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How Does Split Announcement Affect Stock Liquidity? Evidence from Bursa Malaysia

S. Amir Tabibian [1], Zhaoyong Zhang [1,*] and Mohsen Jafarian [2]

1 School of Business and Law, Edith Cowan University, Joondalup WA 6027, Australia; s.tabibian@ecu.edu.au
2 Faculty of Business and Management, UCSI University, 56000 Cheras, Kuala Lumpur, Malaysia; mohsen@ucsiuniversity.edu.my
* Correspondence: zhaoyong.zhang@ecu.edu.au

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Abstract: This study examines the impact of stock splits on stock liquidity in Bursa Malaysia from 2004–2018. The study uses event study methodology and investigates liquidity changes, the role of liquidity, and the relationship between abnormal returns and liquidity as well. We found a significant liquidity improvement on the splits announcement, announcement of book closing date and split execution date (Ex-date), while it declined after the split Ex-date. The findings also indicate that firms with a low-level liquidity prior to split announcements experienced an increase in liquidity after Ex-date. Using panel data analysis, we find that the fixed effect model is more appropriate than the pooled OLS, and the abnormal announcement returns are driven by stock liquidity.

Keywords: split announcement; stock liquidity; stock return; Bursa Malaysia

1. Introduction

Stock splits are still a puzzling and unsolved corporate phenomenon. Financial economists theoretically consider stock splits as a seemingly cosmetic accounting change which have no real effect on firms' cash flows and fundamentals, but are often associated with positive announcement returns (Fama et al. 1969; Grinblatt et al. 1984). In practice, managers also believe that stock split improves stock liquidity. As such, above 90% of the managers in Bursa Malaysia document on split proposals that liquidity improvement is the main rationale for splitting their stock. However, there are contradictory results to stock liquidity improvement. The first empirical study in this area by Copeland (1979) found that stock liquidity permanently decreases in the year after stock splits. Lakonishok and Lev (1987) also report that trading volume temporary increased on announcement day and decreased after split announcement. Consistent with this, the finding of a study by Huang et al. (2013) reveals that there is a liquidity improvement on announcement day, as well as in the period between announcement day and execution date (hereafter, Ex-date). However, the liquidity declined after Ex-date to the level before the announcement. The authors concluded that the liquidity improvement is a short-lived effect of stock splits.

Moreover, Tabibian and Zhang (2018) report an insignificant abnormal Ex-date return similar to the finding of Sloan (1987) for the Australian market. It could be interpreted as lower prices following split Ex-date could not grab the investors' attention, so managers might fail to reach their goal, improving stock liquidity. In regard to the contradictory result and lack of study in Bursa Malaysia, the main objective of this study is to test stock liquidity changes on and around the split event days. In addition, Dennis (2003) subdivided firms based on the pre-split liquidity, and found a liquidity improvement for the firms with higher pre-split stock liquidity. As most researchers report a decline in liquidity after split Ex-date, we contribute to the split literature by investigating the role of liquidity prior to announcement on liquidity changes on and around split days, especially in Bursa Malaysia.

Tabibian and Zhang (2018) also find a significant abnormal return on announcement day, and the announcement of book closing date (hereafter Ann-BC) day, but insignificant abnormal Ex-date return for the stock splits in Bursa Malaysia from 2004–2014, however, they provide no evidence to explain the abnormal returns on split days. Several existing studies investigate if the abnormal returns can be explained by other factors such as liquidity measures, but they consider only a three- or five-day period surrounding the split event day (see, for instance, Grinblatt et al. 1984; Huang et al. 2013), and fail to capture the continuous, long term impacts of the split announcement. These studies also likely suffer problems of multicollinearity, heteroskedasticity, and/or serial correlation. In this study, we intend to examine the liquidity changes on and after the announcement of book closing date (prior to Ex-date), and how that affects the abnormal returns.

The purpose of this paper is to examine the relationship between abnormal returns and liquidity changes, to identify if abnormal returns are driven by liquidity, by employing the event study methodology with 214 stock splits announced and executed in 2004–2018 in Bursa Malaysia. We find evidence of a significant liquidity improvement on announcement day, announcement of book closing date (Ann-BC) and execution date (Ex-date), and the period between Ann-BC day and Ex-date as well. The results show that there is a significant decrease in liquidity after the Ex-date for the whole sample, but an improvement for the subsample of low-level liquidity. Moreover, using the panel data analysis, we found that the abnormal returns are driven by the liquidity improvement on the announcement day. Although there is no significant relationship between abnormal return and stock liquidity on the Ann-BC day for the whole sample, it is found to be significantly positive for the medium-level liquidity subsample. These findings have important implications for investors in their trading strategy.

The rest of this paper is organized as follows. Section 2 provides a brief review of the existing literature on stock liquidity changes, and develops several hypotheses. Section 3 discusses the analytical framework and datasets employed in this study. In Section 4, we analyze the results, including *t*-test for the whole sample and the subsamples, as well as regression estimates. Section 5 uses panel data analysis to robust the result of regressions. Section 6 concludes with suggestions for future studies.

2. Literature Review and Hypotheses

The first official stock split documented by Dolley (1933) is the Commercial Credit Company that subdivided its stock, reducing the par value from 100 USD to 25 USD per share a century ago in 1915. Throughout the decades, stock splits have been popular in markets, a puzzling subject and unsolved phenomenon, which attracts the attention of scholars. Stock splits became quite common as early as the beginning of the 20th century, as Lakonishok and Lev (1987) report, 150 out of 837 firms experienced a share subdivision on the New York Stock Exchange (NYSE) from 1921–1930. Although stock splits have no direct effect on shareholders ownership and firms future cash flow, they involve stock liquidity (Copeland 1979), abnormal returns (Beladi et al. 2016; Devos et al. 2015; Fama 1998), investor sentiment (Kim and Byun 2010), volatility (Gharghori et al. 2017), trading price range (He et al. 2016; Jakob and Whitby 2017) and ownership structure (Dennis and Strickland 2003).

A shareholder receives no tangible benefit from a stock split, while there are some costs, such as cash in lieu (CIL). In addition, a stock split is associated with a direct cost for preparing certificates by the third party that proposes a stock split on behalf of the firm. With such mentioned costs, if a stock split involves merely cosmetic accounting changes, why do managers propose and shareholders accept it? According to Amihud (2012), to compensate the cost, investors expect an increase in stock price that could be driven by a liquidity improvement. Nevertheless, Hu et al. (2017) report that mangers implement stock splits when they have earnt excess earnings in a good market condition.

Although previous studies (Ariff et al. 2004; Li et al. 2013) report abnormal split announcement returns, liquidity improvement has challenged the researchers. The study by Copeland (1979) was the first, which focused on liquidity to justify splitting a stock, while its finding indicated a decrease in liquidity after stock splits. Nevertheless, researchers motivated to investigate the liquidity effect of stock splits. As such, Lakonishok and Lev (1987) and Muscarella and Vetsuypens (1996) found a temporary increase in stock trading volume for the American depository receipts (ADRs).

On the other hand, other researchers (Chern et al. 2008; Guo et al. 2008; Yu and Webb 2009) found that stock splits reduce bid-ask spreads, and increase the number of small traders who are attracted to the lower price on Ex-date, indicating liquidity improvement. Mohanty and Moon (2007) also found a significant improvement in the average trading volume, comparing 12 months post splits announcement with that for prior to announcements. Furthermore, Anshumana and Kalay (2002) introduced a model that proves that stock splits improve stock liquidity. Moreover, Dennis and Strickland (2003) contribute to the stock split's literature by testing the moderating effect of ownership structure on both liquidity and abnormal return for stock splits. Their finding indicates that stock liquidity increases after the splits, if firms have a lower level of institutional ownership.

As above 90% of the managers in Bursa Malaysia document on split proposals that liquidity improvement is the main rationale for splitting their stock, the contradictory results of above-mentioned studies cast doubt upon whether the stock splits increase stock liquidity or not. Moreover, if there is an improvement, is it short or long-lasting? To test the liquidity impact of stock splits in Bursa Malaysia, following Huang et al. (2013) and Tabibian and Zhang (2018), we study liquidity changes on and around announcement day and Ex-date, in addition to announcement of book closing date. Tabibian and Zhang (2018) report that there is a significant abnormal return on the announcement day and Ann-BC day, but it is insignificant on the Ex-date. If the abnormal returns are driven with the liquidity improvement, we expect the same result for stock liquidity on and around the event days. As such, the first hypothesis is stated as follows:

Hypotheses H1a (H1a): *There is a stock liquidity improvement on the split announcements.*

With regard to the finding of the study by Tabibian and Zhang (2018) that indicates no significant abnormal return, we design the following hypothesis to test liquidity after announcement day:

Hypotheses H1b (H1b): *There is no stock liquidity improvement after the announcements prior to the Ann-BC day.*

Since the announcement of book closing date (Ann-BC) informs investors the splits execution date, it might reduce investors' uncertainty concerning whether/when a stock split being executed in the market. At this point, one could expect a portion of the market reaction and liquidity enhancing to happen on the Ann-BC day. This conjunction is consistent with the study by Sloan (1987), which reports a significant abnormal return in a five-day period immediately prior to the splits Ex-date in the Australian Stock Exchange. In this regard, the following hypothesis is designed to test liquidity behavior around Ann-BC day:

Hypotheses H1c (H1c): *There is a stock liquidity improvement on Ann-BC day.*

Hypotheses H1d (H1d): *There is a stock liquidity improvement after Ann-BC (prior to Ex-date).*

Most recently, Tabibian and Zhang (2018) find that there is an insignificant abnormal return on the splits Ex-date, which contrasts the findings of a significant abnormal Ex-date return from the studies on the U.S. capital market (such as Hardin et al. 2005; Lamoureux and Poon 1987; Maloney and Mulherin 1992) and the Stockholm Stock Exchange (Niini 2000). However, Krieger and Peterson (2009) find that abnormal returns are not associated with anticipated stock splits. This could justify the insignificant abnormal Ex-date return in Bursa Malaysia, as investors have already been informed of the Ex-date through the announcement of book closing date, and hence, abnormal returns are not associated with splits execution. Moreover, Black (1986) divides traders into the noise traders and information traders, and states that investors can make a profit from informative trades, while they cannot make a profit from noise trading. He states that noise trading is vital for stock liquidity, and noise traders make markets more liquid. Based on this, if an event increases noise trading, one could expect stock liquidity improvement. However, if the portion of information in the black model increases, one may also predict that the stock liquidity tends to decrease as well. In sum, increasing information by an event might not lead to liquidity enhancement. As the announcement of book closing date reduces uncertainty about execution of stock splits, we expect no liquidity improvement on Ex-date. Furthermore, it is generally believed that the subdivision of stock prices on Ex-date would attract small investors, and consequently lead to an improvement in liquidity. However, recent studies (i.e., Huang et al. 2013) report that there is a decline in stock liquidity after the Ex-date. According to Chittenden et al. (2010), the stock prices are too affordable compared to the past, and the rejection of the affordability of prices after splitting the stock price could be rejected. If the stock prices are too affordable, subdivision of the prices might not attract small investors. In Bursa Malaysia, over 90% of the listed firms document in their split proposals that an improvement in stock liquidity is their main motivation for the stock split. It is argued that an affordable stock price after the split will attract retail investors, and hence lead to a wide range of investors. We expect that the lower prices attract small traders on Ex-date that leads to liquidity improvement, however, liquidity decreases after Ex-date. As such, the following hypotheses are proposed to test liquidity changes on and after the Ex-date:

Hypotheses H1e (H1e): *There is stock liquidity improvement on the split Ex-date.*

Hypotheses H1f (H1f): *There is no stock liquidity improvement after the split Ex-date.*

The early studies (see Murray 1985) report a reduction in trading volume, while bid-ask spreads remain unaffected in both short term and long term. As a decrease in the bid-ask spread indicates a reduction in transaction cost, it could be interpreted as a stock liquidity improvement. The problem arises if stocks experience a decline in stock liquidity in an existence of abnormal return. In an attempt to explain this issue, Dennis (2003) subdivides firms based on the pre-split liquidity, and found a liquidity enhancing for the firms with higher pre-split stock liquidity. Dennis and Strickland (2003) also report that abnormal returns on the split announcement for the firms with a high-level is significantly less than that for the splitting firms with low-level institutional ownership. Furthermore, the sub-sample of firms with a low-level institutional ownership experience stock liquidity improvement after stock splits. These studies indicate a role of liquidity prior to announcements on the stock liquidity around split days. In this regard, we design the following hypothesis to test stock liquidity changes on and around split days, based on the pre-announcement liquidity:

Hypotheses H2 (H2): *The pre-announcement liquidity has an effective role in stock liquidity induced on and around split days.*

Previous studies (Black 1986; Huang et al. 2013) state that stock liquidity improvement following stock splits drives abnormal returns and report a positive relation between abnormal returns and liquidity. Huang et al. (2013) conclude that liquidity improvement could explain abnormal announcement returns, but not abnormal returns on Ex-date. We test the relationship for all the split event days in Bursa Malaysia, to identify if liquidity drives abnormal returns. In this regard, the following hypothesis is designed as follows:

Hypotheses H3 (H3): *There is a positive relationship between abnormal returns and liquidity on and around split event days.*

3. Data and Methodology

We collected the data from all the firms that have stock splits by employing the Company Announcement on the Bursa Malaysia website. Additionally, the information, such as the date of announcement day, Ann-BC day, and Ex-date are extracted from the Company Announcement. Other data items are compiled from the database of Datastream. The sample consists of 214 stock splits that announced and executed between 2004 and 2018. As stock splits became more popular in Bursa Malaysia from 2004, the sample starts in that year. We examine the effect of stock splits on liquidity for the sample on split event days, and expect a short term impact consistent with the literature.

To test whether or not liquidity changes are different among the split sub-samples, we provide groups of firms based on liquidity in a year prior to announcement day. Similar liquidity changes among the groups would support the result of the whole sample. If stock splits are as good news to the investors' viewpoint, then liquidity changes would be positive on a split event day.

In Bursa Malaysia, firms repeatedly inform investors of each step of stock split process, specifically in three days, including announcement day, Ann-BC day, and Ex-date. This study, following Tabibian and Zhang (2018), defines an event window around each day, for instance, as a three-day period, from the day (−1) to the day (+1), for Ann-BC day, (day 0). This covers the effect of telephone calling by the expert's analysts to the managers before split day, and the delay on informing market after split day as well. To find a better explanation for liquidity behavior, we examine the change of stock liquidity over a year window, prior to the announcement day and a year after Ex-date. Considering the three split days, a period from the day 262 prior to announcement day (estimation window) to the day 262 after splits Ex-date provides seven intervals, as follows:

Interval 1, Pre-announcement period: 1–262 (includes 262 days)
Interval 2, Announcement period: 263–264 (includes 2 days)
Interval 3, Announcement to Ann-BC period: 265–649 (includes 385 days)
Interval 4, Ann-BC period: 650–652 (includes 3 days)
Interval 5, Ann-BC to Ex-date period: 653–678 (includes 26 days)
Interval 6, Ex-date period: 679–683 (includes 5 days)
Interval 7, Post Ex-date period: 684–945 (includes 262 days)

Following Huang et al. (2013), this study examines the change in stock liquidity measurement from a year preceding announcement day to a year following Ex-date among the seven intervals. In order to create a robust analysis, this study uses two measures, as follows:

(i) Turnover ratio (TR): It is the average of the daily ratio of trading volume (in shares) to shares outstanding. Dennis and Strickland (2003) state that "turnover ratio standardizes the volume into a statistic that is consistent for large and small firms, and it also controls for the change in the number of publicly available shares around the split date." This variable measures the trading activity, and an increase in the turnover ratio indicates a stock liquidity improvement.
(ii) Relative spread (RS): The measure is computed by dividing the dollar bid-ask spread with the average daily high and low stock price. This measurement reflects the fact that the converting of assets to cash is easy, and a decrease in the relative spread indicates a liquidity enhancement (Huang et al. 2013).

A significantly positive/negative difference of the mean value of TR/RS between each interval time and that for interval prior to announcement identifies liquidity improvement. Dennis (2003) subdivided the splitting firms based on the pre-split stock liquidity, and finds a liquidity enhancing for the firms with a higher pre-split stock liquidity. Following Dennis (2003), this study, using the level approach (25% bottom, 50% medium, and 25% top), provides three sub-samples based on the amount of pre-split liquidity measure of the stock to investigate market reaction and liquidity changes on and following the split days. A firm with a high turnover ratio (High TR) and low relative spread (Low RS) was categorized in a high pre-split stock liquidity group, and a firm with a low turnover ratio (Low TR) and high relative spread (High RS) in a low group. Moreover, a firm with a medium turnover ratio and relative spread is categorized in the medium group as well.

This study also aims to examine the relationship between abnormal returns and liquidity, to identify if abnormal returns are driven by liquidity. In this regard, we propose the following specification, to investigate the relationship between abnormal returns and stock liquidity changes, for each interval compared to Interval 1:

$$AR_{(it)} = \alpha_0 + \alpha_1\, \Delta TR_{(it)} + \alpha_2\, \Delta RS_{(it)} + \varepsilon_{(it)} \quad (1)$$

where $AR_{(it)}$ is abnormal return in an interval, which is an average of predicted residuals in an interval calculated based on the regression of stock returns for each day in the interval against market index returns over the pre-announcement window (Interval 1). The $\Delta TR_{(it)}$ is the change of turnover ratio for each interval compared to Interval 1, and a positive change indicates liquidity improvement. The $\Delta RS_{(it)}$ is the change of relative spread for each interval compared to Interval 1, and a negative change indicates liquidity improvement. A positive α_1 and negative α_2 indicate a strong relationship between abnormal return and liquidity improvement that we expect on announcement day. Moreover, we investigate the role of liquidity in the period prior to the announcement on the relationship between abnormal return (AR) and liquidity, with proposing the following specification:

$$AR_{(it)} = \alpha_0 + \alpha_1\, \Delta TR_{(it)} + \alpha_2\, \Delta RS_{(it)} + LL_{(i)} + \varepsilon_{(it)} \tag{2}$$

where $LL_{(i)}$ is a control variable with a value of 1, 2, or 3 defined as low, medium, or high level, respectively, that indicates the category of the firm's liquidity level.

4. Empirical Analysis

In this section, the results of the stock splits effect on stock liquidity are presented in three parts. First, we evaluate the stock liquidity changes on and around the three split days. Then, we investigate if there is any difference in stock liquidity changes among the groups categorized based on liquidity in a year prior to the announcements. Finally, we assess the relationship between abnormal returns and stock liquidity on and around the split days.

4.1. Stock Liquidity Changes

Previous researchers present contradictory result of stock liquidity changes on and around split days, however, a majority of the managers in Bursa Malaysia believe that the subdivision of their stock improves the stock liquidity. In addition, Huang et al. (2013) show that the stock liquidity improvement is a short-lived effect of split announcements. We test turnover ratio (TR) and relative spread (RS) on and around three split days, including announcement day, announcement of book closing date and Ex-date, to determine stock split impact on stock liquidity in Bursa Malaysia.

Table 1 reports changes in the mean value of the liquidity measurements between an interval and interval 1. The value of a liquidity measure presented in the tables of this study is the real value multiplied by 100. As can be seen in Table 1, there is a significant increase in turnover ratio (1.2%) and a significant decrease in relative spread (−0.73%) on the announcement day (Interval 2). This result indicates a strong liquidity improvement, which is consistent with the finding of previous researchers (i.e., Huang et al. 2013). The liquidity improvement on the announcement day may be due to the investors' optimism on splitting firm performance, or because splits announcement grabbed their attention. The significantly positive abnormal return (1.49%) is also consistent with the finding of study by Tabibian and Zhang (2018), for the sample period 2004–2014. This finding indicates that the strong liquidity improvement could explain the abnormal returns induced on announcement day.

However, as Table 1 shows, there is no evidence of a strong liquidity improvement in the interval between announcement day and the announcement of book closing date (Interval 3). There is a significant decrease in TR (−0.16%), which indicates a decline in liquidity, while a significant decrease in RS (−0.45%) shows a liquidity improvement. A negative change in RS represents decreasing information asymmetry that results in a decline in transaction costs, which leads to liquidity improvement. Consistent with the finding of Tabibian and Zhang (2018), the AR is significantly negative (−0.12%) in Interval 3. The decrease in TR could explain the negative AR in Interval 3. However, a decrease in RS could be interpreted as stock splits convey information that leads to a decline in asymmetric information.

Table 1. Liquidity Measurements (%) and Abnormal Returns (%).

Interval	TR	RS	AR
2	1.20 ***	−0.73 **	1.49 ***
	(−6.471)	(−3.040)	(−10.149)
3	−0.16 ***	−0.45 ***	−0.12 ***
	(−4.534)	(−10.161)	(−4.492)
4	0.34 *	−0.64 **	0.43 ***
	(−2.284)	(−3.163)	(−3.527)
5	0.67 ***	−0.94 ***	0.07
	(−6.994)	(−7.496)	(−0.867)
6	0.37 **	−0.41 **	0.06
	(−3.163)	(−2.682)	(−0.645)
7	−0.80 ***	0.50 ***	−0.13 ***
	(−33.095)	(−16.404)	(−7.196)

Note: This table presents the change in mean stock liquidity measures of the intervals. Change in a liquidity measure is the liquidity differences between the interval and the pre-split announcement (Interval 1). The liquidity measures consist of turnover ratio (TR) and relative spread (RS). The abnormal return (AR) in an interval is the predicted residuals based on a regression of stock returns against market index returns in the pre-announcement window (Interval 1). ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. The t for t-test is shown in parenthesis.

Tabibian and Zhang (2018) introduce announcement of book closing day as a split event day. Their finding shows a significantly positive abnormal return on this day for the sample period in 2004–2014. Consistent with their finding, our results in Table 1 show a significantly positive AR (0.43%). In addition, the finding indicates a significant increase in TR (0.34%) and a significant decrease in RS (−0.64%), that could be interpreted as a strong liquidity improvement in Interval 4. This result provides evidence that shows stock liquidity drives abnormal return on announcement of book closing day. The announcement of book closing date informs investors of the splits execution date, which could reduce investors' uncertainty concerning whether/when a stock split being executed in the market. Increasing stock liquidity on and following Ann-BC indicates that this event removes the investors' uncertainty of stock split execution, and strongly grabs the attention of investors.

The results in Table 1 also indicate that, after the announcement of book closing day (Intervals 5) and on Ex-date (Intervals 6), there is a significant increase in TR (0.67% and 0.37%) and a significant decrease in RS (−0.94% and −0.41%), suggesting that there is a liquidity improvement in both Intervals 5 and 6, while the liquidity improvement did not lead to a significant abnormal return (0.07% and 0.06%). However, it is found that liquidity tends to decline after Ex-date in Interval 7. There is a significant decrease in TR (−0.80%) and a significant increase in RS (0.50%), which indicates a decline in stock liquidity. This result is consistent with the finding of a study by Copeland (1979), that stock liquidity permanently decreases in a year following stock splits. Moreover, there is a significantly negative AR (−0.13%), which is consistent with the finding of a study by Tabibian and Zhang (2018).

4.2. The Role of Liquidity

As for a robustness check, we test the moderating effect of stock liquidity level in the period prior to the announcement on liquidity changes following stock splits. We consider both liquidity measurements (TR and RS) in the subsamples. The firms with a high/low level (25–50–25%) turnover ratio and low/high relative spread in interval 1 are categorized as high/low liquidity level, and those between the two levels make the third group; medium level.

Table 2 reports the results of the three levels of liquidity prior to the announcement (Interval 2). As can be seen in Table 2, there is a significant increase in TR (0.37%/1.64%) and an insignificant decrease in RS (−0.87%/−0.11%) for low and high liquidity in Interval 1, suggesting that there is stock liquidity improvement, but it is not strong. In addition, the result for medium level shows a significant increase in TR (1.31%) and a significant decrease in RS (−0.42%). This result indicates that firms with medium level of liquidity experienced strong liquidity improvement on announcement day. Moreover, the results of AR in Interval 2 shows that the low (0.94%), medium (1.58%) and high (0.8%) levels experience a significantly positive on announcement day. The findings are consistent with that from the whole sample study and the previous studies (i.e., Huang et al. 2013) that report a significant liquidity improvement on announcement day (Interval 2).

Table 2. Liquidity Measurements (%) and Abnormal Returns (%).

		Low Liquidity			Medium Liquidity			High Liquidity	
Interval	**TR**	**RS**	**AR**	**TR**	**RS**	**AR**	**TR**	**RS**	**AR**
2	0.37 **	−0.87	0.94 **	1.31 ***	−0.42 **	1.58 ***	1.64 *	−0.11	0.8 *
	(−7.117)	(−0.684)	(−2.728)	(−12.266)	(−1.439)	(−3.945)	(−2.191)	(−0.212)	(−1.985)
3	0.14 *	−0.55 *	0.03	0.10 ***	−0.30 ***	−0.05	−0.57 ***	0.02	−0.51 ***
	(−2.134)	(−2.344)	(−0.3)	(−4.899)	(−5.451)	(−0.707)	(−3.986)	(−0.212)	(−5.855)
4	0.64 *	1.14	0.34	0.30 ***	−0.43 **	0.36 **	−1.18 *	0.05	0.13
	(−2.325)	(−1.079)	(−0.861)	(−3.496)	(3.635)	(−2.294)	(−2.048)	(−0.119)	(−0.375)
5	0.67 ***	−1.32 *	0.3	0.27 ***	−0.38 *	−0.03	−0.58	−0.02	−0.11
	(−3.857)	(−2.006)	(−1.115)	(−4.66)	(−2.450)	(−0.121)	(−1.521)	(−0.093)	(−0.448)
6	2.55 ***	−1.04	0.41	0.06	−0.05	−0.07	−1.09 *	0.13	−0.05
	(−12.36)	(−1.295)	(−1.8)	(−0.927)	(−0.262)	(−0.278)	(−2.420)	(−0.403)	(−0.191)
7	0.17 ***	−0.02	−0.02	−0.37 ***	0.48 ***	−0.08	−2.97 ***	0.73 ***	−0.32 ***
	(−3.61)	(−0.125)	(−0.323)	(−26.853)	−12.702	(−1.539)	(−32.641)	(−11.71)	(−5.988)

Note: The sample of study is categorized based on level of liquidity prior to the announcement. The level approach provides three groups, including 25% top, 50% middle, and 25% bottom. The stock liquidity changes compared to the pre-announcement are presented for each group in each interval. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. The *t* for *t*-test is shown in parenthesis.

On the announcement of book closing date (Interval 4), Table 2 shows a significant liquidity improvement (TR: 0.30% and RS: −0.46%), with significant AR (0.36%) only for the group with the medium level, which is consistent with the result for the whole sample study. For the low-level of liquidity, there is a significant increase in TR (0.64%) and insignificant increase in RS (1.14%), suggesting that there is a liquidity improvement, though the improvement is not strong. In contrast, it is found that there is a significant decrease in TR (−1.18%) and insignificant increase in RS (0.05) for the high-level liquidity. This finding implies that firms with a high liquidity level experience a decline in liquidity on the announcement of the book closing date. In addition, AR on Ann-BC day is positive but insignificant for both the low (0.34%) and high (0.13%) levels of liquidity.

For Intervals 3 and 5, the low and medium levels experience a liquidity improvement, while there is a decrease in liquidity for the high level. For instance, the result for Interval 3 for the low level shows a significant increase in TR (0.14%) and decrease in RS (−0.55%), that indicates liquidity improvement, while the result at the high level indicates a decrease in liquidity, as there is a significant decrease in TR (−0.57%) and insignificant increase in RS (0.02%). Furthermore, there is an insignificant AR in Intervals 3 and 5 for all except the high level, but with negative abnormal returns. Consistent with the result of whole sample of study, the firms with a low and medium level of liquidity experience liquidity improvement and an insignificant AR after the announcement of book closing date (Interval 5).

Moreover, on Ex-date (Interval 6), only the low-level group experiences liquidity improvement (TR: 2.55% and RS: −1.01%), while the high-level group experiences a decline in liquidity (TR: −1.09% and RS: 0.13%). The medium group experiences liquidity improvement, but it is insignificant (TR: 0.06% and RS: 0.05%). This result could be interpreted as, consistent with the whole sample, lower prices following stock splits on Ex-date for low-level group could grab the investors' attention. The results for AR at all the three levels are consistent with that from the whole sample study, though insignificant.

As Table 2 shows, the results of post Ex-date (Interval 7) for medium and high level of liquidity indicate a decline in liquidity (TR: −0.37%/−2.97% and RS: 0.48%/0.73%), which is consistent with the finding for the whole sample and previous studies (i.e., Huang et al. 2013) as well. However, the result shows that there is a liquidity improvement for the low-level (TR: 0.17% and RS: −0.02%) in the post Ex-date.

4.3. Relationship between Abnormal Returns and Liquidity Measures

We now turn to the investigation of the relationship between abnormal returns and two liquidity measurements, including turnover ratio (TR) and relative spread (RS). According to Black's (1986) viewpoint, stock liquidity improvement could explain abnormal returns associated with stock splits. Since an increase in TR and a decrease in RS indicate liquidity improvement, we expect a positive coefficient for TR and a negative one for RS in relation to AR. We use the Equation (1) to investigate if abnormal returns are driven by stock liquidity changes for each interval.

Table 3 provides the regression estimates of the Equation (1). As Table 3 shows, there is a significantly positive coefficient for TR (0.47), and an insignificantly negative one for RS (−0.13), thus, an increase in TR and decrease in RS will lead to an increase in abnormal return. In other words, a liquidity improvement leads to increase in abnormal return, that is consistent with the result in Table 1 for the Interval 2 (1.49%), that shows a liquidity improvement and positive abnormal returns. This result is consistent with the finding of previous studies (i.e., Huang et al. 2013) that conclude that abnormal returns are driven by stock liquidity.

Table 3. Relation between Abnormal Returns and Liquidity Measurements.

Interval	Turnover Ratio	Relative Spread
2	0.47 ***	−0.13
	(−12.223)	(−1.083)
3	0.06 ***	0.04 ***
	(−8.878)	(−3.928)
4	0.03	−0.1
	(−1.304)	(−1.165)
5	0.02	0.09 **
	(−1.96)	(−3.152)
6	0.09 ***	−0.07 *
	(−5.964)	(−2.084)
7	0.17 ***	0.03 ***
	(−20.099)	(−7.417)

Note: The values are the coefficient (regression estimates) of each liquidity measure (TR and RS) based on the following equation: $AR_{(it)} = \alpha_0 + \alpha_1\,\Delta TR_{(it)} + \alpha_2\,\Delta RS_{(it)} + \varepsilon_{(it)}$. In the table, ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. The *t* for *t*-test is shown in parenthesis.

However, the result with Interval 4 (Table 3) for TR (0.03) and RS (−0.01) is insignificant, that could not explain significantly the reduction of positive abnormal returns (0.43%), on the announcement of book closing date. Table 3 also shows that the coefficients (TR: 0.09 and RS: -0.07) are significant on Ex-date (Interval 6), and indicate a positive relation between AR and liquidity, although the abnormal return (0.06%) is insignificant (Table 1). Moreover, the abnormal returns in Interval 3 and 7 are significantly negative (Table 1), and there is no place for testing the relationship with liquidity improvement. As the coefficients are significantly positive for both measurements in the intervals 3 and 7, it could not be interpreted as a strong relationship between AR and stock liquidity.

To robust the analysis, we test the role of liquidity on the relation between abnormal returns and liquidity on and around split days, using the Equation (2). Table 4 provides regression estimates of the equation. As Table 4 shows, the liquidity prior to announcements could not provide strong evidence that indicates that abnormal returns are driven with stock liquidity, especially for Interval 4. A positive coefficient for TR and a negative one for RS indicates liquidity improvement that could not be seen among the subsamples in any interval.

Table 4. Relation between Abnormal Returns and Liquidity Measurement. Dummy Variable (DV): Liquidity prior to Announcement.

Interval	Low Liquidity		Medium Liquidity		High Liquidity	
	TR	RS	TR	RS	TR	RS
2	0.68	−0.11	0.75 ***	0.03	0.20 **	−0.14
	(−1.142)	(−0.677)	(−12.34)	(−0.099)	(−2.974)	(−0.118)
3	0.71 ***	0.06 **	0.34 ***	0.04	0.02	−0.36 *
	(−4.56)	(−2.714)	(−12.661)	(−1.19)	(−1.058)	(−1.969)
4	0.85	0.16	0.46 **	0.24	−0.07	−0.37
	(−1.824)	(−0.704)	(−2.800)	(−1.163)	(−0.690)	(−0.721)
5	0.02	0.16 ***	0.23	0.13	−0.02	−0.56
	(−0.151)	(−3.797)	(−1.866)	(−1.257)	(−0.238)	(−1.082)
6	0.07 *	0	0.62 **	0.16	0.19	0.6
	(−2.311)	(−0.022)	(−3.126)	(−1.747)	(−1.263)	(−0.78)
7	0.21 **	0.04 ***	0.65 ***	0.02 **	0.15 ***	−0.01
	(−2.915)	(−3.682)	(−11.661)	(−2.949)	(−3.978)	(−0.591)

The values are the coefficient (regression estimates) of each liquidity measure (TR and RS), based on the below equation: $AR_{(it)} = \alpha_0 + \alpha_1\, \Delta TR_{(it)} + \alpha_2\, \Delta RS_{(it)} + LL_{(i)} + \varepsilon_{(it)}$. $LL_{(i)}$ is a Control variable with a value of 1, 2, or 3 defined as low, medium, or high level, respectively, that indicates the category of firm's liquidity level. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. The *t* for *t*-test is shown in parenthesis.

5. Further Results with Panel Data Analysis

The previous studies (i.e., Huang et al. 2013) use cross-sectional regression to test if abnormal returns can be explained by other factors, such as liquidity measures. Since these studies often consider only a three- (i.e., Grinblatt et al. 1984) or five-day (i.e., Huang et al. 2013) period surrounding the split event day, they need to use cumulative or average abnormal return, to regress on other factors such as a liquidity measure. If there was a problem with data such as multicollinearity, heteroskedasticity, and/or serial correlation, the cross-section regression is not appropriate to test the relationship. In this section, we use panel data analysis to further assess the relationship between abnormal returns and stock liquidity, on and around each split day (Intervals 2–7).

The result of Section 4 (Table 3) for announcement day (Interval 2) indicates an insignificant relationship between AR and RS (−0.13). In this regard, we re-examine the relationship between abnormal return and liquidity measures, by using panel data approach for robustness check. For each interval, we first test which model, OLS (pooled model), random effect or fixed effect, is more appropriate, then we use diagnostic checks to test if there is a problem in the data, including multicollinearity, heteroskedasticity, and serial correlation. Finally, we run an appropriate robust test to solve the problem. Table 5 presents the regression results regarding the proper model, and Tables 6 and 7 present the results of robust test for the liquidity measures in each interval.

As can be seen in Table 5, the results of Breusch and Pagan Lagrangian's multiplier test indicate that the OLS (pooled model) is more appropriate than the random effect for the Intervals 2, 4, 5 and 6, however, the results for Intervals 3 and 7 show that random effect is more appropriate than OLS (pooled model). Table 5 also shows that using the Hausman Fixed test leads to the conclusion that fixed effect model is a proper model for Intervals 2, 3, and 7. Using fixed effect model for the Intervals 2, 3, and 7, the TR's coefficients increased from 0.47, 0.06 and 0.17 to 0.67, 0.10 and 0.21, respectively. It also leads to an increase in RS's coefficients for the Intervals 3, and 7, from 0.04 and 0.03 to 0.07 and 0.04, respectively. However, it changes the RS' coefficient for Interval 2, from an insignificant (−0.13) to a significant (−1.47) value. As OLS (pooled model) is more appropriate for the data in the Intervals 4, 5 and 6, the results are the same as those presented in Table 3.

Table 5. Panel Data Analysis: Abnormal Returns—Liquidity measures (TR and RS).

Interval	2	3	4	5	6	7
Test 1	OLS	RE	OLS	OLS	OLS	RE
Test 2	FE	FE	-	-	-	FE
Turnover Ratio (TR):						
Pooled OLS	0.47 ***	0.06 ***	0.03	0.02	0.09 ***	0.17 ***
	(−12.223)	(−8.878)	(−1.304)	(−1.96)	(−5.964)	(−20.099)
Random Effect	-	0.08 ***	-	-	-	0.20 ***
	-	(−10.177)	-	-	-	(−22.305)
Fixed Effect	0.67 ***	0.10 ***	-	-	-	0.21 ***
	(−9.683)	(−11.816)	-	-	-	(−22.478)
Relative Spread (RS):						
Pooled OLS	−0.13	0.04 ***	−0.1	0.09 **	−0.07 *	0.03 ***
	(−1.083)	(−3.928)	(−1.165)	(−3.152)	(−2.084)	(−7.417)
Random Effect	-	0.05 ***	-	-	-	0.04 ***
	-	(−4.432)	-	-	-	(−8.526)
Fixed Effect	−1.47 ***	0.07 ***	-	-	-	0.04 ***
	(−5.116)	(−4.75)	-	-	-	(−8.668)

Test 1 and Test 2 stand for Breusch and Pagan Lagrangian's multiplier test and Hausman Fixed test, respectively. ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively.

Table 6. Turnover Ratio's Coefficient after Robust used to Rectify the problem in Data.

Interval	2	3	4	5	6	7
OLS	0.47 ***	0.06 ***	0.03	0.02	0.09 ***	0.17 ***
	(−12.223)	(−8.878)	(−1.304)	(−1.96)	(−5.964)	(−20.099)
Robust	–	0.08 **	0.03	–	0.09 **	–
	–	(−2.927)	(−0.377)	–	(−3.107)	–
Fe Robust	0.67 ***	–	–	0.04	–	0.21 **
	(−3.863)	–	–	(−1.376)	–	(−3.235)

Note: *** and ** represent significance at 1%, and 5% levels, respectively.

Table 7. Relative Spread's Coefficient after Robust used to Rectify the problem in Data.

Interval	2	3	4	5	6	7
OLS	−0.13	0.04 ***	−0.1	0.09 **	−0.07 *	0.03 ***
	(−1.083)	(−3.928)	(−1.165)	−3.152	(−2.084)	(−7.417)
Robust	–	0.05 *	−0.05	–	−0.07 *	–
	–	(−2.138)	(−0.331)	–	(−2.014)	–
Fe Robust	−1.47 *	–	–	0.1	–	0.04 **
	(−2.368)	–	–	(−1.046)	–	(−3.177)

Note: ***, ** and * represent significance at 1%, 5% and 10% levels, respectively.

The results of diagnostic checks indicate that there is no multicollinearity problem, while there is a heteroskedasticity problem in the data for all the intervals. We also found that there is no serial correlation problem, except for the data in Intervals 2, 5 and 7. So, there are both heteroskedasticity and serial correlation problems in the data in Intervals 2, 5 and 7. Tables 6 and 7 present the result of robust tests for the liquidity measurements, TR and RS, respectively.

The result of a robust test on announcement day (Interval 2) in Table 6 shows an increase in the coefficient for TR from 0.47 to 0.67, and that for Table 7 indicates that RS's coefficient changed from an insignificant (−0.13) to a significant value (−1.47). The positive relation between abnormal returns and turnover ratio (0.67), and the negative relation between abnormal returns and relative spread (−1.47), strongly confirm that stock liquidity improvement leads to an increase in abnormal announcement returns, which is consistent with the findings in Black (1986) and Amihud (2012).

An attempt to solve the heteroskedasticity problem with data in Interval 4 does not improve the significance of the relationship between AR and liquidity. Tables 6 and 7 show insignificant values for both measurements. Although the result for Interval 4 in Table 1 shows liquidity improvement and a significantly positive AR, there is an insignificant relationship between AR and the liquidity measures. Furthermore, Tables 6 and 7 show that the robust test make no changes in the result on Ex-date (Interval 6). Nevertheless, the relationship for TR (0.09) is significantly positive and that is negative for RS (−0.07) that indicates liquidity induces abnormal returns on Ex-date (Interval 6).

The results of using robust standard error estimation in Tables 6 and 7 indicate a significantly positive relationship between AR, and both TR (0.21) and RS (0.04) in Interval 7. There is a similar result for the Intervals 3 (TR:0.08, RS:0.05) and 5 (TR:0.04, RS:0.1). The results for Intervals 3, 5 and 7 introduce no specific liquidity relationship with AR, as TR and RS both have a positive coefficient.

6. Conclusions

We examine how stock splits affect stock liquidity on and around split event days in Bursa Malaysia, using a dataset consisting of 214 firms that announced and executed stock splits from 2004–2018. The results show a significant liquidity improvement on all the three split days, including announcement day, announcement of book closing date, and execution date. This finding seems to be consistent with managers' justification that stock splits are believed to improve liquidity. However, our results also suggest that liquidity improvement is a short-lived phenomenon, as there is a decline in liquidity in a year period after Ex-date. The results from our robustness tests indicate that firms with a low-level liquidity experience a significant increase in stock liquidity after Ex-date, while there is a significant decline in liquidity for medium- and high-level groups. In contrast to the finding over the whole sample period, firms with low liquidity prior to announcement gain, liquidity improvement in a year after Ex-date. Furthermore, the results show that there is a significantly positive/negative relationship between abnormal announcement returns and turnover ratio/relative spread, suggesting that liquidity improvement induces abnormal returns. However, the result is insignificant for the announcement of the book closing date. The robustness test results suggest that there is a significant relationship between abnormal returns on the announcement of book closing date and liquidity measures only for firms with medium liquidity level. These findings confirm that liquidity prior to the announcement has a significant impact on the liquidity changes on and around the stock splits days. Finally, the results from the panel data analysis indicate that the relative spread is negatively associated with the abnormal announcement returns, and the abnormal announcement returns are driven by stock liquidity. It is also found that there exists a heteroskedasticity problem in the data, and the fixed effect model is more appropriate than the pooled OLS.

Overall, we find strong evidence suggesting that liquidity prior to announcement plays a significant role in determining the impact of stock splits on stock liquidity and abnormal returns, but no evidence that abnormal returns are driven by liquidity improvement. Previous studies (Brennan and Copeland 1988; Hausman et al. 1971; Johnson 1966; MCnichols and Dravid 1990) report that there is a strong market reaction to the splits with higher split factor. Hence, future study should investigate the impact of other factors such as split factor on the relationship between abnormal returns and liquidity.

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