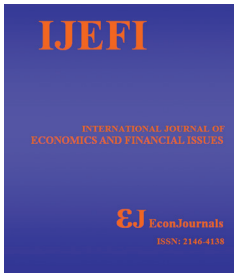

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Evaluation of the Added Value from Risk Diversification Through AEC Capital Market Integration using Stochastic Dominance

Aekkachai Nittayagasetwat[1], Jiroj Buranasiri[2]*

[1]National Institute of Development Administration, Bangkok, Thailand, [2]Srinakharinwirot University, Bangkok, Thailand.
*Email: jirojresearch@gmail.com

ABSTRACT

This research paper investigates the benefit of risk diversification under the increase in the integration of AEC countries' capital markets during 1999 and 2016. The evidences from the correlation and mean-variance analysis confirm the higher stock market integration. However, the empirical results from Stochastic Dominance technique show that the equally weighted portfolio built from combining the stock index portfolios of five AEC countries has lower ability to dominate stock index portfolio of each AEC country. In other words, the value from combining AEC countries' stock markets is decreasing.

Keywords: Integration, Mean-variance Analysis, Stochastic Dominance
JEL Classifications: F3, G1

1. INTRODUCTION

Recently, capital markets in many regions of the world become more integrated. In South-East Asia region, the economic cooperation among the Association of Southeast Asian Nations (ASEAN) has been developed for a long time. The tariffs and trade barriers among the members has been drastically reduced. Consequently, the trade among member keeps increasing. In 2015 the cooperative level changed from ASEAN Free Trade Area into the ASEAN Economic Community (AEC). The more tied members' economies and easier capital movement among these nations are expected to bring about higher integration of these nations' capital market and the possibility to combine stock markets of these countries together. With higher capital market integration, the movements of the members' stock markets are expected to be highly correlated. Consequently, the risk diversification opportunity for investors are expected to be lower and the importance of fund allocation based on countries might be unnecessary for this region in the future. Nevertheless, this conclusion might be overstated. The unique business characteristics of each AEC countries still exist. The variety of core competencies of each AEC countries is obvious. For example, Thailand is highly outstanding in tourism business. The truth of the diversification benefit is still inconclusive.

This paper analyzes the stock market returns from five AEC's countries including Indonesia, Malaysia, Philippine, Singapore, and Thailand during November 1999 - February 2008 and during March 2008 - June 2016 to find out the change in the stock market integration and the diversification benefit by applying mean-variance, and stochastic dominance techniques.

The research results are important in at least two aspects. First, the results would provide more evidences for the academic study on stock market integration and risk diversification. Second, it would help investors to improve their understanding on the nature of risk diversification under the higher capital market integration and, consequently, their investment performance.

2. LITERATURE REVIEW

Since Markowitz (1968) introduced portfolio theory and claimed his key discovery on the investment's risk reduction through diversification process, adding new assets which are not perfectly correlated to the existing portfolio to lower the portfolio's risk, the issues on risk diversification focusing on international assets have gained more interest.

Many studies suggested that international diversification would provide more benefit for investors. For instance, Solnik (1995) concludes that the diversifiable opportunity depends on the independency between the new assets and the existing portfolio and exhibits the lower risk level when global stocks are put in the portfolio and Reilly and Norton (2006) advise that if the countries' economies and markets do not change together, the international investment still provides diversification. The recent research of Bodie et al. (2014) confirms these ideas by suggesting that active investors should pay attention on international diversification for their benefit.

However, the benefit of international investment should not be overstated. Emiris (2002) claims that country's risk should not be counted for the compensation since it could be totally diversified away. Besides, the trend of higher cross-country correlation keeps growing continuously. In other words, the opportunity for risk diversification becomes less. Many researchers discover the high correlation situation among stock market during the important economic crisis period. For instances, Roll (1988) provides the evidences that indicate high correlation among different countries' stock exchange happens during the 1987 crisis and Bodie et al. (2014) reports that the same phenomenon occurs again during the 2008 crisis.

In Asia, there are both evidences to support and counter the importance of adding international assets on investors' portfolios. For the supportive side, Palac-McMiken (1997) applies the co-integration analysis on ASEAN stock markets and finds that there is no long-run relationship among these markets. The international diversification obviously offers benefit to investors. Goh et al. (2014) also shows that the ASEAN portfolio built from stocks of different ASEAN countries performed better than the portfolios built from stocks of each individual ASEAN countries. In contrast, many evidences foster the existence of the linkage or the integration in capital market, for example, Kasa (1992) points out a common stochastic trend which influences the tested markets. Roca et al. (1998) analyze the data during 1988-1995 and report the existence of short-run integration in ASEAN market but no evidences support the long-run capital market integration. Masih and Rumi (1999) concludes that, in Asia, the regional markets affect each country's market. In other words, the impact of diversification by extending investment to different ASEAN stock markets is limited. Eiling et al. (2012) claim that the global industry risk factor is the important driver of the equity return while the country risk factors do not play significant role on the return.

For the analysis tools, the mean-variance has been widely used in analyzing the investors' investment performance and can screen a more optimal portfolio but the main caveat is that the tool cannot be used for ranking the portfolio. Once the risks of two portfolios are not the same and the higher risk portfolio offers a higher return, it is impossible to point out a better portfolio. Stochastic dominance method which has improved by Levy (1992) during 1969-1970 to be employed in finance and economics fields becomes interesting tool for researchers. It allows researchers to point out a better investment portfolio.

3. DATA AND RESEARCH METHODOLOGY

3.1. Data

The monthly stock indices' returns from five countries in AEC are collected from Bloomberg database from November 1999 to June 2016. These five countries include Indonesia, Malaysia, Philippine, Singapore, and Thailand and the stock indices are Jakata Composite Index, FTSE BERSA Malaysia index, Philippine stock exchange index, straits time Singapore index, and stock exchange of Thailand index, respectively. This research uses these countries as a proxy for AEC countries because their stock exchanges have been developed for a long time while the other stock exchanges of AEC countries were found not many years ago. The length of the data from these five countries is more suitable for the study.

3.2. Research Methodology

In order to examine the change in the diversification level and benefit, the data is divided into two groups. Each group contains 100 monthly returns from each stock market. Next, the six portfolios are built for the study's analysis. The first five portfolios are the stock index portfolios from the examined countries. Their monthly returns are directly from their stock index returns. The sixth portfolio is the equally weighted stock index portfolio built by investing the equally amount of money in each of the previous five portfolios. Hence, the monthly returns of the sixth portfolio are the mathematic average of the first five portfolios' monthly returns. The mean-variance and the stochastic dominance technique are employed for the analysis as follow.

3.2.1. Mean-variance analysis

First, the standard deviation (S.D.) and mean $(\bar{r})$ of the monthly return of monthly returns of portfolio from each group of data will be calculated as follows:

$$S.D.=\frac{\sum_i^N (r_i-\bar{r}^2)}{N-1} \quad (1)$$

$$\bar{r}=\frac{\sum_i^N r_i}{N} \quad (2)$$

Where r_i is the return of month i and N is number of months. The SD and mean are annualized as follows:

$$S.D._a=S.D.\times\sqrt{12} \quad (3)$$

$$\bar{r_a}=(1+\bar{r})^{12}-1 \quad (4)$$

The portfolio is considered a sub-optimal portfolio when its SD is higher than any other portfolio but its return does not increase. With better diversification situation, the number of optimal portfolios should be less.

3.2.2. Stochastic dominance analysis

This paper uses stochastic dominance method developed in the study of Levy and Wiener (1998) for the analysis. The equally-weighted portfolio is tested with each country's stock index portfolio one by one for each group of data to find out the existence

of stochastic dominance. Also, the performance of equally-weighted portfolios on the two set of data would be investigated if the previous set dominates or is dominated by another set.

The data is examined in two levels of stochastic dominance: First-order and second-order. When the portfolio first-order stochastic dominates the compared portfolio, it implies that it also second-order stochastic dominates the compared portfolio too.

3.3. Conditions for First Order Stochastic Dominance (FSD)

Let FA(r) and FB(r) be two continuous distribution functions for random return r ϵ [a, b]. Then, FA(r) FSD FB(r) if and only if FA(r) ≤ FB(r) for all r ϵ [a, b] and EA U(r) ≥ EA U(r) for all non-decreasing utility function. Where A and B are the two tested portfolios.

3.4. Conditions for Second Order Stochastic Dominance (SSD)

Let $F_A(r)$ and $F_B(r)$ be two continuous distribution functions for random return r ϵ [a, b]. Then, $F_A(r)$ SSD $F_B(r)$ if and only if for any r, $\int_{-\infty}^{r} [F_B(t) - F_A(t)]\, dt \geq 0$ and EAU(r) ≥ EB U(r) for all non-decreasing utility function and concave utility function U. Variables used for analysis are defined in Table 1.

4. FINDINGS

4.1. Descriptive Analysis

The descriptive data of portfolios' monthly returns during November 1999 to February 2008 and during March 2008 - June 2016 in Panel A and B of Table 2 shows that, in average, portfolios' returns of the previous period is higher than those in the following period. However, the SD which represent the portfolios' risk change in the mixed directions. The data distribution skews to the left for both period but more in the second period. Portfolios' kurtosis in second period is much higher than the kurtosis in the first period the previous period.

Table 3 indicates that the correlation among portfolios in the second period obviously increase from the previous period. In another words, adding these portfolio together provides less risk diversification.

4.2. Mean-variance Analysis

Table 4 and Figure 1 show that there are suboptimal portfolios in both periods. Some portfolios have higher risk or SD but provide

Table 1: Definition of the variables used for the research's analysis

Variables	Description
Indonesia	The monthly return of portfolio built to imitate Jakata composite index which represents the monthly return of Indonesia's stock market
Malaysia	The monthly return of portfolio built to imitate FTSE BERSA Malaysia index which represents the monthly return of Malaysia's stock market
Philippine	The monthly return of portfolio built to imitate Philippine stock exchange index which represents the monthly return of Philippine's stock market
Singapore	The monthly return of portfolio built to imitate straits time Singapore index which represents the monthly return of Singapore's stock market.
Thailand	The monthly return of portfolio built to imitate SET Index which represents the monthly return of Thailand's stock market
AEC_5	The monthly return of equally weighted portfolio built from the indices of 5 AEC countries above and it represents the monthly return of overall AEC countries' stock markets

Table 2: Summary of descriptive data of the monthly returns of each portfolio

Panel A use data from November 1999 to February 2008						
Descriptive statistics	**AEC_5 (%)**	**Indonesia**	**Malaysia**	**Philippine**	**Singapore**	**Thailand**
Mean	1.10	1.96	1.02	0.64	0.52	1.37
Median	1.84	2.75	1.47	0.61	1.17	1.34
SD	4.71	6.79	4.97	6.48	5.54	7.38
Kurtosis	0.627	−0.499	0.144	−0.125	1.285	1.138
Skewness	−0.489	−0.150	−0.094	−0.014	−0.762	−0.179
Range	25.15	29.70	23.80	34.06	29.00	45.25
Minimum	−13.04	−13.75	−10.17	−17.47	−17.01	−21.60
Maximum	12.11	15.95	13.63	16.60	11.98	23.65
Count	100	100	100	100	100	100
Panel B use data from March 2008 to June 2016						
Mean	0.81	1.02	0.55	1.07	0.36	1.07
Median	1.14	1.65	0.96	1.87	0.69	1.91
SD	4.80	6.39	3.62	5.59	5.58	6.20
Kurtosis	8.03	6.28	4.33	3.69	5.03	5.76
Skewness	−1.33	−1.12	−0.51	−0.82	−0.25	−1.37
Range	38.65	51.29	28.72	39.36	45.80	45.64
Minimum	−24.78	−31.09	−14.95	−24.07	−23.72	−30.07
Maximum	13.87	20.20	13.78	15.29	22.08	15.57
Count	100	100	100	100	100	100

Source: Bloomberg

Table 3: Correlation among portfolios

Panel A use data from November 1999 to February 2008						
	AEC_5	Indonesia	Malaysia	Philippine	Singapore	Thailand
AEC_5	1.00					
Indonesia	0.79	1.00				
Malaysia	0.57	0.35	1.00			
Philippine	0.78	0.55	0.25	1.00		
Singapore	0.80	0.53	0.43	0.54	1.00	
Thailand	0.79	0.48	0.29	0.53	0.54	1.00
Panel B use data from March 2008 to June 2016						
AEC_5	1.00					
Indonesia	0.92	1.00				
Malaysia	0.81	0.71	1.00			
Philippine	0.84	0.72	0.59	1.00		
Singapore	0.90	0.78	0.72	0.68	1.00	
Thailand	0.88	0.76	0.64	0.66	0.74	1.00

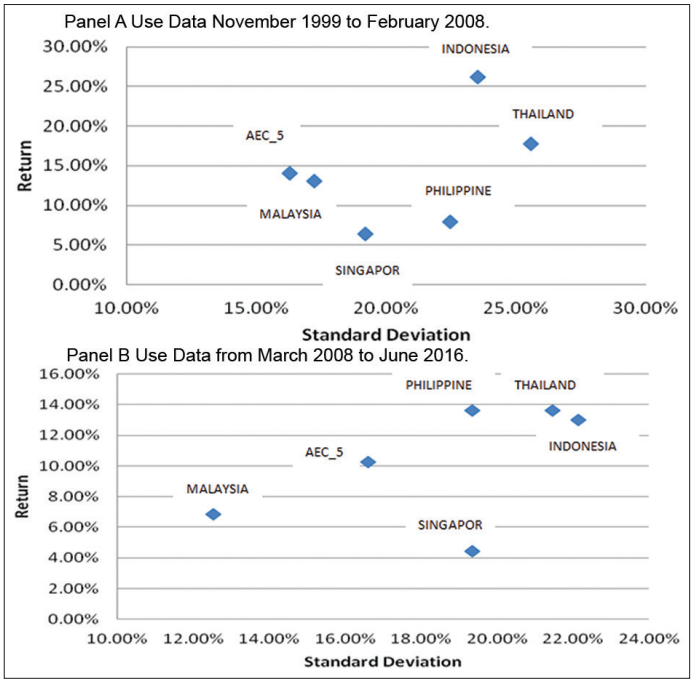
Source: Bloomberg database

Table 4: Relationship between annual standard deviation and return of different portfolios

Panel A use data November 1999 to February 2008		
Portfolios	**Standard deviation per year (%)**	**Average return per year (%)**
AEC_5	16.30	14.07
Malaysia	17.21	13.01
Singapore	19.19	6.41
Philippine	22.44	7.94
Indonesia	23.53	26.21
Thailand	25.57	17.79
Panel B use data from March 2008 to June 2016		
AEC_5	16.62	10.22
Malaysia	12.54	6.82
Singapore	19.35	4.43
Philippine	19.36	13.585
Thailand	21.46	13.595
Indonesia	22.13	12.98

Source: Bloomberg Database

Figure 1: Relationship between standard deviation and return of each portfolio



inferior returns. However, the number of inferior portfolios are lower in the second period. The equally weighted portfolio which contains all of other portfolios is not inferior to any other portfolios in both periods.

4.3. Stochastic Dominance Analysis

For Stochastic Dominance investigation, the study focuses on the ability to stochastically dominate the other portfolio of the equally weighted portfolio since it takes advantage of risk diversification more than other portfolios by adding all portfolios together. Figure 2 indicates that the equally weighted portfolio does not FSD any other portfolios in the period from November 20 1999 to February 2009. However, when the examination goes in-depth, it was found that the weighted equally portfolio SSD portfolio of Philippine's stock exchange index and the portfolio of Singapore's stock exchange index in the first period.

When the study investigates the portfolio in the period from March 2009 to June 2016, the equally weighted portfolio shows no first order and no SSD over any other portfolio. The disappearance of the stochastic dominance implies that the value added on the diversification becomes lower. In addition, there is no stochastically dominance of the equally weighted portfolio on its own performance in different period. The empirical results indicate that the higher integration of AEC countries' stock market comes along with the lower benefit of cross-border risk diversification. The summary of Stochastic Dominance results are shown in Table 5.

5. CONCLUDING REMARKS

The research investigates the integration of AEC countries' stock markets and the benefit from risk diversification by analyzing five stock index portfolios of five AEC nations plus an equally weighted portfolio built from these five portfolios. The data are grouped into two sets. The first set includes the six portfolios' monthly returns from November, 1999 to February, 2008 and the second set includes the six portfolios' monthly returns from March, 2009 to June, 2016. The correlation and mean-variance analysis reveal that these stock markets become more integrated. The correlation increases while the suboptimal portfolios decrease. Nevertheless, the stochastic dominance techniques disclose that two stock index

Figure 2: Value of the difference between cumulative probability distribution of the return of each pair of portfolio

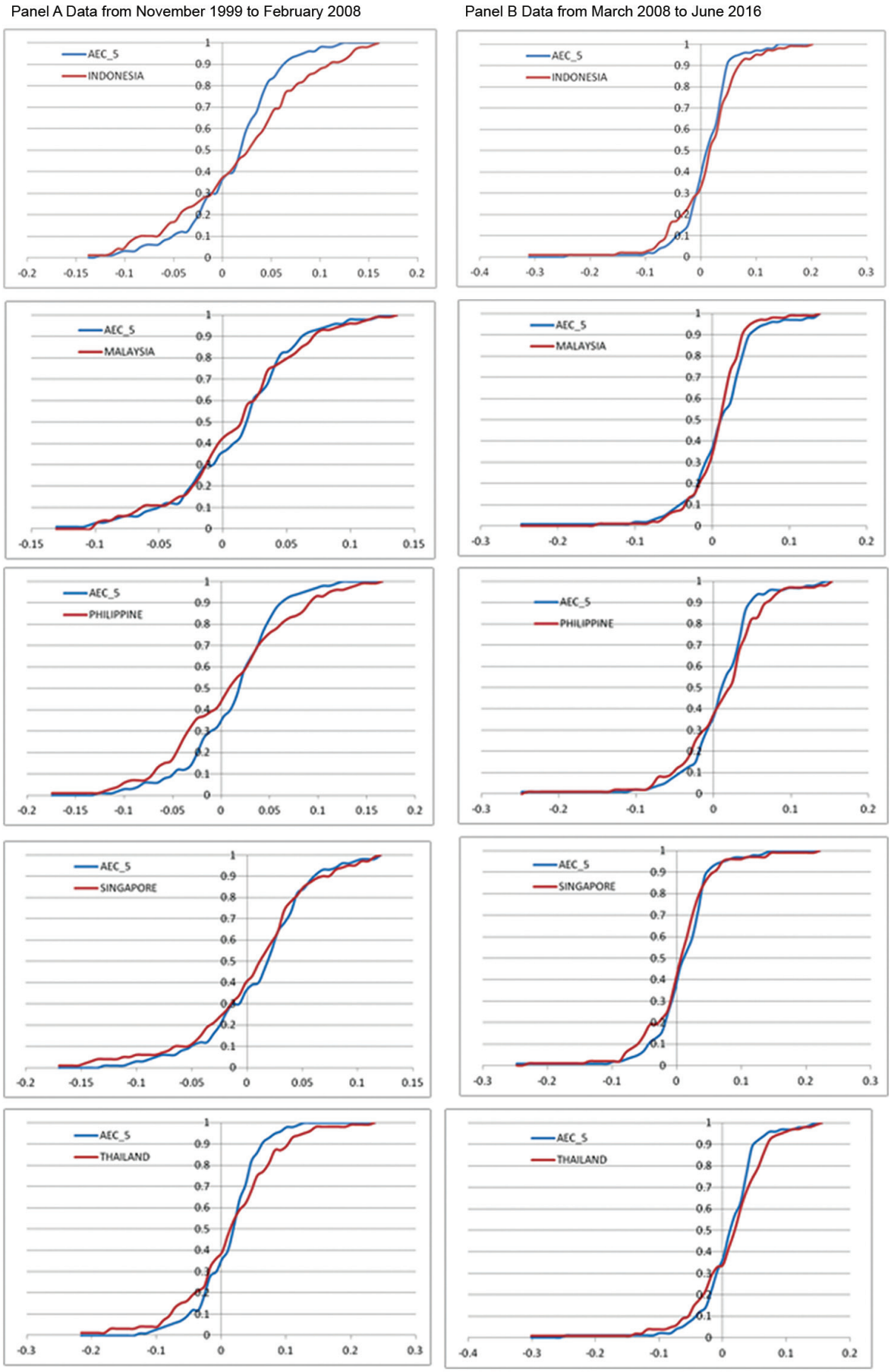


Table 5: Summary of stochastic dominance results

Portfolios	Panel A Data from November 1999 to February 2008				
	Indonesia	Malaysia	Philippine	Singapore	Thailand
AEC_5	No	No	SSD	SSD	No
Panel B Data from March 2008 to June 2016					
AEC_5	No	No	No	No	No
Panel C Data from November 1999 to February 2008					
	AEC_5 (in Panel A)				
AEC_5 (in Panel B)	No				

portfolios are SSD by the equally-weighted portfolio in the first set of data and but no portfolio are stochastically dominated by the equally-weighted portfolio in the second set of data. The reward from diversification for the better diversified portfolio disappears.

The empirical results suggested that, the risk diversification through cross-nation investment must be done carefully. The assumption that international diversification is the effective way in lowering risk might not be correct. As the degree of integration among stock markets increases, the usefulness of international diversification tends to decrease. To lower investors' risk, they should focus on searching for assets which have independent characteristics to add into their portfolios. The further in-depth study concerning the common risk factors which lower the effectiveness of risk diversification for global investment should be done to provide more knowledge for academic people and practitioners.

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