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# Prices of Domestic Bank Stocks and External Shocks in East Asia<sup>\*</sup>

Masahiro Inoguchi<sup>†</sup>

## Abstract

This paper examines the impact of price fluctuations in foreign stock markets on the stock prices of domestic banks' stocks to explore if and how external shocks have affected the banking system in Korea, Malaysia, Singapore, and Thailand during the 2000s. These countries have consolidated their domestic banking system since the Asian crisis of 1997. Some researchers insist that domestic banks in East Asia were less affected by the 2007–2009 global financial crisis since reforms following the 1997 Asian crisis had solidified the banking system. However, few previous articles have investigated how the banking sector in East Asia has been affected by external shocks. Employing a multinomial logit model, this study estimates how changes in the US and Japanese stock market indices affected the banking sectors in Korea, Malaysia, Singapore, and Thailand before, during, and after the 1997 and 2007–2009 crises. This study's regression employs the number of banks in a given country that experienced a large shock on the same day ("coexceedances") as shocks to the domestic banking sector. The regression result suggests that fluctuations in foreign stock market indices had a larger impact on prices of East Asian banking stocks during the 2000s than during the 1990s before the Asian financial crisis. Although the shock brought by the deteriorating foreign stock markets was significant before the 2007–2009 global financial crisis, both increases and declines in the stock prices affected the banking sector during the crisis. Increasing foreign capital flows and foreign assets and liabilities may have greatly influenced East Asia, although the domestic banking system has also improved in the 2000s.

*Keywords:* Domestic banks; Stock prices; Foreign stock market; External influences; Asia

*JEL classification codes:* F36; G01; G15; O16

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## 1. Introduction

A sound banking system is important for any economy, particularly true in case of East Asia, where a significant number of companies rely extensively on bank loans for company financing. Authorities continue to reform their domestic financial systems, including banking systems, through which the East Asian financial systems are now sounder than what they were previous to the 1997 crisis. For instance, some previous articles have described the process of reduction in the number of nonperforming loans by the banking system and the growth in security markets in the East Asian countries and have thereby reported many notable improvements.

During the global financial crisis since 2007, financial shocks to the East Asian banking systems have not seemed so large, especially compared to the serious damage suffered by European banks. At present, it is unclear why these consequences have been small for East Asian banking system, although some researchers point out that the small shocks on domestic banks in East Asia can be consistent with the improvements in the soundness of banking system resulting from the reforms since 1997. If domestic banks have improved more than what they were before the crisis, influences of external financial shocks on the banking system would thus be considered minimal.

Nonetheless, these discussions have produced no consensus whether the East Asian banking system has been sound enough to desensitize global financial crisis. One reason is the lack of an attempt to analyze how shocks in foreign financial sector have affected Asian banks. This paper attempts to do so.<sup>1</sup>

Previous articles have theoretically analyzed the cross-border contagions of banking crises. Freixas et al. (2000) describe how insolvency of one bank can generate systemic risk through interbank markets and withdrawal of deposits, even if all the rest of the banks are solvent.<sup>2</sup> In addition, they insist that their model extends to consider the spread of financial crisis from country to country. Cifuentes et al. (2005) insist that contagious failures of banking system can result when one bank's small liquidity deficit prompts it to sell assets, depressing market prices and prompting further rounds of sales and price declines. Freixas et al. (2000) and Cifuentes et al. (2005) imply that banking failures can spread country to country without any direct inter bank connections between them.

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<sup>1</sup> Because the size of the external impact on banks does not necessarily mean the degree of the soundness of banking system, this paper does not discuss if the domestic banking sector has become sound.

<sup>2</sup> Allen and Gale (2000) suggest that liquidity shock causing a crisis in one region can spread by contagion with incomplete interbank market.

Although there is much empirical literature regarding bank failures via domestic contagion, few studies examine cross-border effects among banking systems.<sup>3</sup> Gropp et al. (2006) use a market-based indicator of bank soundness to estimate cross-border contagion in European banks.<sup>4</sup> Their empirical method follows Bae et al. (2003). Bae et al. (2003) use interest rates, exchange rates, and the stock market indices of individual countries to evaluate contagion in financial markets among the regions (Asia, Latin America, the US, and Europe). They arbitrarily define an extreme return (“exceedance”) measured by either below the 5th or above 95th percentile of the distribution of the daily return and employ the number of countries in a region that experiences a large shock on the same day (“coexceedances”) to capture the coincidence of extreme return shocks across countries within a region and across regions. Their approach enables us to measure this influence across and within regions. Gropp et al. (2006) apply the approach of Bae et al (2003) to test contagion in European banks. This study also utilizes their method to analyze the effect of external financial shocks on East Asian banking systems, particularly in Korea, Malaysia, Singapore, and Thailand.

During the Asian crisis of 1997, Singapore was not severely affected as were the financial systems of Korea, Malaysia, and Thailand. Korea eased the ceilings on foreign ownership of domestic banks in 1998; consequently, foreign ownership ratios in domestic banks grew gradually. Malaysia imposed controls on foreign capital flows and introduced the dollar-pegged exchange rate system after the 1997 crisis, although capital controls were relaxed gradually. That strong capital controls had not been introduced in Asian countries other than Malaysia. Thai authorities eased the assorted financial market regulations and implemented inflation as a monetary policy target in 2000. Singapore deregulated financial markets and improved its financial sector infrastructure after the crisis, becoming Asia’s international financial center. While these countries have different financial systems and policies, all have consolidated their domestic banking sectors since 1997.

This paper employs the daily change in prices of domestic bank stocks and a multinomial logit model to estimate the influence of the Japanese and the US financial shocks on domestic banking systems in Korea, Malaysia, Singapore, and Thailand. In addition, this study examines whether these influences are different before and during

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<sup>3</sup> Hartmann et al. (2005) attempt to assess risks in the banking system in Europe and the U.S. While they insist the relative importance of cross-border bank spillovers as compared to domestic bank spillovers in Europe, they suggest that bank spillover risk in Europe seems to be lower than in the U.S.

<sup>4</sup> They employ the “distance to default” as an indicator of bank soundness. Gropp and Moerman (2004) also use this variable and the Monte Carlo Simulation to show that standard distributional assumptions cannot replicate the patterns of tails of the data.

the 2007–2008 global financial crisis.

The regression result suggests that fluctuations in the US and Japanese stock markets influenced the stock prices of East Asian banks more in the 2000s than in the 1990s before the Asian financial crisis. Both increases and declines in the foreign stock markets influenced the Asian banking sectors during the crisis of 2007–2009, while in the period before 2007–2009, only declines in global markets had a significant effect on Asian banks stocks. In addition, fluctuations in the foreign stock markets had less effect in Singapore than in other Asian countries. While these Asian countries have consolidated their domestic banking system since the crisis, increasing foreign capital flows and foreign assets and liabilities may have had a great influence.

The outline of this paper is provided as follows. Section 2 describes the restructuring of financial sectors in Korea, Malaysia, Singapore, and Thailand. Section 3 graphically illustrates the trends in stock prices and presents data regarding the external assets and borrowings of the banking sector. Section 4 discusses the methods of estimating the effect of external shocks on the domestic banking system in Korea, Malaysia, Singapore, and Thailand using the daily stock prices. Concluding remarks are presented in Section 5.

## **2. Banking sector reforms after 1997**

In the crisis-affected countries, authorities attempted to address the problems of capitalization, governance, risk management, and operational inefficiencies in the aftermath of the 1997 crisis. They either closed or consolidated banks and nationalized them temporarily. Korea, Malaysia, Singapore, and Thailand consolidated their banking sectors based on their plans to reorganize banks, which included enhanced supervision of the banking system and relaxed restrictions on ownership. For example, the level of foreign ownership in domestic banks increased, while regulation of foreign banking was relaxed substantially.

In Korea, the Bank Act was also revised since the 1997 crisis in addition to closures, capital infusions, and purchase of banks' nonperforming loans. Korea's government established a restructuring plan to improve and strengthen the soundness and efficiency of its financial system by relaxing the restrictions on foreign ownership and tightening capital adequacy regulations. Foreign ownership among domestic banks increased and was sustained at high levels. In order to encourage competition among banks and to improve competitiveness of the domestic banking sector, various restrictions were eased. For instance, inauguration of new branches in Korea was liberalized gradually.

Since 2001, Bank Negara Malaysia has implemented its Financial Master Plan

intended to encourage stability and competitiveness of the financial system for the next ten years. Although this plan covered banking and insurance sectors, in the first stage, domestic banking system was encouraged to enhance its stability and capabilities to develop several powerful domestic banks in the initial period of 2–4 years of the plan. In the second stage, the authorities relaxed the restrictions on foreign banks' activities in the country and promoted competition between domestic and foreign banks in order to strengthen the competitiveness of the domestic banking sector. The plan is currently in its third stage, which hopes to boost this competition between domestic and foreign banks further. Bank Negara Malaysia intends to ease the regulations on new foreign banks' entry into Malaysia and to facilitate overseas activities of the domestic banks. For instance, in 2009, the authorities relaxed the restrictions on the opening of new branch offices of foreign banks and issued new licenses for foreign banks to operate in Malaysia.

Similarly, since 1998, the Monetary Authority of Singapore has introduced a Financial Sector Review to promote the reforms for stimulating competition among domestic and foreign banks. This plan includes improving the capital markets as well as promoting various deregulations of the financial system in order to emerge itself as Asia's financial center. Since 1999, liberalization of the banking sector has eliminated the restriction of foreign ownership of domestic banks, relaxed regulations for foreign banks' activities, and issued new licenses for operations to the foreign banks. To consolidate the domestic banking sector, the authorities have tried to enhance the governance of domestic banks, to promote interbank mergers, and to encourage domestic banks' acquisitions of foreign banks.

On the other hand, Thailand has improved its financial and banking system since the 1997 crisis by closing and consolidating banks and non-banks, infusing banks with capital, and relaxing restrictions on foreign ownership of domestic banks. In 2004, Bank of Thailand introduced the Phase 1 of its Financial Master Plan that had been considered since 2002 and tried to consolidate the banking sector further. This plan included changes in the classification of banks. For instance, some finance companies were converted to commercial banks by modifying the definition of a commercial bank. In 2007, the Thai authorities commenced the Phase 2 of the Financial Master Plan aiming to reduce the operational expenses of financial institutions, to enhance banking sector's competitiveness, and to develop the financial system infrastructure. The authorities announced that they would gradually liberalize the banking sector and grant greater operating leeway to the new financial institutions, both domestically and internationally, to enhance domestic banks' competitiveness.

### **3. Balance sheets and stock prices of domestic banks in East Asia**

#### *3.1 Foreign assets and liabilities of the banking sector*

This section reviews the foreign assets and liabilities of the domestic banking sectors in Korea, Malaysia, Singapore, and Thailand in order to present the transactional relationships between their respective domestic and foreign banks. Statistical data reveals an increase in the foreign assets and liabilities of the domestic banking sectors of these four countries between 2000 and 2007. The increase in the period from 2004 to 2007 was significantly large. Although domestic banks in East Asia reduced their foreign assets and liabilities after 1997, capital flows between domestic and foreign banks grew in the 2000s. This implies that the shock occurring in foreign banking sectors could have greatly affected the domestic banking system in Asia after 2000. Tables 1, 2, 3, and 4 provide statistical data regarding the foreign assets and liabilities of the banking system in Korea, Malaysia, Singapore, and Thailand, respectively. Tables 5-1, 5-2, and 5-3 report the debt of local banks from foreign (BIS reporting) banks, the ratio of bank debt from foreign (BIS reporting) banks to total foreign debt in each country, and the deposits of foreign (BIS reporting) banks in local banks, respectively.<sup>5</sup>

Table 1 provides data regarding the external assets and debts of domestic commercial banks in Korea.<sup>6</sup> Their external assets and debts declined until 2001 after the 1997 crisis and increased during the period from 2002 to 2007–2008. The increase in 2006 and 2007 was significantly large. Table 5-1 shows that the foreign debt of domestic banks increased during the period from 2002 to 2007. The ratio of this debt to national foreign debt rose during the period from 2002 to 2004 and has fallen since 2005 (Table 5-2). These statistics indicate that the external assets and liabilities of domestic banks in Korea reached high levels in the latter half of 2000s; however, foreign debt of these banks diminished compared to that of the other sectors since 2005.

Table 2 reports the foreign assets and liabilities of banks in Malaysia, which showed a remarkable increase in 2006 and 2007. Table 5-1 shows a decline in the foreign debt of domestic banks in 1998 and a sustained low level until 2003. The trend was upward from 2004 to 2007. Table 5-2 reports that the ratio of this debt to national debt too has been at a high level since 2004; however, it is lower as compared to that during the mid-1990s. These tables suggest that foreign assets and liabilities of Malaysian banks were greater in late 2000s than in early 2000s.

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<sup>5</sup> All data referenced in Tables 5-1, 5-2, and 5-3 are drawn from the Bank for International Settlements (BIS) data for reporting banks.

<sup>6</sup> The data of Table 1 covers only domestic commercial banks, while data provided by Table 5-1 and 5-2 include data for all types of banks in Korea.



Table 3-1 shows the foreign assets and liabilities of domestic banks in Singapore, and Table 3-2 provides the ratio of every particular item in Table 3-1 to all foreign assets and liabilities of domestic banks. As Table 3-1 demonstrates, fluctuations in the amount of domestic banks' foreign assets and those due from foreign banks showed an upward trend from 1990 to 2008, and increased significantly since 2004. Foreign liabilities of domestic banks and those due to foreign banks expanded from 1990 to 1997, declined in 1998, and increased thereafter, expanding greatly since 2004. In contrast, Table 3-2 highlights that the percentage of assets due from foreign banks did not rise and tended to decrease since 2000, while the percentage of foreign securities and equity assets increased slowly. In addition, the percentage of foreign liabilities due to foreign banks has declined slightly since 2005. Tables 5-1 and 5-2 depict that the foreign debt of domestic banks increased from 2004 to 2007, while the ratio of this debt to national foreign debt has declined continuously. These tables highlight that external assets and liabilities of Singapore's domestic banks have expanded in the 2000s; however, foreign assets and debts of domestic banks due from foreign banks have declined as compared to that from other sectors.

Table 4-1 reports foreign assets and liabilities of commercial banks in Thailand. Table 4-2 shows the ratio of assets and liabilities due from and due to foreign banks to total foreign assets and liabilities of commercial banks. As these tables depict, foreign assets due from foreign banks expanded from 1997 to 2000, declined heavily in 2002, and again increased from 2003 to 2007. The ratio of these assets to total foreign assets increased during 1997–2001 and during 2004–2007. In contrast, foreign liabilities of domestic banks remained at a low level since 2003, and the trend was downward from 1997 to 2003 despite slight increase in 2004 and 2005. Borrowings in foreign currencies and their ratio to total foreign liabilities of the commercial banks declined from 1997 to 2007. Deposits in foreign currencies, however, have showed an upward trend. Table 5-1 and 5-2 show that the debt of domestic banks from BIS reporting banks decreased after the 1997 crisis and increased since 2003. The ratio of this debt to national debt has grown since 2003. Thus, data from these tables imply that assets due from foreign banks and debt from BIS reporting banks expanded from 2003 to 2007 for Thai banks.

In general, these statistics indicate that foreign assets and liabilities of domestic banks in Asian countries have tended to increase in the 2000s, which implies that capital flows between foreign and local banks have expanded and this relationship has become more significant recently. Although external liabilities are still larger in Korea and Singapore, their ratio to country's total foreign liabilities expanded in the 2000s before the global financial crisis of 2008 in Malaysia and Thailand.

### *3.2 An overview of stock prices of domestic banks and stock market indices*

This section graphically illustrates the fluctuations in prices of bank stocks and in stock market indices in Korea, Malaysia, Singapore, and Thailand. We observe that prices of most domestic bank stocks move in similar periods, despite differences in the magnitude of changes, and that stock market indices of most countries fluctuate similarly. Figures 1, 2, 3, and 4 present the daily price fluctuations of each bank stock in Korea, Malaysia, Singapore, and Thailand, respectively. Figure 5 illustrates how the change in representative stock market indices of these Asian countries and also those of Japan and the US. Figure 6 depicts fluctuations in the monthly average rates of change in stock prices and stock market indices.

Figure 1 shows price fluctuations of nine domestic bank stocks in Korea. Most share prices expanded in the first half of 2002, declined afterward, and began to increase from 2003. The trend was upward until 2007–2008, but stock prices fell in mid-2004 and in 2006. Fluctuations in the Korean stock market index KOSPI are similar to those of domestic banks in Korea (Figure 5). As Figure 6 demonstrates, rates of change in prices of Korean bank stocks differ for each bank; however, increases and declines occur in similar periods in the 2000s.

Figure 2 illustrates how prices of nine Malaysian bank stocks have fluctuated in the 2000s. Stock prices generally fell until the first half of 2001, rose in the first half of 2002, declined afterward, and began to increase from the latter half of 2003. The trend was upward until 2007 and declined in mid-2004 and in 2005. As Figure 5 demonstrates, fluctuations in the Malaysian stock market index KLCI are similar to those of domestic bank stocks in Malaysia. Figure 6 illustrates that rates of change in prices of specific domestic bank stocks differ for each bank; however, increases and declines occur in similar periods.

Figure 3 shows the fluctuation in prices of three Singapore bank stocks. Prices fell from 2001 to the first half of 2002, increased afterward, and declined from 2002 to the first half of 2003. Thereafter, the trend was upward until mid-2007. Price fluctuations in these stocks are similar to the fluctuations in Singapore's stock price index ST shown in Figure 5. As Figure 6 demonstrates, rates of change in prices of these three bank stocks differ for each bank; however, their increases and decreases occur in similar periods in the 2000s.

Figure 4 illustrates how prices of eight Thai bank stocks have fluctuated in the 2000s. While the movements of stock market prices indices differ for each bank, many stock prices tended to fall until the first half of 2000, began to expand in 2003–2004, and

remained at a high level until the first half of 2008. As Figure 5 demonstrates, fluctuations in Thailand's stock market index SET are similar to the price fluctuations of domestic banks in Thailand. Figure 6 illustrates that rates of change in prices of individual Thai bank stocks differ for each bank; however, increases and decreases occur in similar periods.

Figures 5 and 6 also illustrate the fluctuations and rates of change in the stock market index for the Tokyo Stock Exchange: Nikkei 225, the Dow Jones Average, and Philadelphia Stock Exchange Bank Index in addition to the KOSPI, KLCI, ST, and SET. Most indices remained low from latter half of 2002 to the first half of 2003 and generally expanded until 2007; however, they fell slightly in mid-2004. The rates of change in those indices have increased and decreased in similar periods. Price movements of domestic bank stocks in each country are more similar than price movements of stock market indices among different countries.

## **4. Regression analysis**

### *4.1 Data and terms*

This paper considers three periods since we can compare the influences of external shocks on domestic banking sector in three time frames: during the 1990s before the Asian financial crisis, during the 2000s before the global financial crisis, and during the 2000s after the global financial crisis. The time periods analyzed for these time frames are January 1993–December 1996, January 2000–May 2007, and June 2007–October 2009 respectively.<sup>7</sup>

Here, we use the daily data of bank stock prices, stock market indices, and interest rates. All stock prices are drawn from the Datastream and TEJ databases. All prices for the Asian and US stock indices mentioned earlier are obtained from the CEIC database, while variables for interest rates are obtained from the official websites of each government and the CEIC database. The slope of the yield curve is calculated as the difference between yields of 10-year and one-year sovereign bonds in Korea, Singapore, and Thailand. Due to constraints of data availability, the regression employs interbank interest rates in Malaysia and does not assimilate the variable measuring the yield curve in the test for January 1993–December 1996.

The analysis uses data of listed domestic commercial banks in Malaysia, Singapore, and Thailand and of listed commercial, regional, and specialized banks in Korea. Some

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<sup>7</sup> The “sub-prime loan” problem had grown since the mid-2007 in the US. Two Bear Stearns-managed hedge funds reported heavy loss due to sub-prime loans in June 2007, and many other hedge funds fell into bankruptcy. In July 2007, Moody's and Standard & Poor's reduced ratings on bonds were backed by sub-prime mortgages.

banks are not included in the test because they either merged or disappeared after the 1997 crisis. In addition, some banks are included in the regression for the period following the 1997 crisis because new banks emerged. The number of banks analyzed for indicated periods of the 2000s is nine in Korea, nine in Malaysia, three in Singapore, and eight in Thailand. The number of banks in the tests for the period January 1993–December 1996 is eight in Korea, nine in Malaysia, three in Singapore, and seven in Thailand.

#### *4.2 Methodology*

This paper estimates how changes in the US and Japanese stock market indices affect prices of domestic bank stocks in order to assess the influence of external shocks on the banking sector in Korea, Malaysia, Singapore, and Thailand. Following Gropp et al. (2006) and Bae et al. (2003), this study employs the number of banks in a given country that experience a large shock on the same day (“coexceedances”) as shocks on the domestic banking sector. Large shocks are arbitrarily defined as an extreme return—an “exceedance”—that lies below the 5th or above the 95th percentile of the marginal return distribution of the daily percentage change in bank’s stock price. We treat positive extreme returns and negative extreme returns separately. In addition, we categorize the number of “coexceedances” to 0, 1, 2, and 3 or more. This approach enables us to measure the influence of foreign shocks on the entire banking sector of an individual country. This paper estimates these coexceedances as a function of variables measuring domestic stock price index, variables concerning stock market indices of Japan and the US, and variables measuring changes in the yield curve.

In regard to the variables for domestic stock markets, we construct two kinds of indicators measuring shocks in the stock market and employ one of them. The first indicator is the variable that is equal to “1” if the country’s general stock market index experiences a shock large enough to rank below the 5th or above the 95th percentile of the distribution of daily returns (“exceedances”). This exceedance includes variables from the positive and negative tail of the distribution. Exceedances from the positive or negative tail are used in regression when the dependant variable is from positive or negative return coexceedances. The second indicator is the daily change in the volatility of the country’s general stock market index.<sup>8</sup> Following Gropp et al. (2006) and Bae et al. (2003), volatility is defined as the conditional variance of the country’s general stock market index as estimated using a generalized autoregressive conditional

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<sup>8</sup> Gropp et al. (2006) and Bae et al. (2003) found this variable to be important when explaining emerging market coexceedances.

heteroskedasticity (GARCH).<sup>9</sup>

This study employs the number of exceedances of stock market indices in Japan and the US or exceedances of the Philadelphia Stock Exchange Bank Index as variables concerning foreign shocks. First, we construct an indicator that is equal to “1” if there are exceedances in the general stock market index of a foreign country. The variable measuring shocks to the Japanese and US stock markets is calculated by the sum of exceedances of the Nikkei 225 and the Dow Jones Average. Therefore, the sum of coexceedances ranges from 0 to 2. The existence of exceedances of the Philadelphia Stock Exchange Bank Index indicates shocks to the foreign banking sector. Regression analysis employs one of them as an explanatory variable. The positive (negative) return coexceedances are used in regression when the dependant variable is from positive (negative) return coexceedances.<sup>10</sup>

The “yield curve” variable is the daily change in absolute value of the slope of the yield curve. This variable is calculated as the difference between yields of 10-year and one-year sovereign bonds. This yield curve is a measure of expectations of economic growth and monetary policy. One view of banking suggests that commercial banks transform short-term liabilities (deposits) into long-term assets (loans). A flat yield curve indicates an increase of the interest rate that the banks must pay on short-term liabilities, while it does not produce a corresponding increase in the interest rates on loans charged by the banks. Any large or small difference between the yields is expected to increase or decrease the price of bank stocks, respectively. Therefore, this yield curve would be related to the number of coexceedances. Due to constraints of data availability, we employ interbank interest rates in the regression for Malaysia, and ignore the variable measuring the yield curve in the test for the period January 1993–December 1996.

Following Gropp et al. (2006) and Bae et al. (2003), this paper also employs a multinomial logit model to estimate coexceedances, because the number of coexceedances is a count variable and marginal effects shown at each number are not the same.<sup>11</sup> According to Bae et al. (2003), Gropp and Moerman (2004), and Gropp et al. (2006), the multinomial logit model should be employed as the primary estimation

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<sup>9</sup> We employ a GARCH (1,1) model.

<sup>10</sup> When the Asian markets are open (closed), the US markets are closed (open). Because the shocks that occur in the US market might influence the Asian markets on the following day, the variable concerning the U.S. is lagged by 1 day.

<sup>11</sup> This implies that the effect of coexceedances in the foreign country on going from 1 to 2 bank coexceedances in the dependent variable is not the same as going from 3 to 4 banks. While the ordered logit model restricts these marginal effects to remain the same, the multinomial logit model allows complete flexibility.

method. The regression equation of this paper is as follows:

$$\Pr[ Y = j ] = \frac{e^{[\alpha_j C_{t-1} + \beta_j S + \gamma_j F + \delta_j R]}}{1 + \sum_{j=1}^J e^{[\alpha_j C_{t-1} + \beta_j S + \gamma_j F + \delta_j R]}} \quad [1]$$

where,

$j$  : number of banks at the tail of the distribution of the daily percentage change in stock prices of domestic banks (“coexceedance”) in a given country ( $j = 1,2,3$ ),

$C_{t-1}$  : lagged number of coexceedances in domestic banks in a given country,

$S$  : variable concerning the domestic stock market; the “exceedance” of stock price index in a given country (this variable takes value “1” if there is exceedance, and “0” otherwise) or price volatility of the general stock index in a given Asian country,

$F$  : variable concerning shocks occurring in foreign stock markets; the sum of exceedance of the Nikkei 225 and the Dow Jones Average index or the exceedance of the Philadelphia Stock Exchange Bank Index,

$R$  : yield curve in each of the three countries except in the case of Malaysia where it is interbank rate. This variable is not assimilated in the regression equation for the period January 1993–December 1996.

As per convention, this study defines  $Y = 0$  (coexceedances = 0 ) as the base category to remove the indeterminacy associated with the model.

Because coefficients from the multinomial logit model are difficult to interpret, it is useful to calculate the marginal effect of regressors. Marginal effects are obtained by differentiating the above equation with respect to explanatory variables. For instance, the marginal effect of  $F$  is as follows:

$$\frac{\partial \Pr[ Y = j ]}{\partial F} = \gamma_j * \Pr[ Y = j ] * [1 - P_j] \quad [2]$$

#### 4.3 Regression results

Tables 6, 7, and 8 report regression results for the period June 2000–May 2007 (before the global financial crisis), for the period January 1993–December 1996 (before the Asian financial crisis), and for the period June 2007–October 2009 (after the global financial crisis).<sup>12</sup> The left side of the tables focuses on positive return, “top tail”

<sup>12</sup> In the regression of the category of three coexceedances in Singapore, there is a possibility

exceedances (Model 1 to 4), and the right side focuses on negative return, “bottom tail” exceedances (Model 5 to 8). All tables show the estimated coefficients alongside the marginal probabilities.<sup>13</sup>

#### *4.3.1. Results in the 2000s before the global financial crisis*

Tables 6-1, 6-2, 6-3, and 6-4 show the results of the period January 2000–May 2007 in Korea, Malaysia, Singapore, and Thailand, respectively. As Table 6-1 demonstrates, the coefficients and the marginal effects for shocks in foreign stock market indices and the Philadelphia Stock Exchange Bank Index are significantly positive in the bottom tail category of 2 and 3 or more coexceedances in Korea. Regarding top tail coexceedances, the coefficients of shocks of foreign stock market indices are significant in the category of 2 coexceedances. Most coefficients and marginal effects of domestic stock market are significant, and the sign of them of the domestic index volatility is positive (negative) in the top (bottom) tail coexceedances. All coefficients and marginal effects of the yield curve are significant in the top tail coexceedances.

Table 6-2 reports that in Malaysia, the coefficients and the marginal effects for shocks occurring in foreign stock market indices and the Philadelphia Stock Exchange Bank Index are significant and positive in the bottom tail coexceedances. In contrast, few coefficients for foreign stock market indices are significant in the top tail coexceedances. However, coefficients and marginal effects for shocks in Malaysia’s KLCI are significant, and the sign of them for volatility in KLCI is positive (negative) in the top (bottom) tail coexceedances.

As Table 6-3 demonstrates, a few coefficients for shocks occurring in foreign stock market indices are significantly positive in Singapore. In contrast, the coefficients for shocks in the domestic stock market are significant, and the sign of the coefficient for the volatility of ST is positive (negative) in the top (bottom) tail coexceedances. While all coefficients and marginal effects of the yield curve are significant in the category of 1 and 2 coexceedances in the top tail coexceedances, many coefficients and marginal effects in the category of 3 coexceedances are not significant.

Table 6-4 shows that the coefficients and the marginal effects for shocks occurring in foreign stock market indices are significant and positive in the bottom tail

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that small sample problem has influences on the result.

<sup>13</sup> We also estimate the model using ordered logit to check the robustness of the result. The test using ordered logit shows that some coefficients of foreign stock markets are significant in the 2000s, while these coefficients are not significant in the regression with multinomial logit. However, there are not many differences between the results of multinomial logit and ordered logit.

coexceedances in Thailand, while those of the Philadelphia Stock Exchange Bank Index are insignificant. Most coefficients of foreign stock market indices are not significant in the top tail coexceedances. Coefficients and marginal effects for the volatility of SET and for the yield curve are significant in Thailand. The sign for the coefficient of volatility in SET is positive (negative) in the top (bottom) tail coexceedances.

This suggests that declines in foreign stock market indices affected the price of domestic bank stocks in Korea, Malaysia, and Thailand. The regression results also imply that shocks to the US banking sector affected the domestic banking sector of Korea and Malaysia during the January 2000–May 2007 period before the global financial crisis.

#### *4.3.2. Results in the 1990s before the Asian crisis*

Tables 7-1, 7-2, 7-3, and 7-4 report the results of the period January 1993–December 1996 in Korea, Malaysia, Singapore, and Thailand, respectively. Table 7-1 shows that the coefficients of shocks occurring in foreign stock markets are not significant in Korea. Table 7-2 reports that a few coefficients for shocks in foreign stock market indices are significant and positive in the bottom tail coexceedances in Malaysia. The coefficients for the Philadelphia Stock Exchange Bank Index are not significant. As Table 7-3 demonstrates, the coefficients for shocks occurring in foreign stock market indices are not significant in Singapore. In Thailand, Table 7-4 reports that coefficients and marginal effects of shocks occurring in foreign stock market indices are significant and positive in the category of bottom tail 2 and 3 or more coexceedances. The coefficients for foreign stock market indices are not significant in the top tail coexceedances. In contrast, most coefficients and marginal effects of domestic stock markets are significant in Korea, Malaysia, Singapore, and Thailand. In addition, the sign of the coefficient of volatility in each country's domestic index is positive (negative) in the top (bottom) tail coexceedances.

These suggest that declines in foreign stock market indices affected the price of Thai domestic banks' stocks in the 1990s. The regression implies suggest that effects of foreign stock shocks on prices of domestic bank stocks are smaller during the pre-crisis period of the 1990s than during the pre-crisis period of the 2000s.

#### *4.3.3. Results in the 2000s during the global financial crisis*

Table 8-1, 8-2, 8-3, and 8-4 report the results of the period June 2007–October 2009 in Korea, Malaysia, Singapore, and Thailand, respectively. As Table 8-1 demonstrates, some coefficients for shocks occurring in foreign stock market indices and Philadelphia



Stock Exchange Bank Index are significantly positive in the category of bottom tail 2 and 3 or more coexceedances in Korea. In addition, coefficients for shocks to foreign stock market indices are significant in the category of top tail 3 or more coexceedances. Most coefficients and marginal effects for domestic stock markets are significant, and the sign of them for volatility of the domestic index is positive (negative) in the top (bottom) tail coexceedances. Coefficients of the yield curve are not significant in the category of 1 and 2 coexceedances, but some coefficients in the category of 3 or more coexceedances are significant in the top tail coexceedances.

In Malaysia, as Table 8-2 demonstrates, some coefficients for shocks in foreign stock market indices are significantly positive in the bottom tail coexceedances and in the category of top tail 3 or more coexceedances. Regarding the Philadelphia Stock Exchange Bank Index, some coefficients and marginal effects are significant and positive in the bottom tail coexceedances. The coefficients and the marginal effects for shocks in domestic stock markets are significant, and the sign of the coefficient for volatility of KLCI is positive (negative) in the top (bottom) tail coexceedances.

Table 8-3 reports that some coefficients for shocks in foreign stock market indices and the Philadelphia Stock Exchange Bank Index are significantly positive. The coefficients of shocks occurring in ST are also significant, the sign of the coefficient for volatility is positive (negative) in the top (bottom) tail coexceedances. Although some coefficients of the yield curve are significant in the top tail coexceedances, all coefficients in the category of 2 coexceedances are not significant.

Table 8-4 shows that many coefficients of shocks in foreign stock market indices and the Philadelphia Stock Exchange Bank Index are significant and positive in the category of 3 or more coexceedances in Thailand, while those in the category of 1 and 2 are not significant. The coefficients and the marginal effects in SET are significant, and the sign of coefficient for volatility in SET is positive (negative) in the top (bottom) tail coexceedances. While the coefficients and the marginal effects of the yield curve are significant in the category of top tail 1 and 2 coexceedances, many coefficients in other categories are not significant.

These results suggest that fluctuations in foreign stock market indices and shocks to the US banking sector affected prices of domestic bank stocks in Korea, Malaysia, Singapore, and Thailand during the global financial crisis. However, fluctuations in foreign stock market indices had no effect in Singapore, and the shock to the US banking system had no influence in Thailand in the 2000s before the crisis. In addition, it implies that both increases and declines in foreign stock market indices had affected East Asia's banking sector during the crisis, while the shock of declines in foreign stock

market indices was important mostly in the pre-crisis 2000s in Malaysia and Thailand. The results also show that changes in the yield curve affected domestic bank stocks less during the global financial crisis than before it.

## **5. Conclusions**

This paper analyzes the impact of fluctuations in foreign stock market indices on the prices of domestic bank stocks to investigate the changes in the influence of external shocks on the banking sector in the 2000s in Korea, Malaysia, Singapore, and Thailand. Few previous researches have examined how the banking sector of East Asian countries has been affected by external shocks in the 2000s. Because we can compare the magnitude of shocks in different periods, the regression focuses on three sample periods: the 1990s before the Asian financial crisis, the 2000s before the global financial crisis, and the 2000s after the global financial crisis.

The dependant variable in the test is the number of coexceedances of banks as the shock to the domestic banking sector. Large shocks are arbitrarily defined as an extreme return that lies above the 5th or below the 95th percentile of the marginal return distribution of the daily percentage change in the bank's stock price. We estimate how these coexceedances are affected by a variable measuring the domestic stock index, the variable concerning stock indices in Japan and the US, and the variable measuring changes in domestic yield curves. This approach can measure the influence of foreign shocks on the entire banking sector of an individual country.

The regression result shows that shocks of the foreign stock market greatly affected the prices of Asian bank stocks during the 2000s than during the period before the Asian financial crisis. In addition, both increases and declines in foreign stock market indices were influential during the 2007–2009 crisis, whereas only price declines were significant before it in Malaysia and Thailand. This implies that in Korea, Malaysia, Singapore, and Thailand, external shocks had greater influence on the domestic banking sector in the 2000s than before the 1997 crisis.

Even though these countries have consolidated their banking systems since the 1997 crisis, increasing foreign capital flows may have exerted a great influence. In addition, fluctuations in foreign stock market indices have had smaller effects in Singapore than in other Asian countries. It is possible that this result arose also from the differences in the capital flows between foreign and local banks among those countries. Foreign assets and debts of domestic banks have declined in comparison to other sectors in Singapore, but the foreign assets and liabilities of domestic banks is larger in Korea and Singapore than in Malaysia and Thailand. The proportion of foreign assets and liabilities of

domestic banks had expanded in the 2000s in Malaysia and Thailand. In Korea, the level of foreign ownership among banks is high.

Our results also suggest that shocks to domestic stock markets have influenced prices of Asian banks' stocks.<sup>14</sup> Regarding the volatility of domestic stock market indices, high volatility can increase prices of bank stocks.<sup>15</sup> In addition, changes in the yield curve affected prices of domestic bank stocks less during the global financial crisis than before it.<sup>16</sup>

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<sup>14</sup> This study considers only the direct channel of external shock from foreign stock markets to the domestic banking sector, and does not estimate the influence of foreign stock markets on the domestic stock market. If there is the path of an impact of foreign stock markets on the domestic banking sector through the domestic stock market, our test would underestimate the external shocks on the domestic banking sector. However, examination of that path is not easy, because it is difficult to extract the shocks of foreign stock markets on domestic stock markets from many domestic and external shocks.

<sup>15</sup> We can not discuss it because the regression does not analyze the relationship between the volatility and the return of stock prices.

<sup>16</sup> Here, we can hypothesize that one of the reasons is that the monetary policy changes had less influences during the crisis due to large external shocks.

Figure 1 Bank stock prices in Korea

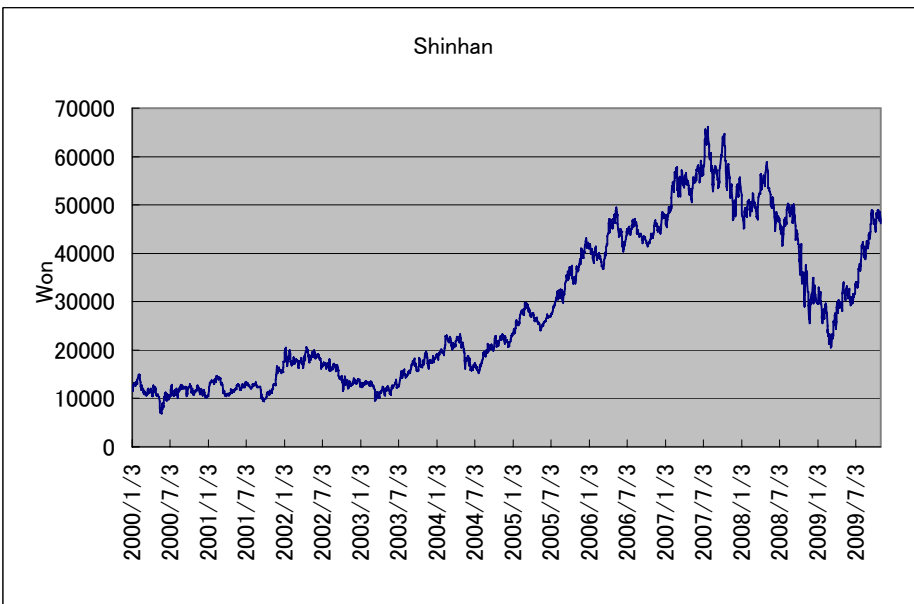
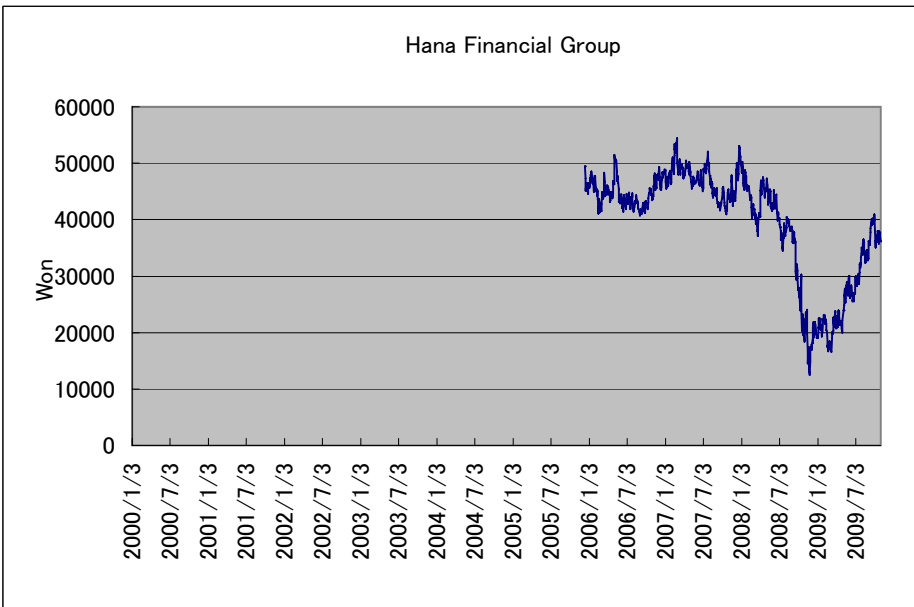
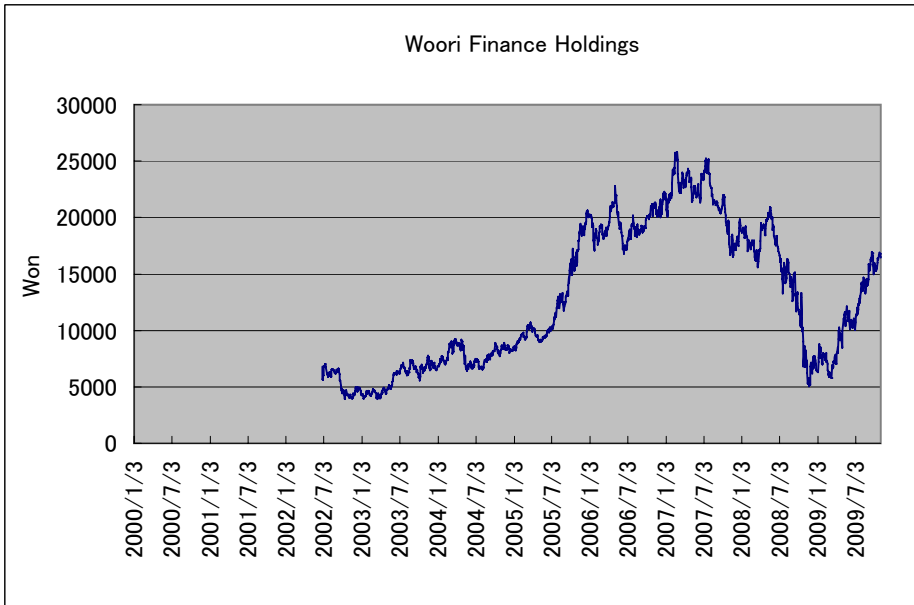


Figure 1 Bank stock prices in Korea (continued)

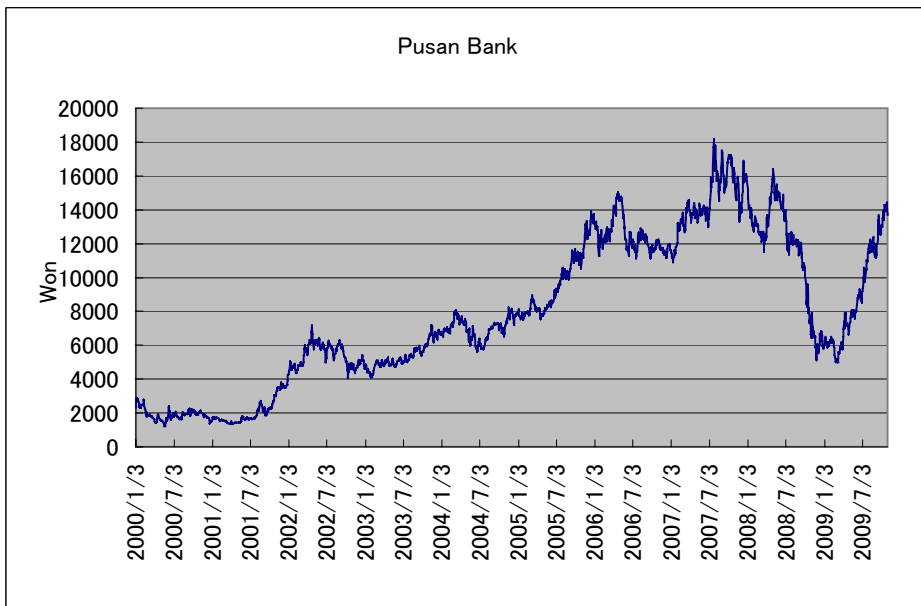
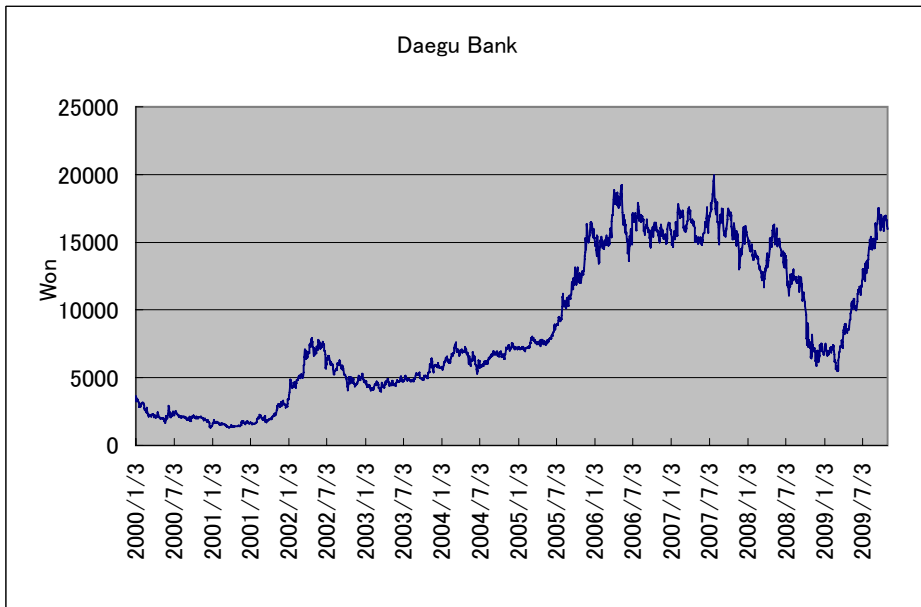
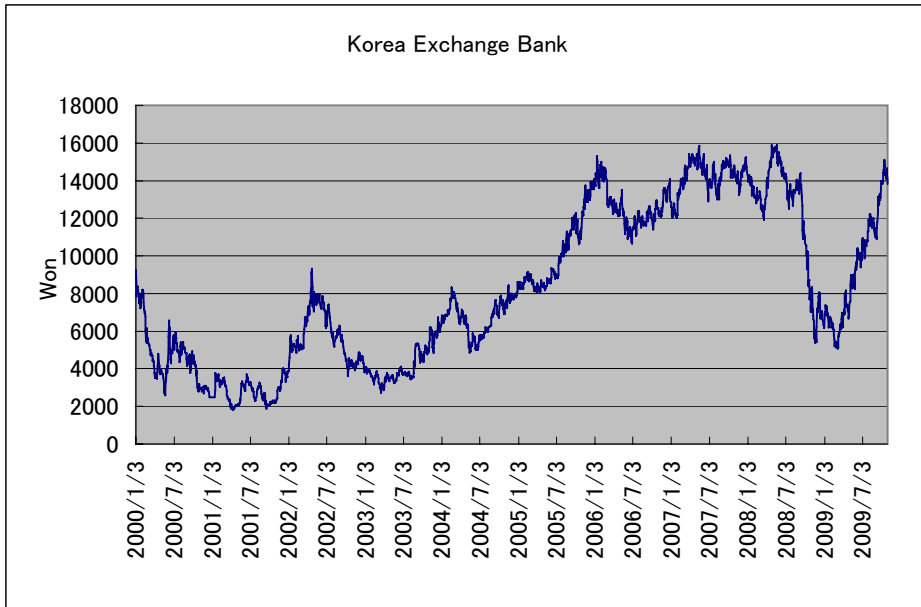


Figure 1 Bank stock prices in Korea (continued)

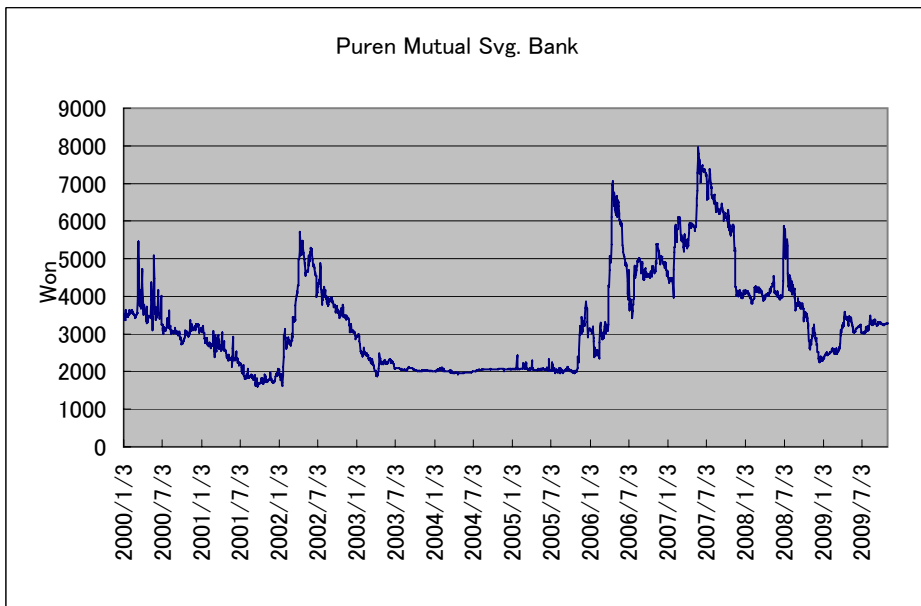
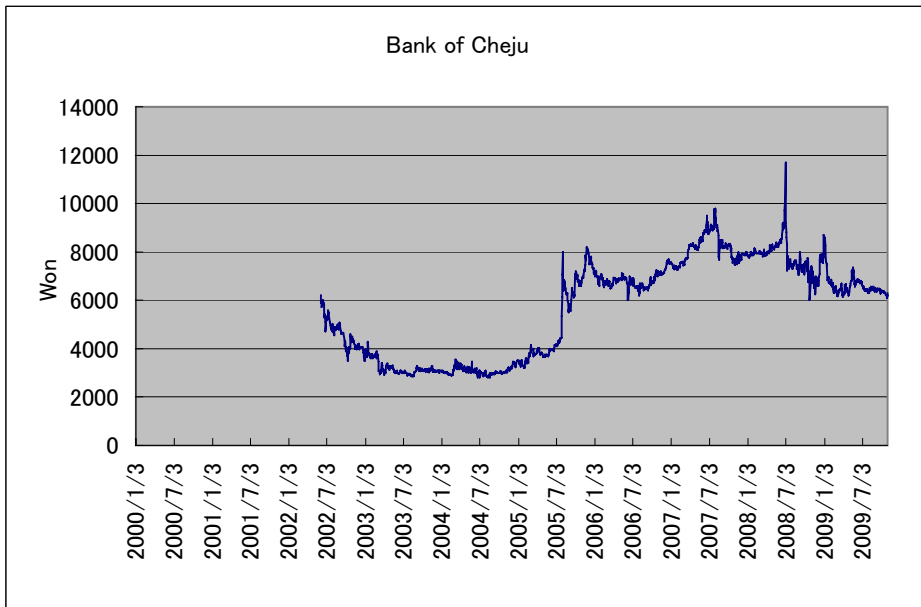
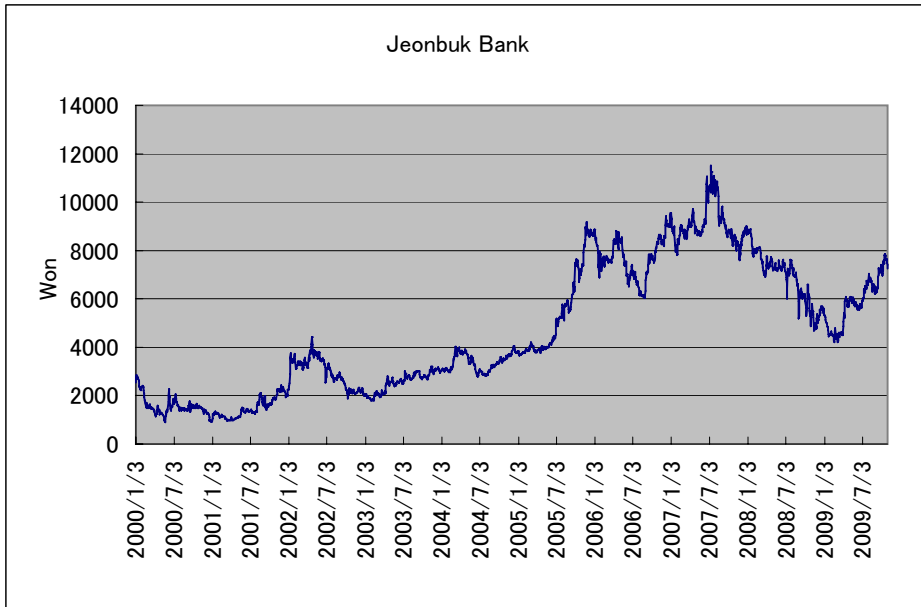


Figure 2 Bank stock prices in Malaysia

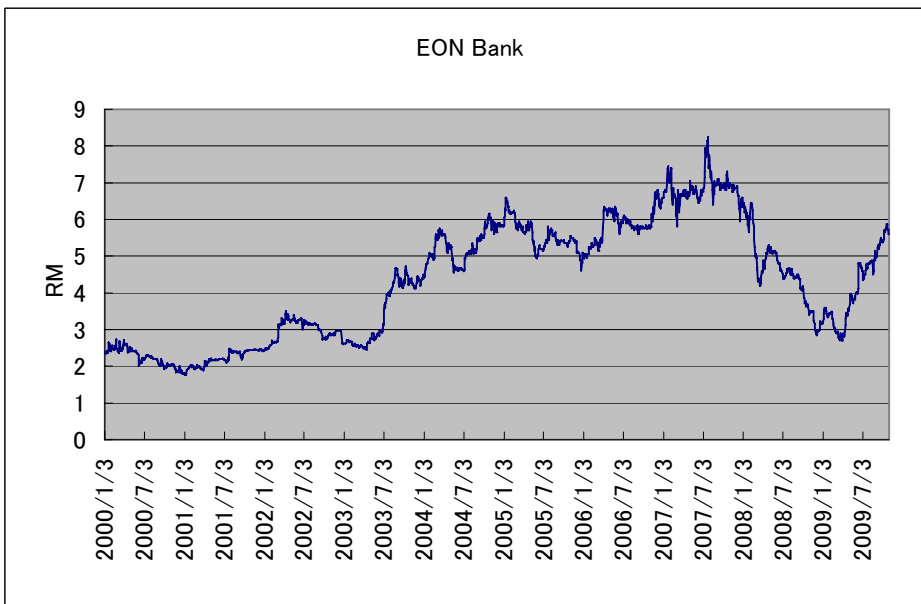
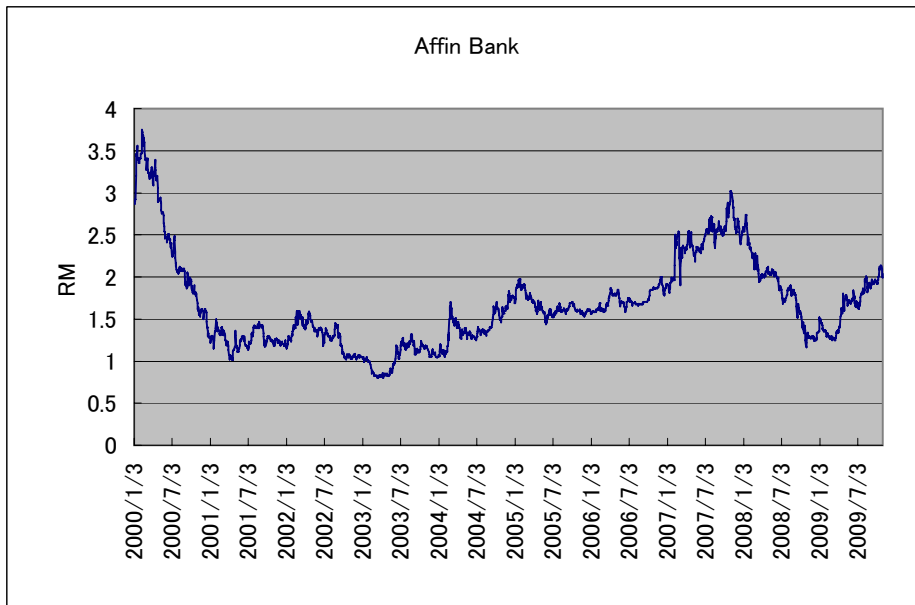


Figure 2 Bank stock prices in Malaysia (continued)

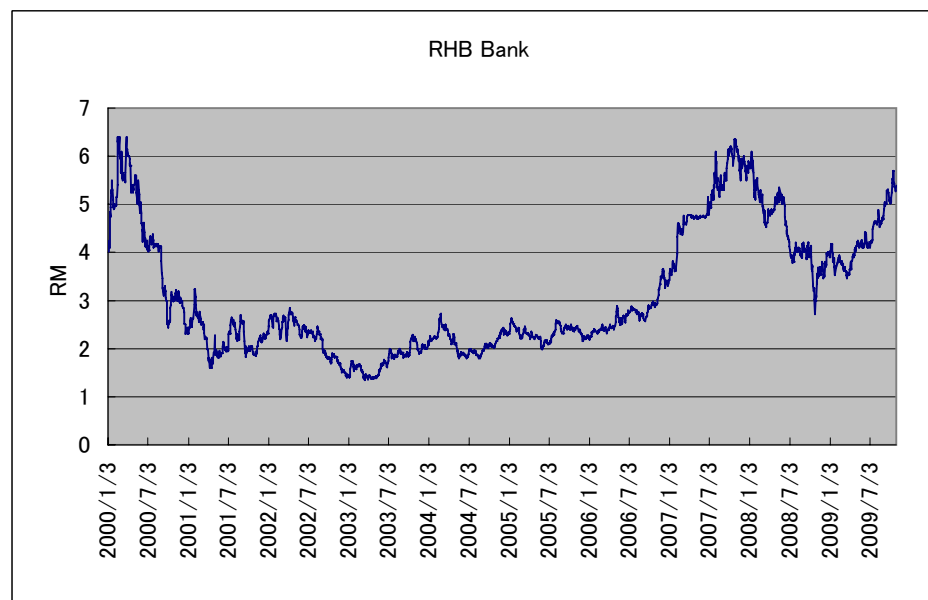
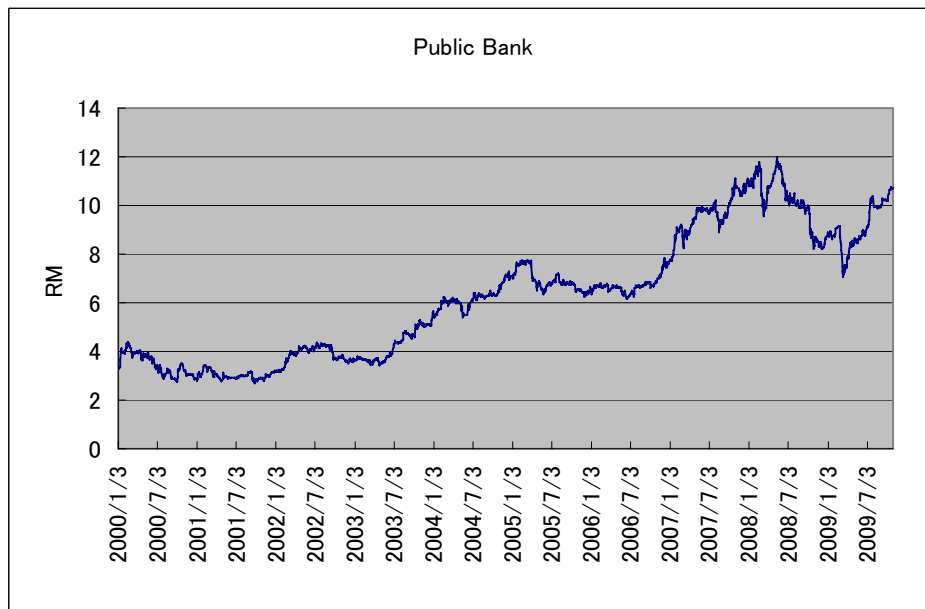
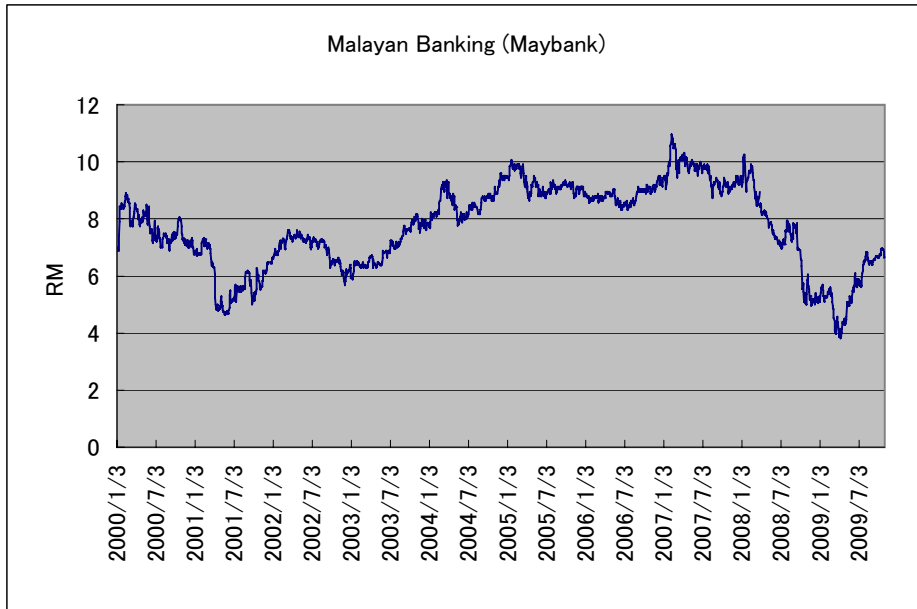




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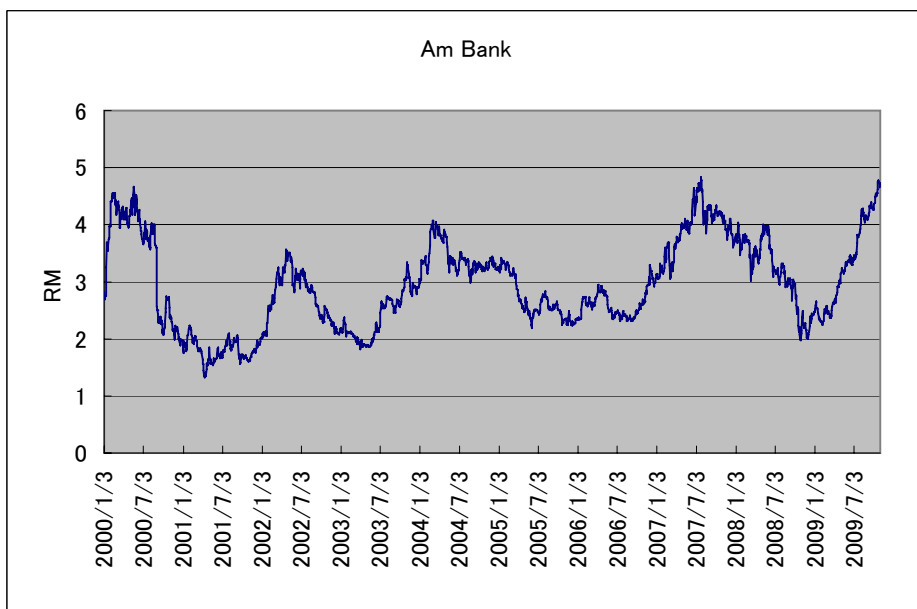
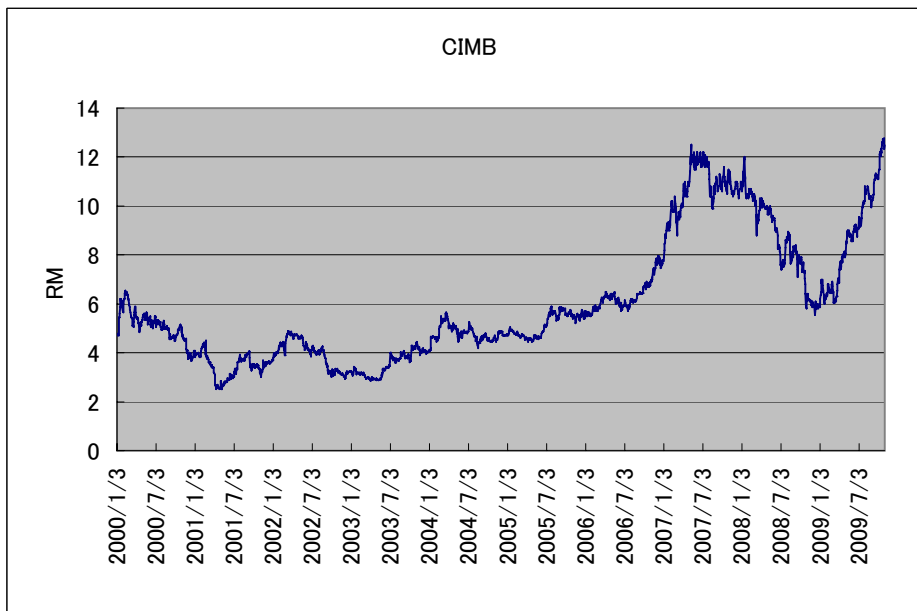
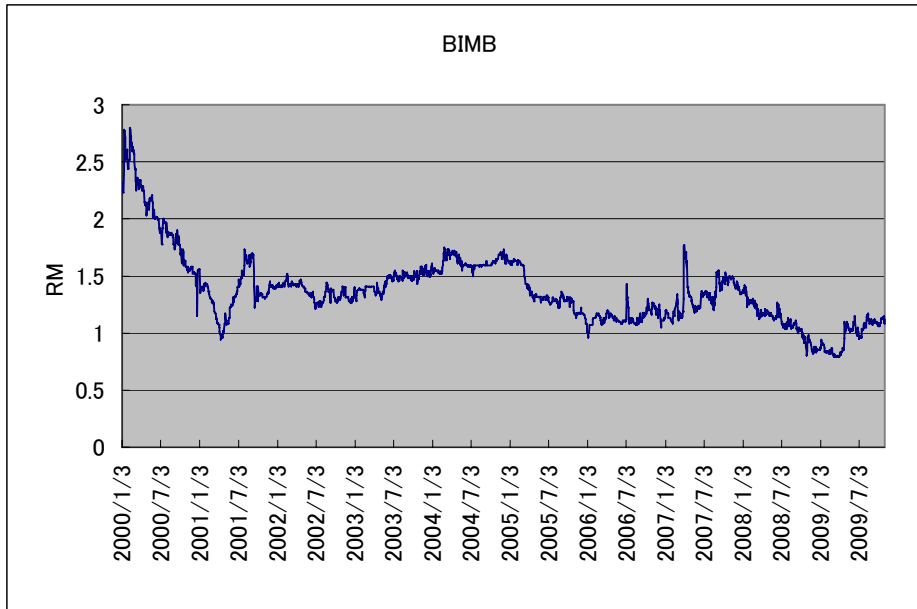


Figure 3 Bank stock prices in Singapore

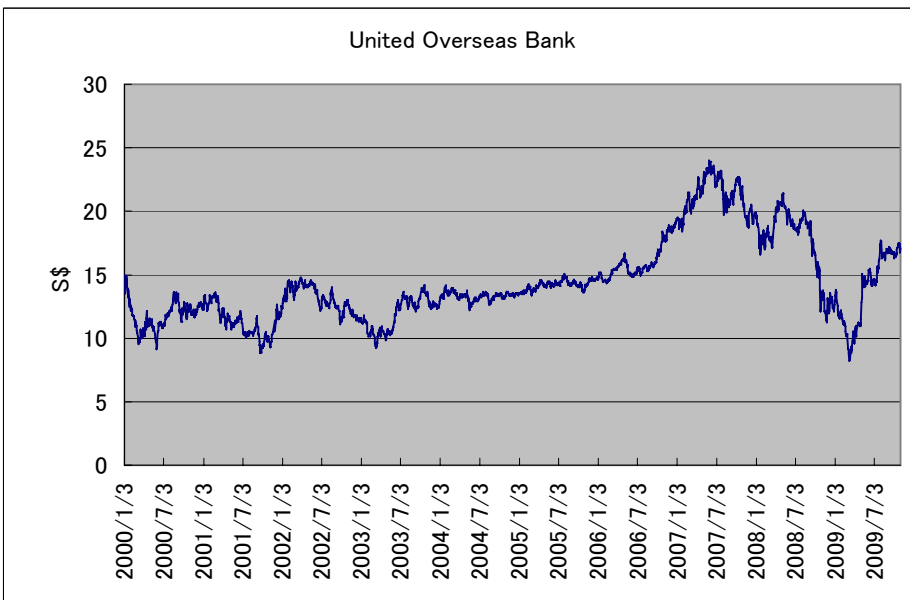
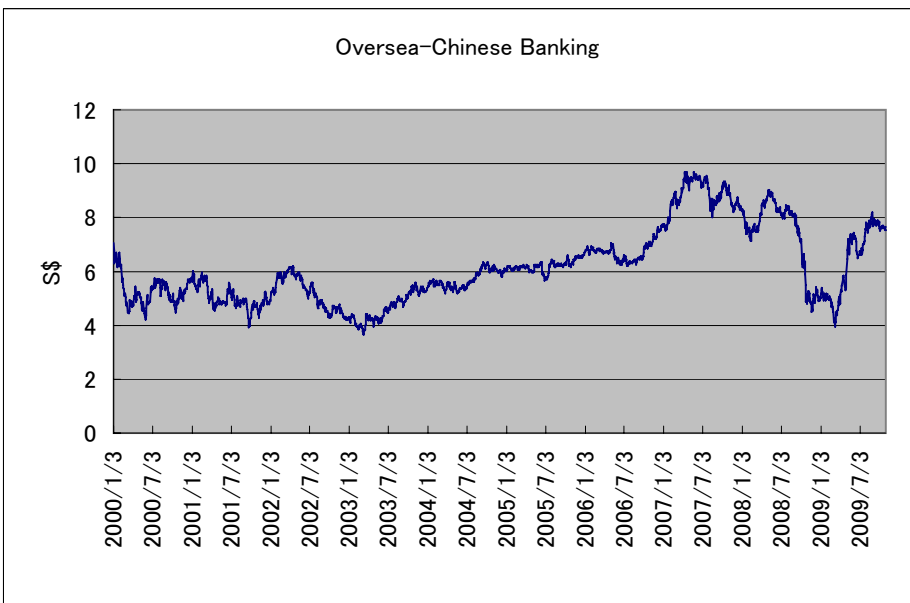
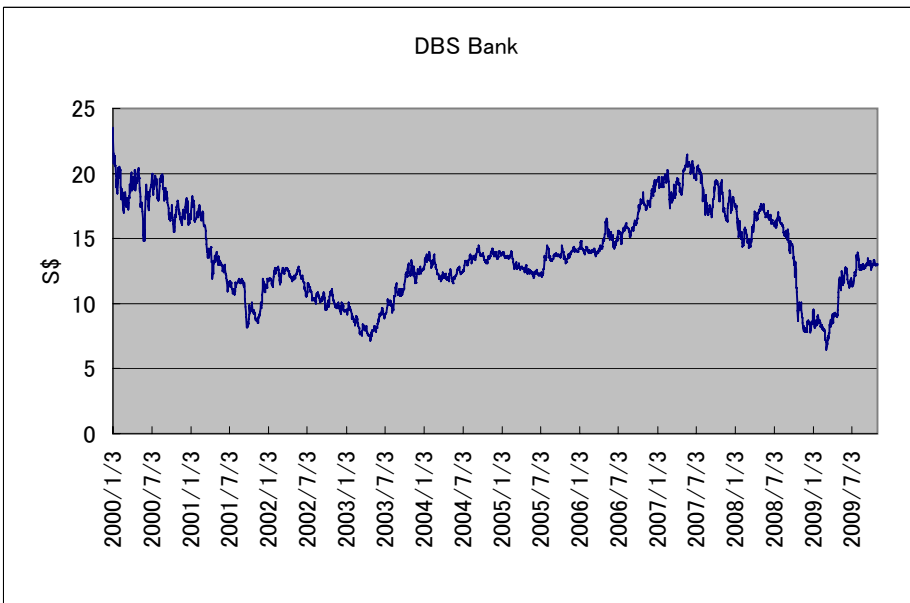


Figure 4 Bank stock prices in Thailand

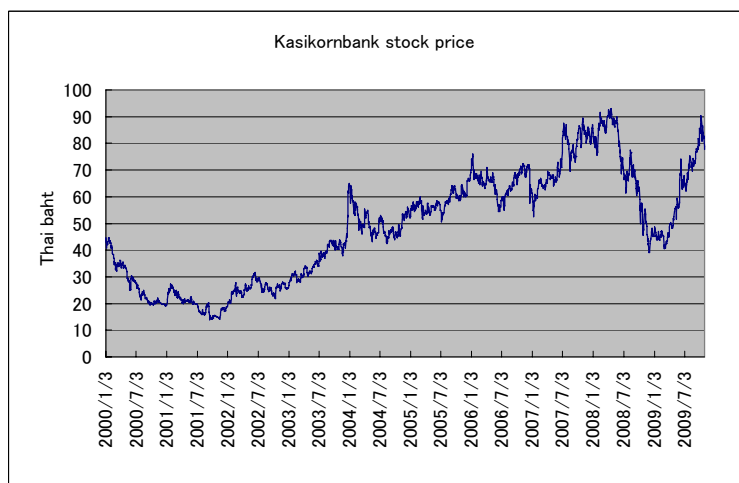
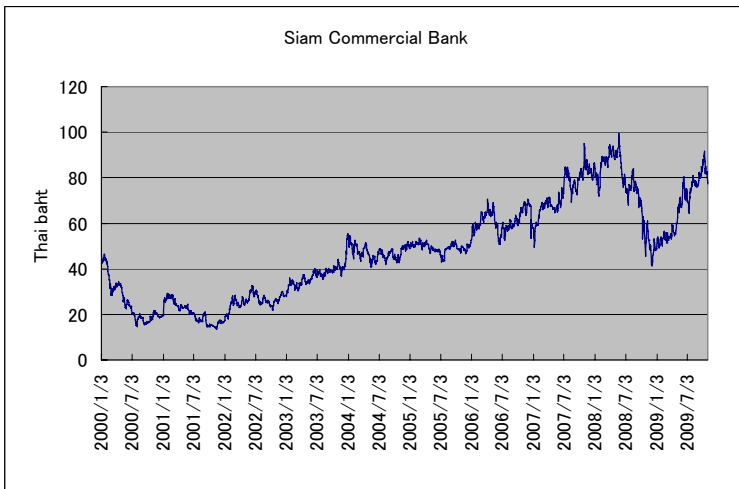
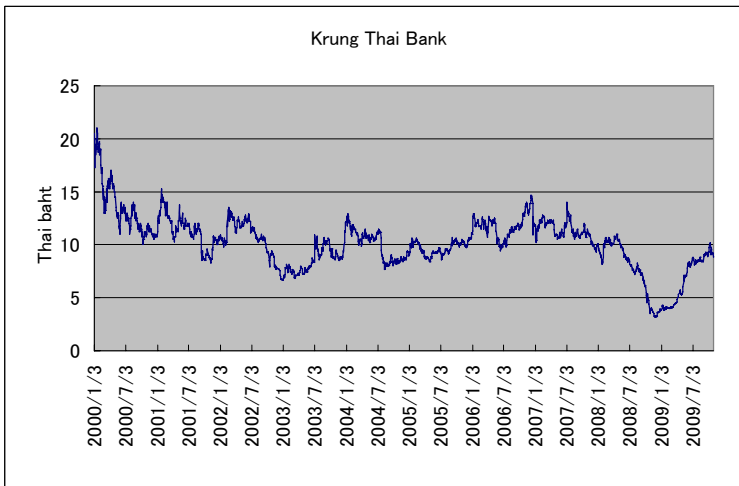
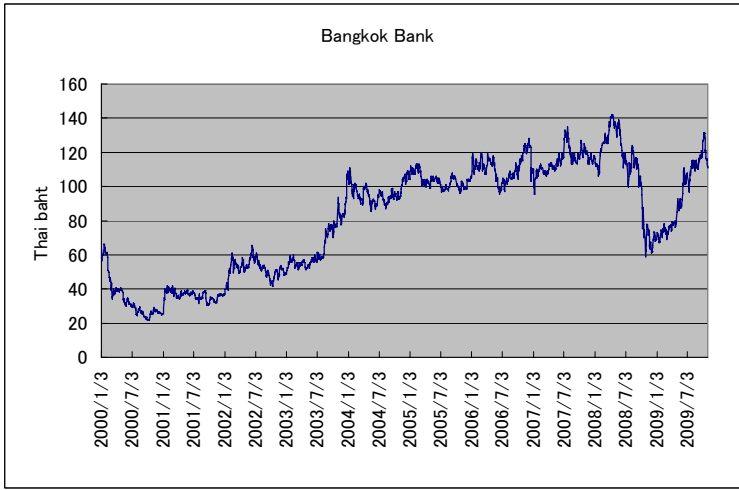


Figure 4 Bank stock prices in Thailand (continued)

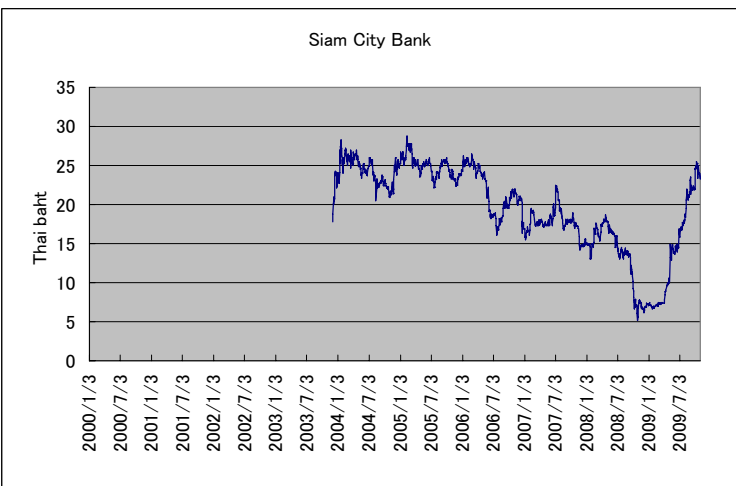
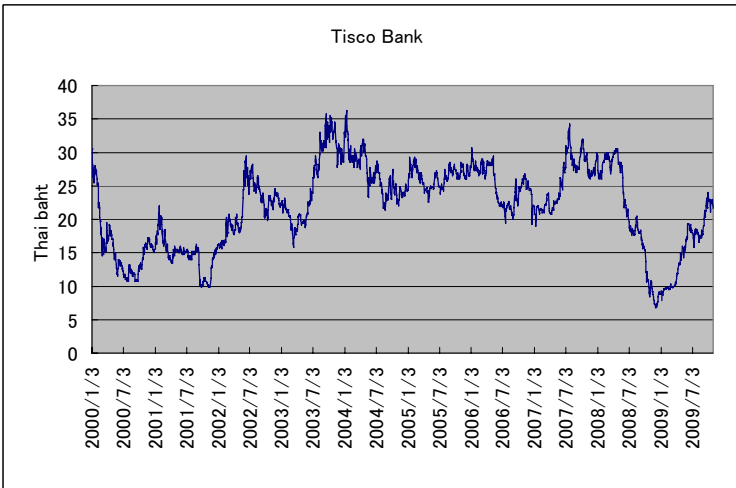
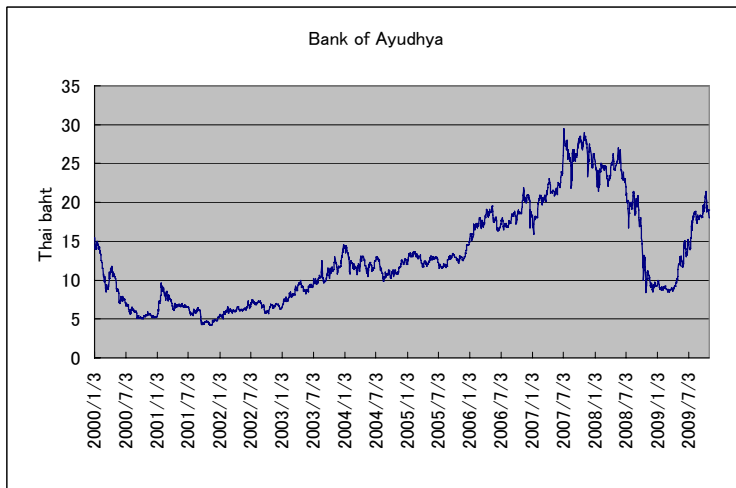
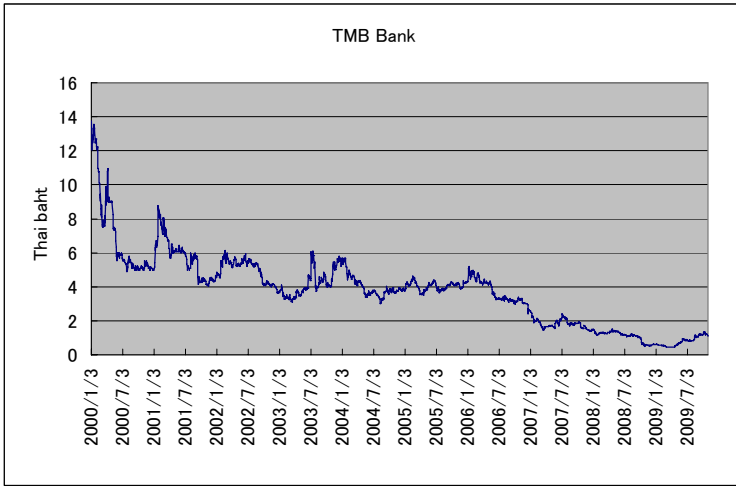


Figure 5 Stock price index

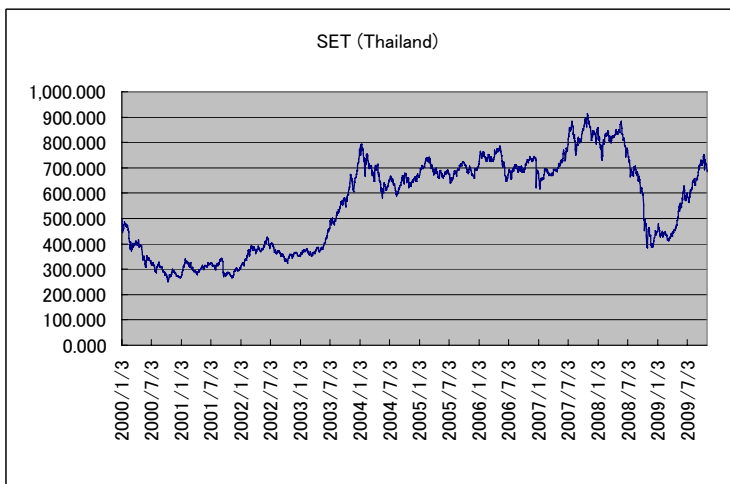
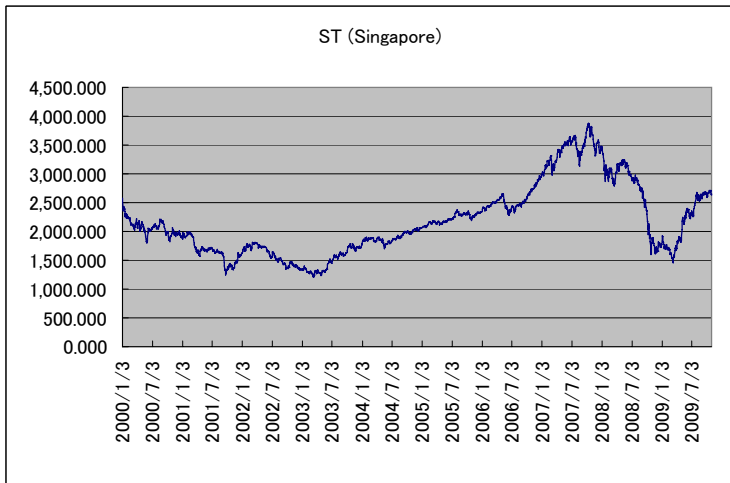
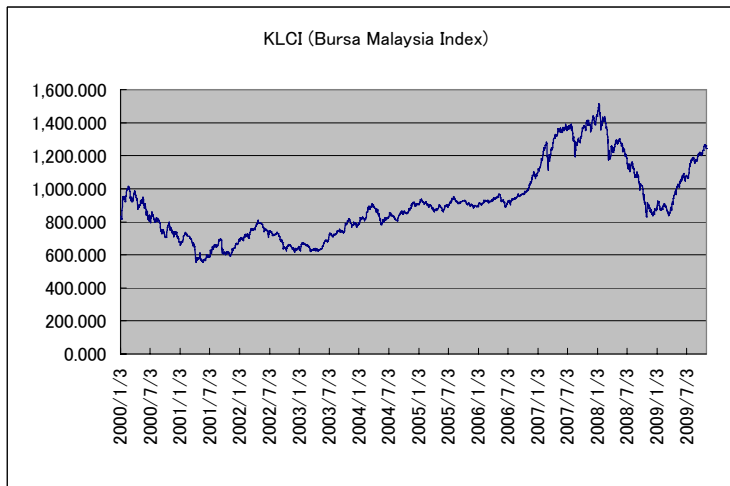
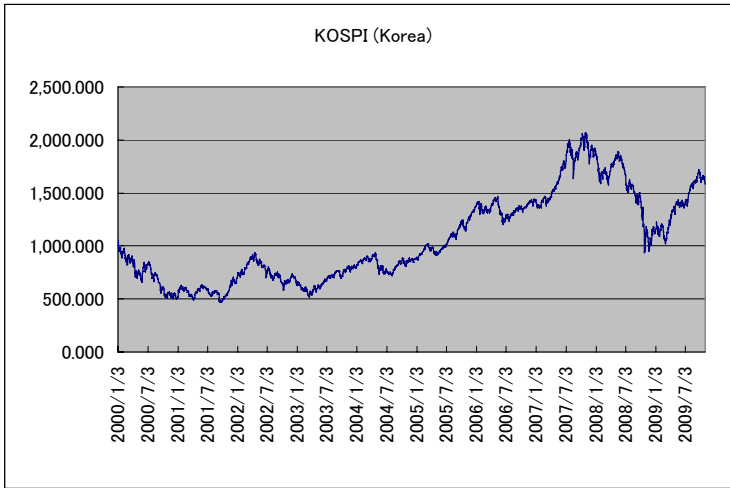


Figure 5 Stock price index (continued)

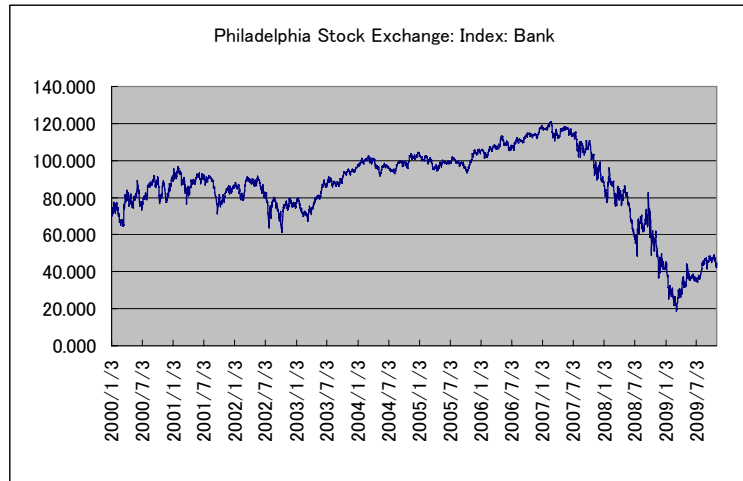
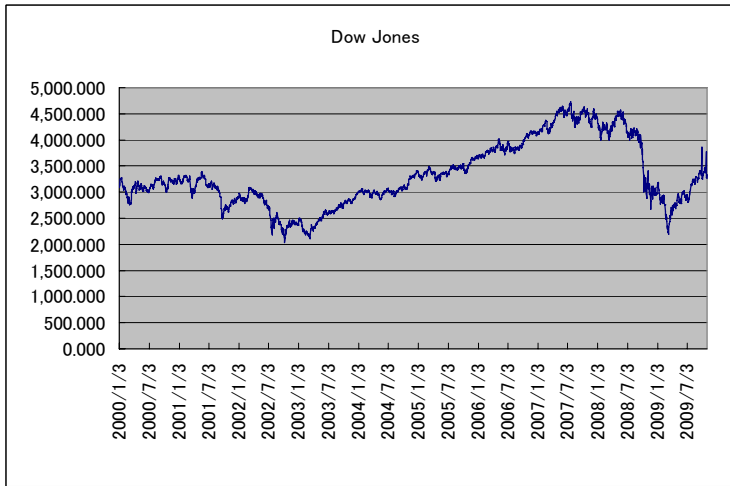
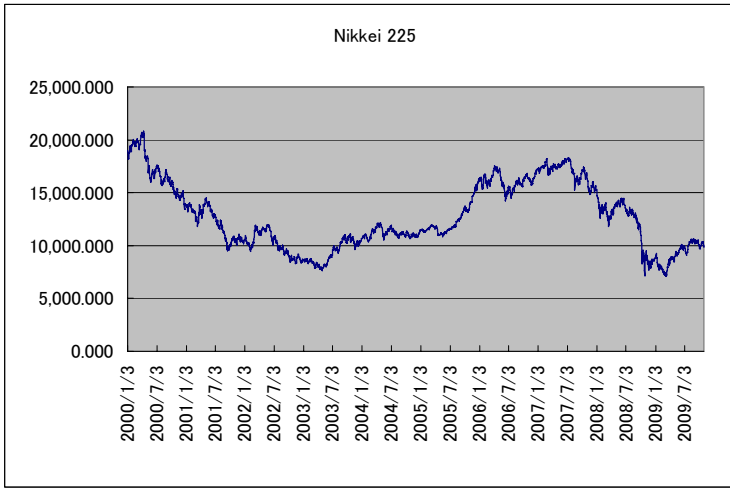
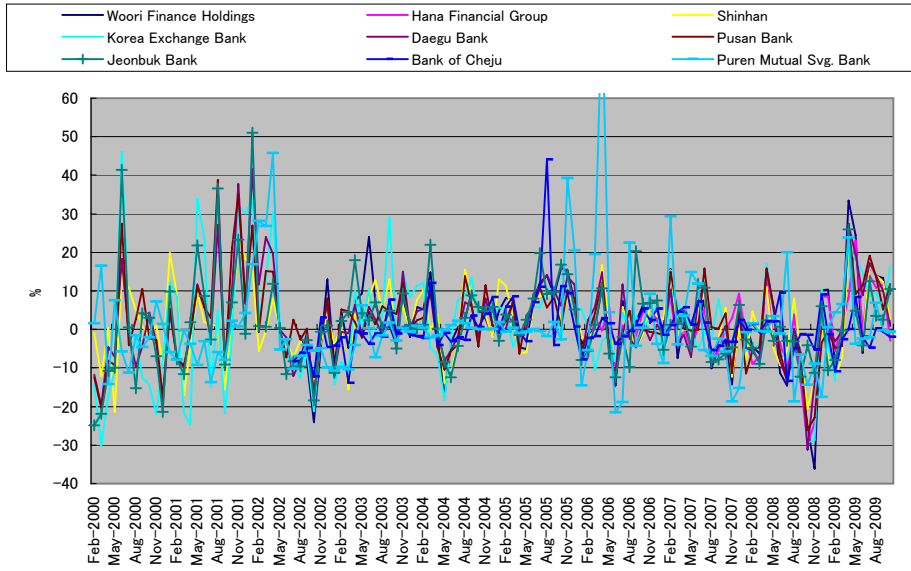
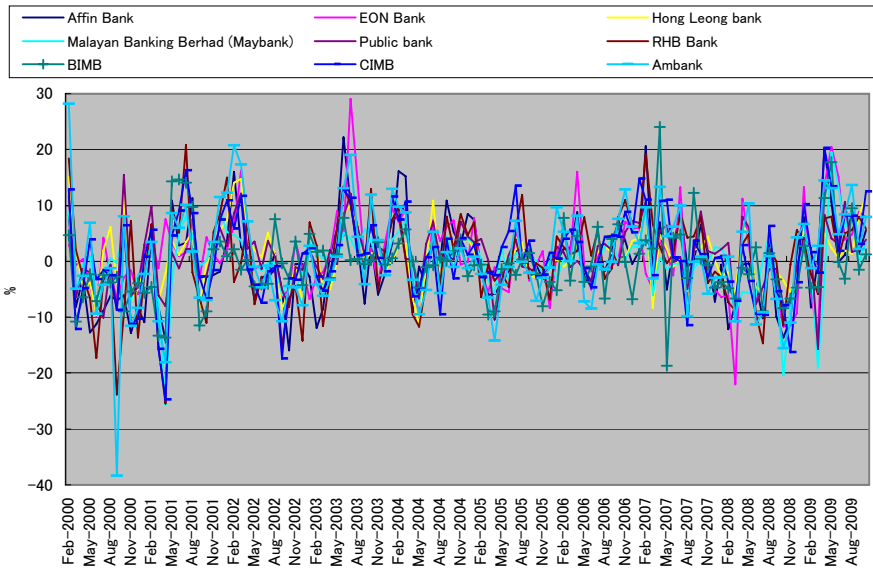


Figure 6 Change rates of stock prices

Korea: change rates of stock prices (monthly)



Malaysia: change rates of stock prices (monthly)



Singapore: change rates of stock prices (monthly)

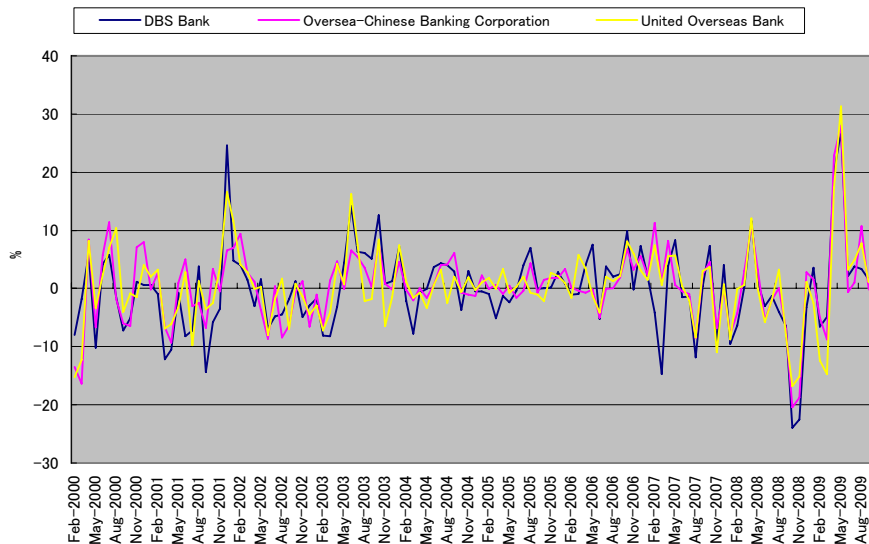


Figure 6 Change rates of stock prices (continued)

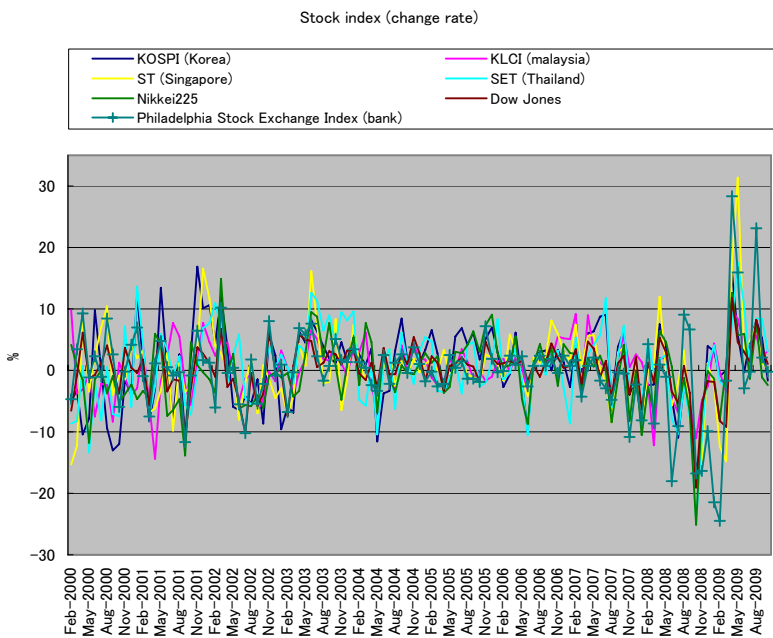
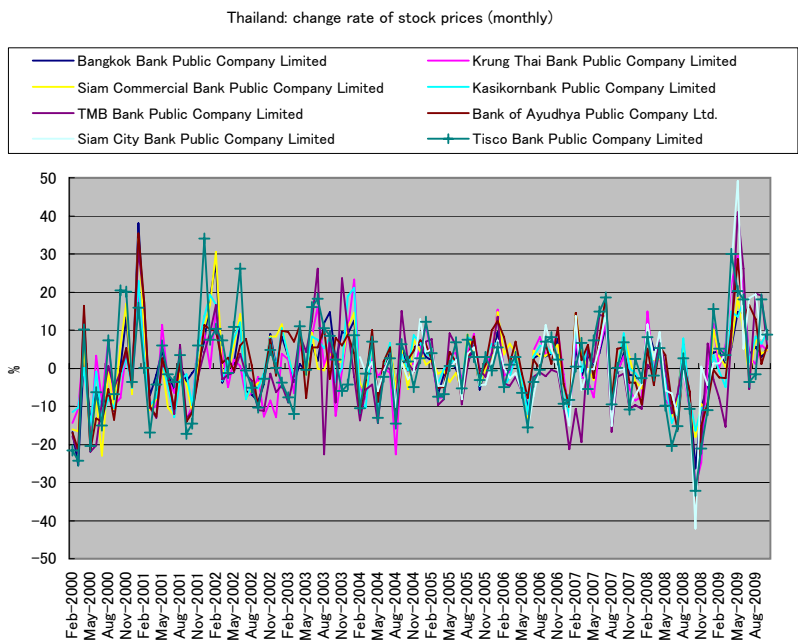




Table1 Korea: External asset and debt of domestic commercial banks (Millions of US Dollars)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
External assets	34,325.0	53,636.0	77,199.0	65,296.0	53,638.0	49,867.0	45,168.0	37,440.0	39,244.0	45,339.0	50,574.0	58,388.0	82,113.0	108,959.0	96,982.0
External debt	26,029.0	36,720.0	51,229.0	57,948.0	50,025.0	44,468.0	40,717.0	33,000.0	34,814.0	35,827.0	39,367.0	42,572.0	53,348.0	63,630.0	71,068.0

Table2 Malaysia: Foreign asset and liability of banks (Millions of RM)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Foreign assets	22,255.2	21,014.1	22,082.8	15,711.0	34,874.6	27,036.7	42,794.0	81,847.2	37,652.3
Foreign liabilities	16,247.7	15,104.2	23,863.8	25,733.6	37,954.7	41,088.4	31,728.5	50,126.6	51,438.0

Table3-1 Singapore: Foreign asset and liability of domestic banks (Millions of Singapore Dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Foreign assets	43,859.7	42,088.6	51,643.6	50,401.6	56,956.1	55,321.0	60,302.3	78,686.9	73,781.5	87,802.5	82,362.6	98,057.6	92,948.6	89,891.8	101,048.1	117,688.1	168,357.3	185,190.6	222,655.6
Due from banks (abroad)	36,767.3	35,625.3	45,787.8	45,115.1	50,741.7	48,910.4	52,557.5	69,714.7	66,935.5	80,191.6	73,939.8	87,180.8	79,372.8	76,192.3	81,240.3	94,501.0	132,434.8	134,904.7	164,517.7
Securities and equities (abroad)	341.6	330.7	287.9	416.2	1,169.8	1,129.2	1,293.9	1,327.5	1,380.5	2,665.6	3,390.8	3,858.5	5,619.7	5,884.7	8,040.8	9,602.2	12,919.4	13,594.3	13,888.9
Foreign liabilities	43,502.1	40,060.2	48,442.5	51,591.9	59,853.7	66,122.5	77,447.4	105,193.6	82,604.9	83,990.2	93,835.9	103,771.0	101,214.7	101,776.4	110,602.3	115,768.0	151,479.4	179,639.1	208,505.8
Due to banks (abroad)	38,184.8	34,582.4	42,534.6	45,638.0	52,169.6	56,182.1	67,248.2	94,721.9	74,338.3	75,058.8	83,699.9	89,805.8	87,841.5	88,357.3	96,138.6	97,838.3	126,588.5	148,295.1	166,121.0

Table3-2 Singapore: Ratio to all foreign asset and liability of domestic banks (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Foreign assets																			
Due from banks (abroad)	83.83	84.64	88.66	89.51	89.09	88.41	87.16	88.60	90.72	91.33	89.77	88.91	85.39	84.76	80.40	80.30	78.66	72.85	73.89
Securities and equities (abroad)	0.78	0.79	0.56	0.83	2.05	2.04	2.15	1.69	1.87	3.04	4.12	3.93	6.05	6.55	7.96	8.16	7.67	7.34	6.24
Foreign liabilities																			
Due to banks (abroad)	87.78	86.33	87.80	88.46	87.16	84.97	86.83	90.05	89.99	89.37	89.20	86.54	86.79	86.82	86.92	84.51	83.57	82.55	79.67

Table4-1 Thailand: Foreign asset and liability of commercial banks (Millions of US Dollars)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Foreign assets	6,722	8,232	18,868	35,163	65,268	67,572	58,462	44,508	34,038	30,702	26,925	23,193	24,163	24,652	25,443	32,600	33,998	24,800
Due from Banks Abroad	1,610	1,288	4,524	5,095	6,438	3,555	5,994	8,898	11,492	13,241	13,221	8,951	9,265	10,326	11,541	19,609	20,910	10,325
Foreign liabilities	4,674	6,462	13,443	32,485	63,197	65,277	53,977	38,410	25,027	18,018	14,290	12,207	10,944	11,349	11,726	11,334	10,816	13,334
Deposits in foreign currencies	401	576	769	995	957	810	1,502	1,821	2,225	1,923	1,775	1,504	1,627	1,795	2,668	2,977	2,575	3,500
Borrowings in foreign currencies	3,600	5,107	11,494	29,719	60,065	62,319	50,679	34,915	21,412	14,363	11,072	9,404	7,805	7,427	6,134	5,160	4,456	5,716

Table4-2 Thailand: Ratio to all foreign asset and liability of commercial banks (%)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Foreign assets																		
Due from Banks Abroad	23.95	15.65	23.98	14.49	9.86	5.26	10.25	19.99	33.76	43.13	49.10	38.59	38.34	41.89	45.36	60.15	61.50	41.63
Foreign liabilities																		
Deposits in foreign currencies	8.58	8.91	5.72	3.06	1.51	1.24	2.78	4.74	8.89	10.67	12.42	12.32	14.87	15.82	22.75	26.27	23.81	26.25
Borrowings in foreign currencies	77.02	79.03	85.50	91.49	95.04	95.47	93.89	90.90	85.56	79.71	77.48	77.04	71.32	65.44	52.31	45.53	41.20	42.87

Table5-1 Debt of local banks from foreign (BIS reporting) banks (outstanding in millions of US dollars)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Korea	15,415	20,062	23,398	26,364	37,027	49,949	65,896	58,310	39,637	38,574	33,622	30,077	36,679	44,888	46,952	47,041	69,835	104,677	84,510
Malaysia	1,047	1,980	2,941	5,249	3,865	4,419	6,504	9,904	6,013	3,921	3,780	3,072	2,990	3,703	7,632	9,975	9,544	11,876	9,472
Singapore	106,657	89,452	87,943	105,297	103,236	164,634	156,863	165,195	106,308	76,461	70,143	65,051	56,452	53,596	64,559	65,723	74,786	90,536	79,276
Thailand	4,489	5,151	6,478	8,890	14,091	25,763	25,904	25,080	15,271	7,312	5,744	4,668	3,282	3,813	4,127	5,175	6,326	6,426	6,495

Table5-2 Ratio of bank debt to country foreign debt from foreign (BIS reporting) banks (%)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Korea	53.63	58.57	62.06	63.45	65.42	64.43	65.93	59.36	57.56	59.44	57.30	56.05	60.28	61.37	64.55	52.71	52.13	49.83	47.50
Malaysia	14.41	25.10	34.74	40.30	28.64	26.33	29.25	35.51	28.17	21.45	18.15	14.13	14.75	15.14	26.55	29.36	25.13	25.51	24.81
Singapore	75.85	70.11	62.49	65.94	58.89	85.53	82.89	80.52	76.27	69.58	70.20	69.41	66.08	64.07	77.97	62.68	54.06	49.91	49.23
Thailand	33.08	26.42	28.26	29.96	32.11	41.01	36.93	37.57	32.04	22.58	21.56	19.65	18.75	21.40	24.40	24.23	28.22	31.37	29.33

Table5-3 Deposits of foreign (BIS reporting) banks to local bankings (outstanding in millions of US dollars)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Korea	21,520	25,578	39,521	32,407	27,673	25,530	26,667	28,077	34,633	47,938	40,507	48,203	63,943	41,302
Malaysia	10,453	14,745	9,605	9,986	8,298	11,789	9,698	8,053	9,607	21,328	14,052	22,175	38,939	11,640
Singapore	158,190	164,208	206,116	231,903	231,536	254,842	253,547	264,832	272,943	297,158	296,077	343,457	436,073	417,970
Thailand	9,676	7,083	7,439	9,725	9,389	10,997	11,768	7,534	14,116	16,395	23,753	29,264	32,008	17,481

Table 6-1 Regression results in the 2000s before the global financial crisis: Korea

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.390 ***	0.040 ***	0.391 ***	0.040 ***	0.442 ***	0.043 ***	0.444 ***	0.044 ***	0.265 ***	0.023 ***	0.259 ***	0.009 **	0.310 ***	0.027 ***	0.300 ***	0.027 ***
Domestic stock index	1.819 ***	0.165 ***	1.824 ***	0.164 ***					1.727 ***	0.068	1.800 ***	0.043				
Volatility					0.043 ***	0.004 ***	0.044 ***	0.004 ***					-0.052 ***	-0.005 ***	-0.052 ***	-0.005 ***
Foreign stock index	0.168	0.016			0.142	0.013			0.384 *	0.033			0.101	0.008 *		
Philadelphia index			0.329	0.037			0.426	0.046			0.465	0.039			0.311	0.027
Yield curve	53.205 ***	5.304 ***	53.538 ***	5.319 ***	54.849 ***	5.332 ***	54.885 ***	5.324 ***	28.497 *	2.643	29.285 *	1.666	34.489 **	3.087 *	34.277 *	3.080 *
Constant	-2.364 ***		-2.369 ***		-2.356 ***		-2.367 ***		-2.358 ***		-2.352 ***		-2.412 ***		-2.414 ***	
Coexceedance = 2																
Coexceedance lagged	0.601 ***	0.015 ***	0.590 ***	0.015 ***	0.662 ***	0.014 ***	0.659 ***	0.014 ***	0.474 ***	0.011 ***	0.434 ***	0.003 ***	0.535 ***	0.007 ***	0.493 ***	0.006 ***
Domestic stock index	2.056 ***	0.054 *	2.296 ***	0.077 **					3.257 ***	0.151 ***	3.373 ***	0.042 ***				
Volatility					0.066 ***	0.001 ***	0.069 ***	0.001 ***					-0.117 ***	-0.002 ***	-0.116 ***	-0.001 ***
Foreign stock index	0.663 **	0.018 **			0.542 *	0.012 *			0.775 ***	0.018 **			0.257	0.003		
Philadelphia index			0.283	0.007			0.373	0.008			1.290 ***	0.025 **			1.121 ***	0.024 *
Yield curve	67.536 **	1.630 **	70.876 ***	1.760 **	71.390 ***	1.464 **	73.412 ***	1.521 **	42.400	0.983	41.576	0.744	58.586 *	0.761 *	56.283 *	0.711 *
Constant	-4.030 ***		-3.987 ***		-4.142 ***		-4.113 ***		-4.048 ***		-4.045 ***		-4.646 ***		-4.681 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.404 ***	0.008 **	0.417 ***	0.008 **	0.504 ***	0.008 ***	0.513 ***	0.008 ***	0.569 ***	0.013 ***	0.551 ***	0.003 ***	0.651 ***	0.009 ***	0.617 ***	0.009 ***
Domestic stock index	3.695 ***	0.292 ***	3.632 ***	0.271 ***					4.191 ***	0.383 ***	4.397 ***	0.057 ***				
Volatility					0.094 ***	0.002 ***	0.094 ***	0.002 ***					-0.123 ***	-0.002 ***	-0.127 ***	-0.002 ***
Foreign stock index	0.063	0.001			0.326	0.0055			0.837 ***	0.019 ***			0.517 **	0.008 *		
Philadelphia index			0.451	0.011			0.927 **	0.023			0.898 **	0.018			0.927 **	0.019
Yield curve	106.413 ***	2.213 ***	106.019 ***	2.188 ***	103.564 ***	1.759 ***	104.661 ***	1.748 ***	19.433	0.364	20.649	0.748	42.213	0.571	40.437	0.531
Constant	-4.409 ***		-4.430 ***		-4.466 ***		-4.508 ***		-4.058 ***		-4.021 ***		-4.546 ***		-4.555 ***	
Log-likelihood	-1188.168		-1189.587		-1170.685		-1169.719		-1106.688		-1107.173		-1045.227		-1042.585	
Pseudo R2	0.086		0.085		0.099		0.100		0.119		0.118		0.168		0.170	

Notes: The period in regression covers Jan. 2000–May 2007. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 6-2 Regression results in the 2000s before the global financial crisis: Malaysia

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.182 **	0.020 *	0.182 **	0.020 *	0.161 **	0.012 *	0.160 **	0.020 *	0.246 ***	0.032 ***	0.240 ***	0.011 ***	0.237 ***	0.032 ***	0.230 ***	0.032 ***
Domestic stock index	2.297 ***	0.036	2.323 ***	0.042					2.049 ***	0.048	2.037 ***	0.047				
Volatility					0.132 ***	0.002 ***	0.133 ***	0.017 ***					-0.132 ***	-0.017 ***	-0.131 ***	-0.017 ***
Foreign stock index	0.335 *	0.052 **			0.217	0.025			0.409 **	0.047 *			0.235	0.029		
Philadelphia index			0.322	0.048			0.352	0.052			0.940 ***	0.051 **			0.904 ***	0.145 **
Interest rate	3.259	0.616	3.327	0.627	1.367	0.766	1.434	0.312	-0.963	-0.150	-1.005	0.736	-0.659	-0.092	-0.740	-0.105
Constant	-1.668 ***		-1.653 ***		-1.596 ***		-1.594 ***		-1.649 ***		-1.658 ***		-1.633 ***		-1.652 ***	
Coexceedance = 2																
Coexceedance lagged	0.404 ***	0.019 ***	0.404 ***	0.019 ***	0.390 ***	0.004 ***	0.388 ***	0.013 ***	0.200	0.007	0.192	0.006	0.176	0.004	0.163	0.004
Domestic stock index	3.825 ***	0.225 ***	3.751 ***	0.206 ***					3.491 ***	0.204 ***	3.569 ***	0.052 ***				
Volatility					0.256 ***	0.001 ***	0.254 ***	0.008 ***					-0.269 ***	-0.008 ***	-0.272 ***	-0.008 ***
Foreign stock index	-0.211	-0.015			-0.286	0.012			0.859 ***	0.037 ***			0.624 **	0.018 **		
Philadelphia index			0.407	0.021			0.503	0.018			1.196 ***	0.033 *			1.124 ***	0.042 *
Interest rate	-6.733	-0.376	-6.658	-0.373	-12.461	0.286	-12.316	-0.440	0.730	0.044	1.017	0.423	0.292	0.014	0.514	0.021
Constant	-2.750 ***		-2.788 ***		-2.923 ***		-2.976 ***		-2.992 ***		-2.973 ***		-3.324 ***		-3.322 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.692 ***	0.014 ***	0.699 ***	0.014 ***	0.714 ***	0.001 ***	0.717 ***	0.003 ***	0.421 ***	0.009 ***	0.412 ***	0.003 ***	0.325 **	0.002 *	0.312 **	0.002 *
Domestic stock index	5.265 ***	0.408 ***	5.305 ***	0.421 ***					4.776 ***	0.388 ***	4.871 ***	0.060 ***				
Volatility					0.418 ***	0.000 ***	0.418 ***	0.002 ***					-0.415 ***	-0.002 ***	-0.419 ***	-0.002 ***
Foreign stock index	0.064	0.000			0.294	0.0016			1.012 ***	0.022 ***			0.637 **	0.004 *		
Philadelphia index			-0.320	-0.008			-0.128	-0.001			1.434 ***	0.023 **			1.038 **	0.007
Interest rate	-14.019	-0.309	-14.155	-0.310	-28.387 **	0.057 *	-28.814 **	-0.130 **	0.669	0.020	2.362	0.264	-3.598	-0.022	-3.060	-0.018
Constant	-3.745 ***		-3.732 ***		-4.873 ***		-4.811 ***		-3.889 ***		-3.896 ***		-4.976 ***		-4.973 ***	
Log-likelihood	-1454.747		-1455.407		-1302.074		-1302.312		-1427.728		-1426.369		-1279.716		-1276.325	
Pseudo R2	0.097		0.096		0.190		0.190		0.096		0.097		0.190		0.192	

Notes: The period in regression covers Jan. 2000–May 2007. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 6-3 Regression results in the 2000s before the global financial crisis: Singapore

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.405 ***	0.026 ***	0.390 ***	0.025 ***	0.523 ***	0.019 ***	0.504 ***	0.019 ***	0.478 ***	0.029 ***	0.444 ***	0.027 ***	0.621 ***	0.023 ***	0.581 ***	0.006 ***
Domestic stock index	2.940 ***	0.279 ***	2.866 ***	0.268 ***					2.348 ***	0.213 ***	2.351 ***	0.194 ***				
Volatility					0.080 ***	0.0030 ***	0.079 ***	0.003 ***					-0.077 ***	-0.003 ***	-0.073 ***	0.000 ***
Foreign stock index	-0.154	-0.010			-0.357	-0.013			0.208	0.012			-0.373	-0.014		
Philadelphia index			0.280	0.020			0.180	0.007			0.747 **	0.057 *			0.408	0.019
Yield curve	22.854 **	1.418 **	22.161 **	1.374 **	45.102 ***	1.651 ***	43.523 ***	1.609 ***	43.848 ***	2.617 ***	42.759 ***	2.541 ***	57.146 ***	2.101 ***	53.747 ***	0.422 ***
Constant	-3.154 ***		-3.166 ***		-3.933 ***		-3.937 ***		-3.553 ***		-3.555 ***		-4.223 ***		-4.187 ***	
Coexceedance = 2																
Coexceedance lagged	0.327	0.003	0.330	0.003	0.460	0.001	0.474 *	0.001	0.553 **	0.007 **	0.480 **	0.006 *	0.652 ***	0.003 **	0.611 **	0.001 **
Domestic stock index	4.407 ***	0.181 ***	4.391 ***	0.185 ***					3.834 ***	0.220 ***	3.914 ***	0.219 ***				
Volatility					0.128 ***	0.0003 ***	0.127 ***	0.0003 ***					-0.111 ***	0.000 ***	-0.110 ***	0.000 ***
Foreign stock index	-0.011	0.0000			-0.068	0.000			0.534 *	0.007			0.003	0.000		
Philadelphia index			0.104	0.001			0.074	0.0002			1.191 ***	0.025			0.672	0.004
Yield curve	57.887 **	0.527 **	57.058 **	0.520 *	102.291 ***	0.234 **	101.406 ***	0.232 ***	56.326 ***	0.714 ***	54.485 ***	0.683 ***	95.304 ***	0.399 ***	92.399 ***	0.112 ***
Constant	-5.766 ***		-5.757 ***		-7.627 ***		-7.625 ***		-5.435 ***		-5.423 ***		-7.079 ***		-7.041 ***	
Coexceedance = 3																
Coexceedance lagged	0.624 **	0.001	0.590 **	0.001	0.800 **	0.0001	0.780 **	0.0001	-0.297	0.000	-0.389	-0.001	-0.892	-0.0002	-0.756	0.000
Domestic stock index	6.513 ***	0.192 ***	6.458 ***	0.188 ***					5.248 ***	0.084 **	5.750 ***	0.133 ***				
Volatility					0.188 ***	0.00002	0.186 ***	0.00002					-0.144 ***	-0.00003	-0.150 ***	0.000
Foreign stock index	0.069	0.000			-0.125	0.0000			1.237 ***	0.002			0.557	0.0001		
Philadelphia index			0.659	0.001			0.474	0.0001			1.537 **	0.004			0.237	0.000
Yield curve	46.138	0.058	45.738	0.057	124.214 ***	0.013	122.954 **	0.013	21.727	0.024	15.028	0.016	116.667 **	0.021	124.268 **	0.016
Constant	-7.713 ***		-7.735 ***		-11.052 ***		-11.041 ***		-7.233 ***		-7.061 ***		-10.399 ***		-10.498 ***	
Log-likelihood	-652.554		-652.12941		-566.718		-567.497		-678.640		-678.002		-574.695		-575.937	
Pseudo R2	0.199		0.200		0.305		0.304		0.180		0.180		0.305		0.304	

Notes: The period in regression covers Jan. 2000–May 2007. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 6-4 Regression results in the 2000s before the global financial crisis: Thailand

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.259 ***	0.026 ***	0.258 ***	0.025 ***	0.310 ***	0.023 ***	0.309 ***	0.023 ***	0.130	0.013	0.126	0.013	0.246 **	0.019 **	0.241 **	0.019 **
Domestic stock index	3.052 ***	0.047	3.052 ***	0.052					2.875 ***	0.080 *	2.932 ***	0.074				
Volatility					0.257 ***	0.019 ***	0.255 ***	0.019 ***					-0.271 ***	-0.021 ***	-0.274 ***	-0.022 ***
Foreign stock index	0.034	0.004			-0.223	-0.017			0.808 ***	0.083 ***			0.574 ***	0.045 ***		
Philadelphia index			0.001	-0.003			-0.209	-0.015			0.406	0.048			0.398	0.036
Yield curve	23.849 ***	2.343 ***	23.907 ***	2.359 ***	29.719 ***	2.237 ***	29.810 ***	2.253 ***	13.255 **	1.305 *	13.202 **	1.297 *	25.795 ***	2.010 ***	25.567 ***	1.992 ***
Constant	-2.636 ***		-2.634 ***		-2.911 ***		-2.920 ***		-2.373 ***		-2.310 ***		-3.166 ***		-3.130 ***	
Coexceedance = 2																
Coexceedance lagged	0.195	0.004	0.190	0.004	0.296 *	0.002	0.293 *	0.002	0.218	0.006	0.213	0.006	0.359 **	0.005 **	0.356 **	0.005 **
Domestic stock index	4.720 ***	0.160 ***	4.713 ***	0.164 ***					3.863 ***	0.106 ***	3.936 ***	0.104 ***				
Volatility					0.416 ***	0.003 ***	0.413 ***	0.003 ***					-0.363 ***	-0.005 ***	-0.368 ***	-0.005 ***
Foreign stock index	-0.035	-0.001			-0.217	-0.002			0.938 ***	0.027 ***			0.722 **	0.010 **		
Philadelphia index			-0.199	-0.006			-0.284	-0.002			0.432	0.014			0.617	0.011
Yield curve	25.824 **	0.619 *	26.128 **	0.630 *	34.485 ***	0.276 **	34.802 ***	0.281 **	24.252 **	0.729 **	24.325 **	0.741 **	45.618 ***	0.613 ***	44.708 ***	0.602 ***
Constant	-4.152 ***		-4.151 ***		-5.155 ***		-5.158 ***		-4.006 ***		-3.925 ***		-5.519 ***		-5.464 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.377 ***	0.010 ***	0.381 ***	0.010 ***	0.538 ***	0.002 ***	0.539 ***	0.002 ***	0.241	0.005	0.225	0.005	0.411 **	0.002 **	0.406 **	0.002 **
Domestic stock index	5.912 ***	0.579 ***	5.874 ***	0.568 ***					5.826 ***	0.570 ***	5.914 ***	0.584 ***				
Volatility					0.520 ***	0.002 ***	0.523 ***	0.002 ***					-0.480 ***	-0.002 ***	-0.486 ***	-0.002 ***
Foreign stock index	-0.105	-0.003			-0.141	-0.001			1.064 ***	0.021 ***			0.915 ***	0.004 **		
Philadelphia index			0.737 *	0.030			0.931 **	0.007			0.285	0.005			0.716	0.004
Yield curve	30.633 ***	0.797 **	28.261 **	0.715 **	44.036 ***	0.200 ***	41.046 ***	0.172 **	23.761 *	0.474 *	25.308 **	0.525 *	69.547 ***	0.325 ***	68.848 ***	0.327 ***
Constant	-4.314 ***		-4.325 ***		-5.961 ***		-6.030 ***		-4.508 ***		-4.420 ***		-7.224 ***		-7.146 ***	
Log-likelihood	-1140.452		-1138.8809		-937.37144		-934.514		-1153.610		-1166.109		-942.430		-947.421	
Pseudo R2	0.143		0.145		0.2959		0.298		0.144		0.135		0.301		0.297	

Notes: The period in regression covers Jan. 2000–May 2007. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 7-1 Regression results in the 1990s: Korea

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.627 ***	0.063 ***	0.619 ***	0.064	0.674 ***	0.066 ***	0.662 ***	0.066	0.669 ***	0.072	0.667 ***	0.070 ***	0.785 ***	0.080	0.786348 ***	0.079 ***
Domestic stock index	1.121 ***	0.086	1.103 ***	0.113					1.244 ***	0.105	1.249 ***	0.083 **				
Volatility					0.052 ***	0.005 ***	0.051 ***	0.005					-0.074 ***	-0.007	-0.07446 ***	-0.007 ***
Foreign stock index	-0.125	-0.011			-0.176	-0.016			-0.125 **	-0.013			-0.150	-0.014		
Philadelphia index			0.599 *	0.077			0.540	0.066			-0.083	-0.011			-0.22436	-0.021
Constant	-2.174 ***		-2.222 ***		-2.179 ***		-2.226 ***		-2.117 ***		-2.125 ***		-2.190 ***		-2.19472 ***	
Coexceedance = 2																
Coexceedance lagged	0.107	0.000	0.080	0.000	0.218	0.002	0.184	0.001	0.376	0.008	0.367	0.008	0.651 **	0.008	0.637725 **	0.008 **
Domestic stock index	2.823 ***	0.132 **	2.786 ***	0.150					3.066 ***	0.282	3.057 ***	0.246 ***				
Volatility					0.127 ***	0.002 ***	0.125 ***	0.002					-0.180 ***	-0.003	-0.18093 ***	-0.003 ***
Foreign stock index	-0.359	-0.006			-0.369	-0.004			0.146	0.005			-0.154	-0.002		
Philadelphia index			0.659	0.013			0.542	0.008			0.432	0.016			0.137639	0.003
Constant	-4.019 ***		-4.085 ***		-4.222 ***		-4.275 ***		-3.579 ***		-3.586 ***		-4.199 ***		-4.22238 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.424 *	0.008	0.419 *	0.001	0.570 **	0.007 *	0.571 **	0.0013	0.925 ***	0.000	0.877 ***	0.007 **	1.230 ***	0.000	1.181116 ***	0.005 **
Domestic stock index	2.621 ***	0.145 ***	2.605 ***	0.030					3.249 ***	0.004	3.325 ***	0.103 **				
Volatility					0.146 ***	0.0019 *	0.146 ***	0.000					-0.197 ***	0.0000	-0.19574 ***	-0.001 ***
Foreign stock index	-0.262	-0.005			-0.384	-0.005			-34.136	-0.012			-32.023	-0.006		
Philadelphia index			-35.428	-0.025			-33.795	-0.014 ***			-0.074	-0.001			-0.46779	-0.002
Constant	-3.785 ***		-3.759 ***		-4.249 ***		-4.230 ***		-4.759 ***		-4.848 ***		-5.533 ***		-5.58853 ***	
Log-likelihood	-582.125		-579.246		-558.778		-556.078		-585.693		-587.080		-542.374		-544.352	
Pseudo R2	0.058		0.063		0.096		0.100		0.083		0.081		0.151		0.148	

Notes: The period in regression covers 1993–1996. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.



Table 7-2 Regression results in the 1990s: Malaysia

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.530 ***	0.061 ***	0.532 ***	0.061 ***	0.468 ***	0.045 ***	0.462 ***	0.045 ***	0.464 ***	0.051 ***	0.465 ***	0.052 ***	0.566 ***	0.058 ***	0.568 ***	0.059 ***
Domestic stock index	1.932 ***	0.130 **	1.940 ***	0.131 **					1.954 ***	0.134 **	1.950 ***	0.135 **				
Volatility					0.114 ***	0.011 ***	0.113 ***	0.011 ***					-0.087 ***	-0.009 ***	-0.088 ***	-0.009 ***
Foreign stock index	0.036	0.004			-0.194	-0.019			0.532 **	0.060 **			0.267	0.029		
Philadelphia index			0.024	0.001			-0.089	-0.009			0.289	0.038			0.034	0.005
Constant	-2.044 ***		-2.043 ***		-2.180 ***		-2.192 ***		-2.107 ***		-2.061 ***		-2.152 ***		-2.125 ***	
Coexceedance = 2																
Coexceedance lagged	0.279	0.006	0.284	0.007	0.185	0.002	0.182	0.002	0.479 **	0.012 *	0.479 **	0.012 *	0.566 **	0.008 *	0.568 **	0.008 *
Domestic stock index	3.157 ***	0.168 ***	3.169 ***	0.170 ***					3.347 ***	0.193 ***	3.370 ***	0.195 ***				
Volatility					0.168 ***	0.003 ***	0.167 ***	0.003 ***					-0.163 ***	-0.002 ***	-0.166 ***	-0.002 ***
Foreign stock index	0.113	0.003			-0.146	-0.002			0.188	0.003			-0.314	-0.006		
Philadelphia index			0.111	0.003			-0.022	-0.0003			-0.774	-0.017			-1.335	-0.012 **
Constant	-3.473 ***		-3.469 ***		-3.887 ***		-3.899 ***		-3.631 ***		-3.588 ***		-4.072 ***		-4.073 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.575 **	0.003	0.532 *	0.003	0.358	0.0003	0.348	0.0003	0.813 ***	0.004 **	0.820 ***	0.004 **	0.801 ***	0.002	0.818 ***	0.002 *
Domestic stock index	5.347 ***	0.296 ***	5.372 ***	0.295 ***					5.386 ***	0.270 ***	5.336 ***	0.265 ***				
Volatility					0.284 ***	0.0003 *	0.283 ***	0.0003 *					-0.226 ***	-0.0005 **	-0.225 ***	-0.001 **
Foreign stock index	0.205	0.001			-0.128	-0.0001			1.064 *	0.005			0.557	0.001		
Philadelphia index			1.098	0.011			0.725	0.001			1.059	0.010			0.386	0.001
Constant	-5.328 ***		-5.375 ***		-6.858 ***		-6.918 ***		-5.621 ***		-5.538 ***		-6.201 ***		-6.123 ***	
Log-likelihood	-598.069		-597.376		-521.538		-521.498		-580.485		-581.990		-531.654		-531.542	
Pseudo R2	0.114		0.115		0.227		0.227		0.129		0.127		0.202		0.202	

Notes: The period in regression covers 1993–1996. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 7-3 Regression results in the 1990s: Singapore

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.198	0.013	0.200	0.014	0.131	0.007	0.132	0.007	0.020	0.001	0.025	0.001	0.176	0.011	0.181	0.012
Domestic stock index	1.953 ***	0.192 ***	2.008 ***	0.233					2.230 ***	0.292 ***	2.227 ***	0.297 ***				
Volatility					0.063 ***	0.0037 ***	0.064 ***	0.004					-0.076 ***	-0.005 ***	-0.075 ***	-0.005 ***
Foreign stock index	0.327	0.023			0.118	0.007			0.099	0.008			-0.197	-0.013		
Philadelphia index			0.177	0.013			-0.202	-0.011			0.158	0.015			-0.114	-0.007
Constant	-2.605 ***		-2.581 ***		-2.749 ***		-2.729 ***		-2.376 ***		-2.375 ***		-2.536 ***		-2.543 ***	
Coexceedance = 2																
Coexceedance lagged	0.751 ***	0.010 ***	0.755 ***	0.010	0.716 ***	0.005 **	0.709 ***	0.005	0.822 ***	0.009 **	0.795 **	0.009 **	1.029 **	0.006 *	1.023 **	0.005 *
Domestic stock index	3.009 ***	0.118 **	3.018 ***	0.131					2.574 ***	0.054	2.775 ***	0.070 *				
Volatility					0.103 ***	0.0007 ***	0.102 ***	0.0007					-0.104 ***	-0.001 ***	-0.113 ***	-0.001 ***
Foreign stock index	0.139	0.002			-0.168	-0.001			0.433	0.005			-0.074	0.000		
Philadelphia index			0.645	0.012			-0.005	0.0001			-0.335	-0.004			-1.099	-0.004
Constant	-4.432 ***		-4.461 ***		-4.977 ***		-4.991 ***		-4.644 ***		-4.577 ***		-5.126 ***		-5.221 ***	
Coexceedance = 3																
Coexceedance lagged	0.105	0.0004	0.126	0.0001	-0.084	-0.0001	-0.125	-0.00002	0.849 **	0.000	0.951 **	0.000	0.699	0.000	0.297	0.00001
Domestic stock index	4.129 ***	0.127 *	4.211 ***	0.031					24.779	0.128 **	24.516	0.100 **				
Volatility					0.170 ***	0.00009	0.174 ***	0.00002					-0.344 ***	0.000	-0.221 ***	-0.00001
Foreign stock index	0.458	0.002			0.033	0.00001			-0.915	0.000			-9.261 *	0.000		
Philadelphia index			-32.532	-0.005 **			-30.865	-0.0005			0.527	0.000			-0.723	-0.00002
Constant	-5.483 ***		-5.385 ***		-7.509 ***		-7.499 ***		-26.031 ***		-26.162 ***		-15.346 ***		-10.059 ***	
Log-likelihood	-412.810		-412.480		-369.456		-368.232		-407.487		-408.227		-357.908		-361.676	
Pseudo R2	0.101		0.101		0.195		0.198		0.120		0.118		0.227		0.219	

Notes: The period in regression covers 1993-1996. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 7-4 Regression results in the 1990s: Thailand

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.359 ***	0.035 ***	0.359 ***	0.034 ***	0.358 ***	0.031 ***	0.356 ***	0.031 ***	0.183	0.016	0.194	0.017	0.180	0.012	0.183	0.012
Domestic stock index	1.580 *	-0.073 **	1.605 *	-0.071 **					2.930 ***	0.054	2.928 ***	0.045				
Volatility					0.094 ***	0.008 ***	0.095 ***	0.008 ***					-0.126 ***	-0.008 ***	-0.126 ***	-0.008 ***
Foreign stock index	0.173	0.023			0.012	0.003			0.262	0.020			0.062	0.003		
Philadelphia index			-0.043	-0.010			-0.248	-0.020			0.403	0.042			0.076	0.005
Constant	-2.169 ***		-2.149 ***		-2.352 ***		-2.340 ***		-2.225 ***		-2.225 ***		-2.635 ***		-2.633 ***	
Coexceedance = 2																
Coexceedance lagged	0.137	0.002	0.154	0.003	0.144	0.001	0.145	0.001	0.139	0.003	0.190	0.005	0.137	0.002	0.169	0.002
Domestic stock index	4.628 ***	0.148 ***	4.479 ***	0.138 ***					4.180 ***	0.110 **	4.284 ***	0.122				
Volatility					0.168 ***	0.002 ***	0.165 ***	0.002 ***					-0.160 ***	-0.002 ***	-0.164 ***	-0.002 ***
Foreign stock index	-1.554	-0.044			-1.569	-0.016			1.035 ***	0.029 ***			0.853 **	0.011 *		
Philadelphia index			0.235	0.006			-0.101	-0.001			0.137	0.002			-0.149	-0.002
Constant	-3.469 ***		-3.563 ***		-4.327 ***		-4.379 ***		-3.670 ***		-3.546 ***		-4.365 ***		-4.269 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.549 ***	0.017 ***	0.550 ***	0.016 ***	0.570 ***	0.002 **	0.590 ***	0.002 **	0.421 ***	0.013 **	0.454 ***	0.014	0.355 *	0.002	0.375 **	0.002
Domestic stock index	5.970 ***	0.704 ***	5.972 ***	0.709 ***					5.733 ***	0.616 ***	5.768 ***	0.615				
Volatility					0.241 ***	0.001 ***	0.242 ***	0.001 ***					-0.238 ***	-0.001 ***	-0.239 ***	-0.001 ***
Foreign stock index	0.106	0.004			-0.063	-0.0002			0.814 **	0.024 **			0.617	0.003		
Philadelphia index			0.878	0.042			0.667	0.003			0.620	0.023			0.203	0.001
Constant	-3.682 ***		-3.733 ***		-5.779 ***		-5.879 ***		-3.738 ***		-3.680 ***		-5.488 ***		-5.442 ***	
Log-likelihood	-615.710		-617.02082		-499.88385		-500.994		-601.557		-604.933		-482.570		-484.831	
Pseudo R2	0.168		0.167		0.3248		0.323		0.154		0.150		0.322		0.319	

Notes: The period in regression covers 1993-1996. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 8-1 Regression results during the global financial crisis: Korea

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexistence = 1																
Coexistence lagged	0.128	0.011	0.134	0.011	0.142	0.012	0.146	0.012	0.303 **	0.028 *	0.324 **	0.030 **	0.410 ***	0.039 ***	0.423 ***	0.040 ***
Domestic stock index	1.807 **	0.074	1.873 ***	0.040					2.499 ***	0.061	2.638 ***	0.055				
Volatility					0.017 ***	0.001 **	0.017 ***	0.001 **					-0.028 ***	-0.003 ***	-0.028 ***	-0.003 ***
Foreign stock index	0.388	0.027			0.342	0.026			0.688 *	0.063			0.508	0.049		
Philadelphia index			0.490	0.047			0.469	0.043			1.312 **	0.132			1.149 **	0.151
Yield curve	22.336	1.936	20.545	1.793	22.934	1.898	21.207	1.746	2.836	0.180	-4.600	-0.458	2.103	0.091	-4.429	-0.529
Constant	-2.403 ***		-2.390 ***		-2.365 ***		-2.353 ***		-2.244 ***		-2.208 ***		-2.263 ***		-2.235 ***	
Coexistence = 2																
Coexistence lagged	-0.023	-0.002	-0.002	-0.001	0.001	-0.001	0.017	0.000	0.325	0.011	0.344	0.011	0.578 **	0.011 **	0.571 **	0.011 **
Domestic stock index	1.951 **	0.038	2.101 **	0.028					3.820 *	0.170 *	3.963 **	0.162 **				
Volatility					0.021 **	0.001 **	0.023 **	0.001 **					-0.066 ***	-0.001 ***	-0.066 ***	-0.001 ***
Foreign stock index	0.813	0.027			0.730	0.024			0.734	0.024			0.348	0.006		
Philadelphia index			1.039	0.057			1.009	0.051			1.437 *	0.056			1.090	0.026
Yield curve	23.382	0.778	19.426	0.632	24.980	0.776	21.454	0.642	5.227	0.160	-3.955	-0.132	23.858	0.485	17.533	0.372
Constant	-3.368 ***		-3.346 ***		-3.358 ***		-3.344 ***		-3.395 ***		-3.349 ***		-4.166 ***		-4.137 ***	
Coexistence ≥ 3																
Coexistence lagged	0.181	0.007	0.373 **	0.015 **	0.290	0.005	0.453 **	0.008	0.411 *	0.012 *	0.486 **	0.013 **	0.767 ***	0.005 **	0.819 ***	0.005 **
Domestic stock index	3.942 ***	0.480 ***	4.388 ***	0.583 ***					4.990 ***	0.493 ***	5.288 ***	0.526 ***				
Volatility					0.067 ***	0.001 ***	0.074 ***	0.001 ***					-0.097 ***	-0.001 ***	-0.098 ***	-0.001 ***
Foreign stock index	1.243 ***	0.046 ***			1.013 **	0.0188 *			1.233 ***	0.036 **			0.822 *	0.006		
Philadelphia index			-0.548	-0.021			-0.308	-0.007			2.353 ***	0.150 **			1.948 ***	0.027
Yield curve	8.418	0.197	4.159	0.048	41.093 *	0.747	44.778 *	0.777 *	22.267	0.708	0.492	0.038	73.649 **	0.540 **	56.185 *	0.384 *
Constant	-3.430 ***		-3.303 ***		-4.178 ***		-4.215 ***		-3.838 ***		-3.773 ***		-5.737 ***		-5.731 ***	
Log-likelihood	-396.537		-399.434		-386.897		-388.932		-390.439		-387.213		-346.830		-343.990	
Pseudo R2	0.108		0.101		0.130		0.125		0.137		0.144		0.233		0.240	

Notes: The period in regression covers June 2007– Oct. 2009. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 8-2 Regression results during the global financial crisis: Malaysia

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.348 ***	0.047 ***	0.345 ***	0.046 **	0.390 ***	0.051 ***	0.391 ***	0.051 ***	0.097	0.010	0.111	0.011	0.096	0.011	0.093	0.010
Domestic stock index	2.104 ***	0.026	2.060 ***	0.012					1.977 **	0.033	2.053 ***	0.010				
Volatility					0.094 ***	0.012 ***	0.094 ***	0.012 ***					-0.095 ***	-0.010 ***	-0.095 ***	-0.010 ***
Foreign stock index	0.549 *	0.069			0.396	0.050			0.473	0.048			0.124	0.013		
Philadelphia index			0.611	0.089			0.362	0.052			1.116 **	0.131			0.890 *	0.124
Interest rate	9.805	1.188	8.354	0.982	3.379	0.338	2.902	0.274	-0.382	-0.273	-4.034	-0.649	5.181	0.466	2.378	0.159
Constant	-1.826 ***		-1.793 ***		-1.768 ***		-1.747 ***		-1.866 ***		-1.862 ***		-2.025 ***		-2.039 ***	
Coexceedance = 2																
Coexceedance lagged	0.205	0.006	0.205	0.005	0.269	0.004	0.293	0.005	0.207	0.007	0.292	0.010	0.208	0.003	0.256	0.004
Domestic stock index	3.706 ***	0.189 **	3.647 ***	0.168 **					3.432 ***	0.145 *	3.728 ***	0.158 *				
Volatility					0.182 ***	0.003 ***	0.180 ***	0.003 ***					-0.190 ***	-0.003 ***	-0.198 ***	-0.003 ***
Foreign stock index	0.656	0.023			0.542	0.010			1.066 **	0.035 **			0.664	0.011		
Philadelphia index			0.740	0.032			0.331	0.006			1.367 **	0.055			1.235 *	0.028
Interest rate	24.888	1.000	23.042	0.923	27.726	0.546	26.355	0.530	25.393	0.913	20.073	0.759	46.771	0.793	42.954	0.705
Constant	-3.346 ***		-3.307 ***		-3.925 ***		-3.867 ***		-3.600 ***		-3.551 ***		-4.616 ***		-4.647 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.528 **	0.008 *	0.677 ***	0.013 **	0.622 **	0.002	0.813 ***	0.003 *	0.272	0.006	0.420 *	0.009	0.385	0.001	0.511 *	0.001
Domestic stock index	5.421 ***	0.455 ***	5.364 ***	0.493 ***					5.018 ***	0.494 ***	5.391 ***	0.534 ***				
Volatility					0.272 ***	0.001 **	0.268 ***	0.001 **					-0.311 ***	-0.001 *	-0.323 ***	-0.001 *
Foreign stock index	1.787 ***	0.030 ***			1.786 ***	0.0053 *			1.278 ***	0.028 **			1.128 **	0.002		
Philadelphia index			0.735	0.015			0.305	0.001			2.251 ***	0.105 *			2.469 ***	0.013
Interest rate	12.689	0.176	12.076	0.203	48.684	0.148	40.842	0.158	24.229	0.552	12.227	0.268	96.538 **	0.180	81.922 *	0.136
Constant	-4.462 ***		-4.207 ***		-6.180 ***		-5.791 ***		-4.158 ***		-4.174 ***		-7.519 ***		-7.578 ***	
Log-likelihood	-442.210		-448.726		-389.559		-394.891		-408.460		-406.949		-344.737		-342.584	
Pseudo R2	0.121		0.108		0.226		0.215		0.124		0.127		0.260		-342.584	

Notes: The period in regression covers June 2007– Oct. 2009. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 8-3 Regression results during the global financial crisis: Singapore

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.338	0.010	0.543 **	0.016	0.496 *	0.006	0.654 **	0.008	-0.136	-0.005	-0.045	-0.002	0.207	0.003	0.323	0.005
Domestic stock index	4.159 ***	0.411	4.216 ***	0.392					3.221 ***	0.178 **	3.481 ***	0.184 **				
Volatility					0.046 ***	0.0005 ***	0.047 ***	0.001 ***					-0.041 ***	-0.001 ***	-0.042 ***	-0.001 ***
Foreign stock index	1.000 **	0.030			0.596	0.007			0.971 **	0.036 **			0.641	0.011		
Philadelphia index			-0.550	-0.014			-0.759	-0.006			0.947	0.052			0.528	0.011
Yield curve	44.143	1.337	52.740	1.604	81.262 **	0.965 **	87.853 **	1.020 **	17.849	0.666	14.564	0.557	42.232	0.698	39.347	0.643
Constant	-4.413 ***		-4.442 ***		-5.663 ***		-5.711 ***		-3.661 ***		-3.576 ***		-4.815 ***		-4.770 ***	
Coexceedance = 2																
Coexceedance lagged	0.291	0.002	0.614 *	0.006	0.559	0.001	0.789 **	0.002	0.615	0.003	0.754 **	0.003	1.137 **	0.001	1.373 ***	0.001
Domestic stock index	5.168 ***	0.297	5.121 ***	0.338					4.916 ***	0.123 *	5.279 ***	0.128 **				
Volatility					0.059 ***	0.0001	0.060 ***	0.0002 *					-0.068 ***	0.000	-0.069 ***	0.000
Foreign stock index	2.065 ***	0.017			1.622 ***	0.004			1.390 **	0.006			1.110 **	0.001		
Philadelphia index			1.134	0.022			0.888	0.0036			2.192 **	0.028			1.832 *	0.003
Yield curve	-17.902	-0.158	-16.943	-0.202	37.413	0.079	44.226	0.112	9.557	0.040 ***	-23.534	-0.106	78.941	0.049	46.224	0.026
Constant	-4.977 ***		-4.615 ***		-6.824 ***		-6.672 ***		-5.897 ***		-5.513 ***		-8.852 ***		-8.484 ***	
Coexceedance = 3																
Coexceedance lagged	-33.486	-0.001	-32.204	-0.002	-34.426	0.0000	-35.622	0.0000	0.292	0.002	0.351	0.002	0.835 *	0.0006	0.914 *	0.0006
Domestic stock index	6.170 ***	0.004	6.123 ***	0.005					5.937 ***	0.420 ***	6.228 ***	0.459 ***				
Volatility					0.118 ***	0.00000	0.116 ***	0.00000					-0.077 ***	-0.00006	-0.080 ***	-0.00005
Foreign stock index	2.289 ***	0.000			1.161	0.0000			1.015 *	0.006			0.663	0.0005		
Philadelphia index			1.859 *	0.000			0.996	0.0000			0.662	0.005			-0.151	-0.0001
Yield curve	33.585	0.001	-1.790	0.000	203.993 ***	0.000	186.359 **	0.000	47.728	0.279	44.599	0.274	126.507 **	0.092	133.520 **	0.089
Constant	-6.152 ***		-5.296 ***		-13.960 ***		-13.321 ***		-6.183 ***		-6.054 ***		-9.309 ***		-9.450 ***	
Log-likelihood	-153.792		-161.12808		-130.277		-133.622		-161.444		-162.598		-144.353		-144.494	
Pseudo R2	0.343		0.312		0.443		0.429		0.303		0.298		0.377		0.376	

Notes: The period in regression covers June 2007– Oct. 2009. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

Table 8-4 Regression results during the global financial crisis: Thailand

	Top tails								Bottom tails							
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Coexceedance = 1																
Coexceedance lagged	0.246	0.018	0.245	0.018	0.275	0.021	0.275	0.021	0.254	0.023	0.274	0.025	0.337 *	0.028 *	0.341 *	0.028 *
Domestic stock index	1.245 *	0.020	1.326 *	0.020					3.455 ***	0.077	3.504 ***	0.061				
Volatility					0.083 ***	0.006 ***	0.085 ***	0.006 ***					-0.102 ***	-0.008 ***	-0.103 ***	-0.008 ***
Foreign stock index	0.536	0.041			0.481	0.036			0.439	0.038			0.237	0.019		
Philadelphia index			0.301	0.010			0.424	0.027			0.346	0.027			0.293	0.025
Yield curve	50.382 ***	4.037 ***	49.899 ***	4.042 **	44.518 **	3.416 **	43.996 **	3.418 **	-1.322	-0.183	-3.591	-0.363	-0.131	-0.021	-1.314	-0.116
Constant	-3.175 ***		-3.129 ***		-3.110 ***		-3.070 ***		-2.298 ***		-2.249 ***		-2.452 ***		-2.430 ***	
Coexceedance = 2																
Coexceedance lagged	0.512 **	0.015 **	0.518 **	0.014 **	0.583 ***	0.009 **	0.643 ***	0.009 **	0.299	0.010	0.335	0.012	0.390	0.004	0.365	0.004
Domestic stock index	2.950 ***	0.166 **	3.040 ***	0.157 **					4.901 ***	0.218 **	4.975 ***	0.202 **				
Volatility					0.176 ***	0.003 ***	0.180 ***	0.003 ***					-0.244 ***	-0.003 ***	-0.248 ***	-0.003 ***
Foreign stock index	0.520	0.014			0.740	0.011			0.633	0.022			0.620	0.006		
Philadelphia index			1.570 **	0.084			1.994 ***	0.073			0.439	0.015			1.058	0.018
Yield curve	67.158 **	1.956 **	70.319 **	1.936 **	66.599 **	1.011 **	62.551 **	0.872 *	20.223	0.792	16.945	0.688	12.637	0.136	7.837	0.084
Constant	-4.654 ***		-4.805 ***		-5.183 ***		-5.250 ***		-3.736 ***		-3.659 ***		-4.945 ***		-4.873 ***	
Coexceedance ≥ 3																
Coexceedance lagged	0.496 **	0.013 **	0.503 **	0.013 **	0.713 ***	0.003 *	0.794 ***	0.003 *	0.286	0.004	0.293	0.004	0.321	0.000	0.112	0.000
Domestic stock index	3.811 ***	0.367 ***	3.981 ***	0.402 ***					6.693 ***	0.517 ***	6.911 ***	0.555 ***				
Volatility					0.272 ***	0.001 **	0.272 ***	0.001 **					-0.427 ***	0.000	-0.458 ***	0.000
Foreign stock index	0.967 **	0.025 **			1.561 ***	0.006 *			1.305 ***	0.018 **			1.412 **	0.000		
Philadelphia index			1.315 **	0.056			2.295 ***	0.029			1.745 **	0.057			3.454 ***	0.005
Yield curve	13.883	0.189	8.903	0.051	42.580	0.151	19.378	0.063	-19.820	-0.307	-34.875	-0.528	-99.207	-0.032	-129.008 **	-0.026
Constant	-4.021 ***		-3.924 ***		-6.267 ***		-5.827 ***		-4.213 ***		-3.953 ***		-6.875 ***		-6.881 ***	
Log-likelihood	-366.066		-365.27399		-315.37195		-313.760		-337.392		-338.798		-283.910		-282.362	
Pseudo R2	0.117		0.119		0.2391		0.243		0.177		0.174		0.308		0.311	

Notes: The period in regression covers June 2007– Oct. 2009. In explanation variables, \*, \*\*, and \*\*\* indicates that the statistic is significant at the 10%, 5%, and 1% levels respectively.

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