CHAPTER 2: LITERATURE REVIEW

2.1 Minute by minute interval

Many studies have been done to investigate the intradaily behaviour of the developed stock markets like the US and Japan markets. One such study is examined by Wood, Mc.Inish and Ord (1985) on the New York Stock Exchange (NYSE). The data period is from September 1971 to September 1972 and a large sample of NYSE stocks for year 1982 show a U- shaped minute by minute mean return. They present evidence that the mean and volatility of returns are very high during the opening and closing of the trading day. There is no correlation between the minute to minute market returns. Mc.Inish and Wood (1990) replicate Wood, Mc Inish and Ord's (1985) study for the year of 1980, 1981, 1983 and 1984 and indicate a similar U-shaped pattern in the market return volatility.

There are a number of studies that investigate pattern of the intraday minute by minute behaviour in Asia. The study by Chang, Fukuda, Rhee and Takano (1993) found two distinct U-shaped curves on the minute to minute volatility of the Tokyo Stock Exchange: one in the morning session and the other in the afternoon session. However, the minute to minute return volatility contradicts the findings of Wood, McInish and Ord (1985) because it does not show a U-shaped pattern. There is also evidence of negative returns between the morning closing and the afternoon opening. Another study by Cheng and Fan (1994) for the period between March 10, 1989 and August 31, 1993,using minute by minute Hong Kong Hang Seng Index (HSI), discovers the similar two distinct U-shaped pattern in the market volatility. In contrast with Wood, Mc.Inish and Ord

(1985), the mean returns only show a U-shaped pattern in the morning trading session but increasing trend during the afternoon session. The mean and volatility are also found to be higher during trading hours than non-trading hours for all periods. Their results indicate that private information is produced at a different rate during the trading period. Cheng and Fan (1994) also classify the sample period into 3 sub-periods in order to detect possible changes in return and volatility. Period 1 covers the days before the trading of HSI options. Period 2 covers the same number of trading days as in Period 3 for the basis of comparison. Period 3 is the period where index option is introduced. The results show that the return volatility of period 3 is higher than period 1 as well as period 2. A similar study done by Cheung, Ho , Pope and Draper (1994) shows a double U-shape of the minute by minute return of the Hang Seng Index from January 3, 1990 to December 31, 1992.

2.2   Fifteen minute interval

Some studies have been done on the 15-minute interval stock returns and volatility. One such study is by Harris (1986). He analyzes the weekly and 15 minutes intervals from December 1, 1981 to January 31, 1983 of the NYSE. He discovers that the returns are high at the beginning and at the end of the trading day for all firms. The trading day returns variances are higher than non-trading period. There is a negative Monday return for large firms and small firms. The negative return of large firms accrues during the non-trading weekend between Friday close and Monday open while the negative return of small firms accrues

during the Monday trading day. The returns for the first 45 minutes trading on Monday are negative whilst positive for other days. There is a strong tendency for prices to rise on the last trade of the day. The mean returns for close to close, close to open and open to close periods are significantly less on Monday compared to other days of the week.

Ho and Cheung (1991) investigate the 15-minute returns of the Hang Seng Index from 9 April 1986 to 30 June 1989. The entire period is divided into two sub periods: the pre crash period from 9 April to 16 October 1987 and the post crash period from 26 October to 30 June 1989 (omitting the crash period from 19 to 25 October 1987). For the entire period, the average daily close to close return and the weekend return from Friday close to Monday open are significantly positive. There is a significant time of the day effect in the post crash period where there are positive returns specifically during the trading time of 11.15 to 11.30 a.m. and during 3.00 to 3.15 p.m. The time of the day effect in the pre crash period is not significant. The lowest returns occurs at 10.45 a.m. in the pre-crash period but at 12.15 a.m. in the post-crash period. They also make a comparison of mean returns between the pre-crash and post-crash period. There is a significant difference in four out of eight 15-minute returns in the morning trading session (from 10.30 a.m. to 12.30 a.m.) and one out of two 15-minute returns in the afternoon trading session (3.00 p.m. to 3.30 p.m.) between the pre crash and post crash period. This shows that the mean return in the morning session is more volatile than in the afternoon session. The Wednesday open to close return is significantly different between the pre-crash and post-crash

period. Similarly, the Friday close to open return is significantly different between the two periods. Another similar study done by Ho, Cheung and Cheung (1993) on the Hong Kong stock market found that the return series has both time of the day effects and day of the week effect. They also observed that the volume series is dominated by the time of the day effect. There exists a significantly positive relationship between the absolute returns and trading volume and the relationship is stronger for positive returns than for negative returns. By using Granger causality test, it is also found that the returns cause volume to change unidirectionally.

An examination on the return and risk behaviour of the Malaysian stock prices is done by Chang, Kang and Rhee (1994). They observe the returns of 15 minute intervals on the Composite Index (CI) of the Kuala Lumpur Stock Exchange (KLSE) from February 3, 1990 to February 10, 1992. During this period, the KLSE operated five trading days from Monday to Friday and had two daily trading sessions: a morning session from 10.00 a.m. to 12.30 a.m. and an afternoon session from 2.30 to 4.00 p.m. They discovered that the CI returns are large at the beginning and at the end of the morning session. Similarly, the CI return is large at the beginning and at the end of the afternoon session. This result is consistent with the index return behaviour of the US and Japanese markets. In other words, the 15 minute CI returns show a U-shaped curve similar to the US and Japanese markets. However, the standard deviation or volatility of the CI returns only shows a U-shaped pattern in the morning trading session whereas the afternoon session does not follow a U-shaped pattern. They also

investigated the intraday and interday stock returns and volatility. The results show the average overnight (non-trading) return and afternoon return are positive while the average morning return, lunch break return and the trading day return are all negative. The return variance is 2.7 times greater during the morning trading session than the afternoon session. The daily trading period is also found to have greater volatility than non-trading period. The variance of the morning open to open returns is the largest while the afternoon close to close is the smallest.

2.3 Other Intradaily Interval

Smirlock and Starks (1986) analyse day of the week effects using hourly returns in the Dow Jones Industrial Average (DJIA) from January 1963 to December 1983. They discovered that intraday patterns related to the day of the week have changed over time. The Monday close to close return is negative throughout the entire sample period. Interestingly, the Monday open to close trading has shifted from negative to a positive return. In contrast, the weekend effect from Friday close to Monday open has shifted from positive to a negative return. In the early part of their sample period or the pre-1974 period, the return from Friday close to Monday open is positive, indicated by the positive first hour of Monday trading while returns accruing later in the day are negative. This pattern is reversed in the post-1974 sample period. The average weekend returns from Friday close to Monday open have turned negative but there are

positive returns towards the later hours on Monday. The post-1974 results are very similar to those first reported by Harris (1984).

Lockwood and Linn(1990) examine the hourly market returns on the Dow Jones industrial Average for the period 1964 to 1989. The return volatility shows a U-shaped pattern. The return volatility falls during the beginning hour until early afternoon and rises thereafter towards the closing trading day. The volatility of hourly time intervals are different from each other. The intraday trading periods are also found to have higher market volatility than the non trading periods. Market variance also changes significantly over time. It rises when NASDAQ began in 1971 as well as when stock options began in 1973. It falls when fixed commissions were eliminated in 1975. It rises again when stock index futures was introduced in 1982 and falls again after larger margin requirements for stock index futures was required in 1982. They also performed equality of variance tests across hourly intraday returns, between close to open and open to close returns, and between open to open and close to close returns. There is a significant difference in the hourly intraday returns for the entire period. The market volatility is also significantly higher during the trading day (open to close returns) than non-trading period (close to open returns) for the whole periods. However, the open to open return variance is significantly higher than close to close return variance during the pre-Nasdaq, Options and Commissions periods but is significantly lower during the Futures period.

Rogalski (1984) examines the behaviour of the trading and non-trading stock returns on the Dow Jones Industrial Average (DJIA) from October 1, 1974

to April 30, 1984 as well as the Standard and Poor's Composite Index (SP500) for the period December 29, 1978 to December 9, 1983. It is observed that on average the Monday returns (Friday close to Monday close) are negative. When the daily returns are decomposed into trading (open to close) and non-trading (close to open) periods, the Monday effect exhibits a non-trading weekend effect. The average negative Monday return is mainly caused by the negative non-trading return from Friday close to Monday open. The open to close return, however, shows no significant difference across all days of the week. Keim and Stambaugh (1984) also observed the negative Monday returns throughout a 55 year period from 1928 to 1982 on the New York Stock Exchange (NYSE) and Standard and Poor 500 (S & P 500). The Monday's average from 1928 to 1952 has higher negative return than the average from 1953 to 1982. The Friday return is lower in weeks that include Saturday trading and it is the second lowest of the week (next to Monday's) for the period 1928 to 1952. In contrast, the Friday mean for 1953 to 1982 is the second highest (next to Wednesday's). This suggests a tendency of higher returns on the last trading day of the week whether the last trading day is a Friday or Saturday.

Amihud and Mendelson (1987) examine the periodic clearing mechanism which has different impact on the prices of the Tokyo Stock Exchange from July 1, 1987 to June 30, 1988. The unusual week of the stock market crash from October 19 to 25, 1987 are excluded. 50 stocks of large trading volumes during 1987 which are divided into two sub samples of 25 each are also included. Their findings show that there is high volatility for both sub samples in the daily

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morning open to open return and it exhibits a more negative autocorrelation than the daily afternoon close to close return. Conversely, the afternoon open to open return has same volatility and autocorrelation as the morning close to close return and the daily afternoon close to close return. This shows the mid-day clearing transaction has less pricing errors than the continuous daily trading.

The interday and intraday return volatility is also investigated in some Asian markets. One such study is done by Choe and Shin (1993) on the Korea Stock Price Index from June 11, 1989 to June 10, 1992. It is found that open to open return variance is consistently greater than close to close return variance. The open to open return volatility is also greater than the volatility measured at any other times of the day. They also discovered that opening prices in the morning and after the lunch break are more volatile than prices at any other times of the day.

Another study on the market return volatility is also conducted by Cheung, Ho, Pope and Draper (1994) on the Hong Kong stock market. A feature of the Hong Kong market that is different from the US is that open to close return variance is not significantly different from the close to open return variance. This may be due to the fact that the close to open period is not actually a non-trading period as some of the major Hong Kong stocks are being traded in the London market. Analysis of individual stocks shows that Hong Kong stocks traded on the London Stock Exchange (after the close of the Hong Kong Stock Exchange), exhibit a lower open to open return variance (versus close to close return variance) than those that are not traded on the London Stock Exchange. The

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Hong Kong stocks traded on the London Stock Exchange also have a less negative open to open return autocorrelation than those not traded on the London Stock Exchange.

There are several studies investigating the day of the week effect on the Kuala Lumpur Stock Exchange. Nasir and Mohamed (1987) investigated the Monday effect using daily returns from the New Straits Times Industrial index. Three null hypothesis were tested: the daily return is not different from zero; the mean return for Monday is not different from other days; and there are no differences in mean return across the five trading days. t-tests and F-tests were employed to test these hypotheses for the period July 1975 to December 1985. Their results show that the Monday and Tuesday returns are significantly negative and the highest average return occurs on Friday.

Wong, Hui and Chan (1992) discovered a Monday effect in the KLSE Industrial Index. Due to non-normality of the data, they employed non-parametric tests (specifically the Mann-Whitney test) to investigate the returns over the period 1975 to 1988. The null hypothesis tested was there is no difference in the returns across the weekdays. They found that there is no difference in the returns between Monday and Tuesday. However, the Monday returns are different from other days of the week.

Ho and Cheung (1994) investigate the volatility of the daily effect for a number of Asian markets from 1975 to 1989. They compute the unconditional variance (standard deviation) and test if they are significantly different across the days of the week. In the case of the Malaysian market, they report that the

highest mean return occurs on Friday while the lowest mean return occurs on Tuesday. However, the highest volatility occurs on Monday.