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The Fast and Slow Speed of Convergence to Market Efficiency A Note for Large and Small Stocks on the Stock Exchange of Thailand*

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Abstract

Financial markets around the world are converging to informational efficiency due to factors such as adaptive investors, strong competition, communication networks, and financial innovations. Within the same markets, however, the benefits of these factors to large and small stocks are not necessarily the same, hence leading to a faster or slower speed of convergence to market efficiency. This study measures the convergence speed for large stocks and small stocks on the Stock Exchange of Thailand from August 16, 1995 to August 31, 2015. For the overall market, the efficiency improves over time. While the market for large stocks exhibits fast speed, the market for small stocks hardly converges. So the improved efficiency is limited only to the market for large stocks.

Keywords: Market Efficiency, Convergence Speed, Large and Small Stocks

I. Introduction

Market efficiency is one the most important working assumptions of finance theories. It has been extensively studied and tested for developed as well as emerging markets over the world (Fama, 1970 and 1991; Dimson and Mussavian, 1998; Lim and Brook, 2011). Most of the studies of weak-form efficiency examine whether the markets are or are not efficient in the absolute sense, meaning that the state of efficiency or inefficiency remains unchanged over the sample periods. Although Grossman and Stiglitz (1980) argue that the market cannot be fully efficient, otherwise informed investors will not be able to earn from their costly information, Lo (2004) proposes that the degree of efficiency can improve over time due to factors such as adaptive investors, strong competition, communication networks, and financial innovations. Empirical studies, based on alternative econometric techniques, consistently report for markets around the world that their efficiency is in fact improving, e.g., Lo (2004) for the U.S.A. market, Emerson, Hall & Zalewska-Mitura (1997) for the Bulgarian market, Zalewska-Mitura and Hall (1999) for the U.K and Hungarian markets, and

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Khanthavit, Boonyaprapatsara, & Saechung (2012) and Buraprathep, Khanthavit, & Pattarathammas (2015) for the Thai market.

Despite the fact that the efficiency of the overall markets improves over time, it is not clear whether or not the degree of and the convergence speed to efficiency are the same for large and small stocks. The reasons include relatively high trading costs (Stoll and Whaley, 1983), low analyst coverage (Hong Lim, & Stein, 2000), and limited institutional ownership (Gompers and Metrick, 2001; Philip, 2003) for small stocks. In this study, the researcher measures the convergence speed for large stocks and small stocks on the Stock Exchange of Thailand. Applying the time-dependent, stochastic, autoregressive (AR) methodology of Buraprathep, et al. (2015) together with the daily data from August 16, 1995 to August 31, 2015, the researcher finds that the efficiency of the Stock Exchange of Thailand improves over time. The market for large stocks--being proxied by the SET 50 Index portfolio, exhibits fast movement toward efficiency, but market for small stocks--being proxied by the MAI Index portfolio as well as the regression residual of the SET index on the SET 50 index returns, hardly converges. The researcher concludes that only the market for large stocks exhibits improved efficiency. The market for small stocks remains inefficient and shows no improvement.

2. Methodology

2.1 The Model

In this study, the researcher adopts the methodology of Buraprathep, et al. (2015). It is a time-dependent, stochastic AR model in which the stock return follows an AR process. The model has been improved upon over those being applied in past studies. This stochastic model is more suitable to investigate the time-varying degree of efficiency than the rolling, constant-parameter AR model applied by Lo (2004). Its specification is in a general form. It is capable of accommodating the specification of the AR(p) coefficient even if it is a random walk, as proposed by Emerson, et al. (1997), or deterministic, as proposed by Khanthavit, et al. (2012), or even a constant. And, the model imposes the functional relationship of the AR(p) coefficient with time in order to align it with the theoretical perspective that the AR(p) coefficient has a negative relationship with time and should move towards a small, long-run value, not necessarily zero, as time goes to infinity.

In the model, the AR coefficient moves stochastically and depends inversely on time as in Equations (1) and (2).

$$r_t = \beta_0 + \beta_{1,t} r_{t-1} + v_t \quad (1)$$
$$\beta_{1,t} = \bar{\beta} + \theta t + \rho \beta_{1,t-1} + u_t, \quad (2)$$

where r_t is the daily return on day t. The independent error terms v_t and u_t are normally distributed with zero means and σ_v^2 and σ_u^2 variances, respectively. $\beta_{1,t}$ is the stochastic AR coefficient. The model is general such that full efficiency is implied by a zero $\beta_{1,t}$. If $\beta_{1,t}$ is a random walk as in Emerson, et al. (1997), $\bar{\beta} = \theta = 0.00$ and $\rho = 1$. Because the degree of market efficiency can be inferred by the size of $\beta_{1,t}$, the fact that $\theta < 0.00$ indicates that the degree of efficiency is improving because $\beta_{1,t}$ gets smaller as time t grows larger. Finally, the constant $\bar{\beta}$ can be interpreted as the level of the efficiency on day $t = 0$, while the constant β_0 is the expected, long-run return.

The researcher chooses the linear specification for $\beta_{1,t}$ as in (2), even though the logistic specification recommended by Buraprathep, et al. (2015) is more flexible, for three reasons. Firstly, the fitting performance of the two specifications in Buraprathep, et al. (2015) is not significantly different. Secondly, the linear structure is much simpler. The model estimation is less burdensome. Thirdly, the interpretation of parameter estimates is intuitive and straightforward. The degrees of efficiency on the starting date ($t = 0$) are measured by $\bar{\beta}$ and those on today's date ($t = 1$) are measured by $\bar{\beta} + \theta$. Moreover, the fast or slow convergence speeds can be inferred from the size of θ.

2.2 The Estimation Technique

Equation (1) can be interpreted as being the measurement equation of the observed return r_t and Equation (2) is the transition equation of the latent coefficient $\beta_{1,t}$. Employing this structure, the researcher estimates the model by using the Kalman filter, which operates recursively on the time series of r_t to produce a statistically optimal estimate of $\beta_{1,t}$. It is possible that the σ_v^2 and σ_u^2 variances are stochastic or conditionally time-varying. Yet the Kalman filter based on Equations (1) and (2) is still the *optimal* linear filter. See Harvey (1989) for details.

3. The Data

The data are daily logged returns on stocks trading on the Stock Exchange of Thailand from August 16, 1995 to August 31, 2015. The starting date of August 16, 1995 is chosen because the SET 50 Index started on that particular date. The researcher uses the SET 50 Index portfolio as the proxy of the portfolio of large stocks. The index is value-weighted average index of the fifty largest and most active stocks on the Exchange.

In order to proxy the behavior of small stocks, the researcher notices that the SET Index portfolio is the value-weighted portfolio of all the stocks—large and small, on the Exchange. Next, he considers the regression model of the SET Index return on the SET 50 Index return, in which the movement of the SET Index return is explained by the SET 50 Index return and the regression residual. Because the movement of the SET 50 Index return is the movement of large stocks, that of the regression residual must be the movement of small stocks. The researcher is aware that the mean of the residual is zero. In its estimation, therefore, β_0 in Equation (1) will be constrained to zero.

On September 3, 2002, the Exchange constructed the Market for Alternative Investment (MAI) Index for smaller SME stocks. In order to check for the robustness of the results, especially for the small stocks, the researcher will consider the more recent samples, including the MAI Index return, from September 2, 2002 to August 31, 2015.

The descriptive statistics are reported in Table 1. According to the data in the table, the returns are skewed and fat-tailed. The Jarque-Bera test rejects the normality assumption for all the returns in the two sample periods. In spite of the rejection, the Kalman filter can still be used because it offers the best liner estimators in the mean square sense.

Table 1
Descriptive Statistics

Statistics	SET Index	SET 50 Index	Residual	MAI Index

	08:16:1995-08:31:2015	09:02:2002-08:31:2015	08:16:1995-08:31:2015	09:02:2002-08:31:2015	08:16:1995-08:31:2015	09:02:2002-08:31:2015	09:02:2002-08:31:2015
Average	0.0011%	0.0426%	-0.0020%	0.0434%	0.0000%	0.0000%	0.0340%
Std. Dev.	1.6077%	1.3344%	1.8563%	1.4885%	0.2013%	0.1633%	1.9011%
Skewness	0.0538	-0.8445	0.2116	-0.6858	-1.4853	-1.5359	-18.1303
Kurtosis	7.2628	12.4358	7.0738	11.4164	14.5965	16.0516	697.2517
Jarque-Bera	10,785.10***	20,842.93***	10,265.38***	17,496.88***	45,357.21***	35,345.01***	6.45*e*+07***
AR(1)	0.0917***	0.0288	0.0857***	0.0168	0.1008***	0.1236***	0.0291*

Note: *** = Significance at a 99% confidence level.

In a conventional test, a significant AR(1) coefficient provides evidence against weak-formed efficiency (Fama, 1970). Table 1 reports the AR(1) coefficients for the sample returns in the two periods. For the SET and SET 50 Index returns, the coefficients are significant for the 1995-2015 period, but not significant for the more recent 2002-2015 period. The coefficients are significant for the small stocks, when they are estimated using either the residual or the MAI Index portfolio return. The results suggest that the overall market exhibits improved efficiency in the more recent periods. The improved efficiency is principally created by the market for large stocks. Because the AR(1) coefficients for the market for small stocks are significant in the two sample periods, it is not clear how its efficiency evolves over time and how it contributes to that of the overall market.

4. The Empirical Results

The researcher estimates the model in Equations (1) and (2) for the overall market and the markets for large and small stocks for the two samples. The results are in Table 2. Turn first to the results for the 1995-2015 period. The beginning degree $\bar{\beta}$ is significant and about the same for the SET Index, the SET 50, and the residual, with results of 0.1873, 0.1869, and 0.1410 respectively. It is important and interesting to find that the convergence speed Θ is negative and significant for the SET and SET 50 Index returns—meaning the overall market and the market for large stocks are converging to efficiency. As of August 31, 2015 or day t=1, the degree of inefficiency was only 0.0275 (=0.1873-0.1598) for the SET and 0.0081 (=0.1869-0.1788) for the SET 50. But for the market of small stocks, the speed Θ of -1.50*e*-18 is practically zero. The degree of inefficiency remains unchanged at 0.1410 over the 20-year sample.

Table 2
Parameter Estimates

Estimates	SET Index		SET 50 Index		Residual		MAI Index
	08:16:1995-08:31:2015	09:02:2002-08:31:2015	08:16:1995-08:31:2015	09:02:2002-08:31:2015	08:16:1995-08:31:2015	09:02:2002-08:31:2015	09:02:2002-08:31:2015
β_0	-0.0013	0.0343	-0.0052	0.0346	N.A.	N.A.	0.0298
σ_v	1.8120***	1.3140***	2.3345***	1.6075***	0.0219***	0.0146***	1.0821***
$\bar{\beta}$	0.1873***	0.1332***	0.1869***	0.1441***	0.1410***	0.1358***	0.1761*
Θ	-0.1598***	-0.0851	-0.1788***	-0.1303*	-1.50*e*-18	-3.81*e*-11	-0.0696
ρ	0.0011*	-2.17*e*-4	0.0003	-2.56*e*-5	0.0034***	0.0026	0.0074***
σ_u	0.2779***	0.2483***	0.3069***	0.2615***	0.5741***	0.5001***	2.4163

Note: * and *** = Significance at 90% and 99% confidence levels, respectively.

Because the researcher uses the residual to examine the behavior of small stocks, the results are reliable only when the residual is a good proxy. In order to check for the robustness of the results for small stocks, the researcher considers the MAI Index portfolio return as an alternative proxy. Because the MAI Index began on July 2, 2002, the estimation will be repeated for all the returns and residuals for the period from 2002 to 2015. In the recent sample period, the results for the SET Index, the SET 50 Index, and the residual are similar to those in the 1995-2015 period. As for the market for smaller stocks, as proxied by the MAI Index return, the beginning degree $\bar{\beta}$ is 0.1761 and is significant. The size is about the same as that of the residual of 0.1358 in the same period. The speed of convergence is not significantly different from zero.

5. Conclusion

Finance theories, such as option pricing models, rely on the market efficiency assumption. In this study the researcher finds that, although Thailand's stock market was inefficient in the past, its degree of efficiency has improved over time. Today, the efficiency hypothesis cannot be rejected. When the market is de-composed into the markets for large stocks and for small stocks, the researcher finds that the improvement can only be found in the market for large stocks. Its convergence speed to efficiency is fast. The efficiency of the market for small stocks has hardly improved for the last 20 years. With respect to these findings, academicians and practitioners must be careful when they apply those finance theories that are based on the efficient-market assumption, in their analyses of small Thai stocks.

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