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SHORT-RUN DYNAMICS BETWEEN TRADING PARTICIPANTS IN BURSA MALAYSIA DURING QE AND POST-QE EXIT

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ABSTRACT

This study investigates the trading dynamics between institutional, foreign and retail investors during Quantitative Easing (QE) Tapering and post-QE exit. An analytical framework is developed to classify all transactions into trading, short-selling or information flow. Notably our results show: Firstly, during QE tapering, there is short-selling by Foreign Investor. Foreign Sales also provides cue to Local Institutional Sales. Net buyers are Local Institution; Secondly, in Post-QE exit, Foreign Sales is the most endogenous variable. Net sellers are Foreign, followed by Local Retail; Thirdly, from 7 to 12 months in Post-QE exit, there are short-selling by Foreign and Local Institution corresponding to sharp market downtrend. Net sellers are Foreign and Retail. Overall, Local Institutional is the net buyer in all sub-periods while Foreign fund is the net seller during Post-QE periods. Our result recognizes the importance of Local Institutional Investors in withstanding the selling pressure of foreign investors during the QE exit periods. This paper contributes to the extant literature by providing the usefulness of trading participant statistics to market players in the backdrop of market uncertainty due to QE exit.

Contribution/Originality: This study contributes to the existing literature of trading participant statistics from emerging market during QE and Post-QE periods. Using econometric modelling, this is the first study that analyses the trading dynamics of buying, selling, information flow and short-selling between different market participants in Malaysian stock exchange.

1. INTRODUCTION

A market is a medium that allows buyers and sellers of specific goods and services to interact in order to facilitate an exchange. In the context of a stock market, Harris (2003) suggests that the buy side of the trading industry consists of individuals, funds, firms, and government that use the markets to solve the various problems they face. For the sell side, dealers and brokers will provide exchange services for the buy side. The dealers and brokers will help buy-side traders to trade. Hence, the sell side exists only because the buy side is willing to pay for the services.

The performance of the stock market is highly dependent on the movement of the fund among the trading participants. The outflow of funds will drag down the stock market or vice versa. As per the news report released by Malaysian Industrial Development Finance Berhad (MIDF), Malaysia bourse recorded the highest net foreign inflow of RM 10.33 billion (USD2.36 billion) and the FBM KLCI Index rose by 9.4% to close around 1800 points

at the year-end of 2017.[1] This robust scenario was not the case during post-U.S. Quantitative Easing (QE) Period in October 2014 as shown in Figure 1.

The QE policy of which was introduced in early 2009 to alleviate the impact of Lehman Brother's bankruptcy on financial market have resulted in fund flow to many foreign markets, especially the equity markets. However, the QE policy started to scale down by the Federal Reserve from the fourth quarter of 2013 and officially ended in mid-2014 [2]. As shown in Figure 1, the KLCI Index declined substantially while USDMYR depreciated during the 12 months post-QE period. The observation was due to the exit of QE policy. This study is motivated to examine the trading behavior of market participants in the pre and post-QE exit, whether foreign institutional investors exert their influence on local market or local investors are more influential in local market.

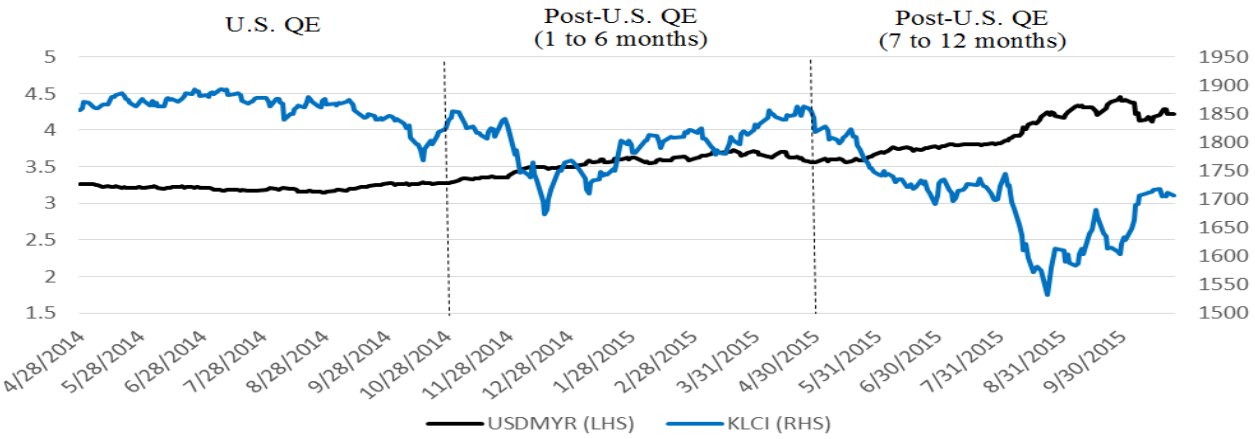

Figure-1. Daily trend of USDMYR and KLCI.

Notes: U.S. QE: 28/4/2014 - 28/10/2014. Post-U.S. QE (1 to 6 months): 29/10/2014 - 27/4/2015.
Post-U.S. QE (7 to 12 months): 28/4/2015 – 26/10/2015.
USDMYR denotes USD to MYR exchange rate (USD 1 equal to RM).
KLCI denotes the Kuala Lumpur Composite Index.
Source of USDMYR: MSCI. Source of KLCI: KLSE.

Based on the Bursa Malaysia Trading Participant Statistics, there are mainly three categories of investors, namely local institutional, local retail and foreign investors as shown in Table 1. The microstructure of demand and supply in local bourse is not well documented although the foreign fund has always been linked to the increase or decrease of KLCI Index. Is it true that only foreign fund leads the pack by sending out buying or selling cue? Does short-selling prevail over profit-taking in the trading activities? This study aims to fill the gap in this area by answering these questions, especially in the context of pre and post-U.S. QE periods.

Table-1. Bursa Malaysia trading participant statistics.

Date	Local institution net movement (RM m)	Local retail net movement (RM m)	Foreign net movement (RM m)	Total (RM m)
22 Jan 2018	-812.8	-59.2	872.8	13,612.5
15 Jan 2018	-734.5	32.2	702.2	15,971.8
08 Jan 2018	-938.5	166.4	772.2	19,113.5
02 Jan 2018	-841.1	-74.2	915.3	13,018.5
26- Dec 2017	-23.1	-141.9	165.0	8,463.6
18- Dec 2017	86.2	-47.9	-38.3	10,942.8
11- Dec 2017	-453.3	-42.1	495.4	13,648.2
04- Dec 2017	-470.5	132.7	337.9	12,055.3
Total	-4,187.7	-34.8	4,222.4	106,826.2

Source: http://www.malaysiastock.biz/Market-Statistic.aspx?m=w.

[1] https://www.klsescreener.com/v2/news/view/325467/First_annual_foreign_net_inflow_since_2013, accessed on 12 October 2019.

[2] https://www.clearias.com/quantitative-easing-federal-tapering/, accessed on 12 October 2019.

In Figure 2, foreign investors had offloaded their stock holdings a few months before the ending of QE. There was a marked increase in the purchase of local equities in the third and seventh month after the end of QE. However, the activities of purchase and sales occurred simultaneously throughout the period.

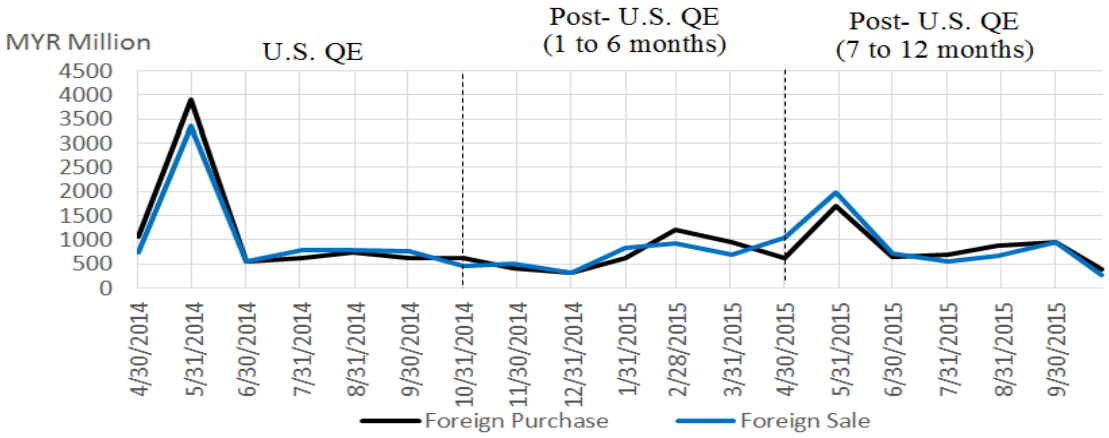

Figure-2. Monthly trend of foreign purchase and sale.

Source: Bursa Malaysia.

In Figure 3, it seems that local institutional investors followed the foreign investors by selling their holdings from May to June 2014 in line with QE tapering. However, there were periods where their purchases of equities outpaced the sale and vice versa. They increased their purchases in the seventh month after the QE ended in tandem with the Foreign Purchase as well.

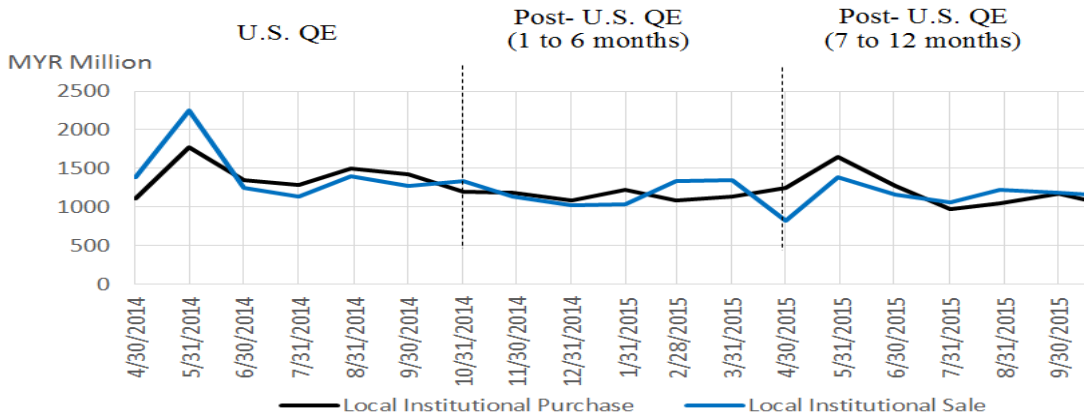

Figure-3. Monthly trend of local institutional purchase and sale.

Source: Bursa Malaysia.

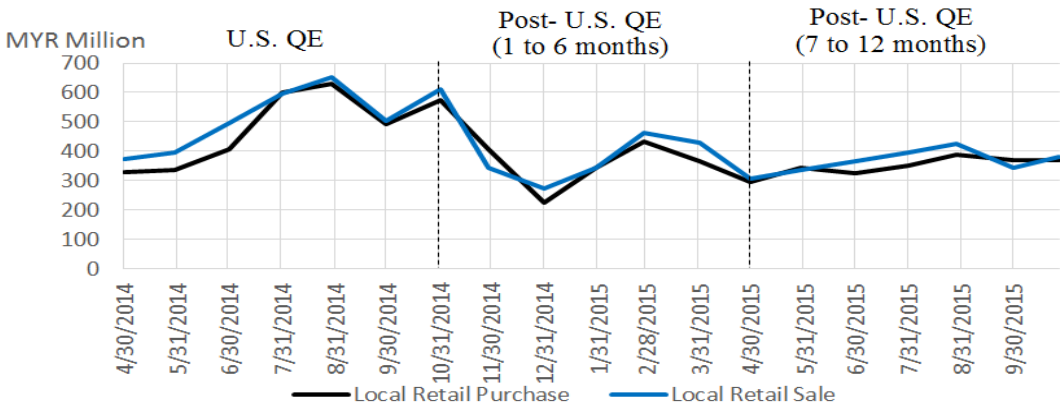

Figure-4. Monthly trend of local retail purchase and sale.

Source: Bursa Malaysia.

Figure 4 shows a different story for local retail investors. There was a marked increase in sales and purchases of local equities in months leading to QE tapering. There was a sharp decline in both sales and purchases once the QE ended, followed by a slow V-shape from the third-month post-QE, where sales seemed to outpace purchases throughout 7th to 12th-month post-QE periods.

The role of local retail investors cannot be ignored. Towards this end, Bursa Malaysia has introduced Regulated Short Selling (RSS) for licensed proprietary traders starting with a list of 100 stocks since 2007. Interestingly, RSS has been extended to retail investors from February 2018.[3] However, the retail investor must have a Stock Borrowing and Lending agreement (SPL) with a Broker in order to become a proprietary day trader (PDT) and involve in intraday short selling (IDSS) activities. In short, the RSS policy has created more depth and liquidity for the market by enabling retail investor to do short-selling like institutional and foreign investors.

To further understand the trading behavior between the investors, Table 2 is constructed to compare the purchases and sales volume of the respective group from April 2014 to October 2015. There are three main observations: First, during U.S. QE period, foreign investor is the net buyer of local equities. However, they are the net seller in post-QE from 1st to 12th month (Panel A); Second, local retail investor has been the net seller of local equities across the three sub-periods (Panel A); Third, local institutional investor has always been an important buyer of local equities as compared to others across QE and post-QE periods (Panel B). However, they are also the main seller of local equities across the three periods (Panel C).

Table-2. Trading volume by type of investors (RM Million).

Panel A: Comparison between sales and purchases by individual group.

Variables	U.S. QE	Obs	Post-U.S.QE (1 to 6 months)	Obs	Post-U.S. QE (7 to 12 months)	Obs
LIP	141458.6		136371.3		139717.02	
LIS	140846.2	LIP > LIS	130121.1	LIP > LIS	124835.13	LIP > LIS
LRP	54264.5		46507.7		43314.42	
LRS	56080.5	LRS > LRP	47373.3	LRS > LRP	44121.49	LRS > LRP
FP	61135.4		61139.2		57019.79	
FS	59899	FP > FS	66513.9	FS > FP	71139.61	FS > FP

Panel B: Comparison of purchases between institutional, foreign and retail investors.

Variables	U.S. QE	Obs	Post-U.S.QE (1 to 6 months)	Obs	Post-U.S. QE (7 to 12 months)	Obs
LIP	141458.6		136371.3		139717.02	
FP	61135.4	LIP > FP	61139.2	LIP > FP	57019.79	LIP > FP
FS	59899	LIP > FS	66513.9	LIP > FS	71139.61	LIP > FS
LRP	54264.5	LIP > LRP	46507.7	LIP > LRP	43314.42	LIP > LRP
LRS	56080.5	LIP > LRS	47373.3	LIP > LRS	44121.49	LIP > LRS

Panel C: Comparison of sales between institutional, foreign and retail investors.

Variables	U.S. QE	Obs	Post-U.S.QE (1 to 6 months)	Obs	Post-U.S. QE (7 to 12 months)	Obs
LIS	140846.2		130121.1		124835.13	
FP	61135.4	LIS > FP	61139.2	LIS > FP	57019.79	LIS > FP
FS	59899	LIS > FS	66513.9	LIS > FS	71139.61	LIS > FS
LRP	54264.5	LIS > LRP	46507.7	LIS > LRP	43314.42	LIS > LRP
LRS	56080.5	LIS > LRS	47373.3	LIS > LRS	44121.49	LIS > LRS

Notes: All values are in MYR Million. U.S. QE: 28/4/2014 - 28/10/2014.
Post-U.S. QE (1 to 6 months): 29/10/2014 - 27/4/2015.
Post-U.S. QE (7 to 12 months): 28/4/2015 – 26/10/2015. LIP denotes Local Institutional Purchase.
LRP denotes Local Retail Purchase. FP denotes Foreign Purchase.
LIS denotes Local Institutional Sale. LRS denotes Local Retail Sale. FS denotes Foreign Sale.

Studies on the interaction between local and foreign investors are scarce in Malaysia. How was the trading behavior between the three groups of investors? How they interact with each other? Is there any information flow between them? These questions will be addressed by the analytical framework set out in Table 3. The remainder of

[3] The Edge, May 03, 2018, refer to https://www.klsescreener.com/v2/news/view/373975/investors-allowed-to-short-sell-again

the paper is organized as follows. Section two develops the theoretical framework for the trading activities, followed by the review of existing literature. Section three describes the data and methodology. Section four discusses the results, and the last section concludes the paper.

2. LITERATURE REVIEW

Earlier study by Bosworth and Collins (1999) demonstrates the importance of capital flows to developing countries, especially to their savings and investment. However, study on the interaction between the buyers and sellers of the stock market can be traced back to the work done by Choe *et al.* (2001). Using intraday data from the Korea Stock Exchange, the study found that domestic individual investors possess more information than foreign and domestic institutional investors over individual stocks. This information advantage can be explained by thefact that foreign investors sell to domestic investors before a stock has a large positive abnormal return and buy from domestic investors before a stock has a large negative abnormal return.

In another study, Choe *et al.* (2001) reaffirms that the domestic investors in Korean possess more information as relative to foreign investors in trading domestic stocks. Results indicate that stock prices move more against foreign investors than against domestic investors before trades.

However, in the case of the Taiwan Stock Exchange, Seasholes (2000) found that foreign investors have an information advantage over local investors in Taiwan. As such, foreign investors buy (sell) ahead of good (bad) earnings announcement while local investors do the opposite.

Subsequently, a study done by Huang and Shiu (2005) reveal that foreign institutional investors in Taiwan outperform than local individual and institutional investors. Results demonstrate that foreign institutional investors are better at forecasting local firm performance, and active at monitoring management and demanding regulatory improvements. Therefore, they are information efficient relative to the local investors.

Next, Agudelo (2010) investigates the investors' behavior in six Asian markets and the Johannesburg Stock Exchange. Results indicate that foreign investors tend to demand liquidity more aggressively than local investors in short term. As such, foreign trade has a negative but transitory impact on the overall liquidity of the market on a daily basis. However, in the longer term, foreign investors can improve liquidity in the domestic market. They are active at monitoring management and transparency of the market. Therefore, foreign investors are information efficient relative to local investors in Asian and Johannesburg Stock Exchange.

Recently, Kim and Yi (2015) employ a large sample of firms listed on the Korea Stock Exchange over 1998 to 2007 to investigate whether and how trading by foreign and domestic institutional investors improves the firm-specific information. Their study defines that the firm-specific information is captured by stock price synchronicity. Results indicate that foreign and domestic institutional investors able to facilitate firm-specific information flow to the market via their trading activities and able to reduce the accrual mispricing.

In the case of Malaysia, Liew *et al.* (2018) find that foreign institutional investors are liquidity demander while local institution and local proprietary day traders are liquidity provider. Since the sell side exists only because of the buy side is willing to pay for its services, therefore their study concludes that foreign institutional investors are the main drivers in Bursa Malaysia. Thus, foreign institutional investors possess more information relative to local institutional and retail investors.

The influence of foreign investors on Japanese financial market has been explored by Lau and Yip (2019). Their studies show the dominance of foreign investors, followed by local institutional investors during the QE tapering and post-QE period in 2014 and 2015.

Using the above-mentioned observation as our starting point, this study investigates whether this plausibly exogenous shock of global capital flow brought by the QE policy has implications for emerging market economic activity, especially on equity market of Malaysia.

2.1. Analytical Framework

In terms of trading activities, there could be a different combination of flow between sellers and buyers. This study develops the following theoretical framework in Table 3 to further analyze the interaction between the investors. A typical transaction from 1 to 8 is for trading purposes. Hypothesis H1 to H10 are set up to test whether there is information flow between different groups of investors. H11 and H12 are set up to ascertain whether there is short-selling between the group.

Table-3. Analytical framework.

Panel A: Trading between different investor

Type	Flow of transaction	Nature
1	Local Institutional Purchase followed by Local Institutional Sale	Trading
2	Local Institutional Purchase followed by Local Retail Sale	Trading
3	Local Institutional Purchase followed by Foreign Sale	Trading
4	Foreign Purchase followed by Local Institutional Sale	Trading
5	Foreign Purchase followed by Local Retail Sale	Trading
6	Foreign Purchase followed by Foreign Sale	Trading
7	Local Retail Purchase followed by Local Institutional Sale	Trading
8	Local Retail Purchase followed by Local Retail Sale	Trading
9	Local Retail Purchase followed by Foreign Sale	Trading
Panel B: Information flow between investor group		
Hypotheses	Flow of transaction	Information
H1	Local Institutional Sale followed by Foreign Sale	LIS→FS
H2	Local Institutional Purchase followed by Foreign Purchase	LIP→FP
H3	Local Institutional Sale followed by Local Retail Sale	LIS→LRS
H4	Local Institutional Purchase followed by Local Retail Purchase	LIP→LRP
H5	Foreign Sale followed by Local Institutional Sale	FS→LIS
H6	Foreign Purchase followed by Local Institutional Purchase	FP→LIP
H7	Local Retail Sale followed by Local Institutional Sale	LRS→LIS
H8	Local Retail Purchase followed by Local Institutional Purchase	LRP→LIP
H9	Local Retail Sale followed by Foreign Sale	LRS→FS
H10	Local Retail Purchase followed by Foreign Purchase	LRP→FP
Panel C: Short-selling within investor group		
Hypotheses	Flow of transaction	Nature
H11	Local Institutional Sale followed by Local Institutional Purchase (LIS→LIP)	Short-selling
H12	Foreign Sale followed by Foreign Purchase (FS→FP)	Short-selling

It is often argued by literature that local institutional investors have privy to certain information disseminated in a local language, they should have better access to information and resources to build the necessary monitoring capabilities than foreign investors. Hence, H1 and H2 are set up to test for such possibilities and the reverse flow (H5 and H6). Likewise, any sales and purchases by local institutional investors may trigger similar activities by local retail investors (H3 and H4). On the contrary, any purchases and sales by local retail investors would influence the trading activities of institutional and foreign investors. Therefore, H7 to H10 is set to confirm such causality.

3. DATA AND METHODOLOGY

3.1. Data

Daily data from the Bursa Malaysia (formerly known as Kuala Lumpur Stock Exchange) has been used. Sample period from 28 April 2014 to 26 October 2015 has selected for this study. The sample period is further divided into three sub-periods. The first sub-period is from 28 April 2014 to 28 October 2014. It captures the trading activities during U.S. QE period. The second sub-period is from 29 October 2014 to 27 April 2015 which marks the first six months after the QE ended. The third sub-period is from 28 April 2015 to 26 October 2015 which captures the subsequent six months post-QE period. Table 4 shows the variables used in this study.

Table-4. List of variables.

Variables	Descriptions	Unit of measurement	Sources
LIP	Local institutional purchase	MYR million	Bursa Malaysia
LRP	Local retail purchase	MYR million	Bursa Malaysia
FP	Foreign purchase	MYR million	Bursa Malaysia
LIS	Local institutional sale	MYR million	Bursa Malaysia
LRS	Local retail sale	MYR million	Bursa Malaysia
FS	Foreign sale	MYR million	Bursa Malaysia

Source: Bursa Malaysia.

3.2. Unit Root Test

3.2.1. Augmented-Dickey Fuller (ADF) Test

The Augmented-Dickey Fuller (ADF) test is an extension of the Dickey-Fuller test of which is used to test the unit root a series by adding lagged terms of dependent variables to ensure that error terms are not correlated. Furthermore, by adding the lagged difference term of variable y_t, the ADF test enables higher-order serial correlation to be avoided.

The ADF test as shown in Equation 1 can be explained below:

$$\Delta y_t = \psi y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + u_t \quad (1)$$

The test for stationarity can be further explained based on the hypothesis below:

$$H_0 : \psi = 0$$

$$H_1 : \psi < 0$$

3.2.2. Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test

However, the power of ADF tests is low if the root is close to a non-stationary boundary. In order to confirm the result of the unit root test, stationarity tests have also been carried out. In this instance, KPSS test by Kwiatkowski *et al.* (1992) as shown in Equation 2 is used.

To further explain the KPSS test, it could be argued that KPSS is another unit root test with time trend, *t*, where:

$$y_t = \mu + \beta t + \varphi \sum_{i=1}^{t} \varepsilon_{t-1} + u_t \quad (2)$$

Where μ is constant, u_t is a stationary process and the past error $\varepsilon_{t-1} \sim$ i.i.d (0,1).

Under the null hypothesis, the series y_t is assumed to be stationary. On the contrary, under the alternative hypothesis, yt is non-stationary. So that by default under the null the series will appear stationary.

$$H_0 : y_t \sim I(0)$$

$$H_1 : y_t \sim I(1)$$

3.3. Vector Autoregression (VAR)

Vector autoregression model VAR (p) as shown in Equation 3, is an extension of the univariate autoregression model to model multivariate time series model. In the case where the k variables are not cointegrated, a VAR model with lag p is defined as:

$$y_t = c + A1 y_{t-1} + A2 y_{t-2} + \ldots + Ap y_{t-p} + \varepsilon_t \quad (3)$$

Where yt defined as ($y_{1,t}$, $y_{2,t}$, $y_{k,t}$) of k × 1 vector, each c is a k × 1 vector of constant (intercept), each A1 is a k × k coefficient matrix and εi is k × 1 error terms vector. The lag length for the VAR(p) model may be determined by using model selection. A standard practice Akaike Information Criterion (AIC) in Equation 4:

$$AIC = n\Sigma\hat{u}_t^2 + 2(k+1) \quad (4)$$

Where u_t denoted as residuals are applied in selecting the lag length.

3.4. Granger Causality Test

The Granger causality test is used to determine whether one of chosen variable helps in explaining the other. This test will be performed based on Granger (1969) bivariate framework, where if variable *x* Granger-causes variable *y*, the mean square error (MSE) of a forecast of *y* based on prior values of both variable *x* and *y* should be lower than the MSE of the forecast which only uses past value of *y*. The Granger causality is further explained in Equation 5 below:

$$\Delta y_t = \alpha + \sum_{i=1}^{p} \beta_i \Delta y_{t-1+} \sum_{i=1}^{p} \beta_i \Delta x_{t-1} + \varepsilon_t \quad (5)$$

And testing the joint hypothesis:

$H_0 : \gamma_1 = \gamma_2 = \ldots = \gamma_p = 0$

H_1 : *At least one of the* γ_1 *is not equal to zero*

The asymptotic chi-square test will then determine the Granger causality between variable *x* and *y*. If the asymptotic chi-square test rejects H_0, therefore short-run dynamics exist from variable *x* to variable *y*. Furthermore, if the test statistic is significant, therefore it could be argued that variable *x* has predictive value for forecasting movement in variable *y*.

Furthermore, the joint significance of the lagged independent variables can be tested using the F-statistics (the null hypothesis is H_0:$\beta_j=\alpha_1=0$ in Eq. 1 and H_0:$\beta i=\alpha_2=0$ in Equation 6.

The test statistics are as below:

$$F = \frac{(RSS_R - RSS_u)/p}{RSS_u/(n-kp-1)} \sim F\ Distribution \quad (6)$$

Which is computed where RSS_R is the residual sum square of the restricted model while the RSS_u is the residual sum square of the unrestricted model; *n* represents a number of observations and *p* is the order of the VAR model. Based on the hypotheses H_0 is rejected if $F>F_{\alpha,n-kp-1}$. The outcomes of the Granger Causality test are either unidirectional causality, bidirectional causality or no causality.

3.5. Cross-Correlation Analysis

Cross-correlation is a standard method to estimate the degree to which two series are correlated. Consider both to be examined series x_t and y_t at time *t*, the cross-correlation function as shown in Equation 7:

$$r_{xy}(k) = \frac{c_{xy}(k)}{\sigma_{xx}\sigma_{yy}} \quad (7)$$

Where c_{xy} is sample cross-covariance of two series at lead k, σ_{xx} and σ_{yy} are the standard deviation of processes of x_t and y_t, respectively.

4. RESULTS

4.1. Descriptive Statistics

In panel A of Table 5, Foreign Purchase (FP) exhibits the highest standard deviation among the purchases and sales of local equity. However, Local Institutional Sale (LIS) is found to have the highest standard deviation in post-U.S. QE period (1 to 12 months in Panel B and C). This implies that LIS is highly volatile relative to retail and foreign investors.

Table-5. Descriptive statistics.

Variables/Periods	Mean	Std. Dev	Skewness	Kurtosis	Jarque-Bera	Obs
Panel A: U.S. QE						
LIP	1150.070	215.370	0.279	2.969	1.600 (0.449)	123
LRP	441.175	119.940	1.166	6.529	91.701 (0.000)	123
FP	497.036	344.413	8.033	79.513	31325.850 (0.000)	123
LIS	1145.091	241.942	0.790	5.725	50.849 (0.000)	123
LRS	455.939	119.036	1.358	7.796	155.672 (0.000)	123
FS	486.984	293.674	7.736	75.989	28529.910 (0.000)	123
Panel B: Post-U.S. QE (1 to 6 months)						
LIP	1108.710	217.572	0.101	4.054	5.900 (0.052)	123
LRP	378.111	85.643	0.295	4.019	7.101 (0.029)	123
FP	497.067	212.279	2.726	16.529	1090.355 (0.000)	123
LIS	1057.895	228.588	0.390	4.522	14.998 (0.000)	123
LRS	385.149	88.522	0.149	3.266	0.816 (0.665)	123
FS	540.763	198.169	1.120	6.301	81.561 (0.000)	123
Panel C: Post-U.S. QE (7 to 12 months)						
LIP	1135.911	215.763	-0.001	2.934	0.023 (0.989)	123
LRP	352.150	62.704	0.287	3.012	1.686 (0.430)	123
FP	463.576	224.865	2.463	11.354	482.024 (0.000)	123
LIS	1014.920	240.389	0.908	4.676	31.297 (0.000)	123
LRS	358.711	70.209	0.502	2.905	5.217 (0.074)	123
FS	578.371	200.793	2.938	20.366	1722.617 (0.000)	123

Notes: All statistics are based on original data values. Values in parentheses are p-value.

4.2. Unit Root Test Results

As shown in panel A of Table 6, during U.S. QE period, LLIP, LFP, LLIS, and LFS are stationary at level. Next, LLRP and LLRS are found to become stationary after taking the first difference. Hence, they are integrated of order one.

Next, in panel B of Table 6, all the purchasers and sellers of local equity are stationary at level. In the subsequent 7 to 12 months after QE ended panel C of Table 6, LLIP and LFS are stationary at level and the rest of the series follow I(1) process.

4.3. Granger Causality Results

As observed in panel A of Table 7, during QE tapering, there is short-selling by Foreign Investor (H12: FS→FP). There is also information flow from Foreign Sales to Local Institutional Sales (H5: FS→LIS) as well as Local Institutional Purchase to Foreign Purchase (H2: LIP→FP). Interesting to note that Retail Sales also Granger causes Local Institutional Sales (H7)

Table-6. Unit root and stationary test results.

Variables	ADF test				KPSS test			
	No trend (Constant)		With trend		No trend (Constant)		With trend	
	Level	First difference	Level	First difference	Level	First difference	Level	First difference
Panel A: U.S. QE								
LLIP	-3.97(1)***		-4.13(1)***		0.38(8)		0.14(10)	
LLRP	-2.63(1)	-10.04(2)***	-3.09(1)	-10.05(2)***	0.59(9)**	0.09(6)	0.21(9)**	0.09(7)
LFP	-8.90(0)***		-9.06(0)***		0.33(1)		0.09(3)	
LLIS	-4.41(1)***		-4.39(1)***		0.11(7)		0.11(7)	
LLRS	-1.77(3)	-10.03(2)***	-1.56(3)	-10.02(2)***	0.53(9)**	0.09(4)	0.22(9)**	0.07(5)
LFS	-8.04(0)***		-8.20(0)***		0.34(1)		0.06(2)	
Panel B: Post –U.S. QE (1 to 6 months)								
LLIP	-6.46(0)***		-6.45(0)***		0.09(6)		0.06(6)	
LLRP	-4.94(0)***		-4.99(0)***		0.20(8)		0.13(8)	
LFP	-7.15(0)***		-7.34(0)***		0.35(6)		0.08(6)	
LLIS	-6.33(0)***		-6.39(0)***		0.21(7)		0.10(7)	
LLRS	-5.09(0)***		-5.28(0)***		0.34(8)		0.13(8)	
LFS	-6.40(0)***		-6.39(0)***		0.15(7)		0.13(7)	
Panel C: Post –U.S. QE (7 to 12 months)								
LLIP	-6.01(0)***		-6.05(0)***		0.20(7)		0.12(7)	
LLRP	-2.89(8)	-15.32(0)***	-6.98(0)***	-15.27(0)***	0.97(7)**	0.11(12)	0.07(5)	0.08(12)
LFP	-2.60(8)	-8.86(0)***	-3.18(8)	-8.82(3)***	0.60(6)**	0.16(39)	0.23(4)**	0.15(39)
LLIS	-2.69(8)	-14.91(0)***	-3.09(7)	-9.27(0)***	0.48(5)**	0.12(17)	0.19(7)**	0.08(17)
LLRS	-2.90(10)	-14.56(0)***	-6.80(0)***	-14.51(0)***	0.83(7)**	0.04(5)	0.06(5)	0.03(5)
LFS	-7.60(0)***		-7.60(0)***		0.22(6)		0.12(6)	

Notes: ** and *** denote statistical significance at 5% and 1% level respectively.
All estimates are asymptotic Granger Chi-squared statistics. Values in parentheses are the optimal lag length.
L denotes all series have transformed to the natural logarithm.

Table-7. The result of granger causality during U.S. QE and Post-QE.

Panel A: Granger causality test results. U.S. QE: 28/4/2014 - 28/10/2014.

Dependent Variables	Variables					
	LLIP	ΔLLRP	LFP	LLIS	ΔLLRS	LFS
LLIP		6.765 (0.454)	5.991 (0.541)	4.855 (0.678)	9.487 (0.219)	5.367 (0.615)
ΔLLRP	7.026 (0.426)		7.402 (0.388)	7.111 (0.417)	5.677 (0.578)	8.171 (0.318)
LFP	12.277* (0.092)	6.553 (0.477)		9.784 (0.201)	8.751 (0.271)	12.233* (0.093)
LLIS	14.792** (0.039)	9.387 (0.226)	15.280** (0.033)		13.601* (0.059)	17.354** (0.0153)
ΔLLRS	6.265 (0.509)	11.904 (0.104)	11.045 (0.137)	7.458 (0.383)		8.817 (0.266)
LFS	4.433 (0.729)	6.204 (0.516)	2.625 (0.917)	2.397 (0.935)	6.691 (0.462)	

Panel B: Granger causality test results. Post-U.S. QE (1 to 6 months): 29/10/2014 - 27/4/2015.

Dependent Variables	Variables					
	LLIP	LLRP	LFP	LLIS	LLRS	LFS
LLIP		5.516** (0.019)	0.713 (0.399)	0.786 (0.375)	2.543 (0.111)	0.471 (0.492)
LLRP	0.036 (0.849)		0.017 (0.898)	0.005 (0.941)	0.349 (0.555)	0.004 (0.948)
LFP	2.060 (0.151)	3.259* (0.071)		2.156 (0.142)	1.592 (0.207)	2.079 (0.149)
LLIS	0.125 (0.724)	3.452* (0.063)	0.493 (0.483)		0.816 (0.366)	0.648 (0.421)
LLRS	0.117 (0.733)	3.030* (0.082)	0.565 (0.452)	0.462 (0.497)		0.264 (0.607)
LFS	6.849*** (0.008)	7.364*** (0.006)	5.124** (0.024)	6.427** (0.011)	6.328** (0.012)	

Panel C: Granger causality test results. Post-U.S. QE (7 to 12 months): 28/4/2015 – 26/10/2015.

Dependent Variables	Variables					
	LLIP	ΔLLRP	ΔLFP	ΔLLIS	ΔLLRS	LFS
LLIP		0.169 (0.680)	0.954 (0.329)	3.106* (0.078)	0.450 (0.502)	2.529 (0.112)
ΔLLRP	9.246*** (0.002)		2.242 (0.134)	0.134 (0.714)	2.523 (0.112)	1.286 (0.257)
ΔLFP	6.450** (0.011)	0.122 (0.727)		1.567 (0.211)	0.539 (0.463)	18.183*** (0.000)
ΔLLIS	1.941 (0.164)	0.214 (0.644)	1.527 (0.217)		3.287* (0.069)	1.642 (0.199)
ΔLLRS	7.714*** (0.005)	0.155 (0.694)	1.764 (0.184)	0.026 (0.872)		2.122 (0.145)
LFS	3.410* (0.065)	0.015 (0.902)	0.596 (0.440)	0.011 (0.916)	0.049 (0.824)	

Notes: *, ** and *** denote statistical significance at 10%, 5% and 1% level respectively.
All estimates are asymptotic Granger Chi-squared statistics. Values in parentheses are p-values.
L denotes all series have been transformed into the natural logarithm. Δ denotes first difference.
Optimal Lag length selection of VAR for panel A is 7; Panel B is 1, and Panel C is 1.

On Panel B, in the first 6 months Post-QE exit, Foreign Sales (FS) is the most endogenous variable. The sales from Retail and Institutional Investor trigger Foreign Sales (H1 and H9). Interesting to note that Retail Purchases also Granger causes Local Institutional Purchases (H8) and Foreign Purchases (H10). This result concurs with an earlier result in Table 2 that Foreign Sales is more than Foreign Purchases in second sub-period.

On Panel C, there are short-selling activities for Foreign and Institutional Investors (H11 and H12), from 7 to 12 months Post-QE Exit, corresponding to a sharp downward trend of KLCI. Retail sales Granger causes Institutional Sales (H7). Nonetheless, there is some support in buying activities in Local Retail and Foreign Purchases (H4 and H12). Table 8 summarizes all the results of hypothesis testing conducted from the above tables.

Table-8. Summary results for the hypothesis. testing

Hypotheses	Information flow	U.S. QE	Post- U.S. QE (1 to 6 months)	Post- U.S. QE (7 to 12 months)
H1	LIS→FS	-	Supported	-
H2	LIP→FP	Supported	-	Supported
H3	LIS→LRS	-	-	-
H4	LIP→LRP	-	-	Supported
H5	FS→LIS	Supported	-	-
H6	FP→LIP	-	-	-
H7	LRS→LIS	Supported	-	Supported
H8	LRP→LIP	-	Supported	-
H9	LRS→FS	-	Supported	-
H10	LRP→FP	-	Supported	-
H11	LIS→LIP(short-selling)	-	-	Supported
H12	FS→FP (short-selling)	Supported	-	Supported

Notes: U.S. QE: 28/4/2014 - 28/10/2014. Post-U.S. QE (1 to 6 months): 29/10/2014 - 27/4/2015.
Post-U.S. QE (7 to 12 months): 28/4/2015 – 26/10/2015. LIP denotes Local Institutional Purchase.
LRP denotes Local Retail Purchase. FP denotes Foreign Purchase.
LIS denotes Local Institutional Sale. LRS denotes Local Retail Sale. FS denotes Foreign Sale.

5. CROSS-CORRELATION ANALYSIS

This study proceeds to cross-correlation analysis as to investigate the lead-lag relationship between the respective series identified in above hypothesis. In Table 9, all the lead-lag relationship shows positive results with the strongest lead at lag 1 in all cases. These results are consistent with the Granger' causality test results.

Table-9. Cross-correlation results.

Hypotheses	Variables		U.S. QE		Post-U.S. QE (1 to 6 months)		Post-U.S. QE (7 to 12 months)	
	Lead	Lag	Day	Strongest lead at	Day	Strongest lead at	Day	Strongest lead at
H1 (sell cue)	LIS	FS	-	-	1	1	-	-
H2 (buy cue)	LIP	FP	1	1	-	-	1-2	1
H4 (buy cue)	LIP	LRP	-	-	-	-	1-3	1
H5 (sell cue)	FS	LIS	1	1	-	-	-	-
H7	LRS	LIS	1-6	1	-	-	1-3	1
H8	LRP	LIP	-	-	1-5	1	-	-
H9	LRS	FS	-	-	1-2	1	-	-
H10	LRP	FP	-	-	1-2	1	-	-

Notes: The approximate critical values at 5% significant level are $\pm 2/\sqrt{n}$.

6. CONCLUSION

This study investigates the trading behavior of institutional, foreign and retail investors during pre and post-U.S. QE period in Malaysian stock market. One major contribution of the paper is to provide the theoretical framework on all the possible transaction and classify them into either trading, short-selling and information flow. In addition, this paper provides a definition of how to measure short-selling in the context of information flow.

Contrary to popular belief that only high-frequency data of 10 minutes in nature can be used, this study uses daily data to model the market microstructure of demand and supply of the various group of trading participants in Malaysian stock market.

This study also provides interesting observations. Firstly, during QE tapering, there is short-selling by Foreign Investor. There is also information flow from Foreign Sales to Institutional Sales as well as Institutional Purchase to Foreign Purchase. Net buyers are Local Institution followed by Foreign Fund. Secondly, in Post-QE exit, Foreign Sales is the most endogenous variable. Net sellers are Foreign, followed by Local Retail Investor; Thirdly, from 7 to 12 months in Post-QE exit, there are short-selling activities for Foreign and Institutional Investors corresponding to KLCI downtrend. Net sellers are Foreign, followed by Local Retail. Overall, Institutional Investor has provided market support as the net buyer in all sub-periods. Due to local advantage, Local Institution provides buying cue while Foreign fund triggers selling cue during the QE tapering. As policy suggestion, local retail investors should be provided with more incentive to trade in local bourse as they also have the role in disseminating information as shown in the post-QE in 2nd sub-period.

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