Chapter 3

The Level of Market Integration Measurement

In financially integrated stock markets, capital should flow across borders to ensure the identical price of risk. Bekaert (1995) shows that there are two major approaches to testing and measuring the level of market integration. The first approach assumes that markets are integrated and that a particular asset-pricing model holds. The second approach models the restriction explicitly and derives their effects on equilibrium returns. The second approach seems to be quite unsatisfactory because the restriction about the particular barrier to investment has to be imposed. Also, in real world, there are too many different barriers to consider. Though the first approach may depend on how well the pricing model selected, the relative measure using the models may still be inferred as explained by Levine and Zervos (1998). In this study, Capital Asset Pricing Model (CAPM) is used as the based model in the analysis concerning the measure of the level of stock market integration.

3.1. The degree of stock market integration

As mentioned earlier that the degree of stock markets integration might be measured in many approaches. The pure measure using law of one price and the indirect measure using the change in capital flow are the two examples of measuring. This study formulates the pure measure via law of one price. Certainly, in this approach, it is necessary to measure how large each stock market "misprices" it's portfolio regarding the systematic risk incorporated. Thus, the model of asset pricing is essential in this task. The Capital Asset Pricing Model (CAPM), the most well-known model in finance since the finding by Sharpe (1964), Lintner (1965), and Mossin (1966), is employed as the base of "mispricing" measure. The traditional model is the *ex ante* and single-period model. Some extension in the model is necessary for this study to meet the objective in the degree of stock markets integration measurement.

The Models

The Conditional Capital Asset Pricing Model (CCAPM) by Mark (1988), Harvey (1989), and Bodurtha and Mark (1991) is applied to measure the degree of market integration. This version of CAPM allows both the expected return and beta to be time-varying. The model could be formulated in this way.

$$E(R_{i,t} \mid \Omega_{t-1}) = E(R_{m,t} \mid \Omega_{t-1})\, \beta_{i,t} \qquad (2)$$

where

$R_{k,t}$ is the rate of return on the asset k, in excess of risk-free rate at time t.

Ω_{t-1} is the information set containing the information upto time t.

$\beta_{i,t}$ is the amount of systematic risk on the asset i at time t conditioning on the information set Ω_{t-1} which is equivalent to

$$cov(R_{i,t}, R_{m,t} | \Omega_{t-1}) / var(R_{m,t} | \Omega_{t-1})$$

Assumptions

1. Ω_{t-1} is common to all market participants especially to investors
2. The market is informational efficient.
3. The expectations are rational.
4. The market is considered to be equilibrium.

It must be noted that the model is in the *ex ante* or the expected form. The expectations are unable to be observed. It is necessary to assume the linearity of the projections of expected excess return of any assets, including the market, onto the information set. Also, the information set, Ω_{t-1}, is unable to be observed in reality. Thus, again, it is necessary to proxy it by the information subset, Z_{t-1} which is contained in Ω_{t-1}.

From the assumption of linearity, the expected return could be formulated as

$$E(R_{k,t} | Z_{t-1}) = Z_{t-1}\gamma_k + V_{k,t} \quad (3)$$

where

Z_{t-1} is an (1 x M) instrumental vector contained in Ω_{t-1} .

γ_k is an (M x 1) projection vector.

$V_{k,t}$ is the projection error.

By the assumption 3, the rational expectation, it yields the relationship between the expectation and the realization.

$$R_{k,t} = E(R_{k,t} | Z_{t-1}) + e_{k,t} \quad (4)$$

where

$e_{k,t}$ is the deviation of the realization from the expectation and $e_{k,t}$ is orthogonal to the information set Z_{t-1}.

I combine this assumption, implies the equation 3, and rewrite the equation 2 as follows.

$$R_{k,t} = Z_{t-1}\gamma_k + \varepsilon_{k,t} \qquad (5)$$

where

$\varepsilon_{k,t} = V_{k,t} + e_{k,t}$ and $\varepsilon_{k,t}$ is also orthogonal to the information set Z_{t-1}.

By equation 5, it implies the statistical models

$$R_{m,t} = Z_{t-1}\gamma_m + \varepsilon_m \qquad (6.1)$$

$$R_{i,t} = Z_{t-1}\gamma_i + \varepsilon_i \qquad (6.2)$$

From 6.1 and 6.2, imposing the restriction on the expected excess return which is implied by Capital Asset Pricing Model (CAPM) could yield the relationship of the two expected returns.

$$Z_{t-1}\gamma_i = Z_{t-1}\gamma_m \beta_i \qquad (7)$$

In equation 7, it could be reduced to the traditional form of CAPM by eliminating the information set Z_{t-1} in the case of constant β_i over time. This will result in the ability to estimate the β_i as an estimated parameter in the system. Interestingly, a number of literatures consistently argued that the constant β_i is not appropriate in modeling. The time-varying β_i, thus, is widely accepted which cause the necessity of assumption of the governing process for the β_i.

$$Cov_{t-1}(R_{i,t}, R_{m,t}) = E[(R_{i,t} - E[R_{i,t} | \Omega_{t-1}])\ (R_{m,t} - E[R_{m,t} | \Omega_{t-1}]) | \Omega_{t-1}] \equiv h_{im,t} \qquad (8)$$

then,

$$\beta_{i,t} = h_{im,t} / h_{mm,t} \qquad (9)$$

Bollerslev (1986) and Bollerslev, Engle, and Wooldridge (1988) proposed the Generalized Auto Regressive Conditional Heteroskedasticity (GARCH). The GARCH(1,1) is widely used in this case.

$$H_{R,t} = H_0 + H_1 .^* \varepsilon_{t-1} \varepsilon_{t-1}' + H_2 .^* H_{R,t-1} \quad (10)$$

where

$\varepsilon_{t-1} = R_{t-1} - E[R_{t-1} | Z_{t-2}]$

H_0 is a symmetric positive definite matrix.

$.^*$ represents Hadamard, element by element, multiplication.

Thus, the expectations restriction of the CAPM in equation 7 can be rewritten

$$Z_{t-1}\gamma_i = Z_{t-1}\gamma_m (h_{im,t} / h_{mm,t}) \quad (11)$$

3.2. The empirical work

Using the *ex post* conditional form of CAPM as shown, the estimation of the degree of stock markets integration is achieved by adding the intercept term to equation (11).

$$Z_{t-1}\gamma_i = \alpha_{i,t} + Z_{t-1}\gamma_m (h_{im,t} / h_{mm,t}) \quad (12)$$

The $\alpha_{i,t}$ in equation (12) is the measure of stock markets integration. If the markets are fully integrated, the $\alpha_{i,t}$ should approach zero which implies no mispricing or no remaining of arbitrage opportunity. Most of the previous works in estimating the degree of market integration treats the pricing errors as constant over the sample period even though there have been significant liberalizations of capital controls in many economies during the period. In this case, the more appropriate $\alpha_{i,t}$ should be allowed to be time-varying which is consistent with Bekaert and Harvey (1995). The estimation of the mispricing over a sequence of time periods implies the time-varying of $\alpha_{i,t}$. The time-series behavior of the mispricing parameters is also attempt to be characterized. The "rolling regression" technique is very useful for time-varying estimation as employed by Foster and Nelson (1991), and Korajczyk (1996). The technique of rolling regression is very understandable. Each national market daily index is rolled over 6 months to form the estimation for each monthly estimation. For example, the Hong Kong daily stock market index is collected from January 1990 to June 1990 for the estimation of the degree of stock market integration in June 1990. Similarly the Hong Kong daily stock market index from February 1990 to July is applied for the estimation of July

1990. The rolled process is performed over the entire horizon of the data period to obtain the monthly time-varying degree of stock market integration for each country.

In focusing on deviations of $\alpha_{i,t}$ from zero in both direction, positive and negative, one of the natural measures of mispricing across markets is to eliminate the sign from the magnitude. This elimination of sign may help the analyst to rank the level of market integration for each country easier. White (1980) and Korajczyk (1996) used the *average squared mispricing coefficient.* The average squared mispricing coefficient is calculated by squaring the $\alpha_{i,t}$ and divide by the number of observations in the sample. However, they employ the selected assets in each national market in their procedure which is quite different from my study. In this study, the market return which is the national portfolio is applied instead of the selected assets in those studies. The estimated mispricing in this study, thus, represents the overall national market. To avoid the ambiguous direction of the mispricing, the *adjusted price deviation* is calculated by squaring the estimated $\alpha_{i,t}$ for each country.

The estimation

I estimate the degree of Asian stock markets integration based on the conditional ICAPM with multivariate GARCH(1,1) as governing process for covariance risk (the equation (12)). The maximum likelihood estimation (MLE) is employed in this study. In a GARCH model (Bollerslev (1986)), the variance term depends on the lagged variances as well as the lagged residuals. Khanthavit (1995) finds that the GARCH (1,1) can explain the behavior of the volatility of stock return in Asian countries quite well. In the multivariate maximum likelihood estimation, the multivariate likelihood function is essential in the process. It might be assumed that the distribution of the return of stock markets in Asian are asymptotically normal (Kiranand (1996)). Thus, working with multivariate normal likelihood function, in this case, might be appropriate

3.3. The likelihood of stock market integration

Another strand in measuring the level of market integration is to measure the likelihood that stock market becomes integrated with world capital market. The capital asset pricing model (CAPM) of Sharpe (1964), Lintner (1965) could be applied to both completely segmented and completely integrated environment. In completely segmented market, only domestic factors influence the expected return of any asset in the country. Constrastly, the world together with other countries' factors affects the domestic asset's expected return if the country is integrated with world capital market.

The models

In completely segmented markets, the conditional form of CAPM could be written.

$$E_{t-1}(r^{A}_{i,t}) \quad = \quad \lambda_{i,t-1}\, cov_{t-1}(r^{A}_{i,t}, r_{i,t}) \qquad (13)$$

where

$E_{t-1}(r^{A}_{i,t})$ is the conditionally expected excess return on asset A in country i.

cov_{t-1} is the conditional covariance operator.

$\lambda_{i,t-1}$ is the conditionally expected local price of risk for time t.

From equation 13, it could be observed that asset A is priced according to its covariance with local market portfolio of country i. In this setting, λ_i is the local price of risk. If we aggregate all the assets in local market portfolio of country i, the equation 13 can be rewritten.

$$E_{t-1}(r_{i,t}) \quad = \quad \lambda_{i,t-1}\, var_{t-1}(r_{i,t}) \qquad (14)$$

The λ_i is now not just the local price of risk but the measure of the representative investor's relative risk aversion [Merton (1980)]. According to equation 14, the expected return of market, in segmented environment, depends on the amount of risk, measured by the volatility of return of the local market. The price of risk, λ, depends on the weighted relative risk aversions of the investors in country i.

On the other extreme side of setting, the fully integrated setting, the restriction of asset A's expected return could be written.

$$E_{t-1}(r^{A}_{i,t}) \quad = \quad \lambda_{i,t-1}\, cov_{t-1}(r^{A}_{i,t}, r_{w,t}) \qquad (15)$$

where

$r_{w,t}$ is the return on a value-weighted world portfolio.

According to Roll's critique (1977), the true world market portfolio or even the local market portfolio is unobservable. Thus, it is necessary to apply world capital market index and national stock market index, the extracted data from Datastream, as proxies for those unobservable data respectively.

Equation 14 and 15 focus on the completely segmented and completely integrated market assumption, respectively. The real markets are impossible to be extremely segmented or integrated because of no complete effects of regulations and liberalization. Factors governing the expected return or price of any asset in any location, though assumed to be solely depended on it's unavoidable risk, are too sophisticated to be traced easily. Also, capital flows from location to location, though affect the price of assets in each location significantly, can not be claimed to be the only mechanism that equalize the price of identical risk assets. Therefore, by common sense, the fully integrated market or the fully segmented market should not be observed in this world. Rather, we might see markets with some degree of integration (segmentation). Also, there might be a change from market integration to market segmentation, or *vice versa*, the valuation of assets should be changed as well. The change in such condition is a stochastic process [Bekaert and Harvey (1995)].

We can view the change as a switch from segmented to integrated market in the next period, or *vice versa*. In this concept, equilibrium expected return on any asset does not depend solely on the variance-covariance risk but also the stochastic switch of the condition of market. The switch becomes a crucial part of the pricing because investors have to additionally consider the change in the switch, which is uncertain or risky. In this case, neither equation 13 nor equation 15 can explain the equilibrium expected return of assets. A regime-switching model can be applied to overcome this difficulty. Bekaert and Harvey (1995) explained the methodology of regime-switching by assignment of S_t^i to be a state variable that takes on the value of

1 when markets are integrated, and

2 when markets are segmented.

In the first regime, the $S_t^i = 1$, the conditional mean is determined by equation 15 and the conditional mean is determined by equation 14 if the market is in the second regime, $S_t^i = 2$. At each point in time, there is a positive probability of a regime switch that is governed by switching probability. From now on, the switching probability, ϕ, is considered as the likelihood that the market is integrated.

The conditional mean return, according to econometrician's view, and given the information set, The conditional mean return could be formulated using the association of the switching probability.

$$E_{t-1}(r_{i,t}) \quad = \quad \phi_{i,t-1}\, \lambda_{i,t-1}\, cov_{t-1}(r_{i,t}, r_{w,t}) + (1 - \phi_{i,t-1})\, \lambda_{i,t-1}\, var_{t-1}(r_{i,t}) \qquad (16)$$

where

$\phi_{i,t-1}$ is the parameter, which value falls between 0 and 1, is the time-varying likelihood that the market is integrated to world capital market.

It could be rewritten the $\phi_{i,t-1}$.

$$\phi_{i,t-1} = \text{Prob}\,[S^i_t = 1 \mid \Omega_{t-1}]$$

The inference of $\phi_{i,t-1}$ can be considered by two different regime switching models. The first model is the standard Hamilton (1989, 1990) model. By this model, the S^i_t follows a Markov process with constant transition probabilities. Although the switching probability, P and Q, are constant, in this model, the likelihood of market integration, $\phi_{i,t-1}$, varies through time as new information changes the econometrician's inference on the relative likelihood of the two regimes. Gray (1995a) derives the recursive representation for the regime probability or the likelihood of market integration.

$$\phi_{i,t-1} = \frac{(1-Q) + (P+Q-1)(f_{1,t-1}\,\phi_{i,t-2})}{(f_{1,t-1}\,\phi_{i,t-2} + f_{2,t-1}\,(1-\phi_{i,t-2}))} \tag{17}$$

where

$P = \text{Prob}\,[S^i_t = 1 \mid S^i_{t-1} = 1]$

$Q = \text{Prob}\,[S^i_t = 2 \mid S^i_{t-1} = 2]$

$f_{j,t}$ is the likelihood at time t conditional on being in regime j and information on time $t-1$, Ω_{t-1}.

The second model, which allow time-varying transition probabilities, is extened by Diebold, Lee, and Weinbach (1995), Ghysels (1993), and Gray (1995a, 1995b). In this formulation, the transition probabilities P and Q are allowed to be the logistic function of the information set, Ω_{t-1}. However, the true Ω_{t-1} is unobservable, the subset of the information, Z_{t-1} is used instead in the estimation. In this study, to be consistent with the estimation of the degree of stock markets integration using asset pricing model to see the mispricing, the economics data is used as information subset in conditioning process. They are the constant, world market return[4], change in term structure spread (term premium), change in default premium, and the change in 30-day US treasury bill.

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[4] The world market return is calculated based upon Datastream Global Index.

$$P_t = \frac{\exp(\beta'_1 Z_{t-1})}{\{1 + \exp(\beta'_1 Z_{t-1})\}} \quad (18)$$

$$Q_t = \frac{\exp(\beta'_2 Z_{t-1})}{\{1 + \exp(\beta'_2 Z_{t-1})\}} \quad (19)$$

where

β'_j, j = 1, 2 are vectors of parameters to be estimated.

Cumby and Khanthavit (1992) investigate the equity returns in Korea, Taiwan, and Thailand using the standard Hamilton model, which allows the transition probabilities invariant. They do not formulate and explicit model of time-varying integration. They explain their results by relating to the capital market policies in these countries. However, Bekaert, Harvey, and Lumsdaine (1998) argue that the endogeneous break dates of the switching is not necessarily consistent with the date of official capital market reforms.

In this study, only the second approach, the time-varying transition probabilities of switching is chosen. The time-varying likelihood of market integration, $\phi_{i,t-1}$ are estimated using equation 16, 17, 18, and 19.

3.4. Discussion of data

Data used in this study can be divided into two main categories, stock markets data and economics data. Stock markets data is the data concerning each national stock market behavior. Price index, traded value, traded volume, etc. are the examples of stock markets data. World market index, liquidity risk premium, change in risk-free rate, etc. are the examples of economics data.

Stock markets data

The daily and monthly data are collected from June 1989 to December 1999. Data, in this study, can be divided into two categories, the stock market index and economics data. The stock market index includes the indices of Hong Kong, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and world capital market index[5]. Datastream market price index[6] is used in calculation.

[5] To compute the world market and regional indices, individual market data is converted to a common currency of US dollars. Exchange rates used are those prevailing on each day of the history. The fluctuation in exchange rate, therefore, affects each index. Datastream regional and world market indices are based on established market and sector Global indices, allowing comparisons of specific equities, sectors and markets with appropriate regional or world indices.

Sectors and market aggregations are weighted by market value and are calculated using a representative list of shares.

$$I_0 = \text{index value at base date} = 100$$

$$I_t = I_{t-1} \left[\sum_{n} (P_t * N_t) \,/\, \sum_{n} (P_{t-1} * N_t * f)\right] \quad (20)$$

where

I_t = index value at day t

I_{t-1} = index value on previous working day (of t)

P_t = unadjusted share price on day t

N_t = number of shares in issue on day t

P_{t-1} = unadjusted share price on previous working day (of day t)

f = adjustment factor for a capital action occurring on day t

n = number of constituents in index

The summations are performed on the constituents as they exist on day t.

Price index for market is typically computed and published by the local stock exchange or by agencies such as Standard & Poors, FAZ, FTSE Actuaries or ANP-CBS. Each price index used in this study comes from the total market calculation by Datastream. Total market calculations do not include all companies in a market. Instead, the most important companies by market value are chosen. The precise number of constituents varies from market to market, according to the size of the market capitalization, and changes to reflect current market conditions. Currently, the total market calculation for each country is calculated according to the number of companies as followed.

Country	*Start date*	*Number of stocks*
Hong Kong	Jan 1973	130
Korea	Sep 1987	100
Malaysia	Jan 1986	90
Philippines	Jan 1980	50
Singapore	Jan 1973	100
Taiwan	Sep 1987	70
Thailand	Jan 1987	50

[6] An index provides a measure of the relative change in some variable or group of variables at a specified date when compared with some fixed period in the past.

To compute the regional indices and world market index, individual market data is converted to a common currency of US dollars. Exchange rates used are those prevailing on each day of the history; exchange rate fluctuation, therefore, has an effect on each index.

The stock market return of each country can be calculated using the daily stock market index.

$$R_{i,t} = (I_{i,t} - I_{i,t-1}) / I_{i,t-1} \qquad (21)$$

The daily stock market return for each country is formed 6-month-roll manner for monthly varying period.

In the study of relationship between the degree of stock market integration and stock market microstructure, traded volume and traded value in stock markets are necessary. Volume shows the number of shares traded for a stock on a particular day. For shares traded on more than one exchange in a country, volumes are generally specific to the main exchange only. Daily figures are adjusted for capital changes. Similarly, the market volume shows the total number of constituent shares traded on an exchange on a particular day.

Economics data

The economics data is used as information subset in conditioning process. They are the constant, world market return[7], change in term structure spread (term premium), change in default premium, and the change in 30-day US treasury bill. The change in term structure spread is the difference between the US 10-year bond yield and the 3-month US bill yield, as suggested by Bekaert and Harvey (1995). The change in term structure spread can be viewed as the proxy for liquidity risk. The change in 30-day US treasury bill return implies the shift in risk-free rate. This information subset is formed consistently with the study of Bekaert and Harvey (1995) and De Santis and Gerard (1997).

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[7] The world market return is calculated based upon Datastream Global Index.

Descriptive statistics

Data of Asian countries, which includes Hong Kong, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, and World capital market, are explored in term of descriptive statistics from January 1990 to December 1999. Six-month rolling for each monthly data is formed and explored statistically. Data of U.S. stock market is also explored as referenced.

Table 3.1.

Descriptive statistics of the stock markets excess return

Monthly dollar-denominated excess returns on the equity indices of eight countries are from Datastream. Excess returns are obtained by subtracting the return on the 30-day United States T-Bill. The sample covers the period January 1990 through December 1999. The Sharpe ratio is the ratio between the average excess return and the standard deviation of the return. It implies the compensation for the risk bearing.

Country	*Mean*	*Standard Deviation*	*Sharpe Ratio*	*Autocorrelation*				
				ρ_1	ρ_2	ρ_3	ρ_6	ρ_{12}
Hong Kong	14.4169	10.2743	1.3727	0.1738	0.0484	-0.0610	-0.0475	-0.1648
Korea	12.3408	13.4024	0.9208	0.0534	-0.373	0.0610	0.081	-0.1666
Malaysia	13.9908	12.4361	1.1250	-0.0015	0.2054	-0.1041	-0.0997	-0.1401
Philippines	15.5328	12.0981	1.2839	0.2933	0.0341	-0.0501	-0.0909	0.0080
Singapore	11.3448	8.5561	1.3259	0.2175	0.0216	-0.0690	-0.1012	0.0083
Taiwan	12.2244	13.3688	0.9144	0.1047	-0.1515	-0.1499	-0.0953	-0.1974
Thailand	12.0924	13.8859	0.8708	0.1336	0.0573	-0.1204	0.0848	-0.0207
USA	12.4608	6.5936	1.8898	0.1356	0.1132	0.0451	0.0617	0.0399
World	12.1848	6.7164	1.8142	0.1101	-0.0032	-0.0168	0.0251	0.1896

The annualized monthly excess return is calculated according to equation (21) and minus by world risk-free rate. The 30-day US treasury bill is used as proxy for the 30-day risk-free rate. The arithmetic mean and variance is calculated for the investigation of general characteristics of the sample, which will be investigated in more detail in this analysis.

The descriptive statistics shown in the table 3.1. and figure 3.1. exhibits the market return in excess of world risk-free rate. It could be observed that the Asian stock markets excess return and the excess return of world capital market exhibited the same trend. Since the middle of 1991, the figure shows us the downtrend of excess return in stock markets investment. During the period of late

1993 to the middle of 1995, the Asian stock market excess return exhibits negative return[8]. Also, in the period between 1996 and the middle of 1998, most of Asian stock market excess return shows the negative excess return obviously. After the period of obviously negative return, 1994 – mid 1995, there is no obvious evidence of downtrend or uptrend of the excess return. It would rather show the mean reverting trend. However, following the period of difficulty due to economic crisis, it showed that from the second quarter of 1999 which is analyzed to be the period of Asian economics recovery, there is a recovery sign of the excess return from Asian stock markets investment.

From table 3.1. and figure 3.2., the volatility for 6-month horizon of Asian stock markets, which implies the total risk in holding national market portfolio, also performs in the similar direction, including the world capital market index. From the middle of 1991, we can observe the downtrend of volatility in excess return until the beginning of 1994. During the 1994 and 1995, there was a shock in volatility of the excess return and then revert to the previous trend. The volatility seems to fluctuate during the period of Asian economic crisis, between 1997 and 1999.

Looking at the table 3.1., together with figure 3.1. and figure 3.2., simultaneously, it could be observed that there is some interesting movement of the excess return and volatility. Except the period of Asian economic crisis (1997 – 1999), when the excess return of Asian stock markets performs well (high excess return), the volatility of the excess return, for most of the samples, seems to perform well (low volatility) as well. This behavior seems to be quite obvious in the period of 1993 –1995. If this is the case, it might be the incentive for private capital inflow from foreign country.

In table 3.2., the correlation between stock markets excess return are investigated. Most of the excess from the countries selected in this study seems to have moderately high correlation to each other, except the Korea, Malaysia, and Taiwan. The developed markets, Hong Kong, Singapore, and United States shows very high correlation to world capital market. This may indicate that the world capital market and the developed stock markets move together quite very closely. The correlation between the Asian emerging stock markets is not so high. The correlation between Asian emerging stock markets and the developed stock markets, both Asian and United States, shows evidence that there is correlation of the excess return between them. Taiwan, one of the Asian emerging stock market, shows quite low correlation of its excess return from stock market with any stock markets, whether it is the emerging or the developed ones. The remaining Asian developing

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[8] Although the realized excess return from the historical data shows the negative excess return, it was unable to conclude that the expected excess return would be negative as well. This is the strong theoretical assumption of non-negativity of the expected excess return in any asset pricing theory.

markets are still be benefit in term of diversification to global investors caused by not to tightly close with the world market. However, the degree of correlation of Asian emerging markets and world capital market, together with the major developed markets are not in too low level. This implies more or less the same direction of movement among them

Table 3.2.

Correlation of stock markets excess return

The correlation of the excess return among Asian stock markets with the United States and World capital market are calculated and reported in the table. Excess returns are obtained by subtracting the return on the 30-day United States T-Bill. The sample covers the period January 1990 through December 1999.

	Correlation of stock markets excess return								
	Hong Kong	*Korea*	*Malaysia*	*Philippines*	*Singapore*	*Taiwan*	*Thailand*	*USA*	*World*
Hong Kong	1	0.4518	0.5926	0.7209	0.8129	0.4876	0.7048	0.6951	0.7052
Korea		1	0.2762	0.4532	0.5035	0.3392	0.5975	0.3848	0.4783
Malaysia			1	0.5196	0.6505	0.42	0.5831	0.4752	0.4975
Philippines				1	0.7671	0.4783	0.6973	0.5753	0.6004
Singapore					1	0.5071	0.7335	0.7607	0.8049
Taiwan						1	0.3565	0.3609	0.4247
Thailand							1	0.557	0.574
USA								1	0.9086
World									1

To be certain that the economics data selected as information subset (the instrumental variables) in my study, is good enough, the investigation of the relationship between the Asian stock markets excess return and the lagged economics data is necessary. The importance of these instrumental variables is that it is assumed to be the pieces of information which investors perceive and make the interpretation to decide in their investment decision. The lagged instrumental variables are put into the multiple regression with the excess return of each stock market as dependent variables. Each stock market is treated by the time-series of the excess return and the time-series of each instrumental variables. As assumed in deriving the conditional models, the information subset should have linear relationship with the Asian stock market excess return. Linear regression, thus, is applied to investigate how good the information is, in this case. The results are shown in table 3.3.

The results shown in table 3.1. lead to my pleasure to use the set of the information as instrumental variables in my study. All the variables in all periods are significantly rejected the null hypothesis of irrelevant to the Asian stock markets excess return. The results show that the excess return from Asian stock markets is linearly positively related to world capital market return and the term premium. The negative relationship between Asian stock markets return and change in default premium and change in risk-free rate can be drawn from the regression.

Table 3.3.

Predictability of the information set

The information set (Z_t) to be used in estimation of degree of stock market integration and the estimation of likelihood of market integration are constant, world capital market excess return, term premium, change in default premium, and shift in risk-free rate. To be certain that the information used as instrumental variables are relevant to Asian stock markets' excess return, the relationship between each instrumental variable and stock market excess return for each market is tested. It is found that all of these variables are appropriate for this study. The t-statistics for all variables are significantly rejected the null hypothesis that the variable is irrelevant.

Information set	Asian stock markets excess return							
(instrumental variables)	*Hong Kong*	*Korea*	*Malaysia*	*Philippines*	*Singapore*	*Taiwan*	*Thailand*	*USA*
World capital market	1.2321	1.3031	1.8998	1.3906	1.8542	1.5010	1.2936	1.88421
excess return	(2.0890)**	(2.8879)**	(2.0749)**	(2.1475)**	(2.2610)*	(2.1352)**	(2.0488)**	(2.1920)**
Change in term structure	0.5188	0.4580	0.1943	0.3504	0.4202	0.1861	0.1620	0.5182
spread	(1.8726)*	(2.0436)**	(1.8945)*	(1.9974)**	(1.9661)**	(1.8161)*	(1.7890)*	(1.9656)**
Change in default	-0.3615	-0.3159	-0.2268	-0.3512	-0.3221	-0.2772	-0.3090	-0.3654
premium	(-1.9867)**	(-1.7537)*	(-1.8907)**	(-2.0156)**	(-1.9701)**	(-2.0152)**	(-1.9811)**	(-2.1405)**
Change in 30-day	-0.1350	-0.7978	-0.5586	-0.1914	-0.4860	-0.3984	-0.1704	-0.5612
US treasury bill	(-1.6508)*	(-1.6983)*	(-1.8634)**	(-1.8008)*	(-1.6769)*	(-1.8503)*	(-1.6429)*	(-1.9868**

* and ** significantly different from zero at 90% and 95% level of significance, respectively

All the data used in this study is extracted from the JDBA Datastream, the database provided by Primark Co., Ltd. All the data concerning to currency is based upon the US dollar denominated to avoid the difficulty in analysis. Therefore, the effect of the currency exposure is avoided.

The trading volume of the Asian stock markets is also interesting. figure 3.3.., we can observe that there was a rising up trend of the trading volume since the middle of January 1992 for Korea, Malaysia, Philippines, Singapore, and Thailand while the trading volume of Hong Kong and Taiwan seems quite stable through the time. However, the uptrend of the trading volume in some Asian stock markets, such as Philippines and Thailand, seems to be slow down during the Asian

Figure 3.1.

The Asian Stock Markets Excess Return

The excess return is calculated as the premium received over the risk-free rate. Each national stock market return is calculated using equation (20) based on 6-month rolling period. The proxy for risk-free rate is the US six-month treasury bill. The data spanned over the period of June 1990 – October 1999. The figure shows in unit of ten.

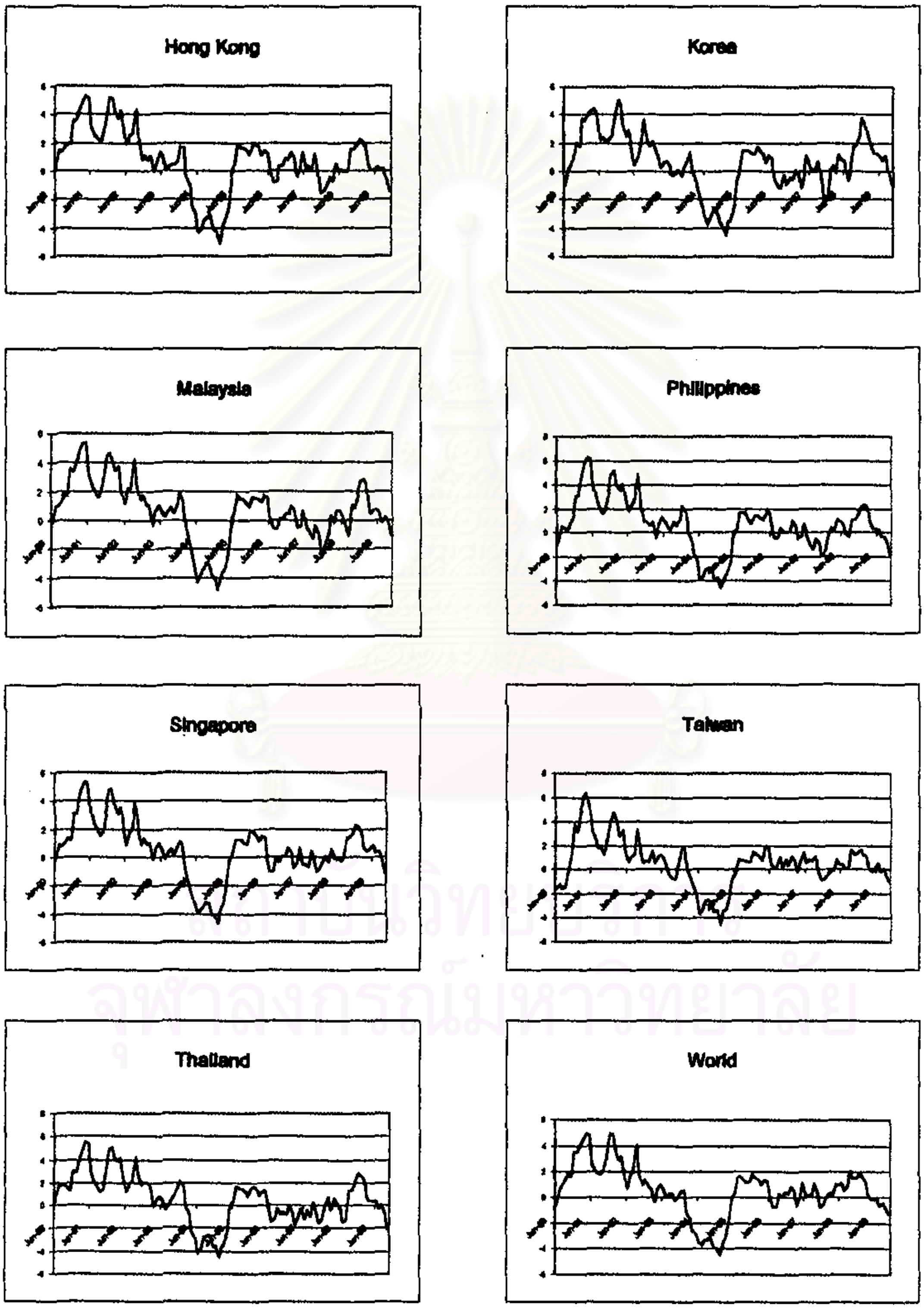


Figure 3.2.

Asian Stock Markets Volatility

The volatility of Asian stock markets is the variance of Asian stock markets excess return during the period of June 1990 – October 1999.

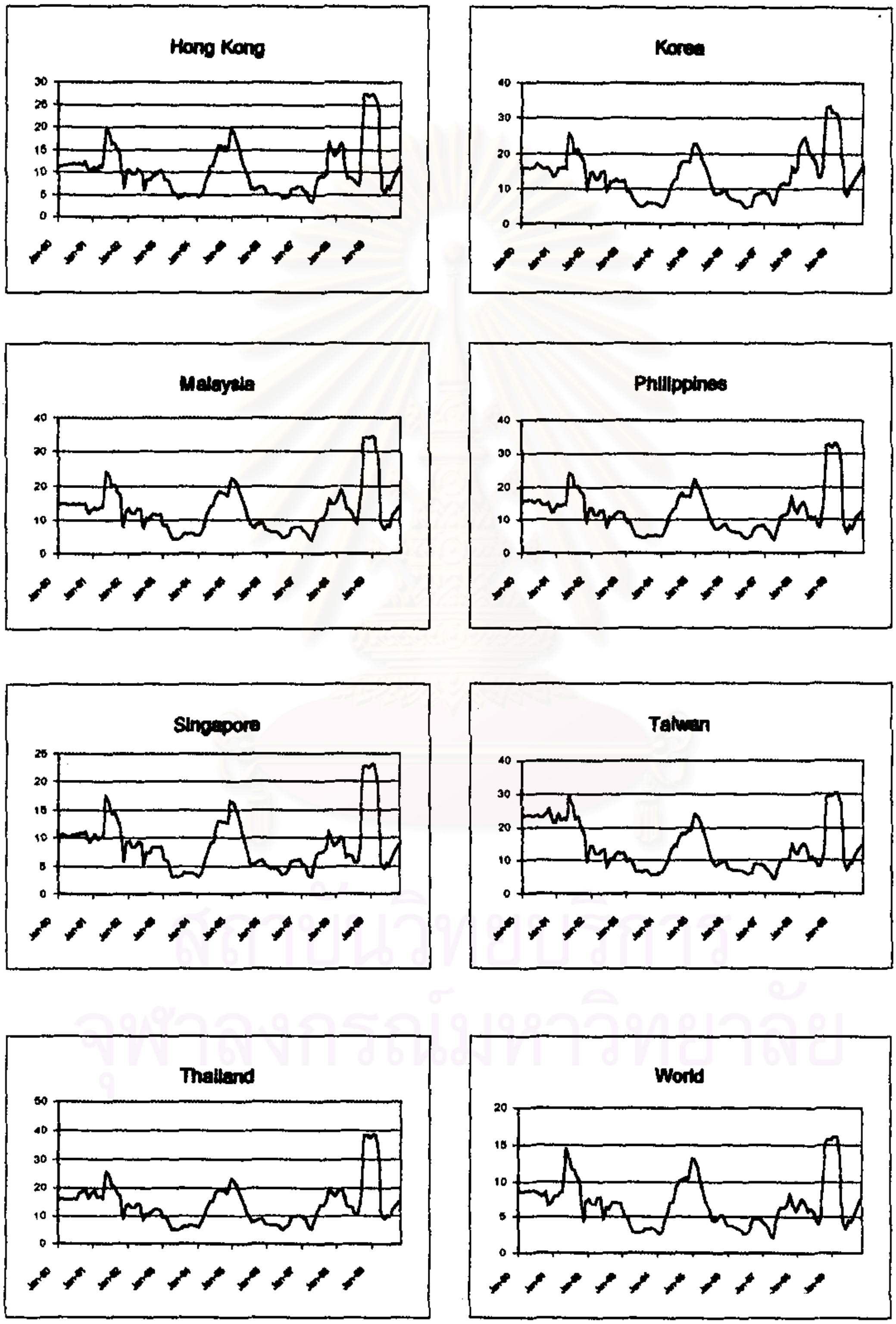
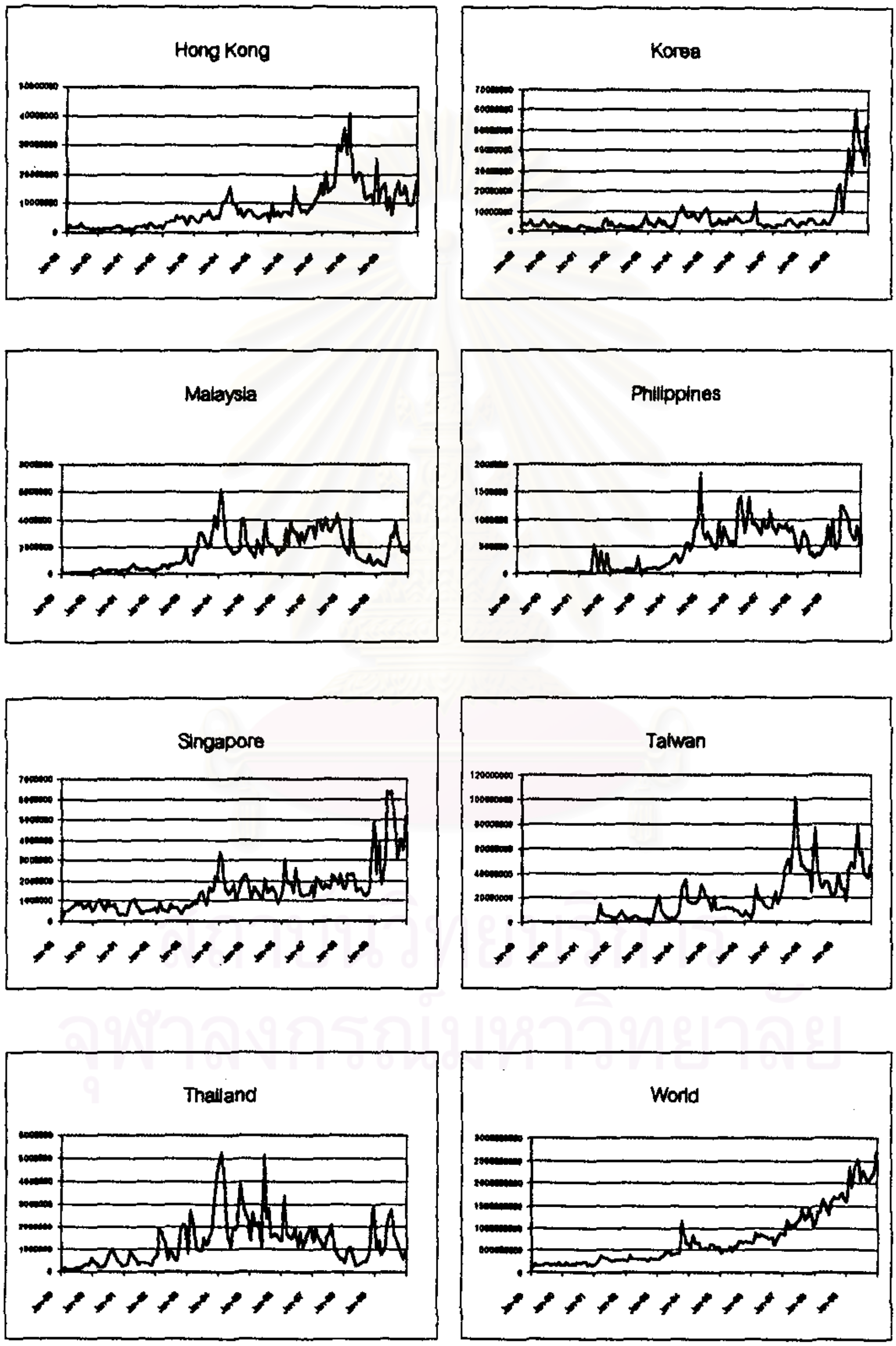


Figure 3.3.

Asian Stock Markets Trading Volume

The trading volume of Asian stock markets is the trading activities of Asian stock markets in term of trading value which is U.S. dollar denominated during the period of June 1990 – October 1999.



economic crisis. The magnitude of the retardation is asymmetric across Asian countries. The recovery sign of the trading volume starts by the end of 1998. From that period, there is increasing in trading volume in all Asian stock markets. Korean stock market, after the period of Asian economic crisis, has the obviously uptrend in trading volume which could be claimed to be much better than the past which the uptrend in trading volume could not be detected obviously.