

CHAPTER 4

RESEARCH RESULTS

4.1 COMPOSITE Index

4.1.1 Descriptive Statistics

Table 2 shows the descriptive statistics of all the 22 15-minute returns by trading time for COMPOSITE Index. In addition to that, 7 sets of intraday returns are also computed, namely:

- i) Overnight break
- ii) Morning trading session
- iii) Lunch break
- iv) Afternoon trading session
- v) Daily trading session
- vi) Previous Open to Today Open
- vii) Previous Close to Today Close

Negative returns are observed throughout the two trading sessions except some spikes in stock returns from 3.30 p.m. to 4.00 p.m. interval. The day-end returns are large and positive, measuring at 0.0411%. Table 2 shows that there are large positive returns during the non-trading overnight break, whereas the morning, afternoon and the daily returns are negative, especially the magnitude of the daily returns which stands at -0.1994%. The negative open-to-open and close-to-close returns do not differ much, but is only half of the daily returns.

Table 2 Descriptive Statistics For Intraday COMPOSITE Index

TRADING TIME	AVERAGE RETURN (%)	VARIANCE (x10000)	SKEWNESS	KURTOSIS
Overnight	0.0896	0.1984	0.3940	9.9808
9.30 - 9.45 a.m.	-0.0043	0.2881	-1.2102	14.4743
9.45 - 10.00 a.m.	-0.0361	0.0709	-0.1393	2.4111
10.00 - 10.15 a.m.	0.0022	0.0942	0.4656	11.1871
10.15 - 10.30 a.m.	-0.0131	0.0526	0.1062	5.1598
10.30 - 10.45 a.m.	0.0160	0.0357	0.8272	3.6547
10.45 - 11.00 a.m.	0.0048	0.0397	0.3721	4.6047
11.00 - 11.15 a.m.	-0.0061	0.0383	0.3440	5.7147
11.15 - 11.30 a.m.	-0.0181	0.0315	0.0382	4.4596
11.30 - 11.45 a.m.	-0.0223	0.0352	-2.1642	21.1573
11.45 - 12.00 noon	-0.0347	0.0292	-2.7916	17.6748
12.00 - 12.15 p.m.	-0.0145	0.0183	-0.1446	3.6520
12.15 - 12.30 p.m.	-0.0260	0.0211	-1.6991	12.4376
Lunch Break	0.0019	0.0075	-0.7885	2.9831
2.30 - 2.45 p.m.	-0.0508	0.0402	-2.8901	19.7860
2.45 - 3.00 p.m.	-0.0365	0.0473	-2.9917	27.0317
3.00 - 3.15 p.m.	0.0017	0.0367	1.4340	6.4253
3.15 - 3.30 p.m.	0.0289	0.0870	6.6193	63.9739
3.30 - 3.45 p.m.	0.0292	0.0393	4.1580	31.8152
3.45 - 4.00 p.m.	0.0156	0.0308	-1.8283	21.8783
4.00 - 4.15 p.m.	-0.0010	0.0258	0.4964	2.6331
4.15 - 4.30 p.m.	-0.0319	0.0254	-0.5407	1.3730
4.30 - 4.45 p.m.	-0.0453	0.0396	0.7784	9.8571
4.45 - 5.00 p.m.	0.0411	0.0641	-0.1993	1.4903
Morning Trading Session	-0.1523	1.5573	-0.8039	6.6347
Afternoon Trading Session	-0.0490	0.6131	-0.0983	2.5597
Daily Trading Session	-0.1994	2.4299	-0.1741	3.7906
Previous Open - Today Open	-0.0980	2.9750	0.0127	3.0797
Previous Close - Today Close	-0.1098	3.0058	0.1947	5.4751

The variances of the trading intervals in between the day's beginning and closing show less variation as compared to the beginning and the end of the trading day. On close examination, the morning session has a higher variance (1.5573) as compared to afternoon session (0.6131). Nevertheless, the overnight break variance (0.1984) cannot be ignored because it is even higher than the lunch break variance (0.0075). The open-to-open variance (2.975) is about the same as the close-to-close (3.0058) variance but they are more volatile than the daily return variance (2.4299).

As to the distribution, no pattern is detected as the sign of the skewness reverses frequently and unpredictably throughout the day. Large and positive kurtosis indicates a relatively peaked distribution.

Figure 1(a) and 1(b) display the intraday mean returns and their volatility respectively for all the trading intervals under study for the COMPOSITE Index. The magnitudes of the variance follow a double U-shaped curve but with a large spike at the beginning of the trading (at 9.45 a.m. interval) and a smaller ripple observed at 3.30 p.m. This results in a larger U-shaped curve for the trading intervals between 9.30 a.m. to 3.30 p.m. and a smaller U-shaped curve from 3.30 p.m. to 5.00 p.m.

Fig. 1(a) Intraday 15-Minute COMPOSITE Index Returns

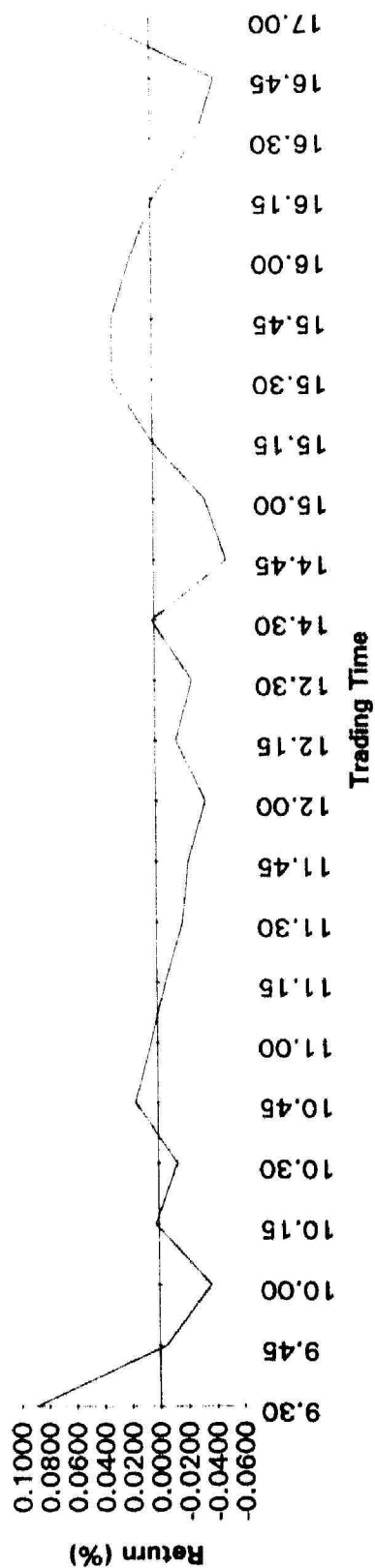
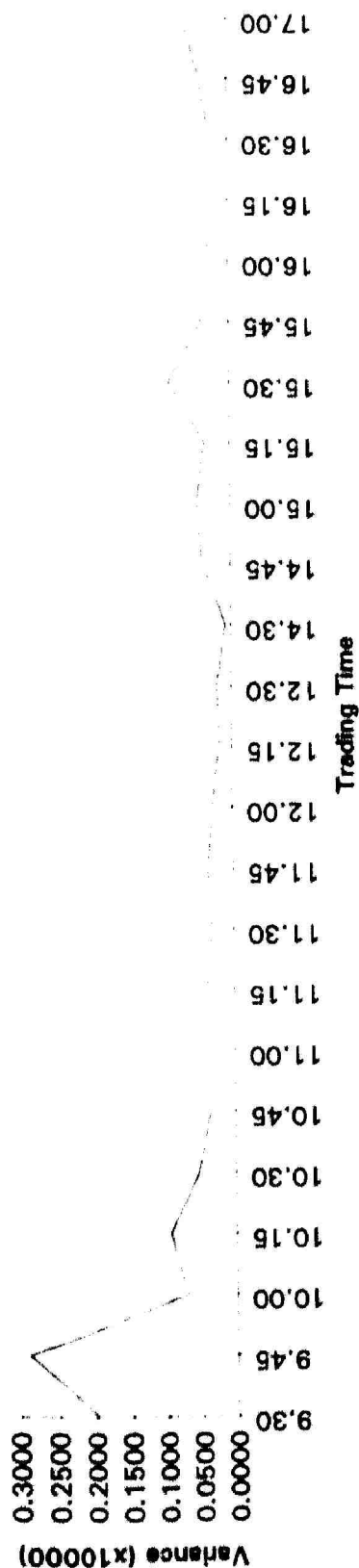


Fig. 1(b) Volatility Of The Intraday 15-Minute COMPOSITE Index Returns



4.1.2 Implication of the Results

The magnitudes of the mean returns suggest that no one is able to make an abnormal return based on intraday trading since they are far below the 2% transaction cost. Even if the traders adopt the strategy to buy at the lowest at 2.45 p.m. and sell at the last interval before the market close, the yield is only 0.0776% [0.0411%-(-0.0365%)].

The variance of the returns suggests a 2.5 times more in volatility in the morning session as compared to the afternoon session. Furthermore, it is more volatile during the beginning of trading and towards the end of trading, but the beginning volatility is 4.5 times greater than the ending volatility. It implies that the investor should demand a higher return in the morning as compared to afternoon for compensation of the higher risk that they face.

4.1.3 Consistency with other empirical evidence

These findings are not consistent with the findings in the United States and Taiwan markets but similar to the Hong Kong market where the variance follows a double U-shaped curve which reflects two active trading sessions with a lunch break in between. However, the COMPOSITE Index differs from the Hong Kong in the sense that the two U-shaped curves meet at 3.30 p.m. instead of at lunch break. The findings also contradict with the research done by Chagné, Kang and Rhee (1993) which conclude that the standard deviations of intraday

COMPOSITE Index returns shows roughly a U-shaped curve during the morning trading session with the afternoon session not following a similar pattern.

4.2 EMAS Index

4.2.1 Descriptive Statistics

Table 3 shows the descriptive statistics of EMAS Index returns by trading time. Negative returns are observed throughout the two trading sessions except some spikes in stock returns from 3.30 p.m. to 4.00 p.m. The day-end returns are large and positive, measuring at 0.0662%. It is observed that there is an even larger positive return during the non-trading overnight break (0.1453%). The morning, afternoon and the daily returns are negative, especially the magnitudes of the daily returns which stand at -0.2671%, out shadowing any positive returns that exist throughout the day. The open-to-open and close-to-close returns magnitudes are quite similar.

The variances of the trading intervals in between the day's beginning and closing show less variation as compared to the beginning and the end of the trading day. On close examination, the morning session has a higher variance (1.7504) as compared to afternoon session (0.8831). Nevertheless, the overnight break variance (0.2593) cannot be ignored because it is higher than the low lunch break variance of 0.0056.

Table 3 Descriptive Statistics For Intraday EMAS Index

TRADING TIME	AVERAGE RETURN (%)	VARIANCE (x10000)	SKEWNESS	KURTOSIS
Overnight	0.1453	0.2593	0.7469	9.4571
9.30 - 9.45 a.m.	0.0043	0.2573	-1.7268	15.6983
9.45 - 10.00 a.m.	-0.0370	0.0731	-0.5913	4.7753
10.00 - 10.15 a.m.	-0.0006	0.1044	0.3147	9.2997
10.15 - 10.30 a.m.	-0.0114	0.0582	0.5275	5.6182
10.30 - 10.45 a.m.	0.0186	0.0395	1.0076	4.2742
10.45 - 11.00 a.m.	0.0016	0.0442	0.5200	5.8804
11.00 - 11.15 a.m.	-0.0131	0.0418	1.1982	10.3065
11.15 - 11.30 a.m.	-0.0222	0.0366	0.5309	7.0182
11.30 - 11.45 a.m.	-0.0290	0.0365	-2.1647	19.3622
11.45 - 12.00 noon	-0.0416	0.0299	-2.5777	17.1410
12.00 - 12.15 p.m.	-0.0256	0.0174	0.2388	4.6513
12.15 - 12.30 p.m.	-0.0262	0.0208	-1.9944	13.1686
Lunch Break	0.0009	0.0056	-0.1581	3.7874
2.30 - 2.45 p.m.	-0.0589	0.0414	-2.8556	18.6369
2.45 - 3.00 p.m.	-0.0531	0.0485	-2.8539	25.5127
3.00 - 3.15 p.m.	-0.0057	0.0390	1.5489	6.3987
3.15 - 3.30 p.m.	0.0299	0.0881	6.4969	62.3694
3.30 - 3.45 p.m.	0.0322	0.0393	4.1876	31.7688
3.45 - 4.00 p.m.	0.0156	0.0306	-1.4547	24.6033
4.00 - 4.15 p.m.	-0.0079	0.0258	0.2698	3.1557
4.15 - 4.30 p.m.	-0.0406	0.0340	0.3191	3.2858
4.30 - 4.45 p.m.	-0.0634	0.0476	1.1860	14.9782
4.45 - 5.00 p.m.	0.0662	0.0802	-1.6214	14.9541
Morning Trading Session	-0.1824	1.7504	-0.7271	5.1418
Afternoon Trading Session	-0.0857	0.8831	0.1575	3.0912
Daily Trading Session	-0.2671	3.1535	-0.2900	4.1844
Previous Open - Today Open	-0.1127	3.9136	-0.1404	3.3251
Previous Close -Today Close	-0.1218	3.8680	0.1463	5.7967

As to the distribution, no pattern is detected as the sign of the skewness reverses frequently and unpredictably throughout the day. Large and positive kurtosis indicates a relatively peaked distribution.

Figure 2(a) and 2(b) display the intraday mean returns and volatility of the returns respectively for the overnight and lunch break and 22 trading intervals for the EMAS Index. The magnitudes of the variance follow a double U-shaped curve but with a large spike at the beginning of the trading and a smaller ripple observed at 3.30 p.m. This results in a larger U-shaped curve for the trading intervals between 9.30 a.m. to 3.30 p.m. and a smaller U-shaped curve from 3.30 p.m. to 5.00 p.m.

4.2.2 Implication of the Results

Again, the magnitudes of the mean strongly defy anyone a chance to make an abnormal return based on intraday buy-and-hold strategy. Even the intraday daily returns or the overnight trading strategy returns are still far below the 2% transaction cost. The variance suggests a 2 times more in volatility in the morning session as compared to the afternoon session. It is more volatile at the beginning and the end of the trading day, but the beginning volatility is 3.2 times greater than that of the end.

Fig. 2(a) Intraday 15-Minute EMAS Index Returns

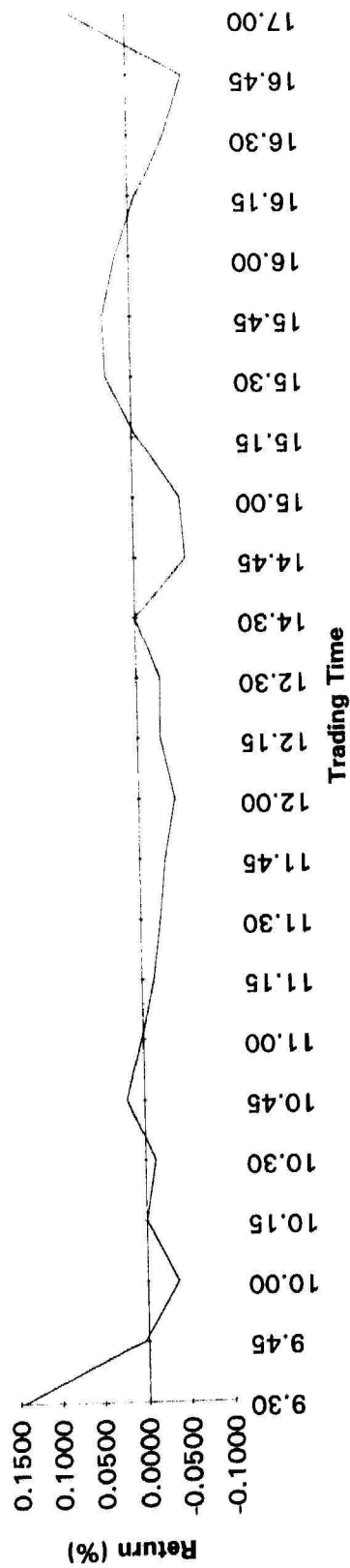
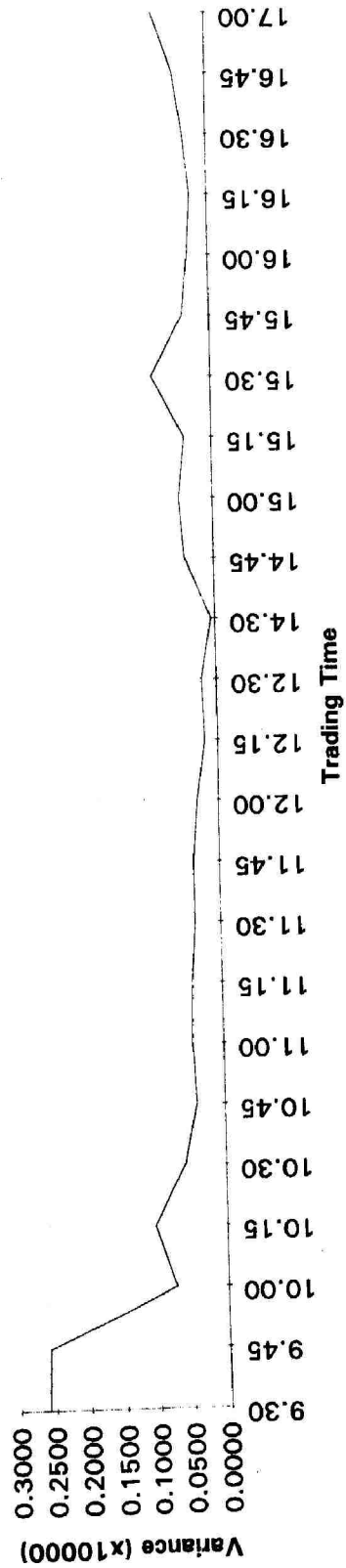


Fig. 2(b) Volatility Of The Intraday 15-Minute EMAS Index Returns



4.2.3 Consistency with COMPOSITE Index

The behavior of the EMAS Index is quite similar to the COMPOSITE Index returns. The EMAS Index returns variance exhibit the similar double U-shaped curve as the COMPOSITE Index.

4.3 SECONDBOARD Index

4.3.1 Descriptive Statistics

Table 4 shows the descriptive statistics of SECONDBOARD Index returns against trading time. Generally, negative returns are observed throughout the two trading sessions. It is very noticeable that the non-trading overnight break yields a large positive returns (0.1254%) but is less than the day end return of 0.1778%. On the other hand, afternoon and the morning returns are negative. The magnitude of the daily returns which stand at -0.2465%, is almost equal to the sum of the loss of the returns of the morning and afternoon sessions. In fact, the daily returns should be the sum of the morning session returns, lunch break returns and afternoon session returns, due to the low return of the lunch break (-0.0049%), the daily returns are contributed mostly by the morning session and afternoon sessions.

The variances of the trading intervals in between the day's beginning and closing show less variation as compared to the beginning and the end of the trading day. On close examination,

Table 4 Descriptive Statistics For Intraday SECONDBOARD Index

TRADING TIME	AVERAGE RETURN (%)	VARIANCE (x10000)	SKEWNESS	KURTOSIS
Overnight	0.1254	0.2158	1.5833	41.5879
9.30 - 9.45 a.m.	0.0453	0.1134	-5.8053	64.1963
9.45 - 10.00 a.m.	0.0313	0.0393	0.0980	2.8493
10.00 - 10.15 a.m.	-0.0064	0.0657	-0.1272	17.5732
10.15 - 10.30 a.m.	-0.0216	0.0436	-0.6313	5.9248
10.30 - 10.45 a.m.	0.0060	0.0290	0.1806	3.5944
10.45 - 11.00 a.m.	-0.0138	0.0245	-0.9978	5.2897
11.00 - 11.15 a.m.	-0.0264	0.0263	-0.9846	5.6325
11.15 - 11.30 a.m.	-0.0269	0.0244	-0.8750	4.7324
11.30 - 11.45 a.m.	-0.0465	0.0292	-3.3392	26.8756
11.45 - 12.00 noon	-0.0462	0.0288	-2.7376	17.3346
12.00 - 12.15 p.m.	-0.0344	0.0207	-0.4823	5.0619
12.15 - 12.30 p.m.	-0.0234	0.0220	-1.5866	11.2069
Lunch Break	-0.0049	0.0110	-2.7660	22.7001
2.30 - 2.45 p.m.	-0.0193	0.0261	-5.6209	50.2507
2.45 - 3.00 p.m.	-0.0380	0.0420	-3.7333	34.7685
3.00 - 3.15 p.m.	-0.0233	0.0372	0.9970	6.7328
3.15 - 3.30 p.m.	-0.0117	0.0839	7.2484	72.7339
3.30 - 3.45 p.m.	-0.0052	0.0381	4.2108	38.0349
3.45 - 4.00 p.m.	-0.0359	0.0247	-3.1841	27.6343
4.00 - 4.15 p.m.	-0.0257	0.0181	-0.3113	2.3628
4.15 - 4.30 p.m.	-0.0366	0.0261	-0.3715	3.4403
4.30 - 4.45 p.m.	-0.0609	0.0384	-0.1226	1.4759
4.45 - 5.00 p.m.	0.1778	0.2659	0.2966	33.5918
Morning Trading Session	-0.1629	1.4372	-1.1593	6.9797
Afternoon Trading Session	-0.0787	0.7560	0.4609	3.0860
Daily Trading Session	-0.2465	2.7419	-0.3700	5.6788
Previous Open - Today Open	-0.1149	3.1699	-0.1927	4.3700
Previous Close - Today Close	-0.1211	3.1001	-0.2562	5.6752

the morning session has a higher variance (1.4372) as compared to afternoon session (0.7560); but the daily variance is more than the sum of the two sessions variances. The overnight break variance (0.2158) is very much higher than the low lunch break variance of 0.0110. The closing interval variance (0.2659) is higher than market opening variance (0.2158). As of the open-to-open and close-to-close variances, no significant difference is being observed.

As to the distribution, the sign of the skewness reverses frequently and unpredictably throughout the day. Large and positive kurtosis indicates a relatively peaked distribution.

Figure 3(a) and 3(b) display the intraday mean and volatility of the returns respectively for the overnight and lunch break and 22 trading intervals for the SECONDBOARD Index. The magnitude of the variance follow a double U-shaped curve but with two moderate spikes at 10.15 a.m. and 3.30 p.m. This results in a larger U-shaped curve and a smaller U-shaped curve that meet at 3.30 p.m. As opposed to the COMPOSITE and the EMAS Indices, the SECONDBOARD Index mean returns only follow a U-shaped curve if we ignore the time it dips into the negative returns region.

4.3.2 Implication of the Results

"Firm's size effects" is a phenomenon where small-sized companies' stocks generally have higher returns than the large companies' stocks. The Second Board comprises of small-sized

Fig. 3(a) Intraday 15-Minute SECONDBOARD Index Returns

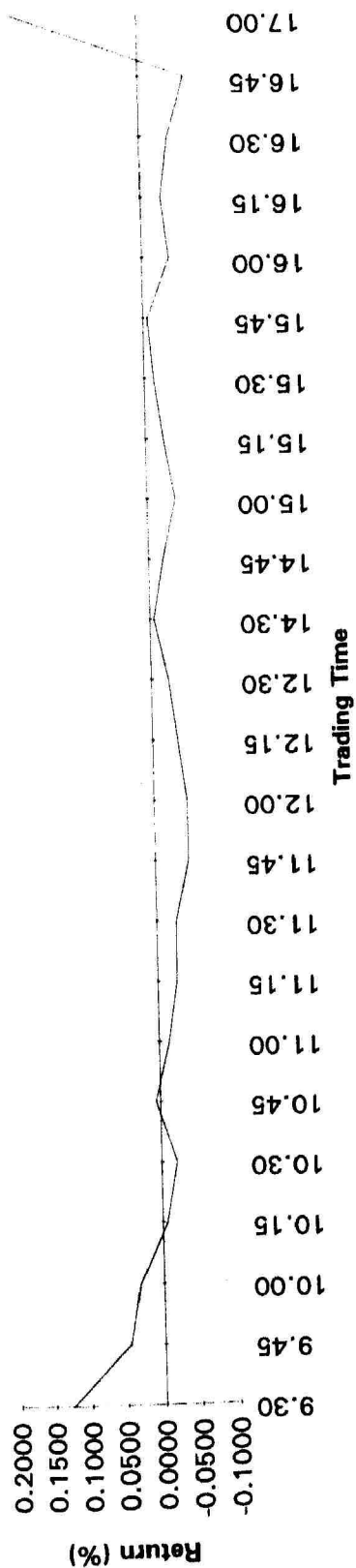
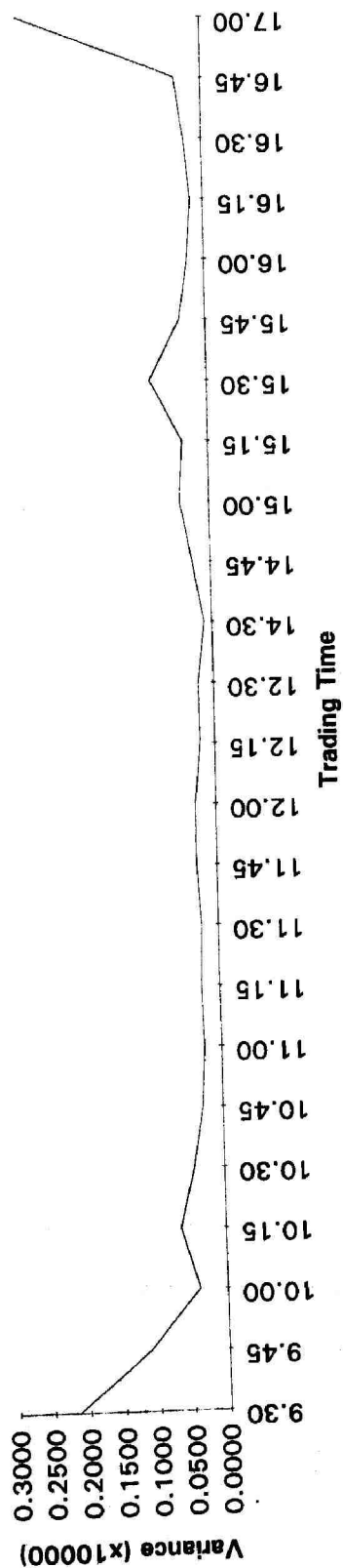


Fig. 3(b) Volatility Of The Intraday 15-Minute SECONDBOARD Index Returns



companies' stocks, but the magnitude of the mean returns does not show any superior returns than EMAS Index which consists of large sized companies' stocks. This implies that the intraday returns do not portray the "firm's size effects" peculiarity. Even if the traders choose to buy at the lowest at 4.45 p.m. interval and dispose the small companies stocks at the last interval before the market close, such a strategy only yields a return of 0.2387% $[0.1778\% - (-0.0609\%)]$, the return is insufficient to cover the 2% transaction cost. The magnitudes of the mean returns suggest that nobody is able to make an abnormal return based on intraday buy-and-hold strategy, in particular the small companies stocks.

The variance shows a 1.9 times more in volatility in the morning session as compared to the afternoon session. It is more volatile at the beginning and the end of the trading day, but the beginning volatility is 3.2 times greater than that of the end.

4.3.3 Consistency with COMPOSITE Index and EMAS Index

The behavior of the SECONDBOARD Index Intraday returns variance is quite similar to the COMPOSITE Index and EMAS INDEX, but the SECONDBOARD Index intraday returns exhibits only a U-shaped curve as opposed to double U-shaped curve for the COMPOSITE Index and EMAS Index. However, the SECONDBOARD Index only reflects the portfolio performance of the small-size firms, as such it is not so representative to use as benchmark for consistencies check with other research.

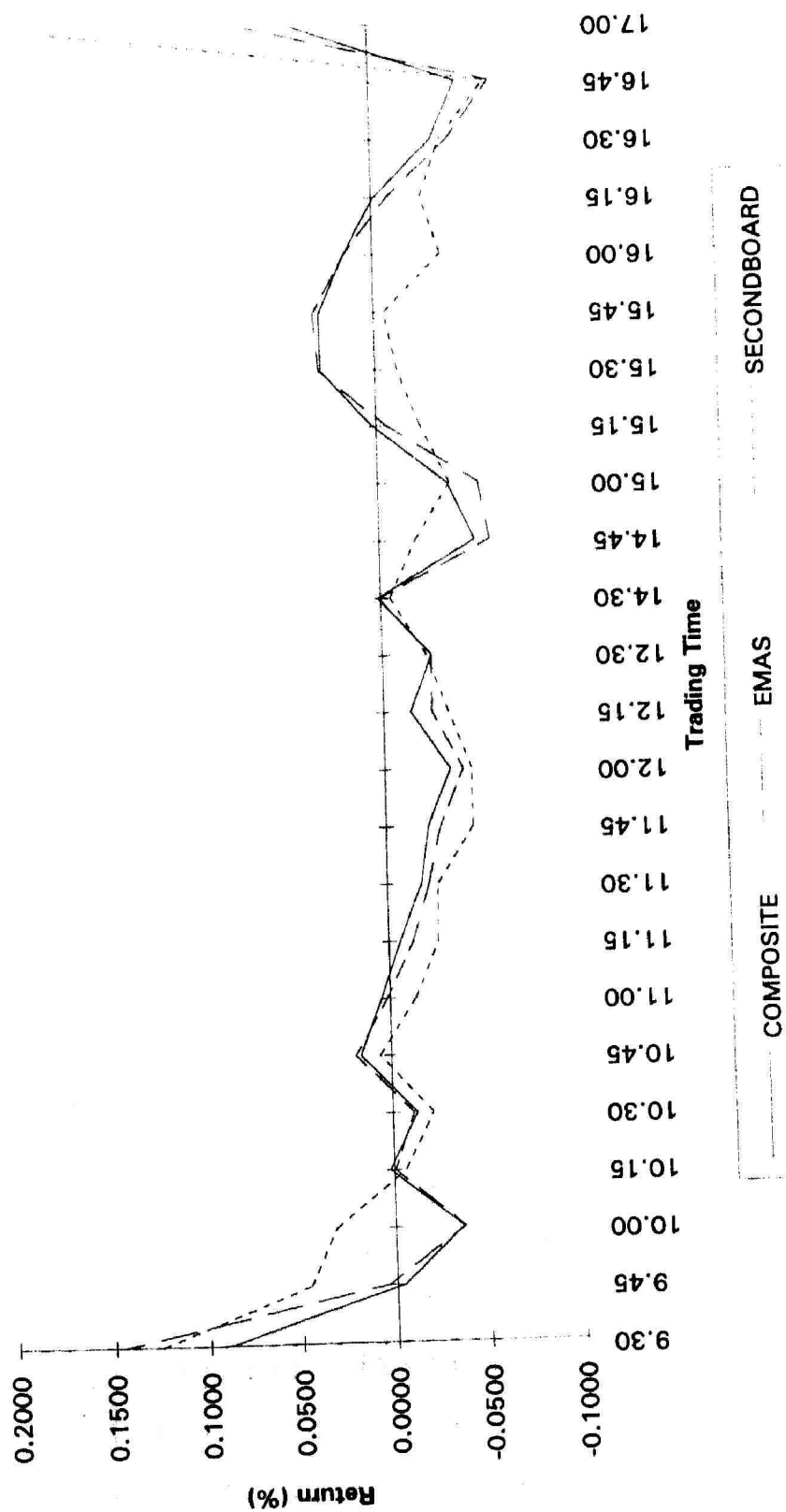
4.4 Overall Perspective

4.4.1 Indices Returns

Figure 4 puts together the returns of all the three indices. A few interesting phenomena can be observed from the figure, namely:

- i) We can see that all the three indices move in tandem or closely correlate with each other.
- ii) All the three indices produce the universal U-shaped curve characteristics, that is all the three indices have the highest returns both at the beginning and at the end of the trading day.
- iii) On the left hand side of the figure, the EMAS Index enjoys the highest overnight returns, followed by the SECONDBOARD Index and lastly the COMPOSITE Index.
- iv) The returns immediately decline after the opening where all the indices slip into the negative returns region throughout the trading time, maybe due to selling pressure.
- v) The SECONDBOARD Index performs poorer than the other two indices for most of the time. This could be due

Fig. 4 Intraday 15-Minute Indices Returns



to the thinness in the trading of the small companies stocks.

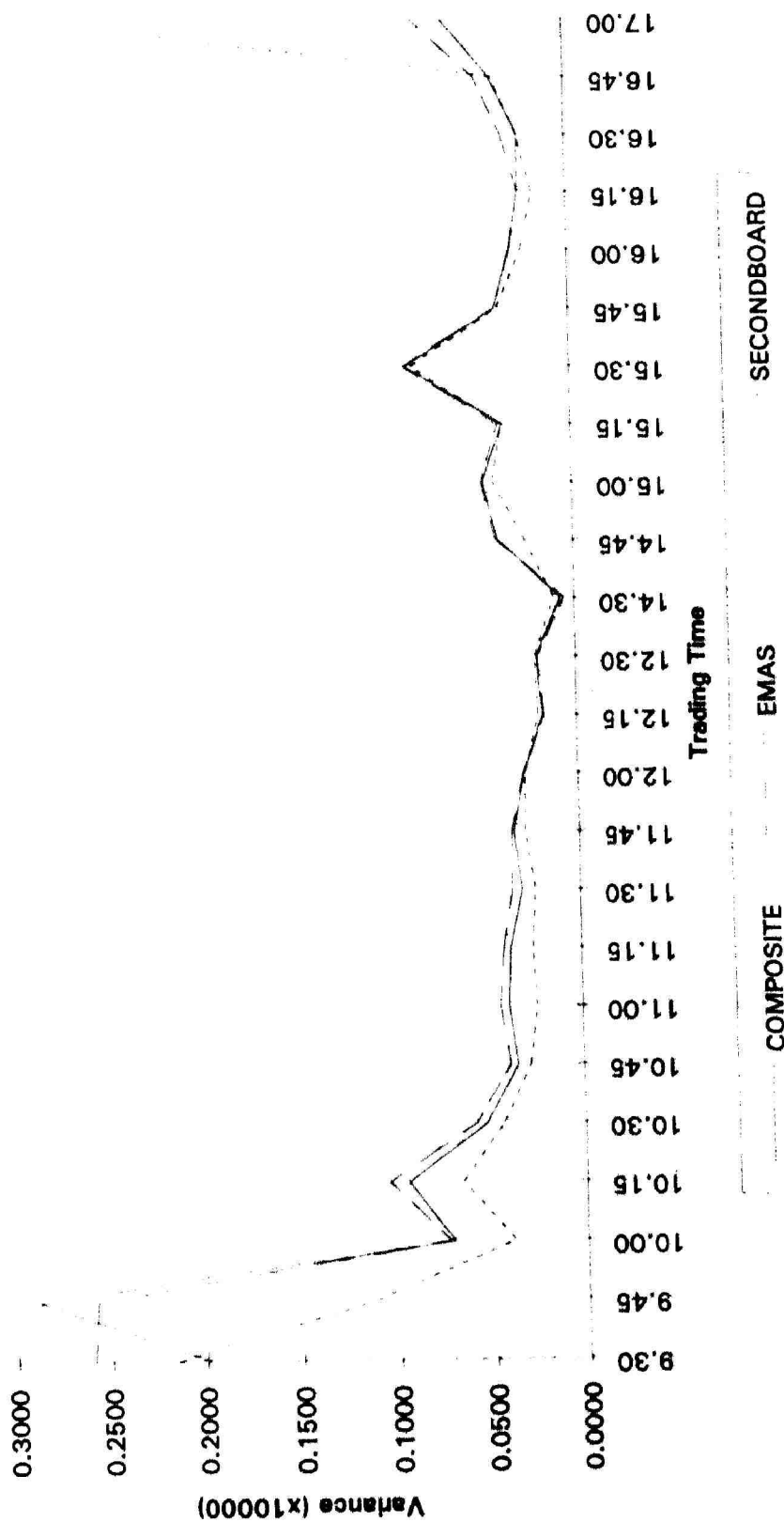
- vi) All the indices tend to converge to zero returns at the end of the lunch break.
- vii) The COMPOSITE Index and EMAS Index seem to follow each other closely. This behavior is not sufficient to refute the common belief that the COMPOSITE Index is very much influenced by the heavily weighted stocks such as Telekom and Tenaga.
- viii) At the end of the trading day, the SECONDBOARD Index tops the list in returns, the least returns are again attained by the COMPOSITE Index.

4.4.2 Volatility of Indices Returns

Figure 5 captures the dynamics of the indices' volatility. A few important observations are recorded as follows:

- i) We can see that the variances of all the three indices move in tandem or closely correlate with each other except at both the beginning and end of the trading day.
- ii) The variances of all the three indices produce the double U-shaped curve characteristics. All the three indices have the highest volatility both at the beginning and at the end of the trading day.

Fig. 5 Volatility Of The Intraday 15-Minute Indices Returns



- iii) On the left hand side of the figure, the COMPOSITE Index exhibits the highest volatility, followed by the EMAS index and lastly the SECONDBOARD Index.
- iv) The volatility of all the indices immediately subsides to a moderate level throughout the trading time. This may be due to the fact that the investors are more certain of the market's immediate direction or that the current corporate or world news is fully digested.
- v) The SECONDBOARD Index records less volatility than the other two indices for most of the time. This could be due to the thinness in the trading of the small companies stocks.
- vi) All the variances tend to converge at the beginning of the lunch break.
- vii) At the end of the trading day, the SECONDBOARD Index volatility suddenly surge upward to about 3.3 times that of the other indices.

4.5 ANOVA Tests

The results of the ANOVA Tests are tabulated in Table 5. The F-values, P-values and Critical F-values are presented together with their significance levels.

Table 5 Results Of Single-Factor Anova Test On Returns Variances Of Various Trading Intervals

INDEX/INTERVAL	F-value	P-value	F-Critical Value	Significance Level		
				0.1	0.05	0.01
COMPOSITE Index						
23 15-minute intervals	2.9340	0	1.8346			*
Overnight & Daily	7.878	0.0052	6.6865			*
Morning & Afternoon	1.2204	0.2698	2.7157			
Previous/Today Open & Close	0.0058	0.9391	2.7157			
EMAS Index						
23 15-minute intervals	5.4582	0	1.8346			*
Overnight & Daily	14.4585	0.0001	6.6865			*
Morning & Afternoon	2.5675	0.1097	2.7157			
Previous/Today Open & Close	0.0027	0.9588	2.7157			
SECONDBOARD Index						
23 15-minute intervals	11.9568	0	1.8347			*
Overnight & Daily	11.6013	0.0007	6.6865			*
Morning & Afternoon	0.8019	0.371	2.7157			
Previous/Today Open & Close	0.0015	0.9692	2.7157			

4.5.1 COMPOSITE Index

4.5.1.1 Twenty three 15-minute Interval Returns Variances

At the 0.01 significance level, with a P-value of 0 and critical F-value of 1.8346, the F-value of 2.934 clearly shows the significant differences in the twenty three 15-minute interval returns variances. Hence, the null hypothesis, H1 which states that the returns variances for the twenty three 15-minute intervals are equal, **is rejected.**

4.5.1.2 Overnight and Daily Intraday Returns Variances

At the 0.01 significance level, with a P-value of 0.0052 and critical F-value of 6.6865, the F-value of 7.878 clearly shows the significant differences between the overnight and daily intraday period returns variances. Hence, the null hypothesis, H2 which states that the returns variances between overnight and daily intraday period are equal, **is rejected.**

4.5.1.3 Morning and Afternoon Sessions Returns Variances

At the 0.1 significance level, with a P-value of 0.2698 and critical F-value of 2.7157, the F-value of 1.2204 clearly shows no significant differences between the morning session and afternoon session returns variances.

Hence, the null hypothesis, H3 which states that the returns variances between the morning session and afternoon session are equal, **is accepted**.

4.5.1.4 Previous Morning Open to Today Morning Open and Previous Evening Close to Today Evening Close Returns Variances

At the 0.1 significance level, with a P-value of 0.9391 and critical F-value of 2.7157, the F-value of 0.0058 clearly shows no significant differences between the open-to-open period and close-to-close period returns variances. Hence, the null hypothesis, H4 which states that the returns variances between the open-to-open and close-to-close periods are equal, **is accepted**.

4.5.2 EMAS Index

4.5.2.1 Twenty three 15-minute Interval Returns Variances

At the 0.01 significance level, with a P-value of 0 and critical F-value of 1.8346, the F-value of 5.4582 clearly shows the significant differences in the twenty three 15-minute interval returns variances. Hence, the null hypothesis, H1 which states that the returns variances for the twenty three 15-minute intervals are equal, **is rejected**.

4.5.2.2 Overnight and Daily Intraday Returns Variances

At the 0.01 significance level, with a P-value of 0.0001 and critical F-value of 6.6865, the F-value of 14.4585 clearly shows the significant differences between the overnight and daily intraday period returns variances. Hence, the null hypothesis, H2 which states that the returns variances between overnight and daily intraday period are equal, **is rejected**.

4.5.2.3 Morning and Afternoon Sessions Returns Variances

At the 0.1 significance level, with a P-value of 0.1097 and critical F-value of 2.7157, the F-value of 2.5675 clearly shows no significant differences between the morning session and afternoon session returns variances. Hence, the null hypothesis, H3 which states that the returns variances between the morning session and afternoon session are equal, **is accepted**.

4.5.2.4 Previous Morning Open to Today Morning Open and Previous Evening Close to Today Evening Close Returns Variances

At the 0.1 significance level, with a P-value of 0.9588 and critical F-value of 2.7157, the F-value of 0.0027 clearly shows no significant differences between the open-to-open period and close-to-close period returns variances. Hence, the null hypothesis, H4 which states that the

returns variances between the open-to-open and close-to-close periods are equal, **is accepted**.

4.5.3 SECONDBOARD Index

4.5.3.1 Twenty three 15-minute Interval Returns Variances

At the 0.01 significance level, with a P-value of 0 and critical F-value of 1.8346, the F-value of 11.9568 clearly shows the significant differences in the twenty three 15-minute interval returns variances. Hence, the null hypothesis, H1 which states that the returns variances for the twenty three 15-minute intervals are equal, **is rejected**.

4.5.3.2 Overnight and Daily Intraday Returns Variances

At the 0.01 significance level, with a P-value of 0.0007 and critical F-value of 6.6865, the F-value of 11.6013 clearly shows the significant differences between the overnight and daily intraday period returns variances. Hence, the null hypothesis, H2 which states that the returns variances between overnight and daily intraday period are equal, **is rejected**.

4.5.3.3 Morning and Afternoon Sessions Returns Variances

At the 0.1 significance level, with a P-value of 0.371 and critical F-value of 2.7157, the F-value of 0.8019 clearly

shows no significant differences between the morning session and afternoon session returns variances. Hence, the null hypothesis, H3 which states that the returns variances between the morning session and afternoon session are equal, **is accepted**.

4.5.3.4 Previous Morning Open to Today Morning Open and Previous Evening Close to Today Evening Close Returns Variances

At the 0.1 significance level, with a P-value of 0.9692 and critical F-value of 2.7157, the F-value of 0.0015 clearly shows no significant differences between the open-to-open period and close-to-close period returns variances. Hence, the null hypothesis, H4 which states that the returns variances between the open-to-open and close-to-close periods are equal, **is accepted**.

4.5.4 Returns of Various Indices

From the results shown in Section 4.4, it appears that all 3 indices portray similar behavior over all the trading intervals under study. A Single-factor ANOVA test was further conducted to test the various indices returns variances at every trading interval and session to reaffirm the above observation. The detailed results are tabulated in Table 6.

Table 6 Results Of Single-Factor Anova Test On Returns Variances Of Various Indices

TRADING TIME	COMPOSITE	EMAS	SECONDBOARD	F-value	P-value	F-Critical Value	Significance Level		
							0.1	0.05	0.01
9.30 - 9.45 a.m.	0.0896	0.1453	0.1254	0.7938	0.4525	4.6339			
9.45 - 10.00 a.m.	-0.0043	0.0043	0.0453	6.2266	0.0021	4.6339			*
10.00 - 10.15 a.m.	-0.0361	-0.0370	0.0313	0.0537	0.9477	4.6339			
10.15 - 10.30 a.m.	0.0022	-0.0006	-0.0064	0.1416	0.8680	4.6339			
10.30 - 10.45 a.m.	-0.0131	-0.0114	-0.0216	0.3145	0.7302	4.6339			
10.45 - 11.00 a.m.	0.0160	0.0186	0.0060	0.6782	0.5079	4.6339			
11.00 - 11.15 a.m.	0.0048	0.0016	-0.0138	0.7458	0.4747	4.6339			
11.15 - 11.30 a.m.	-0.0061	-0.0131	-0.0264	0.1568	0.8549	4.6339			
11.30 - 11.45 a.m.	-0.0181	-0.0222	-0.0269	1.1464	0.3183	4.6339			
11.45 - 12.00 noon	-0.0223	-0.0290	-0.0465	0.2811	0.7550	4.6339			
12.00 - 12.15 p.m.	-0.0347	-0.0416	-0.0462	1.3036	0.2722	4.6339			
12.15 - 12.30 p.m.	-0.0145	-0.0256	-0.0344	0.0293	0.9711	4.6339			
Lunch Break	-0.0260	-0.0262	-0.0234	0.4114	0.6629	4.6339			
2.30 - 2.45 p.m.	0.0019	0.0009	-0.0049	3.0256	0.0491	4.6339			
2.45 - 3.00 p.m.	-0.0508	-0.0589	-0.0193	0.4582	0.6326	4.6339			
3.00 - 3.15 p.m.	-0.0365	-0.0531	-0.0380	1.0927	0.3359	4.6339			
3.15 - 3.30 p.m.	0.0017	-0.0057	-0.0233	1.6158	0.1994	4.6339			
3.30 - 3.45 p.m.	0.0289	0.0299	-0.0117	2.7467	0.0648	4.6339			*
3.45 - 4.00 p.m.	0.0292	0.0322	-0.0052	7.6374	0.0005	4.6339			
4.00 - 4.15 p.m.	0.0156	0.0156	-0.0359	1.7302	0.1780	4.6339			
4.15 - 4.30 p.m.	-0.0010	-0.0079	-0.0257	0.1644	0.8485	4.6339			
4.30 - 4.45 p.m.	-0.0319	-0.0406	-0.0366	0.5729	0.5642	4.6339			*
4.45 - 5.00 p.m.	-0.0453	-0.0634	-0.0609	9.6070	0.0001	4.6339			
Overnight	0.0411	0.0662	0.1778	0.8822	0.4143	4.6339			
Morning Trading Session	-0.1523	-0.1824	-0.1629	0.1658	0.8472	4.6339			
Afternoon Trading Session	-0.0490	-0.0857	-0.0787	0.0364	0.9642	4.6339			
Daily Trading Session	-0.1994	-0.2671	-0.2465	0.1257	0.8819	4.6339			
Previous Open - Today Open	-0.0980	-0.1127	-0.1149	0.0063	0.9938	4.6339			
Previous Close - Today Close	-0.1098	-0.1218	-0.1211	0.0034	0.9966	4.6339			

From the table, it can be seen that there are only 3 intervals where there are significant differences in returns variances for the different indices, namely:

- i) 9.45 a.m. - 10.00 a.m. interval
- ii) 3.45 p.m. - 4.00 p.m. interval
- iii) 4.45 p.m. - 5.00 p.m. interval

Hence, we may conclude that the 3 different indices yield the same returns for most of the time.

4.6 Correlations Tests

The results of the correlations test are presented in Table 7.

4.6.1 COMPOSITE Index

4.6.1.1 Overnight break and Morning Correlation Coefficient

From the table, it can be seen that the correlation coefficient between the overnight break and the morning session is 0.3538. Since the correlation coefficient is positive, the null hypothesis, H_0 which states that the correlation between the returns from the overnight break and the returns from the morning session is negative, is **rejected**.

Table 7 Correlations Of Intraday Returns For Various Trading Intervals

		Overnight	Morning	Lunch Break
COMPOSITE Index	Morning	0.3538	-	-
	Lunch Break	0.04566	0.3387	-
	Afternoon	-0.02535	0.6827	0.0375
EMAS Index				
	Morning	Overnight	Morning	Lunch Break
		0.0372	-	-
SECONDBOARD Index	Lunch Break	0.1179	0.3732	-
	Afternoon	-0.0613	0.1502	0.045
SECONDBOARD Index				
	Morning	Overnight	Morning	Lunch Break
		0.1449	-	-
SECONDBOARD Index	Lunch Break	-0.0427	0.4039	-
	Afternoon	0.0044	0.2057	0.0937

4.6.1.2 Morning and Lunch Break Correlation Coefficient

It can be seen that the correlation coefficient between the morning session and the lunch break is 0.3387. Since the correlation coefficient is positive, the null hypothesis, H6 which states that the correlation between the returns from the morning session and the lunch break is negative, **is rejected**.

4.6.1.3 Lunch Break and Afternoon Correlation Coefficient

It can be seen that the correlation coefficient between the lunch break and the afternoon session is 0.0375. Since the correlation coefficient is positive, the null hypothesis, H7 which states that the correlation between the returns from the lunch break and the afternoon session is negative, **is rejected**.

4.6.2 EMAS Index

4.6.2.1 Overnight break and Morning Correlation Coefficient

From the table, it can be seen that the correlation coefficient between the overnight break and the morning session is 0.0372. Since the correlation coefficient is positive, the null hypothesis, H5 which states that the correlation between the returns from the overnight break and the returns from the morning session is negative, **is rejected**.

4.6.2.2 Morning and Lunch Break Correlation Coefficient

It can be seen that the correlation coefficient between the morning session and the lunch break is 0.3732. Since the correlation coefficient is positive, the null hypothesis, H6 which states that the correlation between the returns from the morning session and the lunch break is negative, **is rejected**.

4.6.2.3 Lunch Break and Afternoon Correlation Coefficient

It can be seen that the correlation coefficient between the lunch break and the afternoon session is 0.045. Since the correlation coefficient is positive, the null hypothesis, H7 which states that the correlation between the returns from the lunch break and the afternoon session is negative, **is rejected**.

4.6.3 SECONDBOARD Index

4.6.3.1 Overnight break and Morning Correlation Coefficient

From the table, it can be seen that the correlation coefficient between the overnight break and the morning session is 0.1149. Since the correlation coefficient is positive, the null hypothesis H5 which states that the correlation between the returns from the overnight break

and the returns from the morning session is negative, **is rejected**.

4.6.3.2 Morning and Lunch Break Correlation Coefficient

It can be seen that the correlation coefficient between the morning session and the lunch break is 0.4039. Since the correlation coefficient is positive, the null hypothesis, H6 which states that the correlation between the returns from the morning session and the lunch break is negative, **is rejected**.

4.6.3.3 Lunch Break and Afternoon Correlation Coefficient

It can be seen that the correlation coefficient between the lunch break and the afternoon session is 0.0937. Since the correlation coefficient is positive, the null hypothesis, H7 which states that the correlation between the returns from the lunch break and the afternoon session is negative, **is rejected**.

4.6.4 Implication of the Results

The small-sized firms generally show more significant negative correlations than the large firms which have larger trading volume. This implies that the smaller firms are expected to have more price reversals. In the case of the SECONDBOARD Index, no particular behavior pattern is detected in support of this hypothesis.