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THE RELATION BETWEEN ECONOMIC FUNDAMENTALS AND STOCK MARKET VOLATILITY IN THE EAST ASIAN CRISIS : AN ASYMMETRIC GARCH

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จากวิกฤตเศรษฐกิจที่เกิดขึ้นในเอเชียตะวันออก มีงานวิจัยหลายงานได้ทำการศึกษาถึงสาเหตุของการเกิดวิกฤตการณ์ทางการเงินซึ่งเริ่มต้นจากการล่มสลายทางการเงินของประเทศหนึ่ง แล้วมีการแพร่กระจายไปยังประเทศอื่นๆ (Contagion effect)

ดังนั้นงานศึกษาฉบับนี้จึงทำการทดสอบว่าวิกฤตการณ์ทางการเงินที่เกิดขึ้นในเอเชียตะวันออก สามารถอธิบายได้ด้วยความอ่อนแอของปัจจัยพื้นฐานทางเศรษฐกิจที่บังเอิญเกิดขึ้นพร้อมๆ กันในแต่ละประเทศหรือไม่ โดยถ้าปัจจัยพื้นฐานทางเศรษฐกิจมีความสัมพันธ์กับความผันผวนของอัตราผลตอบแทนในตลาดหลักทัพย์อย่างมีนัยสำคัญ จะสามารถสรุปได้โดยนัยว่าวิกฤตการณ์ทางการเงินเป็นผลมาจากความอ่อนแอของปัจจัยพื้นฐานทางเศรษฐกิจ จากผลการศึกษาพบว่าความผันผวนของอัตราผลตอบแทนในตลาดหลักทรัพย์ของประเทศไทย เกาหลีใต้ มาเลเซีย และฟิลิปปินส์ ที่สูงขึ้นอย่างมีนัยสำคัญ สามารถอธิบายได้ด้วยความอ่อนแอของปัจจัยพื้นฐานทางเศรษฐกิจ ขณะที่ประเทศญี่ปุ่น สิงคโปร์ และฮ่องกงไม่สามรถอธิบายได้ด้วยปัจจัยพื้นฐานทางเศรษฐกิจ นอกจากนี้ยังสรุปได้ว่าความผันผวนของอัตราผลตอบแทนของตลาดหลักทรัพย์ของประเทศไทย เกาหลีใต้ มาเลเซีย และฟิลิปปินส์ สูงกว่าของประเทศญี่ปุ่น สิงคโปร์ และฮ่องกง

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Numerous researchers have observed a recurring phenomenon in which one country's financial failure could bring about economic breakdowns in other nearby countries as a contagion effect. This paper examines whether the East Asian financial crisis can be explained by fundamental economic weaknesses. The financial crisis is defined as a significant increase in stock market volatility by using an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. If the fundamental economic variables have significant effects on the volatility, it implies that the financial crisis was caused by fundamental economic weaknesses and not by contagion. I find that the stock market volatility of the victim-countries increased significantly. Moreover, I have some evidence that fundamental economic weaknesses are important in explaining the financial crisis.

Department Banking and Finance Student's signature.....

Field of study Finance Advisor's signature.....

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Any appearing omissions and errors in this thesis are my own responsibility and any sincere suggestions from the readers for further improvement of this study are highly appreciated.

Pichanun Aranyanark

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CHAPTER I

INTRODUCTION

1.1 Statement of Problem and its Significance

In recent years, many economists have observed a recurring phenomenon in which one country's financial failure could bring about economic breakdowns in other nearby countries. This rapid and contagious spread of disaster is known as the "Tequila" effect and the "Asian flu" during the economic crises in Latin America and East Asia, respectively. In both cases, the regional crisis sprang from the downfall of just one country, namely Mexico and Thailand. These so-called economic contagions have aroused a large number of debates among economists. These discussions concern the causes and consequences of this contagion, as well as their policy implications, particularly the crisis prevention and management. Understanding how and why these crises occurred are essential in preventing future crises.

In this paper, I define the financial crisis in East Asia as the significance increase in stock market volatility in each country. The evidence represents that the stock market returns during the crisis period were more volatile than during normal periods. I follow Thanyalakpark and Filson (2001) in using an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model to calculate the stock market return volatility of each country at each point in time. In general, the volatility generated by the GARCH model allows for the variance to change over time as a function of past errors and the past conditional variance. The asymmetric GARCH model allows the volatility where it responds to negative shocks more than to positive shocks, whereas the standard GARCH model assumes that volatility responds symmetrically to positive and negative shocks. This is crucial because, during the crisis when most shocks are negative, the symmetry restriction in GARCH leads to a downward bias in the volatility processes. Therefore, I believe that the asymmetric GARCH used in this study is superior.

The Asian financial crisis has revived the long-standing debate between two competing interpretations of financial and currency collapses. The first view believes that the collapses are caused by fundamental weaknesses and policy inconsistencies. These include the imbalances between the financial linkages among trading countries such as persistent current account deficits and widespread fragility of financial firms. The second view considers the contagion effect. Generally, contagion takes place through different channels (Forbes and Rigobon, 1999): trade links, macroeconomic similarities, monsoonal or external effects and herd behavior. As seen from the two causes of the crisis, fundamental economic weaknesses and contagion effects can lead to very different policy prescriptions. In this study, the nature and extent of the contagion based on the herding behavior during the Asian financial turmoil will be examined. The role of the herding behavior of investors is the potential reason for the East Asian financial crisis in terms of stock market volatility. This definition states that the withdrawal of the investors from the market is due to the change in their expectations upon observing a shock in another market. This definition is also useful in evaluating the effectiveness of international diversification and justifying multilateral intervention differentiating between various transmission mechanisms.

There are many empirical works investigating the causes of the East Asian crisis and explaining how fundamental economic variables affected the crisis. These works include those of Radelet and Sachs (1998a and 1998b) and Corsetti, Pesent and Roubini (1998a and 1998c). Radelet and Sachs (1998b) found that the five East Asian crisis economies in 1997 were hit by several international macroeconomic shocks during 1994-1996. These included a dramatic surge by competitor economies (especially China and Mexico), and the abrupt reversal of the long-term trend towards appreciation of the yen against the dollar. These international factors interacted with growing weaknesses in the East Asian financial systems to provoke the crisis. Corsetti, Pesenti and Roubini (1998c) examined the important of structural problems and fundamental weaknesses generating the East Asian crisis. They revealed that the relationship between the currency volatility and financial fragility led to the crisis. They examined the relation between a crisis index as a fundamental imbalance and a financial fragility

index, current account index and foreign reserve adequacy index. They found that the significance of structural imbalances have generated the crisis.

Several empirical works examined whether the financial crisis was amplified by contagion effects. For example, Forbes and Rigobon (1998a) focus on tests for contagion in the context of herd behavior based on cross-market correlation coefficients. Their study defined contagion as a significant increase in cross-market linkages after a shock to one country. Their test based on the unconditional correlation coefficients corrected for heterogeneity, endogeneity and omitted variables. Their results show no evidence of a significant increase in cross-market correlation coefficients in the 1997 East Asian crisis, the 1994 Mexican peso devaluation, and 1987 U.S. stock market crash. They conclude that there was no contagion, only a high level of market co-movement in all states of the world. They called this phenomenon "interdependence." Edwards (1998) examined whether the effects of the rise in Mexican interest rates in 1994 spilled over into Argentina and Chile. He estimated an augmented GARCH model and found that there was strong evidence of contagion from Mexico to Argentina, but not from Mexico to Chile. His tests indicate that volatility was transmitted from one country to the other, but he does not indicate whether this propagation changed during the crisis.

Consequently, it is not certain to justify whether the contagion effects or the fundamental economic weaknesses caused the crisis. The primary purpose of this paper is to examine whether the Asian financial crisis can be explained by fundamental economic weaknesses. If the result shows that fundamental economic factors can explain the crisis, it implies that contagion based on herding behavior did not take place. In this study, I employ the Generalized Least Square (GLS) estimation test for the economic relationship among the volatilities of stock market returns and fundamental economic variables. If the fundamental economic variables have significant effects on the volatility, it implies that the East Asian financial crisis was caused by fundamental economic weaknesses and not by contagion. Understanding the source and the transmission mechanisms of the crisis are important as policy makers contemplate financial markets, macro-political and institutional reforms to foster a recovery while preventing a repetition of the crisis.

1.2 Objectives of the Study

The study has the following specific objectives:

1.2.1 To develop a special time-varying market return volatility model during the crisis period in four emerging markets and four developed markets.

1.2.2 To examine whether the Asian crisis can be explained by fundamental economic weaknesses.

1.3 Framework

1.3.1 In this study, I examine the financial crisis as the stock market volatility of four developed stock markets: USA, Japan, Hong Kong and Singapore. Also of four emerging stock markets: Korea, Malaysia, Philippines and Thailand.

1.3.2 I separate each estimation into three periods: An overall period (Dec 30, 1988 - Jun 30, 1999), a pre-crisis period (Dec 30, 1988 - Jun 30, 1997) and a post-crisis period (Jul 1, 1997 - Jun 30, 1999). This break is reasonable. According to Radelet and Sachs (1998b) by June 1997, Asian currencies were clearly in crisis.

1.4 Contributions of the Study

While extensive studies have been done in the field of crisis causes, none of these earlier studies consider the linkage between stock market volatility, which served as a financial crisis measurement, and fundamental economic weaknesses. This paper aims to measure the stock market volatility at each point in time by using an asymmetric Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. French, Schwert, and Stambaugh (1987) state that GARCH-in-Mean models are appropriate

representations of stock returns volatility on a stock's expected return. In general, the standard GARCH model allows for the variance to change over time as a function of past errors and the past conditional variance but it assumes that volatility responds symmetrically to positive and negative shocks. The asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) process shows that volatility responds more to negative shocks than to positive shocks. Several papers, for example, Engle, and Ng, 1993; Erb, Harvey, and Viskanta, 1996; and De Santis and Gerard, 1997, have argued that volatility processes increase more following negative shocks than following positive shocks. This is crucial because during the crisis most shocks are negative. The volatilities derived from this model are beneficial for further study.

The objective of this paper is to examine the relationship between the fundamental economic weaknesses and the East Asian financial crisis during 1997-1998. This study shows that when choosing an appropriate fundamental economic to be included in the model, we are able to identify the relationship between the fundamental economic weaknesses and stock market volatility. This study will imply whether the stock market volatility was explained by fundamental economics weaknesses. Understanding the source and transmission mechanisms of the crisis are very important as policy makers to contemplate financial market, institutional, and macro-political reforms to foster a recovery while preventing another crisis. It is also a relevant issue in the design of policy capable of containing undesirable effects of the transmission. The results also have interesting implications for investors who want to diversify their portfolios internationally.

I hope we can learn from this event and begin to develop policies to help prevent future crises. In that sense, the Asian crisis represents an opportunity for positive change. I believe this study is an opportunity to significantly increase our understanding of what constitutes effective policy.

1.5 Organization of the Study

There are six chapters in this study. The first chapter is the introduction consisting of the statement of the problem and its significance, objectives, framework, benefits and its implications and organization of the study.

Chapter two states the background of the East Asian crisis during 1997-1998 involving the fundamental economic weaknesses and also represents the factors which generated the crisis. Studying fundamental economic weaknesses can be categorized into two parts: macroeconomic imbalances and the moral hazard problem.

The literature is reviewed in the third chapter. It contains many empirical studies which state the important determinants of contagion and the fundamental economic imbalances which generate the crises.

In chapter four, the methodology, data description and sources of data are discussed. Chapter five analyzes the relationship between the fundamental economic weaknesses and the results. Finally, the last chapter provides the conclusions and limitations.

CHAPTER II

BACKGROUND OF THE EAST ASIAN CRISIS

There are some general patterns linking macroeconomic conditions to the East Asian crisis, but, they are complex. They depend on both the interaction between general economic factors, defined as shared economic weaknesses, and weaknesses in financial institutions followed as moral hazard. To gain a better understanding of how fundamental economic problems explain the East Asian crisis, this study divides the fundamental economics problems into two parts: macroeconomic imbalances and moral hazard problems.

2.1 Macroeconomic imbalances

This is based on the analysis of the available empirical evidence for the following countries: South Korea, Malaysia, the Philippines, Thailand, Singapore and Hong Kong. I can not include Indonesia and Taiwan into my sample. The historical data in Indonesia's stock market and Taiwan's economic fundamental factors are insufficient for me to estimate my model. Macroeconomic events in these markets are assessed within a broad overview of structural evidence: financial liberalization and deregulation, capital account imbalances and current account imbalances.

2.1.1 Financial liberalization and deregulation

The East Asian countries suffered an increase in financial vulnerabilities through the domestic financial liberalization of emerging markets which facilitated a massive flow of capital to these markets.

Since the early 1990s, there has been a process of rapid financial liberalization, including both domestic deregulation and capital-account opening. Regarding domestic deregulation, barriers to entry into the financial sector were eliminated while old and new financial institutions had more freedom in their borrowing and lending decisions. Restrictions on corporate debt financing were removed and regulatory

controls over interest rates and loans were loosened. Regarding capital-account opening, virtually all restrictions on cross-border borrowing were eliminated. These measures increased the number of financial institutions and their range of activities. Large international capital inflows were attracted into emerging markets. Financial liberalization also gave Asian banks and nonbanks greater access to international financial markets for funds. For example, in Thailand, the Bangkok International Banking Facility (BIBF) was established in 1993 to be the center of finance in the region. It caused very rapid growth in the number of financial institutions that could borrow and lend in foreign currencies. In the Philippines, banks are subject to a tax rate of 10 percent for onshore income from foreign exchange loans, whereas other income is subject to the regular corporate income tax rate of 35 percent. Philippines Banks also experienced no reserve requirements for foreign currency deposits. For the Philippines peso deposits, the reserve requirements were 13 percent which is a decreased from 15 percent in 1996. In Korea, financial market reforms in the mid-1990s similarly allowed domestic financial institutions greater freedom in asset and liability management. This was particularly in borrowing from international financial markets. In mid-1994 Malaysia lifted the reserve requirement restrictions on Malaysian bank borrowing from foreign institutions.

2.1.2 Foreign capital inflows

Financial market liberalization and financial deregulation in East Asia has opened new channels for foreign capital flows into the Asian economies. In addition, low interest rates in the U.S. and Japan favored increased outward investment from these countries to Southeast Asia and other emerging markets. High domestic interest rates of troubled countries were also set to attract international capital inflows. The high domestic interest rates of emerging markets in the region were aimed to attract international capital inflows, which are channeled to productive investment activities. If this true, the high interest rates can be an engine of growth. As shown in Table 2.1, most of the crisis victims had high interest rates, except for Malaysia where interest rates were quite low.

Table 2.1

Interest Rates (%, Annual Basis)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
USA	8.10	5.69	3.52	3.02	4.20	5.84	5.30	5.46	5.35
Japan	7.24	7.46	4.58	3.06	2.20	1.21	0.47	0.48	0.37
Singapore	6.61	4.76	2.74	2.50	3.68	2.56	2.93	4.35	5.00
Hong Kong	11.50	4.63	3.81	4.00	5.44	6.00	5.13	4.50	5.50
Thailand	12.87	11.15	6.93	6.54	7.25	10.96	9.23	14.59	13.02
Korea	14.03	17.03	14.32	12.12	12.45	12.57	12.44	13.24	14.98
Malaysia	6.81	7.83	8.01	6.53	4.65	5.78	6.98	7.61	8.46
Philippines	26.52	21.11	14.48	15.94	10.67	12.03	11.55	17.70	13.43

Source: IMF-IFS

Domestical factors contributing to the capital flows included: continuing, and in some cases increasing high economic growth, as presented in Table 2.2, which gave confidence to foreign investors. Nominal exchange rates were effectively pegged to the U.S. dollar, with either limited variation (Thailand, Malaysia, Korea, and the Philippines). Predictable exchange rates reduced perceived risks for investors, further encouraging capital inflows domestically. Data on nominal exchange rates in the 1990s are presented in Table 2.3. In Malaysia, the currency moved in a 7.5% range of 2.53 to 2.72 ringgit to the U.S. dollar during the period 1990 to the beginning of 1997. The Thai baht was effectively fixed between 25.0 to 25.6 to the U.S. dollar from 1990 until 1997. In the Philippines during 1990 to 1995, the peso against dollar rate fluctuated between 24.42 and 28.00. It was effectively fixed, however, at 26.2 from the spring of 1995 until the beginning of 1997. Other countries followed a somewhat more flexible exchange rate policy. In Korea, the won depreciated in nominal terms between 1990 and the beginning of 1993 from 700 to almost 800 won per U.S. dollar. Between 1993 and mid 1996, it was quoted within a very narrow range of 800 to 770, and then it depreciated again, reaching 884 won per US dollar by the end of 1996. In Singapore, the currency actually appreciated in nominal terms, from a 1990 rate of 1.74 to a rate of 1.4 by the end of 1996.

Table 2.2

Growth Rates of GDP* (% p.a.)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
China	3.7	9.5	14.6	13.9	13.0	10.5	9.6	8.8	7.8
Singapore	8.7	6.7	6.3	10.4	10.3	8.0	7.6	8.5	0.1
Hong Kong	3.4	5.1	6.3	6.1	5.4	4.6	4.5	5.0	-5.3
Thailand	11.7	8.0	8.1	8.3	8.8	9.3	5.9	-1.4	-10.8
Korea	9.7	9.2	5.0	5.8	8.4	8.9	6.7	5.0	-6.7
Malaysia	9.7	8.8	7.8	8.4	9.4	9.8	10.0	7.3	-7.4
Philippines	2.7	-0.2	0.3	2.1	4.4	4.7	5.8	5.2	-0.6

* Unless otherwise indicated, figures are based on constant market prices.

Source: ADB, Asian Development Outlook 2001.

Table 2.3

Nominal Exchange Rates (National Currency/ US Dollar at the End of Period)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Japan	134.40	125.20	124.75	111.85	99.74	102.83	116.00	129.95	115.60
Singapore	1.74	1.63	1.64	1.61	1.46	1.41	1.40	1.68	1.66
Hong Kong	7.80	7.78	7.74	7.73	7.74	7.73	7.74	7.75	7.75
Thailand	25.29	25.28	25.52	25.54	25.09	25.19	25.61	47.25	36.69
Korea	716.4	760.8	788.4	808.1	788.7	774.7	844.2	1695.0	1204.0
Malaysia	2.70	2.72	2.61	2.70	2.56	2.54	2.53	3.89	3.80
Philippines	28.00	26.65	25.10	27.70	24.42	26.21	26.29	39.98	39.06

Source: IMF-IFS

Table 2.4 shows the high capital inflows as a percentage of GDP in the victim-countries. In Thailand, the capital inflows were a remarkably high 17.82 percent of GDP in 1995. This is contrasted with a 9.41 percent of GDP in 1992. The Philippines capital inflows reached 21.96 percent of GDP in 1996 vice 5.22 percent of GDP in 1990. The percentage of capital inflows to GDP of Korea and Malaysia was high 14.11 in 1996 and 17.29 in 1993 respectively.

Table 2.4

Capital Inflows* as a Percentage of GDP (%)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Singapore	21.95	3.23	20.72	32.41	20.10	23.87	29.05	52.72	-10.25
Thailand	10.85	11.59	9.41	15.67	11.17	17.82	11.88	-4.25	-8.11
Korea	3.05	4.92	5.58	6.21	7.77	10.77	14.11	7.91	-1.87
Malaysia	3.93	9.73	10.60	17.29	-1.13	7.07	5.06	9.04	4.01
Philippines	5.22	6.55	6.46	10.31	10.03	13.42	21.96	11.23	0.16

** Capital inflows include foreign direct investment, foreign portfolio investments, other investment liabilities and financial account liability from balance of payment.*

Source: calculate from IFS

International capital inflows can be an important engine of growth, if they are channeled to productive investment activities. However, the weaknesses of the Asian financial system are exacerbated by foreign capital inflows, when they are large, volatile, unsustainable, and/or poorly utilized. As seen in Table 2.4, most of the troubled-economies had large capital inflows. They also fluctuated greatly. Regarding the unsustainable, their capital inflows consisted of a large portion of short-term capital flows. Regarding the poorly utilized, the investment projects financed by external debts were not productive enough such as in the property sector. The mainly short-term foreign currency borrowing to finance domestic investments in real estate and other non-tradable activities (long-term basis), without much scrutiny as to the economic worthiness of the projects in the long run, led to financial fragility.

External debt as displayed in Table 2.5 shows that victim-countries had massive amounts of external debt. The Philippines' external debts averaged between 1990-1996 reached 60 percent. Thailand's external debts averaged 45 percent. The bulk of Thailand's external debt came in the form of offshore borrowing by banks and private corporations as shown in Table 2.6. These totaled 50.1 percent of nominal GDP in 1995. Portfolio capital inflows and FDI were 1.2 and 1.9 percent of GDP respectively in 1996. They were substantially smaller. By 1996, the gross external debt of Korea had rapidly increased to 23.36 percent of GDP. It was encouraged by the Korean government policy to finance the rapid investment project expansion by domestic banks and

chaebol. Malaysia is the only exception, where extraordinarily large FDI inflows (6.53 percent of GDP) were larger than bank and private sector borrowing (3.6 percent of GDP).

Table 2.5

External Debts as a Percentage of GDP (%)

Country	1990	1991	1992	1993	1994	1995	1996	Average 1990-1996	1997
Singapore	9.87	9.63	9.40	9.55	10.39	9.98	10.66	9.93	16.51
Hong Kong	16.52	15.39	13.93	15.42	20.52	20.94	24.61	18.19	23.66
Thailand	32.62	38.09	37.74	42.47	45.28	60.24	59.89	45.19	109.68
Korea	14.01	13.96	14.17	13.75	17.66	17.62	23.36	16.36	51.22
Malaysia	34.76	34.38	34.67	41.00	39.73	39.21	39.56	37.62	65.17
Philippines	79.49	69.29	61.29	67.51	56.85	52.02	48.59	62.15	75.26

Source: ADS and IMF-IFS

Table 2.6

Summary of Thailand's external debt

	1995	1996	1997	1998	1999	2000
Total Debt (% of Nominal GDP)	59.9	59.6	70.0	93.1	78.0	65.1
a. …of which Public Debt	9.8	9.2	15.4	28.0	29.7	27.7
b. …of which Private Debt	50.1	50.4	54.6	65.1	48.3	37.4
Long Term Debt (% of Total Debt)	48.0	56.1	65.0	72.9	79.1	81.6
Short Term Debt (% of Nominal GDP)	31.1	26.2	24.5	25.2	16.3	12.0
Short Term Debt (% of Total Debt)	52.0	43.9	35.0	27.1	20.9	18.4
Foreign Direct Investment (% of Nominal GDP)	1.2	1.2	2.3	4.6	2.9	2.3
Portfolio Investment (% of Nominal GDP)	2.0	1.9	2.9	0.4	0.3	0.1
Short Term Debt (% of Foreign Reserves)	145.3	126.3	145.9	98.6	58.5	45.9
Use of IMF Credit (% of Nominal GDP)	0.0	0.0	1.6	2.9	2.8	2.5

Source: ADB

The large amounts of capital inflows lead to a real appreciation of the exchange rate. This could hurt export performance. It also induces new pressure on underdeveloped financial systems including commercial banks and central banks. This

effect on commercial banks leads to rapid bank lending and foreign financing. The effect on the central banks contributes to deregulation and supervision of rapidly growing activities. Both of the effects increase opportunities for excessive risk taking and poor banking judgement.

The structure of the East Asian capital inflows was mainly from short-term liabilities. Current account surpluses reflecting the sustainability of the foreign exchange reserves did not take place in most East Asian countries during the 1990s. Accordingly, not only the large capital inflows, but also the foreign short-term loans affected the foreign exchange reserves, were not sustainable. As a result, an otherwise solvent country may suffer short-term liquidity when the available stock of reserves is low relative to the overall burden of external debt service. This result is a combination of interest payments and the renewal of loans coming to maturity. Liquidity problems emerge when external creditors panic. It causes them respond to rapid devaluation and makes them unwilling to roll over existing short-term credits. Hence, if a large proportion of a country's external liabilities are short-term, a crisis may take the form of a pure liquidity shortfall which is derived from the inability to roll-over its short-term liabilities. The experience of Mexico with its short-term public debt (Tesobonos) in 1994 -1995, and several Asian countries with private external liabilities in 1997 provide striking examples of liquidity problems.

In any analysis of a country's vulnerability to a panic, the strength of its reserve position has to be assessed against a broad of money measure of liquid money assets. Calvo (1995) suggests reserves must be compared with liquid monetary assets that can be converted into foreign exchange to determine the vulnerability to panic of a country. Sachs, Tornell, and Velasco (1996) employed the ratio of M2 to foreign exchange reserves to assess reserve adequacy. The higher ratio points to the country's lower ability to defend its currency or the currency's higher vulnerability to a speculative attack. The most important factor behind the increase in the ratio was rapid growth in M2. This was largely a reflection of rapid expansion of bank credit to the private sector. At the same time, an increase of the country's foreign reserves was constrained by rapid import growth fuelled largely by massive construction projects and a slowing of exports growth (from the latter half of 1995) reflecting adverse demand conditions. In most

Asian countries the ratio between M2 and foreign reserves was high as depicted in Table 2.7.

Table 2.7

Broad of Money as a Percentage of Foreign Exchange Reserves (M2/RES)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Singapore	1.29	1.26	1.16	1.06	1.11	1.06	1.05	1.04	1.30
Hong Kong		5.42	4.84	4.54	4.42	4.36	4.25	3.17	3.65
Thailand	4.56	4.19	4.15	4.08	3.90	3.71	3.91	3.57	4.57
Korea	6.63	8.27	7.34	7.05	6.75	6.22	6.35	6.09	4.13
Malaysia	3.04	3.16	2.49	1.91	2.45	3.23	3.54	3.53	2.88
Philippines	15.18	5.11	4.57	5.00	5.57	6.05	4.70	5.27	4.60

Source: IMF-IFS

When the liquidity crisis struck, foreign reserves in Korea, the Philippines, and Thailand were insufficient to cover short-term liabilities. They also could not service interest payments and repay the principal on long-term debt coming to maturity. Hence, the creditors panicked in those countries. They had to whether to roll-over existing credits or call in their loans. However, the market reactions took place under conditions of political uncertainty, low credibility of the existing governments, and the commitment to structural reforms.

2.1.3 Current account imbalances

The evidence on current account imbalances in the region over the 1990s had the potential role of current account deficits as a source of disruptive tensions in the financial markets. As shown in Table 2.8, several Asian countries whose currencies collapsed in 1997 had experienced large current account deficits in the 1990s. The two countries with the largest and most persistent current account imbalances in the sample were Thailand and Malaysia, both of which experienced deficits for over a decade.

Table 2.8

Current Account as a Percentage of GDP (%)

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Singapore	8.17	10.76	12.13	7.28	15.60	17.22	15.12	20.23	25.19
Hong Kong	4.70	2.90	5.80	7.20	2.30	-2.60	-2.50	-6.80	2.39
Thailand	-8.43	-7.64	-5.68	-5.13	-5.58	-8.16	-8.16	-3.02	11.27
Korea	-0.80	-2.92	-1.27	0.29	-0.94	-1.75	-4.64	-3.05	10.94
Malaysia	-1.97	-8.42	-3.75	-4.69	-5.92	-9.87	-4.45	-8.19	12.73
Philippines	-7.00	-2.21	-1.86	-5.67	-4.26	-2.72	-4.78	-7.17	2.25

Note: Negative values represent deficits

Source: Caculate from IMF-IFS

Since financial liberalization and deregulation led to large capital inflow during 1990s, the massive amounts of capital inflows mainly contributed to real currency appreciation. The significant real exchange rate appreciation may be associated with a loss of competitiveness and a structural worsening of the trade balance. The rise of the U.S. dollar since the spring of 1995 respective to the Japanese yen (and most European currencies), also contributed to this appreciation as the Asian countries had a dollar-

Table 2.9

Real Exchange Rates

Country	1990	1991	1992	1993	1994	1995	1996	1997	1998
Japan	132.86	124.78	118.81	106.05	99.33	94.06	111.82	125.14	136.62
Singapore	1.76	1.70	1.61	1.61	1.51	1.42	1.43	1.51	1.73
Hong Kong	10.39	9.68	9.08	8.70	8.20	7.74	7.48	7.25	7.16
Thailand	27.74	27.27	26.87	26.68	25.88	24.92	24.65	29.56	36.63
Korea	819.41	809.77	835.95	844.63	816.73	771.27	789.12	914.46	1272.42
Malaysia	2.86	2.91	2.66	2.66	2.68	2.50	2.51	2.79	3.75
Philippines	33.56	33.37	29.39	30.10	27.76	25.71	24.76	26.90	34.55

Source: calculate from IFS

pegged exchange rate regime.

Table 2.9 presents the data on the real exchange rate of the Asian countries in our sample. By the end of 1996, the real exchange rate had appreciated by 12.44 percent in Malaysia, 26.23 percent in the Philippines, 11.12 percent in Thailand, 18.7 percent in Singapore, and 27.95 percent in Hong Kong. In Korea, the currency appreciated slightly in real terms, 3.7 percent. Interestingly, all the currencies that crashed in 1997 had experienced a real appreciation.

In fact, a large part of the real appreciation occurred after 1995, in parallel with the strengthening of the U.S. dollar. Countries with more inflexible exchange rate policy rules experienced a much larger real appreciation. Conversely, countries such as Korea that followed a more flexible exchange rate regime experienced a small real appreciation.

As seen, the evidence shows that the countries with appreciating currencies generally experienced a larger deterioration of the current account. This was the case in Thailand, the Philippines and Malaysia. The appreciation of victim-currencies led to an important slowdown in merchandise exports and, subsequently, to an increase in current account deficits. In the other word, the current account deficits stemmed mainly from trade balance deficits, especially in Thailand and Malaysia. In 1996 the growth rate of total exports, as shown in Table 2.10, decreased markedly in Thailand, South Korea and Malaysia. However, the Philippines suffered a less sharp decline. The most extreme case was Thailand. These dollar value of exports actually fell –1.28 percent in 1996, after its last year of growth reached 24.79 percent. Korea's exports grew by just 3.72 percent (down from 30.25 percent growth in 1995), and Malaysia's by only 6.02 percent (down from 25.94 percent the previous year). Only the Philippines registered substantial export growth of 17.75 percent in 1996.

Table 2.10

Export Growth* (US$, % p.a.)

Country	1991	1992	1993	1994	1995	1996	1997
China	15.71	18.23	8.01	31.90	22.95	1.52	21.02
Japan	9.16	7.91	6.04	9.37	11.15	-6.63	2.24
Singapore	12.27	7.58	16.54	30.45	22.53	5.77	0.00
Hong Kong	19.98	21.25	13.19	11.93	14.77	4.02	4.05
Thailand	23.36	14.17	13.85	22.38	24.79	-1.28	3.38
Korea	10.54	6.63	7.31	16.75	30.25	3.72	4.97
Malaysia	16.70	18.42	15.75	24.53	25.94	6.02	0.27
Philippines	7.99	11.13	15.79	18.53	29.40	17.75	22.81

* Merchandise Exports, f.o.b.

Sources: Calculate from ADB Outlook 2001

The decline in exports derived from the loss of competitiveness due to the real appreciation of currencies. The entry of low producers such as China in international sectors was a manifestation of global excess supply also contributed. Moreover, the yen devalued against the U.S. dollar. The value of the US dollar increased from 84.53 yen in June 1995 to 125.51 yen in April 1997 and then to 129.38 yen in December 1997. Therefore, Japanese direct investment in the area and its market for Asian products shrank. The cost-competitiveness of most Asian countries whose currencies were effectively pegged to the dollar deteriorated. Concurrently, Japan increased its competitiveness outside Asia relative to its regional competitors (mainly South Korea, Singapore and Malaysia). This was also due to Japan's recession.

As a result, current account deficits as a percentage of GDP reached very high levels in Malaysia and Thailand, but they were also sizable in the Philippines and South Korea. Only Indonesia had a reasonable current account deficit. Contrarily, Singapore and Taiwan had current account surpluses. As shown in Table 2.8. The current account in Thailand was over 6 percent of GDP virtually every year in the 1990s and approached 8.16 percent in 1995 and 1996. Similar, large numbers were observed in Malaysia where the deficit was above 9.87 percent of GDP in 1995. The Philippines started the decade with a large imbalance (7 percent of GDP in 1990) but the deficit shrank in 1991

and 1992. Later the current account imbalance widened again, reaching 5.67 percent in 1993 and 7.17 percent in 1997. In Korea, the current account deficit was low in the early 1990s (1-3 percent of GDP) and surplus in 1993 (0.29 percent of GDP). However, since 1993 the imbalance has grown very fast approaching 4.64 percent in 1996.

2.2 Moral Hazard Problem

Traditionally, analysts have viewed crises as the result of fundamental macroeconomic and policy weaknesses. Several papers argue that the main problem in East Asia was not macroeconomic imbalances, but rather moral hazard induced **financial system fragility**. A number of authors have argued that implicit government guarantees of foreign currency liabilities of the domestic banks contributed to the financial crisis in Asia. McKinnon and Pill (1996) started with the effect of the credit market liberalization which generated the optimism. The optimism derived from high profit expectations from investment projects. Investors believed that the financial liberalization allowed the potential economies. If the optimism reflected the real economies, it would not damage the financial systems. However, there were the government explicit and implicit guarantees of domestic financial intermediaries' liabilities. This caused the moral hazard. If we accept that the expected return rates are random variables providing the probability density function (pdf). The financial intermediaries would not consider the left-side of the pdf, because, it provided the loss. That is the responsibility of government. Therefore, the financial intermediaries would not include the left-side of the pdf in their decisions. In the financial intermediaries views, the average of returns allowed the higher than the real returns. As a result, the role of implicit government guarantees allowed the over-investments and over-credit expansion. Mishkin (1997) considered the vulnerable financial institutions after financial liberalization. He based his observations on moral hazard theory. He found that financial liberalization without good financial supervisory systems damaged the financial system. The harmful effects derived from the rapid growth of credit expansion after financial liberalization. Calvo (1998) opined that a sovereign government has an incentive to subsidize foreign capital inflows to overcome the problem of its own moral

hazard in setting trade, fiscal and monetary policies. Obstfeld (1998) observed that government guarantees of foreign currency deposits in the event of devaluation appear to be an implicit companion to a pegged exchange rate regime. The emphasis on the fragility of the banking sector bears much in common with the description and analysis of the East Asian crisis by Corsetti, Pesenti and Roubini (1998d). Other models that elaborate on the role of public sector guarantees of foreign currency debt and domestic banking include Burnside, Eichenbaum and Rebelo (1999).

The moral hazard in Asia magnified the financial vulnerability of the region during the process of financial market liberalization in the 1990s. In the early 1990s, financial institutions in East Asian economies, especially commercial banks and finance companies but also private individual and companies, were given vast opportunities to engage in high-risk, high-return property and stock markets. Due to under-regulated liberalization, financial institutions entered new areas of business. Domestic firms became free to borrow both domestically and internationally. Hence, the financial fragility was generated by the dangers of financial liberalization under fixed exchange rates and free international capital flows. The key weaknesses were in the private sector where there were poor corporate structures in which the focus was on increasing scale and market share rather than on economic returns. There was also weak supervision and regulation of the financial system, connected and directed lending, and implicit and explicit guarantees of financial institution liabilities. Especially important factors were implicit guarantees of bank deposits but weak domestic financial supervisory systems. All of these factors created a serious moral hazard problem. These financial distortions in turn led to the build up of weak bank and nonbank balance sheets and increasingly fragile East Asia financial systems.

With regards to government guarantees, in Korea, Thailand, and Malaysia, bank deposits were implicitly guaranteed by the government, as no domestic bank was ever allowed to fail and close. Failing banks were usually taken over by the government and forced to restructure or merge with another bank. Singapore did not provide explicit bank deposit guarantees but, in the absence of domestic bank failures or takeovers, it is difficult to assess the extent of implicit guarantees to depositors. Foreign loans to the domestic banking sector were implicitly guaranteed in each instance. In addition, a

large share of lending and investment decisions in the Asian countries were not made by a decentralized open capital market via arms-length transactions. They were rather influenced by personal and business relationships or government influence. In some cases, banks were controlled directly or indirectly by the government and directed credit to politically favored firms, sectors, and investment projects (Krugman, 1998). Consequently, the financial liability counterpart of the moral hazard problem in investment was the incentive for Asian financial institutions to expand their liabilities excessively. Generally, this was done by borrowing from abroad.

Evidence on the lending boom in the 1990s is provided by the data on the growth of bank credit to the private sector and the ratio of private sector lending to GDP. These are shown in Table 2.11 and 2.12 respectively. Also, Sachs, Tornell and Velasco (1996), provide a synthetic measure of the lending boom by calculating the rate of growth of bank lending as a percentage of GDP ratio in the 1990s. This is depicted in the last column of Table 2.12. This is an indirect measure of the financial fragility suggested by Sachs, Tornell and Veloasco (1996). This variable is the rate of growth between 1990 and 1997 of the ratio between the claims on the private sector of the deposit money banks and nominal GDP. In the case of transition economies where data since 1990 are not available or the ratio is very unstable in the early transition years, 1992 is used (rather than 1990) as the starting date.

Table 2.11

Bank Lending to Private Sector* Growth (%)

Country	1991	1992	1993	1994	1995	1996	1997
Japan	5.29	2.33	-1.12	0.20	1.68	1.17	0.51
Singapore	12.41	9.77	15.15	15.25	20.26	15.82	12.68
Hong Kong	-1.37	10.17	20.15	19.93	10.99	15.75	20.10
Thailand	20.45	20.52	24.03	30.26	23.76	14.65	22.21
Korea	20.78	12.55	12.94	20.08	15.45	20.01	21.95
Malaysia	20.58	10.79	10.80	16.04	30.65	20.82	23.34
Philippines	7.30	24.66	40.74	26.52	45.40	48.72	28.79

* *Claims on private sector*

Source: IMF-IFS

Table 2.12

Bank Lending to Private Sector as a Percentage of GDP* (%)

Country	1990	1991	1992	1993	1994	1995	1996	1997	% change between 1992-1997*
Singapore	83.95	84.82	86.11	85.16	85.66	92.97	98.87	102.10	18.57
Hong Kong	165.14	141.94	134.14	139.95	149.02	155.22	162.37	175.57	30.89
Thailand	64.52	67.70	72.24	80.01	90.91	97.70	101.73	121.20	67.78
Korea	52.76	52.62	52.19	52.19	53.77	53.20	57.57	64.82	24.20
Malaysia	69.41	73.76	73.28	71.05	72.63	83.37	88.32	98.05	33.80
Philippines	19.17	17.76	20.44	26.37	29.06	37.53	48.98	56.46	176.17

* *A synthetic measure of the lending boom suggested by Sachs, Tornell and Veloasco (1996)*

Source: IMF-IFS

Between 1992 and 1997, the ratio of bank lending to GDP of Thailand grew by 67.78 percent. In Thailand went from 72.24 percent to 121.20 percent of GDP. The Philippines grew 176.17 percent, it increased from 20.44 percent to 56.46 percent of GDP. Malaysia grew 33.8 percent, it went from 73.28 percent to 98.05 percent of GDP. Lending growth was as high or higher if increases in nonbank financial claims on the private sector are included. This is particularly true in the case of Korea. These bank

and nonbank financial claims grew almost 40 percent between 1990 and 1996 from 98 percent to 140 percent of GDP.

Much of the new lending was financed by the banks borrowing offshore. This is presented in Table 2.13. In Korea, foreign liabilities of the banking system more than doubled from 4.3 percent of GDP in 1993 to 8.7 percent of GDP in the end of 1996. In the Philippines, these liabilities soared from 8.8 percent of GDP at the end of 1995 to an astonishing 17.4 percent of GDP at the end of 1996, just 12 months later. The most extreme case was Thailand where, after the introduction of the BIBF, foreign liabilities of banks and financial institutions increased rapidly to over 28 percent of GDP by 1995.

Table 2.13

Foreign Liabilities as a Percentage of GDP (%)

Country	1990	1991	1992	1993	1994	1995	1996	1997
Singapore	65.45	54.17	60.58	55.41	56.11	55.94	60.16	74.89
Hong Kong		537.61	460.87	411.13	445.76	445.34	376.36	349.50
Thailand	5.03	4.94	5.92	11.12	21.46	27.81	27.11	40.29
Korea	4.08	4.85	4.70	4.31	5.16	6.46	8.71	10.46
Malaysia	6.83	8.70	12.40	18.29	8.70	7.13	11.20	17.04
Philippines	6.18	4.40	5.56	5.47	6.69	8.83	17.39	25.38

Source: IMF-IFS

Furthermore, a rising share of foreign borrowing was short-term debt. This was especially true in Korea and Thailand. Short-term debts to total debts ratio in these three countries reached 50.2, 41.4, and 24.9 percent respectively at the end of 1996. This is shown in Table 2.14. In Thailand and Korea, the two countries hardest hit by the crisis, the ratio of short-term debt to foreign exchange reserves in 1996 exceeded 100 percent after 1994. This is shown in Table 2.15. A ratio greater than 100 percent is not by itself sufficient to spark a crisis since it can be sustained as long as foreign creditors are willing to roll over their loans. A high ratio, however, does indicate vulnerability to a crisis.

Table 2.14

Short-Term Debts as a Percentage of Total Debts (%)

Country	1990	1991	1992	1993	1994	1995	1996
Singapore	17.51	18.92	19.91	17.87	13.28	14.56	19.81
Hong Kong	45.97	46.63	45.89	41.19	30.04	28.36	43.57
Thailand	29.63	33.13	35.22	53.01	60.67	72.36	41.41
Korea	30.87	28.19	26.99	25.85	25.47	51.60	50.20
Malaysia	12.43	12.14	18.18	26.58	21.13	21.19	27.83
Philippines	14.48	15.24	15.93	14.01	14.29	13.38	19.34

Source: World Bank

Table 2.15

Short-Term Debts as a Percentage of Foreign Reserves (%)

Country	1990	1991	1992	1993	1994	1995	1996
Singapore	2.65	2.67	2.35	2.04	1.75	1.78	2.60
Hong Kong	23.52	21.78	18.38	17.09	16.49	14.16	22.35
Thailand	62.55	71.31	72.34	92.49	99.48	114.21	99.69
Korea	72.13	81.75	69.62	60.31	54.06	171.45	203.23
Malaysia	19.54	19.05	21.12	25.51	24.34	30.60	40.98
Philippines	479.11	152.31	119.37	107.68	95.00	82.85	79.45

Source: World Bank

The mainly short-term foreign currency borrowing to finance domestic investments in real estate and other non-tradable activities (long-term basis) was done without much scrutiny as to the economic worthiness of the projects. In the long run, this led to the financial fragility. The foreign debts were massively unhedged. They were magnified by the impact of exchange rate changes during the crisis. The large capital losses on banks were imposed by the depreciation in local currencies. As a result, balance sheets in banks and other financial institutions featured a growing maturity and currency mismatch between liabilities (borrowing) and assets (lending).

CHAPTER III

LITERATURE REVIEW

This section observes the empirical works studying crises in several ways. I divided it into major two parts: the contagion effect and fundamental economic weaknesses.

3.1 Empirical Evidence of Contagion

Empirical examination of the evidence for contagion has largely focussed on comovements in asset prices. Much less work has been done on excessive comovements in capital flows or disturbances in real markets. We discuss tests under the following categories: correlation of asset prices; conditional probabilities of currency crisis; changes in volatility; co-movements of capital flows and rates of return; and other tests.

3.1.1 Correlation of asset prices

To explain how shocks can be transmitted across markets, the asset price tests were proposed. It consists of estimates of correlation coefficients of changes in interest rates, stock prices, and sovereign spreads of different economies (Forbes and Rigobon, 1999). These tests measure the correlation in returns between two markets during a stable period and then test for a significant increase in this correlation coefficient after a shock. Under this approach, a significant increase in cross-correlations among different countries' markets after a shock is considered as evidence of contagion. Most studies estimating correlations among markets find evidence of large comovements in a variety of asset returns, although there is less of a consensus on whether such comovements increases are the trigger of a crisis. A number of studies suggest that the Mexican crisis in 1994 was contagious. Calvo and Reinhart (1996) used this approach to test for contagion after the Mexican peso crisis in 1994. They found evidence that the correlation of weekly returns on equities and Brady bonds between Asian and Latin

American emerging markets increased significantly. Baig and Goldfajn (1998) used this framework to test for contagion in stock indices, currency prices, interest rates, and sovereign spreads in emerging markets during the East Asian crises. They found that the cross-country correlations significantly increased during the crisis period (from July 1997 to May 1998) compared to other periods.

However, a significant increase in correlations among different countries' markets may not be sufficient confirmation of contagion. If markets are historically cross-correlated, then a sharp change in one market will naturally lead to changes in the other markets. Markets could also exhibit an appreciable increase in correlations during crisis periods. Forbes and Rigobon (1998a) attempted to correct for heterogeneity, endogeneity and omitted variables has shown that the bias from these problems is not insignificant and will affect estimates of contagion. They show that in the presence of heteroskedatisticity of asset price movements, which is likely as volatility increases following a crisis. They also show that an increase in the correlation of asset prices may result when changes in economic fundamentals, risk perception, and preferences are correlated without any additional contagion being present. Because of this endogeneity, estimates of correlations must consider the comovement in these variables during normal times and for the effects of fundamentals in order to be able identify pure contagion.

Forbes and Rigobon (1999) investigate, using daily data for stock indices of up to 28 developed countries and emerging markets the evidence of contagion. The study concerned the 1987 US stock market crash, the 1994 Mexican peso crisis and the 1997 East Asian crisis. They show that correlation coefficients across multi-country returns are not significantly higher during crisis periods. This is true if the problems of endogenous variables, omitted variables and changes in the variance of residuals are properly corrected for.

Thanyalakpark and Filson (2001) investigated the contagion effects in the context of herding behavior across eight developed and emerging East Asian markets during the Asian currency crisis of 1997. They applied the stationary multivariate asymmetric GARCH to calculate the time-varying cross-market correlations matrix without the bias in the conventional correlation coefficient. They examined how

correlations among stock markets change during a crisis. They found that both increases and constant in the correlations after the occurrence of the crisis were consistent with the contagion effect. The result indicated that the pattern of conditional correlation has decreased while the conditional volatility has increased significantly during the crisis. Therefore, the region's equity markets volatility processes represent interdependence but little contagion. The contagion took place only between Thailand and Korea.

3.1.2 Conditional probabilities

Another way to control for the role of fundamentals is to study the conditional correlation or probabilities rather than raw correlations and thus use a narrower definition of contagion. The most commonly used methodology, introduced by Eichengreen, Rose, and Wyplosz (1996), Sachs, Tornell and Velasco (1996), is to examine whether the likelihood of crisis is higher in a given country when there are crises in one ("ground-zero") country or several countries.

This approach estimates the probability of a crisis conditional on information of the occurrence of a crisis elsewhere, contemplated fundamentals or similarities. One advantage of this definition is that it readily allows statistical tests of the existence of contagion. These tests can also try to investigate the channels through which contagion may occur, distinguishing, among others, trade and financial links. Eichengreen, Rose, and Wyplosz (1996) and Kaminsky and Reinhart (2000) estimate probit models to test how a crisis in one country affects the probability of a crisis occurring in other countries. They apply a panel of quarterly macroeconomic and political data covering 20 industrial economies from 1959 through 1993. They show that the probability of a domestic currency crisis increases with a speculative attack elsewhere and that contagion is more likely to spread through trade linkages than through macroeconomic similarities. Using a similar methodology, De Gregorio and Valdes (1999) conducted an extensive test of spillovers of the 1982 debt crisis, the 1994 Mexican crisis and the Asian crisis. They used indexes of exchange rates pressures over 3 and 12-month horizons, real exchange rate movements, and changes in credit ratings. They found that the Mexican

crisis was the least “contagious” while the Asian crisis was as “contagious” as the 1980s crisis.

Glick and Rose (1998) applied a similar approach to five episodes of currency crises and 161 countries. They found that trade linkages are important in propagating a crisis above and beyond macroeconomic and financial similarities. The trade channel for contagion seems consistently important in both statistical and economic terms. While the economic size of the effect varies significantly across episodes, it is consistently different from zero at conventional levels of statistical significance. Its consistently positive sign indicates that a stronger trade linkage is associated with a higher incidence of a currency crisis. On the other hand, the macroeconomic controls such as trade share, percentage change in credit, ratio of budget to GDP, ratio of current account to GDP, real growth, ratio of M2 to reserve and inflation are small economically and rarely of statistical importance. They argue that contagion tends to be regional vice global because trade tends to be more intra-regional than inter-regional. Kaminsky and Reinhart (2000) discovered that, in the context of conditional probabilities, information about a large share of crisis countries in the sample increases the predictability of the knowledge of a crisis elsewhere. This is particularly true at a regional level. Their study further supports the evidence that contagion has been a primarily regional phenomenon.

The evidence on the trade channel as an explanation of the regional nature of contagion appears more relevant for Latin America than for East Asia. Kaminsky and Reinhart (1998) found that the possibility of a crisis spreading through third party linkages among Latin American countries (Brazil, Colombia, Mexico, and Venezuela) is high. Similar linkages, however, are not significant in East Asia. Among Latin American countries, Brazil, Colombia, Mexico, and Venezuela have the largest share of bilateral trade with the U.S. Baig and Goldfajn (1998) analyzed the trade matrix of East Asian countries and found that trade linkages among those countries are weak. They argue that trade linkages were not important in spreading the crisis through East Asia in 1997.

Kaminsky and Reinhart (1998) examined the significance of the common creditor channel. They found that the probability of a crisis in Indonesia, Malaysia, and Thailand, countries massively dependent on Japanese commercial bank lending,

increases with the knowledge that one or two of these countries has a crisis. Similar results were found in the case of Latin America where the conditional probability of a crisis in one Latin American country when several other Latin American countries already faced crisis was estimated as high as 78 percent. Latin American countries obtain a large portion of credit from American commercial banks which are a common creditor to Latin America. Similar effects appear present for other types of investors.

3.1.3 Volatility spillover

The third approach to testing for contagion is to apply a GARCH framework to estimate the variance-covariance spillover mechanism across countries. Edwards (1998) examined whether the effects of the rise in Mexican interest rates in 1994 spilled over into Argentina and Chile. He estimated an augmented GARCH model and found that there was strong evidence of contagion from Mexico to Argentina, but not from Mexico to Chile. His tests indicate that volatility was transmitted from one country to the other, but they do not indicate if this propagation changed during the crisis. Park and Song (1998) applied a GARCH model to East Asian data to test whether a volatility spillover among foreign exchange markets in East Asian countries occurred during the crisis period. They found that the effects of the crisis in Indonesia and Thailand were transmitted to the Korean foreign exchange market. The Korean crisis, though, was not contagious to the two Southeast Asian countries. However, these approaches do not control for fundamentals and so do not distinguish between pure and fundamental based contagion.

3.1.4 Capital flows tests

There have been few tests of the comovements of capital flows which can provide the best insights into the channels of transmission of contagion. Froot, O'Connell and Seasholes (1999) studied the behavior of portfolio flows by US and other investors in and out of 44 countries from 1994 through 1998. They find strong evidence of investor positive feedback trading (trend following). They also find regional factors in the correlations of flows which appear to be increasing in importance over time. This

suggests that the actions of institutional investors could be a channel for transmission of shocks.

This is confirmed by the evidence of Kaminsky, Lyons, and Schmukler (1999) who analyzed mutual funds at the portfolio level over several crisis periods. They found that emerging-market funds exhibit positive momentum, i.e., they systematically buy winners and sell losers in both crisis and non-crisis periods. Contemporaneous momentum (buying current winners and selling current losers) is stronger during crises, whereas lagged momentum (buying past winners and selling past losers) is stronger during non-crisis periods. Momentum was the strongest during the 1994 crisis in Mexico. Importantly, they find that funds use contagion strategies, i.e., they sell assets from one country when crisis hits another. This provides strong evidence of the presence of contagion through the actions of portfolio investors.

3.1.5 Other tests.

Most empirical papers find that macroeconomic weaknesses are an important cause of contagion as they make a country vulnerable to a crisis. Similarities in macroeconomic weaknesses can, however, also lead to a shift in investors' expectations since investors consider these signals as sorting devices and thereby are a cause for a crisis. Goldberg, Dages and Kinney (1999) found that foreign–owned banks may have had a stabilizing influence on overall banking sector credit growth. This potentially reduces a country's vulnerability to crisis. There have been few tests which use structural models to explain the degree of spillovers in real and financial markets. One is the application of a full trade model for crisis-affected East Asian countries by Abeysinghe (1999). He found that although transmission through trade played an important role, the immediate economic contractions are largely a result of direct shocks. These are attributable to pure contagion.

3.2 Fundamental Economic Weaknesses

Fundamental economic weaknesses play a role in and significantly contribute to the crisis. Numerous papers applied the model to explain the causes of the crisis.

Kaminsky and Reinhart (1996) analyzed the links between banking and currency crises. They found that the currency crisis was deepen by the banking crisis and that financial liberalization often precedes banking crises. They examined the empirical regularities and the sources and scope of problems in the trigger of 76 currency crises and 26 banking crises. They found that banking and currency crises are closely linked in the aftermath of financial liberalization. Banking crises, in general, begin before the currency collapse. They also found evidence of vicious cycles in which the currency collapse further undermines an already ailing banking sector. Finally, in both crises they found a multitude of weak and deteriorating economic fundamentals suggesting that it would be difficult to characterize them as self-fulfilling crises. Sachs, Tornell, and Velasco (1996) examined Mexico's unexpected financial crisis in 1994, and presented a model with three factors determining a country's vulnerability to financial crisis, which are large appreciation in real exchange rate, weak banking system, and low levels of foreign exchange reserves. They suggested that the countries experienced lending booms are likely to get suffer currency crises, and that all M2 is a central bank's liabilities resulting from implicit or explicit government guarantee. Linkage between financial liberalization and lending boom is find. They stated financial liberalization without prudential supervision can lead to sharp lending boom by both banks and non-bank financial institutions, and finally to a financial crisis of a country. Kerdpon (1997) examined leading indicators on two financial crises in Thailand, which occurred in 1983-1984 and 1997, by multivariate logit model. She used various macroeconomic variables expected as the leading indicators. She found that seven variables, which are SET index, international reserves, commercial bank deposits, real exchange rate, the ratio of M2 and international reserves, current account, and the ratio of lending interest rate to deposit rate, can signal financial crises in Thailand. However, behavior and trend of leading indicators are different for the two crises. Radelet and Sachs (1998a) examined the broad characteristics of financial crises in Mexico in 1994-95, Argentina in 1995, and the five East Asian crisis economies in 1997. Each of these incidents displayed elements of self-fulfilling crises. Capital withdrawals by creditors cascaded into a financial panic and result in an unnecessarily deep contraction. East Asian was hit by several international macroeconomic shocks during 1994-1996. These included a

dramatic surge by competitor economies (especially China and Mexico) and the abrupt reversal of the long-term trend towards appreciation of the yen via-a-vis the dollar. These international factors interacted with growing weaknesses in the East Asian financial systems to provoke the crisis. Each of the five crisis economies had initiated, but not completed, the process of financial sector liberalization and reform. The partial reforms led to increasingly fragile financial systems characterized by growing short-term foreign debt, rapidly expanding bank credit, and inadequate regulation and supervision of financial institutions. These weaknesses, in turn, left the Asian economies vulnerable to a rapid reversal of capital flows. They pointed out that while the East Asian economies continued to achieve rapid economic growth in the 1990s, there were indeed growing imbalances and weaknesses in the East Asian economies. These both were at the microeconomic and macroeconomic levels. Several aspects of the buildup to the crisis are worth highlighting: capital inflows, exchange rates pegged, real exchange rate appreciation, slow export growth, domestic lending boom and a rise in short-term foreign borrowing. Furthermore, they listed three broad categories of explanations for the East Asian crisis. First, shifts in international markets such as a new global glut in labor-intensive manufactured exports, the rise of China and the sharp real appreciation of the U.S dollar vis-à-vis the European currencies and the yen contributed to the crisis. Second, growing weaknesses and mismanagement in the Asian economies increased their economic vulnerability. Asia's haphazard and partial financial liberalization, coupled with pegged exchange rates, seems to have worsened the allocation of investment funds within the economy. Third, instabilities intrinsic in the international capital markets led to the crisis. Their further study, Radelet and Sachs (1998b) discussed the role of financial panic in the Asian crisis. As the crisis was generated from the large short-term foreign capital inflows to financial system of regional countries caused by the financial vulnerability, financial panic erupted due to its financial vulnerability. They explore this possibility by examining the initial imbalances and weaknesses, the buildup to the crisis and the events that led to the financial panic. There were macroeconomic imbalances, weak financial institutions, widespread corruption, and inadequate legal foundations in each of the affected countries. These factors clearly contributed to the vulnerability of the Asian economies. They used the

probit analysis to test their hypothesis. They found that while there were significant underlying problems and weak fundamentals besetting the Asian economies at both a macroeconomic and microeconomic level, the imbalances were not severe enough to warrant a financial crisis of the magnitude that took place in the latter half of 1997. In their view, certain policy choices and events along the way exacerbated the panic and unnecessarily deepened the crisis. Corsetti, Pesenti and Roubini (1998c) examined the importance of structural problems and fundamental weaknesses generating the East Asian crisis as a contagion effect. They found that the relationship between the currency volatility and financial fragility index led to the crisis. They constructed a crisis index. This is the weighted average of the percentage rate of exchange rate depreciation relative to U.S. dollar and the percentage rate of change in foreign reserves. They also need an index of financial fragility index. This is a combination of non-performing loans index and lending boom indicators, the index of current account imbalance and the index of foreign reserves adequacy. Their methodology was regression analysis. They examined the relationship between the crisis index as a fundamental imbalance and financial fragility index, current account index and foreign reserve adequacy index. They found that the significance of structural imbalances generated the crisis. A recent work is Yoshitomi and Ohno (1999) who stated that the capital account crisis combined with internal credit contraction can explain the Asian crisis during 1997-1998. Similar to most of the studies in this area, Yoshitomi and Ohno (1999) characterized the capital-account crisis as a massive international capital inflow greatly surpassing the underlying current-account deficit. As well, the composition of such an inflow was dominated by short-term, foreign currency denominated loans. The resultant double mismatched both currency and maturity in the balance sheets of domestic financial institutions. These were responsible for the subsequent twin financial crises: currency precipitation accompanied by international liquidity crisis on the one hand and domestic banking crisis leading to credit contraction on the other.

Mei (1999) examined the impact of political uncertainty in financial crises in emerging markets regarding both currency and market volatility. The political election cycles were used as political dummy variables. He used a combination of probit and switching regression analysis. To control the economic condition variables, he applied

the risk indicators as follow Relalet and Sachs (1998b) in his model of financial crisis in emerging markets during the period 1994-1997. To further control the market contagion effects, he also put a regional contagion variable into his probit analysis. The data from 22 emerging countries for the years 1994-1997 were employed. He found that the financial crisis was affected by the political risk without the effects of the different economic condition and contagion. He also discovered an increase in market volatility in emerging markets during the political election periods.

Bustelo, Gaicia, and Olivie (1999) introduced a new approach to identify the causes of the East Asian financial crises. This new approach might be fruitful in reassessing the analyses and theories of financial crises in emerging economies. In their empirical analysis of the macroeconomic situation in the East Asian countries were affected by the financial crises (Indonesia, Malaysia, the Philippines, South Korea and Thailand). They studied how the current financial globalization process brings about an increase in the vulnerability of emerging markets to crises. Such vulnerability arises from two different causes. First, globalization enhances the inherent failures of capital markets, leading to an increase in uncertainty. Second, globalization impinges upon the pace and order of domestic financial liberalization of emerging markets and facilitates massive flows of capital to such markets. This leads to domestic financial vulnerabilities. The East Asian countries suffered an increase in financial vulnerabilities from both causes. Therefore, these vulnerabilities resulting from financial globalization together with intermediate fundamentals fueled a shift in private expectations. This led to the East Asian financial crises. Thanapornpun (2000) mentions about Thailand bubble economy primarily come from outside-country factors and the bubble occurs in real estate market before in stock market. Real estate boom in Thailand had started in 1985, resulting from Japan economic excessive that flowed into Thai market at that time. Japanese came to Thailand for travelling and golf, so many resorts and golf projects had emerged to response them. In addition, high growth economic rate in domestic increased needs in these projects to serve Thai people. These two factors spurred speculation in real estate market. Domestically economic excessive, together with foreign capital inflow after Black Monday, were invested in stock market. Land and stock prices had been spinned over their real value and it leads to bubble economy. Dekle

and Kletzer (2001) focus on the relationship between foreign capital inflows, economic growth and subsequent banking crises under a fixed exchange rate. A key element of their model is that the government provides implicit guarantees of the foreign currency liabilities incurred by domestic banks. They proposed a theoretical model that formalizes this interpretation. The model concentrates on the interactions between domestic financial institutions, the regulation and subsidization of domestic financial intermediation by the government and foreign capital inflows leading up to a financial crisis. The model generated a path for domestic bank lending, capital accumulation and the growth of the foreign currency debt of domestic banks. This ultimately leads to a financial crisis with the collapse of the fixed exchange rate regime.

Demirgüç-Kunt, A., and Detragiache E. (1998) developed the financial liberalization dummy variable and banking crisis dummy variable for a large number of developed and developing countries to evaluate the relationship between banking crises and financial liberalization by using a multivariate logit model. The logit regression estimated the probability of a banking crisis as a function of the financial liberalization dummy variable and of a set of control variables. The banking crisis dummy variable is equal one if there is a crisis and zero otherwise. The criteria of the banking crisis condition is the ratio of non-performing assets to total assets in the banking system exceeded 10 percent; the cost of the rescue operation was at least 2 percent of GDP; banking sector problems resulted in a large scale nationalization of banks; extensive bank runs took place or emergency measures such as deposit freezes, prolonged bank holidays, or generalized deposit guarantees were enacted by the government in response to the crisis. The financial liberalization dummy variable is equal zero for periods in which interest rates were subject to controls, and one when liberalization begins. They found that the financial liberalization dummy variable is strongly positively correlated with the probability of a banking crisis. The banking crises are more likely to take place in liberalized financial systems.

CHAPTER IV

METHODOLOGY AND DATA DESCRIPTION

4.1 Methodology

This study is undertaken to develop a stock market volatility model at a point in time. In general, the returns of emerging markets are claimed to have higher volatility than developed market returns. The study introduces the approach of the volatility of stock market returns in each country at the point in time, applying constant conditional variance estimates from an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) process. This specifies the international capital asset pricing model following Thanyalakpark and Filson (2001). In the asymmetric GARCH process, volatility responds more to negative shocks than to positive ones. The standard GARCH model allows for the variance to change over time as a function of past errors and the past conditional variance but assumes that volatility responds symmetrically to positive and negative shocks. Numerous papers such as Engle and Ng (1993), Erb, Harvey, and Vishanta (1996), Kroner and Ng (1999) and De Santi and Gerard (1999) have argued that volatility processes increase more following negative shocks than following positive ones. During the crisis, moreover, mostly negative shocks were experienced. The symmetry restriction in GARCH leads to a downward bias in the volatility processes. Consequently, I believe that the asymmetric GARCH used in this study is superior.

According to the stock market volatility derived from this study is defined as the financial crisis. I apply the Generalized Least Squares (GLS) to investigate whether the Asian financial crisis can be explained by fundamental economic weaknesses. If the fundamental economic variables have significant effects on the volatility, it implies that the East Asian financial crisis was caused by fundamental economic weaknesses and not by contagion.

In this chapter, I divided into two parts. The first part discusses the asymmetric GARCH process specification of the capital asset pricing model to calculate the volatility

of stock market returns in each country at the point in time. The second part addresses the GLS estimation test for whether fundamental economic weaknesses can explain the East Asian financial crisis of 1997-1998.

4.1.1 The capital asset pricing model and the asymmetric GARCH estimation procedure

To compute the volatility of stock market returns in this paper, I employed the asymmetric GARCH estimation following Thanyalakpark and Filson (2001). The study starts with the stock market returns computation by an international capital asset pricing model (ICAPM). The one-factor ICAPM is developed to indicate the relation between country returns and world market return.

$$E(R_{it}) = R_{ft} + \beta_{it}[E(R_{Mt} - R_{ft})] \qquad (1)$$

where R_{it} is the nominal excess returns on asset i, R_{mt} is the nominal excess on world market portfolio between time t-1 and time t, R_{ft} is the risk-free rate and β_{it} is a systematic risk or nondiversificable risk of asset i. It can be transformed to the ratio of the covariance between the return on asset i and the return on the world market index and the variance of market return portfolio as follow equation (2).

$$\beta_{it} = \frac{COV(R_{it}, R_{Mt})}{VAR(R_{Mt})} \qquad (2)$$

Then, we can transform equation (1) to be

$$E_{t-1}(R_{it}) = \lambda_{t-1} COV_{t-1}(R_{it}, R_{Mt}) \qquad (3)$$

In the one factor ICAPM, the expected excess return on an asset is proportional to the systematic risk of the asset as measured by its covariance with a market-wide portfolio return. λ_{t-1} is the world aggregate risk aversion coefficient. That is constrained to be non-negative and referred to as the price of market risk following the

work by Bekeart and Harvey (1995). One can view the price of market risk as the expected compensation that investors receive for taking on a unit of covariance risk. There are two assumptions under the above specification. First, all returns in this study are expressed in U.S. dollars; therefore, the investor is not assumed to be covered against currency risk. Second, the capital market is assumed to be fully integrated. Hence, the world market systematic risk is the only priced risk under the international equity markets. The expected returns are not affected by domestic factors. Since I want to use a multivariate version of a generalized ARCH process to test the pricing implications of the ICAPM, one needs to assume that the following model in equation (1) has to hold for every asset, including the market portfolio.

$$R_{it} - R_{ft,i} = \lambda_{M,t-1} h_{Mt} + \varepsilon_{it} \qquad (4)$$

where i is a vector of ones, H_T is the n x n conditional covariance matrix of asset returns, h_{Mt} is the n^{th} column of H_T which includes the conditional covariance between each asset and the market portfolio, therefore, measures the exposure to market risk, and ε_{it} is the vector of shocks which represents a shock or a fluctuation for each stock market index i. It also is used to compute the conditional volatility numbers.

In order to carry out this study, it is necessary to apply an asymmetric GARCH and feedback in the covariance process, as proposed by De Santis and Gerard (1997). The asymmetric GARCH in this study will follow the method of Thanyalakpark and Filson (2001). I assume that the ε_t is covariance stationary. Given this assumption, the process H_t, follows can be computed as a function of model parameters:

$$H_t = C_0 + A' \varepsilon_{t-1} \varepsilon'_{t-1} A + B' H_{t-1} B + G' \eta_{t-1} \eta'_{t-1} G \qquad (5)$$

where H_t is nxn conditional covariance matrix of asset returns, C_0 is a [n(n+1)/2] matrix of unknown parameters, A, B, and G are nxn matrices of unknown parameters, and η_{t-1} = ε_{t-1} if $\varepsilon_{t-1} < 0$ and otherwise. In equation (5), the conditional variance and covariance of each return are related to its past squared cross residuals, past squared asymmetric shocks and past squared cross asymmetric shocks of all returns as well as to past

conditional variance and covariance of all residuals. Among others, Bekaert and Wu (2000) and Kroner and Ng (1998) suggest that this specification accommodates the contagion and asymmetry effects in volatility and covariance. Unfortunately, estimating the system with all 11 assets is extremely difficult because there are too many unknown parameters to estimate. To reduce the size of the parameter space, I assume that each asset's variance is affected only by its own residuals and its past conditional covariance. This study further assumes that only the market asymmetric shocks affect individual assets volatility and covariance.

The parameter matrices A, B and G have the following form:

$$A=\begin{bmatrix} a_{11} & 0 & \cdots & 0 \\ 0 & a_{22} & & \\ \vdots & & \ddots & \vdots \\ 0 & 0 & \cdots & 0 \end{bmatrix} \quad B=\begin{bmatrix} b_{11} & 0 & \cdots & 0 \\ 0 & b_{22} & & \\ \vdots & & \ddots & \vdots \\ 0 & 0 & \cdots & b_{mm} \end{bmatrix} \quad G=\begin{bmatrix} 0 & & \cdots & 0 \\ \vdots & \ddots & & \vdots \\ 0 & & 0 & 0 \\ g_{m1} & g_{m2} & \cdots & g_{mm} \end{bmatrix}$$

This specification maintains enough flexibility in modeling all conditional variances and covariances. Having variance and covariance feedback and asymmetry off all equity assets depending on the market shocks makes intuitive sense, since the market portfolio experiences a (large) negative shock only when a large fraction of the country portfolios experiences (large) negative shocks. This implies that the volatility feedback and asymmetry of both small and large stock portfolios stems mostly from shocks in the large stock portfolio.

Finally, I follow De Santis and Gerard (1997) to further reduce the number of unknown parameters; I assume the $\boldsymbol{\varepsilon}_t$ process to be covariance stationary. After I apply the covariance stationary into a system, I can derive the unconditional covariance matrix (H_0) as follows:

$$Vec(C_0) = [I_m - (A \otimes A)' - ((I_m .b) \otimes (I_m .b))' - \frac{1}{2}(G \otimes G)'.Vec(H_0) \qquad (6)$$

where H_0 is the unconditional covariance matrix of residuals.

Lastly, I follow Ding and Engle (1994) approach, in replacing Vec (C_0) with the expression on the right-hand side of equation (6). This last specification further reduces the number of unknown parameters, as one needs to perform an estimation only with respect to A, B and G. Under the assumption of conditional normality, the log-likelihood function can be written as

$$\ln L(\theta) = -\frac{TN}{2}\ln 2\pi - \frac{1}{2}\sum_{t=1}^{T}\ln|H_t(\theta)| - \frac{1}{2}\sum_{t=1}^{T}\varepsilon_t(\theta)'H_t(\theta)^{-1}\varepsilon_t(\theta) \qquad (7)$$

where θ is the vector of unknown parameters in the model.

Since the normality assumption is often violated in financial time series, I use the quasi-maximum likelihood (QML) method proposed by Bollerslev and Wooldrigde (1992) to estimate the model and compute all tests for both covariances processes. QML gives us properties of ML, even when the model is mis-specified. Optimization is performed using the BHHH algorithm (Berndt, Hall, Hall and Hausman, 1974).

4.1.2 Fundamental economic weaknesses

The role of the fundamental economic weaknesses played in the crisis has received attention from many researchers (Corsetti, Penseti and Roubini, 1998; Radelet and Sachs, 1998; Bustelo, Gaicia and Olivie, 1999; Mei, 1999; Yoshitomi and Ohno, 1999; Dekle, and Kletzer, 2001). Numerous research studies on this issue support the evidence that there is a relationship between the fundamental economic and crisis index. However, several papers argue that the crisis took place because of the contagion effect.

In this study, the hypothesis is set so that the relationship exists between fundamental economic weaknesses and the financial crisis in East Asia. This study also employs the stock market volatility as the financial crisis measurement. The significant increasing in the stock market volatility has been defined as financial crisis. On the fundamental economic weaknesses side, the study focuses on the macroeconomic variables. The Generalized Least Squares (GLS) method is used to identify the relationship among these variables. Generally, the method of least squares has some

very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis. For a given sample, the method of least squares provides us with unique estimates of coefficients that give the smallest possible value of sum squared residual. The Generalized Least Square (GLS) is OLS on the transformed variables that satisfy the standard least-squares assumptions. The GLS as estimation methodology in order to correct for heteroskedasticity and serial correlation will be applied to measure how much macroeconomic variables affect the volatilities of the stock market returns. The GLS is seen as a two-step process. First, it transforms the population regression function to one with the desired disturbance term and then applies Ordinary Least Square (OLS) to the transformed variables. The estimator assigns unequal weight or importance to each observation. It is able to satisfy the BLUE properties – best, linear, unbiased, and efficient estimators. Hence, the hypothesis is estimated by using the GLS procedure. The standard errors and t-statistics are computed using a heteroskedasticity consistent covariance matrix as suggested by White (1980).

The regression equation is set up as follows:

$$H_t = fn(LIB_{i,t}, CPG_{i,t}, TG_{i,t}, RER_{i,t}, DRIN_{i,t}, M2R_{i,t}, LBG_{i,t}, FLG_{i,t}, CC^{1}_{i,t})$$

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} (+\beta_{9t} CC_{i,t})^{1} + \varepsilon_{it} \quad (8)$$

where ; ε_{it} = Residual is contagion effect

$\varepsilon_{it} \sim (0, \delta^2)$

$COV(\varepsilon_i, \varepsilon_j) = 0$

[1] To test an effect of paradigm shift to the stock market volatility, this model included the capital control dummy variable as a paradigm shift variable. This variable included only a Malaysia model. See details in Appendix 1.

Hypothesis test

To test the hypothesis of whether the Asian financial crisis can be explained by fundamental economic weaknesses. The hypothesis is:

$$H_0 : \quad \beta_i = 0$$
$$H_1 : \quad \beta_i \neq 0$$

If the null hypothesis (H_0) is rejected, the coefficients (β_i), at least one, are not equal to zero with significance. It shows that the fundamental economic weaknesses have significant effects on the stock market volatility. It also implies that the East Asian financial crisis was caused by fundamental economic weaknesses and not by contagion.

The study classifies the fundamental economic weaknesses as independent variables into two parts: macroeconomic event and moral hazard event.

4.2 Data Descriptions

4.2.1 The data used in this paper to compute volatility via an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) consists of time series of weekly dollar-denominated returns on stock indices of four developed stock markets: USA, Japan, Hong Kong, Singapore and of four emerging stock markets: Korea, Malaysia, Philippines and Thailand. I can not include Indonesia and Taiwan into my sample. The historical data in Indonesia's stock market and Taiwan's economic fundamental factors are insufficient for me to estimate my model. Developed stock market indices are provided by Morgan Stanley Corporation International (MSCI). Emerging stock market indices are obtained from the International Financial Corporation. These data cover the period from January 1988 to June 1999.

4.2.2 The data used as independent variables to explain the fundamental economic weaknesses affected by the East Asian financial crisis. These were a Generalized Least Square (GLS) estimation consisting of capital inflows as a percentage of Gross Domestic Product (GDP), trade balance as a percentage of GDP, real exchange rate, the difference between U.S real interest rates and local real interest rates, broad of money as a percentage of foreign exchange reserve, bank lending as a percentage of GDP and foreign debt as a percentage of GDP. All data are obtained from IMF-IFS and Datastream.

4.2.3 In this study, I break the estimation into three periods: an overall period (Jan 30, 1988 - Jun 30, 1999), pre-crisis period (Dec 30, 1988 - Jun 30, 1997) and post-crisis period (Jul 1, 1997 - Jun 30, 1999). This break is reasonable. According to Roubini (1999), in January 1997 Hanbo Steel, a large Korean Chaebol, collapsed under six billion U.S dollar in debts and was soon followed by Sammi Steel and Kia Motors. In early February, Somprasong Land, one of the biggest Thai real estate companies, missed the payments of its foreign debt. By May 1997, Thailand's baht currency was hit by massive selling by speculators and was finally devalued on July 2. By June 1997, Asian currencies were clearly in crisis.

4.2.4 To enhance the potential of the crisis analysis, the appropriated frequency data are high-frequency data. Macroeconomic data typically is not available at higher frequencies, low-frequency data. Financial market data including the crisis variable on the other hand, is available at much higher frequencies. Thus, there appears to be opportunity to mix the low-frequency macro data with the high-frequency financial data through interpolation of the low-frequency data to be the high-frequency data. (Christoffersen and Errunza, 2001)

Data definitions

- *Dependent variable*

$H_{t,i}$ is a stock market volatility of each country at the point in time

The asymmetric GARCH as mentioned above allows for the weekly stock market volatility of each country. The significant increasing in the stock market volatility has been defined as financial crisis.

- *Independent variables*[2]

a. Macroeconomic imbalances

$LIB_{i,t}$ is liberalization dummy variable

Financial liberalization attracted massive amounts of capital inflows to emerging markets. It led to their financial vulnerabilities as I mentioned in chapter two. Therefore, the next test is a test for whether the stock market volatility can be explained by financial liberalization. Most of the studies in this field conduct the test by including dummy variables in the model. Demirgüç-Kunt, A., and Detragiache E. (1998) developed a financial liberalization dummy variable for a large number of developed and developing countries to evaluate the relation between banking crises and financial liberalization. "LIB" is a dependent variable, which serves as a financial liberalization dummy variable. Its value is one for periods of financial liberalization begin, and zero otherwise. The study determines the financial liberalization date followed by Bekaert and Harvey (1999)[3]. However, the sample covers the liberalization date only in Thailand, Korea, Malaysia and Indonesia. The "LIB", therefore, has been examined in these models. The liberalization date of the rest has not been covered in the sample. The study has not been included the "LIB" in these models.

[2] All independent variables used in this paper need to apply in the terms of weekly data. If it is not, it needs to interpolate.

[3] A Chronology of Important Financial, Economic and Political Events in Emerging Markets: http://www.duke.edu/~charvey/Country_risk/couindex.htm.

$CPG_{i,t}$ is capital inflows as a percentage of GDP

The weaknesses of Asian financial systems were exacerbated by foreign capital inflows as they were large, volatile, unsustainable, and/or poorly utilized. There are several papers that used the ratio of capital flows to GDP to analyze the determinants of currency devaluation, equity returns (in the U.S. dollars) and market volatility. Some are Mei (1999) and Corsetti, Pesenti and Roubini (1998a, 1998c, and 1998d). For GDP calculation the U.S., Japan, Korea, Hong Kong, and the Philippines are on a quarterly quater basis while Thailand, Malaysia, and Singapore are on an annualized quarter basis. Malaysia and Singapore are in millions of units but the rest are in billions of units. So, I need to transform Korea, the Philippines and Hong Kong to be an annualized quarterly basis before I do the interpolation. Therefore, I multiply the series by 4. The capital flows and GDP are obtained from International Financial Statistic (IMF-IFS).

$TG_{i,t}$ is trade balance as a percentage of GDP

There is evidence of current account imbalances in the region over the 1990s. The potential role of the current account deficits is a source of disruptive tensions in the financial markets. The current account deficit of troubled economies was sustainable. This pressured the confidence of foreign investors and encouraging international speculators to attack the local currencies. There are two components of current accounts: the trade balance and the service balance. The trade balance is almost always in deficit for most of the victim-countries. The service balance is usually in surplus. But, the trade deficit is so much larger than the service surplus so that the overall current account is almost always in deficit. Therefore, the slowdown of export growth led to the deficit current account. The ratio of trade balance to GDP is developed to assess the current account imbalance which led to the crisis. Trade balance is the difference between export and import. Export data are on F.O.B basis and Import data are in C.I.F basis. Both are obtained from international transaction of IMF-IFS.

$DRIN_{i,t}$ is the US and domestic real interest rate differential

The high domestic interest rate in most of the troubled economies attracted massive capital inflows. In addition, low interest rates in the U.S and Japan favored increased outward investment from these countries to Southeast Asia and other emerging markets. The difference between the US real interest rate and the domestic real interest rates are calculated from short-term interest rate adjusted for inflation rate. It is computed by the difference of short-term interest rates and the inflation rates in each country. They are on a continuously compounded basis. Originally, the data is on an annual basis. They are then transformed to be on a monthly basis. Short-term interest rates for all countries are from IFS. The inflation rate is calculated from the change in the Consumer Price Index (CPI) as provided by the IMF-IFS.

$RER_{i,t}$ is real exchange rate.

The weekly exchange rates are calculated from the price index in U.S. dollars and the price index in local currency of each country. The data is from Datastream. This variable is also likely to influence the volatility. At the beginning, I compute the rate of change in the exchange rate. Next, exchange rates can be derived from the rate of change in exchange rates multiplied by the exchange rate at the previous period. Finally, I compute real exchange rates by applying the Consumer Price Index (CPI). I obtained CPI data from IMF-IFS.

$$\text{Rate of change in exchange rate}_t = \frac{PI^{LC}_{t-1}}{PI^{LC}_{t}} * \frac{PI^{\$}_{t}}{PI^{\$}_{t-1}}$$

$$\text{Exchange rate}_t = \text{Exchange rate}_{t-1} * \text{Rate of change in exchange rate}_t$$

where PI^{LC}_t = Weekly local price index at period t

$PI^{\$}_t$ = Weekly US dollar price index at period t

$$\text{Discrete RER}_t = ER_t * \frac{CPI^{us}_t}{CPI^{LC}_t}$$

$$\text{Continuous RER}_t = LN(ER_t) + LN(CPI^{US}_t) - LN(CPI^{LC}_t)$$

where, RER_t = Real exchange rate at period t

ER_t = Exchange rate at period t

CPI_t^{US} = U.S. Consumer Price Index at period t

CPI_t^{LC} = Local Consumer Price Index at period t

$M2R_{i,t}$ is broad of money (M2) as a percentage of foreign exchange reserves.

A traditional measure of the adequacy of foreign exchange reserves is the stock of reserves in measured months of imports (of goods and services). As rapid outflows of speculative money have become a more important source of foreign exchange pressure than trade imbalances, the above indicator is no longer regarded as a good measure of reserve adequacy. A better indicator of the adequacy is the ratio of money assets to foreign reserves. This is because in the event of an exchange rate crisis or panic, all liquid money assets can potentially be converted into foreign exchange. An increase in this ratio points to a decrease in the country's ability to defend its currency or increase in the currency's vulnerability to a speculative attack. Calvo (1995) and Sachs, Tornell, and Velasco (1996) suggest the ratio of a broad of money measure of liquid monetary assets to foreign reserves as the liquidity measurement. All data are from IMF-IFS.

b. Moral hazard

$LBG_{i,t}$ is the bank lending to private sector as a percentage of GDP

The ratio of private sector lending to GDP is the measure of the lending boom as described by Sachs, Tornell and Velasco (1996) and Bustelo, Garcia and Olivie (1999). This is an indirect measure of financial fragility. Bank lending to the private sector comes from the claims on the private sector on the deposit money bank. All data are from IMF-IFS.

$FLG_{i,t}$ is foreign debt as a percentage of GDP

There was a rapid buildup of foreign debt into weak financial systems. This was made possible for two reasons, East Asia's successful track record attracted foreign credits and, because of partial financial liberalization in East Asia which opened new

channels for foreign capital to enter into Asian economies. The foreign debt data are obtained from deposit money bank (IMF-IFS).

CHAPTER V

EMPIRICAL RESULTS

5.1 Stock Market Volatility

The weekly stock market volatility of each country has been calculated by using an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model as specified in a previous chapter.

Table 5.1

Percentage Change between the Average of Stock Market Volatility during Pre-crisis Period and during Post-crisis Period

	Japan	Singapore	Hong Kong	Thailand	Korea	Malaysia	Philippines
Pre-crisis	9.50	11.51	12.23	20.60	16.39	13.03	18.14
Post-crisis	13.19	19.82	20.42	66.62	62.05	75.63	39.54
%change	38.83	72.14	67.01	223.36	278.58	480.44	117.91

Table 5.1 shows the percentage of change between the average rate of stock market volatility during pre-crisis and post-crisis. I found that Thailand, Korea, Malaysia and the Philippines have greatly the percentage of change between the average rate of stock market volatility during pre-crisis and post-crisis. These were 223.36, 278.58, 480.44 and 117.91 percent respectively. Japan, Singapore and Hong Kong have a moderately increase in stock market volatility after the crisis triggering. There were 38.83, 72.14 and 67.01 percent respectively. These indicated that Japan, Singapore and Hong Kong were less affected by the regional turmoil. These countries have performed better than other countries affected by the financial crisis. Although their currencies were devalued, the depreciation rates of their currencies were modest. Importantly, these countries did not face severe reversals in market sentiment, financial panic and large-scale debt crises. These countries that were only mildly affected by the

turmoil shared a number of characteristics. There were several explanations to describe the mildly effects. First, their trade and current account balances were in surplus in the 1990s. Second, their foreign debt was low. Third, their financial and banking systems did not suffer from the same structural weaknesses and fragility observed in the crisis countries. Relatively speaking, these countries have sound financial institutions compared to those crisis countries. Fourth, they had a relatively large stock of foreign exchange reserves compared to the crisis countries. Lastly, they were to a large extent immune from forms of “crony capitalism”.

Figure 5.1 shows the weekly stock market volatility of the United States, Japan, Hong Kong, Singapore, South Korea, Malaysia, and Thailand. It covers the period between January 1988 to June 1999. The stock market of developed markets (United States, Japan, Hong Kong, and Singapore) have a small volatility relative to emerging markets (South Korea, Thailand, Malaysia, and the Philippines). By 1996, the U.S. stock market volatility was less than 3.3 percent, Japan’s stock market volatility fluctuated in the narrow range of 3.7 to 5.4 percent. Hong Kong and Singapore’s volatility was in the range of 8 to13 percent. The stock market volatility of emerging markets in this sample is higher than the developed markets for all periods. Before the crisis, Thailand’s stock market volatility had been fluctuating in the range of 14 to 26 percent. The Philippines and South Korea moved in the range of 12 to 17 percent in 1996, but Malaysia ‘s stock market had less than 10 percent volatility.

Figure 5.2 shows the stock market volatility of each country covering the crisis period of 1997 to 1999. It shows that the volatility of many emerging stock markets increased dramatically. Interestingly, the movement of the volatility of emerging markets in the sample follows the same pattern. It increased rapidly and considerably after the financial crisis was triggered in July 1997. Many papers sought to find out the causes of this crisis. Whether it was caused by fundamental economic weaknesses concurrently or the contagion effect. The objective of this paper is to examine whether economic fundamentals can explain the stock market volatility.

Figure 5.1

Stock Market Volatility of Overall Period (Jan 1988-Jun 1999)

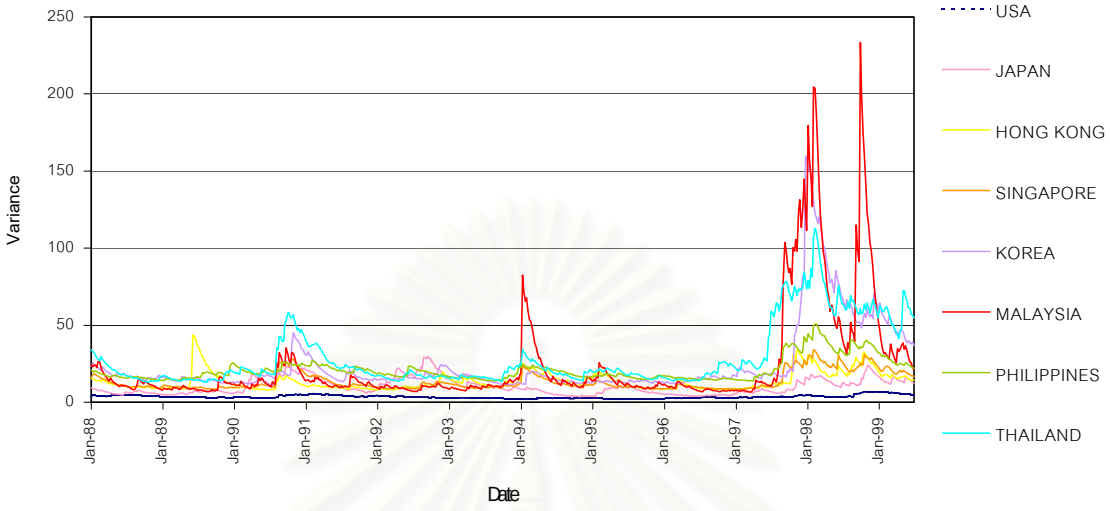
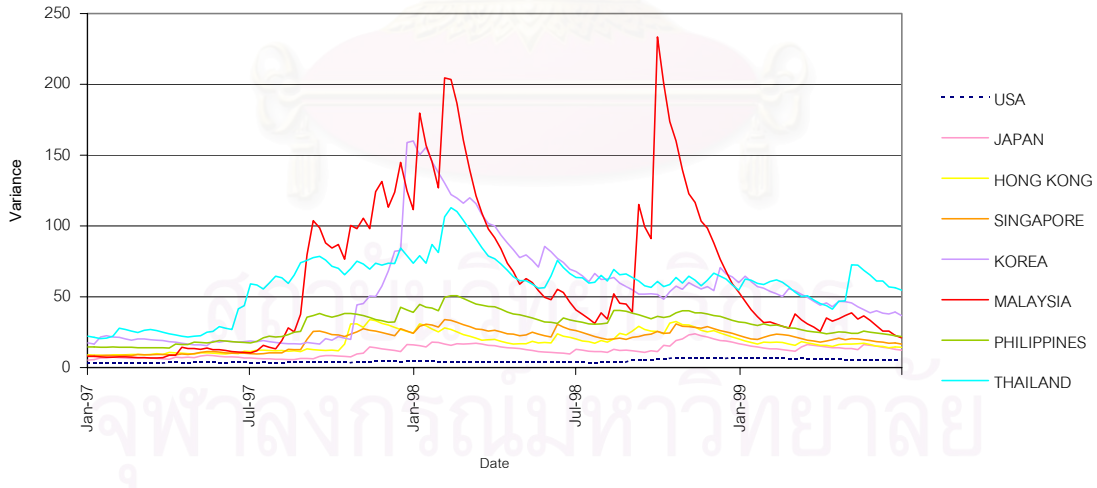


Figure 5.2

Stock Market Volatility of Post-crisis Period (Jul 1997 - Jun 1999)



As shown in Figure 5.1 and 5.2, the East Asia financial crisis started in Thailand in July. The stock market of Thailand experienced sharply increased volatility. It went from 27.61 percent in the first week of June 1997 to 59.11 percent in the first week of July 1997. Through late 1996 and into the first half of 1997, the Bank of Thailand

struggled against speculative attacks on the baht. By May 1997, though, the Thai baht was massively attacked by speculators. They had decided that Thailand's slowing economy and political instability. The level of officially declared foreign exchange reserves declined from US$40 billion in January 1997 to well under US$30 billion six month later. Furthermore, the bank of Thailand suspended the operations of the 16 cash-strapped finance companies and ordered them to submit merger or consolidation plans. All of these measures pressured the Bank of Thailand into announcing the floating of the currency on 2 July 1997. This is what trigger the East Asia crisis. The exchange rate moved immediately from 25 baht per U.S. dollar to 30 baht. By January 1998, it reached 55 baht (as shown in Figure 5.3D). After that, the volatility of Thailand's stock market grew rapidly.

A couple months after from crisis started in Thailand, the stock market volatility of Malaysia and the Philippines jumped to 79.46 and 35.67 percent respectively in the first week of September 1997. It went from 7.74 and 14.62 percent in the first week of January 1997, respectively (Figure 5.2). This was the result of the depreciation of the Malaysian ringgit and the Philippines peso. In Malaysia, for more than a three years prior to the onset of the East Asian crisis, the exchange rate of the ringgit varied in a narrow range of 2.49 to 2.79 ringgit per U.S. dollar. When the Thai baht came under heavy speculative attack in mid-May 1997, the ringgit also experienced heavy selling pressure. The central bank of Malaysia, the Bank Negara Malaysia (BNM), responded with massive foreign exchange market intervention. It sold close to US$1.5 billion to prop up the currency. The BNM kept the ringgit firm through continued market intervention for another week. It then gave way to market forces on 14 July 1997 by floating the currency. The ringgit depreciated by almost 50 percent against the U.S. dollar to 4.59 ringgits per U.S. dollar on 14 January 1998 (Figure 5.3F). As a result of the ringgit depreciation against the U.S. dollar, Dr. Mahathir, the Prime Minister of Malaysia, delayed several multi-billion dollar construction projects. The stock market collapse was even sharper. Between July 1997 and mid-January 1998, the Kuala Lumpur Stock Exchange (KLSE) fell by over 65%. However, this large fall cannot be explained in terms of a ran on local stocks by foreign stockholders only since at the time

of the onset of the crisis, foreign investors accounted for only 30 to 40 percent of activity in the market. Many sellers were local players.

From the end of 1997 through the beginning of 1998, the emerging stock markets were sharply volatile. In particular, Malaysia and South Korea's volatility reached over 100 percent between November and December 1997. Malaysia's volatility climbed to a peak at 204.62 percent on 4 February 1998. The stock market volatility of South Korea surged to 45.02 percent in November 1997 from 17.3 percent in June 1997. The Korea's volatility also jumped to 159.8 percent on 30 December 1997. Thailand's volatility reached 106.6 percent on 4 February 1998. The Philippines stock market volatility ranged between 40 and 51 percent. The higher stock market volatilities during the crisis period probably stemmed from the Asian currencies collapse.

The Korean won started to weaken rapidly in October 1997 as corporate failures continued. Market nervousness about the exact level of the central bank's net foreign exchange reserves combined with a contagion effect from South East Asia. This also prompted selling of the currency. After starting the year at 834.95 won against the U.S. dollar, the exchange rate fell to 893.34 by September (Figure 5.3E). This was a depreciation of only 7 percent. But by October, with four major currencies in the region having devalued by an average of 40 percent[4], the won could not maintain parity. Moreover, Singapore had allowed its currency to depreciate rather than defend its parity. This put Korea at a serious competitive disadvantage. The central bank of Korea also intervened with the won currency by selling U.S. dollars from foreign exchange reserves in an attempt to keep the won in a given band. Hence, South Korea's foreign reserves declined sharply. By early November 1997 the markets were speculating that Korea would have to go to the IMF if it continued to expend reserves defending the won. In response to further downward pressures on the currency, the Central Bank of Korea applied new policies on 19 November 1997. These included widening the daily trading

[4] The four major currencies in the region include Thailand, the Philippines, Malaysia and Indonesia. The percent change of their devaluation are computed between January, 1997 and October, 1997.

band for the currency to 10 percent from 2.25 percent[5], opening more of the local bond market to foreign investors and increasing the size of a bank-bailout fund. Other factors affecting Korea's stock market volatility were increases in bad loans leading to bankruptcy. The evidence shows that 8 of 30 chaebol (largest conglomorates) went bankrupt or faced severe financial strains. Moreover, foreign investors had a negative attitude about South Korea. They thought that Korea's economic crisis was set to get worse. This prompted them to sell their portfolio from the region. International rating agencies also downgraded South Korea's foreign debt. Political uncertainty was discussed during the Presidential election in Korea on 18 December 1997. Thus, the Asian stock price index including the Korean Composite stock price index plunged to 3.9 percent[6].

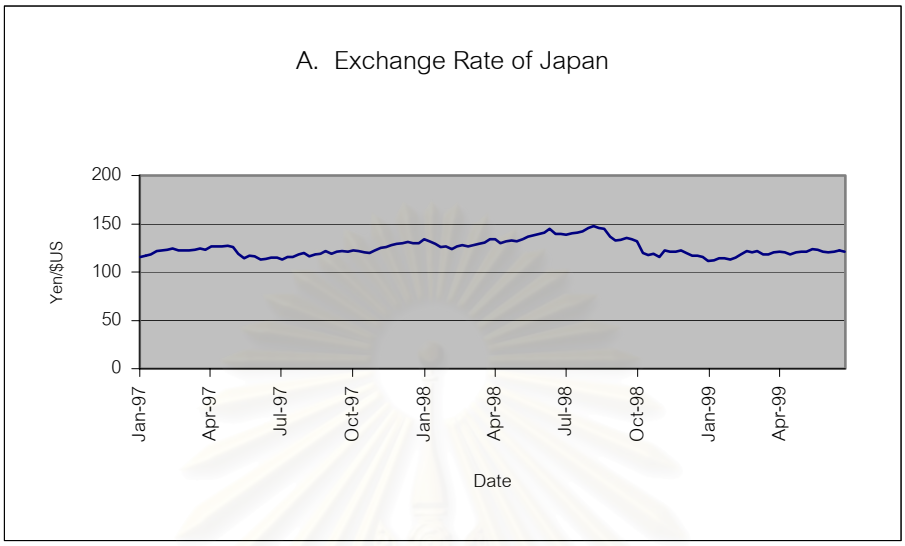
In December 1997, Central bank of Korea intervened by selling U.S. dollars which led to an appreciation of the won against the U.S. dollar from 1891.40 to 1600. The lower won made it difficult for Korea's government, banks and companies to pay off their large foreign currency borrowing. More than $100 billion of which was to come due in less than one year. Foreign lenders did not extend or renew loans and credit facilities to Korean Banks. Lastly, Dongsuh Securities, the second local brokerage house went bankrupt after failing to honor maturing debt. Hence, the won's problems contributed to the equity market turmoil. Stock market volatilities were high.

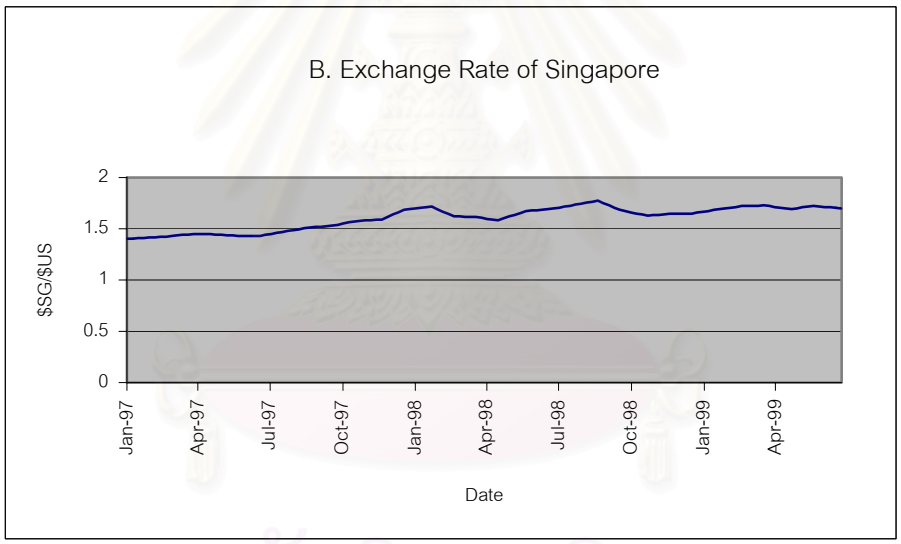
[5] The exchange rate of the won against the U.S. dollar is determined on the basis of the weighted average of interbank rates for the won-dollar spot transactions of the previous day. During each business day, the won rate against the dollar in the interbank market is allowed to fluctuate within a margin of +/- 2.25 percent against the market average rate of the previous day.

[6] South Korea allowed the variation of daily stock price index within a range of 8 percent.

Figure 5.3

Exchange Rate during Crisis Period (Jan 1997 - Jun 1999)





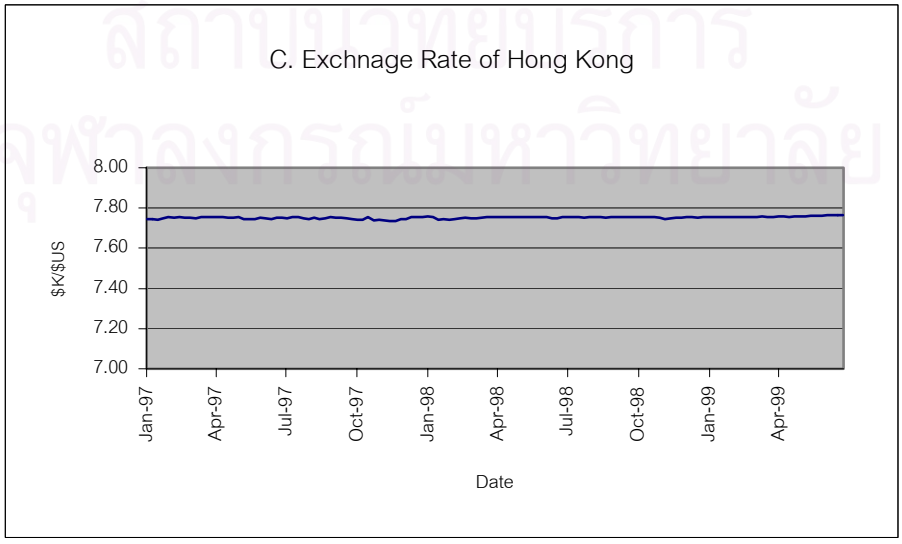


Figure 5.3 - *continued*

Exchange Rate during Crisis Period (Jan 1997 - Jun 1999)

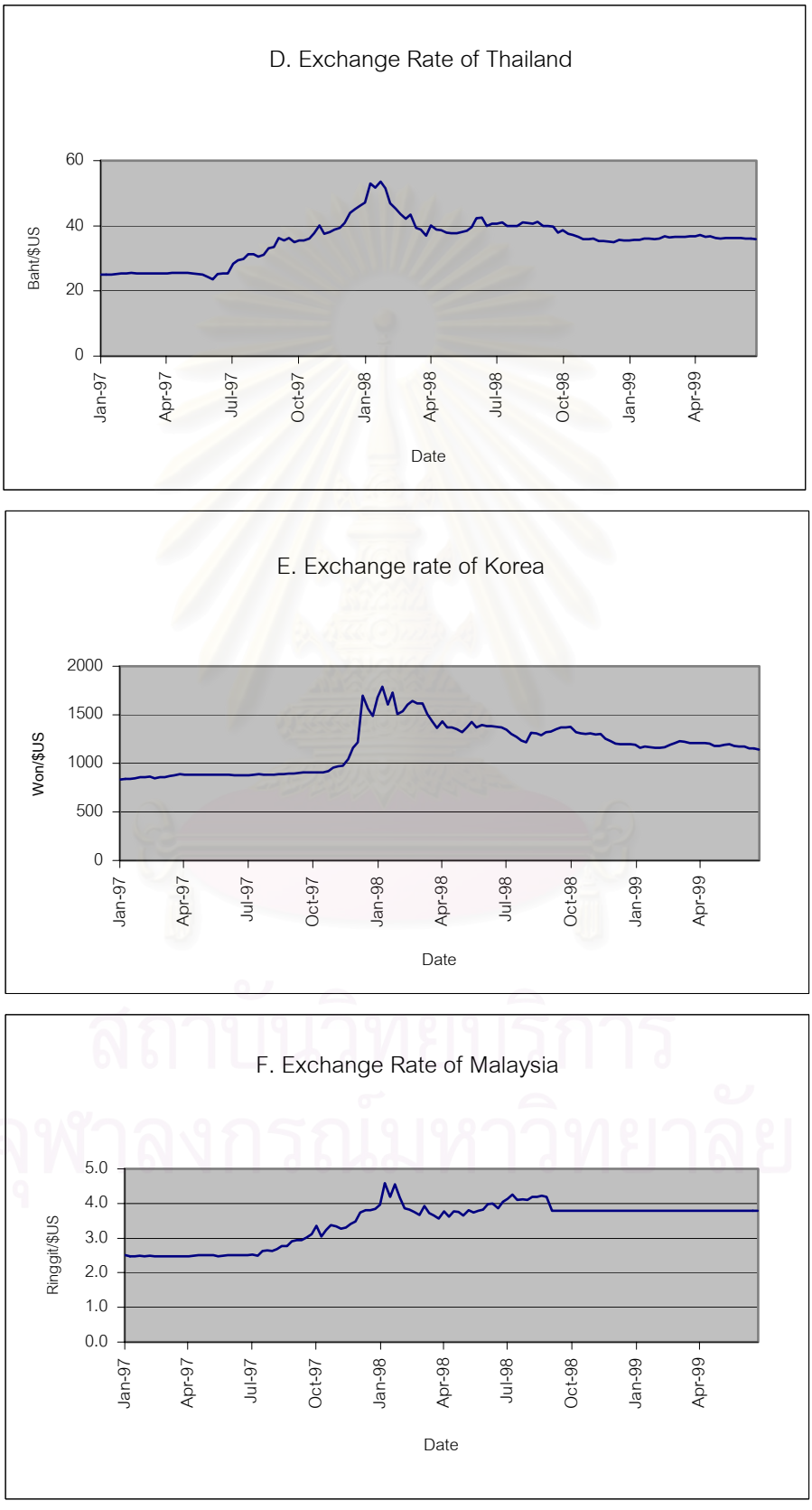
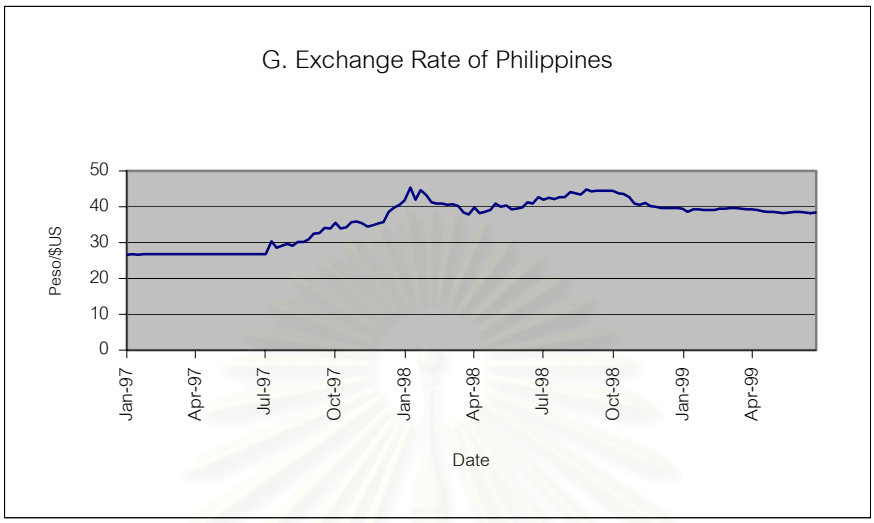


Figure 5.3 - *continued*

Exchange Rate during Crisis Period (Jan 1997 - Jun 1999)



The currency collapse and the severity of the Korea financial crisis, in turn, hurt the Asian equity markets. Figure 5.3 shows the exchange rate movement in each country and covers the period 1997 to 1999.

At the beginning of 1998, the Malaysian ringgit, the Thai baht, the Korean won, and the Philippines peso plunged to new lows. These were 4.06 ringgit, 54.75 baht, 1,780 won and 46.5 peso against the U.S. dollar respectively. Because investors heavily bought U.S. dollars in anticipation of increased corporate demand for the U.S. currency over the next quarter and massively bought the U.S. dollars from local importers, they took stock markets down with them. Asia's slowing economic growth kept investors away from the region. Their weakening currencies had made it sharply more expensive for countries to service their large overseas dollar debt. In addition, the slower economies had reduced tax collections making it harder to produce a budget surplus. Their countries' recovery was also hampered by the spreading downturn throughout the region. This reduced foreign investments and cut into the competitiveness of the cheaper local currencies.

5.2 Estimation Results

The role of the fundamental economic weaknesses which led to the crisis has received attention from many researchers (Corsetti, Penseti and Roubini, 1998; Redalet and Sachs, 1998; Mei, 1999). Numerous researchers studies on this issue support the evidence that there is a relationship between the fundamental economic and crisis index. However, several papers argue that the crisis took place because of the contagion effect.

In this study, the hypothesis is such that a relationship exists between fundamental economic weaknesses and the financial crisis in East Asia. This study employs the stock market volatility derived from an asymmetric GARCH as a financial crisis measurement. The significant increases in stock market volatility has been defined as a financial crisis. It serves as a dependent variable. On the fundamental economic weaknesses side, this study focuses on the macroeconomic variables. These consist of liberalization dummy variable (LIB), capital inflows as a percentage of Gross Domestic Product (CPG), trade balance as a percentage of GDP (TG), real exchange rates (RER), the difference between U.S real interest rates and local real interest rates (DRIN). Also included are broad of money as a percentage of foreign exchange reserve (M2R), bank lending as a percentage of GDP (LBG) and foreign debt as a percentage of GDP (FLG). Malaysia is a special case. Its model also included an additional macroeconomic variable, which is capital control dummy variables (CC). The Generalized Least Squares (GLS) method is used to examine the relationships among these variables as follows:

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} (+\beta_{9t} CC_{i,t}) + \varepsilon_{it} \quad \text{repeated} \quad (8)$$

The set of regression results which were estimated by GLS procedure to reach a relationship between the fundamental economic weaknesses and stock market volatility were reported in Table 5.2. The standard errors and t-statistics are computed using a

heteroskedasticity consistent covariance matrix as suggested by White (1980). Furthermore, the regression includes the multicollinearity and autocorrelation corrections. One way to resolve this problem is to adjust the variables by replacing the variables with a residual of the high pair-wise correlation[7] regression. For instance, Thailand's LBG and FLG have a high correlation, 0.93. I need to run GLS between LBG and FLG. LBG is a dependent variable and FLG is an independent variable. The residual of this regression is defined as "Adjusted LBG". The LBG variable in full model, equation (8), is replaced by Adjusted LBG.

The overall significance of the relationship between explanatory variables and dependent variables has been investigated by the adjusted R-squared and the probability of F-statistic. The t-statistic and probability of t-statistic are used to verify the statistical significance of each coefficient (β_i). I employ the probability of t-statistic in each coefficient to examine whether the economic fundamentals can explain the stock market volatility. The sample period is divided into 3 subperiods: overall period (Jan 1988 to Jun 1999), pre-crisis period (Jan 1988 to Jun 1997) and post-crisis (Jul 1997 to Jun 1999). The regression result of each country is reported as follows:

[7] Correlation matrix shows in Appendix 2

Table 5.2

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

To estimate the relation between stock market volatilty and fundamental economic weaknesses, this study employed GLS. Stock market volatility in each country (Ht) as a dependent variable. It has been developed by an asymmetric GARCH. The data used as the independent variables consist of liberalization dummy variable (LIB), capital inflows as a percentage of GDP (CPG), trade balance as a percentage of GDP (TG), real exchange rates (RER), the difference between U.S. real interest rates and local real interest rates (DRIN). Also included are broad of money as a percentage of foreign exchange reserve (M2R), bank lending as a percentage of GDP (LBG) and foreign debt as a percentage of GDP (FLG).The addition dependent variable for Malaysia model is capital control dummy variable. The study breaks an estimation into three period an overall period (Jan 30, 1988 - Jun 30, 1999), pre-crisis period (Dec 30, 1988 - Jun 30, 1997) and post-crisis period (Jul 1, 1997 - Jun 30, 1999).

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

A. Japan

Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	-37.59	-1.33	*0.1855*	-14.52	-0.54	*0.5888*	-72.25	-1.11	*0.2711*
LIB	NA	NA	NA	NA	NA	NA	NA	NA	NA
CPG	5.85	0.83	*0.4053*	-4.89	-0.53	*0.5973*	9.24	1.44	*0.1557*
TG	-52.99	-2.60	*0.0096***	-30.20	-1.62	*0.1069*	-84.10	-0.98	*0.3301*
RER	2.47	0.98	*0.3265*	1.92	0.69	*0.4888*	-1.67	-0.24	*0.8111*
DRIN[adj]	1.04	2.00	*0.0465**	1.45	2.49	*0.0131***	-2.77	-1.40	*0.1655*
M2R	-0.04	-0.49	*0.6271*	-0.03	-0.33	*0.7436*	-0.08	-0.09	*0.9294*
LBG	28.11	1.19	*0.2356*	6.74	0.32	*0.7456*	69.64	1.63	*0.1074*
FLG	36.13	1.30	*0.1945*	45.43	1.33	*0.1832*	109.76	1.01	*0.3168*
AR(1)	1.00	18.65	*0.0000*	0.99	80.53	*0.0000*	0.95	8.48	*0.0000*
AR(2)	0.15	1.45	*0.1471*				-0.02	-0.22	*0.8229*
AR(3)	-0.18	-2.30	*0.0217*						
Adjusted R-squared	0.9698			0.9738			0.9070		
Prob (F-stat)	0.0000			0.0000			0.0000		
Durbin-Watson stat	2.0283			1.9882			2.0095		

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

B. Singapore									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	20.02	1.75	*0.0810*	16.08	2.32	*0.0209***	16.34	0.50	*0.6152*
LIB	NA	NA	NA	NA	NA	NA	NA	NA	NA
CPG	0.28	0.07	*0.9469*	-0.88	-0.12	*0.9034*	-0.89	-0.21	*0.8353*
TG	0.07	0.62	*0.5356*	-0.05	-0.71	*0.4789*	0.18	0.93	*0.3553*
RER^{adj}	-9.79	-0.39	*0.6969*	-21.14	-1.05	*0.2929*	-33.44	-0.58	*0.5618*
DRIN	0.72	1.36	*0.1741*	-0.23	-0.64	*0.5226*	8.47	3.01	*0.0033****
M2R	-8.01	-0.88	*0.3781*	3.72	0.55	*0.5795*	-23.46	-1.46	*0.1481*
LBG	0.77	0.09	*0.9244*	-3.18	-0.76	*0.4484*	24.29	0.64	*0.5246*
FLG	3.84	0.24	*0.8089*	-10.67	-1.10	*0.2737*	18.41	0.75	*0.4575*
AR(1)	0.98	80.62	*0.0000*	0.96	53.64	*0.0000*	0.89	20.36	*0.0000*
AR(2)									
AR(3)									
Adjusted R-squared	0.9583			0.9305			0.8759		
Prob (F-stat)	0.0000			0.0000			0.0000		
Durbin-Watson stat	1.9826			2.0539			1.9413		

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

C. Hong Kong									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	-14.36	-0.11	*0.9125*	-118.80	-2.27	*0.0245***	-104.36	-0.36	*0.7205*
LIB	NA	NA	NA	NA	NA	NA	NA	NA	NA
CPG	NA	NA	*NA*	NA	NA	*NA*	NA	NA	*NA*
TG^{adj}	-6.29	-0.72	*0.4743*	-11.91	-1.23	*0.2188*	2.51	0.14	*0.8868*
RER	13.79	0.21	*0.8326*	62.28	2.40	*0.0177***	49.99	0.37	*0.7103*
DRIN	-1.65	-1.10	*0.2708*	0.66	0.59	*0.5547*	-4.86	-1.51	*0.1347*
M2R	NA	NA	*NA*	NA	NA	*NA*	NA	NA	*NA*
LBG	NA	NA	*NA*	NA	NA	*NA*	NA	NA	*NA*
FLG	0.37	0.47	*0.6375*	0.86	1.25	*0.2139*	8.77	0.86	*0.3938*
AR(1)	1.04	9.98	*0.0000*	0.90	14.16	*0.0000*	1.02	8.22	*0.0000*
AR(2)	-0.08	-0.71	*0.4811*				-0.10	-0.69	*0.4907*
AR(3)									
Adjusted R-squared	0.9329			0.9335			0.8535		
Prob (F-stat)	0.0000			0.0000			0.0000		
Durbin-Watson stat	1.9868			2.0308			1.9660		

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

D. Thailand									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	-55.06	-1.51	*0.1325*	-227.89	-1.12	*0.2645*	203.47	1.77	*0.0800*
LIB	-0.57	-1.12	0.27	-0.59	-0.87	0.38	NA	NA	NA
CPG^{adj}	-71.14	-3.05	*0.0024***	-60.95	-2.38	*0.0177***	-69.40	-2.64	*0.0095***
TG	132.79	2.55	*0.0111***	166.86	2.02	*0.0438**	107.23	2.11	*0.0371**
RER	29.14	2.82	*0.0049****	24.89	1.94	*0.0525*	23.03	2.14	*0.0329**
DRIN	1.45	0.85	*0.3964*	0.66	0.76	*0.4485*	-0.25	-0.05	*0.9576*
M2R	-2.01	-0.93	*0.3542*	-2.72	-0.59	*0.5569*	0.17	0.07	*0.9479*
LBG^{adj}	85.25	1.52	*0.1302*	165.03	1.69	*0.0920*	-174.60	-1.66	*0.0993*
FLG	25.58	0.54	*0.5869*	500.68	2.41	*0.0165***	92.39	1.58	*0.1174*
AR(1)	0.97	14.17	*0.0000*	1.01	22.03	*0.0000*	0.81	6.13	*0.0000*
AR(2)	0.14	0.96	*0.3374*	0.19	1.87	*0.0624*	-0.07	-0.64	*0.5223*
AR(3)	-0.14	-1.35	*0.1778*	-0.20	-2.15	*0.0318*			
Adjusted R-squared		0.9798			0.9513			0.8235	
Prob (F-stat)		0.0000			0.0000			0.0000	
Durbin-Watson stat		1.9828			1.9801			1.9583	

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

E. South Korea									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	173.01	1.23	*0.2208*	25.15	1.77	*0.0768*	502.68	1.34	*0.1820*
LIB	10.40	1.23	0.22	-0.32	-0.44	0.66	NA	NA	NA
CPG	-357.44	-1.66	*0.0970*	-14.79	-0.81	*0.4178*	-561.94	-1.96	*0.0529*
TG^{adj}	273.97	1.60	*0.1108*	-0.53	-0.04	*0.9667*	503.92	2.19	*0.0313**
RER	-12.25	-0.92	*0.3603*	-0.64	-0.58	*0.5590*	-39.65	-1.12	*0.2654*
DRIN	-2.80	-0.87	*0.3821*	0.12	0.26	*0.7945*	-20.13	-2.08	*0.0405**
M2R	-13.05	-1.46	*0.1455*	-0.13	-0.14	*0.8918*	-20.36	-1.67	*0.0977*
LBG	11.58	0.31	*0.7589*	-7.17	-0.45	*0.6499*	-131.89	-0.72	*0.4704*
FLG^{adj}	-230.70	-0.58	*0.5651*	-60.86	-0.63	*0.5276*	-797.36	-1.04	*0.3001*
AR(1)	1.00	14.75	*0.0000*	1.21	12.56	*0.0000*	0.97	7.79	*0.0000*
AR(2)	0.06	0.48	*0.6282*	-0.26	-2.86	*0.0044*	-0.07	-0.72	*0.4728*
AR(3)	-0.09	-0.86	*0.3890*						
Adjusted R-squared		0.9760			0.9286			0.9545	
Prob (F-stat)		0.0000			0.0000			0.0000	
Durbin-Watson stat		2.0236			1.9486			2.0131	

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \beta_{9t} CC_{i,t} + \varepsilon_{it}$$

F. Malaysia									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	-52.50	-0.66	*0.5116*	105.21	0.88	*0.3769*	-1554.32	-4.28	*0.0000*
LIB	-1.29	-0.80	0.43	-0.84	-1.25	0.21	NA	NA	NA
CPG^{adj}	-71.70	-0.49	*0.6259*	-24.12	-0.85	*0.3977*	2746.38	2.14	*0.0352**
TG^{adj}	14.53	0.64	*0.5219*	-18.47	-2.72	*0.0067***	209.75	2.13	*0.0359**
RER	-54.90	-0.80	*0.4225*	-52.20	-0.65	*0.5162*	-8.81	-0.13	*0.8992*
DRIN	17.16	0.75	*0.4544*	4.79	1.00	*0.3175*	-396.08	-1.88	*0.0628*
M2R	-6.16	-0.50	*0.6154*	-7.28	-1.26	*0.2076*	16.40	0.48	*0.6354*
LBG	191.83	1.35	*0.1778*	-27.01	-0.79	*0.4321*	1654.04	4.43	*0.0000****
FLG	22.62	0.13	*0.8951*	25.01	0.51	*0.6068*	-695.77	-0.87	*0.3879*
CC	-5.90	-1.32	*0.1859*	NA	NA	*NA*	30.34	0.73	*0.4660*
AR(1)	0.95	34.57	*0.0000*	0.88	10.26	*0.0000*	0.63	6.56	*0.0000*
AR(2)				0.03	0.44	*0.6584*			
AR(3)									
Adjusted R-squared		0.9156			0.8442			0.8304	
Prob (F-stat)		0.0000			0.0000			0.0000	
Durbin-Watson stat		2.1437			1.9968			1.9853	

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Table 5.2 - *continued*

The Relation between Stock Market Volatility and Fundamental Economic Weaknesses

$$H_t = \alpha + \beta_{1t} LIB_{i,t} + \beta_{2t} CPG_{i,t} + \beta_{3t} TG_{i,t} + \beta_{4t} RER_{i,t} + \beta_{5t} DRIN_{i,t} + \beta_{6t} M2R_{i,t} + \beta_{7t} LBG_{i,t} + \beta_{8t} FLG_{i,t} + \varepsilon_{it}$$

G. Philippines									
Variable	Overall Sample Period			Pre-crisis Subsample Period			Post-crisis Subsample Period		
	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*	Coeff.	t-Stat	*Prob.*
C	7.71	0.61	*0.5402*	25.03	5.03	*0.0000****	-47.27	-1.14	*0.2580*
LIB	-0.58	-1.73	0.08	-0.57	-1.67	0.09	NA	NA	NA
CPG	-1.56	-0.64	*0.5215*	-0.16	-0.12	*0.9030*	-5.78	-0.65	*0.5204*
TG	-5.98	-1.70	*0.0897*	0.02	0.01	*0.9955*	-8.72	-1.91	*0.0597*
RER	2.53	0.71	*0.4785*	-1.25	-0.90	*0.3679*	10.60	1.01	*0.3164*
DRIN	0.02	0.69	*0.4890*	-0.01	-0.41	*0.6836*	2.65	1.36	*0.1760*
M2R	-0.12	-1.52	*0.1290*	-0.10	-1.31	*0.1918*	3.46	1.22	*0.2263*
LBG^{adj}	-0.51	-0.02	*0.9841*	-8.09	-0.92	*0.3599*	13.91	0.17	*0.8637*
FLG	57.05	1.36	*0.1739*	-21.13	-1.45	*0.1487*	151.92	2.04	*0.0439**
AR(1)	1.00	20.69	*0.0000*	0.96	82.26	*0.0000*	0.89	20.96	*0.0000*
AR(2)	-0.03	-0.50	*0.6182*						
AR(3)									
Adjusted R-squared	0.9732			0.9390			0.9120		
Prob (F-stat)	0.0000			0.0000			0.0000		
Durbin-Watson stat	2.0026			2.0110			2.0105		

Remark: (*) Coefficient is significance at 90 percent confidence.

(**) Coefficient is significance at 95 percent confidence.

(***) Coefficent is significance at 99 percent confidence.

Japan

The empirical result for Japan is depicted in Table 5.2A. I found the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis with 99 percent confidence in each period. The adjusted R-squared of the overall period, pre-crisis period and post-crisis are 0.9698, 0.9738 and 0.9070 respectively.

In the overall period, I found that Japan's stock market volatility can be explained by trade balance as a percentage of GDP (TG) and the difference between U.S real interest rates and Japan real interest rates (DRIN) with 90 percent confidence. TG has a negative effect on the volatility. DRIN has a positive effect on the volatility. In the Pre-crisis period, Japan's stock market volatility can be explained by DRIN in the positive effect. The decrease in DRIN led to the decrease in volatility during normal periods. In the post-crisis period, Japan stock market volatility during the East Asian crisis cannot be affected by its economic fundamentals. Therefore, it is evident that the increase in volatility of Japan stock market during the crisis period was not affected by economic fundamentals since Japan has strong economic fundamentals. Japan has run persistent and substantial current account surplus. It also has enormous foreign reserves relative to stock of money. The government policy of strengthening both bank supervision and prudential regulations make sense from the long-term perspective of building a stable financial system. It may be concluded that the increase in volatility of Japan stock market during the crisis was caused by market expectation. However, Japan's stock market had much less volatility than emerging stock markets.

Singapore

Table 5.2B displays the statistical results of the Singapore stock market. I found the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. Adjusted R-squared of the overall period, pre-crisis period and post-crisis are 0.9583, 0.9305 and 0.8759 respectively.

Economic fundamentals cannot explain the volatility of the stock market in the overall period and pre-crisis period. In the post-crisis period, the difference between U.S real interest rates and Singapore real interest rates (DRIN) has a positive impact on

the Singapore stock market volatility with 99 percent confidence. Although the stock market of Singapore have a moderately increase in volatility after the crisis triggering, this moderately increase in the volatility can be explained by economic fundamentals. DRIN has an insignificant effect on the Singapore's stock market volatility during normal period since the interest rates of the U.S. and Singapore were stable. During crisis period, the interest rate of Singapore had a significant decrease. It led to increasing in DRIN. Furthermore, Singapore had led its currency float rather than lose reserves by attempting to stabilize the exchange rate. It may be result of capital outflows generated Singapore currency depreciation. This is possible effect on a moderately increase in stock market volatility during the crisis period. It was clearly shown that Singapore stock market were highly sensitive to fluctuation in interest rates. It may be implied that Singapore stock market volatility can be explained by economic fundamentals.

Hong Kong

Table 5.2C shows the statistical result of the Hong Kong stock market. I found the probability of the F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. The adjusted R-squared of the overall period, pre-crisis period and post-crisis are 0.9329, 0.9335 and 0.8535 respectively.

In the overall period, economic fundamentals cannot explain the Hong Kong's stock market volatility with 99 percent confidence. In the pre-crisis period, Real exchange rates (RER) positively affected the volatility with 95 percent confidence. Therefore, the Hong Kong's stock market volatility can be affected by its economic fundamental variables in normal period. In the post-crisis period, the volatility cannot be explained by its economic fundamentals. Thus, Hong Kong stock market volatility can not be explained by economic fundamentals. Hong Kong economy has strong economic fundamentals. Moreover, Hong Kong achieved this result even with its dirty currency board system. It was able to stick to a fixed rate against the U.S. dollar. Hong Kong had very large foreign exchange reserves with which they could defend currency regime. It could be concluded that the increase in volatility of Hong Kong stock market during the crisis period was impacted by market expectation.

Thailand

Table 5.2D shows the statistical result of Thailand's stock market. Testing the overall significance, the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. The adjusted R-squared of the overall period, pre-crisis period and post-crisis are 0.9798, 0.9513 and 0.8235 respectively.

In the overall period, Thailand's stock market volatility can be significantly explained by capital inflows as a percentage of GDP (CPG), trade balance as a percentage of GDP (TG) and real exchange rates (RER) with 95 percent confidence. CPG has a negative effect on the volatility. TG and RER have a positive effect. In the pre-crisis or normal period, capital inflows as a percentage of GDP (CPG) and trade balance as a percentage of GDP (TG) significantly affect the volatility with 90 percent confidence. In addition, the volatility also can be explained by foreign debt as a percentage of GDP (FLG) with 95 percent confidence. CPG has a negative effect on the volatility. TG and FLG have a positive effect on the volatility. In the post-crisis period, the volatility can be significantly explained by capital inflows as a percentage of GDP (CPG), trade balance as a percentage of GDP (TG) and real exchange rates (RER) with 90 percent confidence. CPG has a negative effect on the volatility. TG and RER have a positive effect on the volatility. CPG, TG, and FLG have a significant effect on the volatility during the normal period and CPG, TG, and RER have a significant effect on the volatility on the crisis period. The result implies that macroeconomic imbalances guided the financial crisis in Thailand. The negative effect of CPG on stock market volatility in both pre-crisis and post-crisis periods. This implies that the increase in capital inflows led to a significant reduction in the volatility in normal periods and the decrease in capital inflows led to a significant increase in the volatility in the crisis periods. This situation probably derived from a massive amount of capital inflows in the pre-crisis period. As mentioned in chapter 2, this effect contributed to financial vulnerability since the large capital inflows consisted of a large portion of short-term capital inflows. They also financed long-term investments which were insufficiently productive. After the Thai currency collapsed, the investors panicked and lost their confidence in Thailand's economy and stock market. They withdrew their portfolio

investments from the region. As a result, Thailand's stock price index plunged considerably and fluctuated highly from a decrease in capital inflows.

The positive effect of TG to the stock market volatility of Thailand shows that an increase in trade balances as a percentage of GDP led to the significant increase in the volatility. In the pre-crisis period, Thailand experienced persistent trade balance deficits. These stemmed from a loss of competitiveness due to its real exchange rate appreciation, Japanese yen depreciation and new competitors. After the crisis, the trade balance of Thailand increased derived from the depreciation of the Thai baht. The result shows that increase in trade balance during the crisis period led to a significant increase in the volatility. This is possible an increase in trade balance during the crisis period derived from Thailand currency depreciation. This probably contributed to the high stock market fluctuation during the crisis.

RER also had a positive effect on the volatility in the crisis. Increases in real exchange rate (depreciating baht) forced a significant increase in volatility. During the crisis, the depreciation of the currency led to an increase in the value of outstanding obligations on U.S. dollar borrowings. This occurred because domestic firms had built up massive unhedged foreign borrowing in dollars. The larger was the devaluation of baht, the larger became the local currency value of these borrowings. In the crisis period, I found a significant depreciation in the real exchange rate. The sovereign insolvency, hence, generated bad news. Thailand's stock market plummeted rapidly and fluctuated greatly.

Accordingly, Thailand's stock market volatility can be explained by macroeconomic imbalances. The decrease in capital inflows, increase in trade balances and depreciation in the real exchange rate can cause a significant increase in volatility. Policy makers, therefore, should concern themselves about the size of capital inflows and the trade balance. If capital inflows show a decreasing trend, the volatility will have an increasing trend and a financial crisis may be triggered. If trade balances have an increasing trend the volatility may have an increasing trend.

Korea

The empirical result for Japan is depicted in Table 5.2E. Testing for overall significance, I found the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. The adjusted R-squared of the overall period, pre-crisis period and post-crisis are 0.9755, 0.9288 and 0.9622 respectively.

Fundamental economic weaknesses cannot significantly explain Korea's stock market volatility in the overall period and pre-crisis period. However, they can largely explain the volatility during the crisis period. The volatility can be explained by trade balance as a percentage of GDP (TG) and the difference between U.S real interest rates and Korea real interest rates (DRIN) with 90 percent confidence. TG has a positive effect on the volatility. Raises in trade balances as a percentage of GDP forced a significant increase in Korea's stock market volatility. Although trade balances of Korea increased during the crisis, there was a bad effect on volatility. This may be a result of the increase in the trade balances during the crisis derived from the Korean won depreciation. The negative effect of DRIN on the volatility of Korea's stock market shows that decrease in DRIN led to a significant increase in volatility. This probably came from rising domestic interest rates after the Korean won depreciation. This increased the external liabilities of borrowers and the level of non-performing loans (NPLs). Financial institutions began to go bankrupt and financial panic followed. An increasing flow of information about the size of foreign liabilities and the extent of NPLs made it clear that implicit guarantees of a bailout were no longer credible. This led to financial panic. Korea's stock market volatility had greatly increased by the end of 1997.

Thus, financial crisis in Korea as a significant increase in stock market volatility can be explained by fundamental economic weaknesses. In particular, macroeconomic imbalances are important factors which explain the volatility. Notice that the volatility cannot be explained by fundamental economic weaknesses during the normal period. We can imply that Korea could not anticipate the onset of financial crisis from its economic fundamental weaknesses.

Malaysia

The empirical results of Malaysia are depicted in Table 5.2F. I found the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. The adjusted R-squared of the overall period, pre-crisis period and post-crisis period are 0.9156, 0.8442 and 0.8304 respectively.

Economic fundamental factors did not drive the Malaysia stock market volatility in the overall period with 99, 95 and 90 percent confidence. In the pre-crisis period, the volatility can be explained by trade balance as a percentage of GDP (TG) with 95 percent confidence. In the post-crisis period, the probability of t-statistic of capital inflows as a percentage of GDP (CPG), trade balance as a percentage of GDP (TG) and bank lending as a percentage of GDP (LBG) is 0.0352, 0.0359 and 0.0000, respectively. The volatility can be affected by CPG and TG with 90 percent confidence, and LBG with 99 percent confidence. CPG, TG and LBG had a positive effect on the volatility in the crisis. The increase in capital inflows significantly increased Malaysia's stock market volatility during the crisis period. I found that the capital inflow of Malaysia increased during the beginning of the crisis period. Its effect is an increasing in the stock market volatility. Since the Malaysia government restricted their capital inflows by applying the capital control policy, capital inflows of Malaysia remained at the low levels. The stock market volatility gradually decreased. However, the capital control dummy variable can not affected the volatility directly. The capital control did not reduce the volatility, but, based on capital control the increasing in capital inflows will increase the stock market volatility. The positive effect of TG on the stock market volatility of Malaysia shows that an increase in trades balances as a percentage of GDP led to the significant increase in the volatility. Malaysia faced the trade balance deficits during the normal period. These stemmed from a loss of competitiveness due to its real exchange rate appreciation, Japanese yen and new competitors. After the crisis, the trade balance of Malaysia increased, derived from the depreciation of the ringgit currency. This is possible an increase in trade balance during the crisis period derived from Malaysian currency depreciation. The positive effect of the LBG on the volatility shows that bank lending to the private sector increased, volatility will be increased. I found that bank lending increased greatly during the crisis. The rapid expansion of bank lending was a sign of

weakening prudential norms of the banking system, especially, these loans had heavy exposure to the property sector. This probably caused the high volatility in the Malaysian stock market.

In the normal period, the factor which significantly drove the volatility of the Malaysian stock market is trade balance. However, in the post-crisis period, the factor which significantly impacted the volatility is capital inflows, trade balances and credit expansion. Thus, both of macroeconomic imbalances and moral hazard as a channel of economic fundamental are important channels to explain the Malaysia financial crisis.

The Philippines

Table 5.2G shows the statistical result of the volatility of the Philippines stock market. I found the probability of F-statistic in each period is equal to 0.0000. We are able to reject null hypothesis. The adjusted R-squared of the overall period, pre-crisis period and post-crisis period are 0.9732, 0.9390 and 0.9120 respectively.

In the overall period and pre-crisis period, the Philippines stock market volatility cannot be explained by fundamental economic weaknesses with 99 percent confidence. In the post-crisis period, the probability of t-statistic is 0.0439 in foreign debt as a percentage of GDP (FLG). This factor significantly drove the volatility in the crisis with a positive effect. If foreign liabilities increased, the volatility increased. The share of foreign liabilities of private commercial banks rose sharply during the crisis period. In fact, the foreign liabilities had a pretty high level in the pre-crisis period, but it greatly increased during the crisis period. This rapid increase in commercial banks' foreign liabilities derived from the Philippines peso depreciation. The depreciation of the local currency increased the real burden of foreign debt. There was a serious mismatch between foreign liabilities and foreign assets of banks and non-bank firms. The Philippines banks borrowed heavily from foreign banks but lent mostly to local investors. In the normal period, a high level of foreign liabilities may not cause concern as short-term foreign debts are easily rolled-over. In the presence of rapid currency depreciation, however, this imbalance may cause serious financial problems. Foreign lenders may suddenly refuse to roll over short-term lines of credit to domestic banks precipitating a credit crisis. The foreign liabilities increase derived from the currency

depreciation which may be the cause of the significant increase in the volatility in the crisis period.

Notice that the volatility cannot be explained by fundamental economic weaknesses during the normal period. We can imply that the Philippines cannot anticipate the onset of the financial crisis from economic fundamental factors. Thus, the moral hazard as a channel of economic fundamentals is an important channel to explain the financial crisis.

5.3 Policy Implications

Capital flows

I believe that international financial markets are unstable. Since the victim-countries' borrowing was mainly from short-term foreign currency borrowing, it may be true that better banking supervision will solve the problem of unstable capital markets. This involves regulating, monitoring and supervising the banking system. The rapid push toward fully open capital markets among the emerging markets would seem to be misguided. Such short-term financing was useful to finance trade flows, but not longer term investments. Nevertheless, the foreign short-term inflows were less useful to finance domestic long-term lending by highly leveraged financial institutions and investments in real estate and other non-tradable activities. The notion that improved supervision will quickly render short-term capital flows benign is unproven and unlikely.

The policy goal should be to support long-term capital flows. This is especially true for foreign direct investment and equity portfolio flows but also to limit short-term international flows mainly for financing of short-term trade transactions. Bank and non-financial corporations could be discouraged from short-term international financing, for example, with maturities of under six months. The exception would be to finance documented trade transactions. As always, one can approach such limits via taxation (impose a higher reserve requirement rate on dollar deposits in the banking system), or via outright supervisory limits. The administration and monitoring would probably push towards outright qualitative limits on short-term flows.

Balance of Payments

The unsustainable balance of payment could be a root of economic vulnerability. Balance of payment consists of the current account and the capital account. The troubled economies experienced large and persistent current account deficits. Most of the current account deficits were from trade balance deficits. The empirical results show that the trade balance has a significant effect on the Thailand's stock market volatility. Furthermore, their current account deficits were mainly financed by short-term private capital inflows. The surplus of the balance of payment was mainly from the capital account. In particular capital inflows mostly from short-term foreign inflows. Moreover, the victim-countries had a pegged exchange rate which caused speculative attacks on the currencies. To prevent crisis sustainable balance of payment surplus should come from current account surplus and not the capital account. However, current account surplus should be balanced with capital account. We should also avoid large current account deficits financed through short-term private capital inflows. To support a sustainable current account surplus exports should be seriously promoted. Product development and marketing strategies should be emphasized.

Exchange rate regime

The victim-economies had maintained stable exchange rates vis-à-vis the U.S. dollar until the crisis. The pegged exchange rate did not necessarily allow monetary and fiscal discipline and led to an overvalued currency and a widening of current account imbalances. In addition, a pegged rate might encourage excessive foreign currency borrowing as the perceived currency risk is deceptively small. The evidence shows that the victim-countries had large current account deficits and massive capital inflows. This was mainly from short-term private capital inflows. As a result, investors lost confidence in the currency values. Capital inflows stopped abruptly and capital outflows took place in massive amounts. It is therefore important to have a flexible exchange rate regime with a consistent monetary and fiscal policy framework. This will help to deter speculative attacks and avoid massive amounts of capital outflows.

Moral hazard

The moral hazard problem was highly evident in the recent financial crisis in East Asia. This was demonstrated by excessive risk-taking by financial institutions. The moral hazard problem facilitated overlending and overborrowing. Prudential regulation is needed to limit the moral hazard problem. Most governments provided financial institutions with two safety nets: last resort lending and a guarantee for depositors in banks that become insolvent. They therefore generated the moral hazard phenomenon. With safety nets in place, competition for deposits forces banks and non-banks to hold excessively risky asset portfolios. It also pushes banks and non-banks into overlending and overborrowing. Furthermore, mostly borrowings were in the form of short-term foreign currency. These funds were used to finance domestic investments in real estate and other non-tradable activities over which there was not with much scrutiny. This led to financial fragility. To limit the effects of moral hazard, prudential controls must be imposed when safety nets are provided. For instance, deposit insurance should be limited to a minimal share of private liabilities to bound government contingent liabilities in the event of crisis. Risk must be shared with investors and depositors. The domestic financial institutions also should be sufficiently governed for prudent risk-management.

CHAPTER VI

CONCLUSIONS AND LIMITATIONS

6.1 Conclusions

Two objectives are accomplished in this study. First, a special time-varying market return volatility model during the crisis period in four emerging markets and four developed markets is developed. The weekly stock market volatility of each country is calculated by using an asymmetric Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. This model assumes that volatility responds more to negative shocks than to positive shocks. This is crucial because during a crisis most shocks are negative. The emerging stock markets have higher volatility than the stock markets of developed markets. In particular, the emerging stock markets have a significant increase in volatility during crisis periods. In this paper, I account the substantial significant increase in the volatility as a financial crisis. I found that Thailand, Korea, Malaysia and the Philippines have greatly increase in stock market volatility during crisis. Japan, Singapore and Hong Kong have a moderately increase in stock market volatility after the crisis triggering. These indicated that Japan, Singapore and Hong Kong were less affected by the regional turmoil. These countries have performed better than other countries affected by the financial crisis. Although their currencies were devalued, the depreciation rates of their currencies were modest. Importantly, these countries did not face severe reversals in market sentiment, financial panic and large-scale debt crises. These countries that were only mildly affected by the turmoil shared a number of characteristics. First, their trade and current account balances were in surplus in the 1990s. Second, their foreign debt was low. Third, their financial and banking systems did not suffer from the same structural weaknesses and fragility observed in the crisis countries. Fourth, they had a relatively large stock of foreign exchange reserves compared to the crisis countries. Lastly, they were to a large extent

immune from forms of “crony capitalism”. Furthermore, Singapore had let its currency float rather than lose reserves by attempting to stabilize the exchange rate. Hong Kong achieved this result even with its currency board system. It was able to stick to a fixed rate against the U.S. dollar. These economies also were the strength of financial institutions.

Second, the relationship between fundamental economic weaknesses and stock market volatility is examined by using Generalized Least Squared (GLS). On the fundamental economic weaknesses side, the study focuses on the macroeconomic variables. These include liberalization dummy variable (LIB), capital inflows as a percentage of Gross Domestic Product (CPG), trade balance as a percentage of GDP (TG), real exchange rates (RER), the difference between U.S real interest rates and local real interest rates (DRIN), broad of money as a percentage of foreign exchange reserve (M2R), bank lending as a percentage of GDP (LBG) and foreign debt as a percentage of GDP (FLG). The results of this study shows that the East Asian financial crisis resulted from the concurrent fundamental economic weaknesses in victim-countries. Additionally, this study could indicate the factors of the financial crisis in East Asia. For example, CPG, TG and RER had a significant effect on Thailand’s stock market volatility. Korea’s stock market volatility can be explained by TG and DRIN. CPG, TG and LBG had a positive effect on the Malaysian stock market volatility. FLG had a significant effect on the Philippines’ stock market volatility. It can be concluded that macroeconomic imbalances have a significant effect on Thailand, South Korea and Malaysia stock market volatility. Moral hazard has a significant effect on Malaysia and the Philippines stock market volatility. The results also show that financial liberalization had an insignificant effect on the emerging stock market volatilities. Therefore, the significant increase in the volatility of victim-countries during the East Asian financial crisis derived from fundamental economic weaknesses. The results show that the East Asian financial crisis was caused by fundamental economic weaknesses and not by contagion.

6.2 Limitations of the study

6.2.1 The aim of the study is to examine whether the East Asian crisis can be explained by fundamental economic weaknesses. If the fundamental economic variables have significant effects on the volatility, it implies that the East Asian financial crisis was caused by fundamental economic weaknesses and not by contagion. However, if the fundamental economic variables have no significant effects on the volatility, it cannot imply that the East Asian financial crisis was caused by contagion. This study did not test whether the contagion effect took place directly.

6.2.2 Studying the crisis phenomenon we need to use high frequency data. But economic fundamental data which are mostly macroeconomic data used in this paper, are low frequency data. Data Interpolation needs to apply in this study. The real value of some of the variables may not be exact.

6.2.3 Economic fundamentals in this study are particularly quantitative data. It does not include qualitative data which likely have an effect on the stock market volatility. For instance, political uncertainty probably forced a significant increase in stock market volatility.

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APPENDIX 1

$CC_{i,t}$ is capital control dummy variable

To examine the effect of paradigm shift to the stock market volatility, the capital control dummy variable was included in the model as a paradigm shift variable. This variable included only a Malaysia model, due to Malaysia government changed their policy to be capital control policy in August 1998. Its purpose is to restrict the volatile capital inflows. This variable was be included in the Malaysia's model to test the effective of capital control on the stock market volatility. The capital control dummy variable (CC) is one for periods of capital control begin, and zero otherwise. The study determines the capital control date followed by Bakaert and Harvey (1999).

APPENDIX 2

Correlations

A. Japan							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	-0.1969	1.0000					
RER	-0.2029	-0.3930	1.0000				
DRIN	0.2096	-0.0073	-0.0412	1.0000			
M2R	-0.2670	0.1092	0.1060	**-0.8616**	1.0000		
LBG	-0.1842	0.1447	0.1323	-0.5072	0.5914	1.0000	
FLG	0.0925	-0.3669	0.5568	-0.3874	0.5091	0.1104	1.0000

B. Singapore							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	-0.4442	1.0000					
RER	-0.2544	0.7000	1.0000				
DRIN	0.0580	-0.1682	-0.1239	1.0000			
M2R	-0.4230	0.6483	**0.7530**	-0.0453	1.0000		
LBG	0.0438	-0.6530	-0.2322	0.0120	-0.2687	1.0000	
FLG	0.3634	0.1174	0.6263	-0.0261	0.4809	0.0398	1.0000

C. Hong Kong					
	TG	RER	DRIN	LBG	FLG
TG	1.0000				
RER	0.0895	1.0000			
DRIN	-0.6655	0.2196	1.0000		
LBG	-0.1703	-0.5228	-0.0585	1.0000	
FLG	**-0.7346**	-0.4015	0.5555	-0.0354	1.0000

APPENDIX 2-*continued*

Correlations

D. Thailand							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	**-0.8116**	1.0000					
RER	-0.7958	0.7440	1.0000				
DRIN	0.3255	-0.1337	-0.1689	1.0000			
M2R	-0.0716	-0.0581	0.3377	0.3396	1.0000		
LBG	-0.5600	0.6658	0.2331	-0.2999	-0.5562	1.0000	
FLG	-0.5157	0.5497	0.1815	-0.3529	-0.4885	**0.9351**	1.0000

E. Korea							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	-0.6101	1.0000					
RER	-0.6843	**0.8514**	1.0000				
DRIN	-0.0099	0.0607	0.0380	1.0000			
M2R	0.2710	-0.6136	-0.4392	-0.4039	1.0000		
LBG	-0.1214	0.5111	0.5657	-0.0348	-0.5002	1.0000	
FLG	-0.2200	0.4761	0.6079	-0.0005	-0.3850	**0.7299**	1.0000

F. Malaysia							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	-0.2714	1.0000					
RER	0.0005	**0.6370**	1.0000				
DRIN	**-0.7845**	0.1771	-0.0167	1.0000			
M2R	-0.4277	0.1897	0.1260	0.2779	1.0000		
LBG	0.2795	0.2525	0.4644	-0.4681	0.0765	1.0000	
FLG	0.5921	0.0534	0.2332	-0.5260	-0.4927	0.5265	1.0000

APPENDIX 2-*continued*

Correlations

G. Philippines							
	CPG	TG	RER	DRIN	M2R	LBG	FLG
CPG	1.0000						
TG	-0.3884	1.0000					
RER	-0.1827	0.1845	1.0000				
DRIN	0.0475	0.0391	-0.0939	1.0000			
M2R	-0.3998	0.1835	-0.3247	-0.0369	1.0000		
LBG	0.2490	-0.0629	0.1342	0.0708	-0.5435	1.0000	
FLG	0.0591	0.1177	0.2026	0.0578	-0.3972	**0.9472**	1.0000

Biography

The author, Pichanun Aranyanark, daugther of Rear Admiral Nakorn Aranyanark and Mrs. Chiraporn Aranyanark, was born in 1979 in Bangkok, Thailand. She attended Triam Udomsuksa Pattanakarn in Science-Math Program from 1991-1995. Then she attended Thammasat University from 1996-2000 and obtained Bachelor of Arts in Economics. Her major is Mathematics Economics, International Economics and Industrial Economics. Her minor is Marketing. She continued her graduate study at the Chulalongkorn University from 2000-2002.