NEW EVIDENCE FROM S&P 500 INDEX DELETIONS

Rashiqa Kamal, University of Wisconsin-Whitewater

ABSTRACT

Kamal, Lawrence, McCabe, and Prakash (2012) argue that information asymmetry exists in the financial markets and additions to S&P 500 Index convey new information about the added firms to the uninformed investors. They further argue that because of important changes and regulations in the financial markets, like, Regulation Fair Disclosure, Sarbanes-Oxley Act, and Decimalization of the exchanges, in or after the year 2000, information asymmetry has decreased. In support of their arguments, they find that for additions, the positive abnormal returns on announcement day have decreased, and added stocks' liquidity changes have become marginal in the post-2000 period. We extend their work and for a sample of deletions between October 1989 and December 2011, we find that the negative abnormal returns on the announcement day are not significantly different in the post-2000 period, but the negative returns are reversed earlier in the post-2000 period. Contrary to our expectation, liquidity changes after deletion are significant in the post-2000 period. However, when we divide our sample into optioned versus non-optioned stocks and control for other factors that affect liquidity, we find that liquidity changes after deletion are insignificant in the post-2000 period.

JEL: G12; G14

KEYWORDS: S&P 500 Deletions, Information Asymmetry, Liquidity Changes

INTRODUCTION

Research on additions to and deletions from the Standard and Poor's (S&P) 500 Index has recorded significant abnormal returns (Shleifer, 1986, Beneish and Whaley, 1996, 2002, Lynch and Mendenhall, 1997, Dash, 2002, and Chen, Noronha and Singal 2004, 2006a, b) and changes in liquidity (Beneish and Whaley, 1996, Erwin and Miller, 1998, and Hegde and McDermott, 2003) around these events. Several theories have been put forward to explain the price effects around index changes. The downward-sloping demand curve hypothesis (Shleifer, 1986) argues that index funds, which buy stocks added to the S&P 500 to replicate the market, drive price movements associated with S&P 500 inclusion announcements. However, the information hypothesis (Jain, 1987, Dhillon and Johnson, 1991, Denis, McConnell, Ovtchinnikov and Yu, 2003) states that inclusion in the index conveys positive information about the stock and thus, drives up the price. Cai (2007) argues that addition to the S&P 500 Index conveys favorable information about the stock and the industry and hence, can be considered a partial explanation for the positive price effect of additions to the S&P 500.

Recently, Kamal, Lawrence, McCabe and Prakash (2012) argue that additions to the S&P 500 provide information about the performance and future prospects of a firm and hence, reduce the informational asymmetry amongst investors, resulting in a significant positive abnormal return and an increase in stock liquidity on the announcement of firm's addition to S&P 500 (pg. 381). Kamal et al. (2012) further argue that the information environment has changed after the year 2000 due to important regulations and changes in the financial markets. They categorize the additions to the S&P 500 Index into two sub-periods, namely, pre- and post-2000 periods and show that for additions to the S&P 500, abnormal returns have reduced in the post-2000 period, whereas, liquidity of the added firms' stock has become marginal. In light of their arguments, it would be worthwhile to test whether deletions from S&P 500 also experience similar changes in abnormal returns and liquidity around the announcement and effective days in pre- and post-2000 periods. Even though there is a plethora of literature around S&P 500 Index changes, Chen, Noronha and Singal (2004) rightly observe that most of the researchers have focused on

additions. Hegde and McDermott (2003) argue that deletions have unique characteristics that make them noisier events than additions to study (pg. 452). Even though the two aforementioned studies have attempted to address deletions, as such, it is fair to say that there is still a void in the literature regarding the study of deletions from the S&P 500. A recent study by Ivanov (2010) uses a sample of discretionary deletions between October 1989 and December 2007 and shows that firms with analyst following, after deletion, experience an increase in earnings forecasts and actual forecasts, which is contrary to the predictions of the information hypothesis. If Kamal et al (2012)'s observation that the information environment has changed after the year 2000 is accurate, then it could be possible that Ivanov (2010)'s results are affected by this phenomenon.

The purpose of this study is to extend the work of Kamal et al (2012) to deletions from the S&P 500 Index, in an attempt to fill the void in this area of research. We study deletions from the S&P 500 Index between October 1989 to December 2011, and divide the sample period into pre- and post-2000 periods. Researchers have found significant negative abnormal returns around the announcement day and effective day of stocks deleted from the S&P 500 (Lynch and Mendenhall, 1997; Dash, 2002; Beneish and Whaley, 2002), and significant decrease in liquidity after announcement, of deleted stocks (Beneish and Whaley, 1996, and Hegde and McDermott, 2003). Extending the argument of Kamal et al (2012) to deletions, due to reduced information asymmetry in the post-2000 period, we expect the negative abnormal return on the announcement day of deletions to be significantly smaller or marginal in the post-2000 period, as compared to the pre-2000 period. We also expect the increase in the relative bid-ask spread (or the decrease in liquidity) after deletion to be marginal in the post-2000 period, as compared to the pre-2000 period. Using standard event-study methodology, we calculate the average abnormal returns on announcement day for deletions and compare them across the pre- and post-2000 periods.

We find that for the sample of deletions, the average abnormal return on the announcement day is negative and insignificant in the post-2000 period but it is not significantly different from the negative average abnormal return in the pre-2000 period. The same is true for the cumulative abnormal returns between the announcement day and the effective day. However, we find that in the post-2000 period the negative cumulative abnormal returns are reversed in 20 days after the effective day, as compared to in 60 days after the effective day in the pre-2000 period. We argue that the early reversal of abnormal returns in the post-2000 period can be attributed to reduced information asymmetry in the post-2000 period, as found for additions to S&P 500, by Kamal et al (2102). Then we calculate and compare the average relative bid-ask spreads before and after announcement of deletion, in the pre- and post-2000 periods. Contrary to our expectation, we find that even though the relative spread is smaller in magnitude in the post-2000 period, the increase in spread is significant in the post-2000 period.

Erwin and Miller (1998) and Kamal et al (2012) argue that due to informational efficiencies already achieved by optioned stocks, optioned and non-optioned stocks behave differently on addition to the S&P 500 Index. Following them, we separate our sample of deleted stocks into optioned and non-optioned stocks, that is stocks that were trading options at the time of announcement of deletion, and stocks that were not trading options at the time of announcement of deletion, and compare the changes in relative spread before and after announcement, in the pre- and post-2000 periods, by setting up a multivariate regression. After controlling for price, volume, and return variance, as expected, we find that the changes in spread of non-optioned stocks are insignificant in the post-2000 period. However, we are cautious in evaluating these results because of the limited sample size for the pre-2000 period. Overall, our results show some evidence that the information environment has changed in the post-2000 period, with respect to deletions from the S&P 500 Index. The rest of the paper is organized in the following way: the next section reviews the literature briefly, followed by the section on data and methodology. Results are discussed after that, and the last section concludes.

LITERATURE REVIEW

The abnormal returns followed by additions to or deletions from the S&P 500 Index have been a widely researched phenomenon. Several authors have put forward various theories to explain these returns. One of the explanations for the price changes around additions to and deletions from the S&P 500 index is the price pressure effect. Evidence of temporary price pressure is presented by Harris and Gurel (1986) who find a reversal of the initial price response, associated with additions to or deletions from the S&P 500. Lynch and Mendenhall (1997) show that a part of the price decrease resulting from deletions, remains permanent and that it cannot be explained by price pressure effect. Dash (2002) shows that the short-term price reactions, associated with deletions from the index are reversed within six days. Chen, Noronha and Singal (2004, 2006a) find a temporary price effect for deletions from the S&P 500 index and they put forward the concept of "investor awareness" which states that increased investor awareness for added stocks and a corresponding smaller drop in the awareness for deleted stocks can explain asymmetric price effect around additions to and deletions from S&P 500 Index.

However, Beneish and Whaley (2002) present evidence that suggests that deleted firms do not fully recoup their losses, thus they might have information content. Denis, McConnell, Ovtchinnikov and Yu (2003) examine a sample of additions between 1987 and 1999 and find that these firms experience an increase in realized earnings per share and forecasted earnings per share. As such, their findings support the information hypothesis of the price reaction to index additions. Extending their work, Ivanov (2010) tests whether discretionary deletions from the S&P 500 display similar information content and finds that contrary to the predictions of the information hypothesis, the earnings forecasts and actual earnings of deleted firms increase, on average. Recently, Kamal, Lawrence, Prakash and McCabe (2012) analyze additions to the S&P 500 index by dividing them into pre- and post-2000 periods and find that the positive abnormal returns around the announcement day decreased significantly in the post-2000 period.

They also find that the change in the liquidity of added stocks has become marginal in the post-2000 period. They attribute these findings to the changes in the information environment in the post-2000 period. They argue that passage of important regulations in the post-2000 period (namely, Regulation Fair Disclosure in October 2000, Decimalization of NYSE and NASDAQ in 2001, and Sarbanes-Oxley Act in October 2002) has decreased the information asymmetry in this period and hence, announcements of additions to S&P 500 are not as informative as they used to be in the pre-2000 period.

Another possible explanation for the price effects is the liquidity hypothesis that states that inclusion in an index may have valuation consequences because it increases a stock's liquidity. The supporters of this view (like, Erwin and Miller, 1998) argue that inclusion may result in greater institutional interest in the stock leading to an increase in public information about it. As a result, the stock will be held more widely, will become more liquid and the bid-ask spread will fall which lowers the required rate of return on the stock and leads to a price increase. Erwin and Miller (1998) use a sample of 109 additions over the period 1984-1989 and examine the changes in stock liquidity when the stock is added to S&P500 and find a significant decrease in the bid-ask spread upon addition to S&P 500 for the stocks that were not trading listed options. They also find that these liquidity effects are mitigated for those stocks that were already trading listed options and the reduction in bid-ask spread is more prominent for the non-optioned stocks.

Beneish and Whaley (1996) study a sample of 103 additions between 1989 and 1994 and find that spread decreases after announcement. Hegde and McDermott (2003) use a sample of 74 (27) firms over the period 1993-1998 and find a sustained increase (decrease) in the liquidity of added (deleted) stocks. The explanation for the change in liquidity is supported by sound theoretical arguments. According to Shleifer (1986), addition of stocks to S&P 500 may result in closer scrutiny of firm by analysts and investors leading to greater institutional interests, large trading volumes and lower bid-ask spreads. Hegde and McDermott (2003) argue that change in the composition of equity ownership may increase the

proportion of liquidity-motivated traders and greater competition amongst informed traders leading to improvement in the liquidity of added stock.

DATA AND METHODOLOGY

The S&P 500 index started pre-announcing index changes beginning in October 1989; hence, in this paper, the sample period covers deletions from October 1989 to December 2011. We examine the abnormal returns around announcement (AD) and effective days (ED) for the entire period and then split up the period into pre- and post-2000 years. Following Kamal et al (2012), we define deletions occurring up to September 2000 as the pre-2000 period and deletions occurring after that period as the post-2000 period. We exclude deletions announced in October 2000 when Regulation Fair Disclosure was implemented. Some of the reasons that S&P removes a company from the 500 Index are the filing of Chapter 11 by the company or approval of an alternative recapitalization plan by the shareholders of the company that changes the company's debt/equity mix or cessation of the company in its current form due to reasons like mergers, acquisitions, and takeovers. Chen et al (2004) argue that due to requirement of post-announcement data, the sample will be biased because firms that cease to exist after the announcement will not be included in the sample.

Hence, we follow the methodology of Chen et al (2004) to create a "survivorship bias" free sample, and after excluding deletions that resulted from mergers, acquisitions, spinoffs, bankruptcies, liquidation proceedings, and leveraged buyouts, our sample consists of 120 deletions. Fifty-one of these are announced in the pre-2000 period and 69 are announced in the post-2000 period. Daily returns required to calculate the abnormal returns are obtained from Center for Research in Security Prices (CRSP). Firms for which returns were not available for 245 days prior to announcement date were dropped because these returns were used to compute the beta for calculation of risk-adjusted returns. After imposing these data requirement restrictions, and one outlier, the final sample consists of total 115 deletions, out of which 51 were announced in the pre-2000 period and 64 were announced in the post-2000 period. For liquidity tests, to test for a change in the bid-ask spread when a stock is deleted from S&P 500 we obtain daily bid and ask closing quotes during the period 30 trading days before and 30 trading days after the announcement of deletion for each stock. We eliminate all firms with data less than 58 days. Daily stock spread data, stock price, return and trading volume data are obtained from the CRSP database. After excluding the firms with unavailable data there are 42 firms in our pre-2000 sample and 48 firms in the post-2000 sample, for liquidity tests. Information of option trading is obtained from "CBOE Equity Option Volume Archive", http://www.cboe.com/data/AvgDailyVolArchive1998.aspx, and since this information is available only for the year 1998 and forward, our pre-2000 sample is reduced to only 15 deletions. Out of these 15 deletions, eight stocks trade options at the time of deletion announcement, and seven do not trade options. In the post-2000 sample, at the time stocks were deleted from the S&P 500 index, 42 were trading listed options while 6 were not.

This paper basically follows the methodology of Kamal et al (2012). To calculate the average abnormal returns (AARs) and the cumulative abnormal returns (CARs), we use the standard event-study methodology, with the announcement date of deletion as the event date. To compare liquidity changes around announcement date of deletions, in the pre- and post-2000 period, we calculate the absolute spread as the difference between the ask and bid prices. The relative spread is the absolute spread divided by the mean of the ask and bid prices. Similar to Erwin and Miller (1998) and Kamal et al (2012), we test for changes in bid-ask spread while controlling for share price, trading volume and return variance. Return variance on day t is estimated using the variance of the stock's return over the five-day period immediately preceding day t. The following multivariate model is estimated:

$$Spread_{it} = \lambda_0 + \lambda_1 TimeDummy_{it} + \lambda_2 Price_{it} + \lambda_3 Volume_{it} + \lambda_4 Variance_{it} + \varepsilon_{it} \qquad (1)$$

where $Spread_{it}$, $Price_{it}$, $Volume_{it}$, and $Variance_{it}$, are the relative bid-ask spread, the closing share price, the trading volume and an estimate of return variance, respectively. $TimeDummy_{it}$ is a dummy variable which equals 1(0) in the 30 trading days before (after) announcement day for firm i on day t. Table 1 presents the summary statistics for 42 (48) firms deleted from the S&P 500 Index in the pre (post)-2000 period, 30 trading days before, and 30 trading days after the announcement of deletion. The table reports the mean, median and standard deviation for the relative spread, the closing share price, the adjusted volume, and the return variance.

Table 1: Summary Statistics for 90 Firms Deleted from the S&P 500 Index between October 1989 and December 2011

		Pre-2000 period (42 firms)			Post-2000 period (48 firms)		
		Mean	Median	Stdev	Mean	Median	Stdev
30 days before deletion	Relative Spread	0.030	0.025	0.022	0.005	0.002	0.010
	Price	20.18	13.38	23.83	15.88	11.65	14.93
	Volume	585,239	124,000	1,707,550	6,324,206	2,391,900	22,775,069
	Return variance	0.001	0.0004	0.001	0.004	0.001	0.15
30 days after deletion	Relative Spread	0.032	0.024	0.026	0.006	0.002	0.010
	Price	17.86	13.13	23.27	13.86	10.50	13.58
	Volume	741,862	244,000	1,727,751	9,630,464	3,287,450	26,453,010
	Return variance	0.001	0.001	0.002	0.009	0.001	0.037

This table shows the mean, median and the standard deviation for the relative bid/ask spread, the closing share price, adjusted volume, and the return variance for 42(48) firms deleted in the pre(post)-2000 period, 30 trading days before and 30 trading days after the announcement of deletion. The relative spread is the absolute spread (difference between ask and bid prices) divided by the mean of the ask and bid prices. Return variance on day t is estimated using the variance of the stock's return over the five-day period immediately preceding day t.

RESULTS AND DISCUSSION

Panel A of Table 2 shows that for the entire sample of 115 deletions from October 1989 to December 2011, the announcement day average abnormal return is -3.26% and it is significant at the 1% level. This result is consistent with previous research (like, Chen et al, 2004, find significant abnormal returns equal to -7.82% for 16 deletions between March 1990 and April 1995). Panel B of Table 2, reports the announcement day average abnormal return for the pre-2000 period sample as significant -4.34%, and the post-2000 sample has an insignificant return of -2.40%. However, these returns are not significantly different (t-stat=1.16). This shows that our results for deletions do not support the results for additions to S&P 500 as presented by Kamal et al (2012), and we find that the negative abnormal returns around the announcement days of deletions are not significantly different in the pre- and post-2000 periods.

Table 2: Announcement Day Average Abnormal Return For Deletions from the S&P 500 Index

Panel A: For all deleted firms 1989-2011 (115 firms)				
AAR		t-stat		
-3.26%***		3.59		
Panel B: Comparison of Pre- versus Post-2000				
Pre-2000 (51 firms)		Post-2000 (64 firms)		Comparison of Pre- versus Post-2000
AAR	t-stat	AAR	t-stat	t-stat
-4.34%***	7.23	-2.40%	1.54	1.16

*This table presents the announcement day average abnormal return (AAR) for firms deleted from the S&P 500 during October 1989-December 2011, in Panel A, and in the pre- and post-2000 period, in Panel B. Deletions occurring up to September 2000 are defined as the pre-2000 period and deletions occurring after that period as the post-2000 period. AARs are calculated using the standard event-study methodology. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Next, we examine the permanence of the negative abnormal returns. Table 3 presents the cumulative abnormal return for deletions between the announcement day and the effective day, and 20 and 60 days

after the effective day. Previous research has shown that the negative announcement day average abnormal returns around deletions from the S&P 500 are not permanent and that the effect is reversed shortly (Chen et al, 2004, find that for 46 deletions between 1996 and 2001, the stocks recover their losses 60 days after the effective day). For this analysis, our sample is reduced to 106 firms because we need data after 60 days from the effective day. Panel A of Table 3 shows the cumulative abnormal return for the entire sample period and overall our results support the findings in the current literature. We find that the negative cumulative abnormal returns are reversed within 20 days (0.22%) after the effective day but it is significantly reversed only after 60 days (0.27%) of the effective day. Panel B of Table 3 presents the cumulative abnormal return for the deletions in the pre- and post-2000 period.

The results show that the cumulative abnormal return between announcement day and effective day is negative and significant in both pre- and post-2000 periods, but they are not significantly different from each other. The interesting result here is that the negative abnormal returns are reversed earlier in the post-2000 period. Panel B of Table 3 shows that the cumulative abnormal return between announcement day and 20 days after effective day is significant -0.20%, and in the post-2000 period, it is significant 0.58%. These returns are significantly different from each other. Furthermore, the cumulative abnormal returns between the announcement day and 60 days after the effective day are insignificant in the pre-2000 period but positive and significant in the post-2000 period. This result suggests that in the post-2000 period, the negative returns around deletions do not last as long as in the pre-2000 period. This result indicates that probably the announcement of deletion does not convey much new information in the post-2000 period, or information asymmetry has decreased in the post-2000 period.

Table 3: Cumulative Abnormal Return for Deletions from the S&P 500 Index

Panel A: For all deleted firms 1989-2011 (106 firms)				
	CAR		t-stat	
AD	-3.99%***		3.69	
AD to ED	-2.54%***		3.63	
AD to ED+20	0.22%		1.42	
AD to ED+60	0.27%***		3.24	
Panel B: Comparison of Pre- versus Post-2000				
	Pre-2000 (49 firms)		Post-2000 (57 firms)		Comparison of Pre- versus Post-2000
	CAR	t-stat	CAR	t-stat	t-stat
AD	-4.21%***	7.23	-3.79%**	1.94	0.20
AD to ED	-2.20%***	6.15	-2.83%***	2.23	0.48
AD to ED+20	-0.20%***	2.15	0.58%***	2.15	2.73***
AD to ED+60	0.03%	0.53	0.47%***	3.36	2.90***

*This table presents the cumulative abnormal return (CAR) for firms deleted from the S&P 500 during October 1989-December 2011, in Panel A, and in the pre- and post-2000 period, in Panel B. Deletions occurring up to September 2000 are defined as the pre-2000 period and deletions occurring after that period as the post-2000 period. CARs are calculated using the standard event-study methodology. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.*

Overall, from the results presented in Tables 2 and 3, we do not find that the abnormal returns around the announcement of deletions from the S&P 500 have changed much in the pre- and post-2000 period. Even though our results do not show significant difference in the two sub-periods, for completeness' sake, following Kamal et al (2012), we also estimate a multivariate regression with the announcement day average abnormal return as the dependent variable and a dummy variable for the pre-2000 period, a dummy variable for technology firms, a dummy variable for the exchange on which the stock is listed, a dummy variable for bull market, log of the relative size, and shadow cost, as independent variables (pg. 391). We did not find any significance in this regression; hence, the results are not reported here.

Another way that we want to test whether the information content of deletions' announcement has changed in the post-2000 period is to examine the change in liquidity of the deleted stocks before and after announcement, in the pre- and post-2000 period. Table 4 presents the results of this examination. We

calculate the relative bid-ask spread for the 30 days before and 30 days after the announcement of deletion for the entire sample, and for the pre- and post-2000 sample periods. Column 1 of Table 4 shows that for the entire sample, the relative bid-ask spread for deleted stocks significantly increases in the period after the announcement of the deletion. Columns 2 and 3 of Table 4 report the relative bid-ask spread in the pre- and post-2000 periods, respectively. We find that the relative spread increases (hence, liquidity decreases) in both the sub-samples but the spread increases significantly in the post-2000 period. This finding is contrary to our expectation that if information asymmetry has reduced in the post-2000 period, there should be insignificant increase in the spread of deleted stocks in the post-2000 period.

Table 4: Relative Bid-Ask Spread before and after Announcement of Deletion from S&P 500 Index

	Complete Sample (1989-2011)	Pre-200 period	Post-2000 period
Spread before index deletion	0.0168	0.0303	0.0049
Standard Deviation	0.0208	0.0217	0.0100
Spread after index deletion	0.0181	0.0317	0.0061
Standard Deviation	0.0228	0.0257	0.0098
T-stat for equality	2.23	1.48	3.13
p-value	0.03	0.14	0.002
Number of stocks	90	42	48

This table presents the average relative bid-ask spreads before and after deletions from the S&P 500 index. Relative spread is the absolute spread divided by the mean of the ask and bid prices. Average spread is the difference between ask and bid prices. The spreads prior to deletion are calculated over the 30 trading days before announcement date of deletion and the spreads in the post deletion period are calculated over 30 trading days after the announcement date of deletion. Column 1 presents the relative bid-ask spread for the entire sample, and columns 2 and 3 present the spreads in the pre- and post-2000 periods, respectively.

Research has shown that spread can also be affected by other factors, so next, we estimate regression equation (1) described in the previous section.

$$Spread_{it} = \lambda_0 + \lambda_1 TimeDummy_{it} + \lambda_2 Price_{it} + \lambda_3 Volume_{it} + \lambda_4 Variance_{it} + \varepsilon_{it} \qquad (1)$$

where $Spread_{it}$, $Price_{it}$, $Volume_{it}$, and $Variance_{it}$, are the relative bid-ask spread, the closing share price, the trading volume and an estimate of return variance, respectively. $TimeDummy_{it}$ is a dummy variable which equals 1(0) in the 30 trading days before (after) announcement day for firm i on day t. Results are presented in Table 5. The univariate results in Table 4 are also supported by the multivariate results presented in Table 5. TimeDummy is a dummy variable that is equal to 1 (0) in the 30 days trading day before (after) announcement of deletion from the S&P 500 Index. According to our hypothesis, we expect this time dummy variable to be negative (indicating an increase in spread after announcement of deletion) and insignificant in the post-2000 period. In Table 5, we find that the in the post-2000 period, the increase in the spread after deletion is significant at the 10% level, whereas, it is insignificant in the pre-2000 period. This is contrary to our expectation.

Table 5: Multivariate Regression for Relative Spread of Deletions from the S&P 500 Index

	Pre-2000 period	Post-2000 period
Intercept	0.032***	0.008***
Time Dummy	0.0004	-0.0007*
Price	-0.0002***	-0.0002***
Volume	-0.000***	0.000
Variance	2.935***	0.037***
Adjusted R^2	0.1390	0.0742

This table presents the estimates for the following multivariate model: $Spread_{it}=\lambda_0+\lambda_1 TimeDummy_{it}+\lambda_2 Price_{it}+\lambda_3 Volume_{it}+\lambda_4 Variance_{it}+\varepsilon_{it}$ where $Spread_{it}$, $Price_{it}$, $Volume_{it}$, and $Variance_{it}$, are the relative bid/ask spread, the closing share price, the trading volume and an estimate of return variance, respectively. $TimeDummy_{it}$ is a dummy variable which equals 1(0) in the 30 trading days before (after) announcement day for stock i on day t. Return variance on day t is estimated using the variance of the stock's return over the five-day period immediately preceding day t. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

Erwin and Miller (1998) show that changes in liquidity after addition to the S&P 500 index can also be affected by option trading status of the stock at the time of announcement because they find that optioned

stocks show no change in liquidity while the non-optioned stocks show a significant increase in liquidity after addition. They argue that this happens because optioned stocks have already achieved informational efficiencies, while non-optioned stocks have not. Kamal et al (2012) argue that in the post-2000 period, if information asymmetry decreases then non-optioned stocks should show diminished or no liquidity changes. This argument should be true for deletions as well. We also extend our analysis and examine liquidity changes of optioned versus non-optioned stocks in the pre- and post-2000 period. Results are presented in Tables 6 and 7. However, we need to point out a limitation of these results. Since the data on option trading is obtained from Chicago Board of Option Exchange's options archives page and it reports this information only for the year 1998 and forward, the number of deleted firms in the pre-2000 period (15 firms) is small as compared to in the post-2000 period (48 firms). The results should be viewed in light of this limitation. In Table 6, the results indicate that in the pre- and post-2000 periods, the spread for optioned stocks increases significantly, or the liquidity decreases, after the announcement of deletion. For non-optioned stocks, again contrary to expectation, the spread increases significantly after the announcement of deletion from the index.

Table 6: Relative Bid-Ask Spread before and after Announcement of Deletion for Optioned and Non-Optioned Stocks

	Pre-2000 period		Post-2000 period	
	Optioned	Non-optioned	Optioned	Non-optioned
Spread before index deletion	0.0325	0.0316	0.0059	0.0033
Standard Deviation	0.0214	0.0346	0.0106	0.0053
Spread after index deletion	0.0391	0.0300	0.0061	0.0046
Standard Deviation	0.0315	0.0331	0.0105	0.0061
T-stat for equality	2.68	-0.74	2.32	2.81
p-value	0.008	0.46	0.02	0.005
Number of stocks	8	7	42	6

This table presents the average relative bid-ask spreads before and after deletion from the S&P 500 index, for optioned and non-optioned stocks, in the pre- and post-2000 periods. Relative spread is the absolute spread divided by the mean of the ask and bid prices. Average spread is the difference between ask and bid prices. The spreads prior to deletion are calculated over the 30 trading days before announcement date of deletion and the spreads in the post deletion period are calculated over 30 trading days after the announcement date of deletion.

In Table 7, we estimate the multivariate regression equation (1) for optioned and non-optioned stocks in the pre- and post-2000 periods. As can be seen in Table 7, the liquidity change after deletion for non-optioned stocks in the post-2000 period is insignificant (the time dummy variable is insignificant). This is in accordance with our expectation.

Table 7: Multivariate Regression for Relative Spread of Deletions for Optioned and Non-Optioned Stocks

	Pre-2000 period		Post-2000 period	
	Optioned	Non-optioned	Optioned	Non-optioned
Intercept	0.0594***	0.0278***	0.0075***	0.0050***
Time Dummy	-0.0044***	0.0053***	-0.0004	-0.0005
Price	-0.0022***	-0.0003***	-0.0002***	-0.0001***
Volume	-0.0000***	0.0000***	-0.0000	-0.0000
Variance	1.3578***	1.9154***	0.0381***	0.5100***
Adjusted R^2	0.335	0.239	0.061	0.1427

This table presents the estimates for the following multivariate model, for optioned and non-optioned stocks: $Spread_{it}=\lambda_0+\lambda_1 TimeDummy_{it}+\lambda_2 Price_{it}+\lambda_3 Volume_{it}+\lambda_4 Variance_{it}+\varepsilon_{it}$ where $Spread_{it}$, $Price_{it}$, $Volume_{it}$, and $Variance_{it}$, are the relative bid/ask spread, the closing share price, the trading volume and an estimate of return variance, respectively. $TimeDummy_{it}$ is a dummy variable which equals 1(0) in the 30 trading days before (after) announcement day for stock i on day t. Return variance on day t is estimated using the variance of the stock's return over the five-day period immediately preceding day t. ***, **, and * indicate significance at the 1, 5 and 10 percent levels respectively.

CONCLUDING COMMENTS

This paper revisits the abnormal returns and liquidity changes around deletions from the S&P 500 Index, in light of new research that argues that the information environment in the financial markets has changed

after the year 2000, because of major regulations passed in and after year 2000. By examining and comparing deletions in the pre- and post-2000 periods, we find some effect of decreased information asymmetry in the post-2000 period on deletions. Our results indicate that the average abnormal returns on the announcement day of the deletion are not significantly different in the post-2000 period, from in the pre-2000 period. However, we do find evidence that the negative abnormal returns after deletion from the S&P 500 Index are reversed earlier in the post-2000 period from the pre-2000 period.

This could probably be because of reduced information asymmetry in the post-2000 period. We also find that contrary to our expectations, the average relative bid-ask spread after the announcement of deletion increases significantly (that is, liquidity after announcement of deletion decreases) in the post-2000 period. If there is reduced information asymmetry in the post-2000 period, we should see only a marginal increase in the spread in the post-2000 period. However, when we examine optioned versus non-optioned stocks and control for other factors that affect the relative spread, namely, closing price, trading volume, and return variance, we find insignificant increase in the spread after announcement of deletion, in the post- 2000 period, for non-optioned stocks. This is consistent with our expectations. As is true for past studies on deletions from the S&P 500 Index, the small sample size is obviously a limitation of this study.

REFERENCES

Beneish, M. D. and R. E. Whaley (1996) "An anatomy of the 'S&P 500 game': the effects of changing the rules," *Journal of Finance* 51 (5), 1909-1930

Beneish, M. D. and R. E. Whaley (2002) "S&P 500 index replacements: A new game in town," *The Journal of Portfolio Management* 29 (1), 51-60

Cai, J (2007) "What's in the news? Information content of S&P 500 additions," *Financial Management* 36 (3), 113-124

Chen, H., G. Noronha, and V. Singal (2004) "The price response to S&P 500 index additions and deletions: evidence of asymmetry and a new explanation," *Journal of Finance* 59(4), 1901-1930

Chen, H., G. Noronha, and V. Singal (2006a) "S&P 500 Index Changes and Investor Awareness," *Journal of Investment Management* 4 (2), 23-37

Chen, H., G. Noronha, and V. Singal (2006b) "Index Changes and Losses to Index Fund Investors," *Financial Analysts Journal* 62 (4), 31-47

Dash, S. (2002) "Price Changes Associated with S&P 500 Deletions: Time Variation and Effect of Size and Share Prices," *Standard & Poor's*, July 9

Denis, D. K., J. J. McConnell, A. V. Ovtchinnikov, and Y. Yu. (2003) "S&P 500 Index Additions and Earnings Expectations," *Journal of Finance* 58 (5), 1821-1840

Dhillon, U.S. and H. G. Johnson (1991) "Changes in the Standard and Poor's 500 list," *Journal of Business* 64 (1), 75-85

Erwin, G.R. and J.M. Miller (1998) "The Liquidity Effects Associated with Additions of A Stock to the S&P 500 Index: Evidence From Bid/Ask Spreads," *Financial Review* 33 (1), 131-146

Harris, L.E. and E. Gurel (1986) "Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures," *Journal of Finance* 41 (4), 815-829

Hegde, S. P. and J. B. McDermott (2003) "The Liquidity Effects Of Revisions to the S&P 500 Index: An Empirical Analysis," *Journal of Financial Markets* 6 (3), 413-459

Ivanov, S. (2010) "Discretionary Deletions from the S&P 500 Index: Evidence on Forecasted and Realized Earnings," *The International Journal of Business and Finance Research* 4 (4), 1-9

Jain, P.C. (1987) "The Effect on Stock Price of Inclusion in and Exclusion from the S&P 500," *Financial Analysts Journal* 43 (1), 58-65

Kamal, R., E. Lawrence, G. McCabe, and A. Prakash (2012) "Additions to S&P 500 Index: Not So Informative Any More", *Managerial Finance* 38 (4), 380-402

Lynch, A. W. and R. R. Mendenhall (1997) "New Evidence on Stock Price Effects Associated With Changes in the S&P 500 Index," *Journal of Business* 70 (3), 351-383

Shleifer, A. (1986) "Do Demand Curves for Stocks Slope Down?," *Journal of Finance* 41 (3), 579-590

BIOGRAPHY

Dr. Rashiqa Kamal is an Assistant Professor in the Department of Finance and Business Law at the University of Wisconsin-Whitewater. She can be contacted at: Department of Finance and Business Law, College of Business and Economics, University of Wisconsin-Whitewater, 800 W. Main St., Whitewater, WI 53190. E-mail: kamalr@uww.edu