analyst forecasts divided by the mean forecast, and include a one year lag of the scaled forecast dispersion. Research and development is the ratio of research and development expense to total assets. Intangible assets is measured as one minus the sum of property, plant, and equipment plus current assets divided by total assets. Firm size is the log of the market value of equity and the number of shareholders is measured in thousands. The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity. R&D, intangibles, firm size, market to book ratio, and the number of shareholders are calculated for the fiscal year prior to the event date. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

TABLE 13 (continued)

Panel A: Addition Sample				
	Model 1	Model 2	Model 3	Model 4
Post-Event Flag	-0.8824 ***	-2.1848 ***	-0.3803	-0.2677 ***
	-3.55	-3.86	-0.61	-4.77
Number of Analysts	-0.1078 ***	-0.0923 *	0.1241 **	-0.0166
	-3.89	-1.73	2.10	-0.31
Lag Forecast Dispersion	0.1801 ***	0.1861 ***	0.1473 ***	0.1507 ***
	13.47	9.32	7.35	7.53
Research & Development		0.0925	-0.0341	-0.0313
		1.49	-0.55	-0.50
Intangible Assets		0.0676 ***	0.1003 ***	0.0995 ***
		2.59	2.72	3.64
Market/Book Ratio			0.0768	0.0609
			0.79	0.62
Firm Size			-3.5636 ***	
			-7.71	
Firm Size Residuals				-3.4120 ***
				-7.35
R-Squared	0.3148	0.3156	0.3439	0.3421
Number of Observations	4725	2113	2108	2108
Number of Firms	310	143	143	143
Panel B: Deletion Sample				
	Model 1	Model 2	Model 3	Model 4
Post-Event Flag	1.8142	1.3988	0.9211	1.2546
	1.28	1.08	0.71	0.96
Number of Analysts	-0.0656	0.0261	0.2951 *	-0.0935
	-0.39	0.18	1.86	-0.63
Lag Forecast Dispersion	-0.0682 ***	-0.0191	-0.0351	-0.0327
	-2.71	-0.51	-0.94	-0.87
Research & Development		0.0585	-0.1413	-0.1074
		0.21	-0.49	-0.37
Intangible Assets		0.0328	0.0381	0.0388
		0.48	0.52	0.53
Market/Book Ratio			0.2395	0.1899
			0.60	0.47
Firm Size			-3.6220 ***	
			-4.01	
Firm Size Residuals				-3.1837 ***
				-3.55
R-Squared	0.1182	0.1445	0.1608	0.1574
Number of Observations	1803	940	936	936
Number of Firms	120	68	68	68

main variable of interest as a dummy variable equal to one if the forecast occurred after the index inclusion or deletion. We expect analyst forecasts to become more accurate after the inclusion of a firm to the index if information asymmetry declines (a negative coefficient on the dummy variable), and larger errors after removal of a firm from the index (a positive coefficient on the dummy variable). We also control for other factors known to influence forecast accuracy. Specifically, we include the number of analysts who follow the firm and whose individual forecasts enter the consensus, and we expect that more analysts forecasting EPS should make the consensus forecast more accurate. Both Haw, et al (1994) and Bernard (2008) find that more analyst coverage reduces forecast error. Similar to Bernard (2008), to control for firm specific factors that impact analysts' ability to make accurate forecasts, we include the lagged forecast error from the previous fiscal year for the same forecast length. For example, if the current forecast is the two-year ahead forecast, we include the two-year ahead forecast error from the previous year. We hypothesize that firms with larger forecast error will continue to have larger errors. As described in Aboody and Lev (2000), firm's use of R&D and other intangible assets creates information asymmetry because these activities and assets are firm specific and do not have a market value. To ensure that the change in analyst forecast accuracy does not stem from changes in firm policies regarding R&D and intangible assets, we include R&D and intangible assets. We control for the market to book ratio of the firm because higher market to book ratios indicate more growth opportunities which are difficult to value. Finally, we control for firm size because larger firms typically have less information asymmetry and analyst effort may differ based on the size of the firm they cover. To consider the possible correlation between firm size

and the number of analysts, we include the residuals from the regression of firm size on the number of analyst (firm size residuals). We perform firm fixed effects in our regressions, but for brevity we suppress the coefficients in Table 13.

We present the results for inclusion firms in Panel A of Table 13. In three of our models, the coefficient on the dummy variable indicating the forecast occurs after the inclusion announcement is negative and statistically significant. This means that analyst forecast errors are reduced after a firm is included on the S&P 500 index and supports the decrease in information asymmetry that is found in Chen, et al (2004), Hedge and McDermott (2003), and Becker-Blease and Paul (2006). Note that in the above analysis, forecast errors at the consensus level are used. Since analysts may exert more effort on analyzing newly added stocks because of the high profile nature of the S&P 500, our finding can be further supported if the errors of individual analysts declined temporarily following inclusion events. However, if these errors were permanently reduced, we believe that the information asymmetry reduction would be supported. To further explore these two explanations for our results, further research using individual forecast error is suggested.

Consistent to our hypothesis, the number of analysts is negatively related to consensus forecast error in Models 1 and 2. However, when we include firm size, the sign on the coefficient on the number of analyst changes from negative to positive. We suspect that, after including firm fixed effects, firm size and the number of analysts are highly correlated. In fact, studies by Bhushan (1989) and Barth, et al (2001) support this suspicion. Therefore, in Model 4, we include only the residual of a regression of firm size on the number of analysts to remove the multicollinearity. In Model 4, the impact of

the number of analysts on forecast error is negative. We believe that a study of individual forecast errors would mitigate the difficulty of disentangling the correlation between the number of analysts and firm size.

We also include the lagged values for analyst forecast error and the values have the hypothesized impact on the current forecast error. Namely, firms with higher prediction error in the past have higher error in the current forecast. This result on this variable is consistent with the findings of Bernard (2008). We show that the level of research and development is positively related to the analyst forecast error. This confirms the proposition by Aboody and Lev (2000) that research and development is a cause of information asymmetry. Similarly, the coefficient on intangible assets is positive suggesting that firms with more intangible assets have higher information asymmetry measured by analyst forecast error. In Model 3, we also control for firm size and the market to book ratio. We find that firm size and forecast error are inversely related indicating that analysts have more accurate forecasts of larger firms. However, as discussed above, firm size and the number of analysts are correlated. We, therefore, include in Model 4 the firm size residual the regression of firm size on the number of analysts in Model 4. The coefficient on the residual term is negative, confirming that larger firms have more accurate forecasts[5].

One potential criticism of this analysis is the use of consensus level forecasts because the group of analysts may have changed prior to and after the event. New

[5] We present similar results using the median rather than mean analyst forecast in Table F of the Appendix. The coefficient on the post-event dummy variable is negative, but insignificant, in model 3. Aside from this difference, all remaining conclusions are the same.

analysts that begin following the firm have less experience with the firm-specific characteristics and could potentially introduce biases to the forecast accuracy. We plan to perform future research to adjust for the bias and examine whether the improvements to forecast accuracy are permanent.

In Panel B of Table 13, we show the same analysis for deletion firms. Consistent with the finding in Table 11 that information asymmetry does not increase following index removal, the coefficient on the dummy variable indicating the period after removal is insignificantly different from zero. In fact, the only consistent finding is that larger firms (measured by the firm size in Model 3 or the residual firm size in Model 4) have more accurate forecasts. This strengthens the conclusion that information asymmetry does not appear to increase for firms removed from the S&P 500 index.

2.4 Conclusion

This paper contributes to the existing literature on the stock returns around S&P 500 index changes by examining the changes in information asymmetry around these events. While several studies, including Chen, et al (2004), Hedge and McDermott (2003), and Becker-Blease and Paul (2006), imply that information asymmetry is reduced following inclusion, our study is the first to provide a direct test for this proposition. We find that the information asymmetry problem is mitigated following index inclusions supported by the decreases in market to book ratio, analyst forecast error, and forecast dispersion following inclusions. Additionally, we show that firms with higher information asymmetry prior to inclusion accrue larger gains at announcement suggesting that these firms enjoy an increased benefit from inclusion. Finally, we conduct a detailed analysis of analyst forecast errors and show a significant decline in forecast error following inclusion suggesting a reduction in information asymmetry. We also find that analyst forecast errors are reduced when firms are followed by more analysts, have a smaller lagged forecast error, have fewer intangible assets, and are larger in size.

For firms removed from the index, the preponderance of evidence in our study suggests that there is no change in information asymmetry following deletion from the S&P 500 Index. Some proxy variables for information asymmetry show declines in information asymmetry while others point to increases. We observe little relationship between the announcement returns and the level of information asymmetry when we partition the deletion sample into quartiles by the pre-removal levels of information asymmetry proxies. Finally, our multivariate regression analysis of analyst forecast

errors shows an insignificant increase in analyst forecast error following removal from the S&P 500 Index.

CHAPTER 3: BONDHOLDER REACTIONS TO S&P 500 INDEX RECONSTITUTIONS

During the period from 1990 through 2007, Standard and Poors changed the constituents in the S&P 500 index over 400 times. In prior studies of index changes, newly added stocks experienced a positive and sustained price reaction. One hypothesis explaining this reaction is that Standard and Poors, in selecting stocks, certifies some positive information about the company. Since Standard and Poors maintains that they do not use information about future firm performance to make decisions on index changes, the positive price reaction is inconsistent with flat long-run demand curves proposed by Scholes (1972). This paper examines the certification hypothesis by examining the reaction of bondholders to S&P 500 index changes and finds no additional support for the certification hypothesis. Additionally, we further examine the types of information suggested in the certification hypothesis: improved firm performance and better access to capital markets. Our findings of insignificant bond price reaction to index changes cannot help distinguish between improvements in firm future performance and additional access to capital markets.

Five hypotheses emerge from the existing literature on index changes. The imperfect substitutes hypothesis, contradicting a belief in efficient markets, states that the long-run demand curves for S&P 500 index stocks is downward sloping rather than flat. The remaining four hypotheses support the efficient markets hypothesis. The price pressure hypothesis purports that the activity by index funds rebalancing portfolios

creates a short-term price increase for additions and decline for removed stocks. For additions, however, empirical evidence of a sustained price increase is inconsistent with this hypothesis. The liquidity hypothesis suggests that newly added index firms experience a long-lasting increase in liquidity which reduces the cost of equity and increases the stock price. The certification hypothesis states that the inclusion (removal) of a stock in the S&P 500 conveys positive (negative) information which creates a sustained positive (negative) price shock. Finally, the investor awareness hypothesis was developed in response to the asymmetric price reactions of addition and deletion events. This hypothesis claims that reductions in the shadow cost associated with the lack of investor awareness of a stock cause the sustained price reactions for additions. However, removed firms experience a temporary price decline because investor awareness remains the same upon removal from the index.

We investigate bondholder wealth effects surrounding index changes to examine the certification hypothesis. Bondholder yield changes are particularly suited for the examination of the certification hypothesis because bonds are not influenced by factors from the other hypotheses[6]. Unlike stocks, bond prices should not be affected when stock liquidity changes. Additionally, the short-run price pressure or slope of the long-run demand curve for stocks should not affect bond yields. Lastly, the shadow cost imposed from lack of investor awareness of a stock does not impact bond returns. Thus, any significant bondholder wealth effects around index changes can help support the

[6] Interestingly, several papers look at option markets to disentangle the effects of multiple hypotheses on stock return. In particular, Dhillon and Johnson (1991) look at stock returns to optioned and non-optioned stocks and Sui (2004) supports the certification hypothesis by examining the risk-neutral densities of options of addition and deletion firms.

certification hypothesis. A closely related study is Dhillon and Johnson (1991). They use a sample of 39 bonds for index additions from 1978 through 1988 to find positive but insignificant cumulative returns surrounding the announcement date. In our study, we find similar results. In particular, we find insignificant yield changes for bonds of the added firms on the individual bond basis (multiple bonds per firm are regarded as independent observations) and the firm basis (using the average yield change of all bonds for a given firm). For deletion firms, we find positive and statistically significant yield changes on the individual bonds basis, but insignificant changes on the firm basis

Furthermore, we explore the possible types of information that may be conveyed upon selection by Standard and Poors for addition (removal) from the index. The certification hypothesis is broad and does not specify the nature of this information. The studies that investigate the certification hypothesis differ on the type of information included during index reconstitutions. Dhillon and Johnson (1991) and Jain (1987) point to a general "positive information" conveyed at announcement. Denis, et al (2003) and Kappou, et al (2007) show that earnings per share increases following announcement, indicating an improvement in firm performance. If the information was conveyed by index inclusion, we expect bondholders to benefit from the smaller likelihood of default. Therefore, a significant decrease in yield (increase in price) would be consistent with the certification of improved operating performance.

Certain positive information for stockholders can have a negative impact on bondholders. For example, Kappou, Brooks, and Ward (2007) and Chen, Noronha, and Singal (2004) claim that new S&P 500 index members may be able to attract more capital because of the reputation of the index. Better access to capital markets can lead to an

increase in a firm's investment opportunity set. This occurs because funding can be obtained at a lower cost and consequently more value-creating investment opportunities can be taken. The lower cost of capital and/or increased investment opportunity set benefits stockholders, but it might lead to a negative impact on bondholders. In particular, if firms increase their debt significantly as the result of the better access to capital markets, bondholders will be adversely impacted. Bond yields would increase due to the increased risk of default and the further dilution of current bondholder claims in the event of liquidation. Thus, the direction of bondholder reactions will distinguish between the types of positive information conveyed in the announcement. Our univariate and multivariate analyses of bond yields surrounding index inclusion and deletion events yield insignificant changes and thus do not help distinguish between these two types of information in the certification hypothesis.

3.1 Literature Review

The preponderance of literature surrounding S&P 500 index changes agrees that newly added firms experience a positive and sustained price increase following the announcement by Standard and Poors[7]. Given the statement from Standard and Poors that they do not use information about future performance to select stocks for inclusion in conjunction with an assumption of a flat long-run demand curve, this price increase is puzzling. Five hypotheses emerge from the extant literature on S&P 500 index changes: imperfect substitutes, liquidity, certification, investor awareness, and price pressure. The imperfect substitutes hypothesis states that the long-run demand curve for newly added stocks must be downward sloping, a conclusion in opposition to Scholes (1972) who argues for market efficiency. The remaining four hypotheses maintain Scholes' (1972) proposition of market efficiency but argue for various types of information that could be conveyed in the selection of stocks to be included on or removed from the index. We describe each hypothesis below focusing particularly on the certification hypothesis tested in this study.

If stocks have a flat long-run demand curve, then stocks with the same risk level should be perfect substitutes. Stock price must remain unchanged when no information is conveyed, because investors can sell the stock for a substitute if the price begins to increase. The imperfect substitutes hypothesis claims that stocks on the S&P 500 index do not have a flat long-run demand curve and therefore do not have perfect substitutes. When stocks are added to the index, both demand and price increase and remain elevated.

[7] Harris and Gurel (1986) find a short-term rather than sustained price increase for added firms.

When stocks are removed from the index, demand and price decline and remain low. Empirical evidence on this hypothesis is mixed. Shleifer (1986) finds positive abnormal stock returns around inclusion events and suggests they are related to the purchases of index funds, which is a proxy for increased demand. Lynch and Mendenhall (1997) look at the price responses before October 1989 when index changes are not pre-announced and afterwards when Standard and Poors pre-announces the changes several days prior to the implementation of the new index. They conclude that there is a permanent component to the increased demand and prices stemming from downward sloping long-run demand curves.

While these two studies support the imperfect substitutes hypothesis, Edminster, et al (1994) and Hrazdil (2007) find evidence to contradict this hypothesis. Edminster, et al (1994) observe that many addition firms have rising prices in the period preceding the inclusion, leading to biased coefficients in the market model estimated using pre-inclusion data. They use an estimation period after the inclusion event to calculate the unbiased excess returns and show that these excess returns are unrelated to the increased demand from index funds. Therefore, they conclude that stocks on the index are perfect substitutes. Hrazdil (2007) examines the change in the S&P 500 weighting method from market-based to free-float. This change caused the weights of certain stocks in the index to change, which would create buying and selling pressure from index fund rebalancing. With downward sloping demand curves, abnormal returns around this event would be related to the change in a stock's index weight. Hrazdil (2007) finds no such relationship and confirms the conclusion of Edmister, et al (1994) that stocks on the S&P 500 index have perfect substitutes.

The price pressure hypothesis supports a short-term increase in price for added stocks and a short-term decrease in price for removed stocks stemming from the temporary demand imbalance from index funds rebalancing to mimic the index. Harris and Gurel (1986) purport that price and volume increases following index additions that are reversed within two weeks and relate the magnitude of the price increase to the outstanding size of index funds. Elliott and Warr (2003) use a different tactic to support the price pressure hypothesis. They show that Nasdaq traded stocks have a larger and more sustained price increase than NYSE stocks and suggest that their finding supports the price pressure hypothesis. They argue that the auction market (NYSE) is better able to handle increased demands than the dealer market (Nasdaq) and thus the price increase is smaller than in the dealer market.

The liquidity hypothesis relates to the price pressure hypothesis because in both hypotheses increased trading leads to price changes. In the price pressure hypothesis, the increased trading is temporary from rebalancing of index funds, whereas in the liquidity hypothesis liquidity improvements are sustained past the initial rebalancing period. Consequently, the liquidity hypothesis is consistent with a permanent price increase after index addition events. Three main studies find support for this hypothesis. Erwin and Miller (1998) show that the bid-ask spread declines, trading volume increases, and price rises for newly added stocks that did not have traded options before inclusion. The prices of these stocks rise due to increased liquidity. Hedge and McDermott (2003) relate the change in bid-ask spreads to the announcement returns for inclusion stocks and show that the improved liquidity is a permanent effect. This implies that a sustained price increase may be due to improved liquidity. Finally, Becker-Blease and Paul (2006) link liquidity

improvements to expanded growth opportunities in the inclusion firms. They hypothesize that liquidity improvements decrease the cost of capital which consequently enlarges the investment opportunity set and raises firm value. All three studies support a sustained price increase upon addition with evidence of improved liquidity.

Chen, et al (2004) find that the price increases for addition firms are permanent, whereas the price decline for deleted firms is short-lived. Given this asymmetric price behavior, they propose the investor awareness hypothesis which draws upon the Merton's (1987) model of market segmentation. In particular, when investors are aware of a subset of stocks in the market, they demand a premium, or shadow cost, to compensate for lack of diversification. In essence, the lack of investor awareness increases the cost of capital by the amount of the shadow cost. Therefore, when firms are added to the index, more investors become aware of the stocks and the shadow cost component of the required return falls. This reduction in shadow cost and required rate of return is sustained, leading to a sustained price improvement. On the contrary, when firms are removed from the index, investor awareness does not automatically decline. So the short-term price decline is due to price pressure from rebalancing rather than an increase in shadow cost.

The final hypothesis, the certification hypothesis, is the basis for the analysis of bond yield spread changes in this paper. The certification hypothesis states that Standard and Poors, in selecting certain stocks for the index, conveys certain information about newly added (removed) stocks. Work by Dhillon and Johnson (1991), Denis, et al (2003), Kappou, et al (2007), and Cai (2007) supports this hypothesis. On the other hand, Hrazdil and Scott (2007) provide evidence against this hypothesis. In the earliest study of the certification hypothesis, Dhillon and Johnson (1991) examine returns to bonds and

options of newly added firms. As stated previously, bonds and options are not susceptible to changes in stock liquidity, price pressure, and shadow cost, so changes in their value can only be attributable to positive information. They find, for their sample bond returns for 39 firms, positive and significant increases in bond prices on the announcement date, but insignificant cumulative returns in the days surrounding the announcement. Additionally, call option prices increase while put option prices decline on the announcement date. Taken together, their evidence supports the certification hypothesis but does not identify the nature of the positive information. Denis, et al (2003) and Kappou, et al (2007) find evidence to support the certification hypothesis by examining the changes in the forecast and realized earnings per share. In particular, Denis, et al (2003) compute the change in forecast earnings from before to after the index change and show that investor expectations about future performance improve following inclusion events. They verify that these improvements are not due to industry or market-wide effects. Kappou, et al (2007) measure realized improvements in EPS following index inclusion. Two reasons may explain these observations of improved EPS following addition. Either Standard and Poors has superior information about firm performance and specifically selects firms on this basis or firms selected to the index have superior monitoring or access to capital markets which allows them to perform better after inclusion. Denis, et al (2003) clearly state that their tests cannot distinguish between these reasons. The first explanation would be contrary to the stated practice of Standard and Poors. Regardless of which explanation holds true, these two studies find improved operational performance consistent with the certification hypothesis. On the other hand, Hrazdil and Scott (2007) refute the findings of improved EPS. They suggest

that the improved earnings are a byproduct of manipulation of discretionary accruals rather than of significant improvements in operations.

Finally, Cai (2007) decomposes the positive information conveyed in index inclusion announcements into information about the added firm's industry and information specific to the added firm. They examine the returns to both the added firm and industry peers and show that a portion of the positive announcement reaction to index addition is attributable to information about the firm's industry. Since Standard and Poor's selects firms to reflect the national industry breakdown, firms from growing industries are most likely to be added to the index. On the contrary, firms from saturated industries are more likely to removed from the index

3.2 Sample

Our sample consists of firms added to or removed from the S&P 500 index during the period from 1990 through 2007. We begin our sample in 1990 because Standard and Poors changed its timeline for announcing index revisions in October 1989. Prior to this date, the announcement and implementation of index changes occurred simultaneously. Index funds were forced to rebalance portfolios without an advance notice. According to Benish and Whaley (1996), this created a large amount of price pressure on the day of the index revision. After October 1989, Standard and Poors began pre-announcing index changes several days prior to the actual reconstitution. In our sample, the mean (median) length of time between the announcement and actual index change is 5.26 (5) days.

We begin the sample selection using a monthly list of S&P 500 index constituents from Compustat. For each month, we identify newly added or removed firms. We verify the index change announcement and implementation dates using news accounts in Lexis-Nexis. This procedure identifies 838 sample firms with 419 additions and 419 deletions. We further exclude those sample firms that are associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm (11 cases involving 11 added and 11 deleted firms), (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index (5 cases involving 5 deleted firms), (3) when two existing index firms merge and the resulting merged firm remains on the index (9 cases involving 9 added and 18 deleted firms), and (4) when an index firm is replaced by a spun-off subsidiary (17 cases involving 17 added and 17 deleted firms). The final sample of index changes contains 382 added firms and 368 deleted firms.

To ensure that the changes in bond yield spread are not due to changes in the industry, we select a matching peer firm for each sample firm. We require that the matched firms have valid Compustat data for the fiscal year prior to the index change as well as CRSP prices for the seven-day period around the event date. We exclude matching firms currently in the S&P 500 index and exclude firms that were removed from or added to the index within five years of the event. For each sample firm, we identify all peer firms within the same three-digit SIC code and use the one that is closest in size to the sample firm as the matched firm. For both sample and control firms, we gather accounting information from Compustat and use the I/B/E/S database for analyst forecasts of earnings per share.

With the sample and control firms, we then collect bond prices from three sources: TRACE, FISD (NAIC), and Bloomberg. The TRACE (Trade Reporting and Compliance Engine) database starts in 2002 and contains all secondary over-the-counter trades of public bonds. The FISD (Fixed Income Securities Database) contains bond prices for trades from the National Association of Insurance Commissioners (NAIC). Following Bessembinder, et al (2009), if multiple trades occur on the same day, we use the weighted average price where the weights are determined by the size of the trade. Finally, Bloomberg provides daily prices. For a bond to appear in our final sample, we require that it has at least one price within each of the following windows: [30 days prior to announcement date, announcement date] and [completion date, 30 days after completion date]. The announcement date is the day on which the index change is preannounced, and the completion date is the day on which the index change occurs. If the bond has multiple dates with prices in either window, we use the observation closest

to the announcement or completion date. If multiple pricing sources have price information for a given bond on a given day, we use the TRACE data first, followed by the NAIC data. If neither of these two sources yields valid prices, we use the Bloomberg data.

This selection process yields a final sample of 359 bonds from 112 addition sample firms, and 692 bonds from 177 deletion sample firms. We have a sample of 198 bonds from 76 addition matched firms, and 306 bonds from 94 deletion matched firms. Table 14 provides the descriptive statistics for the included sample firms and bonds. Sample firms have a higher average number of bonds per firm than peer firms. Both addition and deletion sample firms have an average of 1.24 bonds per firm, whereas matched pair firms for both additions and deletions have 1.14 and 1.15 bonds per firm respectively. Both addition and deletion sample firms are larger in size (measured by sales) than the matched pair counterparts. Leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. Both addition and deletion sample firms have lower leverage than the control firms. The addition (deletion) sample has leverage of 0.228 (0.231), whereas the control firms have leverage of 0.282 and 0.289 for additions and deletions, respectively. The unlevered volatility of stock returns is the standard deviation of the 24 months of unlevered stock returns ending two months prior to the announcement date. Unlevered stock returns are calculated by multiplying the return by 1 minus the leverage ratio for the given year. While there is no difference between the average unlevered volatility of the deletion firms and matched sample,

TABLE 14: Descriptive Statistics about Firms and Bonds

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. For these sample and control firms, we require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. At the firm level, we measure the average number of bonds per firm. Firm size is the log of sales, and leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. The unlevered volatility of stock returns is the standard deviation of the 24 months of unlevered stock returns ending two months prior to the announcement date. Unlevered stock returns are calculated by multiplying the return by one minus the leverage ratio for the given year. The S&P issuer ratings were converted to a numeric scale where NR = 24, D = 23… AAA+ = 1. At the bond level, we measure the percent of bonds that are senior or callable. Additionally, we measure the average time to maturity.

	Additions		Deletions	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Firm Level Information				
Number of Firms	104	71	160	84
Bonds Per Firm	1.240	1.141	1.244	1.155
Firm Size	9.187	8.588	9.331	8.868
Leverage	0.229	0.284	0.228	0.294
Unlevered Stock Volatility	0.065	0.079	0.079	0.080
Debt Rating	9.244	10.771	9.045	10.653
Bond Level Information				
Number of Bonds	336	181	566	271
Senior	0.810	0.834	0.776	0.756
Callable	0.449	0.558	0.442	0.506
Remaining Maturity	8.417	7.980	9.720	8.934

addition sample firms have a lower unlevered volatility (6.4%) than the matched sample (7.9%). Finally, we show the Standard and Poors issuer rating. The S&P issuer ratings are converted to a numeric scale where AAA = 1, AAA- = 2, …., D = 23, and NR = 24. The addition sample firms have an average rating of 9.192, which corresponds to a rating between BBB and BBB+. Addition control firms have an average rating of 10.677, corresponding to a rating between BBB- and BBB. The average rating for deletion sample firms is 8.965, which corresponds to a rating between BBB+ and A-. Lastly, the deletion sample firms have an average rating of 10.458, corresponding to a rating between BBB- and BBB. At the firm level, sample firms appear to be less risky in terms of leverage and rating for both additions and deletions. We also measure certain key bond characteristics. Fewer addition sample bonds are senior (78%) and callable (43.7%) than the addition control bonds (83.3% senior and 55.6% callable). The same pattern holds for deletion bonds. Bonds across all samples have an average remaining maturity between 8.4 and 9.2 years.

3.3 Methodology

For event studies of stock returns, daily returns in the period surrounding the event are used to compute the abnormal reaction to the announcement (MacKinlay, 1997). Lack of daily trading, and thus daily prices, remains a major challenge in performing event studies using bond returns. A majority of event studies on bondholder wealth effects use monthly prices. However, Bessembinder, et al (2009) demonstrate that tests using monthly bond prices cannot detect abnormal returns as well as those using daily returns. They suggest the use of daily bond returns because of this difference. Their study uses the entire database of bond prices to compute returns, whereas in event studies only the sample bonds are relevant for testing. Additionally, computing returns around the event requires daily prices for two or more subsequent days. These restrictions on the available bond data often yield a sample too small for analysis.

We adopt a methodology that requires fewer data points to overcome the above problem. In particular, Maquieira, et al (1998) and Nishikawa, et al (2008) compute changes in yields rather than cumulative bond returns surrounding the events.[8] Following their method, we search for the last price in the window of [30 days prior to Announcement Date, Announcement Date] and the first price in the window [Completion Date, 30 days after Completion Date]. Using these two prices, we compute the yield to maturity for each bond before and after the event dates. A bond's yield to maturity is then used to compute the yield spread which is the difference between the yield to

[8] Maquieira, et al (1998) examine bondholder reaction to stock-for-stock mergers. Nishikawa, et al (2008) study bondholder wealth effects surrounding open market repurchases.

maturity on the bond and the value from the Treasury yield curve with the same maturity. We use linear interpolation to determine the Treasury yield with the matching maturity. In particular, from the Treasury yields reported by Datastream for the 1-, 3-, and 6-month as well as the 1-, 2-, 3-, 5-, 7-, 10-, 20-, and 30-year Treasuries, we use linear interpolation to complete the full Treasury yield curve from maturities of one month to 30 years. Yield spread change is defined to be the difference in yield spread prior to and after the index change. We then employ the standard event study methodology using the yield spread change rather than abnormal returns. In the following analyses, we present the raw change in yield spread. We also conduct the same analyses using the relative change in yield spread, which is the raw change dividend by the yield spread prior to the event date. The results from this set of analyses are available in the Appendix.

In addition to measuring the yield spread changes, we measured the change in operating performance and leverage around the index reconstitutions in order to distinguish between different types of "positive information." As in Denis, et al (2003) and Kappou, et al (2007), we use the realized changes in earnings per share and changes in analysts' forecasts of earnings per share to measure operational improvement. In newly added firms, we expect a decline in bond yield if investors expect improvements in future performance. The use of analyst forecasts serves as a proxy for investor expectations about future performance. The I/B/E/S database contains monthly forecasts for both quarterly and annual EPS values for up to four quarters and five years ahead of the given month. Following Denis, et al (2003), we use annual EPS forecasts for up to five years, although the majority of firms only have forecasts for one or two fiscal years ahead. For each firm, we get the mean and median analyst forecast from the month most

closely preceding the announcement date and the month immediately following the reconstitution date. Firms without forecast information in the six months prior to the announcement date and/or in the six months following the completion date are excluded. For example, if a firm was added to the index in June 2002 (with the announcement and completion dates within the month of June) and had a fiscal year end of December, we collect the mean and median forecast in May 2002 for the fiscal year ending in December 2002, December 2003, and so on. We also collect the forecasts in July 2002 for the fiscal year ending December 2002, December 2003, etc. Then the change in analyst forecast is computed as the difference between the forecast immediately prior and after the event for the same fiscal year end. If the I/B/E/S database contains forecasts for more than one fiscal year ahead, the average change in forecast is used.

While changes in analyst forecasts serve as one proxy for changes in investor expectations, we also use the realized changes in earnings per share assuming that investors are rational. Denis, et al (2003) and Kappou, et al (2007) use the realized earnings as a proxy for changes in investor expectations at announcement of index change events. We follow Kappou, et al (2007) to measure the absolute change in earnings from before and after the inclusion/exclusion event. We measure the average earnings per share in the three fiscal years before the announcement date and find the difference of this value from the average earnings per share in the three fiscal years following the completion date.

Both improvements in operating performance and better access to capital markets have positive impacts on stock returns. The same does not hold true for bondholders. In particular, improvement in earnings per share is a signal of positive changes in operating

performance that benefits bondholders, whereas additional access to capital markets may be detrimental to bondholders. If newly added firms increase their financial leverage due to better access to capital markets, the firm's default probability increases and existing bondholder claims to the firm are diluted[9]. Thus, we measure the change in firm leverage surrounding index reconstitutions to see how further access to capital markets impacts bondholders. For a given year, leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. Market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. We calculate the change in leverage as the difference in average leverage before and after the event. The average leverage before the event is the mean of the leverage values in years -1, -2, and -3, where year 0 as the announcement year. The average leverage after the event is the mean of the leverage values in years 1, 2, and 3. We also examine leverage changes by using the ratio of the leverage after the event to the leverage before the event, as well as using only long-term debt in calculating leverage. We find similar results (not reported in the paper) using these alternative measures[10]

[9] For example, see studies of bondholder reactions to other leverage increasing events such as leveraged buyouts (Asquith and Wizman (1990), Cook, et al (1992), Warga and Welch (1993), Billett, et al (2010), and Baran and King (2010)) and leveraged recapitalizations (Handa and Radhadkrishnan (1991) and Halpern, et al (2009)).

[10] These results are available upon request.

3.4 Empirical Results

Table 15 presents the univariate results of yield spread changes for both the addition and deletion samples. We include the raw results as well as those after winsorization at the 5% and 95% level. We winsorize the yield spread changes because of extreme values in the deletion sample. Standard and Poor's removes firms from the S&P 500 index for a variety of reasons: rebalancing index composition to better reflect the industry breakdown in the U.S., mergers or acquisitions of index firms, spinoffs from index constituents that decrease the constituent size, bankruptcy or delisting from an exchange, and low market capitalization. One of these confounding events often accompanies the announcement of removal from the S&P 500 index. Since bankruptcy, spinoffs, and delisting harm bondholders, it is not surprising that we observe a large decline on bond value around many deletions.

In Table 15, we present the analysis at the bond and firm level. In studies of bondholder wealth effects, including multiple bonds per firm may bias the standard errors downward because of the return correlation of bonds with the same issuer. Some studies, therefore, choose a single representative bond for each firm or use a weighted average return of all bonds with the same issuer to obtain a single observation per firm[11]. In the firm-level results, we compute the firm-level yield spread change as the average of the yield spread changes for all bonds from a single issuer.

The mean and median yield spread changes for the addition sample are positive at

[11] Billet, King, and Mauer (2004) use a weighted-average of a target's bond returns to create one observation per target and Asquith and Wizman (1990) choose a representative bond from each target to rectify this problem.

TABLE 15: Univariate Yield Spread Changes

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. We exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. For these sample and control firms, we gather daily pricing data from TRACE, FISD, and Bloomberg and require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The yield spread change is the difference between the yield spread before and after the event announcement date. The yield spread changes are reported as percentages. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	0.095	-0.017	0.044	-0.041
Median	0.008	-0.034	0.012	-0.034 *
N	336	181	336	181
Panel B: Addition Sample by Firm				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	-0.009	-0.004	-0.043	0.000
Median	-0.002	-0.001	-0.002	-0.001
N	104	71	104	71
Panel C: Deletion Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	8.146 *	0.174 **	2.226 ***	0.398 **
Median	0.016 **	0.005	0.027 ***	0.002
N	566	271	566	271
Panel D: Deletion Sample by Firm				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	8.285	0.195	1.173 ***	0.374
Median	0.007	0.006	0.022	0.001
N	160	84	160	84

the bond level. This indicates that inclusion to the S&P 500 index is detrimental to bondholders. This is consistent with the proposition by Kappou, et al (2007) and Chen, et al (2004) that these firms have better access to capital markets and might increase leverage following inclusion. However, when we conduct the analysis at the firm level, the mean and median yield spread changes are negative albeit insignificant. A negative yield change indicates that inclusion to the index benefits bondholders. This result is consistent with Denis, et al (2003) and Kappou, et al (2007) who show that future performance improves following index inclusion. The difference in the bond-level and firm-level results is probably due to the fact that firms with a large number of bonds carry more weight in the bond-level analysis, but their weight diminishes significantly in the firm-level analysis. On the other hand, the results for the newly deleted firms from the S&P 500 index are consistent between the bond-level and firm-level results. The mean and median yield spread changes are positive for the winsorized and unwinsorized samples both the bond-level and firm-level analyses. These findings indicate that bondholders accrue losses during these events, which is not surprising due to the negative reasons for deletion events. We also conduct the same analysis using the relative change in yield spreads and find similar results. These results are available in Table G of the Appendix.

One reason for the insignificant results in the univariate analysis may be that certain information may harm bondholders while other information may be positive for bondholders. Thus in an overall sample, these results become mixed and insignificant. To further explore the nature of the information conveyed through the certification of Standard and Poors, we divide our sample into subgroups and examine the yield spread

changes within each subgroup. We first divide our sample by improvements in operating performance. We use the change in forecasted earnings and divide the sample based on the median change in forecasted earnings. Bondholders in firms with forecasted earnings changes above the median should accrue gains because of the decline in default probability stemming from operating performance improvement. We also divide firms by the median change in leverage. Firms with changes in leverage above the median are more likely to have losses to bondholders. In Table 16, we create four subgroups based upon these breakdowns: high forecasted earnings change and high leverage change, high forecasted earnings change with low leverage change, low forecasted earnings change with high leverage change, low forecasted earnings change with low leverage change. We predict that bonds in the above median forecasted earnings change and below median leverage change (upper right quadrant) will have negative yield spread changes, whereas firms in the opposite group (lower left quadrant) will have positive yield spread changes. The remaining two quadrants have mixed positive and negative effects. In the addition sample, we do not find results consistent with these predictions. None of the results shed any light on the type of information conveyed by Standard and Poors based on the analysis. In Table H of the Appendix, we use realized changes in earnings as an alternate proxy variable for changes in investor expectations of future performance. Tables I and J of the Appendix contain the results using relative change in yield spread.

As a final component of our analysis, we conduct multivariate regressions to explore the determinants of yield spread changes. We include the forecast or realized change in earnings per share as a proxy for the change in investor expectations of future performance and the change in firm leverage to proxy for a firm's access to capital

TABLE 16: Yield Changes Subgroup Analysis

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. We exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. For these sample and control firms, we gather daily pricing data from TRACE, FISD, and Bloomberg and require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The yield spread change (reported as a percentage) is the difference between the yield spread before and after the event announcement date. We divide the sample using two dummy variables. We compute the change in leverage from before the event to after the event and assign firms to a group that is above or below the median leverage change in the addition or deletion sample. Similarly, we calculate the change in EPS forecasts from before to after the event and partition the sample based on the median EPS change. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond

	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	0.337 0.001 ** 79	-0.012 0.028 ** 74	0.104 0.009 79	-0.009 0.030 74
Below Median Forecast EPS Change	-0.051 -0.040 ** 79	0.063 -0.002 ** 51	-0.031 -0.015 79	0.061 -0.002 51

Panel B: Addition Sample by Firm

	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	0.104 -0.019 23	-0.136 0.028 20	-0.051 -0.019 23	-0.134 0.029 20
Below Median Forecast EPS Change	-0.126 * -0.098 28	0.129 0.018 16	-0.116 -0.053 28	0.128 0.018 16

markets. We control for two bond characteristics: an investment-grade rating dummy variable and remaining maturity. We also control for firm size using the log of assets and firm risk using the unlevered stock volatility. Table 17 contains the results of these regressions. In Model 1, we include the realized change in EPS and the change in leverage and add the control variables in Model 2. Models 3 and 4 are similar except that we replace the realized change in EPS with the forecast change in EPS. In Panel A (B), we present the bond-level (firm-level) addition results, and in Panel C (D), we present the bond-level (firm-level) deletion results. For additions, all independent variables are insignificant in predicting the yield spread change. Interestingly, at the bond-level, the leverage change for addition firms is positively (albeit insignificantly) related to yield spread changes, but at the firm-level this relationship is negative. The impact of the realized and forecast EPS changes is also inconsistent between specifications. These sign changes are further confirmation that there is no strong relationship between the bond price reaction to index inclusion and the two types of positive information identified in the literature. For deletion firms at the bond-level (Panel C), the change in leverage is positively related to the yield spread changes in Models 2 and 4 where the control variables are included. This result is consistent with larger increases in leverage being detrimental to bondholders in deletions, however this result does not persist across the other models in the analysis by bond (Models 1 and 3 in Panel C) or in the firm-level analysis (Panel D). Lastly, firm size is positively related (although insignificant) to yield spread changes in both the inclusion and deletion results at the bond-level but negatively related at the firm-level. This likely occurs because large firms typically have more bond issues so their impact is larger in the bond-level results.

TABLE 17: Regression Analysis of Yield Spread Changes

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. For these sample and control firms, we gather daily pricing data from TRACE, FISD, and Bloomberg and require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The yield spread change is the difference between the yield spread before and after the event announcement date. The yield spread changes are reported as percentages. The actual EPS change measures the difference in the average annual EPS in the three year period prior to the index change and the three year period following the index change. The forecast EPS change masures the difference in the forecasted EPS values from prior to after the index change. The leverage change is the change in the leverage level from before the event to after the index change. We have a dummy variable to indicate investment grade bonds and measure the remaining bond maturity in years. For the firm-level regressions, we compute the average time to maturity of all firm bonds. We include the log of assets as firm size and control for the unlevered stock volatility. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

TABLE 17 (continued)

Panel A: Addition Sample by Bond				
	Model 1	Model 2	Model 3	Model 4
Intercept	0.081	-0.109	0.072	-0.122
	1.29	*-0.31*	*1.16*	*-0.34*
Actual EPS Change	-0.003	0.003		
	-0.45	*0.23*		
Forecast EPS Change			0.058	-0.016
			0.39	*-0.10*
Leverage Change	0.632	0.980	0.692	0.958
	0.81	*1.14*	*0.86*	*1.16*
Investment Grade		-0.191		-0.186
		-0.95		*-0.95*
Remaining Maturity		-0.006		-0.006
		-1.10		*-1.09*
Firm Size		0.022		0.023
		0.72		*0.76*
Stock Volatility		3.087		3.047
		0.81		*0.82*
N	283	245	283	245
R-Squared	0.003	0.017	0.003	0.017
Panel B: Addition Sample by Firm				
	Model 1	Model 2	Model 3	Model 4
Intercept	-0.032	0.903	-0.016	0.770
	-0.51	*0.83*	*-0.25*	*0.72*
Actual EPS Change	0.014	0.016		
	0.74	*0.77*		
Forecast EPS Change			-0.185	-0.125
			-1.27	*-0.92*
Leverage Change	-0.744	-0.627	-1.066	-0.904
	-0.71	*-0.59*	*-0.98*	*-0.79*
Investment Grade		0.044		0.041
		0.26		*0.25*
Remaining Maturity		-0.005		-0.004
		-0.59		*-0.46*
Firm Size		-0.072		-0.058
		-0.76		*-0.61*
Stock Volatility		-4.088		-3.859
		-1.09		*-1.03*
N	87	74	87	74
R-Squared	0.030	0.048	0.032	0.043

TABLE 17 (continued)

Panel C: Deletion Sample by Bond				
	Model 1	Model 2	Model 3	Model 4
Intercept	13.367	-7.215	14.704	-0.785
	0.70	*-0.63*	*0.78*	*-0.07*
Actual EPS Change	17.952	0.107		
	1.19	*0.10*		
Forecast EPS Change			-18.112	-7.137 *
			-0.67	*-1.90*
Leverage Change	-252.180	43.509 **	-411.692	37.142 **
	-0.96	*2.45*	*-0.97*	*2.23*
Investment Grade		-4.995		-4.137
		-1.04		*-0.91*
Remaining Maturity		0.357 *		0.326
		1.75		*1.62*
Firm Size		0.627		0.065
		0.78		*0.10*
Stock Volatility		38.316		7.580
		0.83		*0.18*
N	130	98	128	98
R-Squared	0.104	0.179	0.038	0.213
Panel D: Deletion Sample by Firm				
	Model 1	Model 2	Model 3	Model 4
Intercept	89.988	3.114	80.298	10.351
	1.18	*0.29*	*1.04*	*0.72*
Actual EPS Change	34.692	-1.194		
	1.15	*-1.29*		
Forecast EPS Change			3.881	-0.391
			0.11	*-0.12*
Leverage Change	-819.735	21.031	-957.974	20.684
	-1.12	*1.24*	*-0.98*	*1.12*
Investment Grade		-1.004		-1.952
		-0.19		*-0.28*
Firm Avg. Maturity		0.164		0.123
		0.83		*0.63*
Firm Size		-0.581		-0.868
		-0.59		*-0.72*
Stock Volatility		15.447		-27.716
		0.19		*-0.31*
N	39	32	37	32
R-Squared	0.217	0.099	0.093	0.055

3.5 Conclusion

In this study, we investigate the yield spread changes on bonds of firms that are added to or removed from the S&P 500 index. We use the yield spread changes to explore the certification hypothesis, which suggests that Standard and Poors conveys positive (negative) information about firms that they select to add to (remove from) the S&P 500 index. Bondholder wealth effects are particularly suited to exploring the certification hypothesis because changes in long- and short- run demand for equity, liquidity, and investor awareness should not affect bond values. Thus improvements or declines in bond value are only attributable to information about the firm conveyed in the inclusion or removal of the stock from the index. In our overall sample, we do not find significant changes in bond prices for either newly added or newly removed firms from the S&P 500 index. This insignificant finding may stem from the type of information certified by Standard and Poors in announcing index reconstitutions.

Existing literature identifies two types of information that may be conveyed in index changes: improvements in operating performance and better access to capital markets. We attempt to distinguish the type of information conveyed through our univariate and multivariate analysis. First, we partition the sample of addition and deletion firms by the changes in operating performance (measured by realized EPS changes and changes in EPS forecasts) as well as changes in leverage to represent access to capital markets. We then test these subsamples and find no significant results to support the certification hypothesis. Furthermore, we conduct a multivariate regression using our proxy variables for improvements in operating performance and access to capital markets, and these results are insignificant and inconsistent across models.

Therefore, we are not able to distinguish between the type of information certified in the selection of firm to be added or removed from the index.

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APPENDIX

TABLE A: Multivariate Analysis of Excess Returns using Market Model

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the excess abnormal return from the index change announcement date through the implementation date. The cost of capital change is estimated from the market model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Firm age is the log of the number of months between a firm's first appearance in the CRSP database and the announcement month, and we include a dummy variable equal to 1 if the firm traded on the NYSE prior to the index change. The market/book ratio is the ratio of the market value of assets to the book value of assets, where the market value of assets is estimated as the book value of assets minus the book value of equity plus the market value of equity. Parameter estimates are presented with t-statistics below. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE A (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3
Intercept	4.6052 ***	11.0490 *	8.5218
	7.91	*1.79*	*1.40*
COC Change	-0.2974	-0.1848	1.5865 **
	-0.66	*-0.39*	*2.26*
Illiquidity Ratio Change	-74.8330	-64.1982	-81.7575
	-1.09	*-0.92*	*-1.21*
Volume Change	0.3401	0.3883	0.4747
	0.57	*0.64*	*0.81*
Turnover Change	0.0015	0.0011	0.0031
	0.29	*0.22*	*0.60*
ShadowCost Change	-0.0302	-0.0160	0.0547
	-0.96	*-0.48*	*1.37*
Relative Size		-0.3095	-0.0640
		-0.41	*-0.09*
Firm Age		-0.7438	-0.7294
		-1.40	*-1.39*
NYSE Dummy		-0.8405	-0.1022
		-0.78	*-0.09*
Market/Book Ratio			0.2432 *
			1.72
COC Change * Market/Book Ratio			-0.2252 **
			-2.43
N	281	281	278
R-Squared	0.0170	0.0267	0.0799

TABLE A (continued)

Panel B: Deletion firms

	Model 1	Model 2	Model 3
Intercept	-8.4471 ***	-17.1968	-20.7948 *
	-6.59	*-1.56*	*-1.76*
Residual COC Change	0.4705	0.9487	2.9221
	0.56	*1.07*	*0.89*
Illiquidity Ratio Change	0.0108	0.0216	-0.2040
	0.06	*0.11*	*-0.48*
Volume Change	0.7920	0.6326	1.2937
	0.64	*0.51*	*0.81*
Turnover Change	-0.0079	-0.0063	-0.0077
	-1.20	*-0.90*	*-0.98*
ShadowCost Change	-0.1861	-0.1143	0.6212
	-0.18	*-0.10*	*0.49*
Relative Size		1.6395	1.3359
		1.65	*1.29*
Firm Age		-0.3629	0.0364
		-0.20	*0.02*
NYSE Dummy		3.1345	3.3988
		0.88	*0.94*
Market/Book Ratio			0.8912
			0.39
Residual COC Change * Market/Book Ratio			-1.4862
			-0.56
N	99	99	99
R-Squared	0.0231	0.0616	0.0792

TABLE B: Multivariate Analysis of Adjusted Excess Returns

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the excess abnormal return from the index change announcement date through the implementation date. The cost of capital change is estimated from four-factor model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Firm age is the log of the number of months between a firm's first appearance in the CRSP database and the announcement month, and we include a dummy variable equal to 1 if the firm traded on the NYSE prior to the index change. The market/book ratio is the ratio of the market value of assets to the book value of assets, where the market value of assets is estimated as the book value of assets minus the book value of equity plus the market value of equity. Parameter estimates are presented with t-statistics below. All variables are adjusted by subtracting the value for the control firms. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE B (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3
Intercept	5.1295 ***	8.0188 ***	6.8999 ***
	9.30	*6.71*	*5.56*
COC Change	-0.6249	-0.7693	-0.1154
	-1.31	*-1.59*	*-0.18*
Illiquidity Ratio Change	-0.1589	-0.4667	-0.6064 *
	-0.51	*-1.42*	*-1.87*
Volume Change	0.4065	0.5436	0.5495 *
	1.24	*1.64*	*1.70*
Turnover Change	-0.0046	-0.0055	-0.0049
	-1.23	*-1.47*	*-1.34*
ShadowCost Change	-0.0042	0.0002	0.0285
	-0.12	*0.01*	*0.75*
Relative Size		-1.1615 **	-1.6312 ***
		-2.32	*-3.19*
Firm Age		-0.5980	-1.0374 **
		-1.31	*-2.18*
NYSE Dummy		-1.9456 *	-0.3397
		-1.75	*-0.29*
Market/Book Ratio			0.4991 ***
			3.40
COC Change * Market/Book Ratio			-0.0615
			-1.03
N	240	240	236
R-Squared	0.0190	0.0583	0.1212

TABLE B (continued)

Panel B: Deletion firms

	Model 1	Model 2	Model 3
Intercept	-8.8876 ***	-11.5047 ***	-11.9321 ***
	-7.31	*-4.17*	*-3.91*
COC Change	2.2307 **	2.2159 **	1.8707
	2.42	*2.26*	*1.01*
Illiquidity Ratio Change	-0.3599 **	-0.3634 **	-0.3664 *
	-2.07	*-2.00*	*-1.81*
Volume Change	-0.8397	-0.7844	-0.3787
	-0.70	*-0.64*	*-0.26*
Turnover Change	-0.0047	-0.0033	-0.0031
	-0.82	*-0.55*	*-0.51*
ShadowCost Change	-0.2702	-0.3101	-0.1124
	-1.00	*-1.08*	*-0.30*
Relative Size		-0.1141	-0.9300
		-0.11	*-0.81*
Firm Age		0.3446	0.4784
		0.31	*0.43*
NYSE Dummy		2.8798	3.7063
		0.93	*1.16*
Market/Book Ratio			2.0251
			1.41
COC Change * Market/Book Ratio			0.2835
			0.22
N	87	87	87
R-Squared	0.0992	0.1134	0.1377

TABLE C: Multivariate Analysis of Cost of Capital Changes using Market Model

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the change in the cost of capital estimated from the market model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The change in these measures is the difference between the measure before and after the announcement date. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. We measure the average leverage in the three years prior to the announcement date and the three years following the announcement date. The change in leverage is the difference of the average after the announcement and before the announcement date. The abnormal reaction to quarterly earnings announcements is measured for every quarter for days [-1, +1]. We find the average of the abnormal reaction for the 20 quarters preceding and following the announcement date respectively. The change in the quarterly earnings announcement is the difference in the average abnormal reaction following the event and preceding the event. Parameter estimates are presented with t-statistics below. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE C (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	-0.2251 ***	2.1285 ***	2.1486 ***	2.1929 ***
	-2.98	*3.07*	*3.09*	*3.19*
Illiquidity Ratio Change	-3.5263	-4.4920	-4.3349	
	-0.49	*-0.62*	*-0.59*	
Volume Change	-0.0312	-0.0428	-0.0495	
	-0.40	*-0.54*	*-0.61*	
Turnover Change	-0.0043 ***	-0.0046 ***	-0.0046 ***	-0.0046 ***
	-6.84	*-6.92*	*-6.92*	*-7.01*
Shadow Cost Change	0.0156 ***	0.0079	0.0074	0.0073
	3.81	*1.57*	*1.44*	*1.44*
Relative Size		-0.3462 ***	-0.3494 ***	-0.3568 ***
		-3.45	*-3.48*	*-3.59*
Leverage Change		-1.6291 **	-1.7261 **	-1.5934 **
		-2.09	*-2.18*	*-2.08*
Quarterly Earn. Ann.			0.0197	0.0183
Reaction Change			*0.66*	*0.63*
N	281	256	256	256
R-Squared	0.1828	0.2097	0.2111	0.2094

Panel B: Deletion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	0.4876 ***	1.7136 ***	2.1066 ***	3.2855 ***
	3.28	*2.77*	*3.34*	*4.65*
Illiquidity Ratio Change	0.1081 ***	0.1216 ***	0.1287 ***	
	5.17	*5.17*	*5.54*	
Volume Change	-0.3423 **	-0.3693 **	-0.3661 **	
	-2.31	*-2.38*	*-2.42*	
Turnover Change	0.0007	0.0008	0.0006	0.0004
	0.91	*1.02*	*0.73*	*0.47*
Shadow Cost Change	0.0346	0.0034	0.0056	-0.0421
	0.44	*0.04*	*0.07*	*-0.42*
Relative Size		-0.2606 **	-0.3203 **	-0.5219 ***
		-2.09	*-2.57*	*-3.68*
Leverage Change		0.7642	1.1843	0.7309
		0.62	*0.97*	*0.52*
Quarterly Earn. Ann.			-0.0955 **	-0.0635
Reaction Change			*-2.20*	*-1.25*
N	99	91	91	91
R-Squared	0.2656	0.3772	0.4115	0.1569

TABLE D: Multivariate Analysis of Adjusted Cost of Capital Changes

The sample consists of all firms added or deleted from the S&P 500 during the period of 1990 - 2007. We exclude added firms and deleted firms where the added firm acquires the deleted firm, where two index firms merge and the merged firm remains, and where an added firm is a subsidiary spun-off from a deleted firm. The dependent variable in each regression is the change in the cost of capital estimated from the four factor model. The three liquidity measures and shadow cost are measured for a year before and after the inclusion or deletion event beginning one month prior to or after the announcement month. The change in these measures is the difference between the measure before and after the announcement date. The illiquidity ratio is the average of the absolute value of the daily return divided by the dollar volume traded on that day. The illiquidity ratio is multiplied by 10^7. Volume is the log of the average daily number of shares traded multiplied by the closing price. The turnover ratio is the average monthly share volume traded divided by the number of shares outstanding. Finally, the shadow cost is the ratio of the product of the residual standard deviation and firm size divided by the product of the S&P 500 index market capitalization and the number of shareholders. The residual standard deviation is the standard deviation of the difference between the firm's return and the S&P 500 total return. Firm size is measured as the number of shares outstanding multiplied by the closing price on the announcement date. The S&P 500 index market capitalization is measured in dollars on the announcement date. The number of shareholders is measured before the event date at the closest point prior to the event, and the number of shareholders after the event is measured at least nine months after the announcement date. Relative size is the log of the ratio of firm size to the S&P 500 index market capitalization and is measured on the announcement date. Leverage is defined as the ratio of the book value of total debt (long-term debt plus debt in current liabilities) to the market value of assets. The market value of assets is defined as the book value of assets minus the book value of equity plus the market value of equity. We measure the average leverage in the three years prior to the announcement date and the three years following the announcement date. The change in leverage is the difference of the average after the announcement and before the announcement date. The abnormal reaction to quarterly earnings announcements is measured for every quarter for days [-1, +1]. We find the average of the abnormal reaction for the 20 quarters preceding and following the announcement date respectively. The change in the quarterly earnings announcement is the difference in the average abnormal reaction following the event and preceding the event. Parameter estimates are presented with t-statistics below. All variables are adjusted by subtracting the value for the control firms. [* indicates significance at the 10% level, ** at the 5% level, and *** at the 1% level.]

TABLE D (continued)

Panel A: Inclusion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	-0.0679	0.1748	0.1706	0.1587
	-0.91	*1.34*	*1.30*	*1.22*
Illiquidity Ratio Change	-0.0059	-0.0378	-0.0606	
	-0.17	*-1.01*	*-1.35*	
Volume Change	-0.0547	-0.0545	-0.0590	
	-1.23	*-1.01*	*-1.10*	
Turnover Change	-0.0026 ***	-0.0030 ***	-0.0030 ***	-0.0031 ***
	-5.28	*-5.52*	*-5.59*	*-5.85*
Shadow Cost Change	0.0091 *	0.0075	0.0064	0.0073
	1.90	*1.44*	*1.22*	*1.41*
Relative Size		-0.2067 ***	-0.2049 ***	-0.1888 ***
		-2.78	*-2.75*	*-2.65*
Leverage Change		-0.8062	-0.9761 *	-1.0147 *
		-1.51	*-1.78*	*-1.89*
Quarterly Earn. Ann.			0.0411 *	0.0355
Reaction Change			*1.74*	*1.52*
N	240	197	195	195
R-Squared	0.1301	0.2106	0.2219	0.2101

Panel B: Deletion firms

	Model 1	Model 2	Model 3	Model 4
Intercept	0.3639 **	0.3472 **	0.3677 **	0.2910 *
	2.60	*2.21*	*2.36*	*1.78*
Illiquidity Ratio Change	0.3639 **	0.3472 **	0.3677 **	0.2910 *
	2.60	*2.21*	*2.36*	*1.78*
Volume Change	0.0496 **	0.0772 ***	0.0887 ***	
	2.61	*3.57*	*3.95*	
Turnover Change	0.2008	0.2365 *	0.2232 *	
	1.55	*1.88*	*1.79*	
Shadow Cost Change	-0.0001	-0.0001	-0.0003	0.0001
	-0.20	*-0.22*	*-0.48*	*0.10*
Relative Size	0.1227 ***	0.1199 ***	0.1141 ***	0.1161 ***
	3.98	*3.83*	*3.67*	*3.38*
Leverage Change		-0.1060	-0.1573	-0.1889
		-0.85	*-1.24*	*-1.36*
Quarterly Earn. Ann.		0.1020	0.2893	0.7370
Reaction Change		*0.14*	*0.39*	*0.91*
N	87	73	73	73
R-Squared	0.2282	0.3688	0.3946	0.2311

TABLE E: Abnormal Return Breakdown by Information Asymmetry Proxy Variables

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. Research and development is the ratio of research and development expense to total assets. Intangible assets is measured as one minus the sum of property, plant, and equipment plus current assets divided by total assets. Firm size is the log of the market value of equity and the number of shareholders is measured in thousands. The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity. R&D, intangibles, firm size, market to book ratio, and the number of shareholders are calculated for the fiscal year prior to the event date. The earnings announcement reaction is the average three day cumulative abnormal return for the 20 quarters preceding the announcement date. The volatility of EPS is the standard deviation of quarterly earnings per share for the five year periods preceding the announcement date, and we measure the standard deviation of monthly stock returns over the same period. The scaled analyst forecast error is absolute value of the ratio of the difference between the mean analyst forecast of earnings per share and the actual earnings per share divided by the mean forecast. We measure this error for the forecasts during the five years before the event and compute the average. The scaled forecast dispersion is the standard deviation of analyst forecasts divided by the mean forecast. We measure this dispersion for the forecasts during the five years before the event and compute the average over each period. We partition the sample for each proxy variable by the median value. The variable measured is the daily average cumulative abnormal return between the announcement and completion dates of the index change. The last column is the difference between the first and fourth quartiles abnormal returns. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

TABLE E (continued)

Panel A: Addition Sample			
	Below Median	Above Median	Difference
Firm Policy Factors			
Research and Development	0.39	1.04	0.65 **
Intangible Assets	0.69	0.82	0.13 *
Size Factors			
Firm Size	0.99	0.55	-0.44 **
Number of Shareholders	0.64	0.78	0.14
Market/Book Ratio	0.74	0.83	0.09
Variability Factors			
Earnings Announcement Rxn	0.76	0.79	0.03
Volatility of EPS	0.86	0.66	-0.20
Volatility of Returns	0.68	0.84	0.16
Analyst Forecast Factors			
Number of Analysts	0.62	0.90	0.28
Analyst Error	0.65	1.05	0.40 *
Forecast Dispersion	0.79	0.94	0.15
Panel B: Deletion Sample			
	Below Median	Above Median	Difference
Firm Policy Factors			
Research and Development	-0.77	-0.73	0.05
Intangible Assets	-0.81	-0.73	0.08
Size Factors			
Firm Size	-1.11	-0.71	0.40 **
Number of Shareholders	-1.05	-0.58	0.47 **
Market/Book Ratio	-1.26	-0.72	0.54 ***
Variability Factors			
Earnings Announcement Rxn	-0.58	-1.06	-0.48 *
Volatility of EPS	-0.92	-1.17	-0.24
Volatility of Returns	-0.79	-1.15	-0.36 *
Analyst Forecast Factors			
Number of Analysts	-1.03	-0.60	0.43
Analyst Error	-1.05	-0.88	0.16
Forecast Dispersion	-0.78	-0.99	-0.21

TABLE F: Median Analyst Forecast Error Regression Results

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Our final sample contains 382 added firms and 368 deleted firms. The dependent variable in the regressions is the scaled analyst forecast error. The scaled analyst forecast error is absolute value of the ratio of the difference between the median analyst forecast of earnings per share and the actual earnings per share divided by the median forecast. We include the one-year and two-year ahead forecast errors from the five years before and after the event. We include a dummy variable to indicate observations occuring after the event announcement date, and a one year lag of the scaled forecast error. The scaled forecast dispersion is the standard deviation of analyst forecasts divided by the median forecast, and include a one year lag of the scaled forecast dispersion. Research and development is the ratio of research and development expense to total assets. Intangible assets is measured as one minus the sum of property, plant, and equipment plus current assets divided by total assets. Firm size is the log of the market value of equity and the number of shareholders is measured in thousands. The market to book ratio measures the market value of assets to the book value of assets where the market value of assets is calculated as the book value of assets plus the market value of equity minus the book value of equity. R&D, intangibles, firm size, market to book ratio, and the number of shareholders are calculated for the fiscal year prior to the event date. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

TABLE F (continued)

Panel A: Addition Sample				
	Model 1	Model 2	Model 3	Model 4
Post-Event Flag	-0.7257 ***	-2.1312 ***	-0.1487	-2.5983 ***
	-2.76	-3.57	-0.22	-4.30
Number of Analysts	-0.1024 ***	-0.1230 **	0.1064 *	-0.0432
	-3.53	-2.17	1.69	-0.76
Lag Forecast Dispersion	0.1994 ***	0.2230 ***	0.1781 ***	0.1815 ***
	14.99	10.49	8.29	8.47
Research & Development		0.0393	-0.0914	-0.8993
		0.61	-1.40	-1.37
Intangible Assets		0.1320 ***	0.1707 ***	0.1709 ***
		4.72	5.84	5.83
Market/Book Ratio			0.1327	0.1235
			1.30	1.20
Firm Size			-3.7973 ***	
			-7.69	
Firm Size Residuals				-3.6953 ***
				-7.46
R-Squared	0.3003	0.3007	0.3826	0.3274
Number of Observations	4584	2044	2039	2039
Number of Firms	310	143	143	143
Panel B: Deletion Sample				
	Model 1	Model 2	Model 3	Model 4
Post-Event Flag	3.4578 ***	3.1607 **	2.5989 *	2.9272 **
	3.51	2.15	1.75	1.97
Number of Analysts	0.0416	0.0607	0.2971 *	-0.0584
	0.37	0.38	1.71	-0.35
Lag Forecast Dispersion	-0.0127	-0.0578	-0.0698	-0.0664
	-0.41	-1.11	-1.34	-1.27
Research & Development		-0.4922 *	-0.6867 **	-0.6412 **
		-1.68	-2.17	-2.03
Intangible Assets		0.1681 **	0.1744 **	0.1741 **
		2.23	2.15	2.13
Market/Book Ratio			0.2621	0.1799
			0.62	0.42
Firm Size			-3.4789 ***	
			-3.45	
Firm Size Residuals				-2.7713
				-2.79 ***
R-Squared	0.1371	0.1699	0.1826	0.1784
Number of Observations	1702	871	867	867
Number of Firms	120	68	68	68

TABLE G: Univariate Yield Spread Percentage Changes

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. Our initial sample includes 419 additions and deletions, but we exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. For these sample and control firms, we gather daily pricing data from TRACE, FISD, and Bloomberg and require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The percentage yield spread change is the difference between the yield spread before and after the event announcement date divided by the yield spread before the event. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	13.148 ***	1.997	11.880 ***	0.771
Median	0.643	-2.748	1.001 **	-2.159
N	336	181	336	181
Panel B: Addition Sample by Firm				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	9.794	2.341	9.862	1.468
Median	-0.032	0.628	-0.032	0.476
N	104	71	104	71
Panel C: Deletion Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	47.822	12.965 **	20.656 ***	12.461 **
Median	0.794 **	0.448	1.656 ***	0.035
N	566	271	566	271
Panel D: Deletion Sample by Firm				
	Unwinsorized		*Winsorized (5,95%)*	
	Sample Firms	Control Firms	Sample Firms	Control Firms
Mean	42.590	5.203	18.575 *	4.574
Median	-0.036	0.638	1.782 *	0.130
N	160	84	160	84

TABLE H: Yield Changes Subgroup Analysis with Realized EPS Change

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. We exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. We require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The yield spread change is the difference between the yield spread before and after the event announcement date. The yield spread changes are reported as percentages. We divide the sample using two dummy variables. We compute the change in leverage from before the event to after the event and assign firms to a group that is above or below the median leverage change in the addition or deletion sample. Similarly, we calculate the change in realized EPS from before to after the event and partition the sample based on the median EPS change. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	0.059	0.004	0.044	0.005
	-0.043	0.012	0.006	0.017
	62	105	62	105
Below Median Realized EPS Change	0.198	0.097 *	0.031	0.094
	-0.008	0.035	-0.003	0.035
	96	20	96	20
Panel B: Addition Sample by Firm				
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	-0.040	-0.084	-0.050	-0.083
	-0.034	0.025	-0.034	0.025
	22	27	22	27
Below Median Realized EPS Change	-0.009	0.180	-0.114	0.179
	-0.047	0.060	-0.025	0.060
	29	9	29	9

TABLE H (continued)

Panel C: Deletion Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	14.041 **	61.208	11.467 ***	9.570 ***
	3.536 **	-0.132 **	13.999 **	0.633 **
	10	60	10	60
Below Median Realized EPS Change	7.762 **	-0.065	6.650 ***	1.352
	0.090 **	0.139 **	0.090 **	0.149 **
	26	34	26	34

Panel D: Deletion Sample by Firm				
	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	6.734	97.526	5.708	4.159
	0.149	-0.131	0.169	-0.066
	5	12	5	12
Below Median Realized EPS Change	3.629	1.760	3.255	2.770
	0.041	0.131	0.041	0.132
	11	11	11	11

TABLE I: Percent Yield Changes Subgroup Analysis with Forecast EPS Change

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. We exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. We require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The percentage yield spread change is the difference between the yield spread before and after the event announcement date divided by the yield spread before the event. We divide the sample using two dummy variables. We compute the change in leverage from before the event to after the event and assign firms to a group that is above or below the median leverage change in the addition or deletion sample. Similarly, we calculate the change in EPS forecasts from before to after the event and partition the sample based on the median EPS change. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond

	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	25.851 **	5.944 *	19.887 *	6.120 *
	0.465	2.054	0.607	2.118
	79	74	79	74
Below Median Forecast EPS Change	3.091	7.642 **	4.070	7.429 **
	-2.369	-0.372	-0.893	-0.372
	79	51	79	51

Panel B: Addition Sample by Firm

	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	31.417	8.744	28.008	8.865
	-1.126	2.352	-1.126	2.352
	23	20	23	20
Below Median Forecast EPS Change	-5.019	11.397	-0.979	11.227
	-6.306	3.668	-3.099	3.668
	28	16	28	16

TABLE I (continued)

Panel C: Deletion Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	-304.504 -15.104 * 7	30.452 -10.554 * 37	-11.089 -1.721 *** 7	45.619 -7.978 *** 37
Below Median Forecast EPS Change	149.257 ** 78.070 * 27	326.715 3.781 * 57	140.958 ** 78.677 *** 27	34.398 *** 16.860 *** 57
Panel D: Deletion Sample by Firm				
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Forecast EPS Change	-513.876 -13.531 4	16.590 -5.083 11	-3.464 -0.756 ** 4	20.682 -7.978 ** 11
Below Median Forecast EPS Change	199.952 13.413 10	503.846 9.607 12	196.886 13.413 ** 10	19.211 11.588 ** 12

TABLE J: Percent Yield Changes Subgroup Analysis using Realized EPS Changes

Our sample includes all newly added and removed firms from the S&P 500 Index from 1990 through 2007. We exclude those sample firms associated with the following types of index changes: (1) When a non-index firm acquires and replaces an existing index firm, (2) when an S&P 500 firm acquires another index firm and the acquired firm is removed from the index, (3) when two existing index firms merge and the resulting merged firm remains on the index, and (4) when an index firm is replaced by a spun-off subsidiary. Matched pairs are firms in the same 3-digit SIC code closest in size to the sample firm based on sales. We require that bonds have a valid price in both the [-30, Announcement date] and [Completion date, +30] windows to compute yield spread changes. The yield spread is the difference between the yield to maturity and the value from the Treasury yield curve with the same maturity. The percentage yield spread change is the difference between the yield spread before and after the event announcement date divided by the yield spread before the event. We divide the sample using two dummy variables. We compute the change in leverage from before the event to after the event and assign firms to a group that is above or below the median leverage change in the addition or deletion sample. Similarly, we calculate the change in realized EPS from before to after the event and partition the sample based on the median EPS change. [***, **, and * denote significance at the 1-percent, 5-percent, and 10-percent levels, respectively.]

Panel A: Addition Sample by Bond

	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	21.301 -2.238 62	5.560 ** 1.506 105	18.949 0.322 62	5.684 ** 1.700 105
Below Median Realized EPS Change	10.060 ** -0.369 96	12.289 1.866 20	7.477 * -0.236 96	11.747 1.866 20

Panel B: Addition Sample by Firm

	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	28.425 -0.803 22	5.156 3.660 27	31.730 1.053 22	5.246 4.112 27
Below Median Realized EPS Change	-1.493 -5.725 29	24.224 2.558 9	-2.803 -1.874 29	23.923 2.558 9

TABLE J (continued)

Panel C: Deletion Sample by Bond				
	Unwinsorized		*Winsorized (5,95%)*	
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	-14.526 46.451 * 10	303.536 -3.485 * 60	191.593 78.253 ** 10	33.721 *** 6.218 ** 60
Below Median Realized EPS Change	78.489 ** 6.646 * 26	45.869 7.957 * 34	69.590 *** 6.646 ** 26	48.300 8.630 ** 34

Panel D: Deletion Sample by Firm				
	Above Median Leverage Change	*Below Median Leverage Change*	*Above Median Leverage Change*	*Below Median Leverage Change*
Above Median Realized EPS Change	-85.085 -1.721 5	494.941 -4.310 12	323.373 8.916 5	12.615 -2.123 12
Below Median Realized EPS Change	33.315 3.267 11	28.324 10.290 11	30.469 3.267 11	29.414 * 12.887 11