CHAPTER 3

SAMPLE AND METHODOLOGY

In this chapter, the sample and methodology used in this paper are presented. The samples are both accounting data and market data of firms listed in the SET from 1992-2003. The methodology mainly based on two models to predict the future earnings; the mean reversion model and the naïve time-series model. The chapter ends with the hypotheses lie behind both models.

3.1 SAMPLE

- Sample covered firms listed in the Stock Exchange of Thailand (SET) from 1992 through 2003 and have the information for every variable.
- All the data are on a yearly basis and are collected from ISIM database and SETSmart.
    - Accounting data: the total asset, the book value of equity, earning before interest and tax, the total sales, number of shares outstanding and dividend yield.
    - Market data: market value of stock.
- I also pick up the multinational companies which report the foreign activities. The source of selected samples is derived from the Thailand Exporter's Directory of Department of Export Promotion[1], Ministry of Commerce. I select the export companies which also are the listed company, approximately 215 firms, and obtain only Thai Multinational firms which have foreign involvement, measured by the export ratio, more than 10 percent. The export ratio represents the proportion of company's export and total sales. This selection is for resolving the currency exposure effect and will be excluded in the model.

[1] http://exporter.thaitrade.com

3.2 METHODOLOGY

Mean Reversion Model

Step 1. Calculate the average profitability (EBIT/Assets) rate for each firm in three periods: Whole period (1992-2000), Before Crisis period (1992-1996), and During Crisis period (1997-2000) and then ranked them in percentile. Afterward, categorized firms by their characteristic and ranked their profitability all over again. The characteristics used in categorizing are sectors, the market-to-book ratio, size, the dividend pay out ratio, and the earnings-to-price ratio.

Step 2. Choose the characteristics from the descriptive panel in step 1., which seems to have a relationship with profitability, to be a variable in the regression against expected profitability. Then regress these variables to capture differences across firms in expected profitability.

$$E(P)_{i,t} = \beta_1 + \beta_2 X1_{i,t} + \beta_3 X2_{i,t} + \ldots\ldots\ldots\ldots\ldots\ldots \beta_n Xn\text{-}1_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Where $E(P)_{i,t}$: The expected profitability at the end of year *t*,

$X1_{i,t} \ldots Xn\text{-}1_{i,t}$: characteristic variables from step 1.

Step 3. Simple partial Adjustment Model[2]: The variables used in explaining the changes in profitability are deviations from expected earnings ($P_{i,t} - E(P)_{i,t}$) and the previous changes in earnings. Regressing the following variables on change in profitability for firm *i*, from time *t* to *t+1*.

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

Where $\Delta P_{i,t+1}$: future changes in profitability,

$P_{i,t}$: observed profitability, ($EBIT_t/Asset_t$)

$E(P)_{i,t}$: expected profitability from step 2,

$\Delta P_{i,t}$: lagged changes in profitability.

---

[2] see Ramanathan (2002) *Introductory Econometrics with Applications, p.442*

Step 4. Non-linear partial adjustment of profitability Model: This test will attempt to gather evidence on whether the predictability of profitability is largely due to the mean reversion of profitability.

$$\Delta P_{i,t+1} = \lambda_1 + [\lambda_2 + \lambda_3 dNDV_{i,t} + \lambda_4 (dNDV_{i,t} * DV_{i,t}) + \lambda_5 (dPDV_{i,t} * DV_{i,t})]DV_{i,t} + [\lambda_6 + \lambda_7 d\Delta NP_{i,t} + \lambda_8 (d\Delta NP_{i,t} * \Delta P_{i,t}) + \lambda_9 (d\Delta PP_{i,t} * \Delta P_{i,t})]\Delta P_{i,t} + \varepsilon_{i,t} \quad (3a)$$

Where $dNDV_{i,t}$, $dPDV_{i,t}$, $d\Delta NP_{i,t}$ and $d\Delta PP_{i,t}$ are dummy variables introduced to captured non-linearity. $dNDV_{i,t}$ is 1 when $DV_{i,t}$, the deviation of profitability from its expected value is negative, and 0 otherwise. $dPDV_{i,t}$ is 1 when $DV_{i,t}$ is positive and 0 otherwise. $d\Delta NP_{i,t}$ is 1 when the change in profitability for *t-1* to *t*, $\Delta P_{i,t}$, is negative. $d\Delta PP_{i,t}$ is 1 when $\Delta P_{i,t}$ is positive.

The derived equation is as followed;

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

Where 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.

Step 5. Earning prediction Model: This test addresses the issue of whether changes in earnings are predictable and how much of the predictability traces to the mean reversion of profitability.

$$\Delta E_{i,t+1} = \omega_1 + [\omega_2 + \omega_3 dNDV_{i,t} + \omega_4 (dNDV_{i,t} * DV_{i,t}) + \omega_5 (dPDV_{i,t} * DV_{i,t})]DV_{i,t} + [\omega_6 + \omega_7 d\Delta NE_{i,t} + \omega_8 (d\Delta NE_{i,t} * \Delta E_{i,t}) + \omega_9 (d\Delta PE_{i,t} * \Delta E_{i,t})]\Delta E_{i,t} + \varepsilon_{i,t} \quad (4a)$$

The variables in the first line are those in the first line of (3a). $d\Delta NE_{i,t}$ is 1 when the change in earnings for *t-1* to *t*, $\Delta E_{i,t}$, is negative. $d\Delta PE_{i,t}$ is 1 when $\Delta E_{i,t}$ is positive.

The derived equation is as followed;

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

Where ΔE i,t+1 : future change in earnings,

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.

And as to make sure that if mean reversion does exist, it happens because the adjustment in earnings (the numerator of profitability), not the change in asset (the denominator of profitability), I scaled the change in earnings with asset; ΔE i,t+1 = (E i,t+1/E i,t)/Asset$_t$

The Naïve time-series Model

This investigation uses only the basic intuitive that earnings have the time-series properties. So, in this model, the variable used is only the lagged earnings.

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

The Exclude Exporters Model

Since the data available in Thailand is only about ten years which include the period of the crisis in 1997 and it might has the effect on the result, so I resolved by running the two models once again but exclude the firm with the significant export ratio[3]. This test is to cut off the currency exposures that might have the effect on prediction of earnings.

[3] more than 10 percent of export to total sales

Evaluation of Models

1. Out-of-the-Sample regression

This tests the forecasting accuracy of each model in order to forecast the change in earnings one year ahead. The coefficients used in the out-of-sample forecasts are those resulted from the last step of each regression. When out-of-the-sample forecasts are generated, calculate criterion statistics as shown followed;

MSE: (ESS)/(n-k) AIC:$(ESS/n)e^{2k/n}$

FPE: (ESS/n)(n+k/n-k) GCV: (ESS/n)[1-(k/n)]-2

HQ: (ESS/n)(ln n)2k/n RICE: (ESS/n)[1-(2k/n)]-1

SCHWARZ: (ESS/n)nk/n SHIBATA: (ESS/n)(n+2k)/n

A model with lower values of these criterion statistics would be judged superior in terms of forecasting ability.

2. Simple linear regression between the forecast and the actual value

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

Where $EBITA_t$: Actual value of EBIT at time t,

$EBITF_t$: Forecast value of EBIT at time t.

If the forecast is accuracy, it is expected that ∂_1 is closer to zero and ∂_2 to be close to 1. To get a clearer outcome, I will also run the regression with the suppression on constant term and expect ∂_2 to be close to 1.

3.3 HYPOTHESIS

Mean Reversion Model

For equation (1), assume that all the characteristics in step 1. can be used in explaining the profitability, the expected result would be as stated follow;

- Sectors: the sector with the records of higher profitability in most of the percentile should has a positive relation with the expected profitability, on the other hand, the sector with the evidences of lower profitability in most of the percentile should has a negative relation with the expected profitability.

- The market-to-book ratio: since the market value of a firm is the current value of all future net cash flows, it is expected to have a positive relation with the expected profitability.
- Size: the result can turn out in both ways; the larger scale of assets might increase the efficiency and opportunity to meet the demand. In this case, a positive relation is expected. Yet, larger asset can also entail some loss in efficiency because managerial may become more difficult given the larger scale of firm, not to mention that the firm has to make the economy of scale to boost the profitability. A negative relation is expected from the latter case.
- Dividend: Miller and Modigliani (1961) state that dividends have information about expected earnings because firms target dividends to the permanent component of earnings. Hence, a positive relation to the expected profitability is expected.
- The earnings-to-price ratio: a low earnings yield might be a consequence of the investors' expectations of a continual high future earnings which, based on the mean reversion theory, should never occur. The other reason may be its recent performance has been poor and earnings are currently depressed. In any case, the same relation is expected, a positive relation. However, if market efficiency is assumed, price should represent the current value of future earnings, a negative relation is expected instead.

For equation (2),

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

To confirm the evidence of mean reversion in profitability, α_2 is expected to be negative and α_3 is expected to be positive. Both of them should be equal, or at least close, in absolute value, which will be the rate of mean reversion per year. α_4 is expected to be negative since firms with a big jump in profitability this year normally will face a limit and not capable of making a big jump again next year. The best they probably can do is to remain at the same level of profitability.

For equation (3b),

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

Since $DV_{i,t} = P_{i,t} - E(P)_{i,t}$, λ_2 is expected to be negative, in line with the previous equation. λ_3 is expected to be negative for the reason that mean reversion should be stronger when profitability is below its mean. λ_4 and λ_5 should have a positive and negative signs respectively because when profitability is farther from its mean, a reversion is more possible to occur. From all these reasons of the mean reversion concept, λ_7 is expected to be negative, λ_8 is expected to be positive, and λ_9 is expected to be negative.

For equation (4b),

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

All the slopes should be like those of equation (3b) to confirm that some extent of the predictability in changes in earnings are from the mean reversion of profitability.

The Naïve time-series Model

From equation (5),

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

Base on the concept of mean reversion, μ_2 should be negative and μ_3 should be positive.

The Exclude Exporters Model

All equations should have more explanatory power as the effect of the currency exposure has been partly removed.