CHAPTER THREE

ANALYSIS
&
DISCUSSION OF
RESULTS

CHAPTER 3

ANALYSIS AND DISCUSSION OF RESULTS

3.1   INTRODUCTION

In this chapter, the results of the tests are discussed after numerous tests were carried out using various computer packages. The analysis of this study is divided into two stages. In the first stage, each stock is tested using different trading techniques. The details of the portfolio returns are attached in Appendix III.

In constructing portfolio returns under each technique, equally weighted method is applied. Under this method, each counter carries equal weight regardless of the price or market value. The portfolio returns are based on the arithmetic average of the percentage changes in the value of the stocks. The counters are further classified according to listing boards and sectors. Under the listing boards classification, 50 counters are divided into Main Board and Second Board. There is one exceptional case, where Lityan, a counter that is listed in the Main Board is classified under the Second Board, as it was promoted to the Main Board during the period of study, and it has longer time in Second Board. The details of the counter classification are attached in Appendix I.

Under the sector classification, 44 counters are classified under 6 sectors, i.e. Industrial Products, Consumer Products, Trading and Services, Finance, Properties and

Construction. Due to the insignificant sample size, the remaining 6 counters that do not fall into these sectors are classified under "others", which would be ignored when the analysis required sector classification.

In order to evaluate the profitability of the technical indicators in the actual trading environment, 1% transaction cost will be included as trading charges based on the entry and exit prices. Interest earned during the out period will be added into the returns for each counter. Out period is defined as a period after closing a long position but before entering a new position.

After obtaining portfolio returns, further tests will be carried out by using statistical methods, chi-square test and ANOVA. ANOVA is used to analyse the differences in portfolio returns by applying different trading signals under each method. If the ANOVA indicates that the returns are significantly different within different trading signals, Tukey test will be carried out to discover the differences within each trading signal. The results of the ANOVA, however, only reveal the situation for a diversified portfolio. This may not be the case for an individual stock investment. Under this situation, chi-square test, which is based on the number of counts, will give a better indication. Chi-square test compares the total number of counts that registered highest returns among the different signals for each counter with the expected number of counts. Due to the small sample size, the chi-square test will be purely based on the trading signals and no further classification is applied.

3.2 COMPARISON OF TRADING SIGNALS

In the first stage of analysis, portfolio returns are computed by using different trading signals under four trading methods. There are four trading signals tested under Simple Moving Average (SMA), three under Moving Average Convergence/Divergence (MACD), four under Relative Strength Index (RSI) and four under Stochastics Oscillator (STOC).

3.2.1 SIMPLE MOVING AVERAGE

Four trading signals are tested under SMA. They are 9-SMA, 21-SMA, 60-SMA and 200-SMA. Table 3.1 (a) shows the average returns, as well as the standard deviation of the returns, after taking into consideration the listing boards while Table 3.1 (b) reveals the descriptive statistics when the counters are categorised by sectors.

Table 3.1 (a) reveals that when the counters are categorised according to the listing boards, 60-SMA generates the highest average return for the Main Board counters, while 21-SMA generates the highest average return for the Second Board counters. Table 3.1 (b) shows that 60-SMA is the best trading signal for all sectors, except for the Trading/Services and Construction sectors where the best trading signal is 200-SMA and 21-SMA, respectively. Overall, 60-SMA generates the highest portfolio return, compared to the 9-SMA, 21-SMA and 200-SMA.

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Table 3.1 (a): SMA Returns According To The Listing Board

		9-SMA	21-SMA	60-SMA	200-SMA
Main Board	Average Return	-0.5790	-0.0798	0.3727	0.1829
	Standard Deviation	0.5153	1.2407	1.1883	1.1367
Second Board	Average Return	0.1221	2.2876	1.1908	0.0937
	Standard Deviation	1.5447	3.1083	1.6251	0.6241
Total	Average Return	-0.3827	0.5831	0.6017	0.1579
	Standard Deviation	0.9612	2.1945	1.3590	1.0139

Table 3.1 (b): SMA Returns According To The Sector

		9-SMA	21-SMA	60-SMA	200-SMA
Construction	Average Return	1.1536	3.1438	-0.0807	-0.1473
	Standard Deviation	3.4399	6.3674	0.6667	0.6172
Consumer Products	Average Return	-0.6318	0.3920	0.7655	0.0400
	Standard Deviation	0.5074	1.9523	2.0391	0.7059
Finance	Average Return	-0.2391	0.4969	1.1506	0.9912
	Standard Deviation	0.7451	2.0254	1.1199	1.7733
Industrial Products	Average Return	-0.5142	0.6351	0.6326	-0.0044
	Standard Deviation	0.4622	1.9327	0.8444	0.5768
Properties	Average Return	-0.5488	-0.0886	-0.0178	-0.1663
	Standard Deviation	0.3336	0.6504	0.5885	0.5109
Trading/ Services	Average Return	-0.5965	-0.0287	0.0357	0.0760
	Standard Deviation	0.4811	1.0481	0.6035	0.7124
Total	Average Return	-0.3790	0.5112	0.5286	0.2127
	Standard Deviation	0.9979	2.2094	1.1864	1.0587

Analysis of variance is carried out to further analyse the differences. Table 3.2 (a) reveals the result of ANOVA for SMA after considering the trading signals and listing boards as the main effects while 3.2 (b) shows the result when the sectors and trading signals are considered as the main effects.

Table 3.2 (a) and 3.2 (b) reveal that portfolio returns are significantly different when applying different trading signals under Simple Moving Average. In addition, Table 3.2 (a) reveals that the effect of listing board and interaction between trading signals and listing boards are also significant at $\alpha = 0.01$. The significance in the interaction term indicates that different trading signals generate different level of returns for Main Board and Second Board counters.

Table 3.2 (a): ANOVA for SMA with Signal and Listing Board as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	32.1517	3	10.7172	5.8155**
Listing Board	36.3386	1	36.3386	19.7185**
Interaction	31.9377	3	10.6459	5.7768**
Error	353.8308	192	1.8429	-
Total	454.2589	199		

Note:
** Significant at $\alpha = 0.01$

Table 3.2 (b): ANOVA for SMA with Signal and Sector as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	23.7117	3	7.9039	3.8747*
Sector	21.8646	5	4.3729	2.1437
Interaction	29.5271	15	1.9685	0.9650
Error	310.0627	152	2.0399	-
Total	385.1661	175		

Note:
* Significant at $\alpha = 0.05$

Since the ANOVA shows that the portfolio returns are different, further test is necessary to analyze the differences in portfolio returns. Table 3.3 reveals the result of Tukey test.

Table 3.3 reveals that portfolio returns obtained by using 21-SMA and 60-SMA significantly outperformed the portfolio return obtained by using the 9-SMA. Meanwhile, 21-SMA, 60-SMA and 200-SMA are not statistically different among one another.

Table 3.3: Tukey Test for Simple Moving Average

Signal (I)	Signal (J)	Mean Difference (I-J)	p-value
9 SMA	21 SMA	-0.9658	0.0021
	60 SMA	-0.9844	0.0016
	200 SMA	-0.5406	0.1912
21 SMA	60 SMA	-0.0187	0.9999
	200 SMA	0.4252	0.3982
60 SMA	200 SMA	0.4438	0.3591

The chi-square test, which is significant at $\alpha = 0.01$ indicates that the number of counts that produce highest return under each trading signal is significantly different. From Table 3.4, it is clear that the number of counts that produce highest returns under 60-SMA is higher than its expected number of counts.

Table 3.4: Chi-Square Test for Different Signals Under SMA

Trading Signal	9 SMA	21 SMA	60 SMA	200 SMA
Actual Count	1	10	24	15
Expected Count	12.5	12.5	12.5	12.5

$\chi^2 = 22.1546$

3.2.2   MOVING AVERAGE CONVERGENCE/DIVERGENCE

There are three trading signals tested under MACD. They are 9-MACD, 12-MACD and 26-MACD. Table 3.5 (a) shows the average returns and standard deviation of the returns, after taking into consideration the listing board. Table 3.5 (b) reveals the average returns and standard deviation when the counters are categorised by sectors.

Table 3.5 (a) reveals that when the counters are categorised according to the listing boards, 26-MACD generates the highest average return for the Main Board counters, while 12-MACD generates the highest average return for the Second Board counters. Table 3.5 (b) shows that 26-MACD is the best trading signal for all sectors, except for the Industrial Products and Constructions sectors. Overall, 12-MACD generates highest portfolio return, compared to the 9-MACD and 26-MACD.

Table 3.5 (a): MACD Returns According To The Listing Board

		9 MACD	12 MACD	26 MACD
Main Board	Average Return	-0.6402	-0.3969	-0.2059
	Standard Deviation	0.3164	0.4599	0.6071
Second Board	Average Return	-0.7430	2.7892	1.4026
	Standard Deviation	0.5044	5.1232	2.2863
Total	Average Return	-0.6690	0.4952	0.2445
	Standard Deviation	0.3757	3.0336	1.4772

Table 3.5 (b): MACD Returns According To The Sector

		9 MACD	12 MACD	26 MACD
Construction	Average Return	-0.8781	4.0642	2.1710
	Standard Deviation	0.0978	7.8891	4.2167
Consumer Product	Average Return	-0.7175	-0.0803	0.0607
	Standard Deviation	0.2181	0.7822	0.8772
Finance	Average Return	-0.4659	-0.3752	-0.3011
	Standard Deviation	-0.4659	-0.3752	-0.3011
Industrial Product	Average Return	-0.6004	1.7387	0.5255
	Standard Deviation	0.6004	5.3854	1.5839
Properties	Average Return	-0.8412	-0.4765	-0.4091
	Standard Deviation	0.1072	0.4730	0.4716
Trading/Services	Average Return	-0.6260	-0.0978	-0.0253
	Standard Deviation	0.3181	0.8044	0.6798
Total	Average Return	-0.6475	0.4501	0.1377
	Standard Deviation	0.3920	3.1972	1.3992

The analysis of variance results presented in Table 3.6 (a) reveal that portfolio returns are affected by trading signals applied under MACD and the listing boards. In addition, the interaction between trading signals and listing boards is also significant at $\alpha = 0.01$. Meanwhile, Table 3.6 (b) shows that the portfolio returns are affected by trading signals used and the sector, which are significant at $\alpha = 0.05$. The interaction between trading signals and sectors, however, is not significant.

Table 3.6 (a): ANOVA for MACD with Signal and Listing Board as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	37.5474	2	18.7737	6.1966**
Board	73.9613	1	73.9613	24.4123**
Interaction	54.5444	2	27.2722	9.0017**
Error	436.2730	144	3.0297	-
Total	602.3261	149		

Note:

** Significant at $\alpha = 0.01$

Table 3.6 (b): ANOVA for MACD with Signal and Sector as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	28.1463	2	14.0731	3.6373*
Sector	50.2074	5	10.0415	2.5953*
Interaction	39.0499	10	3.9050	1.0093
Error	441.0752	114	3.8691	-
Total	558.4787	131		

Note:

* Significant at $\alpha = 0.05$

The Tukey test needs to be done since the results of ANOVA show that the different trading signals generate different levels of returns. Table 3.7 reveals the result of Tukey test.

Table 3.7 reveals that the portfolio returns obtained by using 12-MACD and 26-MACD significantly outperformed the portfolio returns obtained by applying 9-MACD. The portfolio returns under 9-MACD and 26-MACD are not statistically different.

Table 3.7: Tukey Test for Moving Average Convergence/Divergence

Trading Signal (I)	Trading Signal (J)	Mean Difference (I-J)	p-value
9-MACD	12-MACD	-1.1643	0.0024
	26-MACD	-0.9135	0.0236
12-MACD	26-MACD	0.2507	0.7515

The chi-square test indicates that the number of counts that produce highest return under each trading signal is significantly different at $\alpha = 0.01$. From Table 3.8, it is clear that the number of counts that generate highest return under 26-MACD is relatively higher compared to 9-MACD and 12-MACD.

Table 3.8: Chi-Square Test for Different Signals Under MACD

Trading Signal	9 MACD	12 MACD	26 MACD
Actual	6	18	26
Expected	16.6667	16.6667	16.6667

$\chi^2 = 12.1600$

3.2.3   RELATIVE STRENGTH INDEX

Four trading signals are tested under RSI by combining four different oversold and overbought regions. They are RSI-20/70, RSI-20/80, RSI-30/70 and RSI-30/80. Table 3.9 (a) shows the average returns and standard deviation of the return after taking into consideration the listing board classification while Table 3.9 (b) reveals the results when the counters are categorised by sectors.

Table 3.9 (a) reveals that when the counters are categorised according to the listing boards, RSI-30/80 generates the highest average return for the Main Board counters, while RSI-20/70 generates the highest average return for the Second Board counters. Table 3.9 (b) shows that RSI-30/80 is the best trading signal for most of the sectors, except for Properties and Trading/Services, which performed best under RSI-20/70. Overall, RSI-20/70 is the best trading signal, compared to the other trading signals under RSI.

Table 3.9 (a): RSI Returns According To The Listing Board

		RSI-20/70	RSI-20/80	RSI-30/70	RSI-30/80
Main Board	Average Return	-0.2394	-0.2556	-0.4837	-0.1881
	Standard Deviation	0.3780	0.5164	0.2982	0.6344
Second Board	Average Return	-0.2387	-0.4264	-0.5048	-0.4261
	Standard Deviation	0.4961	0.5048	0.2913	0.6053
Total	Average Return	-0.2392	-0.3034	-0.4896	-0.2547
	Standard Deviation	0.4091	0.5139	0.2934	0.6296

Table 3.9 (b): RSI Returns According To The Sector

		RSI-20/70	RSI-20/80	RSI-30/70	RSI-30/80
Construction	Average Return	-0.5754	-0.6489	-0.5856	-0.1127
	Standard Deviation	0.3367	0.3555	0.4022	1.1841
Consumer Products	Average Return	-0.0963	-0.1812	-0.2313	0.0042
	Standard Deviation	0.3635	0.4689	0.2877	0.7006
Finance	Average Return	-0.2176	-0.1197	-0.5009	-0.0547
	Standard Deviation	0.3776	0.6999	0.2207	0.6475
Industrial Products	Average Return	-0.2631	-0.3603	-0.5596	-0.5396
	Standard Deviation	0.3665	0.5036	0.2455	0.1353
Properties	Average Return	-0.4114	-0.5370	-0.6545	-0.3140
	Standard Deviation	0.3325	0.2628	0.2774	1.0121
Trading/ Services	Average Return	-0.1601	-0.3313	-0.4898	-0.4365
	Standard Deviation	0.5314	0.3840	0.2708	0.4080
Total	Average Return	-0.2452	-0.3116	-0.4886	-0.2519
	Standard Deviation	0.3970	0.5007	0.2850	0.6552

Tables 3.10 (a) and 3.10 (b) reveal the result of analysis of variance, by applying different trading signals under RSI, after categorising according to listing boards and sectors. Table 3.10 (a) reveals that the portfolio returns obtained by using different trading signals are significantly different. Table 3.10 (b) shows that there is no strong evidence of a difference among trading signals applied after classifying the counters according to the sector.

Table 3.10 (a): ANOVA for RSI with Signal and Listing Board as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	1.9917	3	0.6639	2.9029[*]
Board	0.4641	1	0.4641	2.0294
Interaction	0.4053	3	0.1351	0.5907
Error	43.9110	192	0.2287	-
Total	46.7721	199		

Note:

* Significant at $\alpha = 0.05$

Table 3.10 (b): ANOVA for RSI with Signal and Sector as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	1.7004	3	0.5668	2.4747
Sector	2.9710	5	0.5942	2.5943[*]
Interaction	1.7250	15	0.1150	0.5021
Error	34.8135	152	0.2290	-
Total	41.2099	175		

Note:

* Significant at $\alpha = 0.05$

Table 3.11 reveals the result of Tukey test for RSI. The result indicates that the portfolio return obtained by using the RSI-20/70 significantly outperformed the portfolio return obtained by using the RSI-30/70. The other portfolio returns obtained by using other trading signals are not significantly different.

Table 3.11: Tukey Test for Relative Strength Index

Trading Signal (I)	Trading Signal (J)	Mean Difference (I-J)	p-value
RSI 20/70	RSI 20/80	0.0642	0.9080
	RSI 30/70	0.2505	0.0438
	RSI 30/80	0.0155	0.9985
RSI 20/80	RSI 30/70	0.1863	0.2083
	RSI 30/80	-0.0487	0.9571
RSI 30/70	RSI 30/80	-0.2349	0.0670

The result of the chi-square test indicates that the number of counters that produce highest return under each trading signals are not statistically different.

Table 3.12: Chi-Square Test for Different Signals Under RSI

Trading Signal	RSI 20/70	RSI 20/80	RSI 30/70	RSI 30/80
Actual	17	12	5	16
Expected	12.5	12.5	12.5	12.5

$\chi^2 = 7.1200$

3.2.4 STOCHASTICS OSCILLATOR

Stochastics Oscillator is a technical indicator that is based on oversold and overbought regions. Under STOC, there are four oversold/overbought combinations. They are STOC-20/70, STOC-20/80, STOC-30/70 and STOC-30/80.

Table 3.13 (a) reveals the average returns and standard deviation of return when the counters are categorised according to the listing boards while Table 3.13 (b) reveals the results when the counters are classified according to the sectors.

Table 3.13 (a) reveals that STOC-20/80 generates highest return for Main Board counters while STOC-30/70 generates the highest return for the Second Board counters. After the sectoral classification, STOC-20/80 generates the highest return for Construction, Industrial Products and Properties sectors. Meanwhile, STOC-20/70 generates the highest return for Finance and Trading/Services sectors. The other trading signal, STOC-30/70 generates highest return for consumer sector. Overall, STOC-20/80 generates highest portfolio return, compared with the portfolio returns obtained by using STOC-20/70, STOC-30/70 and STOC-30/80.

Table 3.13 (a): STOC Returns According To The Listing Board

		STOC-20/70	STOC-20/80	STOC-30/70	STOC-30/80
Main Board	Average Return	-0.6384	-0.6082	-0.6734	-0.6388
	Standard Deviation	0.3204	0.3050	0.2755	0.2408
Second Board	Average Return	-0.7331	-0.7777	-0.4381	-0.7508
	Standard Deviation	0.1538	0.1731	0.7691	0.1921
Total	Average Return	-0.6649	-0.6557	-0.6075	-0.6702
	Standard Deviation	0.2854	0.2834	0.4717	0.2319

Table 3.13 (b): STOC Returns According To The Sector

		STOC-20/70	STOC-20/80	STOC-30/70	STOC-30/80
Construction	Average Return	-0.8137	-0.8161	0.2028	-0.6295
	Standard Deviation	0.1536	0.1132	1.6001	0.2839
Consumer Products	Average Return	-0.6264	-0.5612	-0.6619	-0.5716
	Standard Deviation	0.1255	0.1903	0.1108	0.2034
Finance	Average Return	-0.4128	-0.4309	-0.5217	-0.4974
	Standard Deviation	0.4930	0.4334	0.4430	0.3259
Industrial Products	Average Return	-0.7104	-0.7495	-0.6253	-0.7391
	Standard Deviation	0.1733	0.2170	0.3012	0.1797
Properties	Average Return	-0.7860	-0.7744	-0.7475	-0.7891
	Standard Deviation	0.1476	0.1972	0.2066	0.1579
Trading/ Services	Average Return	-0.7529	-0.7629	-0.7634	-0.7734
	Standard Deviation	0.1722	0.1902	0.0873	0.1272
Total	Average Return	-0.6526	-0.6532	-0.5937	-0.6593
	Standard Deviation	0.2964	0.2935	0.4903	0.2407

Table 3.14 (a) and Table 3.14 (b) reveal that the portfolio returns generated by different trading signals are not statistically different. In addition, Table 3.14 (a) shows that the interaction between listing boards and trading signals is significant at α = 0.05. Table 3.14 (b), which takes into consideration trading signals and sectors,

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reveals that the sector is significant at $\alpha = 0.01$, indicating there is a significant difference in returns among different sectors by applying STOC.

Table 3.14 (a): ANOVA for STOC with Signal and Listing Board as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	0.123	3	0.0411	0.3867
Board	0.050	1	0.0500	0.4702
Interaction	1.014	3	0.3381	3.1822*
Error	20.400	192	0.1062	-
Total	21.587	199		

Note:
* Significant at $\alpha = 0.05$

Table 3.14 (b): ANOVA for STOC with Signal and Sector as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Signal	0.1253	3	0.0418	0.4078
Sector	2.5191	5	0.5038	4.9207**
Interaction	2.2284	15	0.1486	1.4509
Error	15.5633	152	0.1024	-
Total	20.4360	175		

Note:
** Significant at $\alpha = 0.01$

Since the trading signals are not significantly different, further test by using Tukey test is no longer required.

The chi-square test result presented in Table 3.15 indicates that the number of counts that produce highest return under each trading signals are not statistically different. This indicates that there is no statistical difference among trading signals applied.

Table 3.15: Chi-Square Test for Different Signals Under STOC

Trading Signal	STOC 20/70	STOC 20/80	STOC 30/70	STOC 30/80
Actual	10	16	12	12
Expected	12.5	12.5	12.5	12.5

$\chi^2 = 1.5200$

3.3   COMPARISON OF TRADING METHODS

In this section, the trading signal that generates highest portfolio returns will be used to represent that particular trading method. 60-SMA, which produced the highest portfolio return compared to 9-SMA, 21-SMA, and 200-SMA, has been selected to represent SMA. Similarly, 12-MACD has been selected to represent MACD while RSI-20/70 and STOC-30/70 are selected to represent RSI and STOC respectively. In addition to the above methods, a portfolio return based on buy-and-hold strategy will be analysed in this section.

In addition, the chi-square test is also carried out in this section. Under the chi-square test, the number of counters that achieved the highest return under each trading method are aggregated, regardless of trading signal used. A comparison is then made of the total number of counters under each method with the expected number of count.

Table 3.16 (a) and Table 3.16 (b) reveal the average returns and standard deviation of returns, after classifying the counters by listing board and sector. Table 3.16 (a) shows that SMA trading method generates highest return for the Main Board counters while MACD generates the highest return for the Second Board counters. Table 3.16 (b) reveals that SMA is the best trading method for all sectors, except for Industrial Products and Construction sectors, where MACD is the best trading method. Overall, SMA generates the highest portfolio returns, compared to the buy-and-hold method, MACD, RSI and STOC.

Table 3.16 (a): Average Returns According To The Listing Board

		Buy & Hold	SMA	MACD	RSI	STOC
Main Board	Average Return	-0.2635	0.3842	-0.3969	-0.2394	-0.6734
	Standard Deviation	0.4981	1.1800	0.4599	0.3780	0.2755
Second Board	Average Return	-0.1981	1.1908	2.7892	-0.2387	-0.4381
	Standard Deviation	0.3292	1.6251	5.1232	0.4961	0.7691
Total	Average Return	-0.2452	0.6101	0.4952	-0.2392	-0.6075
	Standard Deviation	0.4548	1.3524	3.0336	0.4091	0.4717

Table 3.16 (b): Average Returns According To The Sector

		Buy & Hold	SMA	MACD	RSI	STOC
Construction	Average Return	-0.3940	0.0581	4.0642	-0.5754	0.2028
	Standard Deviation	0.1054	0.5102	7.8891	0.3367	1.6001
Consumer	Average Return	-0.0482	0.7655	-0.0803	-0.0963	-0.6619
	Standard Deviation	0.6521	2.0391	0.7822	0.3635	0.1108
Finance	Average Return	-0.0371	1.1506	-0.3752	-0.2176	-0.5217
	Standard Deviation	0.5206	1.1199	0.5142	0.3776	0.4430
Industrial	Average Return	-0.3722	0.6326	1.7387	-0.2631	-0.6253
	Standard Deviation	0.2499	0.8444	5.3854	0.3665	0.3012
Properties	Average Return	-0.6449	-0.0178	-0.4765	-0.4114	-0.7475
	Standard Deviation	0.2105	0.5885	0.4730	0.3325	0.2066
Trading/ Services	Average Return	-0.1332	0.0357	-0.0978	-0.1601	-0.7634
	Standard Deviation	0.4310	0.6035	0.8044	0.5314	0.0873
Total	Average Return	-0.2324	0.5381	0.4501	-0.2452	-0.5937
	Standard Deviation	0.4692	1.1784	3.1972	0.3970	0.4903

Table 3.17 (a) and Table 3.17 (b) reveal that portfolio returns are affected by the trading methods applied. In addition, Table 3.17 (a) shows that there is a significant difference between listing boards. The interaction term between trading methods and listing boards, which is also significant, indicates that different trading methods generate different levels of returns under different listing boards.

Table 3.16 (b): Average Returns According To The Sector

		Buy & Hold	SMA	MACD	RSI	STOC
Construction	Average Return	-0.3940	0.0581	4.0642	-0.5754	0.2028
	Standard Deviation	0.1054	0.5102	7.8891	0.3367	1.6001
Consumer	Average Return	-0.0482	0.7655	-0.0803	-0.0963	-0.6619
	Standard Deviation	0.6521	2.0391	0.7822	0.3635	0.1108
Finance	Average Return	-0.0371	1.1506	-0.3752	-0.2176	-0.5217
	Standard Deviation	0.5206	1.1199	0.5142	0.3776	0.4430
Industrial	Average Return	-0.3722	0.6326	1.7387	-0.2631	-0.6253
	Standard Deviation	0.2499	0.8444	5.3854	0.3665	0.3012
Properties	Average Return	-0.6449	-0.0178	-0.4765	-0.4114	-0.7475
	Standard Deviation	0.2105	0.5885	0.4730	0.3325	0.2066
Trading/	Average Return	-0.1332	0.0357	-0.0978	-0.1601	-0.7634
Services	Standard Deviation	0.4310	0.6035	0.8044	0.5314	0.0873
Total	Average Return	-0.2324	0.5381	0.4501	-0.2452	-0.5937
	Standard Deviation	0.4692	1.1784	3.1972	0.3970	0.4903

Table 3.17 (a) and Table 3.17 (b) reveal that portfolio returns are affected by the trading methods applied. In addition, Table 3.17 (a) shows that there is a significant difference between listing boards. The interaction term between trading methods and listing boards, which is also significant, indicates that different trading methods generate different levels of returns under different listing boards.

Table 3.17 (a): ANOVA For Trading Method Comparison with Trading Method and

Listing Board as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Methods	55.1913	4	13.7978	7.1940**
Listing Boards	37.1712	1	37.1712	19.3805**
Interaction	72.3066	4	18.0766	9.4249**
Error	460.3140	240	1.9180	
Total	624.9830	249		

Note:

** Significant at $\alpha = 0.01$

Table 3.17 (b): ANOVA For Trading Method Comparison with Trading Method and

Sector as Main Effects

Source	Sum of Squares	df	Mean Square	F
Trading Methods	42.1251	4	10.5313	4.5356**
Sectors	17.2805	5	3.4561	1.4885
Interaction	67.3921	20	3.3696	1.4512
Error	441.1649	190	2.3219	-
Total	567.9626	219		

Note:

** Significant at $\alpha = 0.01$

Table 3.18 reveals that the portfolio return obtained by using SMA ignificantly outperformed portfolio returns obtained by applying RSI, STOC as well as uy-and-hold strategy. MACD also outperformed STOC. There is no statistical ifferent between portfolio return obtained by using buy-and-hold strategy, against ortfolio returns by using other technical indicators

Table 3.18: Tukey Test for Trading Method and Listing Board as Main Effects

Trading Method (I)	Trading Method (J)	Mean Difference (I-J)	p-value
Buy and Hold	SMA	-0.8553	0.0172
	MACD	-0.7404	0.0580
	RSI	-0.0060	1.0000
	STOC	0.3623	0.6862
SMA	MACD	0.1148	0.9938
	RSI	0.8493	0.0185
	STOC	1.2176	0.0001
MACD	RSI	0.7344	0.0614
	STOC	1.1028	0.0007
RSI	STOC	0.3683	0.6726

The chi-square test result in Table 3.19 indicates that there is a significant difference in the number of counts that produce highest return under each trading method. It is very clear that the number of counters that perform the best under SMA is relatively large compared to those for other trading methods.

Table 3.19: Chi-Square Test for Different Trading Methods

Trading Method	Buy & Hold	SMA	MACD	RSI	STOC
Actual	1	26	11	12	0
Expected	10	10	10	10	10

$\chi^2 = 44.2000$

3.4   MODEL ADEQUACY CHECKING

One of the assumptions for analysis of variance is that the samples are drawn from independent populations that can be described by a normal distribution. In this section, the results of the normality distribution tests are presented in Table 3.20.

Table 3.20: Results of Kolmogorov-Smirnov Tests

Method	Trading Signal	Absolute Most Extreme	Z
Buy and Hold	Buy and Hold	0.1577	1.1153
SMA	9 SMA	0.2690	1.9000**
	21 SMA	0.2910	2.0590**
	60 SMA	0.1850	1.3070
	200 SMA	0.1960	1.3820*
MACD	9 MACD	0.2350	1.6590**
	12 MACD	0.3240	2.2930**
	26 MACD	0.2770	1.9600**
RSI	RSI 20/70	0.1210	0.8570
	RSI 30/70	0.1060	0.7520
	RSI 20/80	0.1860	1.3180
	RSI 30/80	0.1920	1.3560
STOC	STOC 20/70	0.1580	1.1150
	STOC 20/80	0.1370	0.9690
	STOC 30/70	0.2700	1.9090**
	STOC 30/80	0.1250	0.8850

Notes:

** Significant at $\alpha = 0.01$

* Significant at $\alpha = 0.05$

The computed Z statistics reveal that seven portfolio returns are not normally distributed. Three portfolio returns under SMA are not normally distributed. Under MACD, all portfolio returns are not normally distributed. One out of four portfolio returns under STOC is not normally distributed while all portfolio returns obtained by using RSI trading signals are not normally distributed. In the trading methods comparison, most of the selected trading signals are normal, except for the MACD and STOC.

Although 43.75 percent of the portfolio returns are non-normal, this would have only little impact in the fixed effects analysis of variance and its related multiple comparison tests, especially in the analysis with small sample sizes. The F test is only slightly affected by a distribution that has considerably thicker or thinner tails than the normal distribution. As such, moderate departure from the normal distribution is acceptable.