Discussion Papers In Economics And Business

The Effects of IMF Supported-Program on the Asian Crisis

Tatsuyoshi Miyakoshi

Yoshihiko Tsukuda

Junji Shimada

Discussion Paper 07-24

Graduate School of Economics and
Osaka School of International Public Policy (OSIPP)
Osaka University, Toyonaka, Osaka 560-0043, JAPAN

The Effects of IMF Supported-Program on the Asian Crisis

Tatsuyoshi Miyakoshi

Yoshihiko Tsukuda

Junji Shimada

Discussion Paper 07-24

June 2007

この研究は「大学院経済学研究科・経済学部記念事業」
基金より援助を受けた、記して感謝する。

Graduate School of Economics and
Osaka School of International Public Policy (OSIPP)
Osaka University, Toyonaka, Osaka 560-0043, JAPAN

The Effects of IMF Supported-Program on the Asian Crisis

by

Tatsuyoshi Miyakoshi *

Yoshihiko Tsukuda**

Junji Shimada***

June , 2007

ABSTRACT:

We assess the IMF supported program on the structural reforms after the Asian crisis in 1997 in terms of the before-after, with-without and event study approaches with applying a time varying parameter model to the nine Asian stock markets. All the supported countries except for Thailand (Indonesia, Korea and Philippine) remarkably improve market efficiency after the implementation of the program, implying positive assessment of the program in the before-after approach. Among the non-supported countries, China, Taiwan, and Malaysia do not improve efficiency after the breakout of the crisis, providing partially positive assessment in the with-without approach. The Thailand, Indonesia and Korean markets show the positive abnormal returns at the dates or at the next dates of program's announcement, providing partially positive assessment of announcement effects in the event study approach.

Keywords: IMF supported-programs; Asian crisis; structural reforms; assessment

JEL Classification Number: C40; F33; G14; G15

---

* Osaka School of International Public Policy, Osaka University

** Graduate School of Economics, Tohoku University

*** School of Management, Aoyama Gakuin University

Correspondence: Tatsuyoshi Miyakoshi, Prof. of Monetary Economics

Osaka School of International Public Policy, Osaka University

1-31, Machikaneyama-machi, Toyonaka, Osaka, 560-0043, Japan.

tel:+81-6-6850-5638; fax:+81-6-6850-5656, E-mail: miyakoshi@osipp.osaka-u.ac.jp

1. Introduction

The IMF program to settle the difficulties caused by the Asian crisis consists of a macroeconomic policy (combining exchange rate, monetary and fiscal policy) and a structural reform policy including corporate governance. The objectives of the first policy in the IMF supported program are to restore the stabilization of exchange rates and financial markets, and to recover the real economy. The second policy in this program aims to lower the possibility of future crises (i.e., a long-run policy). The Annual Reports of IMF (1998, ch.5 and 1999, ch.4) describe the program in detail.

Several papers assessed the first policy in the IMF program. Ito (1999) and Yoo and Moon (1999) assessed no smooth recovery in the real economy and claimed that the IMF programs that do not address the crux of the matter were ineffective and costly. Berg (1999) stated that the issues of short-run stabilization receded as early as 1999. However, Cerra and Sweta (2005) found that while growth recovered fairly quickly after the crisis, there was evidence of permanent losses in the levels of output in all the countries. Lane et al. (1999) presented a preliminary assessment that the developments toward recovery had been much more favorable in Thailand and Korea that had been able to keep to the programs, but Indonesia had been still facing more difficult task in part because of the severity of the underlying political crisis. Kho and Stulz (2000) found the negative impact of IMF bailout announcements on the bank stock indices. In contrast, Lau and McInish (2003) found the positive impact on the individual bank stock returns and on the multiple event dates.

To our knowledge, there are no papers for assessing the second policy. Since the second policy aims at long-run effect, its effect does not appear in a short-run.[1] However, it is interesting to assess the second policy because success of this policy contributes to prevent another Asian-type crisis. This policy is a structural reform policy including corporate governance. The chronological highlights of IMF program on structural reforms for the supported countries of Thailand, Indonesia, and Korea are presented at Table 1. The second policy focusing on the closure of unviable financial institutions is not considered in this paper because the closure is not

[1] Lane et al.(1999) presented a preliminary assessment that in Korea and Indonesia, deficiencies in corporate governance were recognized at the outset but the progress had been very slow. The reform agenda for the financial and corporate sectors is still evolving and it is too early to asses in detail the multitude of measures that were planned and implemented. However, they pointed out a number of important general questions regarding program design from the experience with the first program.

a long-run but short-run policy.[2] The programs for each country were modified several times in the light of climate in its economy. However, the common strand in the policies is to improve governance in both the corporate and government sectors, to enhance economic efficiency and transparency, and then to attract foreign capital through upgrading accounting, auditing and disclosure standards. In actuality, the four supported countries (Thailand, Indonesia, Korea and Philippines) implemented the measures along the supported programs. When the policies become effective in a long-run, the investor's accessibility to the markets increases, the information surrounding the markets prevails instantaneously among the investors, and then the current price should reflect all available information. That is, the success of the second policy in the IMF program means that the assumptions of the efficient market hypothesis are satisfied and then the markets become efficient.[3]

The purpose of this paper is to assess the second policy of the IMF program by the way of examining whether the program contributes to the improvement of market efficiency in the supported countries after the crisis.

First, we employ the two methodologies for assessing the programs which are the two out of four classified by Khan (1990). The methods of evaluating the fund-supported programs are classified into the four distinct categories by Khan (1990): (1) the *before-after approach*, which compares the performance of a country during the program and that of this country prior to the program; (2) the *with-without approach*, which compares the performance of a country with the program and that of other countries without the program; (3) the *actual-versus-target approach*, which compares the actual performance under the program and that specified by the target of the program; (4) the *comparison-of-simulations approach*, which compares the simulated performance of fund program-type policies and the performance of other policies. He argues the advantage and disadvantage about each approach. But it is difficult to single out the best approach. Nevertheless, as Khan (1990) pointed out, approach (1) and (2) are relatively popular based on restricted information for the program, compared with the other approaches. We apply the before-after and with-without approaches for assessing the IMF program which supported Thailand, Indonesia, Korea and Philippines after the break out of the Asian financial crisis. The

[2] The last modification of the supported program for Korea was done on May 2 1998, which is not closely related to structural reform and then deleted from Table 1.

[3] See Fama (1970) and Jensen (1978) for the definition of efficiency market.

combined use of two approaches is expected to complement the shortcoming of each method.[4] The time varying parameter model was introduced to investigate the dynamic efficiency in the East- European emerging markets by Rockinger and Urga (2000, 2001). Their model can enhance the gradual change of market efficiency. We use the time varying parameter model of Tsukuda, Miyakoshi and Shimada (2006) which extends their model to more appropriate one for describing the dynamic behaviors of stock returns and includes their model as a special case.

Second, we employ a recent new methodology for assessing the program's announcement effects which is not picked up by Khan (1990). The *event study approach* is applied to assess the program's announcement by Kho and Stulz (2000) and Lau and McInish (2003), which investigate whether the IMF bailout announcements on the bank stock indices make a positive abnormal return. The positive abnormal returns are evidences that the program's announcements help ameliorate systemic risk in the bailout countries.

We analyze the nine Asian stock markets in which Thailand, Indonesia, and Korea had the support from the IMF program after the breakout of the crisis on July 2 1997, Philippine took the program before the crisis, while Hong Kong, Singapore, China, Taiwan and Malaysia did not take the program. All the IMF-supported countries except for Thailand remarkably improve efficiency in the stock markets after the implementation of the program. In terms of the before-after approach, the IMF program is successful. In terms of the with-without approach, the IMF program is effective if we choose China, Taiwan and Malaysia as the without-supported countries, while the program does not provide the evidence for success if Hong Kong and Singapore are chosen. However, the improvement of market efficiency in Hong Kong and Singapore after the crisis can be attributed to their own structural reform programs. As a whole, the IMF program is positively assessed to improve market efficiency. The announcements of the IMF-supported program for Thailand, Indonesia and Korea have produced positive abnormal returns, ameliorating systemic risk. While the previous researches including Kho and Stulz (2000) and Lau and McInish (2003) analyzed the announcement effects of the macroeconomic policy with the short-run effects which results appear soon, we have investigated the announcement effects of a structural reform policy with the long run effects which results take long time to appear.

[4] See Khan (1990, p.201 and 203): "The shortcoming of the before-after approach makes it a poor estimator of the counterfactual, because the situation prevailing before the program is not likely to be a good predictor of what would have happened in a absence of the program…." and "The problem is that program countries differ systematically from non-program countries prior to the program period, and this difference matters for performance evaluation".

This paper is organized as follows. In Section 2, we sketch a time varying parameter model of Tsukuda, Miyakoshi and Shimada (2006) and explain the testing hypothesis for market efficiency by employing the before-after approach and the with-without approach classified by Khan (1990). In Section 3, we describe the data set and provide some preliminary analyses based on the summary statistics. In Section 4, we estimate the market efficiency and discuss the assessment of IMF supported program. In Section 5 we employ an event study approach. Section 6 concludes.

[Insert Table 1]

2. Before-After Approach and With-Without Approach

The paper employs the before-after approach and the with-without approach classified by Khan (1990) for assessing the IMF supported programs to tackle the problems caused by the Asian financial crisis in 1997. The program did not start at the same date for all countries. In fact the program started at the different dates from country to country and was modified several times. But we suppose that the program for each country started on July 2, 1997 when the Asian crisis broke out. We compare the market efficiency during the program (i.e., after the crisis) with that prior to the program (i.e., before the crisis) for the before-after approach, and compare the market efficiency between the countries with program (Thailand, Indonesia, Korea and Philippine) and those without program (Hong Kong, Singapore, China, Taiwan and Malaysia) for the with-without approach.

We use a time-varying coefficient model of Tsukuda, Miyakoshi and Shimada (2006).[5] Let the return on the stock price index (P_t) at time t be $r_t = 100\{ \log P_t - \log P_{t-1}\}$. The return generating process follows a first order autoregressive (AR(1)) process:

the observation equation:

$$r_t = b_{0,t} + b_{1,t} r_{t-1} + \varepsilon_t, \quad \varepsilon_t \mid I_{t-1} \sim N\left(0, \sigma_t^2\right), \; t = 1, \ldots, T; \tag{1}$$

[5] This type specification was first proposed by Rockinger and Urga (2000) to analyze the market efficiency in the East European emerging economies. The coefficient β is not restricted to one in our model opposed to β = 1 in their model. Our model nests their model. See Tsukuda, Miyakoshi and Shimada

where I_{t-1} is the information set available up to time t-1. The unobservable time varying parameters are assumed to follow the AR(1) process

the state equation:

$$b_{i,t} = \alpha_i + \beta_i\, b_{i,t-1} + \gamma_{i,1}\, t^* + \gamma_{i,2}\, t^{**} + \eta_{i,t}, \quad \eta_{i,t} \sim \text{NID}(0, q^2_{,i}) \quad \text{for } i=0,1; \tag{2}$$

where $\gamma_{0,1} = \gamma_{0,2} = 0$,[6] t* and t** are the dummy variables such that $t^* = 10^{-3}t$ for $t < t_1$ (t_1 denotes the date when the Asian financial crisis broke out, i.e. July 2, 1997) and $t^* = 10^{-3}t_1$ for $t_1 \le t$, and $t^{**} = 0$ for $t < t_1$ and $t^{**} = 10^{-3}(t - t_1)$ for $t_1 \le t$. We have employed 10^{-3} for the scale adjustment, since the number of the sample is about 2000. Figure 1 is a schematic diagram that describes this idea. All random noises in the observation equation are assumed to be independent of $\eta_{i,t}$. If $\gamma_{1,2} \neq 0$ in (2), the model has a structural change at $t = t_1$. The $b_{0,t}$ and $b_{1,t}$ in (1) are the time- varying parameters which measure the predictable part based on the previous returns (i.e., previous information).

[Figure 1]

For the noises of the observation equation (1), we assume EGARCH(1,1) model,

$$\ln \sigma_t^2 = \phi_0 + \delta\, D_t + \phi_1 \ln \sigma_{t-1}^2 + \phi_2 \left(\left| \varepsilon_{t-1} \right| / \sigma_t + \phi_3\, \varepsilon_{t-1} / \sigma_t \right) \tag{3}$$

where D_t is the dummy variable such that $D_t = 0$ for $t < t_1$ and $D_t = 1$ for $t_1 \le t$. The dummy variable D_t changes the level of log volatility

The model constitutes a state space representation with an observation equation of (1) and state equations of (2). Since the behavior of unobservable process $\{b_{i,t}\}$ is a main interest of

---

(2006) for more explanation of the differences between the two models.

[6] Since this paper is interested in the dynamic efficiency of the markets, we introduce a time trend only for the process of $\{b_{1,t}\}$, but do not for the process of $\{b_{0,t}\}$

this paper, we briefly explain a basic idea of estimating $\{b_{i,t}\}$ by using the Kalman filter algorithm. It estimates $\{b_{i,t}\}$ in two ways. The filtering estimate is the expectation of $b_{i,t}$ conditional on the observations up to the period t $\{r_1,\ldots,r_t\}$. The smoothing estimate which we use is the expectation of $b_{i,t}$ conditional on the whole observations $\{r_1,\ldots,r_T\}$. Generally the latter is expected to be more reliable than the former because the latter utilizes the full information available based on the whole samples $\{r_1,\ldots,r_T\}$. We can obtain the maximum likelihood estimates of the unknown parameters $\theta = (b_{0,0}, \alpha_0, \beta_0, q_0, b_{1,0}, \alpha_1, \beta_1, \gamma_{1,1}, \gamma_{1,2}, q_1, \phi_0, \phi_1, \phi_2, \phi_3)$, and the standard asymptotic theory is applicable if the error terms are normal and the state space processes are stationary. For initial conditions, we specify the $b_{0,0}$ and $b_{1,0}$ as the constant coefficients which are calculated by the sample first-order autoregressive model from the first 20 observations.

If $b_{1,t} = 0$ in (1), the returns at period t is not predictable, which in turn implies the market efficiency in the weak form of Fama (1970). We measure the dynamic efficiency through examining the time trend of the smoothed estimates of $b_{1,t}$. The dynamic efficiency over time periods may be confirmed, if $|\beta_1| < 1$ and the non-stochastic part ($\alpha_1 + \gamma_{1,1} t^* + \gamma_{1,2} t^{**}$) with $t^* = 10^{-3} t_1$ goes to zero over time within the sample periods. Seeing Figure 1, we test the hypothesis of $\alpha_1 \geq 0$ and/or $\gamma_{1,1} \geq 0$, $\alpha_1 + \gamma_{1,1} 10^{-3} t_1 > 0$, and $\gamma_{1,2} < 0$ and $\alpha_1 + \gamma_{1,1} 10^{-3} t_1 + \gamma_{1,2} 10^{-3} (t_T - t_1) \approx 0$. Needless to say, our model cannot be extrapolated to the out-of-sample periods, because the non-stochastic part eventually explodes to infinity. Though we have tried to incorporate the quadratic term of time like $1/t^2$, the model did not show good performances.

It is significant to check whether $|\beta_1| < 1$ or not. The specification of (2) includes the Random Walk (RW) type as a special case. If $\beta_1 = 1$, the AR type model reduces to the RW type one. Most of previous researches including Rockinger and Urga (2000, 2001) imposed the RW type restriction to the state equation (2) for investigating the dynamic efficiency of the markets. But they did not test the RW type hypothesis against the AR(1) type one based upon the data from the East European emerging markets. The appropriateness of the statistical models should be determined from the data we observe. As Groenewold and Fraser (1999) did, one way of choosing the model between the AR(1) type and the RW type is to test the hypothesis:

$$H_0 : \beta_1 = 1 \quad \text{v.s.} \quad H_1 : \beta_1 < 1. \tag{4}$$

This constitutes a unit root test applied for the state equation. Although the test is apparently similar to the Dickey and Fuller (1981) test in the framework of observable autoregressive model,

the variable $b_{1,t}$ is not observable in our model. The DF test is not applicable since we do not know the distribution of the DF test statistic in the state space model. With this caution in mind, we formally use the DF test for the hypothesis testing of (4). More rigorously, we implement the unit root test by the methods proposed by Perron (1989,p.1380:equation (13)), because the process has a trend break.

3. The Data and Basic Statistics

The data are compiled from the Nomura Research Institute Japan. The daily closing stock price P_t is measured in local currency. We examine the stock price indices for the nine Asian stock markets, consisting of the Stock Exchange of Thailand Index in Thailand, the Jakarta Composite Index in Indonesia, the Korea Composite Stock Price Index in Korea, the Philippine Composite Index in Philippine, the Hang Seng Index in Hong Kong, the Strait Times Index in Singapore, the Shanghai B Share Index in China, the Taiwan Stock Exchange Weighted Price Index in Taiwan, and the Kuala Lumpur Stock Exchange composite index in Malaysia.[7] The sample periods are the same for all the markets, ranging from January 1, 1995 to December 31, 2001. The number of observations is approximately 2000 for each country. We choose the appropriate sample periods for computation before and after the IMF supported program started.

The stock price indices and the returns for the whole periods are illustrated in Figures 2 and 3. Both the stock price indices and the returns exhibit large fluctuations over the periods. In particular, after the Asian crisis, the indices drastically drop down and the volatilities of returns greatly enlarge. However, it is not apparent to see from Figures 2 and 3 what the drastic changes of movement in the price indexes and the returns really mean.

First, we look carefully at the summary statistics of the data in the pre-crisis and the post-crisis samples. Table 2 indicate the number of observations, mean, standard deviation, skewness, excess kurtosis, the first order autocorrelation for the returns and the first order autocorrelation for the squared returns from the both sub-samples for each country. The asterisks in the columns 4 and 5 denote that the values are significant from zero at 5% level, meaning the non normal distribution of returns. The asterisks in the column 7 reject the null of no first order

7 The Shanghai market is much larger than the Shenzhen market in terms of market capitalization. Each market is separated into the A market (only domestic investors are allowed to trade) and the B market (not restricted to domestic investors). However, the index of the B market is measured in Hong Kong dollars or US dollars. We only analyze the Shanghai B market in this paper.

autocorrelation of the squared returns at 5% level. Table 2 reveals that the typical features of stock returns such as fat tail, spiked peak, and the persistence of variance are observed for the Asian stock markets. Therefore, the ARCH-type model incorporating the above facts is appropriate for analyzing the return series. The asterisks in the column 6 reject the null of no first order autocorrelation of the returns at 5% level. The first order autocorrelations of the returns are significant for the six out the nine markets. This fact indicates that more than half of the Asian markets are inefficient for the periods of January 1, 1995 to December 31, 2001.

[Insert Figure 2, Figure 3 and Table 2]

4. Empirical Results and Discussions

Preliminary Results

We compare Table 2 (a) for the pre-crisis sample with Table 2(b) for the post-crisis. There exist significant first order autocorrelations of the returns in most of the markets. However, if we look at the Table 2 (a) and (b) in detail, the values of autocorrelation for the post-crisis are less than those for the pre-crisis sample in all countries except for Taiwan. Since $\rho(1) = 0$ means the market efficiency, the markets for the post-crisis are generally more efficient than those for the pre-crisis.

In order to find the rough time trend of the first order autocorrelation, we calculate the *moving autocorrelation of 2T+1 days* (MAR_t for 2T+1) defined by

$$MAR_t \; for \; (2T+1) = \left\{ \sum_{i=-T}^{T} (r_{t;i} - \bar{r}_t)(r_{t-1;i} - \bar{r}_t) \right\} \Big/ \left\{ \sum_{i=-T}^{T} (r_{t;i} - \bar{r}_t)^2 \right\} \qquad (5)$$

where $\bar{r}_t$ is a mean of $\{r_{t+i}\}_{i=-T}^{T}$. The MAR_t is an analogue to the construction of the moving average from the returns. Figure 4 plots the MAR_t for 1001,201 and 25 for each country. From visual examination of the MAR_t for 201 in Figure 4, we see that the moving autocorrelation in the supported countries (Thailand, Indonesia and Korea), the quasi-supported country (Philippines) and Singapore seem to approach to zero after the start date of the IMF program (July 2,1997). Among the non-supported countries, the MAR_t of China, Hong Kong and Taiwan seem to be unchanged between the pre- and post-crisis, but the MAR_t of Malaysia seems to rise in the

post-crisis period. However, from those of the MAR_t for 1001 and 25, we can never find the confirmed results.

Applying the before-after approach and the with-without approach to the basic statistics, we may preliminarily say that the IMF-supported programs have a positive effect on the post-crisis Asian market efficiency on the basis of an intuitively reasonable but naive method of the MAR. However, in order to confirm the preliminary results, we need more sound and rigorous analysis of the IMF supported programs.

[Insert Figure 4]

Main Results

Table 3 shows the estimated parameters of the time-varying parameter model presented in (1), (2) and (3).[8] The estimates of $\beta_{\tilde{0}}$ are close to unity for most markets. However, the estimates of β_1 are far from unity expect for the Hong Kong market but rather close to zero for the remained markets. If the RW type model is true in the Asian markets, the estimates of β_1 are expected to be close to unity. We test the unit-root hypothesis of (4) for the process of $\{b_{1,t}\}$. Table 4 shows that the null hypothesis is rejected at 5% level for all the countries expect for the Hong Kong market. The stock prices in the Asian markets do not follow the RW type time varying parameter models. Even though the Hong Kong market is exception, the AR type theoretically covers the RW type.

We have already checked for $|\beta_1| < 1$ in Table 4. The visual examination in Figure 4 should be confirmed by the statistical tests for ($\alpha_1 \geq 0$ and/or $\gamma_{1,1} \geq 0$), ($\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 > 0$), and ($\gamma_{1,2} < 0$ and $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 + \gamma_{1,2}\, 10^{-3}\, (t_T - t_1) \approx 0$) in the equation (2), since the non-stochastic part of $b_{1,t}$ is ($\alpha_1 + \gamma_{1,1}\, t^* + \gamma_{1,2}\, t^{**}$). See Figure 1. For example, if $\alpha_1 > 0$ and/or $\gamma_{1,1} = 0$, $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 > 0$, and $\gamma_{1,2} < 0$ and $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 + \gamma_{1,2}\, 10^{-3}\, (t_T - t_1) \approx 0$, $b_{1,t}$ has no time trend before the crisis but has a decreasing time trend toward zero after the crisis. Table 3 presents the estimates of equations (1) and (2). First, in terms of the before-after approach, the IMF programs for the supported and quasi-supported countries have positive effects on the market efficiency after the crisis, because

[8] As the estimates of EGARCH terms (i.e., equation (3)) are not main interest in this paper, Table 3 did not indicate those estimates. However, those estimates suggest that the EGARC formulation is useful to describe the process of stock returns for the Asian markets. In particular, most of the coefficients for asymmetric responses to positive and negative shocks (ϕ_3) are significant at 5% level. The volatility increases after the Asian crisis for 6 countries out of 9 at 10% level.

the estimates of α_1 and/or $\gamma_{1,1}$ are significant positive and $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 > 0$ while those of $\gamma_{1,2}$ are negative and significant at 5% level, and goes to zero ($\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 + \gamma_{1,2}\, 10^{-3}\, (t_T - t_1) \approx 0$) over time within the sample periods for all the above mentioned countries except for Thailand. Note that $\alpha_1 = \gamma_{1,1} = 0$ at even 10% and $\alpha_1 + \gamma_{1,1} 10^{-3} t_1 + \gamma_{1,2}\, 10^{-3}\, (t_T - t_1) = -0.161$ for Thailand and then, the efficiency is perfect before the program (the crisis) and decreases after it. Second, we assess the IMF program in terms of the with-without approach. The five countries of Hong Kong, Singapore, China, Taiwan and Malaysia are non-supported countries. These countries are divided into the two groups according to the market behaviors after the crisis; the first group consists of China and Taiwan and Malaysia, the second group of Hong Kong and Singapore. All countries in the first group have negative estimates of $\gamma_{1,1}$ but positive estimates of $\gamma_{1,2}$, in particular the estimates of $\gamma_{1,2}$ for Taiwan and Malaysia are significantly positive at 5% level: α_1 and $\gamma_{1,1}$ are significantly positive or insignificant, $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1$ is negative or zero, but $\alpha_1 + \gamma_{1,1}\, 10^{-3} t_1 + \gamma_{1,2}\, 10^{-3}\, (t_T - t_1)$ is positive. The stock markets for these countries did not improve efficiency after the crisis in contrast to the IMF supported countries where the markets improved efficiency after the crisis. That is, as shown at the last column of Table 3, the time trend of $b_{1,t}$ increase roughly from negative to positive values across zero. This fact indicates the success of the IMF program in terms of the with-without approach.

Malaysia more strictly controlled the stock markets to prevent the speculative attacks during the crisis than the pre-crisis period. In fact, in 1998, Malaysia imposed a range of foreign exchange and capital controls that substantially insulated Malaysian financial markets from external influences and effectively closed down the offshore ringgit market. See IMF (1999, pp.180-185) in detail.

On the other hand, the second group (Hong Kong and Singapore) have the same pattern of estimated coefficients as that of the IMF supported countries. Namely, Singapore in the second group has insignificantly positive estimates of $\gamma_{1,1}$, and has significantly negative estimates of $\gamma_{1,2}$ together with positive estimate of α_1 at 5% level. That is, it has a decreasing time trend toward zero after the crisis and goes to zero over time within the sample periods as shown in the last column of Table 3. On the other hand, the Hong Kong market is always efficient. This observation does not provide the evidence confirming the IMF program if we use Hong Kong and Singapore as the *without* countries. However, we note that this observation does not necessary mean failure of the IMF programs implemented into Indonesia, Korea and Pphilippines, because other policy measures taken by Hong Kong and Singapore might have improved the market efficiency. In fact,

many structural reforms in Hong Kong and Singapore are executed toward market deregulation after the crisis, following their own programs. For example, despite of equity market intervention just after the crisis, Hong Kong Monetary Authority and the Securities and Futures Commission lead to upgrade the market transparency and protection of investors with restrictions in 1998. See IMF (1999, pp.170-180) in detail. It may be an interesting question to examine why the smoothing estimates of Hong Kong and Singapore are going toward that of the efficient markets after the crisis. But we need further studies to answer this question.

[Insert Table 3 and Table 4]

5. Event Study Approach

We define the abnormal return abr_j

$$abr_j = r_j - \bar{r}_j \text{ , where } \bar{r}_j \text{ is a mean of } \{r_{j+i}\}_{i=-100}^{+100} \quad , \tag{6}$$

where the j is the date of announcement of IMF-supported program. The $\bar{r}_j$ is the moving average from the returns, based on 201 days which is used for the analysis for MAR_t and yields good suggestions. If $abr_j>0$ or $abr_{j+1}>0$, we can preliminarily say that the program's announcement ameliorate the systemic risk. We consider the one day lag of program's announcement effect because of psychological and physical delay. Table 5 shows that the announcements (of the program shown in Table 1) in Indonesia and Korea indicate the significant positive abnormal returns at the next date of some announcements, while no significant positive abnormal returns appear in Thailand. In general, the effects of the long-run policy like structural reform naturally appears its effects in a long run, and then its announcement's effects based on a short-run view is difficult to be strongly positive. However, Lau and McInish (2003) have studied the announcements of the IMF macroeconomic policy with the short-run effects, providing positive assessment in all supported countries.

[Insert Table 5]

In order to confirm the preliminary results, we implement the test by using the dummy variables for the dates of program announcements or the next dates. That is, we test whether the coefficients of dummy variables for announcement dates are positive significant in the following AR(1) equation:

$$r_t = a + b\ r_{t-1} + \sum_{j=1}^{k} (\gamma_j D_{j,t} + \delta_j E_{j,t}) + \varepsilon_t : \varepsilon_t \sim N(0, \sigma^2) \qquad (7)$$

where j is a suffix from the first to k-th announcement date. The $D_{j,t}$ is a dummy variable for announcement j, equal to 1 for day t when announcement j occurs and zero otherwise. The $E_{j,t}$ is also a dummy variable for announcement j, equal to 1 for next date t+1 to date t when announcement j occurs and zero otherwise. As seen at Tables 1 and 5, the two, four, and three events (announcements of IMF programs) occur in Thailand, Indonesia and Korea, respectively. Table 6 indicates that the Korean market shows that announcement effect is significant positive on the day for the first event, and on the next day for the second event. In the Indonesia market, the significant positive effect appears on the day for the second event. There is a significant effect on the next day for the third event in Thailand.

[Insert Table 6]

These results confirm the preliminary results. Why did the Korean market show the positive abnormal returns replying to the announcement for the long-run policy? Yoo and Moon(1999) concluded that the Korean economy still possesses strong fundamentals, but poor microeconomic policies with regard to the financial sector have disastrous consequence, therefore, the economic recovery is obtained with continuous reform efforts to a safe and sound financial sector. Based on their conclusion, it is imagined that the Korean investors expected positively the structural reform policy by the IMF programs, and then the positive abnormal returns appear replying to even the announcement of long-run policies. However, further researches are necessary.

6. Conclusions

We assessed the IMF supported program for the structural reforms against the Asian crisis

by using three evaluation methodologies of the before-after approach (which compares the performance in a country between the pre- and post-programs), the with-without approach (which compares the performance in different countries with supported program and without supported program) and the event study approach for program's announcements (which investigates whether the announcement produces the positive excess return). We employed a time varying parameter model for analyzing the nine Asian stock markets. Thailand, Indonesia, and Korea took the IMF-supported program after the crisis, Philippines took the program before the crisis, but Hong Kong, Singapore, China, Taiwan and Malaysia did not take the program.

We assessed the IMF-supported program successful in terms of the before-after approach. That is to say, all the IMF-supported countries except for Thailand remarkably improved efficiency in the stock markets after the implementation of the program on July 2, 1997. This result is confirmed by the analysis of the time varying parameter model in addition to the preliminary analysis of moving autocorrelations.

In terms of the with-without approach, the IMF program is effective if we choose China, Taiwan and Malaysia as the without-supported countries. The market efficiency in these non-supported countries does not improve after the program implementation. On the other hand, if Hong Kong and Singapore are chosen as the without-supported countries, the with-without approach does not provide the evidence for success of the IMF programs, because this country improved efficiency after the crisis broke out. However, thinking in mind that the improvement of market efficiency in Hong Kong and Singapore can be attributed to their own structural reform programs, we positively evaluate that the IMF program to improve market efficiency is successful in terms of the with-without approach as a whole except for Thailand.

Also, we assess whether the program announcements help ameliorate systemic risk. This approach was not classified yet by Khan (1990) but a new approach used recently by Kho and Stulz (2000) and Lau and McInish (2003). All the IMF supported countries show the positive abnormal returns replying to the announcements of the IMF-supported program. In general, the announcement's effects based on a short-run view are not strongly positive for the long-run policy like structural reform. Why did the market show the positive abnormal returns? Following Yoo and Moon(1999), the Korean investors already expected positively the structural reform policy by the IMF programs. Then, we can suppose that the positive abnormal returns appear replying to even the announcement of long-run policies.

References

Berg, A. (1999),” The Asia Crisis - Causes, Policy Responses and Outcomes ”, IMF Working Paper No. 99/138.

Cerra,V. and Saxena, S.C. (2005), “Did Output Recover from the Asian Crisis?” IMF Staff Papers 52:1-23

Fama, E. (1970),”Efficient Capital Markets: A Review of Theory and Empirical Work”, Journal of Finance 25:383-417.

Gronewold, N. and P. Fraser, (1999), ”Time-Varying Estimates of CAPM betas”, Mathematics and Computers in Simulation, 48, 531-539.

IMF(1998), The Annual Report 1998, International Monetary Fund.

IMF(1999), The Annual Report 1999, International Monetary Fund.

Ito, T. (1999),”Asian Currency Crisis and the IMF”(in Japanese), The Economic Review (The Institute of Economic Research, Hitotsubashi University) 50:69-93.

Jensen ,M. C. (1978),”Some Anomalous Evidence Regarding Market Efficiency”, Journal Financial Economics 6:95-101.

Khan, M. S. (1990),"The Macroeconomic Effects of Fund-Supported Adjustment Programs", IMF Staff Papers, 37, 2:95-231.

Kho, B-C. and Stulz, R. M. (2000),”Banks, the IMF, and the Asian crisis”, Pacific-Basin Finance Journal 8:135-275.

Lane, T. etc.(1999),”IMF-Supported Programs in Indonesia, Korea, and Thailand: A Preliminary Assessment”, IMF Occasional Paper No.178.

Lau, S-T. and McInish, T. (2003),”IMF Bailouts, Contagion Effects, and Bank Security Reurns”**,** International Review of Financial Analysis 12:3-23.

Perron, P.(1989),”The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis”, Econometrica 57:1361–1401.

Rockinger, M. and Urga, G. (2000),”The Evolution of Stock Markets in Transition Economies”, Journal of Comparative Economics 28:456-472

Rockinger, M. and Urga,G. (2001),”A Time-Varying Parameter Model to Test for Predictability and Integration in the Stock Markets of Transaction Economies”, Journal of Business & Economic Statistics 19:73-84.

Tsukuda, Y., Miyakoshi,T. and Shimada, J. (2006),” Dynamic Efficiency in the East European Emerging Markets”, Asia-Pacific Financial Markets 12,159-179.

Yoo, J-H. and Moon, C. W. (1999),”Korean financial crisis during 1997–1998 Causes and Challenges”, Journal of Asian Economics 10:263-277.

Table 1. Chronological Highlight for IMF Supported Program on Structural Reform

Thailand

August 20,1997: structural initiatives to increase efficiency, deepen the role of the private sector in the Thai economy, and reinforce its outward orientation, civil service reform, privatization, and initiatives to attract foreign capital.

February 24, 1998 and May 26, 1998: Improving governance in both the corporate and government sector. Further deepening the role of the private sector, including through initiatives to attract foreign capital.

Indonesia

November 5,1997: Structural reforms to enhance economic efficiency and transparency, including liberalization of foreign trade and investment, dismantling of domestic monopolies, and expanding the privatization program.

January 15,1998: Limiting the monopoly of the national marketing board to rice, deregulating domestic trade in agricultural produce, and eliminating restrictive market arrangements.

April 10, 1998: An extensive agenda of structural reforms to increase competition and efficiency in the economy, reinforcing the commitments made in January and including the further privatization of six major state enterprises already listed and the identification of seven new enterprises for privatization in 1998/1999.

June 24, 1998: Establishing an effective bankruptcy system, as an essential part of the corporate debt-restructuring strategy envisaged by the June 4 agreement between the government and creditor banks on debt restructuring.

Korea

December 4,1997: efforts to dismantle the nontransparent and inefficient ties among the government, banks, and businesses, including measures to upgrade accounting, auditing, and disclosure standards, to require that corporate financial statements be prepared on a consolidated basis and certified by external auditors, and to phase out the system of cross guarantees within conglomerates.

December 24,1997: speeding up the liberalization of capital and money markets, including the lifting of all capital account restrictions on foreign investors' access to the Korean bond market by December 31, 1997.

February 7,1998: introducing a number of measures to improve corporate transparency, including strengthening the oversight functions of corporate boards of directors, increasing accountability to shareholders, and introducing outside directors and external audit committees.

Note: This table is made from Annual Report 1998, p.23-32, *IMF*.

Table 2. Summary statistics of the daily returns

(a) Pre-crisis sample

Pre Sample	NOBS	MEAN	STD	SKEW	KURT	ρ(1)	ρ2(1)
Thailand	610	-0.155	1.440	0.049	1.698*	0.157*	0.113*
Indonesia	614	0.072	0.919	0.154	3.610*	0.262*	0.182*
Korea	731	-0.040	1.121	0.292*	0.962*	0.174*	0.075*
Philippines	619	0.001	1.152	-0.176	2.455*	0.222*	0.094*
Hong Kong	617	0.107	1.169	-0.288*	4.163*	0.046	0.046
Singapore	621	0.006	0.880	-0.282*	2.972*	0.192*	0.176*
China	612	0.112	2.861	0.965*	18.363*	0.048	0.154*
Taiwan	714	0.035	1.270	-0.396*	2.766*	-0.016	0.028
Malaysia	611	0.017	1.028	0.265*	3.055*	0.151*	0.222*

(b) Post-crisis sample

Post Sample	NOBS	MEAN	STD	SKEW	KURT	ρ(1)	ρ2(1)
Thailand	1107	-0.052	2.285	0.634*	2.769*	0.141*	0.265*
Indonesia	1105	-0.060	2.264	0.308*	4.745*	0.183*	0.154*
Korea	1174	-0.034	2.755	-0.060	0.710*	0.104*	0.090*
Philippines	1122	-0.096	1.944	1.011*	10.382*	0.175*	0.091*
Hong Kong	1107	-0.026	2.273	0.189*	6.794*	0.015	0.365*
Singapore	1132	-0.030	1.852	0.378*	7.231*	0.138*	0.176*
China	1093	0.025	1.566	0.076	6.178*	-0.006	0.250*
Taiwan	1198	-0.050	1.783	0.016	1.228*	0.077*	0.155*
Malaysia	1108	-0.046	2.435	0.507*	21.855*	0.042	0.491*

Notes: "NOBS", "STDEV", " KURT", "ρ(1)", and "ρ2(1)" respectively denote the number of the observations, standard deviation, excess kurtosis, the first order autocorrelation of the return process, and the first order autocorrelation of the squared return process. The asterisks "*" represents statistical significance at the 0.05 level.

Table 3. Estimation results

Parameters for Equ. (1) and (2)

Supported countries

	α_0	β_0	θ_0	α_1	β_1	θ_1	γ_{11}	γ_{12}	$\alpha_1+\gamma_{11}t_1 10^{-3}$	$\alpha_1+\gamma_{11}t_1 10^{-3}+\gamma_{12}(t_T-t_1)10^{-3}$
Thailand	-0.048	0.565	0.556	-0.044	-0.082	0.304	0.361	-0.306**	0.177	-0.161
	(0.025)	(0.067)	(0.222)	(0.141)	(0.203)	(0.076)	(0.251)	(0.124)		
Indonesia	-0.001	0.933	0.087	0.262**	-0.017	0.559	0.083	-0.215*	0.313	0.076
	(0.001)	(0.029)	(0.032)	(0.104)	(0.073)	(0.071)	(0.244)	(0.111)		
Korea	-0.023	0.226	0.451	0.057**	0.040	0.000	0.177**	-0.162**	0.187	-0.003
	(0.014)	(0.031)	(0.076)	(0.011)	(0.077)	(0.000)	(0.015)	(0.045)		
Philippines	-0.040	0.425	0.462	0.133**	-0.436	0.276	0.306**	-0.289**	0.323	-0.001
	(0.026)	(0.070)	(0.097)	(0.025)	(0.067)	(0.051)	(0.033)	(0.112)		

Non-supported countries

	α_0	β_0	θ_0	α_1	β_1	θ_1	γ_{11}	γ_{12}	$\alpha_1+\gamma_{11}t_1 10^{-3}$	$\alpha_1+\gamma_{11}t_1 10^{-3}+\gamma_{12}(t_T-t_1)10^{-3}$
Hong Kong	-0.001	0.969	0.069	0.011	0.881	0.000	0.001	-0.008	0.012	0.003
	(0.002)	(0.018)	(0.023)	(0.011)	(0.079)	(0.000)	(0.018)	(0.011)		
Singapore	-0.002	0.959	0.037	0.248*	-0.319	0.177	0.170	-0.357**	0.354	-0.050
	(0.002)	(0.024)	(0.014)	(0.129)	(0.269)	(0.085)	(0.244)	(0.142)		
China (ShanghiA)	0.002	0.920	0.000	0.243**	-0.176	0.363	-0.509**	0.162**	-0.070	0.107
	(0.003)	(0.041)	(0.000)	(0.046)	(0.136)	(0.132)	(0.074)	(0.067)		
Taiwan	-0.021	0.600	0.514	-0.095	0.027	0.001	-0.009	0.138**	-0.101	0.064
	(0.008)	(0.049)	(0.056)	(0.079)	(0.234)	(0.001)	(0.101)	(0.039)		
Malaysia	-0.001	0.956	0.057	0.189*	-0.175	0.333	-0.164	0.261**	0.088	0.377
	(0.002)	(0.029)	(0.043)	(0.111)	(0.061)	(0.078)	(0.143)	(0.062)		

Notes: Standard errors are in parenthesis. The estimates of α_1, γ_1 and γ_2 with "**" indicate significance at 5% level and with "*" indicate significance at 10% level

Table 4. DF test for $\beta_1 = 1.0$

Thailand	Indonesia	Korea	Philippines	Hong Kong	Singapore	China	Taiwan	Malaysia
-5.33	-13.93	-12.47	-21.43	-1.51	-4.90	-8.65	-4.16	-19.26

Note: The entries denote the values of the unit root test statistic "$(\hat{\beta}_1 - 1)/\hat{\sigma}_\beta$" where $\hat{\sigma}_\beta$ is a standard error for $\hat{\beta}_1$ and denoted in the parenthesis below the estimates in Table 3. The order of the lags is zero (i.e. it is not an augumented test) for the sake of simplicity. The 5% significance point of the t statistic for β_1=1 is –3.96 from Table V.B of Perron (1989, p. 1377), in view of the fact that 180/332≈0.5.

Table 5. Program's Announcements and Abnormal returns

Dates of Announcements	Abnormal returns (at announcement date)	Abnormal returns (at next date)
Thailand		
8/20/1997 γ_1	-0.364	-0.249
2/24/1998 γ_2	-0.555	-0.432
5/26/1998 γ_3	-1.139	-4.075
Indonesia		
11/5/1997 γ_1	-0.637	-2.349
1/15/1998 γ_2	-4.035	6.843*
4/10/1998 γ_3	_____+	-0.508
6/24/1998 γ_4	1.953	-0.382
Korea		
12/4/1997 γ_1	6.951*	6.939*
12/24/1997 γ_2	-3.876	6.825*
2/7/1998 γ_3	0.736	2.445

Notes: +; The market was closed on the day when the announcement was released: the 'next date' is the first trading date after that day.

*; A simple one-sided t-test, $t = abr_j / s$, indicates significance at 5% level, where s denotes the sample standard deviation from the full samples. The estimate of s for each market is shown in Table 2(a). The t-statistic is assumed to be distributed as N (0,1) under the null hypothesis of no announcement effect.

Table 6. Estimated Coefficients of Dummy Variables for Announcement's Date

Countries	Estimated Coefficients			
	γ_1	γ_2	γ_3	γ_4
Thailand				
The date γ	-0.273	-0.842	-1.274	
	(2.001)	(2.000)	(2.000)	
The next date δ	-0.405	-0.587	-3.904*	
	(1.998)	(1.998)	(1.998)	
Indonesia				
The date γ	-0.509	-5.309*		1.737
	(1.853)	(1.857)		(1.852)
The next date δ	-2.327	7.501*	-0.570	-0.849
	(1.848)	(1.851)	(1.848)	(1.848)
Korea				
The date γ	6.701*	-3.300	0.184	
	(2.177)	(2.184)	(2.178)	
The next date δ	6.029*	7.004*	2.082	
	(2.178)	(2.175)	(2.173)	

Notes: The standard errors are in the parentheses. The asterisk "*" indicates significance at 10% level.

Figure 1. Time Trend Structure

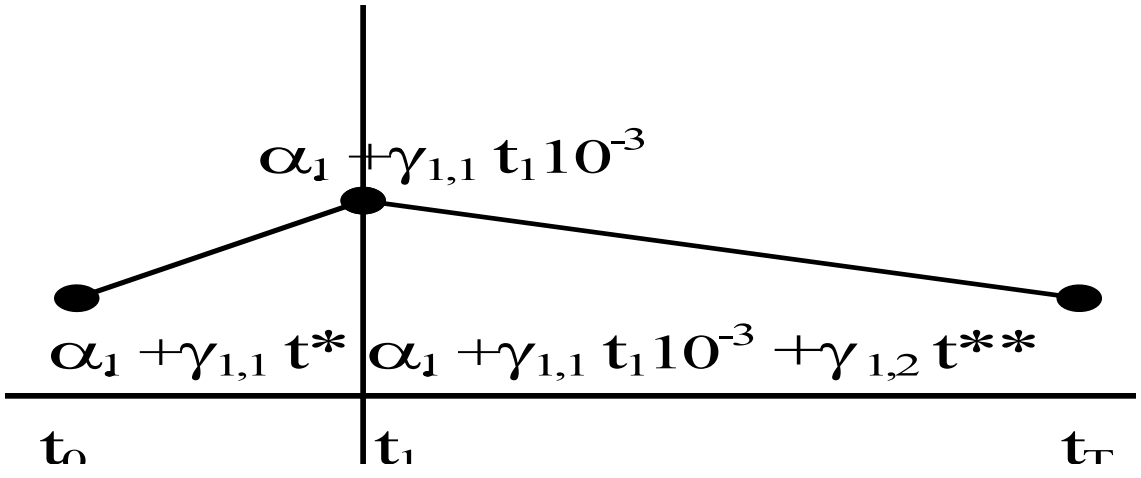
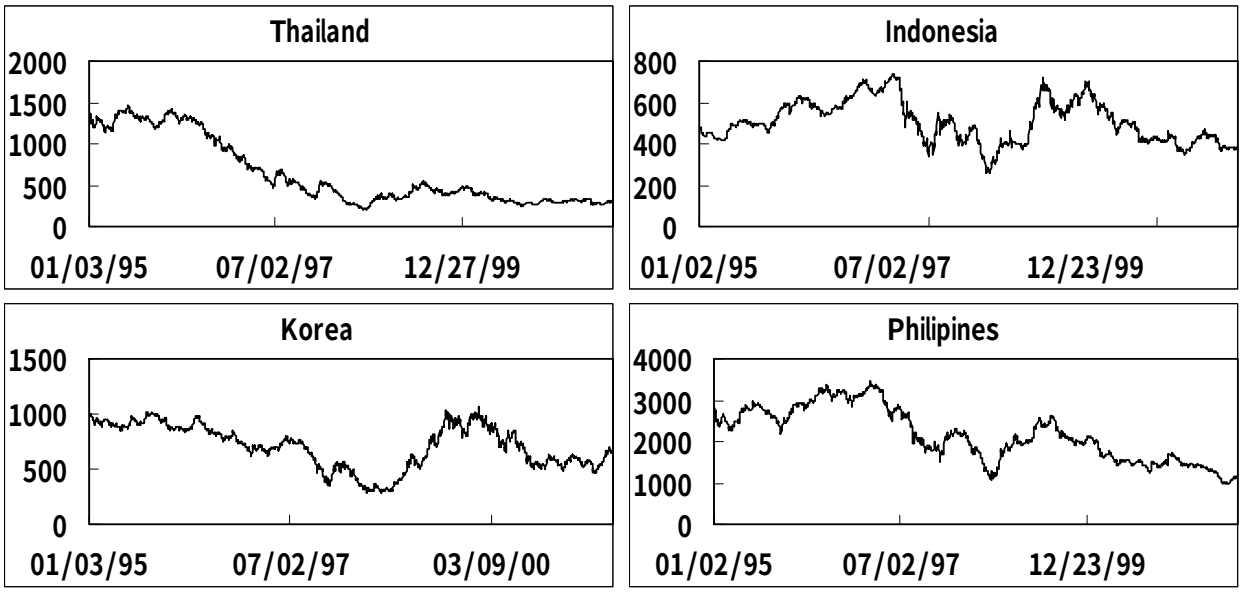


Figure 2. Stock price indices

(a) Supported countries



(b) Non-supported countries

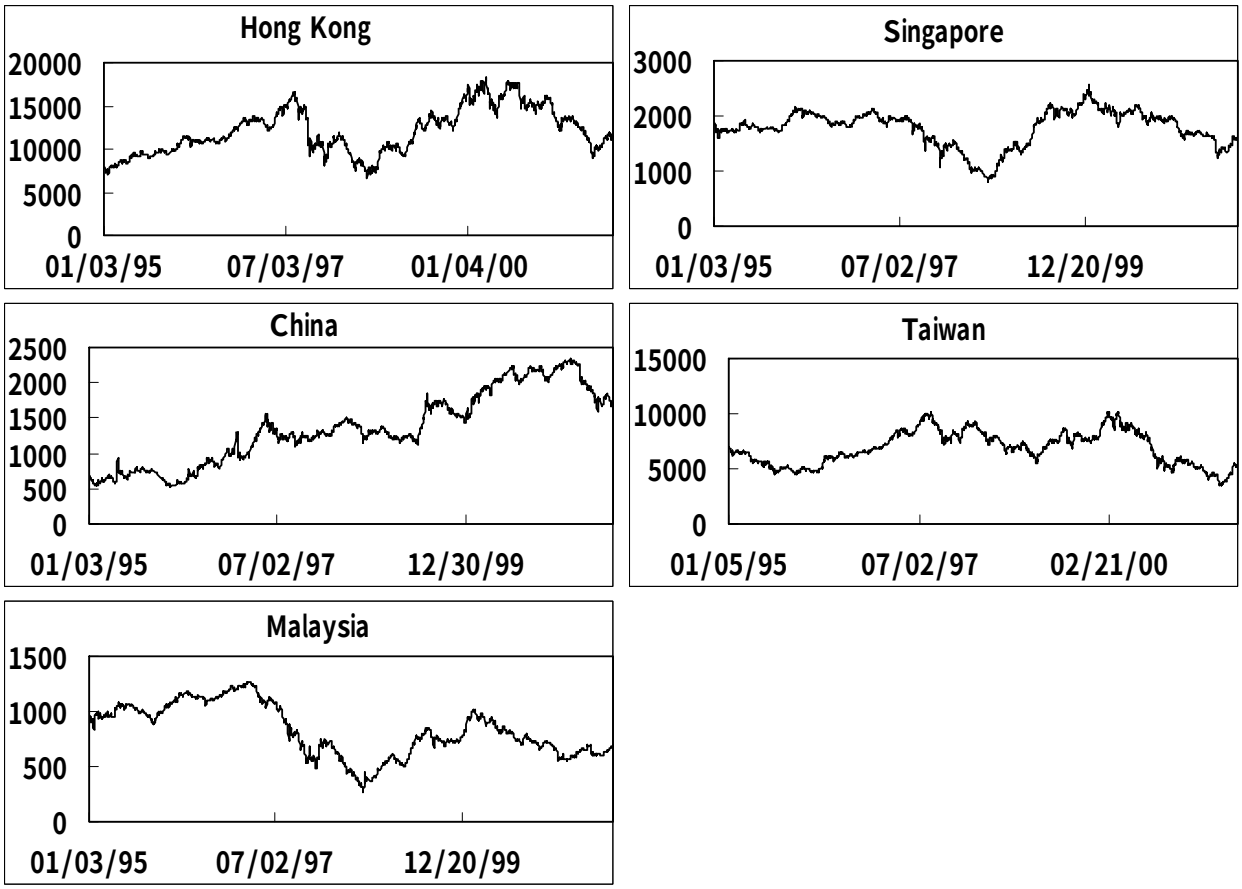
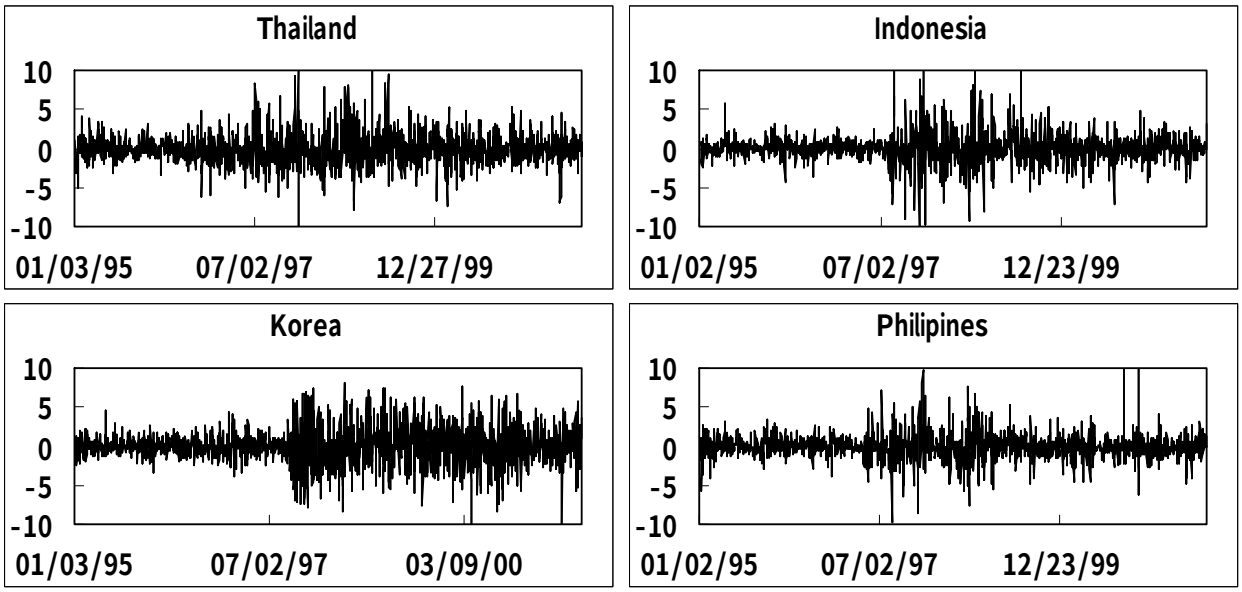


Figure 3. Returns on the Stock price indices

(a) Supported countries



(b) Non-supported countries

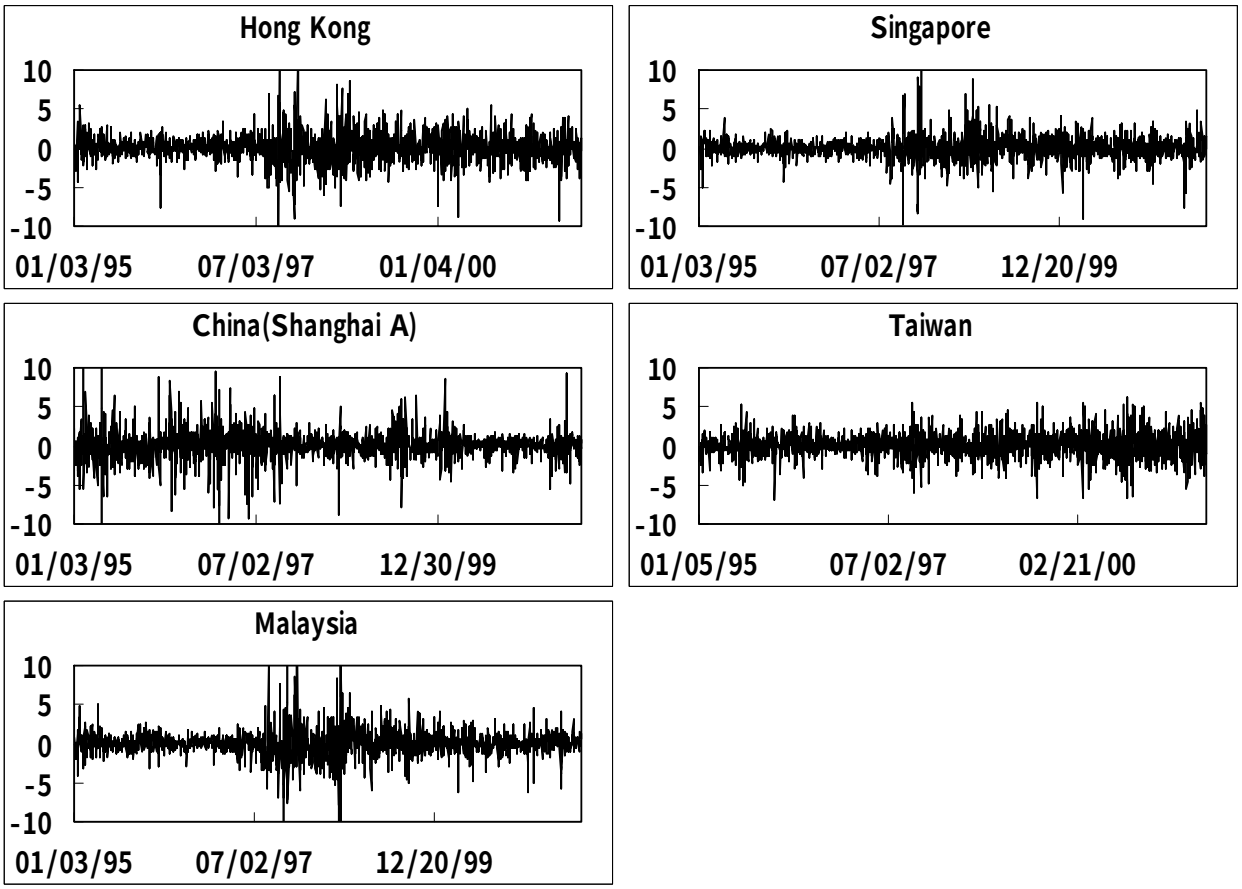
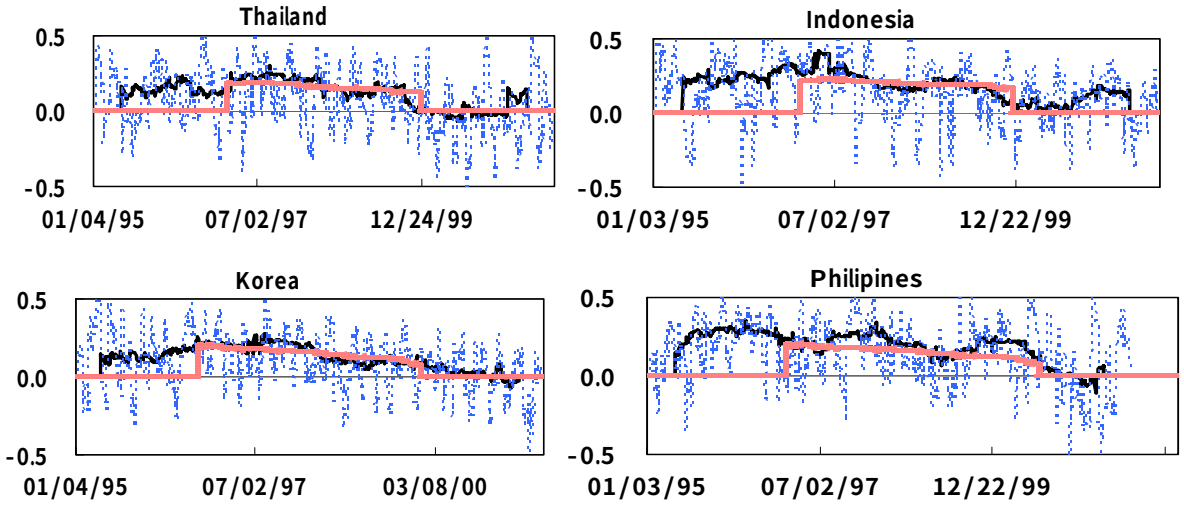


Figure 3. Moving autocorrelations for 1001, 201 and 25 days

(a) Supported countries



(b) Non-supported countries