Event Study Methodology\(^1\)
Existing literature concerning the estimation of abnormal returns typically employs the event study methodology originated by Fama et al (1969)\(^2\), who employ it to test the market’s efficiency in responding to stock split announcements.

**Returns**
We employ the Event Study Workbook\(^3\) to calculate the average abnormal returns. The package estimates abnormal returns using continuously compounding returns\(^4\), and estimates beta using ordinary least squares regression (OLS)\(^5\). We stipulate 250 trading days of data to estimate beta to capture seasonality effects.

Individual abnormal returns are calculated as:

\[ AR_{it} = R_{it} - E(R_{it}) \]  \hspace{1cm} (1)  

Where:  
\( AR_{it} \) = The abnormal return for company \( i \) in period \( t \);  
\( R_{it} \) = The actual return for company \( i \) period \( t \); and,  
\( E(R_{it}) \) = The expected return for company \( i \) in period \( t \).

In turn, the expected return for stock \( i \) at time \( t \) in equation (1) is calculated as:

---

\(^2\) This methodology has been used to identify abnormal returns in response to announcements pertaining to: annual profit reports (see for example Ball and Brown, 1968; and, Brown, 1970); changes in earnings forecasts (see for example Brown et al, 1977); and, block trading of shares (see for example Ball and Finn, 1989).  
\(^3\) Thanks to Kate Barraclough for providing help on the programming associated with the event study method.  
\(^4\) Continuously compounded returns are less affected by the influence of outliers and are consistent with return generation through calendar time rather than trading time (Brailsford, Faff and Oliver 1997).  
\(^5\) OLS is a method commonly used to estimate betas by regressing daily returns for individual stocks against market returns.
\[ E(R_{it}) = \alpha_i + \beta_i R_{mt} \]  

Where:
- \( E(R_{it}) \) = The expected return for company \( i \) in period \( t \);
- \( \alpha_i \) = The intercept term;
- \( \beta_i \) = A regression constant; and,
- \( R_{mt} \) = The return on the market in period \( t \).

Average abnormal return is calculated as:

\[ AAR_t = \frac{1}{n} \sum_{t=1}^{n} AR_{it} \]  

Where:
- \( AAR_t \) = The average abnormal return for time \( t \);
- \( AR_{it} \) = The abnormal return for company \( i \) at time \( t \); and,
- \( n \) = The sample size.

To ascertain the significance of the average abnormal returns for each day in the window period, testing is performed with t-statistics calculated for each average abnormal return (AAR\(_t\)) using the following equation:

\[ t_{AR} = \frac{AAR_t}{\sigma_{AR}/\sqrt{n}} \]  

Where:
- \( t_{AR} \) = The t-statistic;
- \( AAR_t \) = The average abnormal return for time \( t \);
- \( \sigma_{AR} \) = The standard deviation of abnormal returns at time \( t \); and,
\[ n = \text{The sample size.} \]

In order to ascertain the magnitude of abnormal returns over the entire event window, we then calculate firm specific cumulative abnormal returns (CARs), and cumulative average abnormal returns (CAARs) overall, which are defined as follows:

\[ CAR_t = CAR_{t-1} + AR_t \quad (5) \]

Where:
- \( CAR_t \) = The cumulative abnormal return at time \( t \);
- \( CAR_{t-1} \) = The cumulative abnormal return at time \( t-1 \); and,
- \( AR_t \) = The abnormal return at time \( t \).

\[ CAAR_t = CAAR_{t-1} + AAR_t \quad (6) \]

Where:
- \( CAAR_t \) = The cumulative average abnormal return at time \( t \);
- \( CAAR_{t-1} \) = The cumulative average abnormal return at time \( t-1 \); and,
- \( AAR_t \) = The average abnormal return for time \( t \).

The significance of these overall cumulative abnormal returns is ascertained via the calculation of a t-statistic, defined as follows:

\[ t_{\text{CAR}} = \frac{CAAR_t}{\sigma_{\text{CAR}} / \sqrt{n}} \quad (7) \]

Where:
- \( t_{\text{CAR}} \) = The CAR t-statistic;
\[ \text{CAAR}_t = \text{The cumulative average abnormal return at time } t; \]
\[ \sigma_{\text{CAR}} = \text{The cross-sectional standard deviation of the abnormal returns for the sample of } n \text{ firms at time } t; \text{ and,} \]
\[ n = \text{The sample size.} \]

It is evident from examination of equations (1) through (7) that in employing the event study method to calculate returns, we need to choose an appropriate event window.

**Event Window**
A trade off is required when determining the length of the event study window.
Specifically, the window must capture the total share price reaction to the trading halt announcement whilst excluding price fluctuations from other announcements. The decision as to the size of the event window is subjective, as it may vary in accordance with the market and event examined. Typically, event studies specify an event window surrounding the event of interest in order to capture the pre-event and post-event reaction (MacKinlay 1997). Information leakages can lead to investors' anticipation of a trading halt, so it is important to include trading days before the trading halt in the event window. We expect the market reaction to a trading halt to be immediate, however, it may take some days to resolve uncertainty regarding the financial impact of the trading halt. Existing studies of trading halts using daily data have adopted various event windows in testing their hypotheses\(^6\). Accordingly, we examine the shareholder wealth effects of trading halt announcements using an 11 day (-5,5) window.

---
\(^6\) Howe and Schlarbaum (1986) use \( t \pm 5 \) days; Corwin and Lipson (2000) use \( t \pm 4 \) days; and, Kryzanowski and Nemiroff (2001) use \( t \pm 5 \) days.
**Matched Firm Approach**

According to Barber and Lyon (1997) the standard event study approach to calculating abnormal returns will lead to misspecified test statistics and therefore biased results. More specifically, they conclude that abnormal returns should be calculated as a buy-and-hold return on the sample firm less the buy-and-hold return on a control firm, the latter matched based on size and book-to-market ratio. Assessing the impact of the average abnormal returns is done using the Barber and Lyon cumulative average abnormal return (BLCAAR) and average buy-and-hold abnormal return (ABHAR), both calculated using discrete returns. Applying this rationale to the current case, control firms are to be selected from those firms listed on the ASX that do not experience a trading halt over the sampling period, with market capitalisation (size) at the last reporting date prior to the sampling period being 70 to 100% of the sample firms market capitalisation with the closest book-to-market ratio.

**Barber and Lyon Cumulative Average Abnormal Return (BLCAAR)**

Returns for each trading halt and control company are calculated as follows:

\[
R_{it} = \left[ \frac{P_i - P_{t-1}}{P_t} \right]
\]

(8)

Where: \( R_{it} \) = The discrete return for company \( i \) in period \( t \);
\[ P_t = \text{The return index for stock } i \text{ at time } t; \text{ and,} \]
\[ P_{t-1} = \text{The return index for stock } i \text{ at time } t-1. \]

In turn, the abnormal returns for the trading halt company and control company are calculated as:

\[ AR_{it} = TH_{it} - C_t \]  \hspace{1cm} (9)

Where:
\[ AR_{it} = \text{The abnormal return for company } i \text{ in period } t; \]
\[ TH_{it} = \text{The return for trading halt company } i \text{ in period } t; \text{ and,} \]
\[ C_t = \text{The return for the control company in period } t. \]

Average abnormal for time \( t \) across all stocks is calculated as:

\[ AAR_t = \frac{1}{n} \sum_{i=1}^{n} AR_{it} \]  \hspace{1cm} (10)
Where: $AAR_t = \text{The average abnormal return for time } t;$  
$AR_{it} = \text{The abnormal return for company } i \text{ at time } t; \text{ and,}$  
$n = \text{The sample size.}$

To ascertain the significance of the average abnormal returns for each day in the window period, testing is performed, with t-statistics calculated for each abnormal return ($AAR_t$) using the following equation:

$$t_{AR} = \frac{AAR_t}{\sigma_{AR} \sqrt{n}}$$

(11)

Where: $t_{AR} = \text{The t-statistic;}$  
$AAR_t = \text{The average abnormal return for time } t;$  
$\sigma_{AR} = \text{The standard deviation of abnormal returns at time } t;$  
and,  
$n = \text{The sample size.}$

In order to ascertain the magnitude of abnormal returns over the entire event window, we then calculate firm specific Barber and Lyon cumulative abnormal returns.
(BLCARs), and overall Barber and Lyon cumulative average abnormal returns (BLCAARs), which are defined as follows:

\[ \text{BLCAR}_t = \text{BLCAR}_{t-1} + \text{AR}_t \]  \hspace{1cm} (12)

Where:

\[ \text{BLCAR}_t = \text{The Barber and Lyon cumulative abnormal return at time } t; \]

\[ \text{BLCAR}_{t-1} = \text{The Barber and Lyon cumulative abnormal return at time } t-1; \text{ and,} \]

\[ \text{AR}_t = \text{The abnormal return for time } t. \]

\[ \text{BLCAAR}_t = \text{BLCAAR}_{t-1} + \text{AAR}_t \]  \hspace{1cm} (13)

Where:

\[ \text{BLCAAR}_t = \text{The Barber and Lyon cumulative average abnormal return at time } t; \]

\[ \text{BLCAAR}_{t-1} = \text{The Barber and Lyon cumulative average abnormal return at time } t-1; \text{ and,} \]

\[ \text{AAR}_t = \text{The average abnormal return for time } t. \]
The significance of these overall cumulative abnormal returns is ascertained via the calculation of a t-statistic, defined as follows:

$$t_{BLCAR} = \frac{BLCAAR_t}{\sigma_{BLCAR} \sqrt{n}}$$

(14)

Where: 
- \( t_{BLCAR} \) = The BLCAR t-statistic;
- \( BLCAAR_t \) = The Barber and Lyon cumulative average abnormal return at time \( t \);
- \( \sigma_{BLCAR} \) = The Barber and Lyon cross-sectional standard deviation of the average abnormal returns for the sample of \( n \) firms at time \( t \); and,
- \( n \) = The sample size

**Average Buy-and-Hold Abnormal Returns (ABHAR)**

However, Barber and Lyon (1997) report that cumulative abnormal returns (CARs) obtained by summing daily or monthly returns introduce biases by ignoring compounding, and are basically a biased predictor of long run buy-and-hold returns. Further, they argue CARs suffer from measurement bias, new listing bias and skewness bias, whilst buy-and-hold abnormal returns are subject to new listing bias,
skewness bias and rebalancing bias, all of which can be eliminated by the use of control firms. We also calculate the buy-and-hold abnormal returns, defined as:

$$BHAR_{it} = \prod_{t=1}^{T} [1 + TH_{it}] - \prod_{t=1}^{T} [1 + C_{it}]$$

(15)

Where: $BHAR_{it}$ = The buy-and-hold abnormal return at time $t$; $TH_{it}$ = The return for trading halt company $i$ in period $t$; $C_{it}$ = The return for control company $i$ in period $t$; and, $n$ = The sample size.

In turn, the average buy-and-hold abnormal return is calculated as:

$$ABHAR_{i} = \frac{1}{n} \sum_{i=1}^{n} BHAR_{it}$$

(16)

The significance of these overall buy-and-hold abnormal returns is ascertained via the calculation of a t-statistic, defined as follows:
\[ t_{\text{BHAR}} = \frac{ABHAR_t}{\sigma_{\text{BHAR}}/\sqrt{n}} \]

Where:

- \( t_{\text{BHAR}} \) = The BHAR t-statistic;
- \( ABHAR_t \) = The average buy-and-hold abnormal return at time \( t \);
- \( \sigma_{\text{BHAR}} \) = The cross-sectional sample standard deviation of abnormal returns for the sample of \( n \) firms; and,
- \( n \) = The sample size.

**Robust Tests of Barber and Lyon Cumulative Abnormal Return (BLCAR) and Buy-and-Hold Abnormal Return (BHAR) Significance**

This matched sample method fails to account for potential heteroscedasticity in returns. In order to overcome this, and provide a means of comparing Barber and Lyon cumulative abnormal returns and buy-and-hold abnormal returns of sample and control firms with HAC standard errors, we model the return for each of the sample and control companies over the 11 day window period as follows:
\[\text{BLCAR} = \alpha_i + \beta_i D \quad (18)\]

Where:

- \(\alpha_i\) = The intercept term;
- \(\beta_i\) = The slope coefficient;
- \(D\) = A dummy variable equal to 0 if company \(i\) is a
  control company, and 1 otherwise; and,
- \(\text{BLCAR}_i\) = The cumulative abnormal return for company \(i\)
  over the 11 day window, calculated as in (12).

and;

\[\text{BHAR}_i = \alpha_i + \beta_i D \quad (19)\]

Where:

- \(\alpha_i\) = The intercept term;
- \(\beta_i\) = The slope coefficient;
- \(D\) = A dummy variable equal to 0 if company \(i\) is a
  control company, and 1 otherwise; and,
\[
\text{BHR}_i = \text{The buy-and-hold abnormal return for company } i \text{ over the 11 day window, calculated as in (15)}. 
\]

We fit this using ordinary least squares (OLS) regression, with White’s (1980) standard (HAC) errors. Statistical inference is carried out by testing whether the regression slope coefficient is zero; if the slope coefficient is found to be significant, trading halt companies exhibit statistically significantly different returns from control companies over the event window.

**Multivariate Analysis**

We employ multivariate analysis in an attempt to explain the cross-sectional variation in the abnormal returns calculated in Section 4.2. Moreover, we attempt to explain this variation as a function of firm specific characteristics, namely halt length, reason for halt, industry and company size. Given problems with abnormal returns not explicitly employing a matched firm approach, noted by Barber and Lyon (1997), we perform testing using abnormal returns calculated via the event study method, and those obtained with a control approach for robustness.
Existing trading halt literature doesn’t attempt to ascertain the magnitude of cross-sectional variation in abnormal returns as a function of firm specific characteristics. Given the absence of prior literature that provides evidence on variables important in explaining the cross-sectional variation in the shareholder wealth effects of trading halt announcements, we seek guidance from other areas of the literature. In light of this, the explanation of cross-sectional variation in abnormal returns arising from trading halt announcements arguably represents the biggest contribution of this dissertation.

We consider four firm specific characteristics in modelling, namely: Length of halt (Section 4.3.1); Reason for halt (Section 4.3.2); Industry (Section 4.3.3); and Company size (Section 4.3.4). The model we fit as part of our multivariate analysis is formally defined as:

\[
\text{Return}_{it} = \alpha_i + \beta_1 \text{TIME}_i + \beta_2 \text{RESTRUCTURING}_i + \beta_3 \text{PERFORMANCE}_i + \beta_4 \text{CAPITAL}_i + \beta_5 \text{ACQUISITION}_i + \beta_6 \text{MERGER}_i + \beta_7 \text{FINANCIALS}_i + \beta_8 \text{NATURALS}_i + \beta_9 \text{SIZE}_i
\]

(18)

Where:
\[
\text{Return}_i = \text{The return for company } i \text{ at time } t \text{ calculated as a cumulative abnormal return and a buy-and-hold abnormal return as specified;}
\]
\[
\text{TIME}_i = \text{The length of the trading halt for company } i ;
\]
\[
\text{RESTRUCTURING}_i = \text{Dummy equal to 1 if the reason for the trading halt for company } i \text{ is restructuring and 0 otherwise;}
\]
\[
\text{PERFORMANCE}_i = \text{Dummy equal to 1 if the reason for the trading halt for company } i \text{ is performance and 0 otherwise;}
\]
\[
\text{CAPITAL}_i = \text{Dummy equal to 1 if the reason for the trading halt for company } i \text{ is capital raising and 0 otherwise;}
\]
\[
\text{ACQUISITION}_i = \text{Dummy equal to 1 if the reason for the trading halt for company } i \text{ is acquisition or takeover and 0 otherwise;}
\]
\[
\text{MERGER}_i = \text{Dummy equal to 1 if the reason for the trading halt for company } i \text{ merger or joint venture and 0 otherwise;}
\]
\[
\text{FINANCIALS}_i = \text{Dummy equal to 1 if the company } i \text{ lies in the financial services industry and 0 otherwise;}
\]
NATURALS}_i \quad = \quad \text{Dummy equal to 1 if the company}_i \text{ lies in the natural resources industry and 0 otherwise; and,}

\text{SIZE}_i \quad = \quad \text{The natural log of the market capitalisation of company}_i \text{ at the start of the sampling period.}

As noted previously, we fit the model twice: once where abnormal return is defined as that calculated using the event study method; and a second time when abnormal return is that obtained using the approach of Barber and Lyon (1997), using White’s (1980) standard (HAC) errors.
Bibliography


