CHAPTER 4

THE RESULT OF REGRESSION ANALYSIS

The content in this chapter presents the result of regression analysis in accordance with the model presented in previous section which attempt to predict the earnings of firms listed in the Stock Exchange of Thailand since 1992 through 2003. The results are in five separate parts. The first part regards the results of the mean reversion model. The second's provides the results from the mean reversion model with the exclusion of exporters. The third is the results from the naïve time-series model while the fourth is the naïve time-series model without exporters results. The last part is the evaluation of models.

4.1. Mean Reversion Model

The first set of regressions reported in Table 1. are the average results of the individual regressions for each firm, run each year to determine expected profitability where the proxies are $DP_{i,t}$, $DD_{i,t}$, and $MB_{i,t}$. The first two variables have information about expected profitability, $E(P)_{i,t}$. The positive slope on $DP_{i,t}$ is 0.357 and the t-statistics is 4.673. The negative slope on $DD_{i,t}$ is $_t$ -0.068 and the highly t-statistics is -9.427. These two dividend-related variables capture a great deal of information about expected profitability. It comes into view that these variables in SET have more influence on expected profitability than the UK study of Allen and Salim (2001) (UK study, hereafter) with the coefficients 0.287 and -0.027 on $DP_{i,t}$ and $DD_{i,t}$ respectively and also to the US study of Fama and French (2000) (US study, hereafter) with the coefficients 0.19 and -0.026. Yet, the last variable, $MB_{i,t}$, which have a very significant relationship to expected profitability in those two markets turns up to contain a lot less information of expected profitability, with a t-statistic only 0.962 and a slope 0.001.

As Fama and French stated in their paper that more extensive tests for industry effects would also be reasonable and there must be some variation in expected profitability missed by the dividend related variables. Hence, I assembled a descriptive panel, as Table 4.2., of many other characteristics that might have an effect on profitability. At every calendar year-end over the sample period, profitability rates are calculated. Then calculate the average for the whole period (1992-2000), the before-crisis period (1992-1996), and the during-crisis period (1997-2000) and are reported by percentile ranking.

Table 4.1

Regressions to Explain the Level of Profitability, $E(P)_{i,t}$: For all firms

$$E(P)_{i,t} = \beta_1 + \beta_2 DP_{i,t} + \beta_3 DD_{i,t} + \beta_4 MB_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Where $E(P)_{i,t}$: The expected profitability at the end of year *t*, $DP_{i,t}$ is the dividend payout to common equity, $DD_{i,t}$ is the dummy, that is 0 for dividend payers and 1 for non-payers, $MB_{i,t}$ is the market-to-book ratio.

1. Means and t-Statistics for the means of the regression coefficients

	Int	DP*t*	DD*t*	MB*t*	Adjusted R-squared
Mean	0.073	0.357**	-0.068**	0.001	0.243
t(Mn)	13.811	4.673	-9.427	0.962	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$E(P)_{i,t}$	DP*t*	DD*t*	MB*t*
Mean	0.062	0.046	0.393	1.711
Std. Dev.	0.107	0.075	0.488	6.566

Table 4.2

Presented here are profitability of firms listed in the SET, rank by percentile for each characteristics and each periods. Whole period means the average profitability of that firm from 1992-2000, before crisis means the average profitability of that firm from 1992-1996, and during crisis means the average profitability of that firm from 1997-2000. Sectors in each industry (section b. to h.) are reported in the Appendix. Big cap firms comprise of firms in the top two deciles by equity market value, mid cap firms comprise of firms in the third through seventh deciles, while small cap firms comprise of firms in the bottom three deciles. Glamour stocks comprising firms in the top two deciles by market-to-book ratio, while value stocks comprising firms in the bottom three deciles. Large stocks represent firms in the top two deciles by size of the assets; medium stocks represent firms in the third through seventh deciles, while small stocks represent firms in the bottom three deciles. High dividend payout represent firms in the top two deciles by the ratio of dividend payout to EBIT; medium dividend payout represent firms in the third through seventh deciles, while low to non-dividend payout represent firms in the bottom three deciles.

	Percentile								
	5%	10%	25%	40%	50%	60%	75%	90%	95%
				a.All Firms					
Whole period	-3.41%	-0.87%	2.97%	5.66%	6.73%	8.38%	10.50%	15.38%	16.68%
Before Crisis	0.53%	1.82%	4.97%	7.48%	8.76%	10.13%	12.50%	15.40%	18.06%
During Crisis	-10.08%	-6.08%	-0.91%	2.94%	4.75%	6.38%	9.60%	15.56%	18.00%
				b. Service Stocks					
Whole period	2.00%	4.27%	6.08%	7.34%	8.64%	9.50%	11.13%	15.74%	16.95%
Before Crisis	4.26%	5.30%	7.70%	8.98%	10.22%	11.26%	13.99%	17.56%	21.35%
During Crisis	-1.07%	-0.59%	3.25%	4.95%	5.67%	7.79%	9.70%	14.73%	15.62%
				c. Techno Stocks					
Whole period	-10.76%	-8.51%	-0.64%	4.96%	9.03%	9.73%	11.30%	16.38%	17.59%
Before Crisis	-3.23%	1.00%	5.14%	8.06%	9.23%	11.50%	15.86%	17.92%	19.01%
During Crisis	-28.05%	-17.15%	-3.76%	-2.41%	2.42%	7.09%	11.69%	15.40%	16.70%
				d. Bank Stocks					
Whole period	-2.24%	-1.31%	-0.38%	0.02%	1.60%	2.47%	4.87%	7.71%	9.15%
Before Crisis	1.04%	1.27%	1.80%	2.53%	3.61%	5.80%	7.47%	9.12%	11.51%
During Crisis	-9.32%	-4.69%	-3.70%	-2.08%	-1.52%	-0.60%	2.15%	4.57%	6.72%
				e. Property Stocks					
Whole period	-0.85%	1.22%	1.99%	4.04%	4.67%	4.98%	5.83%	9.27%	10.37%
Before Crisis	4.34%	4.40%	5.32%	7.16%	8.06%	8.97%	10.16%	12.13%	14.75%
During Crisis	-9.14%	-8.18%	-3.15%	-1.87%	0.35%	1.05%	4.01%	6.41%	8.90%
				f. Consumer Stocks					
Whole period	0.07%	5.67%	6.21%	8.26%	9.11%	9.74%	12.23%	14.79%	15.41%
Before Crisis	3.59%	5.31%	7.35%	8.39%	10.04%	11.84%	12.97%	15.21%	16.79%
During Crisis	-7.57%	0.66%	4.31%	6.86%	7.45%	9.22%	12.70%	15.71%	16.34%
				g. Agri Stocks					
Whole period	-2.38%	0.33%	6.86%	9.75%	10.43%	12.83%	15.52%	17.74%	21.62%
Before Crisis	-3.11%	-1.85%	4.88%	9.66%	11.25%	12.80%	13.86%	16.17%	18.95%
During Crisis	0.33%	1.73%	6.42%	10.18%	12.17%	14.02%	17.39%	19.39%	24.94%
				h. Industrial Stocks					
Whole period	-3.52%	-0.34%	4.19%	4.94%	6.59%	7.28%	8.59%	12.69%	15.02%
Before Crisis	0.65%	2.73%	4.06%	7.01%	8.57%	10.47%	12.34%	14.51%	16.14%
During Crisis	-12.47%	-9.12%	-0.59%	3.63%	4.95%	5.64%	7.78%	12.76%	18.10%

High EP ratio represent firms in the top two deciles by the ratio of EBIT-to-price; medium EP ratio represent firms in the third through seventh deciles, while low EP ratio represent firms in the bottom three deciles.

	Percentile								
	5%	10%	25%	40%	50%	60%	75%	90%	95%
i. Big Cap Firms									
Whole period	-0.78%	-0.42%	0.13%	4.65%	5.81%	6.85%	9.55%	10.97%	13.94%
Before Crisis	1.26%	1.41%	3.66%	7.25%	8.64%	9.78%	12.31%	15.21%	17.58%
During Crisis	-4.11%	-2.96%	-1.86%	2.67%	4.26%	5.06%	7.95%	16.40%	18.80%
j. Mid Cap Firms									
Whole period	-7.41%	-1.40%	3.43%	5.36%	7.34%	8.67%	12.52%	16.11%	17.42%
Before Crisis	1.21%	2.77%	4.82%	7.69%	8.72%	10.42%	13.17%	16.84%	18.60%
During Crisis	-8.26%	-3.83%	1.05%	5.09%	6.92%	8.84%	12.59%	15.76%	18.28%
k. Small Cap Firms									
Whole period	-3.36%	-1.18%	4.15%	6.26%	7.16%	8.57%	9.85%	13.67%	14.81%
Before Crisis	-2.28%	1.93%	5.56%	7.34%	8.89%	10.01%	11.44%	14.29%	15.26%
During Crisis	-22.01%	-9.58%	-2.77%	0.34%	2.66%	3.92%	6.27%	8.94%	12.80%
l. Large Stocks									
Whole period	-1.75%	-0.84%	-0.12%	1.78%	3.20%	6.01%	7.73%	10.32%	13.94%
Before Crisis	1.26%	1.28%	2.02%	4.15%	5.32%	7.15%	9.77%	12.35%	14.39%
During Crisis	-8.16%	-4.14%	-2.62%	-1.76%	0.68%	3.88%	5.42%	9.45%	14.19%
m. Medium Stocks									
Whole period	-3.96%	0.99%	4.47%	5.87%	7.18%	8.36%	11.43%	15.59%	16.55%
Before Crisis	0.39%	2.57%	5.31%	7.86%	8.96%	10.45%	12.62%	15.36%	18.06%
During Crisis	-9.10%	-3.83%	1.05%	4.42%	6.03%	7.30%	11.53%	16.58%	18.83%
n. Small Stocks									
Whole period	-3.64%	-1.18%	3.89%	6.28%	8.65%	9.54%	11.29%	15.40%	19.51%
Before Crisis	1.87%	3.62%	7.09%	8.57%	10.03%	11.27%	14.09%	16.86%	19.34%
During Crisis	-12.90%	-8.23%	-0.28%	2.63%	3.82%	6.45%	9.97%	14.18%	15.62%
o.High Dividend Payout									
Whole period	-1.26%	-0.13%	4.17%	6.24%	8.06%	10.47%	13.11%	17.14%	21.35%
Before Crisis	1.64%	2.47%	5.78%	6.96%	8.00%	9.08%	11.99%	17.66%	20.77%
During Crisis	-0.97%	1.53%	4.46%	6.90%	8.09%	10.09%	13.75%	18.92%	24.16%
p. Medium Dividend Payout									
Whole period	-0.42%	0.13%	4.96%	6.61%	8.42%	9.19%	11.23%	15.49%	16.20%
Before Crisis	1.80%	4.15%	6.64%	8.86%	10.13%	11.31%	13.83%	16.27%	18.09%
During Crisis	-2.71%	-1.96%	2.29%	7.74%	9.75%	12.33%	14.64%	16.87%	18.12%
q.Low to Non-Dividend Payout									
Whole period	-11.06%	-7.41%	-1.32%	1.76%	3.16%	4.24%	6.55%	8.46%	11.99%
Before Crisis	-5.05%	-2.31%	2.59%	4.06%	4.77%	7.54%	9.80%	12.52%	14.61%
During Crisis	-19.54%	-10.14%	-3.80%	-0.77%	1.04%	3.43%	5.10%	7.61%	8.78%
r.High EP ratio(low valuation)									
Whole period	4.79%	5.80%	7.25%	8.74%	9.76%	10.66%	13.70%	15.61%	16.03%
Before Crisis	1.70%	3.98%	7.46%	9.72%	10.85%	12.07%	14.15%	16.20%	16.79%
During Crisis	3.06%	3.47%	6.18%	7.77%	9.75%	12.33%	13.82%	16.67%	18.39%
s.Medium EP ratio									
Whole period	2.50%	3.70%	5.29%	7.00%	8.04%	9.15%	11.21%	16.28%	18.53%
Before Crisis	3.08%	4.50%	6.01%	7.83%	9.23%	10.31%	13.08%	16.92%	18.48%
During Crisis	-1.09%	-0.10%	2.63%	4.76%	5.26%	7.15%	9.46%	15.63%	18.92%
t. Low EP ratio(High valuation)									
Whole period	-11.06%	-8.61%	-3.08%	-0.92%	-0.25%	0.13%	1.64%	4.22%	5.14%
Before Crisis	-5.05%	-2.31%	1.40%	3.26%	4.05%	5.79%	8.66%	12.27%	14.42%
During Crisis	-25.45%	-19.54%	-8.81%	-6.28%	-3.83%	-3.28%	-2.16%	-0.49%	0.34%

From Table 4.2., on average, the good performance firms seem to have profitability rates around 16.68 % and the poor performance firms have profitability rates around -3.41%. On before-crisis period both types of firms behaved better than average with profitability rates at 18.06% and 0.53%, respectively. On the other hand, on during-crisis period, the top firms are having profitability rates at 18 % but the poor are having -10.08% profitability rates.

From section b. to h., I divided firms into 7 industry groups. Agri-stocks, which included firms in agribusiness and food and beverages business, seem to have the best profitability on average while bank-stocks, which included firms in banking, financial and insurance business, have the worst profitability on average. This finding contradicts to those in the western countries which techno-stocks (firms in electrical, electronics, and pharmaceuticals business) always are superior in growth and profits. This might be because Thailand is a developing country and agriculture is still a main business.

From i. to k., firms are categorized from their market capitalization but the results are not direct to the same point so, from l. to n., I divided firms from their asset-size (natural logarithm of asset-size, in particular). The results show that normally small firms yield a better profitability except for those low-ranked which really are incompetent.

From o. to q., I use dividend information to classified firms. Obviously, firms with high dividend payout achieve higher profitability rates than those who payout less.

The last section, from r. to t., I sorted out firms from another valuation ratio, earnings-to-price ratio (EP), and it pointed out that generally firms with high EP have a better profitability.

Accordingly, I gather all the variables I have considered individually previously into one model to explain expected profitability. The results are shown in Table 4.3. All the variables from equation (1) have the expected signs and are statistically significant except for the asset-size variable. The slope of the dividend variable is positive 0.359 with a t-value of 4.795 while the slope on dividend dummy variable is negative -0.06 with a t-value of -9.555. These follow the finding of Fama and French (1999) that pointed out that firms that do not pay dividend tend to be much less profitable than dividend payers. The slopes on two sector dummy variables are as follow; 0.025 for agribusiness sector and -0.053 for banking sector with t-statistics 4.077 and - 10.28 respectively.

Table 4.3

Regressions to Explain the Level of Profitability, $E(P)_{i,t}$: For all firms (II)

$$E(P)_{i,t} = \beta_1 + \beta_2 DP_{i,t} + \beta_3 DD_{i,t} + \beta_4 LA_{i,t} + \beta_5 DA_{i,t} + \beta_6 DB_{i,t} + \beta_7 MB_{i,t} + \beta_8 EP_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where $E(P)_{i,t}$: The expected profitability at the end of year *t*, $DP_{i,t}$ is the dividend payout to common equity, $DD_{i,t}$ is the dummy, that is 0 for dividend payers and 1 for non-payers, $LA_{i,t}$ is the natural logarithm of the assets, $DA_{i,t}$ is the dummy, that is 1 for agribusiness sector and 0 otherwise, $DB_{i,t}$ is the dummy, that is 1 for banking sector and 0 otherwise, $MB_{i,t}$ is the market-to-book ratio, and $EP_{i,t}$ is the earnings-to-price ratio.

1. Means and t-Statistics for the means of the regression coefficients

	Int	DP*t*	DD*t*	LA*t*	DA*t*	DB*t*	MBt	EPt	Adjusted R-squared
Mean	0.0717**	0.359**	-0.061**	0.001	0.025**	-0.053**	0.001	0.023**	0.451
t(Mn)	6.054	4.795	-9.555	0.385	4.077	-10.280	0.797	6.757	
Mean	0.076**	0.364**	-0.061**		0.026**	-0.053**		0.023**	0.450
t(Mn)	14.378	4.861	-9.520		4.130	-10.450		6.717	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$E(P)_{i,t}$	DP*t*	DD*t*	LA*t*	DA*t*	DB*t*	MBt	EPt
Mean	0.062	0.046	0.393	1.711	7.968	0.136	0.171	0.014
Std Dev	0.107	0.075	0.488	6.566	1.610	0.343	0.376	1.851

For earning-to-price ratio, the slope is 0.023 and t-value is 6.757 consistent with the descriptive data that firms with higher EP should have higher profitability. However, for the asset-size variable, the slope is 0.0005 with an insignificant t-value of 0.415. The market-to-book also has the same insignificant value. It can be say that the other variables are better at capturing the expected profitability. Thus, I run the equation once again but without these two insignificant variables and obtain the not-much-different results.

The fitted value of $E(P)_{i,t}$ from equation (1) is then use in the equation (2). Table 4.4 reports the average results for the slopes of the second stage estimates of the partial adjustment regression in equation (2) that do not constrain the slopes on expected profitability, $E(P)_{i,t}$, and actual profitability, $P_{i,t}$. The prediction of the partial adjustment model would be that the slope of $P_{i,t}$ is negative and that of $E(P)_{i,t}$ is positive. Besides, their slopes should be equal in absolute value (or with a relatively small different). The results show that the average slope of $P_{i,t}$ and $E(P)_{i,t}$ are -0.316 and 0.304 respectively, quite close in absolute value. The results here are consistent with the average slope of -0.25 and 0.26 for UK study and -0.39 and 0.38 for US study. These slopes are also having the explanatory power with the t-statistics -4.116 and 3.895. Thus, these products can be the evidence of mean reversion of profitability in Thailand, with the convergence to the mean of 30% per year, roughly.

As a further check, the lagged change in profitability, $\Delta P_{i,t}$, is also adopted into equation (2) as an explanatory variable to assess whether the mean reversion captured by the partial adjustment term, $DV_{i,t} = P_{i,t} - E(P)_{i,t}$, is the only source of information about predictable changes in profitability. It can be seen that $\Delta P_{i,t}$ has a coefficient of 0.133 with an insignificant t-statistics 1.902. Thus, the prediction component of the change in profitability in the sample of Thai firms is picked up by the partial adjustment term. This result contradicted to those from both UK study and US study which found negative relations in changes in profitability. The explanation might be that the competitive advantage of firms in Thailand is not equal. Though they might want to leave the unprofitable industries and enter the profitable one but their abilities might not allow them to do so. Also it should be noted that the average explanatory power of this regression is low with an R^2 of 0.046.

Table 4.4

Regressions to Explain the Change in Profitability, $\Delta P_{i,t+1}$: For all firms

$$\Delta P_{i,t+1} = \alpha_1 + \alpha_2 P_{i,t} + \alpha_3 E(P)_{i,t} + \alpha_4 \Delta P_{i,t} + \varepsilon_{i,t} \qquad (2)$$

$$\Delta P_{i,t+1} = \lambda_1 + \lambda_2 DV_{i,t} + \lambda_3 NDV_{i,t} + \lambda_4 SNDV_{i,t} + \lambda_5 SPDV_{i,t} + \lambda_6 \Delta P_{i,t} + \lambda_7 \Delta NP_{i,t} + \lambda_8 \Delta SNP_{i,t} + \lambda_9 \Delta SPP_{i,t} + \varepsilon_{i,t} \qquad (3b)$$

Where $\Delta P_{i,t+1}$: future changes in profitability, $P_{i,t}$: observed profitability, $E(P)_{i,t}$: expected profitability from equation (1), $\Delta P_{i,t}$: lagged changes in profitability, DV: is deviation of profitability from its expected value ($P_{i,t} - E(P)_{i,t}$), NDV: dummy variable; 1 when DV is negative and 0 otherwise, SNDV: square negative deviation of profitability, SPDV: square positive deviation of profitability, ΔNP: negative change in profitability, ΔSNP: square negative change, ΔSPP: square positive change.

1. Means and t-Statistics for the means of the regression coefficients

	Int	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta P_{i,t}$	$\Delta NP_{i,t}$	$\Delta SNP_{i,t}$	$\Delta SPP_{i,t}$	Adjusted R-squared
Mean	-0.016**	-0.316**	0.304**				0.133				0.046
t(Mn)	-2.642	-4.116	3.895				1.902				
Mean	-0.008**						-0.529**	0.536**	1.717**	0.628**	0.219
t(Mn)	-2.366						-5.529	3.371	3.618	2.825	
Mean	0.009	-0.345**	0.194	0.257	1.093**	-0.161	-0.356**	0.424**	0.535	0.511**	0.280
t(Mn)	1.478	-2.869	1.390	1.222	2.370	-0.329	-4.145	3.250	0.899	2.411	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$\Delta P_{i,t+1}$	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta P_{i,t}$	$\Delta NP_{i,t}$	$\Delta SNP_{i,t}$	$\Delta SPP_{i,t}$
Mean	-0.007	0.066	0.076	-0.036	0.005	0.003	-0.013	-0.032	0.005	0.004
Std. Dev.	0.102	0.104	0.062	0.064	0.027	0.012	0.093	0.064	0.023	0.025

The next set of tests involve the expand equation for mean reversion in profitability which includes terms designed to capture non-linear effects. The derived variables in equation (3b) are representative of negative deviations of profitability from their expected value, NDV $_{i,t}$, squared negative deviation, SNDV $_{i,t}$, squared positive deviations, SPDV $_{i,t}$, negative changes in profitability, ΔNP $_{i,t}$, squared negative changes, ΔSNP $_{i,t}$, and squared positive changes, ΔSPP $_{i,t}$. Briefly, λ_6 in equation capture non-linearity in the mean reversion of profitability, whilst λ_7, λ_8, λ_9 capture non-linearity in the autocorrelation of changes in profitability.

The results in Table 4.4 show that when equation (3b) is estimated with suppression of the mean-reversion variables (λ_2- λ_5), it appears that only two variables (out of four) have the predicted signs, which are ΔP $_{i,t}$ with a negative slope and ΔSNP $_{i,t}$ with a positive slope. They imply that the changes in profitability tend to reverse and reversal is stronger for more extreme negative changes. However, the other two variables are contradicted to the predicted signs. ΔNP $_{i,t}$ and ΔSPP $_{i,t}$ should have negative signs because those who underperformed last year are supposed to perform better to catch up with the over all market and those who performed very well last year should drop down since there are more competition from the new comers. The opposite results here can be explained by the fact that, in Thailand, the competitive advantage between the top firms and the poor firms is too much different. Thus, the top firms will outperform for a few more years before their competitors can draw nearer. Yet, it is different for the very unprofitable firms since they have to fight real hard to avoid a broke; the potential for reversal is more for them. Another point to note is that both US study and UK study are statistically weak but in Thailand, the results are statistically significant and the R^2 is higher at 0.22(compare to 0.15 and 0.05 of US and UK, respectively).

When the full version is estimated to examine whether the autocorrelation of changes in profitability can be attributed to mean reversion in the level of profitability; the slopes λ_6- λ_9 on the autocorrelation variables move toward zero and still have high t-values. Allowing for non-linearity, the slopes on $P_{i,t}$ and $E(P)_{i,t}$ (the two components of the linear partial adjustment term, DV $_{i,t}$) remain opposite in sign but not close in absolute value(-0.345 and 0.194 respectively). Mean reversion is not stronger when profitability is below its mean; the slope on NDV $_{i,t}$ is 0.257 (t-value= 1.22). However, it is stronger when profitability is further from its mean; the slopes on the quadratic terms SNDV $_{i,t}$ and SPDV $_{i,t}$ are 1.093 and -0.161 with t-statistics 2.370 and -0.329 respectively.

The next set of tests examines whether earnings changes are predictable and the extent to which changes in earnings can be traced to non-linear mean reversion of profitability. Table 4.5 shows that when the lagged change in earnings, $\Delta E_{i,t}$, is used solely to predict $\Delta E_{i,t+1}$, the coefficient is -0.398 with a significant t-statistic -5.862. This suggests that successive changes in earnings do not follow a random walk and should be predictable to some extent. When $\Delta NE_{i,t}$, $\Delta SNE_{i,t}$ and $\Delta SPE_{i,}$ are added to the regression, the lagged change remained at high negative -0.534 with high t-value -5.195. The rest variables of earnings behaved much like those of profitability, the reversal is strong for only the severe negative changes in earnings (slope 1.173 and t-value 2.246) but for the normal negative changes or the extreme positive changes, there are no signs of reversal on the next year ($\Delta NE_{i,t}$ slope = 0.399 t-value = 2.035, $\Delta SPE_{i,t}$ slope = 0.669 t-value = 4.690).

To explore whether the autocorrelation of earnings changes can be attributed in whole or in part to non-linear mean reversion in the level of profitability, the full equation is estimated. The results show that the slopes on the autocorrelation variables move closer to zero, but t-values are still significant for two out of four. Hence, it can be roughly stated that the non-linear behavior of profitability is just a good-but-not-complete indicator for the predictable variation in earnings. All the signs are alike those estimated in the equation of variation in profitability. (slopes and t-values of the rest variables are: $P_{i,t}$ = -0.281 and -2.172, $E(P)_{i,t}$ = 0.103 and 0.668, $NDV_{i,t}$ = 0.117 and 0.533, $SNDV_{i,t}$ = 1.074 and 3.932, $SPDV_{i,t}$ = -0.576 and -1.083)

All the results are consistent in the meaning that, in Thailand, mean reversion of profitability is not perfect due to the inequality problem. Even so, accounting decisions might be the other explanation for the question why some of the results are conflicting to the predicted sign. Basu (1997) pointed out that bias toward conservative reporting leads firms to report losses quickly but to spread gains over longer periods.

However, to use this model to forecast changes in earnings, more adjusting is considered necessary. I successively eliminated the variable with the highest p-value one at a time to achieve the final model with only the significant variables subsist. As a result, the slopes on all the variables left are the last set shown in Table 4.5, though each value has a small change but the signs are all the same.

Table 4.5

Regressions to Explain the Change in Profitability, $\Delta E_{i,t+1}$: For all firms

$$\Delta E_{i,t+1} = \omega_1 + \omega_2 DV_{i,t} + \omega_3 NDV_{i,t} + \omega_4 SNDV_{i,t} + \omega_5 SPDV_{i,t} + \omega_6 \Delta E_{i,t} + \omega_7 \Delta NE_{i,t} + \omega_8 \Delta SNE_{i,t} + \omega_9 \Delta SPE_{i,t} + \varepsilon_{i,t} \qquad (4b)$$

Where ΔE i,t+1 : future change in earnings, DV: is deviation of profitability from its expected value ($P_{i,t} - E(P)_{i,t}$), NDV: dummy variable; 1 when DV is negative and 0 otherwise, SNDV: square negative deviation of profitability, SPDV: square positive deviation of profitability, ΔE i,t : lagged change in earnings, ΔNE i,t : negative change in earning, ΔSNE: square negative change in earning, ΔSPE: square positive change in earning.

1. Means and t-Statistics for the means of the regression coefficients

	Int	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta E_{i,t}$	$\Delta NE_{i,t}$	$\Delta SNE_{i,t}$	$\Delta SPE_{i,t}$	Adj R2
Mean	-0.002						-0.398**				0.129
t(Mn)	-0.826						-5.862				
Mean	0.001						-0.534**	0.399**	1.173**	0.669**	0.171
t(Mn)	0.144						-5.195	2.035	2.246	4.690	
Mean	0.013	-0.281**	0.103	0.117	1.074**	-0.576	-0.259**	0.222	0.228	0.399**	0.263
t(Mn)	1.810	-2.172	0.668	0.533	3.932	-1.083	-2.256	1.156	0.437	2.262	
Mean	0.011**	-0.222**			1.195**	-1,123*					0.255
t(Mn)	2.168	-3.667			4.30129	-2.8156					

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$\Delta E_{i,t+1}$	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta E_{i,t}$	$\Delta NE_{i,t}$	$\Delta SNE_{i,t}$	$\Delta SPE_{i,t}$
Mean	0.000	0.066	0.076	-0.036	0.005	0.003	-0.004	-0.030	0.005	0.004
Std Dev	0.106	0.104	0.062	0.064	0.027	0.012	0.096	0.064	0.025	0.029

4.2. Mean Reversion Model :Exclude exporters

When excluded firms that high portion of earnings are from export, the results are still having the expected signs, shown in Table 4.6. After excluding the same two insignificant variables, $MB_{i,t}$ and $LA_{i,t}$, the slope of the dividend variable is positive 0.352 with a t-value of 4.572 while the slope on dividend dummy variable is negative -0.062 with a t-value of -9.235. The slopes on two sector dummy variables are as follow; 0.019 for agribusiness sector and -0.052 for banking sector with t-statistics 2.820 and -10.232 respectively. For earning-to-price ratio, the slope is 0.022 and t-value is 6.509. All are consistent with the regression of all firms.

The results from second stage estimation, shown in Table 4.7, are similar as well except for the rate of mean reversion for non-exporter firms is around 26% (slopes on $P_{i,t}$ and $E(P)_{i,t}$ are -0.257 and 0.277 with t-value -6.016 and 4.521 respectively). Yet again, the partial adjustment term is the one who picked up the prediction component of change in profitability as the lag of change in profitability has an insignificant value (slope = 0.085, t-value = 1.296).

When adding mean reversion in profitability variables, all the signs and values are quite similar to those results from all firms but with a slightly higher R^2 0.2812.

The last regression to predict change in earnings achieve no big different as well. When the lagged change in earnings, $\Delta E_{i,t}$, is used solely to predict $\Delta E_{i,t+1}$, the coefficient is -0.416 with a t-statistic -5.286, confirms that successive earnings changes do not follow a random walk and should be predictable to some extent. When $\Delta NE_{i,t}$, $\Delta SNE_{i,t}$ and $\Delta SPE_{i,}$ are added to the regression, the lagged change remained at high negative -0.511 with a significant t-value -4.6. The remainder variables of earnings have the same signs as the test for all firms, the reversal is strong for only the severe negative changes in earnings (slope 1.144 and t-value 1.869) but for the normal negative changes or the extreme positive changes, there are no signs of reversal on the next year ($\Delta NE_{i,t}$ slope = 0.321 t-value = 1.397, $\Delta SPE_{i,t}$ slope = 0.6 t-value = 3.516). After adding the non-linear mean reversion of profitability, all the signs and values are alike the results attained before except that the slope on $P_{i,t}$ is insignificant (slope= -0.191, t-value = -1.425) and the R^2 for the full regression is a little higher at 0.269 (compare to 0.263 of the all-firms regressions).

Table 4.6

Regressions to Explain the Level of Profitability, $E(P)_{i,t}$: Excluded exporters

$$E(P)_{i,t} = \beta_1 + \beta_2 DP_{i,t} + \beta_3 DD_{i,t} + \beta_4 LA_{i,t} + \beta_5 DA_{i,t} + \beta_6 DB_{i,t} + \beta_7 MB_{i,t} + \beta_8 EP_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where all the variables are the same as in Table 4.3

1. Means and t-Statistics for the means of the regression coefficients

	Int	DP*t*	DD*t*	LA*t*	DA*t*	DB*t*	MBt	EPt	Adjusted R-squared
Mean	0.074**	0.347**	-0.062**	0.000	0.019**	-0.053**	0.001	0.022**	0.452
t(Mn)	6.023	4.511	-9.227	0.240	2.735	-9.974	0.842	6.539	
Mean	0.077**	0.352**	-0.062**		0.020**	-0.052**		0.022**	0.451
t(Mn)	13.821	4.572	-9.235		2.820	-10.232		6.509	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$E(P)_{i,t}$	DP *t*	DD *t*	MBt	LA *t*	DA *t*	DB *t*	EPt
Mean	0.058	0.046	0.396	1.834	8.023	0.118	0.201	-0.038
Std. Dev.	0.107	0.078	0.489	7.105	1.704	0.323	0.401	1.974

Table 4.7

Regressions to Explain the Change in Profitability, $\Delta P_{i,t+1}$: Excluded exporters

$$\Delta P_{i,t+1} = \alpha_1 + \alpha_2 P_{i,t} + \alpha_3 E(P)_{i,t} + \alpha_4 \Delta P_{i,t} + \varepsilon_{i,t} \qquad (2)$$

$$\Delta P_{i,t+1} = \lambda_1 + \lambda_2 DV_{i,t} + \lambda_3 NDV_{i,t} + \lambda_4 SNDV_{i,t} + \lambda_5 SPDV_{i,t} + \lambda_6 \Delta P_{i,t} + \lambda_7 \Delta NP_{i,t} + \lambda_8 \Delta SNP_{i,t} + \lambda_9 \Delta SPP_{i,t} + \varepsilon_{i,t} \qquad (3b)$$

Where all the variables are the same as in Table 4.4

1. Means and t-Statistics for the means of the regression coefficients

	Int	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta P_{i,t}$	$\Delta NP_{i,t}$	$\Delta SNP_{i,t}$	$\Delta SPP_{i,t}$	Adjusted R-squared
Mean	-0.021**	-0.257**	0.277**				0.085				0.035
t(Mn)	-4.692	-6.016	4.521				1.296				
Mean	-0.012**						-0.499**	0.449**	1.628**	0.552**	0.222
t(Mn)	-3.308						-4.656	2.595	3.071	2.241	
Mean	0.005	-0.283**	0.130	0.243	1.359**	-0.205	-0.399**	0.367**	0.058	0.517**	0.281
t(Mn)	0.805	-2.092	0.813	1.084	3.793	-0.339	-4.414	3.175	0.096	2.300	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$\Delta P_{i,t+1}$	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta P_{i,t}$	$\Delta NP_{i,t}$	$\Delta SNP_{i,t}$	$\Delta SPP_{i,t}$
Mean	-0.009	0.062	0.073	-0.036	0.006	0.003	-0.014	-0.032	0.005	0.004
Std . Dev.	0.102	0.104	0.062	0.066	0.029	0.011	0.092	0.064	0.023	0.025

Table 4.8

Regressions to Explain the Change in Profitability, $\Delta E_{i,t+1}$: Excluded exporters

$$\Delta E_{i,t+1} = \omega_1 + \omega_2 DV_{i,t} + \omega_3 NDV_{i,t} + \omega_4 SNDV_{i,t} + \omega_5 SPDV_{i,t} + \omega_6 \Delta E_{i,t} + \omega_7 \Delta NE_{i,t} + \omega_8 \Delta SNE_{i,t} + \omega_9 \Delta SPE_{i,t} + \varepsilon_{i,t} \quad (4b)$$

Where all the variables are the same as in Table 4.5

1. Means and t-Statistics for the means of the regression coefficients

	Int	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta E_{i,t}$	$\Delta NE_{i,t}$	$\Delta SNE_{i,t}$	$\Delta SPE_{i,t}$	Adjusted R-squared
Mean	-0.004						-0.416**				0.136
t(Mn)	-1.261						-5.286				
Mean	-0.014**						-0.212**	-0.382**			0.155
t(Mn)	-3.307						-2.249	-2.281			
Mean	-0.003						-0.511**	0.321	1.144	0.600**	0.178
t(Mn)	-0.699						-4.600	1.397	1.689	3.516	
Mean	0.009	-0.191	0.011	0.036	1.200**	-0.634	-0.311**	0.191	0.125	0.396**	0.269
t(Mn)	1.201	-1.342	0.064	0.146	6.599	-1.801	-2.637	0.892	-0.194	1.983	
Mean	0.009	-0.180**			1.127**		-0.318**				0.263
t(Mn)	1.008	-3.448			3.665		-2.390				

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$\Delta E_{i,t+1}$	$P_{i,t}$	$E(P)_{i,t}$	$NDV_{i,t}$	$SNDV_{i,t}$	$SPDV_{i,t}$	$\Delta E_{i,t}$	$\Delta NE_{i,t}$	$\Delta SNE_{i,t}$	$\Delta SPE_{i,t}$
Mean	-0.001	0.062	0.073	-0.036	0.006	0.003	-0.005	-0.029	0.005	0.004
Std Dev.	0.106	0.104	0.062	0.066	0.029	0.011	0.094	0.063	0.024	0.031

As in the previous part, the last adjustment is taking up. After removing three insignificant variables, the results are as in the last set of Table 4.8. Every slope change slightly but remain in the same signs.

4.3. Naïve Time-series Model

Firstly, I regressed $EBIT_{t+1}$ against $EBIT_t$ and get a positive relation between them with a slope 1.125 and a highly t-value 44.677. It means that firms with higher earnings this year will continue to have higher earnings in the next year. When one-period-lagged earnings, $EBIT_{t-1}$, is added, the results show that a slope on $EBIT_t$ is still positive (1.418) and highly significant (52.971) while $EBIT_{t-1}$'s is -1.083 with a t-value -21.91. Noted here that R^2 is a lot higher (0.359) compare to the first regression (0.118). This confirms the theory of a mean reversion; firms can continue its satisfied earnings for only one more year and then drop whereas firms with unsatisfied earnings tend to improve after a year has passed. As more lagged variables can cause a higher autocorrelation problem, I solved by using a Breusch-Godfrey Lagrange Multiplier test. The results in section 3. of Table 4.9 show that there are no autocorrelations since the coefficients of the lagged residual are insignificant.

4.4. Naïve Time-series Model : Exclude exporters

When exporters are excluded, all results are almost the same. Regressing with one lag, the slope on it is a positive 1.127 with a t-value 41.263 and R^2 0.118. Adding one more lag, the slope on $EBIT_t$ and $EBIT_{t-1}$ are 1.419 and -1.088 respectively and both are perfectly significant (t-value = 48.946 and -20.225) while R^2 for this regression is 0.36.

Table 4.9

Regressions on the lagged variables of earnings: For all firms

$$E_{i,t+1} = \mu_1 + \mu_2 E_{i,t} + \mu_3 E_{i,t-1} + \varepsilon_{i,t} \qquad (5)$$

Where $E_{i,t+1}$ is the earnings before interest and tax at time t+1, $E_{i,t}$ is the earnings before interest and tax at time t, and $E_{i,t-1}$ is the earnings before interest and tax at time t-1

1. Means and t-Statistics for the means of the regression coefficients

	Int	$EBIT_t$	$EBIT_{t-1}$	Adjusted R-squared
Mean	-302.864**	1.125**		0.118
t(Mn)	-3.675	44.677		
Mean	178.533**	1.418**	-1.083**	0.359
t(Mn)	2.114	52.971	-21.910	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$EBIT_{t+1}$	$EBIT_t$	$EBIT_{t-1}$
Mean	52 .208	434 .691	633 .296
Std . Dev .	5502 .016	3733 .234	1969 .838

3. Breusch-Godfrey Lagrange Multiplier Test for autocorrelation

	Int	$EBIT_t$	$EBIT_{t-1}$	$Residual_t$	$Residual_{t-1}$	Adj. R-squared
Mean	-37.101	0.194	-0.221	-0.279	-0.017	0.010
t(Mn)	-0.273	1.089	-1.719	-1.321	-0.061	

Table 4.10

Regressions on the lagged variables of earnings: Exclude exporters firms

$$E_{i,t+1} = \mu_1 + \mu_2 E_{i,t} + \mu_3 E_{i,t-1} + \varepsilon_{i,t} \qquad (5)$$

Where all the variables are the same as in Table 4.9

1. Means and t-Statistics for the means of the regression coefficients

	Int	$EBIT_t$	$EBIT_{t-1}$	Adjusted R-squared
Mean	-352.483**	1.127**		0.119
t(Mn)	-3.640	41.263		
Mean	183.820**	1.419**	-1.088**	0.360
t(Mn)	1.848	48.946	-20.225	

** Significant at 95% confidence level.

2. Descriptive statistics of the regression variables

	$EBIT_{t+1}$	$EBIT_t$	$EBIT_{t-1}$
Mean	7.346	461.270	703.774
Std. Dev.	5966.531	4046.399	2126.224

3. Breusch-Godfrey Lagrange Multiplier Test for autocorrelation

	Int	$EBIT_t$	$EBIT_{t-1}$	$Residual_t$	$Residual_{t-1}$	Adj. R-squared
Mean	-50.146	-0.023	0.002	0.015	-0.037	0.002
t(Mn)	-0.444	-0.794	0.039	0.408	-0.580	

4.5. Model Evaluation

1. Using model selection criteria

From the results of using model selection criteria presented in Table 4.11, the adjusted mean reversion model, after excluding exporters, seems to be the best predictor of earnings since it has the lowest value in all criteria. It also should be noted that, overall, the mean reversion models are more accuracy than the naive time-series models.

2. Using linear regression

Table 4.12 panel A. is the estimation of a simple linear regression between the forecast and the actual value of EBIT. The expected results if the forecast is perfect are 0 for the slope on a constant term and 1 for ∂_2. The slope on a constant term which closest to 0 is a constant term of the mean reversion model after exclude the exporters but the slope on the forecast value from the adjusted mean reversion model is the closest to 1. However, the R^2 for the adjusted mean reversion model after exclude the exporters is the highest at 0.711. Since the slope indicators did not point to the same model, I estimate the equation again but with suppression on a constant term. The results presented in panel B. give the same sense, the slope points to the adjusted mean reversion model but the R^2 favors the adjusted mean reversion model after exclude the exporters.

Conclusively, on average, the adjusted mean reversion model, both for all firms and excluded exporters, are the best predictors, especially if compare to the naïve time-series model.

Table 4.11

Results from Model Selection Criteria

	All Firms			Excluded Exporters		
	Mean Reversion Model	Naïve Model	Adj. Mean Reversion Model	Mean Reversion Model	Naïve Model	Adj. Mean Reversion Model
ESS	1,667,438,060	2,495,822,514	1,493,400,520	1,188,141,098	2,497,242,964	1,121,657,367
MSE	8,775,990	12,669,150	7,619,390	7,425,882	14,953,551	6,756,972
AIC	9,172,327	12,796,469	7,734,238	7,820,554	15,130,499	6,876,893
FPE	9,172,894	12,796,478	7,734,256	7,821,343	15,130,516	6,876,918
HQ	9,742,252	12,969,042	7,891,220	8,367,856	15,359,653	7,033,710
SCHWARZ	10,645,471	13,227,101	8,127,918	9,239,026	15,701,445	7,269,789
SHIBATA	9,136,993	12,793,919	7,730,792	7,779,223	15,126,327	6,872,660
GCV	9,191,695	12,797,771	7,736,014	7,843,588	15,132,635	6,879,086
RICE	9,212,365	12,799,090	7,737,827	7,868,484	15,134,806	6,881,334

where mean reversion model: the regression from the third section of Table 4.5

naïve model: the regression from the Table 4.9

adjusted mean reversion model: the regression from the fourth section of Table 4.5

mean reversion model(exclude exporters): the regression from the third section of Table 4.8

naïve model(exclude exporters): the regression from the Table 4.10

adjusted mean reversion model(exclude exporters): the regression from the fourth section of Table 4.8

Table 4.12

Regressions to test the forecasting performance

$$EBITA_t = \partial_1 + \partial_2 EBITF_t + \varepsilon_{i,t} \qquad (6)$$

When $EBITA_t$ is the actual value of EBIT at time t, and $EBITF_t$ is the forecast value of EBIT at time t.

A. Constant allowed

	Int	$MM_{i,t}$	$NM_{i,t}$	$AMM_{i,t}$	$XMM_{i,t}$	$XNM_{i,t}$	$XAMM_{i,t}$	Adj. R2
Mean	116.118**	1.060**						0.618
t(Mn)	0.635	17.942						
Mean	584.581**		0.745**					0.258
t(Mn)	2.333		8.354					
Mean	222.364			1.023**				0.479
t(Mn)	1.041			13.538				
Mean	77.986				1.377**			0.681
t(Mn)	0.396				18.963			
Mean	689.567**					0.738**		0.254
t(Mn)	2.342					7.625		
Mean	81.059						1.403**	0.711
t(Mn)	0.433						20.335	

** Significant at 95% confidence level.

MM: Mean reversion Model, NM: Naïve time-series Model, AMM: Adjusted Mean reversion Model (for all firms) and

XMM: Mean reversion Model, XNM: Naïve time-series Model, XAMM: Adjusted Mean reversion Model (excluding exporters firms)

B. Constant suppressed

	$MM_{i,t}$	$NM_{i,t}$	$AMM_{i,t}$	$XMM_{i,t}$	$XNM_{i,t}$	$XAMM_{i,t}$	Adj. R-squared
Mean	1.070**						0.620
t(Mn)	18.858						
Mean		0.787**					0.241
t(Mn)		8.918					
Mean			1.045**				0.479
t(Mn)			14.363				
Mean				1.385**			0.683
t(Mn)				19.958			
Mean					0.784**		0.234
t(Mn)					8.164		
Mean						1.403**	0.686
t(Mn)						20.116	

** Significant at 95% confidence level.