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# THE IMPACT OF CHANGES IN THE DOW JONES INDUSTRIAL AVERAGE LIST ON PRICES AND TRADING VOLUMES

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## ABSTRACT

The price-pressure hypothesis (PPH) assumes that a temporary increase (or decrease) in returns and trading volumes occurs around the announcement day when firms are added to (or deleted from) a market index. On September 10, 2013, the Dow Jones Industrial Averages Index Committee announced that Goldman Sachs Group Inc. (GS), Visa Inc. (V) and Nike Inc. (NKE) would be added to the Dow Jones Industrial Average (DJIA) and Bank of America Corp. (BAC), Hewlett-Packard Co. (HPQ) and Alcoa Inc. (AA) would be deleted from the DJIA after the close of trading on September 20, 2013. According to the Index Committee, GS replaced BAC, V replaced HPQ and NKE replaced AA. This event study analyzes the effects that these changes have on the prices and volumes of these stocks. Changes of prices and trading volumes of the firms added to the DJIA are statistically significant enough to support the PPH. **JEL classifications:** G14

## INTRODUCTION

According to S&P Dow Jones Indices LLC (2014), key facts of Dow Jones Industrial Average Index are as follows: 1) The index is maintained by the Averages Committee. Components are added and deleted on an as-needed basis. 2) For the sake of continuity, such changes are rare, and typically occur following corporate acquisitions or other significant changes in a component company's core business. 3) While stock selection is not governed by quantitative rules, a stock typically is added only if the company has an excellent reputation, demonstrates sustained growth and is of interest to a large number of investors. 4) Maintaining adequate sector representation within the index is also a consideration in the selection process. 5) The index is price weighted.

This study examines the composition changes to the DJIA announced on September 10, 2013. The purpose of this study is to determine if recent changes in the DJIA caused any significant impact on the prices and volumes of stocks that were either added to or deleted from the DJIA. The efficient market theory (EMT) suggests that including a stock in or removing a stock from the DJIA should not affect either a stock's price or volume if the change does not convey any new information. However, the price-pressure hypothesis (PPH) assumes that a temporary increase (or decrease) in returns and volume results as firms are added to (or deleted from) an index around the announcement day. Several studies

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have been conducted to examine these important issues. Prior studies focused on changes in the composition of the S&P 500, FTSE 100, Australian All Ordinaries and DJIA.

This paper is organized as follows: the first section is a literature review; the second section describes the methodology; the third section explains the findings; the final section sets forth a summary and conclusion. There are three tables presenting the key descriptive and analytical statistics of this study.

## LITERATURE REVIEW

Harris and Gurel (1986) confirmed the PPH in examining prices and volume surrounding changes in the composition of the S&P 500. The PPH assumes that investors who accommodate demand shifts must be compensated for the transaction costs and portfolio risks that they bear when they agree to immediately buy or sell securities, which they otherwise would not trade. The PPH and EMH are similar in that both suggest that long-run demand is elastic at the full-information price, but they differ in that the PPH hypothesizes that short-term demand curves may be less than perfectly elastic. They found that immediately after an addition is announced, prices increased by more than 3 percent, but the increase was nearly fully reversed after two weeks.

Lamoureux and Wansley (1987) supported the PPH. By examining market responses to changes in the S&P 500, they found that stocks added to (or deleted from) the index experienced a significant positive (or negative) announcement day excess return. The average announcement day trading volume for firms added to the S&P 500 was substantially larger than the average pre-period trading volume of traded stocks. Pruitt and Wei (1989) also supported the PPH by showing that institutional holdings increased when listing occurred.

Sahin (2005) analyzed the valuation and volume effects of 219 additions of Real Estate Investment Trusts (REITs) to various S&P indices since 2001. Salin's analysis supported the PPH. The study found that the inclusions of REITs in various S&P indices experienced approximately a 5 percent market-adjusted abnormal return on average at the time of the announcement.

Chan and Howard (2002) examined additions to and deletions from the Australian All Ordinaries Share Price Index (AOI). They found significant changes in daily returns and volume around the change date, which supported the PPH. They believed their findings, which were contrary to some findings based on the S&P500, were due to institutional differences in how changes in the composition of the AOI and S&P 500 are determined.

Gregoriou and Ioannidis (2006) examined changes in the FTSE 100. They found no evidence that suggested that changes of the FTSE 100 supported the PPH. However, their findings were consistent with the information cost and liquidity explanation in that inclusion in (or deletion from) the FTSE 100 list increased (or decreased) the likelihood that they would be widely followed. Their study supported Merton's attention hypothesis in that the changes in the FTSE 100 affected the likelihood of the market's attention.

Beneish and Gardner (1995), examining changes in the composition of the DJIA, found that the price and the trading volume of newly added DJIA firms were unaffected. However, firms removed from the index experienced significant price declines, which was consistent with the PPH. They believed that the market demanded an extra-return premium for higher trading costs due to relatively less information available to those stocks removed from the index. This suggested that the short-term demand curves of firms removed from

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the index would not be perfectly elastic, supporting the downward-sloping demand curve hypothesis.

Poloncheck and Krehbiel (1994) compared the price and volume responses associated with changes in the DJIA and Dow Jones Transportation Averages. They found that firms added to the roster of the DJIA experienced significantly positive abnormal returns and significantly greater trading volume on the event date; however, firms added to the Transportation Average experienced neither event period abnormal returns nor increased trading volume. They attributed the lack of significant effects on the Transportation Average to much less media attention, supporting Merton's (1987) attention hypothesis.

## METHODOLOGY

Table 1 shows profiles of the additions and deletions of DJIA constituents effective with the close of trading on Friday, September 20, 2013 with the key descriptive statistics as of close on Feb. 14, 2014. The actual trading with the new constituents began on Monday, September 23, 2013. The average retail price per share of the added stocks is eight times higher than that of the deleted stocks; the market caps and dividend yields are about in the same ranges, but the average P/E ratio of the added stocks is 1.4 times higher than that of the deleted. The significantly higher average price of the new additions means that these stocks will influence the index value in much greater proportion due to the fact that DJIA index is price-weighted. Another conspicuous difference is on PEG, Price/Earnings to Growth ratio. That is, the average PEG of the added stocks is 1.77, which is absolutely superior to that of the deleted stocks, -1.63. An implication of this comparison is that investors and the index observers should pay attention to the PEG ratio in particular for identifying likely candidates for additions or deletions.

As shown in TABLE 1, three firms, GS, V, and NKE, were added and three firms, BAC, HPQ, and AA, were deleted. For all six firms, daily stock price and trading volume data were collected from historical data provided by Commodity Systems, Inc. for the period from June 27, 2013 to December 16, 2013, spanning 121 days, 60 days before and after September 23, 2013, the first day of trading reflecting the changes. Actual rates of return data will be calculated for 59 days before and after Monday, September 23, 2013. DIA, DIAMONDS Trust Series I (ETF) was used for market proxy with the data collected for the same period.

An event study was conducted to evaluate the impact on returns and volume on the two portfolios. The market model was used to calculate excess returns or the prediction error as follows:

$$PE_t = R_t - [a + (b \cdot RM_t)] \quad (1)$$

where  $PE_t$  = the prediction error for market period or day  $t$ ,  
 $R_t$  = the logarithmic return of the stock for day  $t$ , defined by  $\ln(P_t/P_{t-1})$  or  $\ln(P_t) - \ln(P_{t-1})$ ,  
 $RM_t$  = the logarithmic market return for period  $t$  or day  $t$ , and  
 $a$  and  $b$  are ordinary least squares estimates of the coefficients of the market model.

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A positive (or negative) prediction error means that the underlying stock price increased (or decreased) more than was predicted. As in Beneish and Gardner (1995) and Gregoriou and Ioannidis (2003), prediction errors are examined over the 120-day period that extends from 59 days before to 59 days after the changes were announced. Average prediction errors, APE, are computed by dividing the prediction errors by the number of firms in the sample on each day  $t$ .

To assess the presence of abnormal returns, the average prediction errors are cumulated over intervals of  $k$  days from  $t$  through  $t+k$  to obtain cumulative average prediction errors, CAE. That is,

$$CAE_{t,t+k} = \sum APE_i \quad i = t, t+1, t+2, t+3, \dots, t+k. \quad (2)$$

Following the procedure used by Beneish and Gardner (1995) and Gregoriou and Ioannidis (2003) to test the null hypothesis that CAE equals zero, the following  $t$ -statistic with 79 degrees of freedom was computed:

$$t = CAE_{t,t+k} / [ks^2_{APE}]^{1/2} \quad (3)$$

$$s^2_{APE} = \frac{1}{79} \sum_{t=1}^{80} (APE_t - \overline{APE})^2 \quad (4)$$

where  $s^2_{APE}$  is an equally weighted portfolio variance estimate and  $\overline{APE}$  is the mean average prediction error for the 80-trading-day estimation period.

The behavior of trading volume is analyzed based on the procedures used by Beneish and Gardner (1995) and Polonchek and Krehbiel (1994). Three announcement periods are examined: 1) the day of the announcement; 2) the day of the announcement and the day before the announcement; and 3) the day before the announcement, the day of the announcement, and the day after the announcement. First, trading volume is evaluated around the announcement with the mean volume in the prior eight weeks adjusted for changes in the market volume. Then, the mean trading volume for the eight weeks prior to and after the announcement period of DJIA changes (excluding days -1 to +1) are compared.

Following the procedure of Beneish and Gardner (1995), Polonchek and Krehbiel (1994) and Gregoriou and Ioannidis (2003), trading volume is examined using the market-volume adjustment approach. The null hypothesis is that this ratio is 1. The relative trading volume, VR, is measured for firm  $i$  by the following equation:

$$VR_{it} = (VOL_{it}/VOL_{mt}) \quad (5)$$

where  $VOL_{it}$  is the natural logarithm of trading volume of security  $i$  traded in period  $t$  of added (deleted) firms and  $VOL_{mt}$  is the natural logarithm of trading volume for DIA in period  $t$ .

The natural logarithm is used to compensate for the fact that daily volume distributions have been found to be skewed to the right and leptokurtotic (Polonchek and Krehbiel, 1994). Ajinkya and Jain (1989) found that natural log transformations of the volume measures are approximately normally distributed. Following the procedure of Beneish and Gardner (1995) and Gregoriou and Ioannidis(2003), the  $t$ -test is used to test the hypothesis of no significant statistical difference.

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## FINDINGS

Table 2 summarizes the results of the tests to determine if stock prices are affected when stocks are either added to or deleted from the DJIA list. As can be seen from Table 2, the stock returns of firms added to the DJIA are significantly affected by their inclusion. For example, the CAE is significant at the 1 % level for the added firms: on the day after announcement day (Day -9) is +2.183% ( $t = 2.8910$ ); on the day before first trading day (Day -1), +2.626% ( $t = 3.4767$ ); and on Day +4, +2.111% ( $t = 2.7962$ ).

The stock returns of firms deleted from the DJIA are mostly not affected by their deletion. However, the CAE on the Day +4 for firms deleted from the DJIA is statistically significant at the 5 % level; on the Day -3, +2.1% ( $t=1.8952$ ). Our findings suggest that changing the composition of the DJIA does provide significant new information or pricing pressure as proposed by the PPH in that the stock returns of the added firms are significantly affected by the decision.

Table 3 presents the results of the tests on market-adjusted trading volume effects. For the five sets of trading periods, there are significant increases in trading volume on the days surrounding the first trading day compared to the prior eight weeks for firms that were either added to or deleted from the DJIA. For the case of stocks added, the magnitude of trading volume increases is much more significant around the first trading day after the DJIA list changes become effective, compared to the days around the announcement day (Day -10). For example, the mean VR of days -1 ~ +1 is 7.648 times the benchmark volume, statistically significant at the 1 percent level; the mean VR of days -9 ~ -8 is 3.343 times the benchmark volume, significant only at the 10 percent level. Overall, the volume analyses support the PPH.

## SUMMARY AND CONCLUSION

This study examines the 2013 changes to the DJIA that had not previously been examined. In recent years, the stock markets have experienced several operational changes. For example, high-frequency trading has become a dominant force; individual investors are able to quickly alter their portfolios for tactical and/or strategic reasons by engaging in online trading; individuals and institutions can easily invest in DJIA by purchasing Diamonds ETF fund (DIA). Probably because of these changes, significant additional information was provided when stocks were announced to be included in the DJIA list on September 10, 2013. Trading volumes changed significantly both for added and deleted stocks around the first trading day. Therefore, the findings of this study are consistent with prior research findings supporting the PPH. In essence, changing the composition of the DJIA in September 2013 provided the market with significant changes in returns and trading volumes particularly for the added firms.

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**TABLE 1**  
**ADDITIONS TO AND DELETIONS FROM DJIA CONSTITUENTS EFFECTIVE AT THE CLOSE OF**  
**TRADING ON FRIDAY, SEPTEMBER 20, 2013 WITH THE KEY DESCRIPTIVE STATISTICS AT THE**  
**CLOSE OF FEB. 14, 2014**

ADDITIONS:								
<u>Symbol</u>	<u>Company</u>	<u>Retail Price</u>	<u>Market (SB)</u>	<u>Cap</u>	<u>Div/Yld</u>	<u>Beta</u>	<u>P / E</u>	<u>PEG (5 yr expected)</u>
GS	Goldman Sachs	\$163.72	\$76.52		1.30%	1.98	10.59	1.9
NKE	Nike, Inc.	\$73.98	\$65.51		1.30%	0.7	23.61	2.03
V	Visa Inc.	\$221.78	\$140.52		0.70%	0.6	28.23	1.39
	[Average]	\$153.16	\$94.18		1.10%	1.09	20.81	1.77
DELETIONS:								
<u>Symbol</u>	<u>Company</u>	<u>Retail Price</u>	<u>Market (SB)</u>	<u>Cap</u>	<u>Div/Yld</u>	<u>Beta</u>	<u>P / E</u>	<u>PEG (5 yr expected)</u>
AA	Alcoa Inc.	\$11.37	12.18		1.10%	1.6	N/A	N/A
BAC	Bank of America	\$16.70	176.88		0.20%	2.03	18.56	0.61
HPQ	Hewlett-Packard	\$29.36	56.04		2.00%	1.75	11.21	-3.87
	[Average]	\$19.14	\$81.70		1.10%	1.79	14.89	-1.63

Note:

SB = \$Billions

Data provided by Thomson Reuters or derived from multiple sources.

**TABLE 2**  
**STOCK PRICE EFFECTS**

Days Relative to Event	Days in Cumula- tion	Additions		Deletions	
		CAE	t-Statistic	CAE	t-Statistic
-60, -2	59	0.00121	0.1601	0.00126	0.1139
-60, -41	20	-0.00013	-0.0170	-0.00157	-0.1425
-40, -21	20	0.00153	0.2024	0.00224	0.2029
-20, -11	10	-0.00058	-0.0003	-0.00030	-0.0270
-10 (A)	1	0.00165	0.2185	0.00419	0.3786
-9	1	0.02183	2.8910 ***	0.01158	1.0473
-8	1	0.01727	2.2864 **	0.01260	1.1397
-7	1	-0.00544	-0.7205	0.00377	0.3406
-6	1	0.00032	0.0429	-0.00161	-0.1454
-5	1	0.00205	0.2717	-0.00626	-0.5660
-4	1	0.00218	0.2880	0.00399	0.3608
-3	1	0.00346	0.4582	0.02095	1.8952 *
-2	1	0.00448	0.5931	0.01183	1.0704
-1	1	0.02626	3.4767 ***	0.01088	0.9837
0 (F)	1	0.01137	1.5055 *	0.00812	0.7344
1	1	-0.01381	-1.8289 *	-0.00086	-0.0775
2	1	-0.00512	-0.6774	0.00182	0.1647
3	1	0.00413	0.5465	0.00422	0.3817
4	1	0.02111	2.7952 ***	0.02074	1.8763 *
5	1	0.01200	1.5889	0.01273	1.1512
6	1	-0.00287	-0.3806	-0.00281	-0.2539
7	1	-0.00105	-0.1389	-0.00619	-0.5602
8	1	-0.00191	-0.2532	-0.01157	-1.0465
9	1	-0.00169	-0.2242	-0.00020	-0.0181
10	1	-0.00616	-0.8154	0.00307	0.2780
+11, +20	10	0.00375	0.4965	0.00806	0.7290
+21, +40	20	-0.00164	-0.0008	-0.00080	-0.0726
+41, +60	20	0.00200	0.2655	0.00290	0.2621
+2, +60	59	0.00105	0.1397	0.00244	0.2205
-9, -8	2	0.01955	2.5887 ***	0.01209	1.0935
-1, 0	2	0.01881	2.4911 ***	0.00950	0.8590

Note: CAE = cumulative average prediction error.

\*\*\* indicates significant at the 1 percent level; \*\* indicates significant at the 2.5 percent level;

\* indicates significant at the 5 percent level; \* indicates significant at the 10 percent level.

(A) Indicates the announcement day.



**TABLE 3**  
**TRADING VOLUME EFFECTS**

Market-Adjusted Volume Effects Evaluating Trading Volumes of Days after the Announcement Day (=Day -10), and around First Trading Day (= Day 0), with respect to the Changes of Mean Volume in the Prior Eight Weeks

Period	Additions		Deletions	
	Mean VR	t-Statistic	Mean VR	t-Statistic
Days -9,-8	3.343	1.596*	1.123	1.251
Days -2, 0	6.939	3.314***	3.897	4.338***
Day 0	15.641	7.470***	8.819	9.817***
Days -1,0	8.127	3.928***	5.582	4.993***
Days -1,+1	7.648	3.653***	3.772	4.199***

Note:

VR = relative trading volume

\*\*\* Indicates significant at the 1 percent level.

\* Indicates significant at the 10 percent level.

