Return and Volume and the 2008 Market Crash

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This paper examines the dynamic relationship between stock market trading volume and returns for four major stock markets: New York, Tokyo, London and Toronto using daily data covering March 1, 2003 to Nov. 1, 2012 period. We investigate the information content of volume for the stock returns. We find a positive contemporaneous relation between volume and absolute value of return in all markets. In addition, we find support for the proposition that lagged volume has predictive power for future absolute returns. We also investigate whether the 2008 market crash has had a significant impact on the relationship between the trading volume and return on all markets.

INTRODUCTION

Many studies have examined the relationship between stock returns and volume. Gul and Javed (2009) examined the relationship between trading volume and performance of stock exchange index on a given day in the Pakistani market. Copeland and Copeland (1998) explore the contemporaneous and lead-lag relations of market returns using the Dow Jones global industry indexes. Copeland (1976) suggest that a latent variable, representing the rate of information arrival to the market, jointly affects price variance and volume, causing contemporaneous movements between the absolute value of returns and trading volume. Empirical work, surveyed in Karpoff (1987), provides support for this prediction in both equity and future markets. Suominen (2001) argues that the information content of volume is useful in determining the extent of information asymmetry in the markets. The idea is that there exist a positive relationship between volume and subsequent price movements and traders that use that information i their strategies achieve better trading results.

The objective of the present study is to examine the relationship between return and volume in four major markets using a long time-series data spanning from March 1, 2003 to Nov. 1, 2012. More specifically, we examine the predictive power of volume for both the magnitude and direction of stock price movements, i.e., absolute value of return and returns per se. We also examine whether the 2008 market crash has had any significant impact on the return and volume relationship.

MODEL

To examine the linkage between volume and absolute value of returns, following Foster (1995), we construct the following structural model (Figure 1):

FIGURE 1
FOSTER'S STRUCTURAL MODEL

$$V_t = \alpha_0 + \alpha_1 R_t + \alpha_2 V_{t-1} + \alpha_3 V_{t-2} + u_{1t}$$
$$R_t = \beta_0 + \beta_1 V_t + \beta_2 V_{t-1} + \beta_3 R_{t-1} + u_{2t}$$

R_t denotes return calculated as log price changes at time t and V_t denotes the log of trading volume at time t. We treat volume and absolute returns as endogenous and therefore use Instrumental Variable method as a GMM estimator to avoid problems of simultaneity bias. In addition, the use of a GMM framework produces heteroskedastic-consistent estimates by correcting the covariance matrix of the consistent IV estimator. Statistical significance of $\alpha 1$ and $\beta 1$ provides support for the presence of contemporaneous relation between volume and absolute returns. Significance of $\beta 2$ indicates that lagged volume has predictive power for future absolute returns.

EMPIRICAL RESULTS

Before estimating the above models, we need to examine the univariate properties of the series used in this study. Proper statistical inference based on the above models is contingent upon the stationarity of the underlying variables used in the models. To examine the univariate properties of the variables used in this study, we subjected them to a series of tests. First, we used the augmented Dickey-Fuller (ADF) test which included a constant and lags of first differences as regressors as suggested by Dickey and Fuller (1979, 1981) and Said and Dickey (1984). The optimum lag length is determined by the procedure suggested by Ng and Perron (1995).

It is well known that the Dickey-Fuller test has low power. Elliot, Rothenberg and Stock (1996) proposed a variant of the ADF test, referred to as ADF^{GLS}, in which the series are transformed by a generalized least-squares regression. A Monte Carlo study by Ng and Perron (2001) suggests that the ADF^{GLS} test is more powerful than the standard ADF test. Therefore, in the second stage, we used ADF^{GLS} to examine the time series properties of the rates used in this study. In fact, these two tests should be treated as complementary rather than substitutes. Results reported in Table 1 show that all test statistics are highly significant suggesting that series used in this study are stationary.

TABLE 1
UNIVARIATE PROPERTIES OF RETURNS AND VOLUME

	ADF	ADF^{GLS}
S&P500		
log (return)	-64.64	-24.14
log(volume)	-22.65	-2.68
FTSE		
log (return)	-15.38	-8.69
log(volume)	-9.31	-5.21
NIKKEI		
log (return)	-14.68	-35.72
log(volume)	-9.28	-3.61
TSX		
log (return)	-15.47	-14.84
log(volume)	-5.92	-7.23

Next, we estimated Model 1 using GMM estimator. Results are reported in Table 2. T-statistics are in parentheses.

TABLE 2
GMM ESTIMATION OF MODEL (1) (2003-2012)

Coefficient	FTSE	NIKKEI	S&P500	TSX
α_0	3.77 (13.23)	1.79 (12.71)	1.46 (8.86)	5.42 (18.80)
α_1	0.03 (6.14)	0.03 (8.98)	0.03 (7.84)	0.07 (11.03)
α_2	0.58 (29.46)	0.56 (28.84)	0.62 (32.49)	0.50 (26.92)
α_3	0.24 (12.13)	0.29 (14.93)	0.31 (16.18)	0.21 (11.39)
β_0	-0.8 (0.78)	-5.79 (7.568)	-11.39 (13.41)	-9.83 (10.97)
β_1	0.45 (6.37)	0.95 (9.16)	0.83 (8.54)	0.61 (10.82)
β_2	-0.38 (5.4)	-0.38 (3.62)	-0.8 (2.81)	-0.06 (2.45)
β_3	0.27 (13.71)	0.22 (11.21)	0.16 (7.97)	0.28 (14.72)

Table 2 shows that the estimated α_1 and β_1 are positive and highly significant in all markets suggesting the presence of a positive contemporaneous relation between volume and absolute returns in all markets. In addition the estimated β_2 is statistically significant in all markets supporting the proposition that lagged volume has predictive power for future absolute returns. It is of interest to examine whether the 2008 market crash has had any significant impact on the relationship between return and volume. Results of estimating model (1) for the 2003-2007 and 2009-2012 periods are reported in Table 3. Focusing on the period prior to the 2008 market crash, Table 3 shows that $\alpha 1$ and $\beta 1$ are positive and highly significant consistent with the results obtained for the full sample. Similarly, the estimated β_2 for all markets is statistically significant suggesting that past volume has predictive power for future absolute returns. Turning to the results for the period after the 2008 crash, we observe that volume and return remain contemporaneously correlated. However, the estimated β_2 is no longer significant in any of the markets suggesting that information in past volume can no longer help predicting future returns. This is a significant finding suggesting a change in the relationship between volume and return in the post 2008 crash period.

CONCLUDING REMARKS

It is commonly held that large trading volumes are related to increasing prices, while falling prices correspond to low trading volume. Such relationship suggests that the direction of price change is related to the magnitude of trading volume. The present paper examined the above relationship between trading volume and return in four major stock markets. We found that the absolute value of returns and trading volume are contemporaneously correlated. We also found significant support for the proposition that trading volume has predictive power for stock returns for the full sample and the period before the 2008 market crash. This lends support to the sequential information flow model of Copeland (1976). We found that the predictive power of volume for stock return disappears after the 2008 market crash.

TABLE 3
GMM ESTIMATION OF MODEL (1)

	March 1, 2003 to Dec. 31, 2007				Jan.1, 2008 to Nov. 1, 2012			
	FTSE	NIKKEI	S&P500	TSX	FTSE	NIKKEI	S&P500	TSX
α_0	8.27 (14.40)	1.76 (8.38)	1.98 (7.03)	5.76 (13.76)	6.81 (12.29)	3.66 (12.44)	4.97 (9.62)	9.47 (15.26)
α_1	0.06 (5.38)	0.04 (4.75)	0.08 (8.99)	0.08 (5.89)	0.07 (7.38)	0.06 (10.32)	0.04 (5.47)	0.08 (7.66)
α_2	0.49 (17.36)	0.55 (19.77)	0.66 (24.24)	0.50 (19.41)	0.48 (15.70)	0.49 (16.33)	0.53 (17.02)	0.36 (11.72)
α_3	0.11 (3.92)	0.30 (10.78)	0.25 (9.18)	0.19 (7,27)	0.19 (6.17)	0.19 (6.52)	0.24 (7.73)	0.14 (4.62)
β_0	-3.56 (2.66)	-0.31 (0.41)	-2.86 (3.25)	9.47 (15.26)	-13.96 (7.94)	-11.44 (7.03)	-22.07 (8.44)	-12.57 (6.56)
β_1	0.35 (5.21)	0.45 (4.58)	0.78 (9.32)	0.08 (7.66)	0.74 (7.78)	1.63 (10.28)	1.01 (6.43)	0.72 (7.82)
β_2	-0.16 (2.32)	-0.35 (3.56)	-0.62 (7.35)	0.35 (11.72)	-0.018 (0.19)	-0.59 (1.56)	0.03 (0.18)	-0.02 (0.27)
β_3	0.20 (7.25)	0.04 (1.49)	0.03 (1.08)	0.14 (4.62)	0.04 (1.30)	0.10 (3.22)	0.03 (0.79)	0.13 (4.25)

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