CHAPTER 5

DETERMINANTS OF STOCK RETURN AND VOLATILITY

In this chapter, we need to find the daily return figure on SET index and other sectors index. The other sectors index, (or industrial sector index) includes Banking sector index, Financial sector index, Communication sector index, Energy sector index, Electronic sector index. We selected the data during 1995-2000. The reason that we need to find the return of each variable, is each variable has a difference number and the way to calculating for making the weighted index. Let see Dow Jone Industry Average is somewhere around 9000 points while SET index is 600 points. So we need to adjust those numbers to be the changed number or sometime it was called "percent change".

5.1 Calculating Return

For the computing return on each sector index, we used index of that sector at time (t) minus index of that sector at one lag time (t −1). And then divided by index of that sector at one lag time (t −1). For example, today SET index closed at 370 points and yesterday SET index closed at 360 points. So the return on SET index will be

$$RSET = \frac{370 - 360}{360}$$

$$RSET = 0.028$$

The return on SET index can be called "changed" of SET index. So the equation that we will get is

SET index:

$$RSET = \frac{SET_t - SET_{t-1}}{SET_{t-1}}$$

$RSET$ = Return on SET index

SET_t = SET index in the present or at time (t)

SET_{t-1} = SET index in the past or at one lag time (t-1)

Then we did apply this algebra to Banking sector index and other sector index as followed:

Banking Sector Index:

$$RBANK = \frac{BANK_t - BANK_{t-1}}{BANK_{t-1}}$$

RBANK = Return on Banking sector index

$BANK_t$ = Banking sector index in the present or at time (t)

$BANK_{t-1}$ = Banking sector index in the past or at one lag time (t-1)

Financial sector index:

$$RFIN = \frac{FIN_t - FIN_{t-1}}{FIN_{t-1}}$$

RFIN = Return on Financial sector index

FIN_t = Financial sector index in the present or at time (t)

FIN_{t-1} = Financial sector index in the past or at one lag time (t-1)

Communication sector index:

$$RCOM = \frac{COM_t - COM_{t-1}}{COM_{t-1}}$$

RCOM = Return on Communication sector index

COM_t = Communication sector index in the present or at time (t)

COM_{t-1} = Communication sector index in the past or at one lag time (t-1)

Energy sector index:

$$RENER = \frac{ENER_t - ENER_{t-1}}{ENER_{t-1}}$$

RENER = Return on Energy sector index

$ENER_t$ = Energy sector index in the present or at time (t)

$ENER_{t-1}$ = Energy sector index in the past or at one lag time (t-1)

Electronic sector index:

$$RELEC = \frac{ELEC_t - ELEC_{t-1}}{ELEC_{t-1}}$$

RELEC = Return on Electronic sector index

$ELEC_t$ = Electronic sector index in the present or at time (t)

$ELEC_{t-1}$ = Electronic sector index in the past or at one lag time (t-1)

5.2 OLS (Ordinary Least Square)

Secondly we will use the equation similar to OLS (Ordinary Least Square) methodology. We put various variables that will have effect to the return on each sector. The equation will be:

$$Y_t = \beta_1 + \beta_2 X_{2t} + \beta_3 X_3 + \ldots \varepsilon_t$$

But one thing that we have to monitor closely is "Y". Y is a dependent variable that we used for estimating the return on SET index and other sector index. "X" that is independent variable. It had to be the return data (similarly to the lift hand side data). Now we will se what independent variables will be used.

Dependent variable Y_i	Variable	Meaning
	RSET	SET index return
	RBANK	Bank sector index return
	RFIN	Financial sector index return
	RCOM	Communication sector index return
	RENER	Energy sector index return
	RELEC	Electronic sector index return
Independent variable X_i	Variable	Meaning
	RDJIA	Dow Jone index return
	RIXIC	Nasdaq index return
	RNIX	Nikkei 225 index return
	RHK	Hang Seng index return
	RCNET	Changed of net volume buy / sell of local investors
	RINET	Changed of net volume buy / sell of institution investors
	RFNET	Changed of net volume buy / sell of foreign investors
	RVOL	Changed of market volume
	RBAHT	Changed of Baht/Dollar US

RDJAI:

$$RDJIA = \frac{DJIA_t - DJIA_{t-1}}{DJAI_{t-1}}$$

RDJIA   =   Return on Down Jone Industry Average

$DJIA_t$ =   Dow Jone Industry Average in the present or at time (t)

$DJIA_{t-1}$ =   Dow Jone Industry Average index in the past or at one lag time (t-1)

RIXIC:

$$RIXIC = \frac{IXIC_t - IXIC_{t-1}}{IXIC_{t-1}}$$

RIXIC   =   Return on Nadaq index

$IXIC_t$ =   Nasdaq index in the present or at time (t)

$IXIC_{t-1}$ =   Nasdaq index in the past or at one lag time (t-1)

RNIX:

$$RNIX = \frac{NIX_t - NIX_{t-1}}{NIX_{t-1}}$$

RNIX   =   Return on Nikkei 225

NIX_t =   Nikkei 225 in the present or at time (t)

NIX_{t-1} =   Nikkei 225 in the past or at one lag time (t-1)

RHK:

$$RHK = \frac{HK_t - HK_{t-1}}{HK_{t-1}}$$

RHK   =   Return on Hang Seng Index

HK_t =   Hang Seng index in the present or at time (t)

HK_{t-1} =   Hang Seng index in the past or at one lag time (t-1)

RCNET:

$$RCNET = \frac{CNET_t - CNET_{t-1}}{CNET_{t-1}}$$

RCNET   =   Changed of net volume of buy/sell of local investors

$CNET_t$ =   Net volume buy/sell of local investors in the present or at time (t)

$CNET_{t-1}$ =   Net volume buy/sell of local investors in the past or at one lag time (t-1)

RINET:

$$RINET = \frac{INET_t - INET_{t-1}}{INET_{t-1}}$$

RINET = Changed of net volume of buy/sell of institution investors

$INET_t$ = Net volume buy/sell of institution investors in the present or at time (t)

$INET_{t-1}$ = Net volume buy/sell of institution investors in the past or at one lag time (t-1)

RFNET:

$$RFNET = \frac{FNET_t - FNET_{t-1}}{FNET_{t-1}}$$

RFNET = Changed of net volume of buy/sell of foreign investors

$FNET_t$ = Net volume buy/sell of foreign investors in the present or at time (t)

$FNET_{t-1}$ = Net volume buy/sell of foreign investors in the past or at one lag time (t-1)

RVOL:

$$RVOL = \frac{VOL_t - VOL_{t-1}}{VOL_{t-1}}$$

RVOL = Changed of market volume

VOL_t = Market volume in the present or at time (t)

VOL_{t-1} = Market volume in the past or at one lag time (t-1)

RBAHT:

$$RBAHT = \frac{BAHT_t - BAHT_{t-1}}{VOL_{t-1}}$$

RBAHT = Changed of Baht/Dollar US

$BAHT_t$ = Baht/Dollar US in the present or at time (t)

$BAHT_{t-1}$ = Baht/Dollar US in the past or at one lag time (t-1)

OLS for Return on SET index:

$$RSET_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} + \beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

DJIA, Dow Jone Industry Average is one of index that weights the price and market capital of stocks from top 30 companies in New York Stock Exchange (NYSE). It was one of variables that would effect to emerging market such as Stock Exchange of Thailand (SET). Foreign investors or fund managers use DJIA as a leading indicator for the world of stock market. Foreign investors and fund managers did not only invest in Thailand country, but also invest in many countries or regions. Their fund would go, wherever it offered higher return. Thailand stock market, for example, did not have favorable condition such as unstable political, liquidity trap, and so on. The foreign investors then would reallocate their (hot) money to the other places where stock prices were cheap and could provide higher return.

We would expect that Dow Jone Industry Average will have a positive correlation to SET index, Banking sector index, and Financial sector index, because of all type of investors like to use DJIA to be a leading indicator to see how the situation of the whole stock market is.

IXIC is NASDAQ index. It is the index that calculates by using technology stocks such as Microsoft, Intel, Sun Micro-system and so on. Nowadays we use technology in life. For example, people demand computer that can work more effectively. They want faster IT-processor and Intel, who can supply the fastest chip to the market, can take away the market from its competitors. Thus Intel stock price in IXIC will rise as the company releases its positive operating performance. What would happen to other countries? Those foreign investors and fund managers will look for other countries that produce the products (OEM) for Intel. Then, they invest in a company, which its stock price is still cheap. In Thailand, HANA is one of company that producing chip (Wafer Fabrication) for Intel.

For IXIC index, we would expect that NASDAQ index would have positive correlation to SET index, Communication sector index, and Electronic sector index. Because NASDAQ index is a weighted index that presents about technology stocks that traded in NYSE (New York Stock Exchange). If NASDAQ goes up then investors will look for stocks that are technology stock. In Thailand there are not so many technology stocks but in the future some more technology stocks will be issued as IPO (Initial Public Offering).

Nikkei 225 and Hang Seng index are in the same regional as SET index. We expect Nikkei 225 and Hang Seng index would normally moved the similar pattern with SET index that is the reason why we pick up Nikkei 225 and Hang Seng index to be a part of our variables. And also foreign investors use both markets to be the leading indicators of stock market around the Asia regional. The recovery of SET Index after crisis in 1997 is not as fast as Nikkei 225 and Hang Seng Index. Nikkei and Hang Seng have more financial instrument for foreign investors and fund managers to invest. The other financial instruments are option index, future index. People in both countries can also buy or sell stocks in United States. Thailand brokers, however, are not allowed.

OLS for Return on Banking sector index:

$$RBANK_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} + \beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

In Thailand most of local investors are short-term investors. Some of them are speculators. If the market around our regional such as Hang Seng or Nikkei 225 go up, these speculators will buy stock in the early morning (market pre-open, an open) and (1) sell as soon as they can have capital gain, or (2) sell at the end of market close. That implies that these short-term investors do not have enough money to hold the stocks for over night. Local investors, mostly short-term investor, are 35 percents of Thai stock market. Most of them do not do the fundamental analysis of the stock. We can observe the behavior of these local investors by visiting at some brokers and watch them sitting in the front of real-time trading monitor. When some stock jumps, they will buy that stock no matter if there is good news or not. If there is any "panic" sell, they will follow selling as quickly as they can without any reason, no greed but fear.

Banking sector is the important frames for financial system. NPL was happen after the bubble has been exploded. Every bank has to increase their reserves under the new BOT's (Bank of Thailand) regulation. And they prefer holding more money, as they are afraid of NPL. Asset management department for each bank is working hard. Some of them such as DBS Thai Danu Bank had sold their non-performing assets that came from bad debt restructuring at 75 percents discount.

Banking sector is still have high correlation to SET index. It has similar moving pattern. As a result, local investor will buy Banking stocks if they expect SET index will go up and will sell it if the market moves opposite way. So this variable would be present how foreign investors use this sector index to be the leading sector to make the other sectors to follow.

OLS for Return on Financial sector index:

$$RFIN_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} +$$
$$\beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

In 1997 many financial institutions had been collapsed. There were 56 institutions that had been closed as a result of economic crisis. Some of them have to merge with other foreign company to stay alive. Most of assets that financial institutions had, were loans in property sector. In the past financial institutions made money buy leading money and earn higher interest. After the crisis, financial institutions have more service to sell to the market. Investment banking, for example, becomes important to this sector. What does investment banking do? They consult with the companies who need a debt-restructuring plan, listed companies that had negative operating result. Listed companies, that have "Net Loss" for 3 years, have to move to rehabilitation sector. The investment banking help them out by corporate re-sturcturing, re-engeineering, re-financing. Moreover non listed-companies need a consult for IPO (Initial Publish Offering).

For institution investors, there are many mutual investment funds after the crisis. Institution investment is under the management of fund manager(s). He or she will manage his or her portfolio to keep in SET index and try to make more return than return on SET or if the return on SET is negative he or she have to make less negative return then SET index, similar to foreign fund manager. Institution investors have more information from government than other market player does. He or she cares if his or her fund have a good NAV (net asset value). They need NAV to increase. People will invest in the funds that have positive NAV and higher rate of return. We except this variable would be the highest weighted investment sector those foreign investors would put their investment capital on their portfolio more than the other variables would.

OLS for Return on Communication sector index:

$$RCOM_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} +$$
$$\beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

Communication sector has high correlation to SET index. As we know our world have to communicate in many ways such as cellular phone, satellite or Internet. There are many companies such as AIS, TA, JASMIN, SHIN SATELLITE, TAC, AND UCOM. Those are in the communication industry and they make a lot of money from airtime. This communication sector is a variable that

would explain the new economy stock that all types of investors as local, institution and foreign investors would pay more attention for keeping in their portfolio to be positive return. For foreign investors, he or she is under this industry because it had boom in their countries. What do foreign investors invest in SET market? They are doing the same as institution investors. Most of them are fund manager and will invest in the stocks that have strong fundamental. Sometime we call a good stock is a "blue chip" stock because "blue chip" is the most expensive chip in casino. Foreign investors are a medium-term and long-term investment. They buy when they think that stock is undervalued. Foreign Investors sometimes speculate in the market. They, however, do not speculate as often as Hedge Funds[1] do.

OLS for Return on ENERGY sector index:

$$RENER_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} + \beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

Energy sector, is the important variable that related to exchange rate since Thailand has to import energy such as crude oil from other countries. The energy cost is much more expensive after BOT has shift "fixed exchange rate system" to "managed float system." Thai Bath was devaluated from Bt25 to Bt45-50 per USD. The crude oil price increased more than 70 percent and had impacted the cost of production. All manufacturer electricity or gasoline to run their plants. Two-third of electricity in Thailand is generated from Natural Gas, Oil. If the energy price such as crude oil price is high, the electricity price will also high.

Foreign investors use this data for forecasting economic and pick up stocks. Foreign investors can make huge return both from capital gain in stock market and form the exchange rate. Let analyze some of their strategies: foreign investors buy Thai stock. They need to convert their currency to local currency i.e. Thai Baht. When they sell their stocks, they need to convert Baht back

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[1] Hedge fund is mutual fund that trades in the market very quick, make profit and leave immediately. The money is called "hot" money. The hedge fund mangers do not need a good research form broker, but do need more discounts to trim the transaction cost. Currently, behaviors of foreign investor have changed. Sometime they sell very heavily in order to dump the price and then they buy back since SET allows foreign investor to do "shot-selling" (borrow stocks for selling and then buy stock back to return to borrower). The foreign investors reports it "shot-selling" position and transaction to SET and do not publish the position to the public. This tool provides more opportunities to foreign investors than local and institution investors.

to their currency or US dollar and sent it to their home country. What would happen if they could buy BBL stock at Bt50 per share. (FX rate at Bt50 per USD) It means that 1 US dollar can buy one share of BBL. Then the price of BBL goes up to 60 Baht a share. They will sell it and get capital gain of Bt10. We knew that stock market and exchange rate had negative correlation. If the market is good then many foreign investors will came and make Thai Baht appreciated. Thai Baht jumped from Bt50 to Bt45 Baht per USD. Then this foreign investors will convert its Bt50 at new rate and get 1.11 USD which already include both Bt10 from capital gain, and Bt5 from FX gain.

OLS for Return on Electronic sector index:

$$RELEC_t = \beta_1 + \beta_2 RDJIA_{2t} + \beta_3 RIXIC_{3t} + \beta_4 RNIX_{4t} + \beta_5 RHK_{5t} + \beta_6 RCNET_{6t} + \beta_7 RINET_{7t} + \beta_8 RFNET_{8t} + \beta_9 RVOL_{9t} + \beta_{10} RBAHT_{10t} + \varepsilon_t$$

Electronic sector has less correlation to SET index. It has high volatility. Most of electronic companies in Thailand ship their product abroad. Therefore all key players; local, institution and foreign investors; watch index such as NASDAQ. If they found that analysts forecast high growth rate in NASDAQ for a few years, they will invest in this sector. The volume trade presents for how interesting stock market is. If the volume is hefty, and stock prices increase, it implies that tons of money flow into stock market. It will look bright as long as volume remains increasing. Electronic sector is still interesting unless the volume trade is hefty one day and turns tedious another day.

For volume trading in stock market can be separated to three types as volume from local investors, institution investors, and foreign investors. The market volume was summarized by the volume of buying and selling of local investors, institution investors and foreign investors.

Net volumes buy or sell of local investors, institution investors and foreign investors, are the number that calculated by using buying volume minus selling volume on everyday. If the numbers come out with positive numbers, which means investors buy stocks more than sell their stocks. On the other hand, if the number come out with negative numbers, which means selling side of investors more than buying side. These numbers are posted in newspaper everyday. Local investors always asked for this number as the reasons those local investors, want to know the foreign and institution investors are selling or buying, and also how much of money are flowing in to the market.

5.3 GARCH (Generalized Autoregressive Conditional Heteroscedasticity

Third, we will see for the how error or volatility was during the specified period of time. So we use Generalized Autoregressive Conditional Heteroscedasticity or it called as GARCH model to study the volatility. In this study we will use the GARCH (p,q) that is GARCH (1,1). It means the one lag of error and one lag of variance. Because Robert Engle had tested that GARCH (1,1) was suitable for stock, currency exchange and bond market. The model for GARCH (1,1) is:

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{q} \lambda_j \sigma_{t-1}^2$$

With GARCH (1,1) then we get value of α_0, α_1, and λ_j then we can find the variance σ_t^2 of error term in OLS equation in each stock sector return. After that we plot all σ_t^2 in period of time and see the pattern of σ_t^2. Next we will compare the σ_t^2 of return on each sectors by measuring the σ_t^2 in the form of standard deviation. The measuring technique was GARCH variance series. Completing this process, we can identify which return of stock sector(s) will be more volatile and find out the correlation with the behavior of foreign investors (Foreign volume trading). In summary the methodology in this study is to calculate return of each sector, then put some variables into the equation. After that we use GARCH (1,1) to calculate the value of σ_t^2 or error term. Finally we use GARCH variance series to find out the standard deviation of σ_t^2 and rank its sector by sector.

A problem that we meet is each country has its own holiday. Some country has that holiday while other has working day. So we need to cut some data from that date for every country out. For example 5 December of each year is our King birthday. So SET does not be traded but other will be traded as this result we need to cut that data on date out for every country out.