Low Volume and Future Changes in the Stock Market

Paul Bursik
St. Norbert College

This paper provides an empirical investigation of whether low volume days produce different subsequent results than other days. Daily S&P 500 returns are groups classified by volume as well as market direction. Subsequent returns are tied both to previous market direction and volume. High volume is associated with higher subsequent daily return variability, and low volume is associated with lower subsequent daily return variability. Of particular note, down market days with low volume have the highest next-day average returns and the lowest next-day return standard deviation.

INTRODUCTION

Stock market trading volume has been widely studied for a long time. The largest segment of the "volume literature" explores the relationship between trading volume and stock market volatility. For the most part, the idea is that volume is a reaction to information in the market. In two of the most cited papers in this area, (Schwert, 1989) and (Karpoff, 1987) reach a standard conclusion that volume and volatility tend to rise and fall together. Yet the relationship is difficult to tease out as to which may tend to cause the other. (Campbell, et.al., 1991) focus on different types of investors whose trading could lead to subsequent patterns in returns. In particular, they argue that high volume could be caused by less informed investors' changes in risk aversion. If, for instance, they become more risk averse, we should see high volume (with a falling market) followed by higher average returns in the market due to the greater returns for risk bearing. This would lead to negative serial correlation in returns. Indeed, they reach what they find as a "striking fact," that daily autocorrelation is lower on high volume days than on low volume days.

Other, more recent work, focuses on the composition of volume and its impact on return predictability. For instance, (Tetlock, 2007) shows an association between excessive media optimism and excessive media pessimism on volume that temporarily pushes stock prices away from their fundamental values. Other papers, such as (Bordino, 2012) focus on predicting volume from web searches. For the most part, these papers point out that the nature of the work involving stock market volume is concerned with high volume rather than low volume. The reason for this is usually related to some sort of potentially irrational trading by uninformed investors giving rise to future predictability in returns.

DATA, METHODOLOGY, AND RESULTS

The idea of this paper follows from the original motivation for exploring the issue – the claim that volume, in particular low volume, is a market "event." That is, if low volume is noteworthy, then those days that have low volume should produce subsequent returns that are different in some way. In

particular, the commentary implies that an investor should be wary of low volume. To investigate the impact of volume on subsequent returns, the default approach would be to simply use volume as an explanatory variable in a predictive model of stock returns. This is well-ploughed ground, and mostly relies on small changes in volume producing marginal effects in returns (or vice versa) over all ranges of volume and returns. Instead, this paper separates S&P 500 Index return days (all days from January 2005 to December 2014) into three main groups – High Volume, Normal Volume, and Low Volume. While it seems at first to be a bit odd to take a quantitative, nearly continuous variable like volume and transform it into a qualitative one, there are some advantages. First, this investigation is most concerned with values in the tails of the volume distribution. Often it is what happens in the more extreme cases that is of interest. For instance, consider possible behavioral factors. Perhaps low volume days are associated with market under-reaction to the news of the day leading to positively correlated returns between the low volume day and the subsequent day or days; perhaps high volume days are associated with market over-reaction to the news of the day leading to negatively correlated returns between the high volume day and the subsequent day or days; perhaps "normal volume days," within a large range of values, are not associated with either under-reaction or over-reaction. To be clear, this paper is not making this behavioral claim. Instead, the example is used to highlight why it might be advantageous to transform volume into a qualitative variable in "event space." If this were an event study of earnings announcements, this would be similar to classifying some earnings as "large negative surprises" and "large positive surprises."

Of course, one problem is to determine what constitutes "high volume" and "low volume." Two factors dominated the approach taken here to define the dividing line. First, high and low volume thresholds need to be adjusted over time, since average volume changes over time. Second, high or low volume should not be exceedingly rare. In a calendar year, there are about 250 trading days. Thinking in terms of deciles, the 25 highest trading volume days during the year were put into the High group, while the lowest 25 trading volume days during the year were put into the Low group. Of course, this leaves about 200 days per year in the Normal group.

Another factor that also needs to be taken into account is the tendency for returns to reverse from one day to the next, which was particularly pronounced during this time horizon. So all of the days were also classified as to whether the index closed up or down (from the previous day's close). For the overall data and each of the groups and subgroups, subsequent returns were examined over the following 10 days. Average returns along with standard deviations were calculated for each day and for cumulative returns. Selected descriptive statistics for the daily returns for each class of observations are reported in Table 1. Probably the most noteworthy numbers on the table are related to the "All Up" and "All Down" groupings. We see there the strong tendency of return reversals from the previous day. The other result of note (in bold Table 1) is that the "Low Down" group has the highest one-day returns and lowest one-day standard deviation of returns.

TABLE 1
DAILY RETURNS BY GROUP (DAY 0 THROUGH DAY 5)

GROUP	VALUE	DAY 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
All Days	Mean	*0.0293%*	0.0297%	0.0294%	0.0292%	0.0295%	0.0303%
N = 2517	St. Dev.	*1.2870%*	1.2868%	1.2872%	1.2873%	1.2874%	1.2879%
All Up	Mean	*0.7677%*	-0.0437%	0.0123%	0.0265%	0.0209%	0.0156%
N = 1390	St. Dev.	*0.9362%*	1.1443%	1.1831%	1.1871%	1.1462%	1.1652%
All Down	Mean	*-0.8813%*	0.1201%	0.0505%	0.0325%	0.0401%	0.0484%
N = 1127	St. Dev.	*1.0567%*	1.4388%	1.4052%	1.4015%	1.4432%	1.4252%
All High	Mean	*-0.0720%*	-0.0180%	0.1342%	-0.0099%	0.0480%	0.2003%
N = 250	St. Dev.	*2.2749%*	2.0655%	1.8800%	2.1139%	1.9202%	2.0020%
All Low	Mean	*0.0080%*	0.0158%	0.0416%	0.1463%	0.0519%	0.1018%
N = 250	St. Dev.	*0.8971%*	1.1143%	1.0028%	1.0848%	0.8639%	0.8929%
All Normal	Mean	*0.0446%*	0.0373%	0.0149%	0.0195%	0.0244%	0.0003%
N = 2017	St. Dev.	*1.1519%*	1.1773%	1.2269%	1.1699%	1.2333%	1.2131%
Low Down	Mean	*-0.6231%*	**0.2021%**	0.0194%	0.1840%	0.0340%	0.1368%
N = 106	St. Dev.	*0.8737%*	**1.0217%**	1.0428%	1.2012%	0.8719%	0.8422%
Normal Down	Mean	*-0.8108%*	0.1128%	0.0289%	0.0250%	0.0219%	0.0056%
N = 896	St. Dev.	*0.9834%*	1.2906%	1.3359%	1.2907%	1.3914%	1.3521%
High Down	Mean	*-1.6187%*	0.1237%	0.2312%	-0.0279%	0.1657%	0.2763%
N = 124	St. Dev.	*1.3730%*	2.4248%	2.0307%	2.1390%	2.0732%	2.1465%
Low Up	Mean	*0.4726%*	-0.1213%	0.0580%	0.1185%	0.0650%	0.0761%
N = 144	St. Dev.	*0.5729%*	1.1624%	0.9758%	0.9940%	0.8607%	0.9305%
Normal Up	Mean	*0.7282%*	-0.0231%	0.0037%	0.0152%	0.0264%	-0.0039%
N = 1121	St. Dev.	*0.7499%*	1.0749%	1.1328%	1.0642%	1.0912%	1.0898%
High Up	Mean	*1.4501%*	-0.1575%	0.0387%	0.0078%	-0.0678%	0.1255%
N = 126	St. Dev.	*1.9354%*	1.6351%	1.7217%	2.0973%	1.7573%	1.8543%

In Table 2 and Table 3 we see the tests for significant differences for daily returns and cumulative returns for selected groups. For each group, an F-test of variances is conducted to check for significance in terms of the difference from the "All Days" distribution. Two overarching themes emerge when considering the F-test results. First, after "Up" days, there is less variability in returns than after "Down" days; and this persists throughout the 10-day return horizon examined here. Second, high volume is associated with greater than average subsequent variability in returns; and low volume is associated with less than average subsequent variability in returns. Again, the association persists throughout the 10-day return horizon. The finding that volume has a positive association with volatility is consistent with the previous literature, but the persistence may be stronger than expected.

The tests for differences in returns from the "All Days" mean yields two significant results. The first is that we observe one-day return reversals, and the strength of the day one return is enough to significantly impact cumulative returns over a number of days. Second, low volume on down days is associated with above-average returns over a number of days. The significance of this lies in the fact that this group is also associated with below average volatility.

TABLE 2
TESTS FOR DAILY RETURN DIFFERENCES FROM THE "ALL DAYS" DISTRIBUTION

Group	Value	Day1	Day2	Day3	Day4	Day5	Day6	Day7	Day8	Day9	Day10
All Up	Mean	<**									>*
	Variance	<**	<**	<**	<**	<**	<**	<**	<**	<**	<**
All Down	Mean	>**									
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**
All High	Mean								>*		
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**
All Low	Mean										
	Variance	<**	<**	<**	<**	<**	<**	<**	<**	<**	<**
Low Down	Mean	>*									<**
	Variance	<**	<**		<**	<**	<**	<**	<**	<**	<**
High Down	Mean										
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**
Low Up	Mean										
	Variance	<*	<**	<**	<**	<**	<**	<**	<**	<**	<**
High Up	Mean										
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**

* Denotes a 10% Significance Level ** Denotes a 5% Significance Level

TABLE 3
TESTS FOR CUMULATIVE RETURN DIFFERENCES FROM THE "ALL DAYS" DISTRIBUTION

Group	Statistic	1Day	2Day	3Day	4Day	5Day	6Day	7Day	8Day	9Day	10Day
All Up	Mean	<**	<**	<*	<*	<*	<*	<*	<*	<*	
	Variance	<**	<**	<**	<**	<**	<**	<**	<**	<**	<**
All Down	Mean	>**	>*	>*		>*	>*	>*		>*	
	Variance	>**	>**	>**	>**	>**	>**	>*	>**	>*	>**
All High	Mean										
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**
All Low	Mean					>*					
	Variance	<**	<**	<**	<**	<**	<**	<**	<**	<**	<**
Low Down	Mean	>*		>*		>*	>*				
	Variance	<**	<**			<*	<**	<**	<**	<**	<**
High Down	Mean										
	Variance	>**	>**	>**	>**	>**	>**	>**	>**	>**	>**
Low Up	Mean										
	Variance	<*	<**	<**	<**	<**	<**	<**	<**	<**	<**
High Up	Mean										
	Variance	>**	>**	>**	>**	>**	>**	>**		>**	>**

* Denotes a 10% Significance Level ** Denotes a 5% Significance Level

In Tables 4-6, this mean-variance relationship is further explored. Table 4 shows 3-day Returns for each group, ranked by the standard deviation of returns. The low volume groups are in bold. All of the low volume groups have lower-than-average volatility (the All Days group is italicized for comparison purposes). Of particular note is that the "Low Down" group has below average volatility while having the largest 3-day returns.

TABLE 4
THREE-DAY COMPOUND RETURNS

Group	Observations	Day 0 Returns		3-Day Returns	(Low to High)
		Mean	St. Dev.	Mean	St. Dev.
Low Up	**144**	**0.4726%**	**0.5729%**	**0.0486%**	**1.4209%**
All Low	**250**	**0.0080%**	**0.8971%**	**0.2006%**	**1.6804%**
Normal Up	1121	0.7282%	0.7499%	-0.0069%	1.7404%
All Up	1390	0.7677%	0.9362%	-0.0092%	1.8059%
All Normal	2017	0.0446%	1.1519%	0.0684%	1.8936%
Low Down	**106**	**-0.6231%**	**0.8737%**	**0.4072%**	**1.9678%**
All Days	*2517*	*0.0293%*	*1.2870%*	*0.0836%*	*2.0032%*
Normal Down	896	-0.8108%	0.9834%	0.1627%	2.0665%
All Down	1127	-0.8813%	1.0567%	0.1980%	2.2181%
High Up	126	1.4501%	1.9354%	-0.1265%	2.6255%
All High	250	-0.0720%	2.2749%	0.0887%	2.9453%
High Down	124	-1.6187%	1.3730%	0.3074%	3.2343%

TABLE 5
FIVE-DAY COMPOUND RETURNS

Group	Observations	Day 0 Returns		5-Day Returns	(Low to High)
		Mean	St. Dev.	Mean	St. Dev.
Low Up	**144**	**0.4726%**	**0.5729%**	**0.1883%**	**1.8309%**
All Low	**250**	**0.0080%**	**0.8971%**	**0.3535%**	**2.0373%**
Normal Up	1121	0.7282%	0.7499%	0.0135%	2.2230%
Low Down	**106**	**-0.6231%**	**0.8737%**	**0.5779%**	**2.2780%**
All Up	1390	0.7677%	0.9362%	0.0241%	2.2906%
All Normal	2017	0.0446%	1.1519%	0.0903%	2.4348%
All Days	*2517*	*0.0293%*	*1.2870%*	*0.1387%*	*2.5180%*
Normal Down	896	-0.8108%	0.9834%	0.1864%	2.6745%
Down Days	1127	-0.8813%	1.0567%	0.2800%	2.7674%
High Up	126	1.4501%	1.9354%	-0.0840%	3.1896%
All High	250	-0.0720%	2.2749%	0.3143%	3.4377%
High Down	124	-1.6187%	1.3730%	0.7190%	3.6410%

Tables 5 and 6 tell a similar story – the low volume days are followed by strong returns with low volatility. Table 6, in particular shows how different low volume days translate into future market performance. Consider that without the low volume groups, the mean-variance ranks are very close to what we would predict from an efficient market. The higher volatility groups experience higher returns. However, this is not the case with the low volume groups, where the returns are far higher than the standard deviation ranking would predict.

TABLE 6
TEN-DAY COMPOUND RETURNS

Group	Observations	Day 0 Returns		10-Day Returns	(Low to High)
		Mean	St. Dev.	Mean	St. Dev.
Low Up	**144**	**0.4726%**	**0.5729%**	**0.2350%**	**2.2599%**
All Low	**250**	**0.0080%**	**0.8971%**	**0.3293%**	**2.5722%**
Normal Up	1121	0.7282%	0.7499%	0.1460%	3.0919%
Low Down	**106**	**-0.6231%**	**0.8737%**	**0.4575%**	**2.9506%**
All Up	1390	0.7677%	0.9362%	0.1764%	3.0850%
All Normal	2017	0.0446%	1.1519%	0.2277%	3.3125%
All Days	*2517*	*0.0293%*	*1.2870%*	*0.2700%*	*3.3382%*
Normal Down	896	-0.8108%	0.9834%	0.3300%	3.5685%
Down Days	1127	-0.8813%	1.0567%	0.3855%	3.6244%
High Up	126	1.4501%	1.9354%	0.3152%	3.8395%
All High	250	-0.0720%	2.2749%	0.5517%	4.1291%
High Down	124	-1.6187%	1.3730%	0.7921%	4.4066%

DISCUSSION AND CONCLUSIONS

It would appear that any adage warning about investing on low volume days is probably not warranted. Low volume days are associated with below-average volatility on subsequent days, but with no sacrifice in returns. Indeed, it would seem that low volume days constitute an anomaly such that investors tend to earn high returns while bearing low risk. However, a caveat is in order. To call the previously mentioned result a tradable anomaly would be premature. First, no attempt was made here to create a trading rule that could have been implemented in real time. For instance, the high and low volume days were determined after the fact. Still, it appears that investors should not be shying away from trading when volume is low, especially when the market closes down.

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