News, Not Trading Volume, Builds Momentum

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Recent research has found that price momentum and trading volume appear to predict subsequent stock returns in the U.S. market and that they seem to do so in a nonlinear fashion. Specifically, the effect of momentum appears more pronounced among high-volume stocks than among low-volume stocks. This effect would suggest the existence of an exploitable deviation from market efficiency. We argue that this phenomenon is a result of the underreaction of investors to earnings news—an effect that is most pronounced for high-growth companies. We show that, after earnings-related news and a stock's growth rate have been controlled for, the interaction between momentum and volume largely disappears.

Recent research (Lee and Swaminathan 2000) found that momentum and trading volume appear to predict subsequent returns in the U.S. equity market and that they seem to do so in a nonlinear fashion. Specifically, the effect of momentum appears more pronounced among high-volume stocks than among low-volume stocks. This effect suggests the existence of a predictable deviation from market efficiency. Furthermore, because both volume and momentum are standard tools of technical analysis, these findings also suggest that investors can use technical analysis to earn abnormal profits.

We also found a momentum–volume effect in the research reported here. We propose a different explanation from that of Lee and Swaminathan, however—an explanation based on investor reaction to news about company fundamentals. First, we argue that news about a company's earnings often creates volume and a change in stock price (i.e., price momentum). Furthermore, news creates greater volume and greater momentum for growth stocks. Second, investor overconfidence delays some of the reaction because investors are slow to adjust their beliefs. Just as the initial reaction is greater for growth stocks, the delayed reaction also is greater for growth stocks. This nonlinear reaction to earnings news by stocks with different growth rates creates the nonlinearities in the momentum–volume effect. In short, we believe that the momentum–volume interaction is explainable as a delayed reaction to news about company fundamentals.

We begin with reporting the result we found from replicating earlier findings that suggested a momentum–volume interaction. We then offer our alternative explanation and provide various tests of the two hypotheses. Distinguishing between such closely related hypotheses is difficult. We believe our case is persuasive, but we leave it to readers to decide between the two.

Data

For the study we report, our sample consisted of stocks of the largest 1,500 publicly traded companies in the United States each quarter between 1981 and 1998. The sample starts in 1981 because that was the year I/B/E/S International began reporting long-term expected earnings growth.[1] For a stock to be included in our sample, we required that a long-term earnings growth forecast be available and that the stock have return and volume data for at least one year prior to portfolio formation. The result was 91,356 total observations, or an average 1,324 observations a quarter. We formed portfolios at the end of each quarter on the basis of data (e.g., expected earnings growth) available at that time.[2]

We defined "average monthly trading volume" as the average of the monthly trading volume over the year preceding portfolio formation. Monthly trading volume is the total number of shares traded each month as a percentage of the total number of shares outstanding at the end of the month. We obtained monthly volume and return data from FactSet Data Systems. We adjusted the data for stock splits.

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We defined excess return as the difference between a stock's return in any quarter and the equal-weighted average return of all stocks in the sample in that quarter.

Momentum–Volume Interaction

The quarterly data on U.S. stocks for 1981–1998, reported in **Table 1**, are consistent with the momentum–volume interaction found by previous research. Table 1 ranks stocks independently on both price momentum and average monthly trading volume and reports the average excess returns of stocks in each momentum–volume quintile. The average excess return for any momentum–volume portfolio is simply the equal-weighted average of excess returns of all the stocks in the portfolio. As in the momentum-related studies of Lee and Swaminathan and others (Jegadeesh and Titman 1993; Rouwenhorst 1998), we used a one-year ranking interval and measured excess returns over the subsequent quarter. The rightmost column in Table 1 shows that stocks in the highest-momentum quintile outperformed the average stock by 1.09 percentage points in the ensuing quarter whereas stocks in the lowest-momentum quintile subsequently lagged the average stock by 1.24 pps.

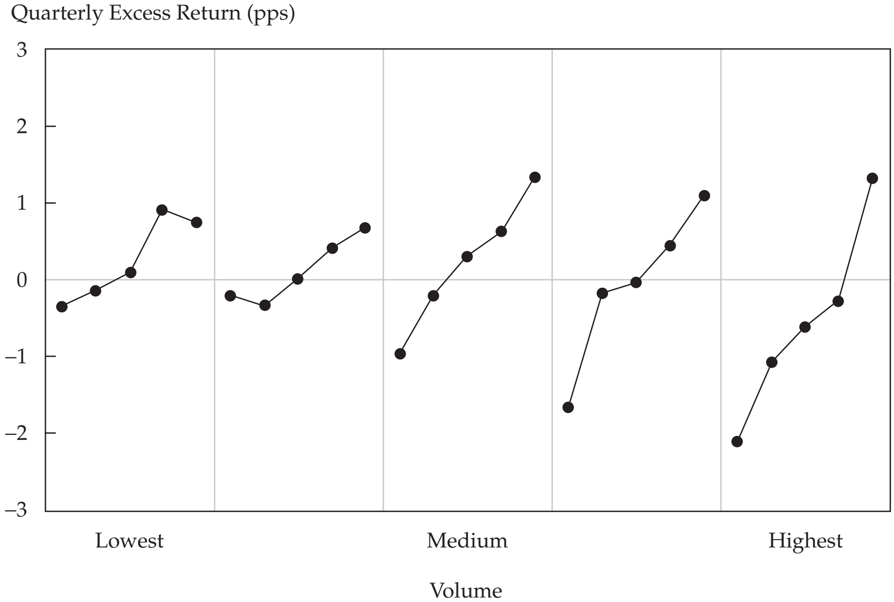
Table 1 also shows that volume is related to future returns. Although the relationship is not monotonic, the bottom row in Table 1 shows that overall trading volume was negatively correlated with subsequent stock returns in the 1981–98 period.

More important than trading volume and momentum individually, however, is the interaction between them. Simply put, most of the payoff from momentum investing in this period came from high-volume stocks. Table 1 shows that for stocks in the highest-volume quintile, the difference in excess return between the lowest- and highest-momentum stocks is 3.41 pps. Conversely, the return spread for momentum is only 1.08 pps for stocks in the lowest-volume quintile.[3] This disparity is easier to see in **Figure 1**, which depicts graphically the results shown in Table 1. Each vertical panel in Figure 1 represents a volume quintile. Within each panel is a plot of quarterly excess return against past momentum; the top circles identify the highest-momentum group, and the bottom circles, the lowest-momentum group. The lengthening of the line from the left panel to the right in Figure 1 shows

Table 1. Quarterly Excess Returns on Momentum and Volume Portfolios, 1981–98
(excess returns in percentage points; data in parentheses are *t*-statistics; numbers below *t*-statistics are number of observations in each quintile)

	Trading Volume					
Momentum	0 (low)	1	2	3	4 (high)	All
0 (low)	–0.34	–0.21	–0.95	–1.64	–2.09	–1.24
	(–1.20)	(–0.66)	(–3.29)	(–5.95)	(–6.70)	(–9.00)
	2,824	2,598	3,249	4,356	5,216	18,243
1	–0.14	–0.35	–0.21	–0.18	–1.06	–0.34
	(–0.69)	(–1.82)	(–0.96)	(–0.69)	(–2.62)	(–3.10)
	4,224	4,148	3,933	3,464	2,517	18,286
2	0.09	0.01	0.30	–0.04	–0.61	0.01
	(0.49)	(0.07)	(1.47)	(–0.16)	(–1.44)	(0.13)
	4,366	4,713	4,002	3,067	2,139	18,287
3	0.91	0.41	0.63	0.46	–0.28	0.49
	(4.75)	(2.25)	(3.13)	(1.84)	(–0.68)	(4.72)
	4,163	4,265	3,978	3,401	2,479	18,286
4 (high)	0.74	0.67	1.34	1.09	1.32	1.09
	(2.69)	(2.26)	(5.07)	(4.05)	(4.43)	(8.16)
	2,666	2,562	3,125	3,998	5,903	18,254
All	0.25	0.08	0.21	–0.11	–0.44	0.00
	(2.58)	(0.87)	(2.05)	(–0.95)	(–2.76)	(0.00)
	18,243	18,286	18,287	18,286	18,254	91,356

Figure 1. Excess Returns within Volume Categories for Increasing Levels of Momentum



that the momentum effect becomes more pronounced at higher levels of volume—largely because negative momentum is particularly strong for stocks with high trading volumes.

One of the possible explanations of these results, discussed in Lee and Swaminathan, is the "momentum life cycle" hypothesis. According to this hypothesis, stocks cycle sequentially through intervals of glamour and neglect, with high trading volume during periods of glamour and low trading volume during periods of neglect. For example, high-volume stocks with low momentum are considered to be in the early stages of a move from glamour to neglect and thus have lower subsequent returns than low-volume, low-momentum stocks, which are considered to be near the end of a period of neglect. The momentum life-cycle hypothesis is similar to the "earnings expectation" hypothesis postulated by Bernstein (1993).

Although the momentum life-cycle hypothesis can explain some of the empirical results, we found it to be unsatisfactory and believe trading volume per se should not convey any information. In the next section, we present an alternative hypothesis for what we think is behind the interaction between momentum and volume.

Delayed Reaction to Fundamental News

The first part of our explanation relies on well-known empirical research that has found a delayed reaction on the part of investors to earnings information. Latane and Jones (1979) and Bernard and Thomas (1989, 1990) showed that stock prices do not fully reflect the information in earnings announcements. Several other studies have found a similar delayed reaction to other public information (Desai and Jain 1997; Ikenberry, Lakonishok, and Vermaelen 1995; Womack 1996.)

This partially delayed reaction to fundamental news is consistent with the theoretical arguments of Daniel, Hirshleifer, and Subrahmanyam (1998), as well as of Scott, Stumpp, and Xu (1999). Daniel et al. argued that the delay is caused by the influence of investors who are overconfident in their own predictions and, as a result, are overly slow in adjusting to new information.

The second part of our explanation is that earnings-related information should have a greater impact on the valuation of more rapidly growing stocks because the more rapidly a stock grows, the more its valuation depends on estimates of the speed and profitability of its growth.[4] Information that causes changes in those estimates will have dramatic effects on valuation.[5] The price reaction is greater for such companies at the time of the information release and also in the delayed response. Earnings news in one quarter, for example, results in volume and momentum change in that quarter, and the effect is greatest on growth stocks. In the next quarter, a second, delayed reaction to the news of the previous quarter occurs, and this reaction also affects growth stocks the most. We believe this nonlinear reaction to information explains most, if not all, of the momentum–volume interaction effect documented by Lee and Swaminathan.

Table 2 contains data on quarterly excess returns that are consistent with our hypothesis. The table presents next quarter's stock returns as they relate to this quarter's earnings news and the company's expected long-term earnings growth rates from I/B/E/S. We used estimates available at the time of portfolio formation to group stocks. Our measure of earnings news was the proportion of security analysts revising earnings forecasts upward. To be consistent with the measurement of trading volume and momentum in Table 1, revision activity was calculated over the one-year interval prior to portfolio formation. We subtracted the total number of downward revisions from the total number of upward revisions over the previous year and then divided by the number of earnings forecasts at the end of the year. The resulting measure is essentially the number of times the average analyst revised a forecast upward (downward if the figure is negative) over the one-year period. For example, suppose that a stock was followed by five analysts and over the prior year, each of them changed his or her earnings estimate upward four times and downward twice. Then, the total net number of upward revisions would be 10 and, when divided by the number of analysts, the resulting measure of news would be 2.

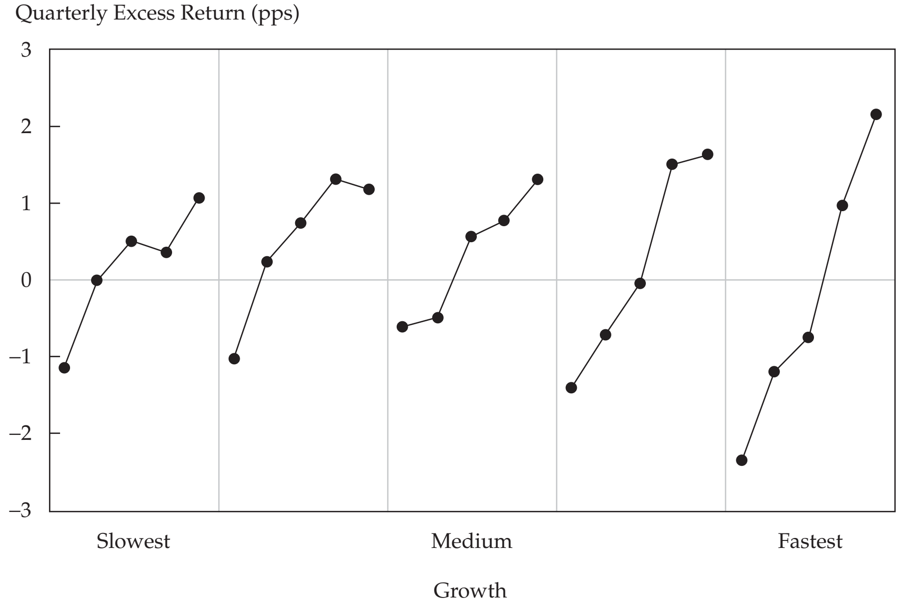
We separated stocks into five categories on the basis of this measure of news. If this measure was 2 or larger, we categorized the stock as having "very good" news. If this measure was between 1 and 2, we defined the news as "good." "Bad" and "very bad" news were defined similarly. Because analysts tend to revise their forecasts downward, we had substantially more observations in the negative-news categories than in the positive-news categories.

The results in Table 2 show a delayed reaction to earnings news that increases as growth rates increase. Like the momentum–volume effect, this relationship is nonlinear; the delayed effect of earnings news is strongest for growth stocks. **Figure 2** presents these data graphically in a manner similar to Figure 1. Each vertical panel represents a long-term growth quintile. Within each panel, excess returns over the quarter after portfolio formation are plotted against news (net upward estimate revisions). The leftmost point in each line shows the excess return for very bad news; the rightmost point shows the excess return following the very best news.

Table 2. Quarterly Excess Returns on News and Growth Portfolios, 1981–98
(excess returns in percentage points; data in parentheses are *t*-statistics; numbers below *t*-statistics are number of observations in each quintile)

	Growth Rate					
News	0 (low)	1	2	3	4 (high)	All
Very bad	–1.12	–1.02	–0.58	–1.39	–2.33	–1.24
	(–4.13)	(–5.01)	(–2.57)	(–5.52)	(–6.45)	(–10.75)
	3,594	4,924	4,638	4,446	3,609	21,211
Bad	–0.01	0.24	–0.48	–0.69	–1.18	–0.40
	(–0.05)	(1.00)	(–1.94)	(–2.45)	(–3.03)	(–3.17)
	3,345	3,210	3,361	3,172	2,813	15,901
Neutral	0.50	0.74	0.57	–0.03	–0.74	0.22
	(3.53)	(4.64)	(3.47)	(–0.15)	(–3.03)	(2.76)
	7,878	6,585	6,778	6,550	6,605	34,396
Good	0.36	1.31	0.78	1.50	0.96	0.98
	(1.36)	(4.71)	(2.73)	(4.65)	(2.11)	(6.58)
	2,159	2,065	1,907	2,162	2,221	10,514
Very good	1.05	1.17	1.30	1.62	2.14	1.58
	(2.92)	(3.60)	(3.44)	(4.10)	(5.12)	(8.56)
	1,234	1,556	1,620	1,941	2,983	9,334
All	0.11	0.28	0.17	–0.12	–0.44	0.00
	(1.06)	(2.82)	(1.65)	(–1.02)	(–2.83)	(0.00)
	18,210	18,340	18,304	18,271	18,231	91,356

Figure 2. Excess Returns within Growth Categories for Increasing Good News



Visually, the relationships in Figure 2 are very similar to those in Figure 1. To gain further insight into the competing hypotheses, we investigated the effect of earnings news and expected growth rates on volume and momentum.

News, Growth, and the Momentum–Volume Effect

How is the momentum–volume effect related to growth and news? To begin to answer this question, we started by looking at what happened if we replaced volume by growth in Table 1. We wanted to know whether there is a momentum–growth interaction that resembles the momentum–volume interaction.

Table 3 is identical to Table 1 except that growth has replaced volume. We divided stocks into different quintiles with respect to both prior momentum and growth. Table 3 indicates that, just as we found a momentum–volume interaction, we found a momentum–growth interaction. In fact, the momentum–growth interaction appears to be the somewhat stronger effect. Comparing Tables 1 and 3 suggests that stocks in the highest-growth quintile display a stronger momentum effect than stocks in the highest-volume quintile.

Table 4 reveals the effect of news and momentum on subsequent performance. Not surprisingly, most of the observations in this table lie on or close to the diagonal. In other words, most stocks that suffered bad news in the past experienced negative momentum and good-news stocks had positive momentum. This relationship strongly suggests that momentum may be largely a surrogate for news about future earnings.

Furthermore, the impact of news on subsequent performance appears to be slightly stronger than the impact of momentum. In our sample, very bad news always resulted in significantly negative subsequent performance whereas very low momentum did not. In addition, regardless of momentum, stocks with very good news had subsequent returns that were either significantly positive or insignificantly different from zero, which was not the case for momentum. These results, which suggest that a substantial portion of the momentum effect can be explained as investors' delayed reaction to news, are consistent with those found by Chan, Jegadeesh, and Lakonishok (1996).

Our measure of news does not, however, explain all of the momentum effect. For example, in the Neutral column, the average excess return in the subsequent quarter increases monotonically from the lowest- to the highest-momentum quintile. As discussed in Chan et al., this apparently independent momentum effect is likely to be caused by underreaction to news that is not captured in our measure of earnings estimate revisions.

The results in Tables 3 and 4 suggest that the momentum–volume interaction in Table 1 may be explainable by the effects of news and growth on the momentum effect. To test this hypothesis, we examined more closely how trading volume is related to growth and news.

Table 3. Quarterly Excess Returns on Momentum and Growth Portfolios, 1981–98
(excess returns in percentage points; data in parentheses are *t*-statistics; numbers below *t*-statistics are number of observations in each quintile)

	Growth Rate					
Momentum	0 (low)	1	2	3	4 (high)	All
0 (low)	0.13	–1.02	–0.12	–1.52	–3.09	–1.24
	(0.42)	(–3.55)	(–0.41)	(–5.46)	(–9.00)	(–9.00)
	3,340	3,274	3,359	3,985	4,285	18,243
1	–0.09	0.26	–0.48	–0.48	–1.26	–0.34
	(–0.45)	(1.36)	(–2.27)	(–1.90)	(–3.13)	(–3.10)
	4,067	4,163	3,976	3,467	2,613	18,286
2	–0.24	0.49	0.14	–0.16	–0.32	0.01
	(–1.39)	(2.54)	(0.73)	(–0.65)	(–0.79)	(0.13)
	4,488	4,118	4,012	3,383	2,286	18,287
3	0.31	0.73	0.61	0.65	0.04	0.49
	(1.60)	(3.76)	(2.89)	(2.80)	(0.10)	(6.58)
	3,857	3,961	3,964	3,585	2,919	18,286
4 (high)	0.75	0.91	0.83	0.99	1.50	1.09
	(2.58)	(3.41)	(2.92)	(3.46)	(5.39)	(8.56)
	2,458	2,824	2,993	3,851	6,128	18,254
All	0.11	0.28	0.17	–0.12	–0.44	0.00
	(1.06)	(2.82)	(1.65)	(–1.02)	(–2.83)	(0.00)
	18,210	18,340	18,304	18,286	18,231	91,356

Table 4. Quarterly Excess Returns on Momentum and News Portfolios, 1981–98
(excess returns in percentage points; data in parentheses are *t*-statistics; numbers below *t*-statistics are number of observations in each quintile)

	News					
Momentum	Very Bad	Bad	Neutral	Good	Very Good	All
0 (low)	–1.58	–1.01	–0.77	–0.07	–1.47	–1.24
	(–8.23)	(–3.42)	(–2.70)	(–0.09)	(–1.20)	(–9.00)
	9,620	3,894	3,938	530	261	18,243
1	–0.92	–0.12	–0.09	–0.14	0.61	–0.34
	(–4.84)	(–0.49)	(–0.52)	(–0.29)	(0.93)	(–3.10)
	5,722	4,178	6,648	1,142	596	18,286
2	–0.95	–0.08	0.22	0.69	0.51	0.01
	(–3.80)	(–0.36)	(1.54)	(2.34)	(1.08)	(0.13)
	3,327	3,637	8,293	1,983	1,047	18,287
3	–0.82	–0.17	0.57	1.08	1.23	0.49
	(–2.26)	(–0.59)	(3.96)	(4.50)	(3.78)	(4.72)
	1,764	2,706	8,703	3,036	2,077	18,286
4 (high)	–1.64	–0.82	0.67	1.54	2.18	1.09
	(–2.30)	(–1.80)	(3.16)	(5.60)	(8.25)	(8.16)
	778	1,486	6,841	3,823	5,353	18,254
All	–1.24	–0.40	0.22	0.98	1.58	0.00
	(–10.75)	(–3.17)	(2.76)	(6.58)	(8.56)	(0.00)
	21,211	15,901	34,396	10,514	9,334	91,356

News, Growth, and Volume

Trading should take place because investors need liquidity or have received new information.[6] The primary catalyst for the second type of trading should be an event that alters the rate at which rational investors discount the future or, more importantly, news relating to future profitability.

Figure 3 indicates the dependence of trading volume on growth and earnings news. We used analysts' earnings revisions as a proxy for news and used analysts' forecasts of future growth as a proxy for growth. Figure 3 shows that both growth and news have a significant effect on volume. As one would expect, the more important (more extreme) the news and the higher the growth rate, the higher the volume. The relationship is also strongly nonlinear. The effect of news on volume appears to be particularly pronounced for rapidly growing stocks.

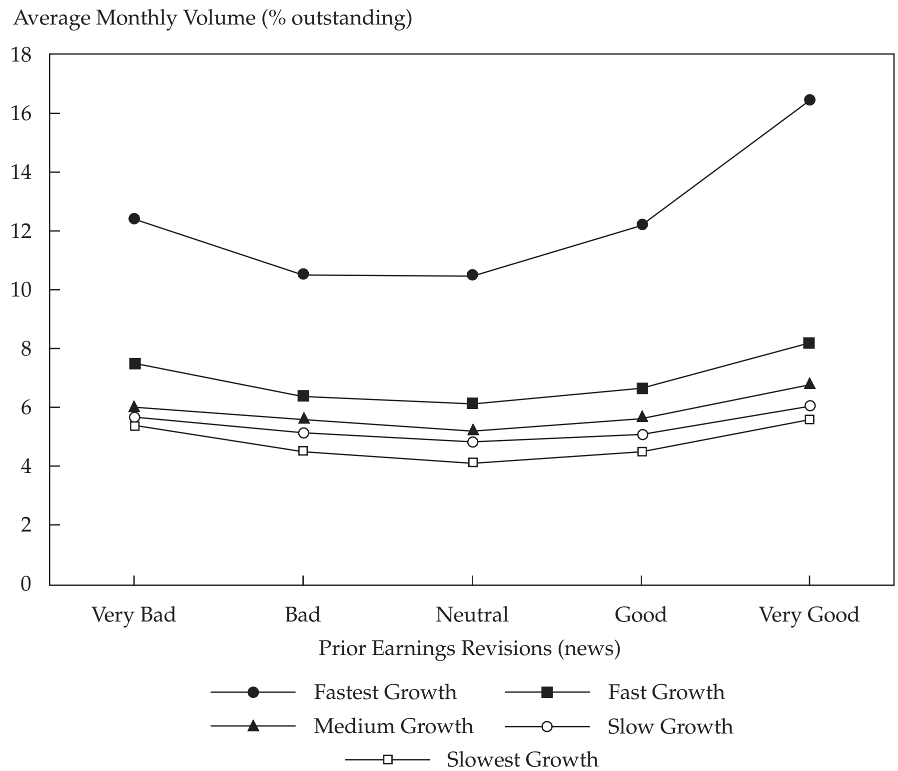
Because our measure of news was net upward revisions as a percentage of the total number of forecasts and could be either positive or negative, the relationship between trading volume and this news measure in Figure 3 is U-shaped. Intuitively, however, trading volume should be better explained by the total number of revisions than by downward or upward revisions. For instance, a stock in the "neutral" news category may have had a lot of both upward and downward revisions over the year and would thus be likely to have had high trading volume. Therefore, we examined the relationship between trading volume and an alternative measure of news based on the total (not net) number of revisions. As expected, we found that trading volume increased monotonically with the total revision activity in each growth category.[7]

Relative Importance of Volume

Does volume matter even after growth and news are controlled for? The results shown in Figure 3 are strong, but finding that important news and high growth lead to high volume is not surprising. The more interesting question is whether expected growth rate and news, two fundamental variables, explain the momentum–volume effect.

We started by calculating "residual" volume for each stock, where residual volume equals the difference between a stock's actual trading volume and the average volume for each point plotted in Figure 3. Simply put, residual volume controls for the average amount of trading for stocks with similar revisions and similar rates of growth. We did

Figure 3. Volume Increases with Prior News and the Importance of News (Growth)



this calculation for each quarter in the sample period, thereby normalizing volume for the type of stock and amount of news. We then replicated the analysis in Table 1 but replaced absolute trading volume with this measure of residual volume.

The results, reported in **Table 5**, demonstrate that the interactions among volume, momentum, and subsequent returns disappear when volume is controlled for news and growth. The spread in excess returns between the high- and low-momentum quintiles now varies randomly across columns (i.e., across residual volume ranks).

Table 6 presents results from cross-sectional regressions of quarterly excess returns of individual stocks on volume and momentum. To facilitate a comparison, we ran two regressions. The first row shows results when price momentum and unadjusted average monthly trading volume were the independent variables; the second row shows results when price momentum and residual trading volume adjusted for earnings growth and news were the independent variables. In both regressions, the dependent variable was the excess return of individual stocks in the quarter after they were ranked on one-year price momentum and trading volume. The independent variables were quintile ranks of momentum and volume, which were assigned integer values of 0 through 4. To test the statistical significance of the interaction effect between momentum and volume (that is, to test whether the momentum effect varied with different levels of volume), we included an interaction term, namely, the product of the momentum and volume ranks.

Consistent with the results shown in Table 1, the first row of Table 6 shows a strong positive interaction effect between momentum and trading volume when trading volume was not adjusted for earnings growth and news. The coefficient on the interaction term, 0.13, is positive and statistically significant. The coefficient for the momentum rank, 0.26, implies that the momentum effect for the lowest-volume quintile is about half the momentum effect for the average-volume quintile and a third that for the highest-volume quintile.

Table 5. Quarterly Excess Returns on Momentum and Residual Volume Portfolios, 1981–98
(excess returns in percentage points; data in parentheses are *t*-statistics)

	Residual Trading Volume					
Momentum	0 (low)	1	2	3	4 (high)	Average
0 (low)	–1.32	–0.95	–0.88	–1.44	–1.42	–1.24
	(–4.42)	(–3.26)	(–2.92)	(–4.98)	(–4.53)	(–9.00)
1	–0.70	–0.14	–0.18	–0.05	–0.75	–0.34
	(–2.84)	(–0.72)	(–0.87)	(–0.22)	(–2.11)	(–3.10)
2	0.05	0.03	0.11	0.32	–0.70	0.01
	(0.19)	(0.17)	(0.62)	(1.43)	(–1.97)	(0.13)
3	0.79	0.55	0.54	0.49	–0.07	0.49
	(3.23)	(2.80)	(2.82)	(2.36)	(–0.20)	(4.72)
4 (high)	1.16	1.23	0.75	1.34	0.98	1.09
	(4.34)	(4.16)	(2.49)	(4.73)	(3.23)	(8.16)
Average	0.03	0.13	0.07	0.11	–0.34	0.00
	(0.25)	(1.30)	(0.67)	(0.96)	(–2.24)	(0.00)

Table 6. Momentum–Volume Interaction Effect: Evidence from Cross-Sectional Regressions, 1981–98
(*t*-statistics in parentheses)

Volume	INT	MM	VOL	MM×VOL	R^2	F
Unadjusted for growth and news	–0.19	0.26	–0.42	0.13	0.0029	86.9
	(–1.12)	(3.70)	(–6.60)	(4.97)		
Adjusted for growth and news	–0.96	0.55	–0.06	–0.00	0.0024	73.3
	(–6.02)	(8.51)	(–1.01)	(–0.09)		

Note: INT is the intercept; MM is momentum; VOL is volume; MM×VOL is the interaction term.

The second row shows that the interaction effect between momentum and volume completely vanishes when residual volume (which was adjusted for growth and news) was used in the regression. This finding is consistent with the data in Table 5. These results suggest that the interaction between news and earnings growth explains the momentum–volume effect.[8]

Finally, the coefficient for trading volume in the first row is negative and significant. The reason is that trading volume is correlated with earnings growth and slow-growth stocks tended to outperform fast-growth stocks in the period studied (see Lakonishok, Shleifer, and Vishny 1994). As shown in the second row, when trading volume was adjusted for growth, the coefficient for volume became no longer significant.

Conclusions

Our evidence suggests that once the company's growth rate is controlled for, the momentum–volume effect is largely explainable by news. That is, the apparent deviation from market efficiency that has been dubbed the momentum–volume effect should be considered a delayed reaction by investors to fundamental news, not a technical trading rule driven by volume or momentum.

Notes

1. The I/B/E/S forecasts are three- to five-year earnings growth forecasts made by sell-side security analysts.
2. The sample includes companies that were delisted, went bankrupt, or merged after the quarter under investigation; a small fraction, 0.8 percent, of the observations were eliminated from the sample because they did not have a return in the quarter following portfolio formation. This circumstance raises the possibility of survivorship affecting the results. Although survivorship may have influenced our findings, the impact is likely to be small because of the small number of excluded companies and our use of equal weighting. Only two companies were dropped because they went bankrupt—too few to affect our results. Most of the deletions from the study were the result of missing returns and were companies involved in mergers in the quarter following portfolio formation. A majority of them fell in the high-momentum/high-volume category in the period preceding portfolio formation (the rest were distributed evenly among the quintiles). Although we have no reason to believe that returns would be especially unusual for these stocks, a merger-related "bounce" in the missing quarter would strengthen our conclusions. Note that we lost only the terminal quarters of bankruptcies and mergers; they were included in prior quarters, when these (pending) events were also likely to elicit strong price responses. Finally, we also examined whether the exclusion of small stocks from the sample might skew our results. We broke the sample in half by market capitalization and recompiled the tables. Results for the large-cap sample and for the sample containing mid-sized and small-cap stocks were similar. Although very-small-cap stocks might exhibit a different result, we believe that the results shown are probably robust to variations in company size.
3. Lee and Swaminathan examined the momentum–volume interaction effect for various subperiods from 1965 through 1995. They found that for the 1985–95 period, high-momentum stocks with high volume (measured over the preceding six months) tended to subsequently outperform high-momentum stocks with low volume. They also showed that the opposite held for earlier time periods. As we show later in this article, volume is a proxy for growth. Thus, the difference in results reported by Lee and Swaminathan for different periods may have been driven by the relative performance of slow-growth stocks (many of which can be characterized as "value stocks") versus fast-growth stocks. In the periods prior to 1985, growth stocks underperformed value stocks, whereas the opposite tended to hold in the late 1990s.
4. In 1961, Miller and Modigliani made a distinction between companies that are "expanding" and companies that are "growing." Expanding companies simply get larger, whereas growing companies get larger profitably. In other words, expanding companies get larger by accepting projects that have net present values of zero; growing companies grow by accepting projects with positive NPVs. We do not make this distinction here: Whether the company's expansion is profitable or not, it is growing in our terminology. Technically, our theory is based on different expansion rates.
5. A simple growth-stock formula makes this point: If stock price equals $d/(r - g)$, where d is next period's expected dividend, r is the cost of equity, and g is the expected rate of growth of dividends per share, any change in g can have dramatic effects on valuation (see Scott et al. for a fuller discussion).
6. See Harris and Raviv (1993) and Kandel and Pearson (1995) for a discussion of information effects.
7. These results are not reported here. We chose to report the results found when we used net upward revision in order to be consistent with the news measure in Tables 2 and 4. The choice of news measure had virtually no effect on the results in the next section.
8. Because news appears to predict future performance, our empirical results raise the possibility that investors could pursue a profitable revisions-based trading strategy. We are aware of practitioners pursuing both volume- and revisions-based trading strategies, but simulating a revisions-based strategy and testing whether it could outperform a volume-based approach is beyond our intent in this article.

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