Trading Volume and Stock Returns Volatility: Evidence from Industrial Firms of Oman

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Abstract
This study analyzes the relationship between trading volume and stock return volatility for industrial firms listed on Muscat securities market. Several tests were utilized to include: Brailsford model, vector autoregressive model (VAR), and the pairwise Granger causality test. The empirical results provide evidence of a significant positive effect for return volatility on trading volume. Likewise, the VAR model provides evidence of a significant positive effect of trading volume on stock returns. On the other hand, the pairwise Granger causality test reveals that trading volume Granger-cause stock return. The previous findings are inconsistent with the weak-form of the efficient market hypothesis.

Keywords: trading volume, stock return volatility, vector autoregressive model, pairwise Granger causality test, weak-form efficiency, Muscat securities market

1. Introduction
There is a considerable amount of research that investigated the relationship between trading volume and stock returns. In a simple term, trading volume can be referred to as the amount of security or securities (even the entire market) that were bought and sold during a given trading day. Accordingly, many practitioners and academicians in the investment field consider trading volume as an important technical indicator utilized to measure the strength of the market. On the other hand, the efficient market hypothesis assumes that investigating this relationship will not help investors in achieving abnormal rate of return. Fama (1970) states that current stock prices reflect all security market information including the historical sequence of prices, rates of return, and trading volume. Therefore, it will be futile to use any trading rules to make a purchasing or selling decision based on past rate of return, trading volume or any past market data.

Results from previous studies related to this issue are abundant and mixed. However, most of them regardless of the econometrical models they used, found a relation between trading volume and market return such as in Osborne (1959), Ying (1966), Morgan (1976), Epps & Epps (1976), Westerfield (1977), Rutledge (1984), Saatcioglu & Starks (1998), and Mahajan & Singh (2009). On the other hand, a very few studies found some conflicting results about this relationship such as in Granger & Morgenstern (1963), James & Edmister (1983), Rogalski (1978), and Harris & Raviv (1993).

The aims of this paper are two-fold. First, it analyzes the relationship between trading volume, and stock return volatility for industrial companies listed on Muscat stock market. It is worth mentioning that there are a scarcity in the literature regarding the behavior of Omani financial market including the relation between trading volume and stock return volatility. Moreover, Oman is rapidly growing emerging market; therefore, this study will be beneficial to investors by giving them a brief preview to the structure of the Omani stock market if they are interested in entering such an emerging market. In addition, the study concentrates on examining only one sector, the industrial sector, instead of including all sectors. We believe that the characteristics of different sectors may have influence on the results. Therefore, this study limited itself to the industrial sector only to avoid biasness.
The second objective of this study is to derive into a conclusion whether the results of such a relationship are consistent with the weak-form of the efficient market hypothesis.

This study includes the following sections: Section 2 explains briefly the results of previous studies. On the other hand, section 3 describes data and research methodology. Analysis of the empirical results is reported in section 4. Finally, section 5 presents the concluding remarks.

2. Literature Review

There is an extensive empirical research in the literature that investigated the relationship between stock return and trading volume. For instance, early study by Granger and Morgenstern (1963) utilized the spectral analysis on New York stock exchange composite index for the period 1939 till 1961. The findings show no relation between the absolute value of daily price change and the daily volumes. A few years later, contrary results were obtained by Ying (1966) where a strong positive correlation was found between the changes in prices and volume. The study revealed that a small volume is associated with price fall and large volume is associated with a price rise. Later on, Crouch (1970a), Crouch (1970b), Westerfield (1977), and Tauchen and Pitts (1983) all reached the same conclusion of a positive correlation between volume and returns.


On the other hand, Smirlock and Starks (1985) used individual stock data and Granger causality test. The results show a strong positive lagged relation between absolute price changes and volume. Similarly, Jain and Joh (1988) examined the joint characteristics of hourly stock trading volume and returns on New York stock exchange. Their findings show a strong contemporaneous relation between trading volume and return lagged up to four hours. Hiemstra and Jones (1994) investigated the dynamic relation between the daily Dow Jones stock return and the percentage changes in New York stock exchange trading volume. They found a significant bi-directional nonlinear causality between return and volumes. On the other hand, Datar, Naik, and Radcliffe (1998) tested the relation between liquidity and stock returns. They found evidence that liquidity plays a significant role in explaining the cross-sectional variation in stock returns.

Six Latin American stock markets were investigated by Saatcioglu and Starks (1998). Their findings show a unidirectional relationship where trading volume changes lead to price changes. Similar conclusion was reached by Chordia and Swaminathan (2000). They found daily and weekly returns on high volume portfolios lead returns on low volume portfolios.

As for China stock market, Lee and Rui (2000) investigated the contemporaneous and causal relationship between trading volume, stock returns and return volatility for four Chinese stock exchanges. They found that trading volume does not Granger-cause stock market returns. In addition, US and Hong Kong trading volumes do not Granger-cause either return or volatility in China stock market. On the other hand, a positive correlation between trading volume and the absolute value of stock price change were found by Chen, Firth, and Rui (2001). They tested the dynamic relation between stock returns, trading volume and volatility of stock indexes for nine national markets. They found that returns Granger-cause volume and volume Granger-cause returns for some countries. Similar tests were also conducted by Lee and Rui (2002) on New York, Tokyo, and London stock markets. Their results reveal that trading volume does not Granger-cause stock returns for each of the three markets. In addition, they found a positive relationship between trading volumes and return volatility in the three stock markets. Moreover, the US trading volume exhibited a significant predictive power for Tokyo and London financial markets.

Investigating the emerging stock market of Kuwait, Al-Saad (2004) detected asymmetric relationship between change in price and volume. Similar results were obtained by Kamath and Wang (2006). They examined the daily rate of return and the trading volume for six Asian equity markets. They found a significant contemporaneous relation between volume and returns.

On the other hand, Léon (2007) found that volume has a predictive power of stock returns volatility for the regional stock exchange of the West African Economic and Monetary Union. Similarly, Assogbavi, Schell and Fagnissé (2007) examined the Russian stock exchange. Their findings reveal a strong evidence of bi-directional relation between volume and price change. Moving into the Southeast Asian markets, Pisedtasalasai and Gunasekaraage (2007) tested the causal and dynamic relationship among returns, return volatility and trading volume for the equity markets of Indonesia, Malaysia, the Philippines, Singapore, and Thailand. They found a strong asymmetric relationship between stock returns and trading volume. They conclude that returns are
important in predicting their future dynamics as well as those of trading volume. However, trading volume found to have a limited impact on the future of dynamics of stock returns.

Testing Pakistan equity market, Khan and Rizwan (2008) found a positive contemporaneous relationship between trading volume and return preserves after taking heteroskedasticity into account. Besides, Al-Saad and Moosa (2008) tested again the emerging equity market of Kuwait. They found evidence of asymmetry and concluded that trading volumes are higher in a rising market. On the other hand, Sabri (2008) examined eight Arab stock markets and found that volume and prices are significantly integrated and volume volatility represents the most predicted variable of increasing price volatility. However, the correlation between volume and price movements was higher in the stock markets of oil Arab countries.

Using the ARCH and GARCH-M models, Mubarik and Javid (2009) investigated Pakistan stock market. Their results show a significant relationship between trading volume and volatility. Similar results were obtained by Khan and Ahmad (2009) when they investigated Karachi, KSE 100 index. They found that trading volume and stock returns are affected by the arrival of events such as a terrorist attack or the assassination of a political figure.

The Indian stock market was tested by Tripathy (2011) who also found a bi-directional causality between trading volume and stock return. On the other hand, Pathirawasam (2011) investigated the relationship between trading volume and stock returns for 266 stocks listed on Colombo stock exchange. The findings show that stock returns are positively related to trading volume. In addition, past trading volume change is negatively related to stock returns.

Similarly, Al-Jafari and Tliti (2013) empirically tested the banking sector of Amman stock exchange. Their findings show a significant relationship between trading volumes and return volatility. The VECM revealed evidence of long-run causality from return to trading volume. On the other hand, Sun and Li (2015) examined stock returns, volatility and volume in a simultaneous equations model. Their results show that the three variables are interrelated and that intraday skewness has a significant impact on daily returns, volatility and volume.

3. Data and Research Methods

3.1 Data

The research sample consists of monthly trading volume and stock return for 17 industrial companies listed on Muscat securities market from January 2009 till December 2013 for a total of 1020 observations for each variable. The monthly data were collected from the website of Muscat securities market (www.msm.gov.om).

3.2 Methodology

The stock return is calculated as the logarithm of the first difference of closing price at each month as shown in equation 1:

\[ R_t = \ln \left( \frac{P_t}{P_{t-1}} \right) \] (1)

As for trading volume, we utilize the natural logarithm of traded shares as commonly used in previous literature and indicated in equation 2.

\[ V_t = \ln (Vol_t) \] (2)

To examine the relationship, we employ first the unit root test as proposed by Dickey & Fuller (1979), and Phillips & Perron (1988) to check if the times series is stationary. Equation 3 states the general model of the Augmented Dickey-Fuller (ADF) test:

\[ \Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t \] (3)

On the other hand, the Phillips-Perron test is stated in equation 4:

\[ \Delta y_t = \alpha y_{t-1} + \beta X_t + \varepsilon_t \] (4)

In addition, the study utilizes the model proposed by Brailsford (1996) to investigate the relationship between trading volumes and return volatility as in equation 5:

\[ V_t = \alpha_0 + \beta_1 V_{t-1} + \beta_2 V_{t-2} + \alpha_1 R_t^2 + \alpha_2 D_t R_t^2 + \varepsilon_t \] (5)

In general, the presence of cointegration suggests that we should model the data using the vector error correction
model (VECM) rather than using the VAR model. However, if variables are stationary at the level, this means there is no long-run relationship and a short-run relationship may exist. In this case, there will be no need for estimating the cointegration.

It is worth mentioning, the estimation of the VECM will reduce the estimation of the VAR model for a multivariate time series. Therefore, VAR is considered one of the most successful, flexible, and easy to use model for the analysis of multivariate time series. Accordingly, each variable is a linear function of past lags of itself and past lags of the other variables. Afterward, the causality analysis can be conducted to investigate the causality between the variables. The VAR model can be expressed as follows:

\[ R_t = a_0 + \sum_{i=1}^{m} \beta_i R_{t-i} + \sum_{j=1}^{n} \beta_j V_{t-j} + \varepsilon_{1t} \]  
\[ V_t = a_0 + \sum_{i=1}^{m} \beta_i V_{t-i} + \sum_{j=1}^{n} \beta_j R_{t-j} + \varepsilon_{2t} \]  

4. Analysis of the Empirical Results

Table 1 shows the descriptive statistics of the natural logarithm of trading volume and stock returns. We can observe that the mean of stock return is 0.0083 with a big difference between the maximum return of 1.26 and the minimum return of -2.08. These results are consistent with the high standard deviation values. Also we can see from the table that the return series does not follow a normal distribution which was tested by using Jarque-Bera test that rejects the null hypothesis of a normal distribution. Furthermore, the results are also consistent with the skewness and the kurtosis statistical values. Similarly, the Jarque-Bera test, the skewness and kurtosis values indicate that trading volume series does not also follow a normal distribution.

| Return (Mean) | 0.008341 | 13.18061 |
| Return (Median) | 0.000000 | 14.04375 |
| Return (Maximum) | 1.263487 | 18.00831 |
| Return (Minimum) | -2.087058 | 0.000000 |
| Return (Std. Dev.) | 0.144869 | 3.441792 |
| Return (Skewness) | -4.843385 | -2.358183 |
| Return (Kurtosis) | 90.34868 | 9.343058 |
| Jarque-Bera | 322783.2 | 2608.477 |
| Probability | 0.000000 | 0.000000 |

Tables 2 and 3 below show the panel unit root test for stock return and trading volume. According to the results, we reject the null hypothesis that the series has a unit root and conclude that stock return and trading volume are integrated at the level. This means there is no cointegration between trading volume and stock returns and that further analysis for the relationship will be conducted using the VAR model.

| Return ADF - Fisher Chi-square | 305.923 | 0.00 | 247.656 | 0.00 |
| Return ADF - Choi Z-stat | -14.9455 | 0.00 | -12.9572 | 0.00 |
| Volume ADF - Fisher Chi-square | 120.342 | 0.00 | 144.847 | 0.00 |
| Volume ADF - Choi Z-stat | -7.15812 | 0.00 | -8.22189 | 0.00 |

Note: *, denotes significance at the 1% level.

| Return ADF - Fisher Chi-square | 571.087 | 0.00 | 499.319 | 0.00 |
| Return ADF - Choi Z-stat | -21.7828 | 0.00 | -20.0974 | 0.00 |
| Volume ADF - Fisher Chi-square | 205.756 | 0.00 | 246.769 | 0.00 |
| Volume ADF - Choi Z-stat | -10.9537 | 0.00 | -12.574 | 0.00 |

Note: *, denotes significance at the 1% level.
Table 4 below shows the results of the relationship between trading volume and return volatility. They indicate a positive effect for return volatility on trading volume at 1% significant level. The value of adjusted R-squared indicates that 42.5% of total variation in trading volume is explained by this model. In addition, the F-test is significant and the results are reliable. Therefore, we can conclude that there is a significant relationship between trading volume and stock return.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume(-1)</td>
<td>0.45652</td>
<td>14.73743</td>
<td>0.0000</td>
</tr>
<tr>
<td>Volume(-2)</td>
<td>0.246939</td>
<td>8.02183</td>
<td>0.0000</td>
</tr>
<tr>
<td>Return^2</td>
<td>1.124993</td>
<td>2.592124</td>
<td>0.0097</td>
</tr>
<tr>
<td>DU*R^2</td>
<td>-4.707915</td>
<td>-3.259609</td>
<td>0.0012</td>
</tr>
<tr>
<td>C</td>
<td>3.955634</td>
<td>10.92339</td>
<td>0.0000</td>
</tr>
<tr>
<td>F-statistic</td>
<td>178.9618</td>
<td></td>
<td>0.0000</td>
</tr>
<tr>
<td>Durbin-Watson stat.</td>
<td>2.128488</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.424515</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 5, the results of the VAR estimates considering stock return as an endogenous variable show elasticity of stock return to trading volume of 0.0041 at 5% significant level. This means that stock return is responding positively to changes in trading volume. Likewise, the value of F-test is significant at the 1% level. Therefore, we can conclude a significant positive effect of trading volume on stock returns.

<table>
<thead>
<tr>
<th>D(Stock Return)</th>
<th>D(Trading Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R(-1)</td>
<td>0.005255</td>
</tr>
<tr>
<td>R(-2)</td>
<td>0.050320</td>
</tr>
<tr>
<td>V(-1)</td>
<td>4.090000</td>
</tr>
<tr>
<td>V(-2)</td>
<td>0.004100**</td>
</tr>
<tr>
<td>C</td>
<td>-0.046011**</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.012743</td>
</tr>
<tr>
<td>Adj. R-squared</td>
<td>0.008633</td>
</tr>
<tr>
<td>F-statistic</td>
<td>3.100945***</td>
</tr>
</tbody>
</table>

Note: *** and ** denote significance at 1%, and 5% level respectively.

To test for causality, the pairwise Granger causality test at lag 2 is utilized. The results are listed in Table 6 and it show that we cannot reject the null hypothesis stating stock return does not Granger-cause trading volume. On the other hand, we can reject the null hypothesis stating that trading volume does not Granger-cause the stock return for industrial firms in Oman. Therefore, we can conclude that trading volume Granger-cause stock return.

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume does not Granger cause return</td>
<td>4.69963</td>
<td>0.0093</td>
</tr>
<tr>
<td>Return does not Granger cause volume</td>
<td>0.54636</td>
<td>0.5792</td>
</tr>
</tbody>
</table>

5. Conclusion

This study empirically examines the relationship between trading volume and stock return volatility for 17
industrial companies that are listed on Muscat securities market. Therefore, several tests were utilized to examine such a relationship. The results show that stock return and trading volume are integrated at the level. In addition, the study provides evidence of a positive and significant effect of return volatility on trading volume. These results are similar to the findings of Sabri (2008), Mubarik & Javid (2009), Tripathy (2011), Pathirawasam (2011), and Al-Jafari & Tliti (2013). Likewise, the study finds a significant and a positive effect of trading volume on stock returns. Finally, the pairwise Granger causality tests reveal that trading volume Granger-cause stock return. The study concludes that the findings contradict the weak-form of the efficient market hypothesis.

References


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