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HIGH-FREQUENCY CONTAGION BETWEEN
THE EXCHANGE RATES AND STOCK PRICES

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High-Frequency Contagion Between the Exchange Rates and Stock Prices
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ABSTRACT

This paper analyzes the co-movement of the exchange rates and the stock prices from the viewpoint of contagion among the eight countries in the region during the period of Asian currency crisis, 1997-1999. Ito and Hashimoto (2002; NBER working paper) proposed a new definition of high-frequency contagion using daily exchange rate data.

This paper extends the idea to include the stock market origins that are separately identified for the exchange rate and the stock price. Then contagion is defined not only among the exchange rates and stock prices separately, but also between an exchange rate and a stock price of the same country or of different countries. One of the motivations is the following observation. Hong Kong successfully defended the peg to the U.S. dollar throughout the Asian currency crisis period. However, the Hong Kong stock market was affected by the decline in currencies of neighboring countries, most notably in October 1997.

We use a friction model and a Tobit model to analyze the impact of a negative shock in one asset price to others. The difference between mildly-affected countries and severely-affected countries is analyzed; categories of large declines in the exchange rates (or stock prices) are made differentiated; and whether the stock prices were increasing or decreasing is distinguished. It is found, among others, that there was, in general, the contagion between the exchange rates and stock prices; that the stock prices in Hong Kong were found to suffer from contagious effects from the decline in the Asian currencies; and that Indonesian, Korean and Thai currency depreciation and Hong Kong stock price declines had impacts on other currencies and stock prices in the region during the crisis period.

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1. Introduction

Frequent currency crises among the emerging market economies have become one of the most important global financial problems in the 1990s. Most prominent crises include Mexico in 1994; Thailand, Korea, and Indonesia in 1997; Russia in 1998; Brazil in 1999; and Argentina in 2001-2002. Among them, the Asian crisis differs from other crises in its speed, depth and width of contagion: there are many studies on the currency crisis and its contagious effect as described in, for example, Corsetti, Pesenti and Roubini (1998a, b), Flood and Marion (1998), Radelet and Sachs (1998), Ito (1999, 2000), Ito and Hashimoto(2002), to name a few. In particular, the simultaneous occurrence of a currency crisis and financial (banking) sector crisis triggered the sharp drop in stock prices in the crisis region. The most remarkable feature of the recent crisis is the simultaneous fall of currency and stock prices in the region. Of course, the simultaneous fall of stock prices and currencies, that is contagion of different asset prices, is by no means limited to the crisis period or crisis-hit countries. As we all know, the world-wide stock market declines were apparent during the Depression and the Black Monday. During the even more stable period, movements in the prices of different assets—currencies and equities—are likely to influence directly each other in the major markets.¹ The comovement of asset prices is found to become more strengthened during the unstable period in 1980s and 1990s. According to Rigobon (2003), the contemporaneous responses of daily return of stock prices from 1994 to 2001 in Latin American and Asian countries are found to have strengthened when markets are more volatile. The contemporaneous interactions between stock prices and exchange rates in a crisis-hit country emerge on the presumption of the strong interconnections between asset prices.

When the currency of one country depreciates sharply, or becomes a target of speculative attacks, the authorities are likely to raise interest rate in an attempt to reduce the capital outflow (or increase capital inflow) so that a further depreciation can be avoided. The higher interest rate,

¹ See, for example, Hung and Cheung (1995), Malliaropulos (1998), Ng (2000), Forbes and Rigobon (2002).

however, may put a downward pressure on its stock prices. Even if the country survives the speculative pressure on exchange rate, the financial market may suffer the negative shock by the turndown of the stock price, as evidenced by the Hong Kong in October 1997 and the summer of 1998. In August 1998, the Hong Kong Monetary Authority, and equivalent of a central bank, has purchased stocks to defend the financial markets from the so-called double-play—simultaneous attack on the currency and equity markets. Did Hong Kong suffer the Asian currency crisis? No, in terms of exchange rate depreciation, but yes in the stock price declines. The contagion effect can be said to have had a great impact even in Hong Kong.

Stock price declines sometimes works as a leading indicator of crises. The slowdown of economy affects stock prices, investors pull their capital out of the country, putting a downward pressure on the currency. In the case of Thailand, the stock price was at its peak in mid-1990s and had fallen by half on the eve of crisis. The substantial decline of stock prices for three years led the weakened economy into another recession and finally plunged into currency crisis. However, in the other cases, the stock prices only reacted to the currency crisis, such as in Indonesia. The sharp depreciations triggered insolvency of corporations and banks that had currency mismatch on their balance sheets. The stock prices fell once the currency depreciated sharply. Thus, by examining the stock price reactions and exchange rate behaviors, we gain a more detailed insight in the crisis contagion. There are at least five channels of spillovers among the foreign exchange rates and the stock prices. The first channel is the spillover effect from the exchange rate shock to stock prices. The second channel is the one from the stock price shocks to the exchange rate, based on the perspective that the stock price reflects economic fundamentals. The third channel originates from the third factor (other than shocks in foreign exchange market/stock market), e.g., Monetary policy. The fourth channel is contagion among the currencies, which was the topic of Ito and Hashimoto (2002), and others. The final transmission channel is cross-border contagion among different stock markets.

This paper examines the contagion between the exchange rates and stock prices during Asian crisis. Ito and Hashimoto (2002) proposed a method to identify the direction of causality among currencies in crisis. The paper expands to examine interaction between the exchange rate depreciations and stock price declines. The existing literature that focuses on the correlations between the exchange rates and stock prices during crises lacks the viewpoint to analyze the cause-and-effect relationship. The existing papers provide little evidence to substantiate high-frequent spillover from an origin country to other countries. In this paper, we identify the interconnections between stock and foreign exchange markets and characterize the contemporaneous responses of each market during the crisis period.

There are two branches of the empirical literature that closely relate to this paper. The first one addresses the interaction between the exchange rate market and stock market. Rigobon (1999) analyzes the crises contagion using vector-autoregressions (VAR), taking into account the omitted variables and heteroskedasticity to claim the evidence of stock market contagion during the Asian crisis. Pavlova and Rigobon (2003) shows that the exchange rates serve as a transmission channel of stock price movements. The second one is the estimation methodology. Most of the previous studies use the VAR methodology, which only prove (or disprove) the presence of correlation in the financial markets. Our methodology has several advantages over VAR. First, the dependent variable in our model is constructed to capture only large responses, eliminating noises. Second, the origin of shocks and the causality direction is determined by comparing daily changes of the exchange rates (or stock prices) before running regressions. Third, by employing these steps, the number of explanatory variables is less than VAR, so that the estimation is done efficiently.²

² Khalid and Kawai(2003), for example, analyze the crisis contagion among 9 Asian countries based on VAR and conclude that there was no spillover effect between stock markets and foreign exchange markets during the 1997 crisis. The difficulty with their VAR estimation is the use of too many (27) explanatory variables in the model--- 3 variables (daily stock prices, exchange rates and interest rates) for 9 countries. The inclusion of the autoregressive terms in the model also weakens to significantly detect the underlying relationship.

Other macro-based empirical analyses suffer from lack of explanatory variables when high-frequency (daily) data is used. Kaminsky and Reinhart (2003) investigates the spillover effects of stock price returns using Logit estimation and find that US, Japan and Germany markets plays an important role in the spillover relationships in the case of Brazil, Thailand and Russian crises.

This paper investigates the interaction between the exchange rates and stock market prices in Asian financial markets using daily observations in the aftermath of the 1997 crisis. Based on the concept of “origin” and “affected” in the spillover relationship, developed in Ito and Hashimoto (2002), we will be able to identify contagion causality within the day. We first estimate the contagion threshold for the depreciations (and stock price declines), so that we can identify whether the change in exchange rate (and stock price) movements was due to contagion or a noise. Then, the model identifies the causes of contagion—which factor most likely affects economies of neighboring countries, the hard-hit (origin) country, the trend in the market, other countries. The model predicts that the exchange rates and stock prices are correlated internationally even at a high-frequency (daily) level, providing support to theoretical inferences in favor of financial contagion between foreign exchange market and stock market.

Major findings of this paper are as follows. First, the Indonesian, Korean and Thai exchange rates had large impacts on the stock prices of other countries, while other currencies did not have impacts on stock prices of other countries. Second, the Hong Kong stock market was significantly affected by the Indonesian, Korean, and Thai depreciation. Therefore, the contagion effect of Asian crisis can be said to have a great impact even in Hong Kong. Third, the Indonesian and Korean, but not Thai, exchange rates had impacts on other currencies in the region. This may be contrary to casual observation that the currency crisis spread from Thailand to other countries in the second

half of 1997. Fourth, contagion among stock markets was not significant for most pairs of the countries. Fifth, Hong Kong stock price was found to have substantial effects on Asian exchange rates in the midst of crisis. Sixth, Thai exchange rates were quite sensitive to shocks in stock prices of other countries. Seventh, other than Hong Kong stock price effects on other currencies, and any stock price shocks on the Thai currencies, the spillovers from the stock price shocks to the exchange rate were not significant.

The rest of the paper is organized as follows. In section 2, movements of the exchange rates and stock prices of the region during the crisis period are reviewed. In Section 3, we present the estimation methodology used in this paper. Section 4 shows the results of estimations based on the Tobit equation that include contagion terms. Section 5 concludes the paper.

2. Data and Empirical Evidence of Currencies and Stock Prices

The data set used in this paper consists of two time-series, the nominal exchange rates (vis-à-vis US dollar) and stock price indices³ of eight Asian countries; Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand. The data source is Datastream. The sample period is from January 4, 1994 to July 7, 1999 for stock prices and from June 30, 1997 to July 7, 1999 for exchange rates.

Figure1-1 shows the exchange rates of eight currencies against the US dollar from June 30, 1997 to July 7, 1999. They are normalized at 100 at beginning of the sample period. As is well known, most of the Asian countries suffered the series of speculative attacks that led to the floatation (devaluation) of their currencies after July 1997, although the rate of devaluation and depreciation through the crisis period varied considerably across the countries and the sample period. Most

³ Hang Seng Price Index (Hong Kong), Jakarta SE Composite Price Index (Indonesia), Korea SE Composite Price Index (Korea), Kuala Lumpur Composite Price Index (Malaysia), Philippines SE Composite Price Index (Philippines), Singapore DBS 50 Price Index (Singapore), Taiwan Weighted Index (Taiwan), Bangkok Book Club (Thailand).

Asian countries had recovered the stability of their currencies as the nation's economy got back on a recovery track by summer 1998.

The behavior of stock prices for the sample period does not show a pattern that is commonly found among currencies. As Figure 1-2 clearly shows, some stock price rose over a few years before the Asian currency crisis and others showed relatively stable behavior of stock prices. Overall, the stock prices of most of the East Asian countries did not show the consistent downward trend, except Thailand, until the onset of crisis. From October, 1996, Thailand began to become an origin of a stock price decline in the region. In April and July 1997, decline in stock prices contagiously spilled over to the Philippines and then Indonesia in August 1997. From September 1997, the stock prices continued falling more rapidly in Malaysia, Indonesia, and South Korea. The magnitude of stock price declines was eased after December 1998. While the currency crisis in the summer of 1997 accelerated a drop in stock prices in each of the Asian countries, stock prices went back up again in the mid-1998 due to the recovery of macro economy in each country.

Figure1-1, and Figure1-2, inserted here

Examining these figures, the exchange rate devaluations of Thailand, the Philippines, and Indonesia seemed preceded by the stock price declines in 1997.⁴ For example, the fall of stock prices in Thailand first appeared in late 1996 and continued in the first half of 1997, prior to the floatation of the currency on July 2. As for the Philippines, before it experienced a large devaluation in September 1997, the stock price showed a large fall in April and July in 1997. The Indonesian currency dragged down by Thai baht in mid-August and then slumped to a historic low after November, with preceding fall of stock prices in early August and in September.

⁴ The decline in stock prices in Asia in mid October, 1997, was a spillover from a sharp drop of Hong Kong stock prices.

Linkage among financial markets---between currency markets and stock markets---is of great interest, while the definition of the contagion is yet to be well-established. Many previous studies used, for example, the size of correlation coefficients or rate of change as a measure, which lacks to identify the causes and the crisis spillover channel. This paper uses the definition first developed by Ito and Hashimoto (2002).⁵ We first identify the origin of the depreciation (stock price decline) and then statistically analyze the causes and the propagation of a crisis. We also investigate the interaction between exchange rate behaviors and stock price movements during the crisis and non-crisis periods. Since the high-frequency dynamics of exchange rate and stock prices includes a noise behavior, it is difficult to identify whether a big depreciation (stock price decline) arises from a shock or it is only a noise. Therefore, by using econometric methodology, we calculate the level of threshold of contagion that allows us to identify the contagion from the noise. We then estimate the relationship between the exchange rates and stock prices and find out whether there existed contagion, how large was the effect, and what likely explains the contagion.

3. The Model

3-1. Origin of Crisis

Following the concept of contagion by Ito and Hashimoto (2002) that a financial crisis appears to transmit from the hard-hit country to others, we first calculate the rate of depreciation (decline in stock prices) to identify the “origin”, the hardest-hit country, and the “affected” on the same day.

First, daily percentage change of the exchange rate (or the stock price) is written as:

$$DR(t,j) = R(t, j) - R(t-1, j),$$

⁵ Ito and Hashimoto (2002) first provide the methodology to demonstrate clear cause-and-effect relationship in exchange rate depreciation (stock price declines) spillover relationship. We also found a positive relationship between trade link indices and the contagion coefficients, implying that the bilateral trade linkage is an important crisis transmission channel in the exchange rate markets.

where $R(t,j)$ is log of the nominal exchange rate with respect to the US dollar (or the stock price) of country j at date t . The weighted cumulative change, $DRR(t,j)$, is computed as the weighted cumulative change with the declining weights of past DRs:

$$DRR(t,j) = 0.5DR(t,j) + 0.25DR(t-1,j) + 0.125DR(t-2,j) + 0.0625DR(t-3,j) + 0.0625DR(t-4,j).$$

Then, the largest DRR for day t among different countries is selected as an origin, if it exceeds 2% in depreciation (or declines) and denoted as DOR. In many days, there is no DOR because none of DRRs exceeds 2%.

Table 1-1, Table 1-2

Table 1-1 and Table 1-2 list the origins of exchange rate depreciation and stock price declines. The table makes it possible to pin down the crisis date in each country. Countries that experienced the hardest-hit was Thailand in July 1997, Indonesia in August-September 1997, Korea from October 1997 to January 1998, and again Indonesia after January 1998. As is clear from Table 1-2 that a large fall in stock prices was triggered by the currency crisis. The frequency of large declines (origin) soared after the Thai crisis and as the contagion of exchange rate depreciation spread in the region, the downward pressure on stock prices was further intensified in Malaysia, Korea, and Indonesia.

3-2. Friction Model

Since the exchange rates and stock prices follow random walk, the error term in the daily rate of change may contain a nuisance noise in the data generating process. For example, the reaction of Asian foreign exchange market was too excessive following the floatation of 1997 in a reflection of the crisis as well as the exchange rate regime changes. Also, the stock prices were more volatile

during that period. In many studies, the dummy variable(s) that represents the state of the economy, crisis or not, is used to focus on the behaviors during crises. Others set an arbitral threshold, e.g., a 3% or more of daily change, to define the contagion.

In this paper, we employ the more practical approach to account for the noise in the exchange rate and stock price behavior. In the model, the rate of change (of exchange rates or stock prices) is specified by the following: contagious depreciation (stock price fall), no-significant contagion, and contagious appreciation (rise in stock prices). Thus, there are three types of observations. What we first do is to estimate the level of threshold in order to classify the daily rate of change for the sample period into contagion or the noise. The estimation model is written as following:

$$y^* = x'b + e$$

$$y^* < a_1 \quad y < 0 \quad (1)$$

$$a_1 \leq y^* \leq a_2 \quad y = 0 \quad (2)$$

$$a_2 < y^* \quad y > 0 \quad (3).$$

Here y^* is the observed rate of change in exchange rates or stock prices; that is, $y^* = \text{DRR}(t) - \text{DRR}(t-1)$. In the equations above, a_1 and a_2 represent the level of threshold. We regard changes in the currency (stock prices) as spillover, or contagion, only when they exceed the threshold. That is, if the rate of change, y^* , exceeds a_1 or falls below a_2 , it is inferred as due to the spillover effect, not the noise, provided that there is a larger changes in the asset price of somewhere else.

Equation (1) is the case where either the exchange rate contagiously appreciates or the stock price contagiously rises. Equation (2) is the case of no significant change in exchange rates/stock prices, and equation (3) is the case either the depreciation or the fall in stock prices.

The high-frequency behavior of exchange rates and stock prices of one country can be attributed to,

for example, the closing (previous day) exchange rates and stock prices, the exchange rates and stock prices of neighboring countries, and the effect of hard-hit country. In the model, we consider the three types of explanatory variables: (i) difference between the domestic stock prices and other Asian stock prices, (ii) difference between the home exchange rate and other Asian exchange rates, and (iii) “Origin” of exchange rates and stock prices.

The first and second explanatory variables, (i) and (ii), account for the difference between the home and other Asian countries. In the midst of crisis, a country with overvalued stock prices and exchange rates is more likely to be a candidate of speculative attack regardless of macroeconomic performance of the country. In the financial market, investors often pull their capital out of countries in the same region after one country is hit by a crisis. Investors’ perception of overvaluation depends on several factors, but the relatively smaller rate of depreciation (stock price fall) may be one of the signals that investors would assess the country as overvalued. The third variable considers the impact of the origin country. It is a dummy variable.

In estimating the threshold, we further assume the symmetric response in the market. That is, the magnitude of the impact to either appreciation (rise in stock prices) or depreciation (fall of stock prices) is the same: $a_1 = -a_2$. Then, the log-likelihood will be:

$$\begin{aligned} \ln L = & \sum_{i \in (y_i^* < a_1)} \ln \left\{ \phi \left[\frac{y_i^* + a_1 - x_i' b}{\sigma} \right] \frac{1}{\sigma} \right\} \\ & + \sum_{i \in (a_1 \leq y_i^* \leq a_2)} \ln \left\{ \Phi \left[\frac{y_i^* + a_1 - x_i' b}{\sigma} \right] - \Phi \left[\frac{y_i^* + a_1 - x_i' b}{\sigma} \right] \right\} \\ & + \sum_{i \in (a_2 < y_i^*)} \ln \left\{ \phi \left[\frac{y_i^* + a_2 - x_i' b}{\sigma} \right] \frac{1}{\sigma} \right\}, \end{aligned}$$

where $x = [FXKAIRI, SPKAIRI, FXORIGIN, SPORIGIN]'$. FXKAIRI and SPKAIRI are variables indicating differences between the home and other Asian countries' exchange rates (stock prices). More precisely, they are defined as a difference between DRR of home country and averaged DRR of other Asian countries. FXORIGIN and SPORIGIN are dummy variables.

3-3. Tobit estimation

In this section, the impact of the large devaluation (the fall of stock price) of one country to other countries is examined. The model incorporates the idea of contagion—when the five-day weighted average of devaluation (stock price fall) breaks the barrier, it may be due to the contagion. In the estimation, we examine whether the differences between the domestic stock prices and other Asian stock prices, (domestic exchange rate and other Asian exchange rates), and “Origin” country were statistically more likely to attribute the possibility of contagion. The dependent variable used in the estimation was predicted using a previously estimated Friction model and is thus available for all countries, whether contagion exists or not.

The daily changes of the stock prices and exchange rates in one country may follow the process that contains two parts: the autoregressive part and non-linear response to large shocks. First, the small changes of day $t-1$ in the exchange rates and the stock prices in one country in relative to other countries will have impacts on today's exchange rate. If the currency of one country depreciates with other currencies in the region, the trade competitiveness and corporate profitability does not change, so that today's exchange will be little affected. On the other hand, if depreciation (stock price declines) occurs in only one country, and not in other countries, that means that this country had an idiosyncratic shock that has trade competitiveness implications. The market may take some time to digest the information, and investors will likely respond to change the exchange rate or the stock prices on the following day. Therefore, whether the exchange rate changes (or the stock price changes) are region-wide or idiosyncratic has difference implications

for today's exchange rate (or the stock price). We will model this inference by choosing the relative exchange rate change on the right-hand side, while the currency (or the stock price) of one country is the left-hand-side variable. Second, the large depreciations (or sharp declines in the stock prices) have non-linear effects on the exchange rate and stock prices of other countries as well as the country of origin. The identification of origin country is made by the largest declines, and the non-linearity is taken into account by selecting only declines beyond some threshold. Beyond the first part of exchange rate (stock price) process, the large shocks have cross-border implications. The shocks of the different origin countries may have different effects. The large changes in the exchange rates (or the stock prices) of different countries are separately used as the right-hand-side variables.

We will be interested in examining the effects of contagion, namely cross-border effects of (infrequent) large changes in the exchange rates or stock prices on those of other countries. The impact of relative changes in the exchange rate (or stock prices) on today's exchange rate (or stock prices) is used to control for small (every day) changes.

The regression model we employ in this section is the Tobit model. The general formulation of the model is given as follows:

$$y^* = x'b + e$$

$$y = y^* \quad \text{if } y^* > a_1,$$

$$= 0 \quad \text{if } y^* \leq a_1,$$

where a_1 is the threshold.

The probability that $y=0$ is calculated as

$$\begin{aligned}
& \text{Pr ob}(y = 0) \\
&= \text{Pr ob}(y^* \leq 0) \\
&= \text{Pr ob}(x'b + e \leq 0) \\
&= \text{Pr ob}(e \leq -x'b) \\
&= \Phi(-x'b/\sigma).
\end{aligned}$$

Then, the likelihood that $y=y^*$ can be rewritten as

$$\begin{aligned}
& f(y = y^* | y^* > a1) \\
&= \text{Pr ob}(y^* > a1) \\
&= f(y = y^*) \\
&= \phi\left(\frac{y-x'b}{\sigma}\right) \frac{1}{\sigma}.
\end{aligned}$$

The log likelihood for this Tobit regression model is

$$\ln L = \sum_{i \in (y_i=0)} \ln \Phi\left[\frac{-x'b}{\sigma}\right] + \sum_{i \in (y_i=y^*)} \left\{ \ln \phi\left[\left(\frac{y-x'b}{\sigma}\right)\right] - \ln \sigma \right\}.$$

where $x= [\text{FXKAIRI}, \text{SPKAIRI}, \text{FXORIGIN}, \text{SPORIGIN}]'$. In the model, the “FXKAIRI” and “SPKAIRI” variables are used to control for small changes in those variables. They compare the differences of exchange rate (stock price) trend between the home and other Asian countries. That is, FXKAIRI and SPKAIRI are 8 by 1 vectors (Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand). FXORIGIN and SPORIGIN are dummy variables indicating whether the depreciation (stock price fall) is affected by the hard-hit country. FXORIGIN is a 6 by 1 vector because the (five-day averaged) exchange rates of Hong Kong and Singapore did not show depreciations over 2% and therefore these two countries were excluded from “origin”, and SPORIGIN is a 8 by 1 vector.

The expected sign of parameters is as follows:

In SP equation

(i) SPKAIRI (stock price difference between the home and other Asian countries)

The parameter is expected to be positive if the stock prices exhibit an autoregressive tendency (that is, loss of confidence in the stock market carries over to the next day).

(ii) FXKAIRI (exchange rate difference between the home and other Asian countries)

The parameter is expected to be negative if relative depreciation in one day results in the stock price declines in the following day (that is, the depreciation does not result in trade competitiveness but loss of confidence in the country; or depreciation triggers the monetary tightening that affects adversely the stock market.)

(iii) FXORIGIN and SPORIGIN

the FXORIGIN and SPORIGIN are dummy variables taking either 1 or 0. Thus the parameter is expected to be positive when the large change is contagious, that is, the stock prices are adversely affected by the large declines in the value of currency or the stock prices at an origin country of previous day.

In FX equation

(i) SPKAIRI

The parameter is expected to be negative if the stock price declines result in depreciation in the following day (that is, the decline in stock prices come from loss of confidence in the country, rather than the common interest rate shock.)

(ii) FXKAIRI

The parameter is expected to be positive if depreciation in day $t-1$ results in depreciation in day t (that is, the loss of confidence in the exchange rate tends to show the autoregressive nature).

(iii) FXORIGIN and SPORIGIN

the FXORIGIN and SPORIGIN are dummy variables taking either 1 or 0. Thus the parameter is expected to be positive when the large change is contagious, that is, the exchange rates are adversely affected by the large declines in the value of currency or the stock prices at an origin

country of previous day.

4. Results

There are several channels and factors that transmit a shock in exchange rates to stock prices and vice versa. Before findings are reported in details, several channels of high-frequency contagion among the exchange rates and stock prices are reviewed.

The first channel is the spillover effect from the exchange rate shock to stock prices. There are two competing effects through this channel. If the exchange rate depreciation is orderly and moderate, the depreciation boosts its trade competitiveness at least temporarily, in the presence of nominal domestic price rigidities and is expected to have a positive effect on the stock prices. This is the case of the Indonesian and Korean stock prices at the early stage of Asian currency crisis, where the exchange rates of these two countries were relatively stable and the stock prices were rather rising. On the other hand, a sharp and rapid depreciation will induce a fall in stock prices, due to the change in sentiment (confidence) of market participants and the monetary policy reaction to depreciation. Depreciation will increase in probability of corporate failures for those with foreign currency denominated liabilities. Moreover, depreciation likely prompts the central bank to raise the interest rate to defend the currency from falling sharply.⁶ But, the higher interest rate will cause a decline in stock prices. Although the signs of spillover effects from the exchange rate to stock prices cannot be theoretically determined, the sharp depreciation, as opposed to moderate, orderly depreciation, tends to cause the stock prices to decline.

The second channel is the one from the stock prices to the exchange rate. From the perspective that

⁶ In October 1997, Hong Kong dollar was targeted by speculative attacks and the Currency Board system raised interest rate that resulted in a decline in stock prices. In order to avoid the financial market turmoil due to the stock price fall, several measures, a buying up stocks with public funds, to shore up the stock market were taken in the speculative attack in August 1998. Countries with fixed exchange rate regime, for example, People's Republic of China and Malaysia (from September 1998), experienced a rise in interest rate under a pressure of devaluation.

the stock price reflects economic fundamentals, the news announcement of weak fundamentals causes economic growth slowdown, a smaller profit opportunity, and further, the currency depreciation. A fall in stock price may result in depreciation.

The third channel is contagion among the currencies. This was the topic of Ito and Hashimoto (2002), and other papers on the contagion of currency crisis.

The final transmission channel is cross-border contagion among different stock markets. From the market interdependence perspective, such as macroeconomic similarities and trade linkage, a fall in stock price contagiously spillovers to other countries. Regardless of macroeconomic fundamentals and other financial markets, a negative shock in one country spreads to another through real and financial linkages. There is a large literature on the co-movements of stock prices among industrialized countries. For example, a country with declining stock prices most likely experiences an economic slowdown, and that would reduce the import, negatively affecting the exporting countries in the medium run: even if it takes several months for this process to work through the export-import linkage, the impact of stock price declines, especially large ones, is immediate. Investors tend to downgrade their assessment of neighboring countries with trade linkage when a large stock price decline occurs in one country. Indeed, a change in sentiment of and risk assessment of an entire region serves as a transmission channel of stock price declines.

Table 2 shows the estimated threshold for both exchange rates and stock prices. It is found from our estimation that the change in exchange rate (stock price) exceeding 1% can be regarded as “significantly” different from the noise over the sample period. In the Tobit estimation below, we set the threshold at 1%.

Table2 inserted here

The Tobit estimates are reported in Tables 3-1 to 3-6. We run regressions for three sample periods: entire sample (July 1, 1997-July 7, 1999), first-half (July 1, 1997-June 18, 1998), and second-half (June 19, 1998-July 7, 1999) periods.

The dependent variable takes 1 if the fluctuations of exchange rates (stock prices) exceed 1% and 0 otherwise. A Tobit regression is estimated for all countries for the cases with the stock prices as a dependent variable. However, in the case where dependent variable is a change in exchange rates, Tobit estimates for Indonesia, Korea, Malaysia, Philippines and Thailand are reported for the full sample period and the first-half sample period, and Indonesia for the second-half sample period. This is due to the fact the rate of change in exchange rates above 1% are hardly observed after mid 1998, consistent with what we found in Table 1-1. Most of the Asian countries put the crisis behind by mid-1998 and the risk of further exchange rate instability was decreased by then.

Table3-1 – 3-3 inserted here

The estimates of the parameters on the exchange rate are shown in Table 3-1-Table 3-3. Table3-1 reports results of the entire sample period, Table 3-2 reports the first-half, and Table 3-3 reports the latter-half. The effect on the SPKAIRI coefficients is significant in 2 countries (out of 5) during the first-half period, and 1(out of 1) for the latter-half period. As expected, the decline in stock prices in Malaysia had an effect to further deteriorate the stock prices in the midst of crisis; in Indonesia, the decreasing in stock prices exacerbated falling stock prices in a weakening market even after the mid 1998. The effect on the FXKAIRI coefficients is significant in 5 (out of 5) countries against 0 (out of 1) for the first- and the latter-half period, respectively. The coefficient estimates are all positive, indicating that the decline in exchange rate accelerate its depreciation.

The effect on the ORIGIN coefficient estimates is relatively minor, except Hong Kong stock prices, but the most of parameters on the SPORIGIN estimates on the Thailand exchange rate are significant and positive. Given the devaluation of Thailand, the turndown of the stock market in the region weakened the exchange rate of Thailand. With this exception, it is found that the contagious impact on exchange rates was relatively small from the stock price origin countries.

In contrast to the stock price origin, the impact of exchange rate origin is remarkable. The effect on the exchange rate origin of Indonesia and Korea coefficients appears to be significant in most countries.

In summary, the Asian exchange rates during the crisis were found particularly vulnerable to Hong Kong stock prices, Indonesia and Korea exchange rates.

Table3-4 – 3-6

The estimation results of contagious impact on stock prices are shown in Table 3-4 to Table 3-6. Table3-4 reports results of the entire sample period, Table 3-5 reports the first-half, and Table 3-6 reports the latter-half.

The effect on the SPKAIRI coefficients is significant in 6 countries (out of 8) during the first-half period, and 7(8) for the latter-half period. The parameter sign is as expected, indicating that the decreasing stock prices leads to a further decline. The effect of the FXKAIRI coefficients is significant in 5(8) countries in both the first- and latter-half period.

The impact of SPORIGIN on stock prices is time-varying. During the first-half period, Hong Kong, Korea, Malaysia and Philippines are the four major stock price origin countries, while the

Indonesia, Singapore and Taiwan became the major origin countries after mid 1998. These are consistent with the fact that Hong Kong stock market was targeted as speculative attack in October 1997 and Korean stock price index declined sharply in late 1997, while stock prices in Indonesia remained unstable even after 1998 due to its economic and political instability.

The estimation results of the exchange rate origin shows that Indonesia, Korea and Thailand are found to be the three main origin countries on stock prices of other countries during the crisis. The effect of the exchange rate origin on stock prices dramatically reduced for the latter-half sample period, reflecting the return of stability to the foreign exchange markets in the region.

In summary, our estimation results clearly show the evidence of contagion between an exchange rate and a stock price of the same country or of different countries during the crisis period. It is also shown that the contagious impact on exchange rates was mainly due to the Hong Kong stock price fall and Indonesia and Korean depreciations. In contrast to the impact on exchange rates, the stock prices are found to be more under influences of exchange rates and stock prices of other countries.

Table4-1, 4-2

Tables 4-1 and 4-2 summarize the estimation results. They provide the parameter signs and the significance level, with shaded areas are those with significance with correct signs. Focusing on the crisis period, the impact of exchange rates on exchange rates of other countries is as much as that on stock prices of other countries. In particular, Indonesian and Korean exchange rate fluctuations exercised considerable influence over the foreign exchange markets and stock markets in Asia. In contrast, the contagious effect of stock price on other countries' stock prices seems relatively minor, compared to the stock price effect on exchange rates. As shown in the tables above, the contagious impact on stock prices and on exchange rates from other countries are

asymmetric; we find contagion among exchange rates and from stock prices to exchange rates, but relatively small (minor) evidence of contagion among stock prices.

It is obvious from Table4-1 that the exchange rate of Thailand was affected by the stock price movements—not only by the domestic stock prices but by other Asian stock price behaviors. One might conjecture a process of the collapse of exchange rates in Thailand; the gradual deterioration of fundamentals led the stock price fall and finally triggered the currency crisis of July 1997. In addition, the battered stock markets in Asia accelerated the continuing fall of exchange rates after August 1997.

By examining the stock price reactions, we got a new insight in the crisis contagion. From our estimation, the Hong Kong stock price was found to be affected by the Indonesian, Korean and Thai currency depreciation during the crisis. The Hong Kong was said to have survived the contagious effects during the crisis in terms of the exchange rate regime, but our finding was that the Hong Kong also suffered the crisis in terms of contagion from currencies to stock prices.

Surprisingly, stock prices of Asia had little contagious effect on Korean exchange rate. Only Hong Kong stock prices are significantly estimated to affect the Korean exchange rate. The Korean stock prices are found to suffer no contagious effect from stock prices and exchange rates of other Asian countries. Although, we need a more careful examination of Korean financial markets, but our estimation results support the common perception that the Korean crisis in 1997 was the simultaneous occurrence of twin (currency and banking) crises and it is not the fundamentals-led crisis.

5. Concluding remarks

In this paper we analyze the co-movement of the exchange rates and the stock prices from the

viewpoint of contagion among the eight countries in the region during the period of Asian currency crisis, 1997-1999. By examining the stock price reactions and exchange rate movements, a new insight with regard to the crisis contagion is obtained. In this paper we do not use the orthodox analytical method, VAR, to examine the contagion in financial markets. Instead, we use a friction model and a Tobit model to analyze the impact of a negative shock in one asset price to others. In estimation, we take into account the difference between mildly-affected countries and severely-affected countries, large declines in the exchange rates (or stock prices) and others, and the asset price trend in each country.

Our results show the evidence of contagion between an exchange rate and a stock price for selected pairs of countries during the crisis period. It is also shown that the contagious impact on exchange rates was mainly due to the Hong Kong stock price fall and Indonesia and Korean depreciations. In contrast to the impact on exchange rates, the stock prices are found to be more under influences of exchange rates and stock prices of other countries.

Major findings of this paper are as follows. First, the Indonesian, Korean and Thai exchange rates had large impacts on the stock prices of other countries, while other currencies did not have impacts on stock prices of other countries. Second, the Hong Kong stock market was significantly affected by the Indonesian, Korean, and Thai depreciation. Therefore, the contagion effect of Asian crisis can be said to have a great impact even in Hong Kong. Third, the Indonesian and Korean, but not Thai, exchange rates had impacts on other currencies in the region. This may be contrary to casual observation that the currency crisis spread from Thailand to other countries in the second half of 1997. Fourth, contagion among stock markets was not significant for most pairs of the countries. Fifth, Hong Kong stock price was found to have substantial effects on Asian exchange rates in the midst of crisis. Sixth, Thai exchange rates were quite sensitive to shocks in stock prices of other countries. Seventh, other than Hong Kong stock price effects on other currencies, and

any stock price shocks on the Thai currencies, the spillovers from the stock price shocks to the exchange rate were not significant.

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Figure 1-1: Asia Exchange Rates
June 30, 1997 = 100

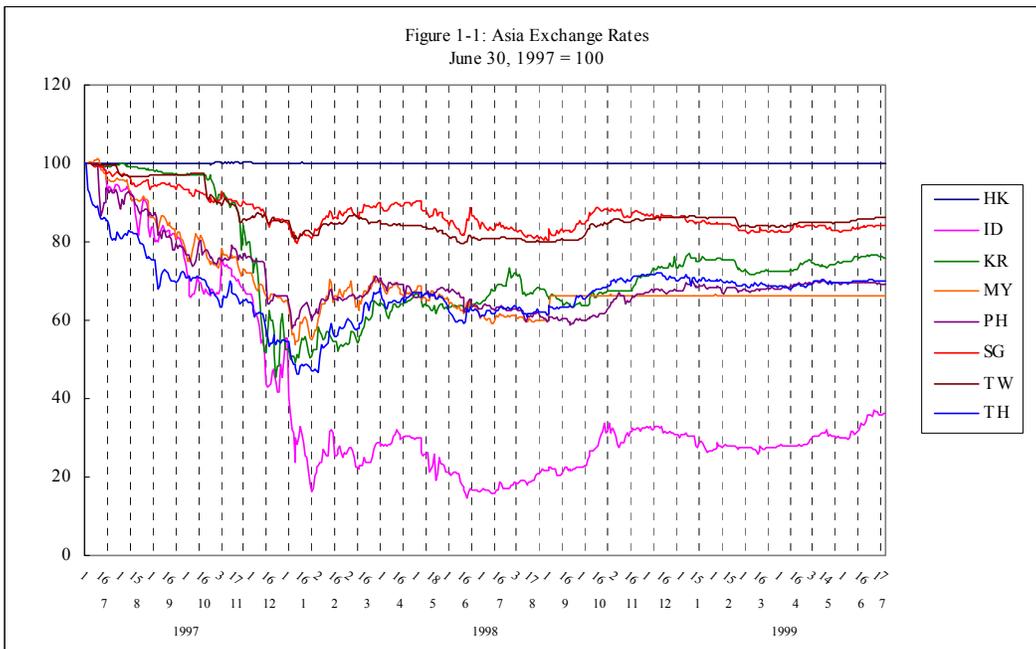


Figure 1-2: Asia Stock Price Index
July 1, 1997 = 100

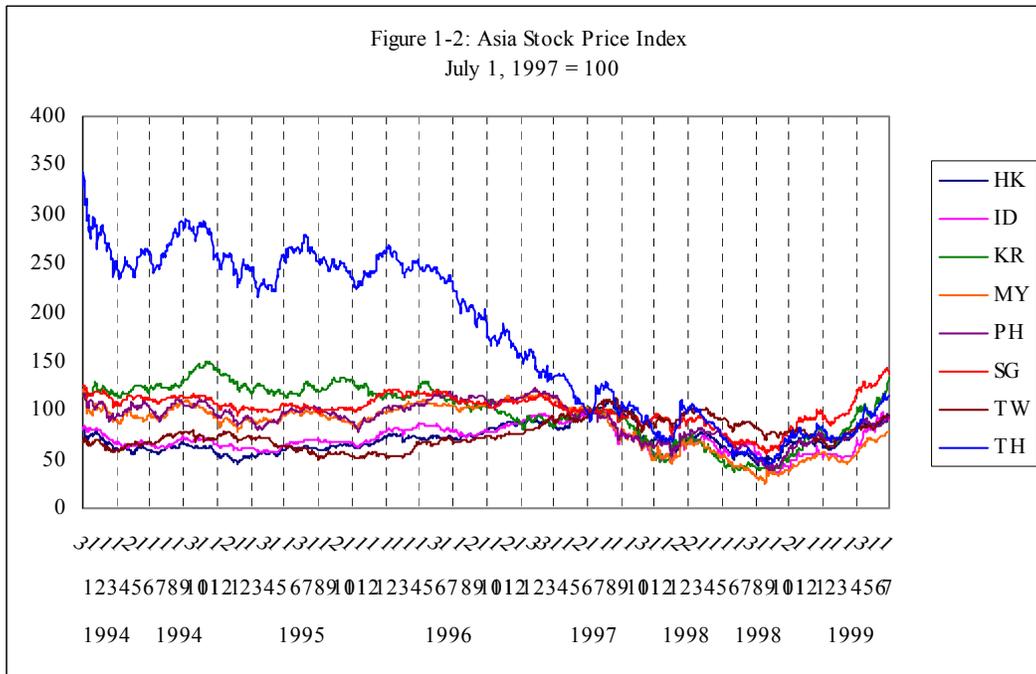


Table 1-1
Daily Origin of Exchange Rate, July 1997-March 1999

	Origin	devaluation rate(%)		Origin	devaluation rate(%)		Origin	devaluation rate(%)
1997 7 2	TH	-3.40	1997 12 11	KR	-8.02	1998 3 6	ID	-4.24
1997 7 3	TH	-2.22	1997 12 12	ID	-10.97	1998 3 9	ID	-2.40
1997 7 4	TH	-2.06	1997 12 15	ID	-6.72	1998 4 16	ID	-2.23
1997 7 14	PH	-5.30	1997 12 16	TH	-3.66	1998 4 21	PH	-2.49
1997 7 21	ID	-2.83	1997 12 22	KR	-10.12	1998 5 6	ID	-6.12
1997 7 23	TH	-2.06	1997 12 23	KR	-10.12	1998 5 7	ID	-4.99
1997 8 15	ID	-2.99	1997 12 24	ID	-4.32	1998 5 13	ID	-10.37
1997 8 18	ID	-3.23	1997 12 25	ID	-2.34	1998 5 14	ID	-3.24
1997 8 27	ID	-2.93	1997 12 31	KR	-3.96	1998 5 19	ID	-12.50
1997 8 28	ID	-3.19	1998 1 2	ID	-14.38	1998 5 28	ID	-5.17
1997 9 2	ID	-2.39	1998 1 5	ID	-13.08	1998 6 10	ID	-5.08
1997 9 3	TH	-2.81	1998 1 6	ID	-11.93	1998 6 11	ID	-4.66
1997 9 4	TH	-3.74	1998 1 7	ID	-7.57	1998 6 12	ID	-4.02
1997 9 18	PH	-2.06	1998 1 8	ID	-18.31	1998 6 15	ID	-4.48
1997 9 29	ID	-2.38	1998 1 12	TH	-2.39	1998 6 16	ID	-4.32
1997 9 30	ID	-2.33	1998 1 16	ID	-4.01	1998 6 17	ID	-6.82
1997 10 1	ID	-3.19	1998 1 19	ID	-7.87	1998 6 29	MY	-2.01
1997 10 3	ID	-4.32	1998 1 20	ID	-4.72	1998 8 6	KR	-3.21
1997 10 6	ID	-2.56	1998 1 21	ID	-11.10	1998 8 11	ID	-2.27
1997 10 20	TW	-2.45	1998 1 22	ID	-12.87	1998 9 8	ID	-3.44
1997 11 20	KR	-5.52	1998 1 23	ID	-12.77	1998 9 9	ID	-2.22
1997 11 25	KR	-2.24	1998 1 26	ID	-3.85	1998 10 27	ID	-2.08
1997 11 28	KR	-2.92	1998 2 12	MY	-3.04	1998 11 2	ID	-2.74
1997 12 1	KR	-2.21	1998 2 13	ID	-9.30	1998 11 3	ID	-4.26
1997 12 2	KR	-2.82	1998 2 16	ID	-3.99	1998 11 4	ID	-3.98
1997 12 3	TH	-3.66	1998 2 17	KR	-2.17	1998 12 15	ID	-2.29
1997 12 8	KR	-5.39	1998 2 23	ID	-2.62	1998 1 13	ID	-3.84
1997 12 9	KR	-6.88	1998 3 4	ID	-3.31	1999 1 14	ID	-2.08
1997 12 10	KR	-6.73	1998 3 5	ID	-6.84	1999 3 11	ID	-2.17

Source: Ito and Hashimoto (2002)

Table 1-2 Origin of Stock Price (1994-1999)

year	month	date	Origin	% decline of stock price	year	month	date	Origin	% decline of stock price
1994	1	11	ml	-3.382	1997	4	29	ph	-2.622
1994	1	12	ml	-5.068	1997	4	30	ph	-2.489
1994	1	13	ml	-4.250	1997	5	15	th	-2.540
1994	1	14	tw	-2.391	1997	5	16	th	-2.464
1994	1	18	th	-2.152	1997	5	19	ph	-2.083
1994	1	20	th	-2.176	1997	6	9	th	-2.023
1994	1	25	ml	-2.639	1997	6	19	th	-2.313
1994	2	7	th	-3.864	1997	6	20	th	-3.085
1994	2	14	tw	-2.215	1997	7	9	ph	-2.562
1994	2	16	hk	-2.223	1997	7	10	ph	-2.744
1994	2	25	hk	-2.338	1997	8	5	ml	-2.551
1994	2	28	tw	-2.470	1997	8	7	id	-2.163
1994	3	1	ph	-2.750	1997	8	15	id	-2.756
1994	3	2	ph	-2.424	1997	8	18	id	-2.738
1994	3	4	ph	-2.392	1997	8	19	hk	-2.185
1994	3	9	ph	-2.609	1997	8	20	th	-2.088
1994	3	18	hk	-2.742	1997	8	22	id	-2.182
1994	3	21	hk	-3.979	1997	8	25	id	-3.810
1994	3	22	id	-2.025	1997	8	26	th	-3.987
1994	4	21	hk	-2.104	1997	8	27	th	-2.331
1994	5	4	hk	-2.459	1997	8	28	ph	-5.402
1994	10	6	tw	-2.850	1997	8	29	hk	-4.746
1994	10	11	tw	-4.272	1997	9	1	hk	-4.310
1994	11	1	tw	-3.175	1997	9	2	tw	-2.457
1994	11	22	hk	-2.386	1997	9	3	ml	-3.418
1994	11	23	th	-3.433	1997	9	4	ml	-2.915
1994	12	9	hk	-2.348	1997	9	12	id	-2.114
1995	1	3	hk	-2.213	1997	9	18	ml	-2.165
1995	1	12	th	-2.116	1997	9	22	ml	-2.321
1995	1	13	ph	-3.186	1997	9	23	kr	-2.004
1995	1	23	th	-2.886	1997	10	3	id	-2.259
1995	2	27	ph	-2.078	1997	10	8	kr	-2.037
1995	4	17	tw	-2.311	1997	10	15	hk	-2.468
1995	7	19	tw	-2.527	1997	10	16	kr	-2.556
1995	7	20	tw	-2.620	1997	10	17	tw	-2.108
1995	8	9	tw	-2.260	1997	10	20	tw	-4.357
1995	8	11	tw	-2.739	1997	10	21	hk	-3.435
1995	11	20	ph	-2.039	1997	10	22	hk	-4.658
1995	12	14	kr	-2.117	1997	10	23	hk	-7.569
1995	12	18	kr	-2.323	1997	10	24	ml	-2.593
1996	1	5	tw	-3.430	1997	10	27	kr	-4.463
1996	1	29	tw	-2.700	1997	10	28	hk	-8.475
1996	3	11	hk	-3.737	1997	10	29	th	-3.535
1996	3	13	hk	-2.174	1997	10	30	kr	-3.169
1996	5	20	tw	-2.391	1997	10	31	kr	-3.107
1996	7	29	id	-2.305	1997	11	7	kr	-2.308
1996	10	4	th	-2.053	1997	11	11	id	-2.291
1996	10	8	th	-4.189	1997	11	12	hk	-2.433
1996	10	28	ph	-2.633	1997	11	17	kr	-2.234
1997	1	7	kr	-2.242	1997	11	18	ml	-3.900
1997	2	4	th	-3.427	1997	11	19	ml	-3.440
1997	2	14	th	-2.147	1997	11	20	ml	-7.229
1997	3	4	th	-2.279	1997	11	21	id	-2.266
1997	3	7	th	-4.563	1997	11	24	kr	-4.854
1997	3	24	tw	-2.406	1997	11	25	kr	-3.588
1997	4	8	ph	-2.244	1997	11	26	ml	-2.882

Note: Authors' calculation

Table 1-2 (cont'd) Origin of Stock Price (1994-1999)

year	month	date	Origin	% decline of stock price	year	month	date	Origin	% decline of stock price
1997	11	28	kr	-3.629	1998	6	12	kr	-4.309
1997	12	1	kr	-3.825	1998	6	15	kr	-4.552
1997	12	2	kr	-3.914	1998	6	16	kr	-3.775
1997	12	9	kr	-2.996	1998	7	10	ml	-2.967
1997	12	10	hk	-2.143	1998	7	13	ml	-2.377
1997	12	11	hk	-3.864	1998	7	22	ml	-2.065
1997	12	12	kr	-5.242	1998	7	23	kr	-2.386
1997	12	15	id	-6.215	1998	7	29	ml	-2.839
1997	12	16	ml	-2.677	1998	8	3	hk	-2.303
1997	12	23	kr	-4.231	1998	8	4	ph	-2.131
1997	12	24	kr	-4.260	1998	8	5	id	-3.063
1997	12	25	kr	-2.291	1998	8	6	id	-2.422
1998	1	5	ml	-2.864	1998	8	7	hk	-2.804
1998	1	6	ml	-3.444	1998	8	10	ml	-2.473
1998	1	7	hk	-3.818	1998	8	11	ml	-3.917
1998	1	8	ph	-3.960	1998	8	12	ph	-3.850
1998	1	9	ph	-6.210	1998	8	13	ml	-2.721
1998	1	12	hk	-6.163	1998	8	17	ml	-2.448
1998	1	22	ph	-3.084	1998	8	18	kr	-2.081
1998	2	5	th	-2.195	1998	8	21	ml	-2.426
1998	2	11	id	-3.406	1998	8	24	id	-3.312
1998	2	12	id	-6.178	1998	8	25	id	-2.018
1998	2	13	id	-2.595	1998	8	27	ml	-2.005
1998	2	16	kr	-3.767	1998	8	28	ph	-3.749
1998	2	17	kr	-2.488	1998	8	31	hk	-3.704
1998	3	5	kr	-2.656	1998	9	1	hk	-3.353
1998	3	6	kr	-2.545	1998	9	10	ph	-3.173
1998	3	9	kr	-2.859	1998	9	11	ph	-2.242
1998	3	30	kr	-2.207	1998	9	15	id	-4.884
1998	4	1	kr	-2.001	1998	9	17	id	-2.278
1998	4	2	kr	-2.488	1998	9	18	id	-3.559
1998	4	3	kr	-3.502	1998	9	21	id	-4.754
1998	4	16	ml	-2.068	1998	9	22	ph	-2.221
1998	4	23	kr	-2.432	1998	10	2	tw	-2.645
1998	4	29	id	-2.350	1998	10	5	hk	-2.071
1998	5	1	id	-2.123	1998	10	27	kr	-2.304
1998	5	4	kr	-3.199	1998	11	9	ph	-2.299
1998	5	5	id	-2.002	1998	11	10	ph	-3.259
1998	5	6	id	-3.264	1998	11	11	th	-3.624
1998	5	11	kr	-2.100	1998	11	13	th	-2.695
1998	5	12	kr	-2.518	1998	11	25	id	-2.961
1998	5	13	id	-3.240	1998	12	3	th	-2.821
1998	5	14	th	-2.181	1998	12	4	th	-2.183
1998	5	18	id	-2.379	1998	12	17	kr	-2.656
1998	5	20	th	-2.587	1999	1	5	tw	-2.130
1998	5	25	kr	-3.730	1999	1	26	th	-2.368
1998	5	26	kr	-4.838	1999	2	8	ml	-3.783
1998	5	27	hk	-2.803	1999	2	9	kr	-2.451
1998	5	28	hk	-2.065	1999	2	10	th	-2.069
1998	5	29	th	-2.010	1999	2	19	kr	-2.022
1998	6	1	tw	-2.659	1999	5	7	hk	-2.009
1998	6	2	th	-2.996	1999	5	13	kr	-2.730
1998	6	8	sg	-2.042	1999	5	17	kr	-2.324
1998	6	10	hk	-3.175	1999	5	26	th	-2.586
1998	6	11	ph	-2.516					

Note: Authors' calculation

Table 2
Threshold (Stock Price)

	1997-1999			1997-1998			1998-1999		
	coefficient	s.e.	***	coefficient	s.e.	***	coefficient	s.e.	***
Hong Kong	0.00957	6.65E-04	***	0.01005	1.17E-03	***	0.00817	9.91E-04	***
Indonesia	0.01006	7.10E-04	***	0.01059	1.01E-03	***	0.00966	1.02E-03	***
Korea	0.01124	6.71E-04	***	0.01241	1.06E-03	***	0.00970	9.37E-04	***
Malaysia	0.00925	9.43E-04	***	0.01012	9.30E-04	***	0.00757	2.02E-03	***
Philippines	0.00806	5.21E-04	***	0.00829	7.63E-04	***	0.00764	7.29E-04	***
Singapore	0.00711	4.41E-04	***	0.00694	6.18E-04	***	0.00741	6.88E-04	***
Taiwan	0.00642	3.66E-04	***	0.00644	4.65E-04	***	0.00673	5.74E-04	***
Thailand	0.00772	6.73E-04	***	0.00827	1.15E-03	***	0.00755	8.02E-04	***

Threshold (Exchange rate)

	1997-1999			1997-1998			1998-1999		
	coefficient	s.e.	***	coefficient	s.e.	***	coefficient	s.e.	***
Hong Kong	0.00950	6.78E-04	***	0.01008	1.21E-03	***	0.00879	7.40E-04	***
Indonesia	0.01009	7.08E-04	***	0.01076	1.03E-03	***	0.00952	9.95E-04	***
Korea	0.01140	6.94E-04	***	0.01246	1.07E-03	***	0.01003	8.96E-04	***
Malaysia	0.00925	9.42E-04	***	0.01016	9.55E-04	***	0.00756	1.96E-03	***
Philippines	0.00805	5.18E-04	***	0.00744	9.44E-04	***	0.00769	7.32E-04	***
Singapore	0.00715	4.34E-04	***	0.00696	6.17E-04	***	0.00741	6.88E-04	***
Taiwan	0.00657	3.58E-04	***	0.00654	4.59E-04	***	0.00674	5.69E-04	***
Thailand	0.00775	6.79E-04	***	0.00852	1.10E-03	***	0.00755	8.02E-04	***

***: significant at 1%

Table 3-1

Tobit estimation: dependent variable: exchange rate
1997-1999

	Indonesia		Korea		Malaysia		Philippines		Thailand	
	coefficient	s.e.								
SPKAIRI	0.0452	2.05E-01	-0.0772	2.01E-01	-0.2758	1.13E-01	0.0714	1.90E-01	0.1496	7.48E-02
FXKAIRI	0.5850	1.30E-01	0.8374	2.56E-01	0.5649	2.02E-01	0.7853	2.47E-01	0.6751	1.69E-01
SPORIGIN(HK)	0.0283	1.10E-02	0.0185	1.03E-02	0.0108	4.81E-03	0.0074	8.62E-03	0.0068	4.11E-03
SPORIGIN(ID)	0.0185	1.13E-02	0.0133	9.40E-03	0.0030	4.98E-03	0.0062	7.52E-03	0.0095	3.56E-03
SPORIGIN(KR)	-0.0028	9.21E-03	0.0132	9.24E-03	0.0039	3.97E-03	0.0075	6.33E-03	0.0083	3.23E-03
SPORIGIN(MY)	-0.0038	1.34E-02	0.0105	1.12E-02	0.0033	5.42E-03	0.0116	7.47E-03	0.0075	3.93E-03
SPORIGIN(PH)	-0.0207	1.89E-02	0.0078	1.53E-02	-0.0007	7.80E-03	0.0132	1.14E-02	0.0098	4.97E-03
SPORIGIN(SG)	-0.2227	1.09E+03	-0.1470	2.98E+03	-0.0652	1.23E+02	0.0357	1.83E-02	-0.0731	1.31E+04
SPORIGIN(TW)	0.0079	2.32E-02	-0.1545	9.22E+02	0.0075	9.16E-03	-0.1215	1.21E+03	0.0188	6.35E-03
SPORIGIN(TH)	-0.0026	1.54E-02	-0.1492	2.46E+02	0.0117	6.00E-03	-0.1315	1.97E+03	0.0097	5.53E-03
FXORIGIN(ID)	0.0334	9.64E-03	0.0199	7.22E-03	0.0166	3.36E-03	0.0226	5.74E-03	0.0117	3.06E-03
FXORIGIN(KR)	0.0581	1.25E-02	0.0250	1.34E-02	0.0116	5.82E-03	0.0227	9.08E-03	0.0140	4.47E-03
FXORIGIN(MY)	0.0747	3.11E-02	-0.1532	8.34E+02	-0.0884	3.48E+02	-0.1117	6.41E+02	-0.0648	1.89E+02
FXORIGIN(PH)	-0.2039	4.84E+02	-0.1412	7.17E+02	-0.1006	0.00E+00	-0.0088	2.01E-02	-0.0684	8.77E+02
FXORIGIN(TW)	-0.2194	7.77E+02	0.0155	2.00E+03	0.0149	1.70E-02	0.0252	1.59E+03	0.0018	1.35E-02
FXORIGIN(TH)	-0.2369	3.05E+02	-0.1379	4.17E+02	-0.0003	9.52E-03	0.0118	1.22E-02	0.0091	5.98E-03
SIGMA	0.0403	2.96E-03	0.0288	3.61E-03	0.0144	1.79E-03	0.0216	3.09E-03	0.0120	1.34E-03

Note:***, **, and * indicate the significance at the 1,5 and 10%, respectively.

Table 3-2

Tobit estimation: dependent variable: exchange rate

1997-1998

	Indonesia		Korea		Malaysia		Philippines		Thailand	
	coefficient	s.e.								
SPKAIRI	0.3511	2.74E-01	-0.0018	2.18E-01	-0.3482	1.35E-01	0.1077	2.10E-01	0.1377	7.48E-02
FXKAIRI	0.5853	1.45E-01	0.8780	2.55E-01	0.4122	1.81E-01	0.6984	2.40E-01	0.5181	1.51E-01
SPORIGIN(HK)	0.0311	1.27E-02	0.0147	1.07E-02	0.0075	4.67E-03	0.0044	8.97E-03	0.0050	4.05E-03
SPORIGIN(ID)	0.0248	1.40E-02	0.0097	9.99E-03	-0.0006	4.88E-03	0.0043	7.92E-03	0.0081	3.64E-03
SPORIGIN(KR)	-0.0055	1.03E-02	0.0084	9.81E-03	0.0002	3.79E-03	0.0041	6.58E-03	0.0061	3.17E-03
SPORIGIN(MY)	-0.0049	1.49E-02	0.0054	1.18E-02	-0.0014	5.71E-03	0.0091	7.75E-03	0.0062	3.87E-03
SPORIGIN(PH)	-0.0177	2.13E-02	0.0057	1.71E-02	-0.0035	7.51E-03	0.0147	1.26E-02	0.0095	5.31E-03
SPORIGIN(SG)	-0.2363	8.28E+02	-0.1454	1.58E+03	-0.0771	1.17E+03	-0.1363	8.92E+04	-0.0705	1.47E+04
SPORIGIN(TW)	0.0129	2.75E-02	-0.1534	4.99E+02	0.0057	9.45E-03	-0.1140	2.48E+02	0.0201	7.02E-03
SPORIGIN(TH)	0.0009	1.85E-02	-0.1587	3.73E+02	0.0097	6.35E-03	-0.1218	2.91E+02	0.0087	5.82E-03
FXORIGIN(ID)	0.0267	1.16E-02	0.0167	7.54E-03	0.0132	3.15E-03	0.0192	5.86E-03	0.0081	3.01E-03
FXORIGIN(KR)	0.0501	1.33E-02	0.0178	1.32E-02	0.0069	5.37E-03	0.0172	8.93E-03	0.0099	4.18E-03
FXORIGIN(MY)	0.0730	3.28E-02	-0.1543	6.59E+02	-0.0797	1.63E+02	-0.1145	4.71E+02	-0.0635	1.28E+02
FXORIGIN(PH)	-0.2198	4.62E+02	-0.1423	5.86E+02	-0.0833	4.67E+03	-0.0097	1.95E-02	-0.0668	4.83E+02
FXORIGIN(TW)	-0.2468	7.85E+02	0.0139	1.03E+03	0.0106	1.63E-02	0.0137	6.54E+02	-0.0046	1.32E-02
FXORIGIN(TH)	-0.2610	2.88E+02	-0.1390	3.01E+02	-0.0047	8.81E-03	0.0077	1.18E-02	0.0084	5.65E-03
SIGMA	0.0422	3.39E-03	0.0283	3.63E-03	0.0133	1.63E-03	0.0214	3.14E-03	0.0114	1.26E-03

Note:***, **, and * indicate the significance at the 1,5 and 10%, respectively.

Table 3-3

Tobit estimation: dependent variable: exchange rate
1998-1999

	Indonesia		
	coefficient	s.e.	
SPKAIRI	-0.4942	2.22E-01	**
FXXKAIRI	0.2643	2.16E-01	
SPORIGIN(HK)	-0.1320	9.83E+04	
SPORIGIN(ID)	-0.0125	1.38E-02	
SPORIGIN(KR)	-0.1318	8.68E+02	
SPORIGIN(MY)	-0.1411	0.00E+00	
SPORIGIN(PH)	-0.1485	0.00E+00	
SPORIGIN(SG)	-0.2507	0.00E+00	
SPORIGIN(TW)	-0.1395	0.00E+00	
SPORIGIN(TH)	-0.1023	2.76E+02	
FXORIGIN(ID)	0.0209	1.09E-02	**
FXORIGIN(KR)			
FXORIGIN(MY)			
FXORIGIN(PH)			
FXORIGIN(TW)			
FXORIGIN(TH)			
SIGMA	0.0198	3.67E-03	***

Note:***, **, and * indicate the significance at the 1,5 and 10%, respectively.

Table 3-4

Tobit estimation: dependent variable: stock price
1997-1999

	Hong Kong		Indonesia		Korea		Malaysia	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.355845	8.56E-02 ***	0.402265	7.20E-02 ***	0.345724	5.95E-02 ***	0.123239	5.24E-02 ***
FXKAIRI	-1.20958	1.79E-01 ***	0.14821	4.49E-02 ***	0.170809	8.73E-02 **	-5.94E-03	1.22E-01
SPORIGIN(HK)	-4.88E-03	4.26E-03	6.64E-03	3.68E-03 **	-2.51E-03	3.92E-03	6.01E-03	3.28E-03 **
SPORIGIN(ID)	-1.03E-03	3.45E-03	1.06E-03	3.60E-03	-3.34E-05	3.01E-03	-1.44E-03	3.00E-03
SPORIGIN(KR)	-6.26E-03	3.22E-03 **	-4.06E-03	3.23E-03	-2.08E-03	2.87E-03	1.26E-04	2.53E-03
SPORIGIN(MY)	-0.010135	4.44E-03 **	-1.74E-04	3.90E-03	1.85E-03	3.33E-03	6.94E-03	3.35E-03 **
SPORIGIN(PH)	5.73E-03	4.66E-03	-1.03E-03	5.03E-03	3.29E-03	4.32E-03	5.47E-03	4.05E-03 *
SPORIGIN(SG)	-5.13E-03	1.09E-02	-0.098195	3.33E+02	3.54E-03	1.10E-02	-0.093373	4.04E+02
SPORIGIN(TW)	6.02E-04	7.78E-03	-3.71E-03	8.35E-03	4.84E-04	7.35E-03	6.23E-03	6.46E-03
SPORIGIN(TH)	-0.012897	6.00E-03 **	-0.013759	5.99E-03 **	-0.010895	4.96E-03 **	-8.87E-03	4.82E-03 **
FXORIGIN(ID)	-0.020979	3.89E-03 ***	-0.013775	3.81E-03 ***	-1.87E-03	2.38E-03	-3.70E-03	2.35E-03 *
FXORIGIN(KR)	-0.017583	5.95E-03 ***	-4.56E-03	5.42E-03	-1.08E-03	5.47E-03	5.74E-04	4.18E-03
FXORIGIN(MY)	-9.61E-03	1.22E-02	-9.77E-03	1.31E-02	-5.18E-03	1.13E-02	9.86E-04	1.13E-02
FXORIGIN(PH)	-0.10166	3.23E+02	-0.099643	2.04E+02	-3.02E-03	1.12E-02	-0.012781	1.17E-02
FXORIGIN(TW)	0.010053	1.72E-02	-0.092406	4.65E+02	-1.93E-04	1.56E-02	-3.26E-04	1.54E-02
FXORIGIN(TH)	-0.027611	9.45E-03 ***	-0.114395	2.13E+03	-0.091259	1.64E+02	-0.019297	7.77E-03 ***
SIGMA	0.015314	1.08E-03 ***	0.015482	1.08E-03 ***	0.013802	8.65E-04 ***	0.013945	8.89E-04 ***

	Philippines		Singapore		Taiwan		Thailand	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.236868	6.60E-02 ***	0.29764	8.07E-02 ***	-0.069835	5.99E-02	0.055788	4.79E-02
FXKAIRI	-0.118022	9.65E-02	-0.821474	1.53E-01 ***	-0.530489	1.38E-01 ***	0.067899	1.01E-01
SPORIGIN(HK)	5.22E-03	2.75E-03 **	2.18E-03	2.76E-03	-2.48E-03	2.78E-03	3.96E-03	2.81E-03 *
SPORIGIN(ID)	2.29E-03	2.51E-03	-4.62E-03	2.97E-03 *	-8.93E-03	2.98E-03 ***	1.82E-03	2.51E-03
SPORIGIN(KR)	-6.22E-03	2.49E-03 ***	-4.28E-03	2.43E-03 **	-0.010583	2.94E-03 ***	1.53E-03	2.16E-03
SPORIGIN(MY)	1.05E-03	2.92E-03	-8.97E-03	3.53E-03 ***	-7.53E-03	3.10E-03 ***	-3.52E-03	2.97E-03
SPORIGIN(PH)	2.84E-03	3.90E-03	5.79E-03	3.40E-03 **	-4.20E-03	3.57E-03	1.65E-03	3.84E-03
SPORIGIN(SG)	4.32E-03	9.16E-03	2.44E-03	8.66E-03	-4.39E-03	8.25E-03	-0.077927	2.05E+02
SPORIGIN(TW)	-3.11E-03	6.18E-03	-3.38E-03	6.06E-03	0.010065	4.97E-03 **	-1.52E-03	6.32E-03
SPORIGIN(TH)	-6.75E-03	3.87E-03 **	-8.61E-03	3.92E-03 **	-9.22E-03	3.95E-03 **	1.10E-03	3.40E-03
FXORIGIN(ID)	1.02E-03	1.97E-03	-0.010773	2.68E-03 ***	-0.011558	2.65E-03 ***	-4.60E-03	2.19E-03 **
FXORIGIN(KR)	-8.87E-03	4.74E-03 **	-0.019786	5.89E-03 ***	-0.01169	4.96E-03 ***	-1.96E-03	3.82E-03
FXORIGIN(MY)	-3.69E-04	9.70E-03	2.03E-03	9.12E-03	-0.068622	2.10E+02	-2.54E-03	9.69E-03
FXORIGIN(PH)	-0.077182	1.31E+02	-5.43E-03	9.68E-03	-0.08512	0.00E+00	-2.64E-04	8.65E-03
FXORIGIN(TW)	4.90E-03	1.34E-02	3.73E-03	1.27E-02	-0.082937	0.00E+00	0.013003	1.36E-02
FXORIGIN(TH)	-0.012466	5.79E-03 **	-0.086784	3.32E+02	-9.98E-03	5.78E-03 **	-9.68E-03	6.27E-03 *
SIGMA	0.011914	8.61E-04 ***	0.01114	9.43E-04 ***	0.010164	9.79E-04 ***	0.012099	7.87E-04 ***

Note: ***, ** and * indicate the significance at the 1,5 and 10%, respectively.

Table 3-5

Tobit estimation: dependent variable: stock price
1997-1998

	Hong Kong		Indonesia		Korea		Malaysia	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.458615	1.21E-01 ***	0.569856	1.06E-01 ***	0.289114	8.37E-02 ***	0.385267	8.50E-02 ***
FXKAIRI	-0.984415	2.00E-01 ***	0.107653	5.04E-02 **	0.236878	1.02E-01 ***	0.012784	1.20E-01
SPORIGIN(HK)	-5.67E-03	5.54E-03	8.85E-03	4.29E-03 **	-5.68E-04	4.67E-03	6.27E-03	3.22E-03 **
SPORIGIN(ID)	4.26E-04	4.45E-03	-3.33E-03	4.55E-03	1.40E-03	3.94E-03	1.69E-03	2.94E-03
SPORIGIN(KR)	-3.57E-03	3.75E-03	-5.32E-04	3.57E-03	7.20E-04	3.67E-03	2.86E-03	2.36E-03
SPORIGIN(MY)	-6.58E-03	5.23E-03	-1.68E-03	4.74E-03	8.99E-04	4.21E-03	2.11E-03	3.72E-03
SPORIGIN(PH)	9.81E-03	6.48E-03 *	4.79E-03	6.29E-03	5.40E-03	6.18E-03	9.36E-03	4.43E-03 **
SPORIGIN(SG)	-3.21E-03	1.69E-02	-0.104513	1.01E+03	-0.093039	4.14E+02	-0.085652	4.67E+02
SPORIGIN(TW)	-1.36E-03	1.12E-02	-2.33E-03	1.10E-02	5.67E-03	9.38E-03	0.011914	7.08E-03 *
SPORIGIN(TH)	-6.44E-03	7.69E-03	-8.54E-03	7.03E-03	-5.96E-03	6.29E-03	-4.52E-04	5.02E-03
FXORIGIN(ID)	-0.019634	4.61E-03 ***	-0.012022	4.47E-03 **	-2.62E-03	2.93E-03	-3.39E-03	2.28E-03 *
FXORIGIN(KR)	-0.018251	6.61E-03 ***	-6.27E-03	5.66E-03	-4.98E-03	6.24E-03	-9.92E-04	3.78E-03
FXORIGIN(MY)	-9.18E-03	1.36E-02	-0.014188	1.41E-02	-6.57E-03	1.25E-02	-2.51E-03	1.02E-02
FXORIGIN(PH)	-0.110952	3.20E+02	-0.102022	2.08E+02	-3.10E-03	1.23E-02	-0.011591	1.03E-02
FXORIGIN(TW)	0.013501	2.03E-02	-0.093508	4.25E+02	-4.92E-03	1.78E-02	-7.23E-03	1.40E-02
FXORIGIN(TH)	-0.030444	1.05E-02 ***	-0.114406	1.35E+03	-0.098372	1.71E+02	-0.020092	7.13E-03 ***
SIGMA	0.016907	1.42E-03 ***	0.01584	1.33E-03 ***	0.015099	1.14E-03 ***	0.012094	8.68E-04 ***

	Philippines		Singapore		Taiwan		Thailand	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.272756	9.35E-02 ***	0.355713	1.23E-01 **	0.062532	9.34E-02	0.010926	6.18E-02
FXKAIRI	-0.094302	1.03E-01	-0.788533	1.78E-01 ***	-0.556161	1.66E-01 ***	0.090588	1.12E-01
SPORIGIN(HK)	8.13E-03	3.12E-03 ***	3.59E-03	3.41E-03	-7.84E-04	3.48E-03	3.40E-03	3.43E-03
SPORIGIN(ID)	2.62E-03	2.98E-03	-3.36E-03	3.61E-03	-9.51E-03	4.15E-03 **	4.71E-03	3.03E-03 *
SPORIGIN(KR)	-4.78E-03	2.73E-03 **	-3.09E-03	2.83E-03	-9.03E-03	3.48E-03 ***	2.44E-03	2.50E-03
SPORIGIN(MY)	1.03E-03	3.37E-03	-8.78E-03	4.27E-03 **	-8.94E-03	4.20E-03 **	-3.50E-03	3.51E-03
SPORIGIN(PH)	7.64E-03	5.05E-03 *	0.012257	4.45E-03 ***	-3.61E-03	5.19E-03	-3.12E-04	5.17E-03
SPORIGIN(SG)	-0.079461	3.35E+02	-0.082687	2.10E+02	-0.072671	6.21E+02	-0.08151	2.44E+02
SPORIGIN(TW)	-5.18E-03	8.32E-03	-6.55E-03	8.81E-03	0.01586	6.84E-03 ***	4.64E-03	7.86E-03
SPORIGIN(TH)	-1.52E-03	4.72E-03	-7.21E-03	5.29E-03 *	-4.82E-03	4.92E-03	4.41E-03	4.65E-03
FXORIGIN(ID)	2.74E-04	2.27E-03	-0.011172	3.25E-03 ***	-0.012865	3.41E-03 ***	-4.28E-03	2.58E-03 **
FXORIGIN(KR)	-9.86E-03	4.89E-03 **	-0.021114	6.45E-03 ***	-0.013337	5.63E-03 ***	-2.85E-03	4.08E-03
FXORIGIN(MY)	1.01E-04	9.89E-03	1.15E-03	9.72E-03	-0.076868	3.34E+02	-4.96E-03	1.04E-02
FXORIGIN(PH)	-0.078743	1.42E+02	-5.45E-03	1.02E-02	-0.088417	3.42E+02	9.27E-05	9.02E-03
FXORIGIN(TW)	7.62E-03	1.46E-02	7.65E-03	1.47E-02	-0.099734	0.00E+00	6.37E-03	1.49E-02
FXORIGIN(TH)	-0.013171	5.90E-03 **	-0.095724	4.59E+02	-0.011392	6.41E-03 **	-0.011031	6.60E-03 **
SIGMA	0.011957	1.04E-03 ***	0.011749	1.24E-03 ***	0.010986	1.42E-03 ***	0.012668	9.58E-04 ***

Note: ***, ** and * indicate the significance at the 1,5 and 10%, respectively.

Table 3-6

Tobit estimation: dependent variable: stock price
1998-1999

	Hong Kong		Indonesia		Korea		Malaysia	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.115354	8.10E-02 *	0.198308	8.52E-02 **	0.343656	6.69E-02 ***	-0.034493	7.27E-02
FXKAIRI	-2.49193	4.65E-01 ***	0.260521	1.02E-01 ***	-0.132354	2.07E-01	-0.537116	3.22E-01 **
SPORIGIN(HK)	2.84E-03	4.98E-03	5.07E-04	6.55E-03	-0.059911	3.39E+02	4.14E-03	8.02E-03
SPORIGIN(ID)	-1.18E-04	3.64E-03	0.010403	5.42E-03 **	-2.15E-03	3.73E-03	-0.017342	8.76E-03 **
SPORIGIN(KR)	-0.063295	5.61E+01	-0.081337	9.07E+01	-6.55E-03	4.19E-03 *	-0.119466	1.45E+04
SPORIGIN(MY)	-0.072505	1.18E+04	6.75E-03	6.03E-03	5.26E-03	4.46E-03	4.85E-03	7.16E-03
SPORIGIN(PH)	1.48E-03	4.25E-03	-0.0137	8.65E-03 *	1.86E-03	4.53E-03	-5.76E-03	7.52E-03
SPORIGIN(SG)	-1.99E-03	8.59E-03	-0.088263	7.31E+03	0.012326	9.30E-03 *	-0.12704	0.00E+00
SPORIGIN(TW)	8.63E-03	6.68E-03 *	-3.23E-03	1.03E-02	-0.071575	0.00E+00	-5.65E-03	1.23E-02
SPORIGIN(TH)	-0.058714	2.59E+02	-0.081754	1.12E+02	-0.082693	0.00E+00	-0.106712	9.22E+02
FXORIGIN(ID)	-0.023769	6.48E-03 ***	-0.016751	6.78E-03 ***	-3.09E-03	3.96E-03	-0.098267	7.13E+01
FXORIGIN(KR)								
FXORIGIN(MY)								
FXORIGIN(PH)								
FXORIGIN(TW)								
FXORIGIN(TH)								
SIGMA	8.30E-03	1.04E-03 ***	0.012627	1.53E-03 ***	9.28E-03	1.02E-03 ***	0.015087	1.98E-03 ***

	Philippines		Singapore		Taiwan		Thailand	
	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.	coefficient	s.e.
SPKAIRI	0.168052	8.00E-02 **	0.192666	8.75E-02 **	-0.123847	7.26E-02 **	0.112872	6.59E-02 *
FXKAIRI	-0.061393	2.71E-01	-0.873346	2.86E-01 ***	-0.993364	3.59E-01 ***	0.054053	2.83E-01
SPORIGIN(HK)	-4.47E-03	5.35E-03	7.09E-04	4.02E-03	-2.40E-03	4.85E-03	5.44E-03	4.45E-03
SPORIGIN(ID)	2.11E-03	4.14E-03	-5.50E-03	4.60E-03	-4.50E-03	3.78E-03	-6.85E-03	4.60E-03 *
SPORIGIN(KR)	-0.010106	5.82E-03 **	-8.00E-03	5.04E-03 *	-0.071801	0.00E+00	-2.29E-03	4.34E-03
SPORIGIN(MY)	3.20E-03	4.97E-03	-6.65E-03	5.25E-03 *	-2.71E-03	4.29E-03	-3.37E-03	5.08E-03
SPORIGIN(PH)	-4.33E-03	5.61E-03	-4.57E-03	4.66E-03	-2.41E-03	4.25E-03	5.39E-03	4.77E-03
SPORIGIN(SG)	0.019226	1.01E-02	0.021213	8.60E-03 ***	1.43E-03	8.13E-03	-0.0656	2.76E+03
SPORIGIN(TW)	1.43E-03	7.74E-03	2.97E-03	6.61E-03	-2.04E-03	7.35E-03	-0.081986	0.00E+00
SPORIGIN(TH)	-0.013571	6.45E-03 **	-7.49E-03	4.64E-03 *	-0.065999	1.60E+04	-2.64E-03	4.26E-03
FXORIGIN(ID)	5.40E-04	3.94E-03	-0.013894	5.11E-03 ***	-0.011133	4.35E-03 ***	-0.011091	5.17E-03 **
FXORIGIN(KR)								
FXORIGIN(MY)								
FXORIGIN(PH)								
FXORIGIN(TW)								
FXORIGIN(TH)								
SIGMA	9.85E-03	1.26E-03 ***	8.06E-03	1.13E-03 ***	8.12E-03	1.16E-03 ***	9.48E-03	1.19E-03 ***

Note: ***, ** and * indicate the significance at the 1,5 and 10%, respectively.

Table 4-1: Contagion effects (July 1997-June 1998)

From	To	stock price								exchange rate				
		Hong Kong	Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	Indonesia	Korea	Malaysia	Philippines	Thailand
Stock price origin	Hong Kong	-	+(**)	-	+(**)	+(***)	+	-	+	+(***)	+(*)	+(*)	+	+(*)
	Indonesia	+	-	+	+	+	-	-(**)	+(*)	+(**)	+	-	+	+(**)
	Korea	-	-	+	+	-(**)	-	-(***)	+	-	+	+	+	+(**)
	Malaysia	-	-	+	+	+	-(**)	-(**)	-	-	+	-	+	+(*)
	Philippines	+(*)	+	+	+(*)	+	+(***)	-	-	-	+	-	+	+(**)
	Singapore	-	-	-	-	-	-	-	-	+	-	-	-	-
	Thailand	-	-	-	-	-	-(*)	+	+	-	-	+(*)	-	+(*)
exchange rate origin	Indonesia	-(***)	-(***)	-	-	+	-(***)	-(***)	-(**)	+(**)	+(**)	+(***)	+(***)	+(***)
	Korea	-(***)	-	-	-	-(**)	-(***)	-(***)	-	+(***)	+(*)	+	+(**)	+(***)
	Malaysia	-	-	-	-	+	+	-	-	+(**)	-	-	-	-
	Philippines	-	-	-	-	-	-	-	+	-	-	-	-	-
	Taiwan	+	-	-	-	+	+	-	+	-	+	+	+	-
	Thailand	-(***)	-	-	-(***)	-(**)	-	-(**)	-(**)	-	-	-	+	+(*)

Note:***, **, and * indicate the significance at the 1,5 and 10%, respectively.

Table 4-2: Contagion effects (July 1998-July 1999)

From	To	stock price								exchange rate				
		Hong Kong	Indonesia	Korea	Malaysia	Philippines	Singapore	Taiwan	Thailand	Indonesia	Korea	Malaysia	Philippines	Thailand
stock price origin	Hong Kong	+	+	-	+	-	+	-	+	-	-	-	-	-
	Indonesia	-	+(**)	-	-(**)	+	-	-	-(*)	-	-	-	-	-
	Korea	-	-	-	-	-(**)	-(*)	-	-	-	-	-	-	-
	Malaysia	-	+	+(*)	+	+	-	-	-	-	-	-	-	-
	Philippines	+	-(*)	+	-	-	-	-	+	-	-	-	-	-
	Singapore	-	-	+	+	+(**)	+(***)	+	-	-	-	-	-	-
	Thailand	-	-	-	-	-(**)	-(*)	-	-	-	-	-	-	-
exchange rate origin	Indonesia	-(***)	-(***)	-	-	+	-(***)	-(***)	-(**)	+(**)	-	-	-	-
	Korea	na	na	na	na	na	na	na	na	na	na	na	na	na
	Malaysia	na	na	na	na	na	na	na	na	na	na	na	na	na
	Philippines	na	na	na	na	na	na	na	na	na	na	na	na	na
	Taiwan	na	na	na	na	na	na	na	na	na	na	na	na	na
	Thailand	na	na	na	na	na	na	na	na	na	na	na	na	na

Note:***, **, and * indicate the significance at the 1,5 and 10%, respectively.