On Currency Crises, Exchange Rate Regimes and Contagion

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A thesis submitted to the University of Adelaide in fulfilment of the requirements for the degree of Doctor of Philosophy

School of Economics

February 2006

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Abstract

The enormous literature that the East Asian crisis generated has provided the necessary fertile inputs that brought forth specific proposals on how to strengthen the *architecture* of the international monetary and financial system. Viewed in this context, this thesis attempts to revisit or re-assess prevailing conventional wisdom or recent empirical evidence on some key issues that have arisen in discussions/debates regarding reform efforts towards strengthening the international financial architecture. Towards this end, the core chapters rely on recently developed research methods in time-series econometrics and examine the major East Asian countries that were acknowledged to have either directly or indirectly been impacted by the crisis of 1997-98.

The starting point or the first core chapter (chapter 2) focuses on speculative attacks and crises identification, one of the basic ingredients of early warning system models that seek to identify and measure the determinants of a countries' vulnerability to crises. The underlying contention is that the current design of these early warning models in terms of empirically defining or identifying currency crises is that it implicitly assumes that either the changes in exchange rates alone or an index of exchange market pressure are normally distributed. If, on the contrary, however, these variables are not normally distributed, this signifies that the conventional method of employing the mean and some arbitrary multiples of the standard deviation in current designs of early warning systems underestimates the frequency or incidence of speculative attacks. Using three indices of exchange market pressure popularly adopted in the literature and employing an alternative approach that makes far fewer parametric assumptions, the results reveal that these indices are non-normal, while, in

the process, there is evidence to suggest that the identification of currency crises is sensitive to the choice one adopts with regard to the weights of the index of exchange market pressure. This finding is not only true among the East Asian countries of Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand, but also for a select group of Latin American countries (Argentina, Brazil, Chile and Mexico).[1] More tellingly, a statistical method that avoids *a-priori* assumptions about the statistical distribution of any exchange market pressure series will dominate conventional method regardless of whatever standard weighting scheme one adopts.

Soon after the East Asian crisis, the proposition that countries are, or should be, moving to the corners according to a certain continuum of exchange rate policy, was rapidly adopted as the new conventional wisdom and rapidly thrown into the mix with regards to reforms in the international financial architecture. Either keep convertibility and a stable currency but abandon monetary independence and fix the currency, backed by some institutional commitment such as through a currency board, or keep monetary policy and convertibility but abandon currency management and adopt a free float. This so-called 'corner solution' emanates from some broad consensus that behind almost all recent crises is the collapse of a non-credible exchange rate peg, the foremost examples being that the East Asian countries of Indonesia, Korea, Philippines, Thailand, and to a lesser extent, Singapore, were widely acknowledged to have operated a *de-facto* or soft US dollar peg several years before the crisis.

As such, the second core chapter (chapter 3) analyses the behaviour of exchange rate policy before and, especially after the crisis in each of these countries.

[1] The select group of Latin American countries were included in the analysis to test the robustness of the results in this chapter whether apart from the East Asian countries, the findings will also be true for a geographical group of countries that are acknowledged to be no stranger to speculative attacks and currency crises.

The primary motivation in undertaking this worthwhile task is that more recent evidence, however, have shown that that the post-crisis exchange rate policies of these countries have reverted to an arrangement akin to their pre-crisis *de facto* US dollar peg. The concern is that in view of the bipolar hypothesis and the increased international financial integration of these countries, the resumption of such practices might make these same countries vulnerable to a similar fate that befell previously on these countries in 1997-98.

The empirical results suggest that the *de facto* exchange rate regimes of the four crisis-hit countries of Indonesia, Korea, Philippines and Thailand changed after the crisis. To be more precise, these four East Asian countries, in contrast to previous evidence, have tended to manage their exchange rates more flexibly after the crisis, whereas, the evidence in Singapore's case is in conformity with its exchange rate-centred monetary policy strategy before and after the crisis.[2]

The result that the countries of Indonesia, Korea, Philippines and Thailand have tended to manage their exchange rates more flexibly after the crisis appear consistent with the establishment in these countries of institutions and mechanisms to implement monetary policy around an inflation target. In particular, these same countries have fashioned most, if not all, elements of inflation targeting as a monetary policy strategy in terms of an institutionalised commitment to price stability, publication and presentation of inflation reports, policy of communicating to the public and financial markets the rationale for the decisions taken by the central bank.

The third core chapter (chapter 4) examines the issue of shift-contagion. Previous literature has attempted to test whether there is a shift in how shocks are transmitted across countries, with preliminary results that suggested the existence of

[2] Malaysia is excluded from the analysis as the decision to peg the ringgit in September 1998 was officially-declared which makes it trivial to examine its *de facto* exchange rate regime since its *de-jure* (actual or official) exchange rate regime is also its *de-facto*.

contagion. But Forbes and Rigobon (2002) and others have argued that these conclusions might be misleading, since the problem of heteroscedasticity in the data was not properly accounted for. Taking this econometric concern into account, these authors found that there is in fact, little or no contagion. However, an important limitation of empirical studies to date on shift-contagion is that these same studies are beset with the problem of sample selection bias, i.e., the crises and the associated low-variance periods are generally designated, ex post.

Therefore, this chapter goes one step further by implicitly adjusting for this problem by letting the entire detection of normal and crisis periods be endogenous for a sample of seven East Asian countries, namely, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, and Thailand, instead of exogenously determined.[3] The results reveal some evidence of shift-contagion, which suggests that, apart from permanent or long run channels being predominantly at work when crisis simultaneously occur, there is also some support for the role of transitory or temporary transmission channels. More importantly, this implies that aside from the role of introducing domestic policies that temporarily insulate countries, at the international level, there is justification for short-term multilateral support to mitigate the adverse effects of shocks that originated elsewhere.

[3] As this chapter examines specifically East Asian stock market data, the Hong Kong stock market is now included, in contrast to the previous two core chapters. The main reason for this is that according to Forbes and Rigobon (2002), during the onset of the East Asian crisis, for instance, American and British newspaper and periodical accounts paid little attention to the earlier movements in the Thai and Indonesian markets until only the sharp decline in the Hong Kong market that discussions about the possibility of contagion to the rest of the world from the crisis quickly started.

Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and beliefs, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

Victor Pontines, 16th February, 2006.

Acknowledgements

This arduous but deeply fulfilling journey towards completing a PhD owes a great deal to many individuals. First, the greatest intellectual debts are owed to my supervisors. I am deeply grateful to Dr. Ramkishen Rajan, my former principal supervisor who was primarily responsible for offering me the opportunity to study at the University of Adelaide and his supervision during the formative years of this work. My deep and sincere gratitude is also due to my current supervisor, Dr. Reza Siregar, who not only with his overall supervision effort, but also the opportunity to learn and interact during the completion of this work as well as in ongoing research endeavors, I feel especially grateful.

I also would like to thank the School of Economics, University of Adelaide, for the Teaching Assistantship support, which provided the additional financial funding during my PhD study. Dr. Colin Rogers, Dr. Ian McLean and Dr. Richard Pomfret, each of whom, as Department Head, are owed special thanks for their help and support in database and software acquisitions and conferences. Other former and current members of the department who have contributed immensely in my training as an economist include — Dr. John Whitley, Dr. Louise Allsopp, Dr. Tony Hughes, Dr. Ralph Bayer, and Dr. Raul Baretto. Special mention must also be made of Nick Robinson, our IT master guru, for the unwavering help and support in every IT/computer-troubleshooting related issues. I also would like to thank the respective organizers of the 2004 Australasian Econometric Society Conference and the 2004 Annual Convention of the East Asian Economic Association in accepting previous drafts of this work. Thanks also to Peter Wilson and an anonymous examiner who read through the previous draft of this thesis and made several excellent suggestions.

I also need to extend my thanks to other individuals who have also offered their useful comments and feedback to earlier versions of this work. In particular, I am grateful to Dr. Charles Marrewijk of Erasmus University, Netherlands for reading earlier drafts of chapters 2-4, Mr. Juanito Sioson and Mr. Matt Palmer for carefully proofreading chapters 3 and 4, respectively. I also owe sincere thanks to Dr. James Hamilton of the University of California at San Diego for generously entertaining some of my questions in implementing the SWARCH program in GAUSS. I must also extend my thanks to all graduate students in the department for contributing towards a working and learning environment conducive to us all.

Finally, albeit most importantly, I owe my deepest thanks to my wife, Jing, and to my son, Vincent, for providing the essential moral support throughout this work.

This dissertation was supported by a University of Adelaide Scholarship International (ASI).

Chapter 1

Introduction

The crisis in East Asia has been the guiding inspiration in sparking a vast array of literature on its origins, consequences, and ramifications for policy making. Having said that, the enormous literature that the crisis generated has provided fertile inputs that brought forth specific proposals on how to strengthen the *architecture* of the international monetary and financial system—the current buzzword that encapsulates reforms both at the national and international hierarchies. This architectural reforms have revolved around two central themes: measures aimed at reducing the frequency of crises (crisis prevention) such as attempts in developing early warning system models in order to identify vulnerable countries before they succumb to crises, efforts in fostering compliance with international standards and codes; and, measures aimed at reducing the costs or severity of crises (crisis resolution or management) such as reforming the policies and practices of the IMF, efforts in involving private sector creditors in resolving debt-related problems of emerging-market countries.

Given the context described above, this thesis attempts to revisit or re-assess prevailing conventional wisdom or recent empirical evidence on some key issues that have arisen in discussions/debates regarding reform efforts towards strengthening the international financial architecture. In order to address these issues, this thesis uses recently developed research methods in time-series econometrics and examines the East Asian countries that were acknowledged to have either directly or indirectly impacted by the crisis of 1997-98, i.e., Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand.[1]

In chapter 2 I pose the question: can one of the basic designs of early warning systems, that is, the conventional approach of empirically defining or identifying currency crises, be substantially improved on statistical grounds? It is widely cited in the literature that the empirical performance of early warning system models is mixed. Most existing models are significant predictors of actual crises but still generate considerable errors (Edison, 2003; Berg, et al. 2004). In other words, existing models suffer two common statistical errors: predicting a crisis where none has actually occurred (type I error) and failing to predict a crisis that did occur (type II error) (Joosten, 2004). For instance, the latter has a crucial policy implication. Failing to predict a crisis that did erupt thereafter could cause private investors to blame the IMF for the losses they then faced, placing the IMF under pressure to rescue the investors by bailing out the crisis country (Kenen, 2002).

Clearly, this not so far-fetched scenario depicted above should provide enough motivation in drawing our attention to exploring the underlying reasons for the not so desirable performance of these models. Apart from an overemphasis on some crisis-specific indicators, data quality, among other possible reasons, one objection is that the current design of these early warning models in terms of empirically defining or identifying currency crises is that it implicitly assumes that either the changes in exchange rates alone or an index of exchange market pressure are normally distributed. As such, the construction of so-called statistical thresholds for these variables, i.e., computed magnitudes of these variables that are more than the

[1] In Chapter 2 I also included four major Latin American emerging-market countries aside from the sample of East Asian countries in order to lend more substance to the central results of Chapter 2. In chapter 3, Malaysia was excluded, while in chapter 4, Hong Kong was included in the analysis. For the underlying reasons, refer to footnote 2, pages ix and 4 in the case of Malaysia, and footnote 3, p. x in the case of Hong Kong.

thresholds are counted as crises periods, often conveniently involved arbitrary multiples of the standard deviation of the said variables to be above its mean. For example, 1.5, 2, or 3 standard deviations above the mean are the usual arbitrary choices. If, however, after a careful examination of the statistical properties of these variables, they are found to be non-normally distributed, this significantly implies that the conventional method of employing the mean and standard deviation in current designs of early warning systems underestimates the frequency of speculative attacks.

After carefully laying out the motivation for this chapter, the first part of the empirical analysis examines the statistical properties of three indices of exchange market pressure popularly adopted in the literature. The aim is to verify the normality, or its non-existence, of the three indices of exchange market pressure. The results reveal that the said three indices are non-normal. This takes us to the second part of the empirical section by evaluating the existing methodology used in identifying currency crises and presenting an alternative approach that makes fewer parametric assumptions. In the process, there is evidence to suggest that the identification of currency crises is sensitive to the choice one adopts with regards to the weights of the index of exchange market pressure. And, more tellingly, a statistical method that avoids *a-priori* assumptions that underpins the statistical distribution of any exchange market pressure series will dominate the conventional methodology regardless of whatever standard weighting scheme one adopts.

Chapter 3 examines the behaviour of exchange rate policy before and after the crisis in Indonesia, Korea, Philippines, Singapore, and Thailand.[2] Although the debate over exchange rate regimes is an old one, discussions about changes in exchange rate regimes is an enduring issue, and, as expected, have come to the fore in discussions of

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[2] Malaysia was excluded from the analysis due to its explicit adoption of an exchange rate peg on September 1, 1998.

international monetary reform. The justification for this is not difficult to come by—the collapse of an exchange rate peg has marked almost all recent crises (Roubini and Setser, 2004).[3] In East Asia, in particular, it is widely cited in the recent literature (and also examined in this chapter) that most of the countries in Southeast Asia maintained a *de facto* US dollar peg for much of the decade before the crisis. Banks and corporations in these countries, as a result, took the commitment to exchange rate stability as an invitation to unhedged foreign currency borrowing, as it was cheaper to borrow abroad, e.g., Thailand, which, in effect, the *de-facto* US dollar peg functioned as an implicit guarantee. When a devaluation occurs, as it ignominiously did in 1997-98, their domestic currency revenues were inadequate for servicing their debts, and so most went bankrupt or faced near bankruptcy, with devastating eventual consequences for the economy (Frankel, 2004).

Such that, soon after the crisis, the proposition that countries are, or should be, moving to the corners was rapidly adopted by the international financial establishment as the new conventional wisdom and rapidly thrown into the mix with regards to efforts in reforming the international financial architecture. Colourfully described in various places as the "bipolar view or hypothesis", the "hypothesis of the vanishing intermediate regime", the "vanishing or hollowing of the middle", the conventional wisdom asserts that, assuming high capital mobility, the choice between exchange rate regimes becomes a discrete one—one either allows full flexibility or none at all (either fixed with credibility to one currency or a basket of currencies). It should also be noted at this point that, this hypothesis is to be a corollary of the well-known "Impossible Trinity". According to this, in the context of increased integration with

[3] Mexico in 1995, Russia in 1998, Brazil in 1999 all had soft-pegs or pegged but adjustable exchange rates before the crisis. Turkey had a programmed rate of depreciation well below the current rate of inflation and Argentina had a currency board (Roubini and Setser, 2004).

international capital markets, this forces the choice among monetary authorities to giving up on exchange rate stability or giving up on monetary independence (Frankel, 2004).

When we return our attention to the particular case of the East Asian countries mentioned above, more recently, doubts have arisen about the post-crisis exchange rate policies of these countries. Evidence provided by McKinnon (2000, 2001), Ogawa (2001) and McKinnon and Schnabl (2002) indicate that these countries have reverted towards a *de-facto* post-crisis US dollar peg. The concern is that in view of the bipolar hypothesis and the increased international financial integration of these countries, the resumption of such practices might make these countries vulnerable to a similar fate that befell these countries in 1997-98. The main question I asked, therefore, in this chapter is: did these same East Asian countries reverted to their pre-crisis exchange rate policies?

This chapter recognises that in order to do away with the problem of classifying exchange rate arrangements let alone the difficulty of measuring a country's commitment to a *de-facto* peg, I first used information on the respective conditional volatilities of the changes in the exchange rate, foreign reserves and interest rates in order to construct so-called indices of intervention. However, in contrast to other studies that use observed volatilities of these monetary variables via unconditional measures of volatility, this chapter deals with a regime-switching ARCH in order to arrive at the conditional volatilities. The empirical results suggest that the *de facto* exchange rate regimes of the four crisis-hit countries of Indonesia, Korea, Philippines and Thailand changed after the crisis. To be more precise, these four East Asian countries, in contrast to previous evidence, have tended to manage their exchange rates more flexibly after the crisis, whereas, the evidence in

Singapore's case is in conformity with its exchange rate-centred monetary policy strategy before and after the crisis. In other words, the supposedly middle ground of exchange rate policy has not really become hollow or vanishing for these countries, while, at the same time, it can also be argued that part of the middle which has become "hollow" for most of these countries is the maintenance of a soft US dollar peg after the crisis.

Chapter 4 looks at the issue of shift-contagion. One motivation of the extensive literature on contagion is to address how countries can reduce their vulnerability to external shocks during periods of heightened volatility. In this vein, it is an interesting policy issue whether a shock is transmitted across markets via temporary or transitory channels that appear only during turbulent periods, or whether it is rooted in more permanent or long run channels or real inter-linkages between markets that exist in all states of the world. The effectiveness of short-term or temporary policy measures, such as capital controls or a stronger defence of the exchange rate, aimed at reducing a market's vulnerability to contagion will depend on whether or not contagion occurred as a result of the transmission of shocks through pre-existing or long-run interdependent linkages or through transitory or temporary channels. Likewise, the effectiveness of short-term multilateral support would also depend on this distinction.

Previous literature has attempted to test whether there is a shift in how shocks are transmitted across countries, with preliminary results that suggest that contagion exist. But Forbes and Rigobon (2002) and others have argued that these conclusions might be misleading, since the problem of heteroscedasticity in the data was not properly accounted for. Taking this into account, these authors found that there is in fact, little or no contagion. However, an important limitation of empirical studies to date on shift-contagion is that these studies are beset with the problem of sample selection bias. The problem occurs when crisis periods are designated, ex post, and the associated low-variance periods are generally also determined in the same manner. Since test results depend crucially on the choice of the normal and crisis periods, such practices may lead to spurious results (Gravelle, et al. 2001).

In accordance, this chapter goes one step further by implicitly adjusting for the problem of sample selection bias by letting the entire detection of normal and crisis periods be endogenous, instead of exogenously determined. For this purpose, I make use of a multivariate version of the univariate Markov regime switching model earlier developed by Hamilton (1988, 1989). In doing so, this also allows the contemporaneous correlations of the cross-country asset returns to shift between high- and low-volatility regimes, which, in turn, allows one to test for shift contagion. The results reveal that not only permanent or long run channels are predominantly at work when crises simultaneously occur, but also, there is some support for the role of transitory or temporary transmission channels.

This importantly suggests that aside from the role of introducing domestic policies that temporarily insulate countries, at the international level, there is justification for short-term multilateral support in mitigating the adverse effects of shocks that originated elsewhere. Arguments to the contrary that financial assistance made available by the international community increased the risk of moral hazard, that is, governments might be more tempted to engage in reckless behaviour in the expectation that the IMF is likely to bail them out in a crisis, is certainly a real one. However, within the context of discussions towards strengthening the international financial architecture, it is not an argument for eliminating short-term liquidity support, but should be considered as an argument in involving to a larger extent the private sector in forestalling and resolving crisis.

Chapter 5 presents some thoughts on the policy implications of the issues examined in this thesis and the scope for further research.

Chapter 2

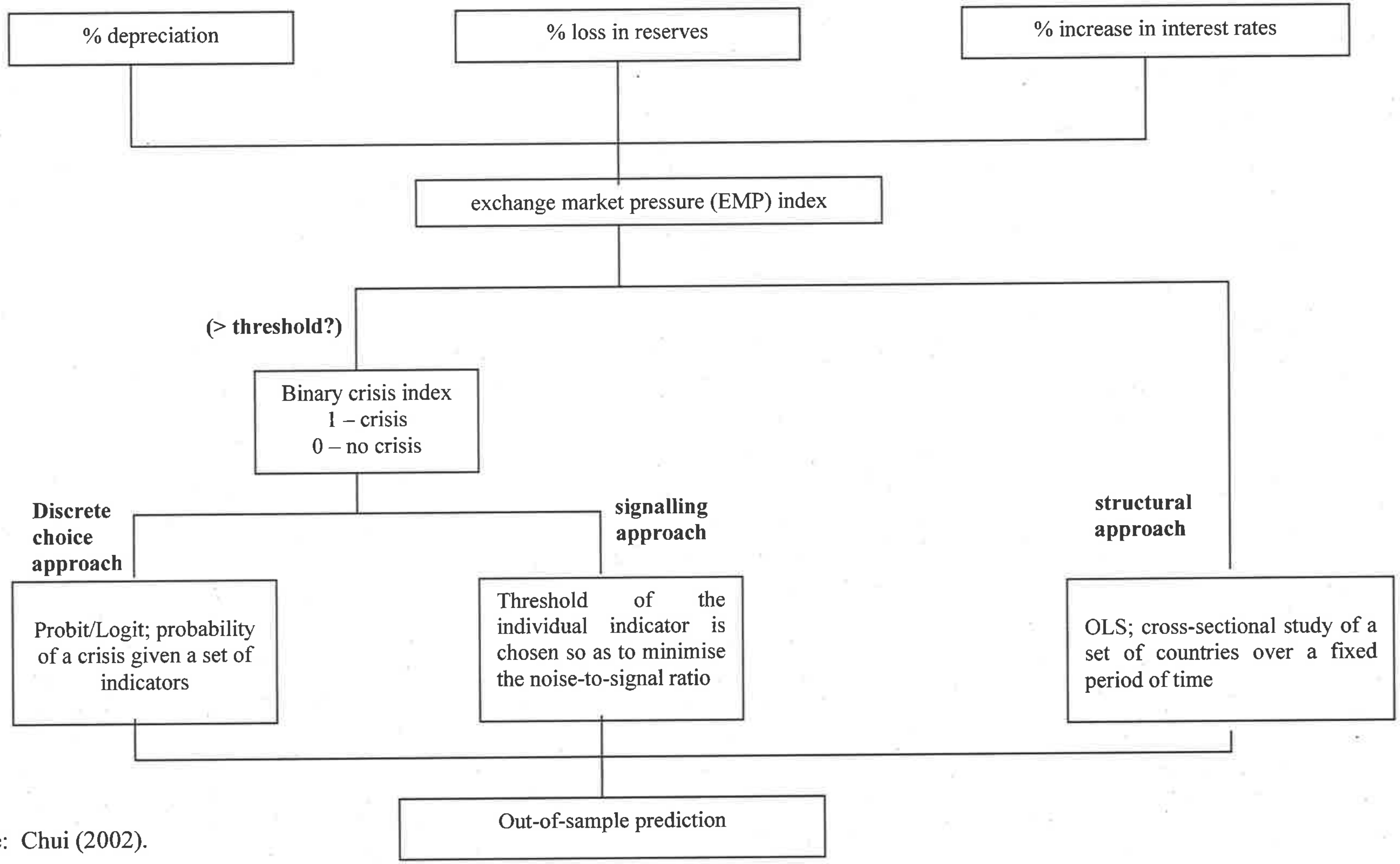
An Extreme Value Approach in Identifying Speculative Attacks in East Asia and Latin America

2.1 Introduction

A common feature of studies that tries to understand the fundamental determinants of currency crises is the construction of a single composite index, or to be more precise, an index of exchange market pressure--henceforth EMP, that will systematically identify the presence and severity of currency crises or speculative attacks on a currency. Studies such as Eichengreen, Rose and Wyplosz (1995, 1996)--henceforth ERW, Sachs, Tornell and Velasco (1996)--henceforth STV, and Kaminsky, Lizondo and Reinhart (1998, 1999)--henceforth KLR, have proposed different constructions of this EMP index.

As shown in Figure 2.1, the EMP index will eventually be employed directly to either construct a binary dependent index variable in logit/probit models, in which case a speculative attack episode is identified once the index is above a certain threshold, or, instead, as a continuous dependent variable in a more structural empirical model of currency crises. The objective of this chapter is neither to construct another crises index, nor to conduct another study on the determinants of crises through the different approaches listed in Figure 2.1 (discrete, signalling or structural approach), and, as such, I do not set out to determine whether currency crises can be forecasted or not. What I, instead, seek is to highlight the few shortcomings emanating from the literature of identifying the incidence of currency crises or speculative attacks on a currency.

Figure 2.1 : Approaches to building leading indicator models of currency crises



Source: Chui (2002).

The problem with the literature when it comes to the identification of speculative attacks on a currency is largely its arbitrary process. More specifically, the usual fashion of choice for the statistical threshold mentioned above, has involved arbitrary multiples of the standard deviation of the EMPs above its mean. In view of this, this chapter will show that the conventional method of defining currency crises is statistically flawed or inaccurate in capturing the 'true' dispersion of any given EMP series. In other words, the conventional method of employing the mean and standard deviation underestimates the frequency of speculative attacks.

More importantly, due to the non-normality of the statistical distribution of the EMP indices, we have to avoid relying too much on parametric assumptions in identifying the statistical threshold. In accordance, this study will employ an alternative statistical method known as extreme value theory—henceforth EVT, in identifying large values of the constructed EMP index. Hardly any study has applied this methodology to the study of identifying currency crises. A recent exception is by Pozo and Dorantes (2003). Their study applied the EVT to identify periods of currency crisis for a broad cross-section of Asian, European and Latin American countries from the mid-1960s to 1997.

This chapter investigates the episodes of currency crises in two sets of countries: the Latin American countries (Argentina, Brazil, Chile and Mexico) and the East Asian countries (Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand). However, the study is distinguished from Pozo and Dorantes (2003) in several ways. Firstly, the extreme value analysis—EVA, is applied to three different weighting schemes popularly adopted in the literature in constructing exchange market pressure indices, namely, ERW, STV, and KLR. Pozo and Dorantes (2003), on the other hand, only applied the ERW index. The results show that it is highly recommended to adopt more than one EMP index to ensure the robustness and conclusiveness of the findings.

Secondly, to avoid the potential problem of a small sample when calculating the tail index parameter of the Hill (1975) estimator, the Hill tail index estimator is modified in view of the proposed estimator of Huisman, et al. (2001)---henceforth HKKP, which is unbiased in small sample. Pozo and Dorantes (2003), on the other hand, opted to pool the countries' EMPs and estimate the regional values of the tail parameter. The pooling of the countries on a regional basis, however, is arguably a statistically inappropriate measure. Even during the pre-1997 financial crisis period that they cover, we can immediately capture the wide divergences of the EMP mean and the standard deviations among the East Asian and the Latin American countries.[1] And, as will be shown later, this statistical divergence continues to be the case when data are included from 1998 to 2003. To generate more consistent analyses, we evaluate country-by-country cases and apply the HKKP methodology to deal with the relatively small number of observations.

The chapter is organised as follows. The next section presents the underlying issues within the context of identifying currency crises and reviews the relevant literature. Section 2.3 briefly reviews the basic constructions of the three most commonly used exchange market pressure indices—ERW, KLR and STV. The theoretical underpinnings of the EVT as well as the proposed modification by HKPP to the Hill tail index estimator are discussed in section 2.4. The empirical section of the chapter covers the next two succeeding sections, and section 2.7 ends the chapter with a brief conclusion.

[1] Refer to Table 2 of Pozo and Dorantes (2003), pp. 598.

2.2 Review of the Related Empirical Literature

2.2.1 Definition of Currency Crises

An assortment of issues have to be decided in designing an early warning system of currency crises, namely, the appropriate definition of a crisis, the choice of which explanatory variables to include as potential determinants of currency crises, the choice of sample under analysis (countries to be included, frequency, and length of the sample); and the choice of the appropriate statistical and econometric method to be employed. Perhaps much of the ongoing controversies and recent advances in the empirical modelling of currency crises relate to the second (which explanatory variables to include) and the fourth (econometric method to be used). The third issue (country coverage, frequency of data, and sample period) has been typically, settled by employing a cross-country data set, and focusing on currency crises experienced during the last three decades. On the second issue (crisis definition), while an assortment of crisis definitions has increased in recent studies, the underlying arbitrary nature, in general, of the dating schemes employed in the literature has important implications, for instance, on the effective dates of currency crises. As Eliasson and Kreuter (2001) note:

> we believe that the main limitation of the crisis models today lies in the…crisis definition rather than the explanatory variables, and hence that a different approach is called for (p. 2).

In fact, once we carefully restrict our attention to the issue of defining and dating currency crises, we also find a host of related and important issues which may have a significant bearing on the generally mixed results of existing estimates of early warning system models. According to Table 1, we can identify six various issues in the definition of currency crises, namely: (i) variation in the variables used in the EMP index; (ii) appropriate weights to use in the EMP index; (iii) whether to use the real or nominal exchange rate in the EMP index; (iv) either a continuous or binary EMP index; (v) if binary EMP index, threshold or cut-off value used; (vi) if imposing an exclusion or crisis window, the length or duration of the exclusion window.

With regards to the first issue, as depicted in Figure 2.1, most studies share a common feature of using an exchange market pressure index, sometimes also referred to as the speculative/currency pressure index, defined as a weighted average of the changes in exchange rate, in foreign exchange reserve, and interest rate (the latter usually excluded due to the lack of market-determined data on emerging markets prior to the early 1980s), in identifying currency crises. However, some studies use variants of this EMP index by focusing only on large movements of the exchange rate.[2] The underlying interest here is only to capture those episodes of successful speculative attacks, that which leads to full-blown currency crises as opposed to capturing both instances of successful and unsuccessful attacks which a standard EMP index is supposed to measure. Whereas, some studies eschew altogether the use of the EMP index, for example, Ghosh and Ghosh (2002) defined crises as a decline in the GDP growth rate of at least 3 percentage points, while Grier and Grier (2001) used exchange rate depreciation and stock market returns to define currency crises.

In the second issue, the use of appropriate weights in the EMP index is an important one because an unweighted index will be biased towards that variable in the index which exemplifies the most volatile behaviour over time. Three types of arbitrary weighting schemes have been used in the literature all of which have implications on the effective dating of currency crises (Edison, 2003). The first is to

[2] Examples of such studies are by Frankel and Rose (1996) where a crisis is defined as a depreciation of at least 25 per cent and exceeding last year's depreciation by at least 10 per cent; Kumar, et al. (2003) defined it as depreciations of at least 5, 10, and 15 per cent, respectively; Apoteker and Barthelemy (2001), Apoteker (2000) defined it as the 20 per cent change in the real exchange rate in one-quarter, 30 per cent in two quarters or 40 per cent in 3-6 quarters; Bruggemann and Linne (2000) defined it as a 20 per cent depreciation against the U.S. dollar within ten trading days.

use the inverse of the corresponding standard deviation of each components of the EMP index. First employed by ERW (1995, 1996), it has proven to be the most popular weighting scheme.[3] The second weighting scheme first employed by KLR (1998) is similar to the first as it uses the inverse of the standard deviation of each components of the EMP index, but each multiplied by the standard deviation of the changes in the exchange rate.[4] And the last type of weighting is to divide each inverse of the standard deviation of the components of the EMP index, by the sum of the inverses of the standard deviation of the three components.[5] Meanwhile, two such studies that avoid weighting issues altogether are by Zhang (2001) which treated exchange rate and reserve changes separately, and Hawkins and Klau (2000) where scores from -2 to 2 were assigned based on changes in each components of the EMP index.

In the third issue, Kamin, et al. (2001) cited two reasons why using the real exchange rate as opposed to the nominal exchange rate in the construction of the EMP index may have important advantages. First, on a conceptual level, a depreciation of the real exchange rate rather than the nominal exchange rate would most likely reflect episodes of financial crisis. Second, on a practical level, using the real exchange rate eliminates the need to treat high-inflation episodes separately (such as in the KLR

[3] Subsequent studies that employed this weighting scheme were: Glick and Hutchison (1999); Kamin and Bobson (1999); Gelos and Sahay (2001); Leblang (2001); Bussiere and Fratzscher (2002); Wyplosz (2002); Leblang (2003); Block (2003); Cipollini and Kapetanios (2003); Fratzscher (2003); Lestano, et al. (2003); Jacobs, et al. (2004).

[4] Subsequently studies that employed this weighting scheme were by Kaminsky, and Reinhart (1999), Goldstein, Kaminsky, and Reinhart (2000); Berg and Patillo (1998); Berg, Borenzstein, Milesi-Ferretti and Patillo (1999); Komulainen and Lukkarila (2003); Edwards (2003); Lestano, Jacobs and Kuper (2003); Jacobs, Kuper and Lestano (2004).

[5] First employed by STV (1996), Berg and Patillo (1998); Glick and Rose (1998); Tornell (1999); Ahluwalia (2000) were some of the subsequent papers which employed this weighting scheme.

(1998) study), or requiring the rate of depreciation of the nominal exchange rate to be more than a given margin in the prior year (e.g., Frankel-Rose (1996)).[6]

In the fourth issue, once a decision has been made regarding the first three issues discussed above one is then faced with two options depending on how one would proceed with the econometric methodology. According to existing surveys,[7] there are three broad econometric methodologies, which can be ranged from the non-structural, i.e., the limited-dependent or discrete choice approach, the signalling approach and the structural approach. If the methodology to be employed is non-structural, in dating currency crises the values of the EMP index is converted to a binary or dichotomous variable when it crosses a certain arbitrary threshold or 'cut-off' value (1 for crisis, 0 for tranquil or non-crisis). On the other hand, if the method to be employed is structural as in standard ordinary least squares, the values of the index are maintained and no further conversion is needed such that the index is defined as a continuous dependent variable. The primary rationale of proponents of the latter approach is the huge loss of information when converting from a continuous to a binary variable, especially when one is interested in the depth of a crisis. However, majority of the numerous studies have either employed the discrete-choice technique or the signals approach compared to the structural approach.[8]

A corollary of the previous issue is the fifth issue of which appropriate value of the threshold or cut-off to use if the EMP index is converted into a binary/dichotomous variable. This threshold is often defined as a percentage value or

[6] For example, Bussiere and Fratzscher (2002) and Arias and Erlandsson (2004) used the real exchange rate.

[7] Vlaar (2000); Hawkins and Klau (2000); Chui (2002); Abiad (2003), Arias (2003).

[8] The STV (1996) study can be considered as the first well-cited example of the structural approach which applied a cross-country regression model with dummy variables on the nature of financial crisis after the devaluation of the Mexican peso in 1994-1995 by examining data of 20 emerging markets. Other studies which used the structural approach were Berg and Patillo (1998); Corsetti, et al. (1998); Bussiere and Mulder (1999, 2000); Tornell (1999); Ahluwalia (2000); De Gregerio and Valdes (2000); Hawkins and Klau (2000); Kwack (2000); Nitithanprapas and Willett (2000); Cartapanis, et al. (2002); and Mulder, et al. (2002).

a multiple of the currency pressure index's standard deviation plus the mean of the EMP index. The usual fashion of choice among studies is to use cut-offs ranging from 1.5σ to 3σ. More specifically, studies have either used 1.5, 1.645, 1.75, 2, 2.5 and 3 times the standard deviation plus the mean of the EMP index.[9] The sixth and final issue is whether to impose an 'exclusion or crisis window, i.e., excluding later observations when two or more crises occur in successive months, and, if so, the appropriate length or duration of the window. Studies that impose an exclusion or crisis window recognise that a crisis often lasts for over a month such that this is to avoid counting the same crisis more than once. The choices of the length or duration of the window have varied from as short as 3, 5 and 6 months to relatively longer exclusion windows of 12 months (one year), 18 and 24 months.[10]

[9] For instance, ERW (1996); IMF (1998); Kruger, et al. (1998); Aziz, et al. (2000); and, Peltonen (2001) used the threshold $1.5\sigma + \mu$. While, Gelos and Sahay (2001); Caramazza, et al. (2000, 2004) used a $1.645\sigma + \mu$ threshold. Kamin, et al. (2001) used a $1.75\sigma + \mu$ threshold. Examples of studies which used a $2\sigma + \mu$ threshold were: ERW (1994, 1995); Glick and Moreno (1999); Glick and Hutchison (1999); Kamin and Bobson (1999); Glick and Hutchison (2000); Leblang (2001); Bussiere and Fratzscher (2002); Zhuang and Dowling (2002); Leblang (2003); Komulainen and Lukkarila (2003); Lestano, et al. (2003); Jacobs, et al. (2004). Edison (2003) used a $2.5\sigma + \mu$ threshold. Finally, examples of studies which used a $3.0\sigma + \mu$ threshold were: KLR (1998); Kaminsky and Reinhart (1999); Berg and Patillo (1998); Berg, et al. (1999); Zhang (2001); Leblang (2001, 2003); Edwards (2003); Block (2003); Collins (2003).

[10] Shorter exclusion windows of 3, 5, and 6 months were used in ERW (1996); Peltonen (2001); Yan (2001); Jacobs, et al. (2004). A one-year exclusion window was used in the papers of Glick and Moreno (1999); Ahluwalia (2000); Zhuang and Dowling (2002); Edwards (2003); Komulainen and Lukkarila (2003); Jacobs, et al. (2004). An exclusion window of 18 months was used in the IMF (1998) study, whereas, Glick and Hutchison (2000); Collins (2003) used an exclusion window of 24 months.

Table 2.1

Various Issues in the Definition of Currency Crises											
Variation in the index of exchange market pressure used		**Appropriate weights in the index of exchange market pressure**		**Nominal versus real exchange rates**		**Continuous versus binary EMP Index**		**If binary/dichotomous variable, threshold or cut-off value used**		**If imposing crisis/exclusion window, duration of the window**	
exchange rate depreciation of at least 25% and exceeding last year's depreciation by at least 10%	e.g., Frankel and Rose (1996)	inverse of the standard deviation of each component of the exchange market pressure index (changes in exchange rates, reserves, interest rate/interest rate differential)	e.g., Eichengreen et al. (1995, 1996); Glick and Hutchison (1999); Kamin and Bobson (1999)	Nominal exchange rate	e.g., Kaminsky et al. (1998); Frankel and Rose (1996)	Continuous	e.g., Sachs et al (1996); Berg and Patillo (1998); Corsetti et al. (1998); Bussiere and Mulder (1999, 2000)	$\mu + 1.5\sigma$	e.g., Eichengreen et al. (1994, 1995, 1996); IMF (1998); Kruger et al. (1998);	24 months	e.g., Glick and Hutchison (2000); Collins (2003)

Variation in the index of exchange market pressure used		Appropriate weights in the index of exchange market pressure		Nominal versus real exchange rates		Continuous versus binary EMP Index		If binary/dichotomous variable, threshold or cut-off value used		If imposing crisis/ exclusion window, duration of the window	
exchange rate depreciation of at least 5, 10 and 15%, respectively (currency crashes)	e.g., Kumar, Moorthy, Perraudin (2003)	inverse of the standard deviation of each components, each multiplied by the standard deviation of the change in exchange rate	e.g., Kaminsky et al. (1998); Kaminsky, and Reinhart (1999); Goldstein et al. (2000)	real exchange rate	e.g., Bussiere and Fratzscher (2002); Arias and Erlandsson (2004)	Binary	e.g., Eichengreen et al. (1994, 1995, 1996); IMF (1998)	$\mu + 1.645\sigma$	e.g., Gelos and Sahay (2001); Caramazza, et al. (2000, 2004)	18 months	e.g., IMF (1998)
20% change in real exchange rate in 1 quarter, 30% in 2 quarters or 40% in 3-6 quarters	e.g., Apoteker and Barthelemy (2001), Apoteker (2001)	inverse of the standard deviation of each component, each divided by the sum of the inverse of the standard deviation of the three components	e.g., Sachs et al. (1996); Berg and Patillo (1998); Glick and Rose (1998)							12 months	e.g., Glick and Moreno (1999); Ahluwalia (2000); Zhuang and Dowling (2002)

Variation in the index of exchange market pressure used		Appropriate weights in the index of exchange market pressure		Nominal versus real exchange rates		Continuous versus binary EMP Index		If binary/dichotomous EMP Index, threshold or cut-off value used		If imposing crisis/exclusion window, duration of the window	
20% exchange rate depreciation against U.S. dollar within ten trading days	e.g., Bruggemann and Linne (2000)	exchange rate and reserve changes treated separately	e.g., Zhang (2001)					$\mu+1.75\sigma$	e.g., Kamin et al. (2001)	3, 5 and 6 months	e.g., Eichengreen et al. (1996); Peltonen (2001); Yan (2001)
								$\mu+2.0\sigma$	Eichengreen et al. (1994, 1995); Glick and Moreno (1999); Glick and Hutchison (1999, 2000)		

Variation in the index of exchange market pressure used		**Appropriate weights in the index of exchange market pressure**		**Nominal versus real exchange rates**		**Continuous versus binary EMP Index**		**If binary/dichotomous variable, threshold or cut-off value used**		**If imposing crisis/exclusion window, duration of the window**	
scores from -2 to 2 assigned on reserve changes, real interest rate changes and exchange rate changes	e.g., Hawkins and Klau (2000)							$\mu + 2.5\sigma$	e.g., Edison (2003)		
decline in GDP growth of at least 3 percentage points	e.g., Ghosh and Ghosh (2002)							$\mu + 3.0\sigma$	e.g., Kaminsky et al. (1998); Kaminsky and Reinhart (1999)		

2.2.2 The Statistical Distribution of Financial or Asset Returns (Speculative Prices)

As early as the 1960s, the collection of papers by Mandelbrot (1963, 1964, 1967) among others have clearly recognised and established that financial or asset returns, e.g., exchange rates, share prices, and interest rates are characterised as non-normal, displayed heavy and fat-tails and volatility clustering.[11] As a result, subsequent studies have concentrated their efforts on suggestions of alternative statistical distributions for speculative price series, and proposals ranged from the stable class of distributions by Mandelbrot (1963), Student *t* distribution by Blattberg and Gonedes (1974), Engles's (1982) ARCH distributed innovations, discrete mixtures of normals studied by Kon (1984), the mixed diffusion jump process advanced by Press (1967) and the power exponential or GED discussed in Bailie and Mcmahon (1989), and Hsieh (1989).

Studies that specifically concentrated on the statistical properties of the two variables of interest, i.e., changes in exchange rate and interest rates have indicated strong and convincing evidence that, indeed, the two variables are not normally distributed.[12] In the context of studies on currency crises and in view of the evidence that asset returns are non-normal and characterised as having heavy and fat-tails, a basic shortcoming of studies that used thresholds and the subsequent conversion to a binary crisis variable is the common assumption that the EMP index and its corresponding components, i.e., changes in exchange rates, reserves, and interest rates are normally distributed. This fundamental defect in the current design of early

[11] Others are by Fama (1965, 1970) and Roll (1970).

[12] Specific examples of papers that suggested various other distributions for changes in exchange rates other than the normal distribution were by: Rogalski and Vinso (1978); McFarland, et al. (1982); Calderon-Rossel and Ben-Horim (1982); Boothe and Glassman (1987); Akgiray, et al. (1988); Bailie and Bollerslev (1989; Hsieh (1989). Meanwhile, Brenner, et al. (1996); Andersen and Lund (1997); Koedijk, et al. (1997) are examples of studies on changes in interest rates.

warning system models has received very little attention in the empirical literature on currency crises.

On the other hand, there is an alternative approach that does not need the use of thresholds and this is the extreme value approach (EVA).[13] The theoretical appeal of the EVA is that it focuses explicitly on the tail behaviour of the distributions of asset returns. This has significant and direct application to how we define currency crises, as the tails of any distribution are the regions of rare and extreme events. Nonetheless, most applications of the EVA have centred on either understanding the tail behaviour of foreign exchange rates, but only a few can be found which has direct application of EVA to currency crises, particularly in the identification of currency crises.[14,15]

2.3 The Concept of an Exchange Market Pressure Index

For purposes of this study, it is immediately important to underscore that a currency crisis in the context of an exchange market pressure is not only defined as capturing instances of successful attacks, i.e., when a depreciation of the currency occurs, but also instances of unsuccessful attacks (pressure rebuffed by loss in reserves and/or rise in interest rates) (KLR, 1998; Goldstein, et al. 2000). The seminal idea is from the early work of Girton and Roper (1977) that any excess demand for foreign exchange can be fulfilled through non-mutually exclusive conduits. If the speculative attack (currency pressure) is successful, there is a sharp depreciation of

[13] Another approach which does not require a priori crisis dates at all is the Markov-switching EWS model, and has found application in the currency crisis literature with the papers of Abiad (2003), Arias and Erlandsson (2004).

[14] Examples of studies that looked into the tail behaviour of exchange rates were by: Koedijk, et al. (1990); Hols and de Vries (1991); Koedijk, et al. (1992); Huisman, et al. (2001, 2002)). While studies that looked into the tail behaviour of share prices were by: Jansen and de Vries (1991); Longin (1996), Jondeau and Rockinger (1999); Phoa (1999); Tsay (1999); Pownall and Koedijk (1999); and Longin (2000).

[15] Studies such as Pescatori and Sy (2004) and Pozo and Dorantes (2003) used the EVA in defining debt and currency crises, respectively.

the domestic currency. However, at other times, the attack can be repelled or warded off through raising interest rates and/or running down on the foreign exchange reserves.[16]

In doing so, a measure of the extent of currency pressure, or, an exchange market pressure (EMP) index can be constructed, which is a weighted average of changes in the exchange rate, foreign exchange reserves, and interest rates. The exchange rate is said to be under 'stress' (there is selling pressure) if there is a significant increase in the exchange market pressure index.

The question is how to weight the three components of the index of speculative pressure. An unweighted index is simpler to construct, but the major drawback is that an unweighted index will be driven or dominated by the most volatile variable, and usually it is the movement in reserves. Next, three recent works are briefly reviewed focusing on the different weighting schemes each of this study used in their respective construction of the EMP index, which will, in turn, be employed in the empirics.[17] It should be noted here that whereas the weighting scheme of ERW is used here in its original form, the weighting schemes of KLR and STV where slightly modified by including the interest rate. The original KLR and STV studies did mentioned the need to consider the role of the interest rate, however

[16] Notice that such an intuitive measure (proxy) of unsuccessful speculative attacks is still imperfect, because countries, especially, developing countries, can impose capital controls to repel pressures on their currencies.

[17] It should be stressed at this point that the corresponding weighting schemes of the three recent studies to be reviewed and employed in the empirics have utilised a so-called model-independent definition of the EMP index. This should be contrasted from the so-called model-dependent definition of the EMP where the EMP is derived from a series of structural simultaneous equations that includes important macroeconomic fundamentals. For instance, the seminal Girton and Roper (1977) study that was mentioned earlier is considered to be of the model-dependent tradition. In the next chapter, I again expound on the concept of exchange market pressure, however, this time using a slightly modified-version of the Girton and Roper in order to explain the basic mechanics of exchange rate management.

due to constraints with the interest rate data, they decided not to include the interest rate component.[18]

2.3.1 Eichengreen, Rose and Wyplosz (1995, 1996)

The exchange market pressure index of Eichengreen, Rose, Wyplosz (ERW) (1995, 1996) is expressed as:

$$EMP_{i,t} = \frac{1}{\sigma_e}\frac{\Delta e_{i,t}}{e_{i,t}} - \frac{1}{\sigma_r}\left(\frac{\Delta rm_{i,t}}{rm_{i,t}} - \frac{\Delta rm_{US,t}}{rm_{US,t}}\right) + \frac{1}{\sigma_i}(\Delta(i_{i,t} - i_{US,t})) \qquad (2.1)$$

where $EMP_{i,t}$ is the exchange rate market pressure index for country *i* in period *t*; $e_{i,t}$ the units of country *i*'s currency per U.S. dollar in period *t*; σ_e the standard deviation of the relative change in the exchange rate $(\frac{\Delta e_{i,t}}{e_{i,t}})$; $rm_{i,t}$ the ratio of gross foreign reserves to money stock or monetary base for country *i* in period *t*; σ_r is the standard deviation of the difference between the relative changes in the ratio of foreign reserves and money (money base) in country *i* and the reference country (US) $\left(\frac{\Delta rm_{i,t}}{rm_{i,t}} - \frac{\Delta rm_{US,t}}{rm_{US,t}}\right)$; $i_{i,t}$ the nominal interest rate for country *i* in period *t*; $i_{US,t}$ the nominal interest rate for the reference country (U.S.) in period *t*; σ_i the standard deviation of the nominal interest rate differential $(\Delta(i_{i,t} - i_{US,t}))$.

2.3.2 Sachs, Tornell and Velasco (1996)

The modified exchange market pressure index of Sachs, Tornell and Velasco (STV) (1996) is expressed as follows:

[18] For instance, KLR (1999) argued that they did not include the interest rate component in their application because of the lack of complete interest rate data for the countries that they studied (p. 498).

$$EMP_{i,t} = \left(\frac{1/\sigma_e}{((1/\sigma_e)+(1/\sigma_r)+(1/\sigma_i))} \right) \frac{\Delta e_{i,t}}{e_{i,t}} - \left(\frac{1/\sigma_r}{((1/\sigma_e)+(1/\sigma_r)+(1/\sigma_i))} \right) \frac{\Delta r_{i,t}}{r_{i,t}} + \left(\frac{1/\sigma_i}{((1/\sigma_e)+(1/\sigma_r)+(1/\sigma_i))} \right) \Delta i_{i,t} \qquad (2.2)$$

where $EMP_{i,t}$ is defined as before; $r_{i,t}$ gross foreign reserves of country *i* in period *t*; $i_{i,t}$ the nominal interest rate for country *i* in period *t*; σ_e the standard deviation of the rate of change in the exchange rate ($\frac{\Delta e_{i,t}}{e_{i,t}}$), σ_r is the standard deviation of the rate of change in reserves $\left(\frac{\Delta r_{i,t}}{r_{i,t}}\right)$, and σ_i the standard deviation of the change in the nominal interest rate, $\Delta i_{i,t}$.

2.3.3 Kaminsky, Lizondo and Reinhart (1998, 1999)

The modified exchange market pressure index of Kaminsky, Lizondo, and Reinhart (KLR) (1998, 1999) is expressed as follows:

$$EMP_{i,t} = \frac{\Delta e_{i,t}}{e_{i,t}} - \frac{\sigma_e}{\sigma_r}\frac{\Delta r_{i,t}}{r_{i,t}} + \frac{\sigma_e}{\sigma_i}\Delta i_{i,t} \qquad (2.3)$$

where $EMP_{i,t}$, $e_{i,t}$, $r_{i,t}$, $i_{i,t}$, σ_e, ($\frac{\Delta e_{i,t}}{e_{i,t}}$), σ_r, $\left(\frac{\Delta r_{i,t}}{r_{i,t}}\right)$, and σ_i is defined as the above.

2.4 Extreme Value Theory[19]

In defining extreme values to identify currency crisis periods, we focus exclusively on extreme positive values of the EMP. Consider a stationary sequence $X_1, X_2, \ldots, X_n$ of iid random variables with a common distribution function F (d.f.F). Suppose one is interested in the probability that the maximum

$$M_n = \max(X_1, X_2, \ldots, X_n) \qquad (2.4)$$

of the first n random variables is below a certain level x. As is well known, this probability is given by

$$P(M_n \leq x) = F^n(x) \qquad (2.5)$$

Extreme value theory studies the limiting distribution of the order statistic M_n appropriately scaled. That is, one is interested in the conditions under which there exists two suitable normalising constants $a_n > 0$ and b_n, such that:

$$P(M_n - b_n \leq a_n x) \xrightarrow{d} G(x) \qquad (2.6)$$

where $G(x)$ is a so-called extreme value distribution and the superscript d indicates convergence in distribution. If $1 - F(x)$ is regularly varying at infinity, choosing $b_n = 0$ and $a_n = F^{-1}(1 - 1/n)$ we have

$$G(x) = \exp(-x^{-\alpha}) \qquad \alpha > 0 \qquad (2.7)$$

where α is the tail index. The tail index is a good indicator of the tail fatness as it is related to the number of moments that exist.

The advantage of the extreme value approach is that all fat-tailed models are nested with respect to their tail index into one model. The tail index, given a number of observations X_i can be estimated by parametric and nonparametric methods. The

[19] This section draws heavily on de Vries (1994), Koedijk and Kool (1992), Koedijk, et al. (1992); Huisman, et al. (2001).

latter method is presented. Assume that $X_1, \ldots, X_n$ is a sample of independent realisations from a distribution $F(x)$ with a regularly varying tail. Thus,

$$\lim_{t \to \infty} \frac{1 - F(tx)}{1 - F(t)} = x^{-\alpha} \qquad \alpha > 0 \qquad (2.8)$$

Suppose the density $f(x)$ exists. Through integration by parts we have the following equivalence:

$$\int_1^\infty \frac{1 - F(tu)}{u} du = \log u[1 - F(tu)]\Big|_1^\infty + \int_1^\infty \log u f(tu)t \, du$$

$$= \int_1^\infty [\log(tu) - \log t] f(tu)t \; du$$

$$= \int_t^\infty \log x - \log t) f(x) \; dx \qquad (2.9)$$

Combining equations (2.8) and (2.9) and applying the Lebesgue convergence theorem (interchanging the limit of the integral with the integral of the limit):

$$\frac{\int_t^\infty (\log x - \log t) f(x) dx}{1 - F(t)} = \int_1^\infty \frac{1 - F(tu)}{1 - F(t)} \frac{du}{u} \to \int_1^\infty u^{-\alpha} \frac{du}{u} = \frac{1}{\alpha} \qquad (2.10)$$

Let $X_{(n)} \geq X_{(n-1)} \geq \ldots \geq X_{(1)}$ denote the ascending order statistics from the sample $X_1, \ldots, X_n$. Replace the left-hand side expression of equation (2.10) by its sample analog in order to estimate the inverse tail index $\gamma = 1/\alpha$. Let $F_n(.)$ denote the empirical distribution function. Thus, for some k, which is the number of tail observations used to estimate α and n represents the total number of return observations, take $t = X_{(n-k)}$ and hence

$$\hat{\gamma} = \frac{1}{k} \sum_{i=0}^{k-1} \log \frac{X_{(n-i)}}{X_{(n-k)}} \qquad (2.11)$$

is the estimator first proposed by Hill (1975). Mason (1982) proved that under some regularity conditions $\hat{\gamma}$ is a consistent estimator for γ. Goldie and Smith (1987) showed that $(\hat{\gamma}-\gamma)k^{1/2}$ is asymptotically normal with mean 0 and variance γ^2. Consequently, $\hat{\alpha}$ is also asymptotically normal with mean α and variance α^2/k.

2.4.1 The Hill and the HKPP Estimators

Since the Hill estimator is asymptotically unbiased and given the relatively small sample size in the present chapter, the Hill estimator will suffer from small sample bias. To deal with this, I apply the tail index estimator proposed by HKKP (2001), which is unbiased in small sample cases. The HKKP methodology starts with the Hill (1975) estimator presented earlier (eq. 2.10) with a slightly different expression:

$$\gamma(k) = \frac{1}{k}\sum_{j=1}^{k} \log(x(n-j+1) - \log(x(n-k)) \quad (2.12)$$

where, as before, we assume that there is a sample of n positive independent observations drawn from some unknown fat-tailed distribution. The parameter γ is the inverse tail-index of the distribution, and $x(i)$ is the ith-order statistic such that $x(i-1) \le x(i)$ for $i = 2,......,n$. k is the pre-specified number of tail observations. The choice of k is crucial to obtain an unbiased estimate of the tail-index.

HKKP (2001) show that for a general class of distribution functions the asymptotic expected value of the conventional Hill estimator to be biased and increasing monotonically with k. Similarly, the asymptotic variance of the Hill estimator to be proportional to $\left(\frac{1}{k}\right)$. Generally, this problem will only be resolved when the sample size goes to infinity for given k. The estimator that HKKP (2001) proposed overcomes the problem of the need to select a 'single' optimal k in small sample observations. For values of k smaller than some threshold value κ, the bias of the conventional Hill estimate of γ increases almost linearly in k and can be approximated by:

$$\gamma(k) = \gamma + \beta k + \varepsilon(k), \qquad k = 1,2,...., \kappa \qquad (2.13)$$

where: γ and β are the intercept and the estimated coefficient. $\varepsilon(k)$ is a disturbance term. HKKP (2001) also shows that the modified Hill estimator is quite robust with the choice of κ to be around $\left(\frac{n}{2}\right)$. Accordingly, for the empirics, $\gamma(k)$ is computed for a range of values of k from 1 to κ (roughly equal to $\left(\frac{n}{2}\right)$). Subsequently, the vector of the $\gamma(k)$'s is used in equation (2.13).

To estimate equation (2.13), HKKP (2001) adopted the weighted least squares (WLS), instead of the ordinary least squares (OLS), to deal with the potential heteroscedasticity in the error term $(\varepsilon(k))$ of equation (2.13). The weight has $\left(\sqrt{1}, \sqrt{2}, ...\sqrt{k}\right)$ as diagonal elements and zeros elsewhere. The estimate of γ from the WLS regression is an approximately unbiased estimate of the tail-index.

2.5 Data and Some Preliminary Results

2.5.1 Data

All data in monthly frequencies were drawn from the IMF International Financial Statistics database covering the period from 1985 to 2003. I considered a number of countries in two distinct regions: East Asia (Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand) and Latin America (Argentina, Brazil, Chile, Mexico). The exchange rate is expressed in local currency per U.S. dollar. To capture the periods of relatively high inflationary pressures, a measure of the real exchange rate is adopted in the calculation of the EMP index.[20] The real exchange rate is calculated by multiplying the nominal exchange rate by relative price levels given as:

$$RER_t^{local/U.S.} = NER_t^{local/U.S.} \frac{P_t^*}{P_t} \qquad (2.14)$$

where P_t is the domestic consumer price index, and P^* is the U.S. consumer price index. An increase in RER_t (real exchange rate) or NER_t (nominal exchange rate) implies an appreciation and depreciation of the U.S. dollar and the relevant local currency, respectively.

The remaining data requirements in the construction of the exchange market pressure indices are as follows. A measure of the interest rate differential is defined as the difference between the domestic interest rate and the U.S. federal fund rate, with the overnight money market rates used as the measure of domestic interest rate, except in the cases of the Philippines (91-day Treasury bill rate) and Chile (deposit rate). Line 11 (foreign assets of the monetary authorities) and 14 of the IMF-IFS database were used as the measure of foreign exchange reserves and reserve money (only for ERW index), respectively.

2.5.2 Preliminary Results

2.5.2.1 Summary Statistics

Tables 2.2 and 2.3 present summary statistics of the individual EMP indices. For one, the mean and standard deviation of the three sets of EMP indices show considerable divergence within each country for each geographic region. For instance, according to Table 2.2, the ERW index suggests that Indonesia experienced the lightest market turbulence. In contrast, both the KLR and STV indices suggest, instead, that Indonesia have experienced the most severe currency pressure compared

[20] Similar results were obtained when the nominal exchange rate is used. To ensure brevity and conciseness, the results using the nominal exchange rate are presented in Appendix A.1.

to the other East Asian countries. Likewise, according to Table 2.3, the ERW index indicates that Mexico experienced the most severe currency pressure among the four Latin American countries. However, both the KLR and STV indices indicate that Brazil, instead, experienced the most severe currency pressure. Thus, these results show the potential inconsistencies between different EMP indicators. It is therefore critical that we adopt a number of them to ensure the robustness of the test results.

Tables 2.2 and 2.3 also convey the following observations. First, in almost all of the countries in East Asia and Latin America, the three EMP indices are skewed to the right. Second, all of the three EMP indices exhibit excess kurtosis which reflects fat-tailedness.[21] Third, the Jarque-Bera statistics are highly significant for all countries which further confirm the non-normality of the three EMP indices. These results are further supported by additional tests of normality and are displayed in Tables 2.4 and 2.5. The Kolmogorov-Smirnov and Shapiro-Wilk statistics clearly reject the null hypothesis of normally distributed data. All these results show that despite the EMP indices are not, strictly speaking, speculative price series, nonetheless, with two of the three components of the EMP indices being speculative price series, the results confirm the suspicion that the EMP indices also share the same statistical characteristics of any speculative prices.

[21] Excess with respect to the normal distribution which has a kurtosis equal to 3.

Table 2.2
Descriptive Statistics of Individual EMP Measures (East Asian Sample)

	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Statistic
East Asia					
Indonesia					
ERW	0.00	1.34	1.08	18.46	2253.828*
KLR	-1.00	9.71	1.17	27.10	5448.91*
STV	0.65	5.56	5.35	50.99	22459.28*
Korea					
ERW	-0.12	1.97	1.98	21.48	3302.40*
KLR	-1.05	6.22	1.66	18.24	2272.20*
STV	0.23	1.64	6.21	66.93	39583.66*
Malaysia					
ERW	0.06	1.97	-1.23	15.71	1550.91*
KLR	-0.45	4.61	-0.78	16.91	1837.17*
STV	0.21	0.81	0.50	10.35	515.47*
Philippines					
ERW	-0.10	2.02	0.14	10.73	552.89*
KLR	-0.43	4.58	-0.22	10.35	508.09*
STV	0.19	1.56	1.45	9.03	419.05*
Singapore					
ERW	-0.07	1.96	0.11	10.37	503.22*
KLR	-1.15	2.83	-0.06	6.75	131.93*
STV	0.24	0.54	-0.42	10.25	499.54*
Thailand					
ERW	-0.06	1.61	1.43	11.17	693.05*
KLR	-0.86	4.17	1.30	11.08	675.49*
STV	0.35	2.07	2.29	24.57	4559.03*

Note: $e_{i,t}$ is measured as the real exchange rate.
*The null hypothesis of a normally distributed EMP measure is rejected.

Table 2.3
Descriptive Statistics of Individual EMP Measures (Latin America Sample)

	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Statistic
Latin America					
Argentina					
ERW	-0.05	1.47	-0.13	48.40	19070.25*
KLR	-4.33	24.45	-1.83	45.22	16836.93*
STV	3.64	20.88	4.31	43.16	15884.13*
Brazil					
ERW	0.04	1.77	3.37	38.93	12364.5*
KLR	-12229	32054.85	0.81	40.70	13351.25*
STV	16.20	32.37	4.36	30.21	7655.06*
Chile					
ERW	-0.04	1.50	0.41	14.91	1317.18*
KLR	-0.87	3.79	0.64	11.10	631.26*
STV	0.52	2.15	1.29	9.30	435.35*
Mexico					
ERW	-0.14	2.15	1.24	18.16	2182.23*
KLR	-0.97	7.74	1.11	19.21	2508.48*
STV	-0.55	4.37	1.11	19.29	2544.13*

Note: $e_{i,t}$ is measured as the real exchange rate.
*The null hypothesis of a normally distributed EMP measure is rejected.

Table 2.4
Normality Tests for the individual EMP measures (East Asian Sample)

	Kolmogorov-Smirnov[a]	Significance	Shapiro-Wilk	Signficance
Indonesia				
ERW	0.116	0.00*	0.798	0.00*
KLR	0.184	0.00*	0.722	0.00*
STV	0.242	0.00*	0.555	0.00*
Korea				
ERW	0.098	0.00*	0.827	0.00*
KLR	0.123	0.00*	0.832	0.00*
STV	0.167	0.00*	0.606	0.00*
Malaysia				
ERW	0.189	0.00*	0.759	0.00*
KLR	0.156	0.00*	0.794	0.00*
STV	0.129	0.00*	0.857	0.00*
Philippines				
ERW	0.114	0.00*	0.883	0.00*
KLR	0.140	0.00*	0.868	0.00*
STV	0.154	0.00*	0.865	0.00*
Singapore				
ERW	0.053	0.20	0.915	0.00*
KLR	0.070	0.01*	0.955	0.00*
STV	0.061	0.04*	0.924	0.00*
Thailand				
ERW	0.067	0.02*	0.918	0.00*
KLR	0.109	0.00*	0.891	0.00*
STV	0.168	0.00*	0.700	0.00*

Notes: $e_{i,t}$ is measured as the real exchange rate.
[a] Liliefors Significance correction.
* the null hypothesis of normally distributed data is rejected.

Table 2.5
Normality Tests for the Individual EMP Measures (Latin American Sample)

	Kolmogorov-Smirnov[a]	Significance	Shapiro-Wilk	Signficance
Argentina				
ERW	0.255	0.00*	0.484	0.00*
KLR	0.277	0.00*	0.483	0.00*
STV	0.332	0.00*	0.410	0.00*
Brazil				
ERW	0.181	0.00*	0.624	0.00*
KLR	0.189	0.00*	0.654	0.00*
STV	0.179	0.00*	0.628	0.00*
Chile				
ERW	0.075	0.00*	0.880	0.00*
KLR	0.079	0.00*	0.916	0.00*
STV	0.102	0.00*	0.901	0.00*
Mexico				
ERW	0.154	0.00*	0.754	0.00*
KLR	0.171	0.00*	0.742	0.00*
STV	0.171	0.00*	0.741	0.00*

Notes: $e_{i,t}$ is measured as the real exchange rate.
[a] Liliefors Significance correction.
* the null hypothesis of normally distributed data is rejected.

This outcome is further substantiated by visual evidence in Figures 2.2-2.3 (based on the ERW index), Figures 2.4-2.5 (based on the KLR index) and Figures 2.6-2.7 (based on the STV index) with the histogram of the EMP series for each countries overlaid by its corresponding normal probability density functions. In all cases, it is obvious that the EMP indices depart significantly from the normal distribution—mass of observations in the tails and the observed regularity of a great number of peak observations at the centre of the distribution.

Figure 2.2

Histogram of Country ERW-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the real exchange rate

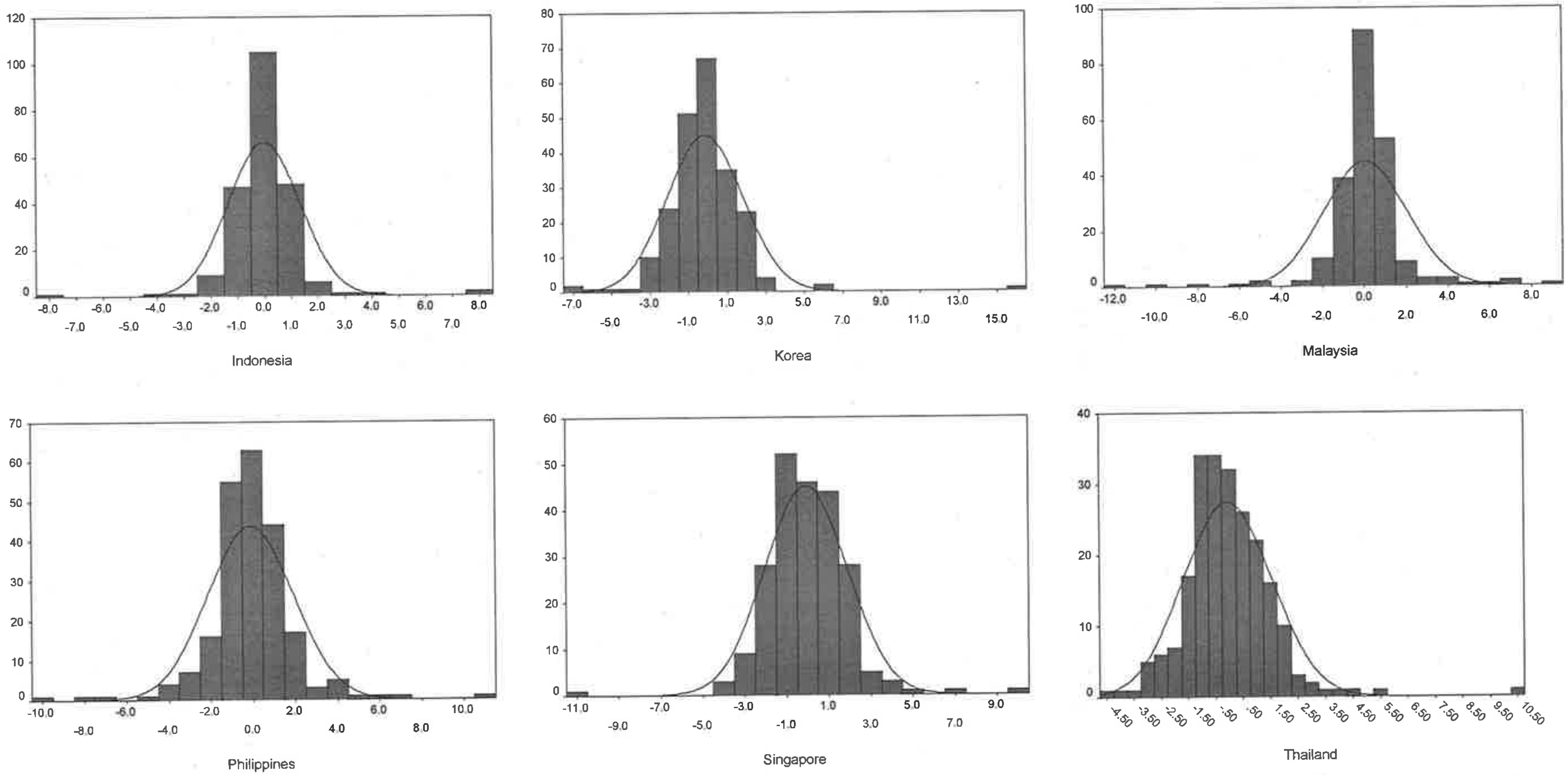


Figure 2.3

Histogram of Country ERW-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with $e_{i,t}$ measured as the real exchange rate

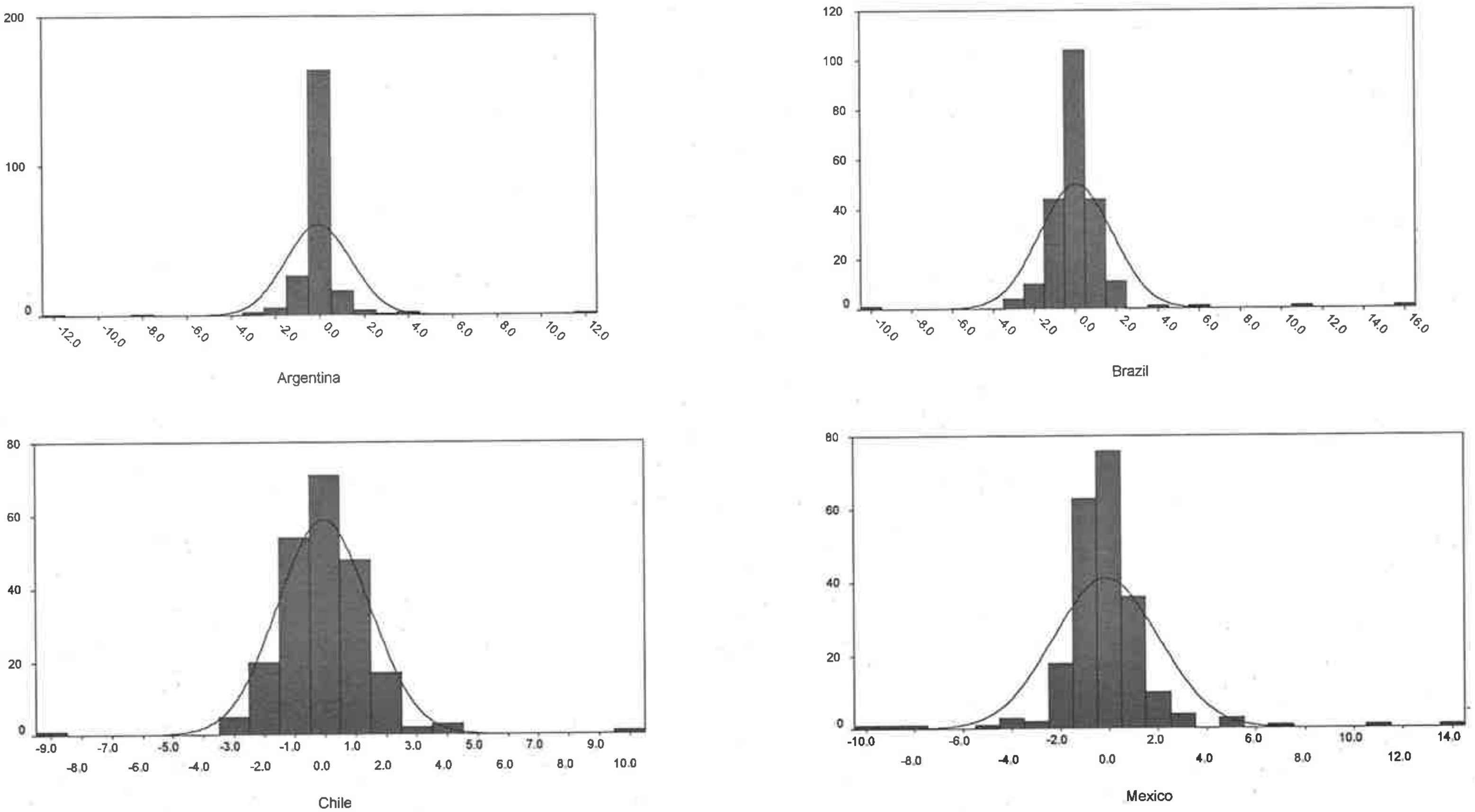


Figure 2.4

Histogram of Country KLR-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the real exchange rate

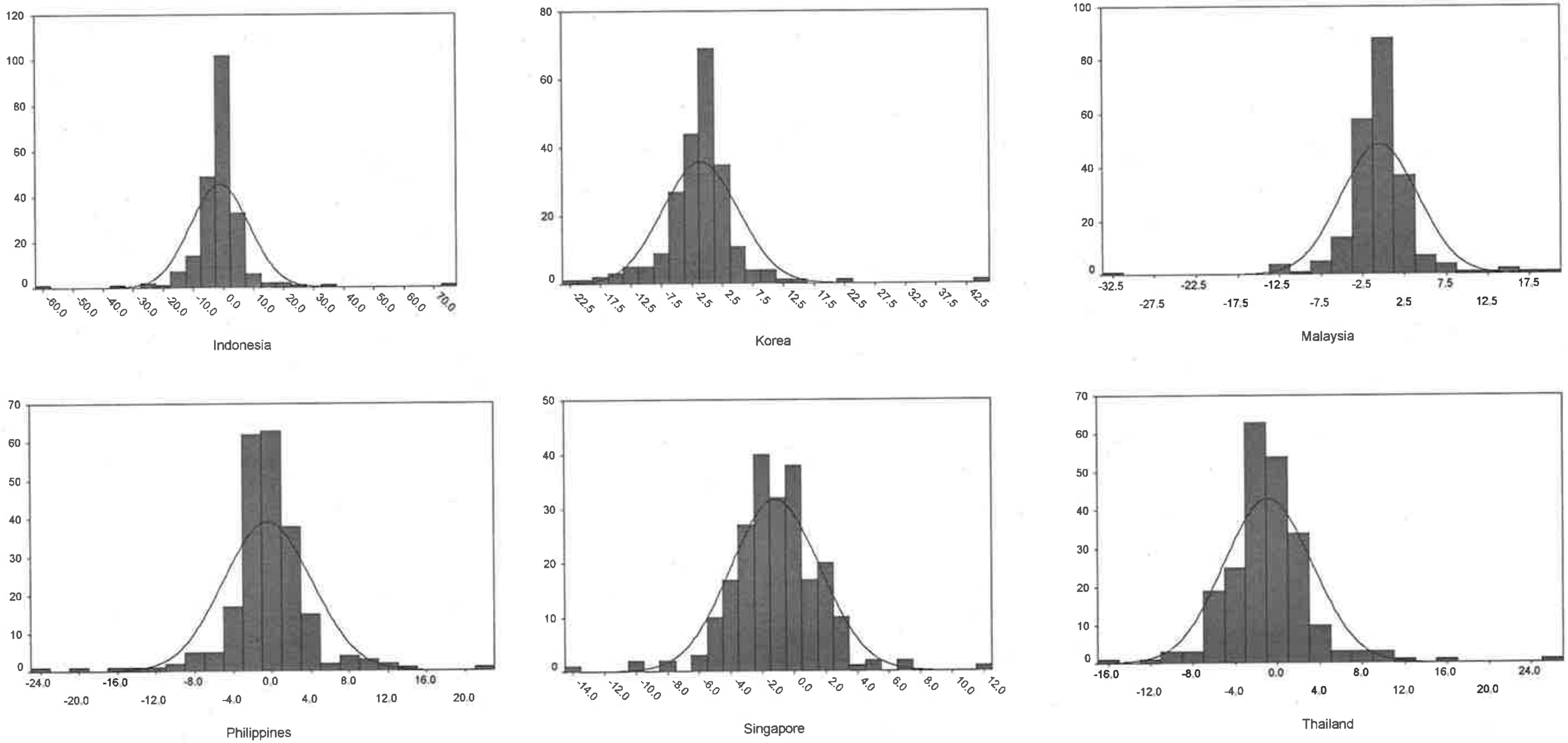


Figure 2.5

Histogram of Country KLR-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with *ei,t* measured as the real exchange rate

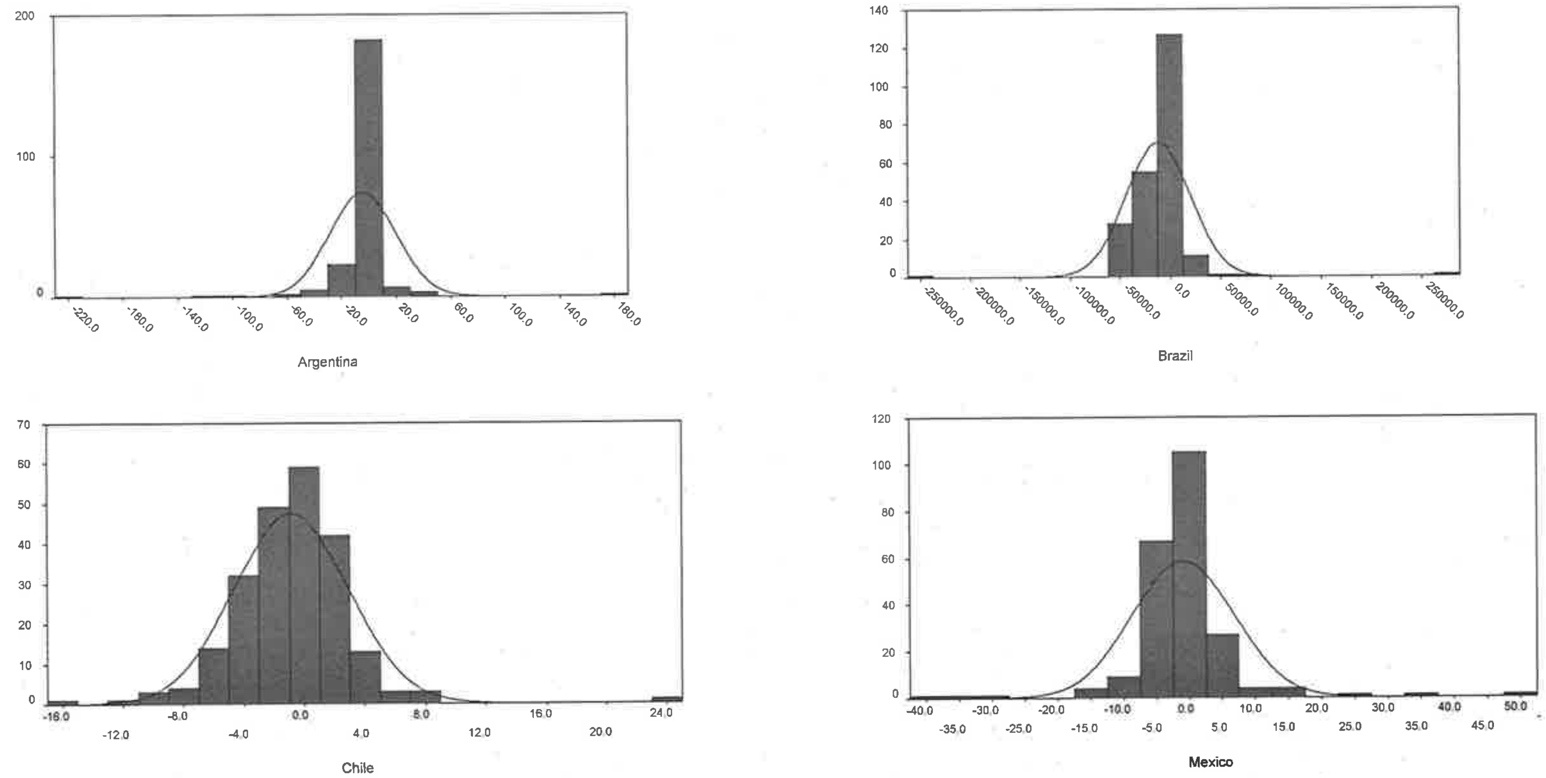


Figure 2.6

Histogram of Country STV-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the real exchange rate

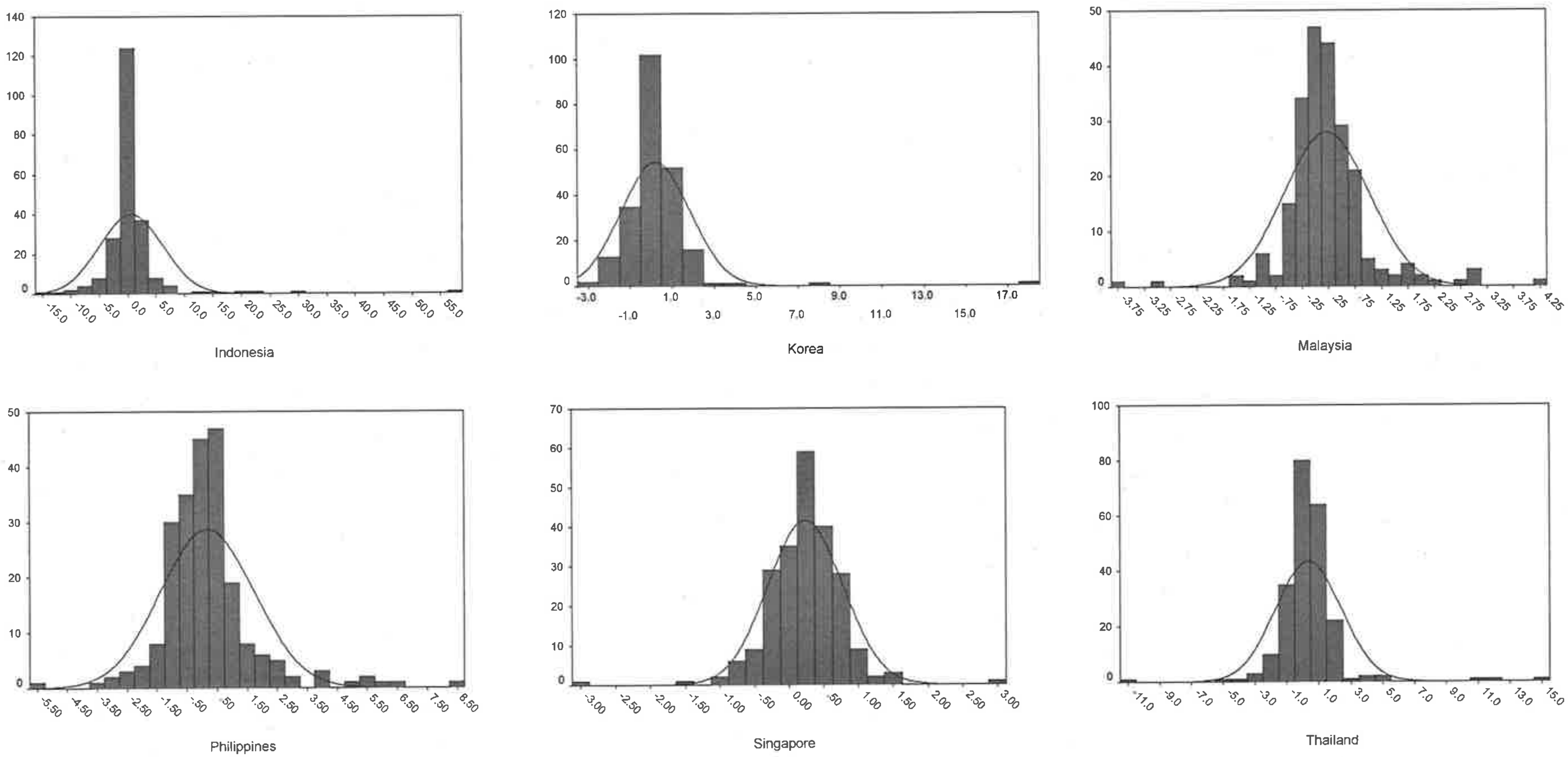
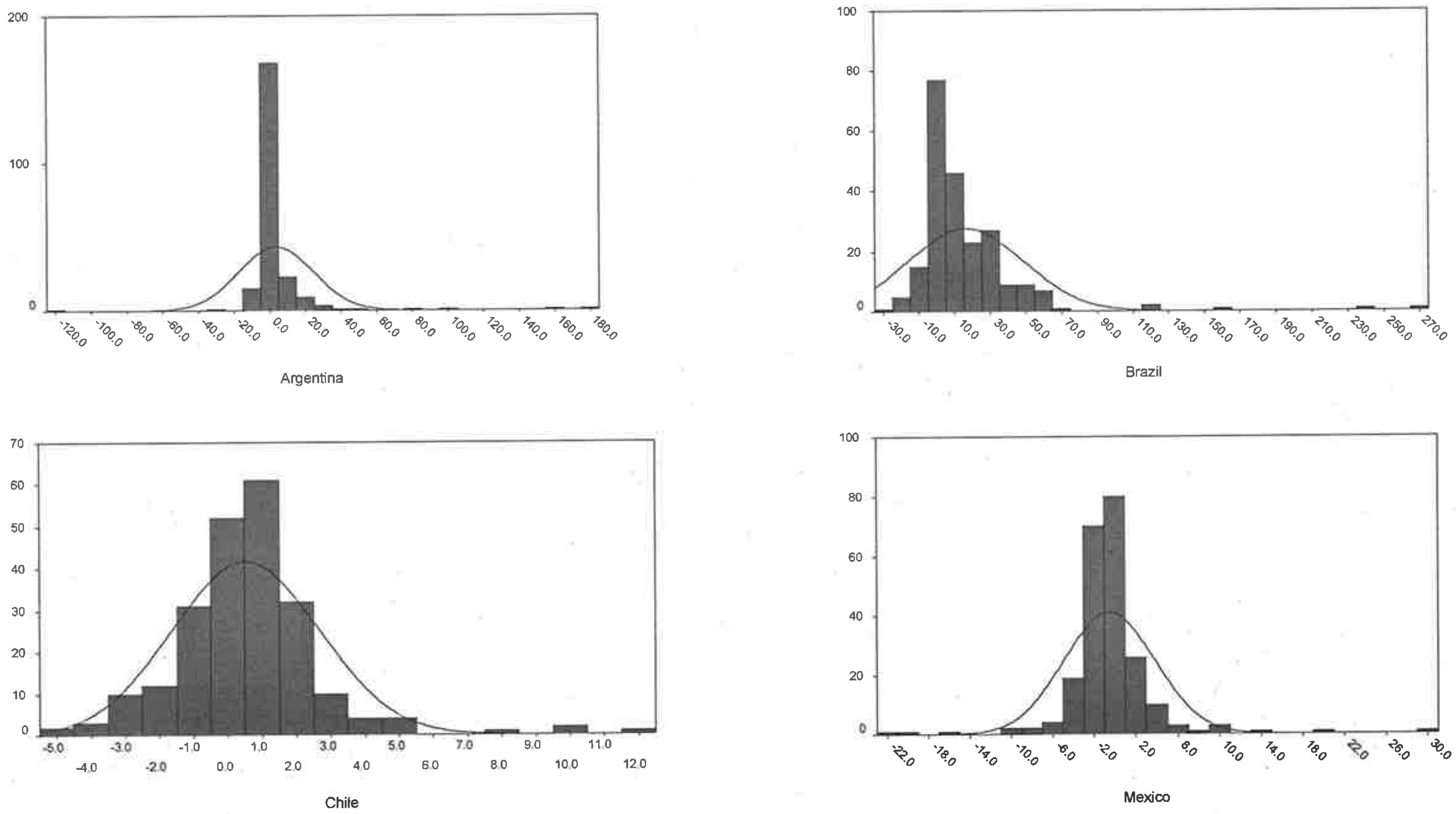


Figure 2.7

Histogram of Country STV-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with $e_{i,t}$ measured as the real exchange rate



In dealing with the non-normality of the EMP indices, the extreme value approach will be considered next. A preliminary step in proceeding with extreme value analysis is to examine some of the time-series properties of the three EMP indices, in particular, its unit-root and serial-correlation properties as the Hill estimator requires the use of stationary and serially-uncorrelated data. Tables 2.6 and 2.7 present the combined results from the commonly used ADF unit root test as well as from alternative unit root tests—the DF-GLS and the KPSS tests. In all, the three EMP indices for all countries are *I(0)* variables at the 1 per cent significance level according to the ADF test. Confirmatory results from the DF-GLS test and the KPSS unit-root test generally show that the EMP indices are stationary at the 10 percent significance level or even stronger. In addition, we also report the Ljung-Box Q-statistic in Table 2.8 which tests the null hypothesis of no autocorrelation. Except for Korea (ERW, KLR), Argentina (STV), Brazil (STV), we cannot reject the null hypothesis for the countries listed in this study.

2.5.2.2 The Hill and HKKP Estimators

In order to capture the tail mass or outliers it is mandatory to estimate the so-called tail index (γ), and as earlier mentioned, we use the Hill estimator for this purpose.[22] The Hill estimator requires that the EMP series are rank-ordered from lowest to highest denoted as (x_i), and uses maximum likelihood estimation of the tail index (γ). Although asymptotically unbiased, the Hill estimator is biased in relatively small samples.[23]

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[22] As earlier defined in section 2.4, γ also equals $1/\alpha$, where α refers to the maximum number of existing finite moments. As is customary in the literature, the tail index is either referred to as γ or α, it is used here interchangeably.

[23] In a related paper, Pozo and Dorantes (2003) faced with a similar small sample size opted to pool the EMP values in each region and estimate a regional α with the much larger number of observations. However, as earlier emphasised, due to the wide divergence in the mean and standard deviation of each

Table 2.6
Unit Root tests for the Individual EMP Measures (East Asian Sample)

	ADF test[a] without trend	**ADF test[a] with trend**	**DF-GLS[a] without trend**	**DF-GLS[a] with trend**	**KPSS test[b] without trend**	**KPSS test[b] with trend**
East Asia						
Indonesia						
ERW	-14.103***	-14.10***	-3.090***	-13.265***	0.074	0.050
KLR	-14.791***	-14.778***	-2.611***	-13.947***	0.075	0.044
STV	-4.531***	-4.521***	-4.286***	-4.501***	0.076	0.077
Korea						
ERW	-11.300***	-11.276***	-10.784***	-11.111***	0.045	0.038
KLR	-10.107***	-10.087***	-10.100***	-10.113***	0.039	0.035
STV	-11.719***	-11.695***	-11.465***	-11.618***	0.036	0.034
Malaysia						
ERW	-14.190***	-14.165***	-1.439	-2.838*	0.046	0.044
KLR	-12.952***	-12.951***	-1.537	-2.979**	0.062	0.043
STV	-13.228***	-13.203***	-4.871***	-12.188***	0.054	0.040
Philippines						
ERW	-8.877***	-8.943***	-8.722***	-8.952***	0.122	0.047
KLR	-8.879***	-8.560***	-8.727***	-8.791***	0.250	0.049
STV	-12.042***	-12.017***	-1.098	-2.533	0.048	0.047
Singapore						
ERW	-14.768***	-14.761***	-2.383**	-11.997***	0.125	0.092
KLR	-11.821***	-12.040***	-1.400	-9.509***	0.820***	0.172**
STV	-12.236***	-12.236***	-1.432	-11.455***	0.126	0.060
Thailand						
ERW	-15.975***	-16.049***	-1.994**	-3.458**	0.138	0.027
KLR	-9.649***	-10.027***	-0.833	-2.006	0.512**	0.066
STV	-16.406***	-16.389***	-5.254***	-15.432***	0.065	0.033

Notes: $e_{i,t}$ is measured as the real exchange rate.
***, **, * indicate rejection of the null hypothesis at the 1%, 5% and 10%, respectively.
[a] The ADF/DF-GLS procedure test the null that H_0: $y_t \sim I(1)$ against the alternative H_a: $y_t \sim I(0)$.
[b] The KPSS procedure test null that H_0: $y_t \sim I(0)$ against the alternative H_a: $y_t \sim I(1)$.

country's respective EMP indices, it is implausible to assume conformity in the distribution of the EMP indices across the individual countries.

Table 2.7
Unit Root tests for the Individual EMP Measures (Latin American sample)

	ADF test[a] without trend	ADF test[a] with trend	DF-GLS[a] without trend	DF-GLS[a] with trend	KPSS test[b] without trend	KPSS test[b] with trend
Latin America						
Argentina						
ERW	-8.179***	-8.178***	-7.810***	-8.126***	0.092	0.037
KLR	-12.778***	-13.541***	-12.672***	-13.404***	0.856***	0.113
STV	-11.893***	-12.004***	-11.878***	-12.027***	0.361*	0.087
Brazil						
ERW	-15.669***	-15.645***	-9.045***	-15.670***	0.048	0.034
KLR	-12.850***	-13.351***	-12.867***	-13.083***	0.725**	0.194**
STV	-5.990***	-6.304***	-5.879***	-5.985***	0.620**	0.207**
Chile						
ERW	-16.399***	-16.396***	-1.808*	-9.720***	0.215	0.154**
KLR	-14.261***	-14.614***	-9.342***	-10.171***	0.743***	0.136*
STV	-13.716***	-13.826***	-0.976	-2.782*	0.488	0.078
Mexico						
ERW	-14.511***	-14.478***	-14.200***	-14.445***	0.047	0.047
KLR	-14.798***	-14.779***	-8.652***	-14.511***	0.071	0.045
STV	-14.837***	-14.817***	-8.740***	-14.541***	0.068	0.044

Notes: $e_{i,t}$ is measured as the real exchange rate.
***, **, * indicate rejection of the null hypothesis at the 1%, 5% and 10%, respectively.
[a] The ADF/DF-GLS procedure test the null that H_0: $y_t \sim I(1)$ against the alternative H_a: $y_t \sim I(0)$.
[b] The KPSS procedure test null that H_0: $y_t \sim I(0)$ against the alternative H_a: $y_t \sim I(1)$.

Table 2.8
Ljung-Box Q-statistics for East Asian and Latin American Countries

	EMP Indices		
	ERW	**KLR**	**STV**
East Asia			
Indonesia	18.22	16.2	8.46
Korea	38.74*	53.34*	13.61
Malaysia	17.65	9.49	13.5
Philippines	7.35	9.07	16.79
Singapore	11.68	12.98	3.48
Thailand	7.25	4.13	8.25
Latin America			
Argentina	0.49	0.54	57.2*
Brazil	7.52	4.91	192.14*
Chile	9.54	14.37	13.19
Mexico	17.55	17.48	17.47

Notes: The Q-statistic tests the null hypothesis of no autocorrelation at the relevant lag. An * denotes rejection of the null hypothesis.

In accordance with the suggestion of HKPP (2001), in dealing with the estimation of the tail index with a small sample size, equation (2.13) is used in estimating a weighted least squares (WLS) regression for the individual EMP indices across all countries, after computing the $\gamma(k)$ for a range of values of k. Since we focus exclusively on extreme positive values of the EMP, the essence is to identify the 'right-tail' observations since the right-tail distribution of any EMP index ordered distribution determines which observations are extreme observations. In other words, the right-tail distribution of the EMP index are interpreted as the outcome of (un)successful speculative attacks against the currency of the country and have direct links to currency crises dates. It turns out that this is easily done because in finding our estimate for the optimal k and, consequently, the optimal γ, we have identified the right-tail observations noting that the parameter γ is an indicator of tail fatness, i.e., individual empirical currency return distributions yield more frequent crises that would be predicted by the normal distribution. Accordingly, Diebold, et al. (2000) suggested, similarly employed by Pozo and Dorantes (2003), that recursive residuals be derived from the weighted least squares regression to diagnose structural change which will guide us in the selection of the optimal k.

Figures 2.8 to 2.13 depict the recursive residuals for the three individual EMP indices across the countries in each region with the horizontal axis showing the range of values of k. The recursive residuals are plotted against the bandwidth of plus and minus two standard errors, and examination of the recursive residuals in relation to the standard errors captures the period of instability, generally, starting at the right-hand side of the plots. When we consider the empirical distribution of the individual ordered EMP indices, the apparent break around the right-hand side of the recursive residual plots appropriately correspond to the optimal choice of k, or equivalently, the number of 'extreme' or right-tail observations have now been identified.

Figure 2.8

Recursive Residuals for East Asia using ERW as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate

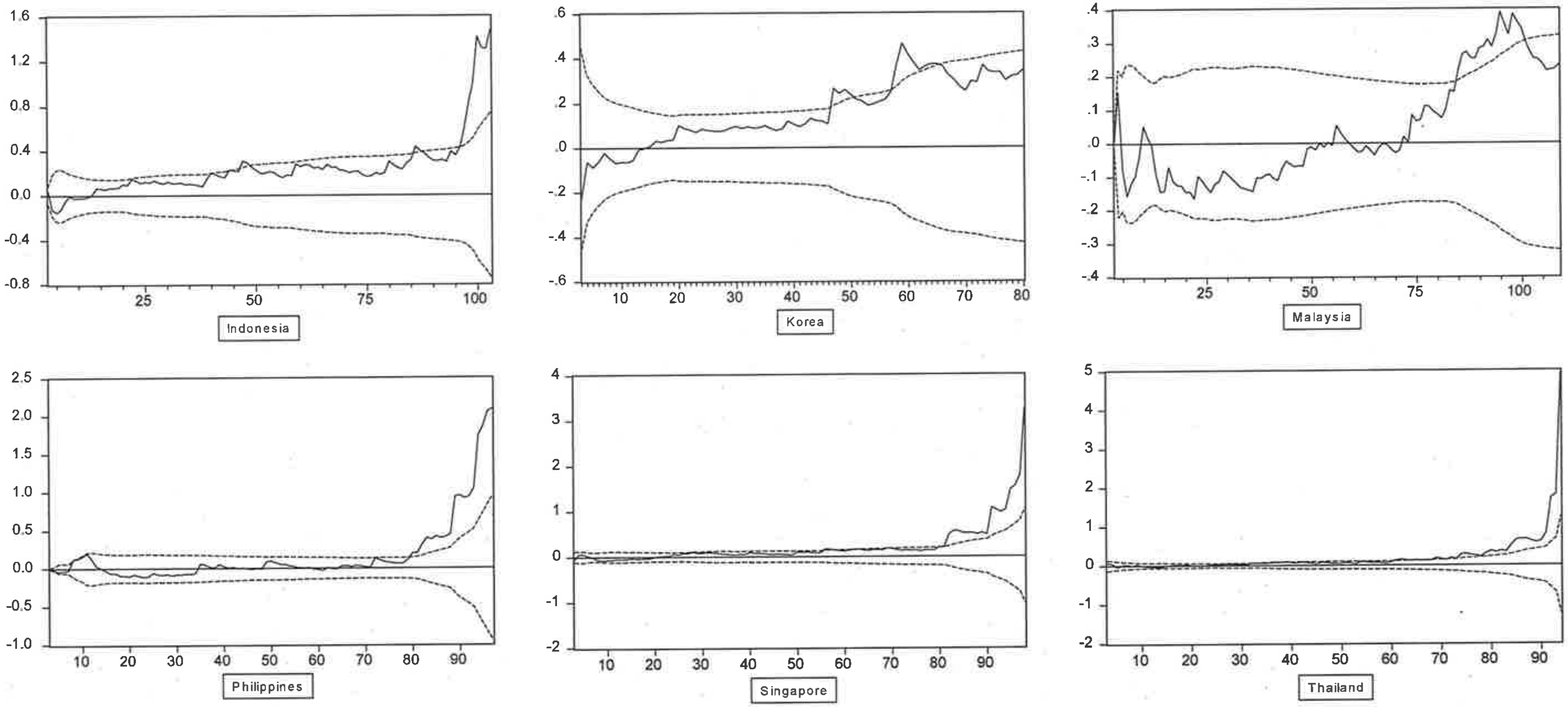


Figure 2.9

Recursive Residuals for Latin America using ERW as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate

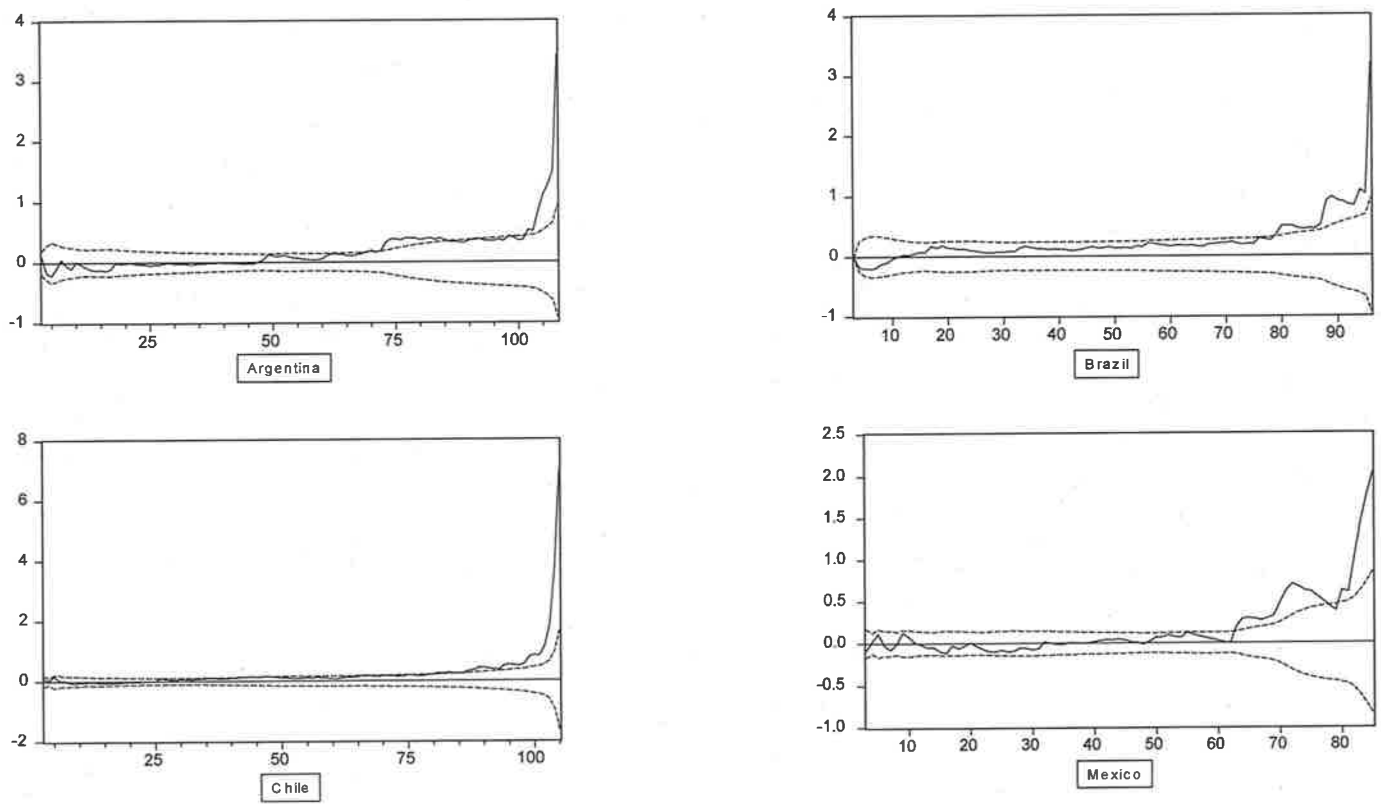


Figure 2.10

Recursive Residuals for East Asia using KLR as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate

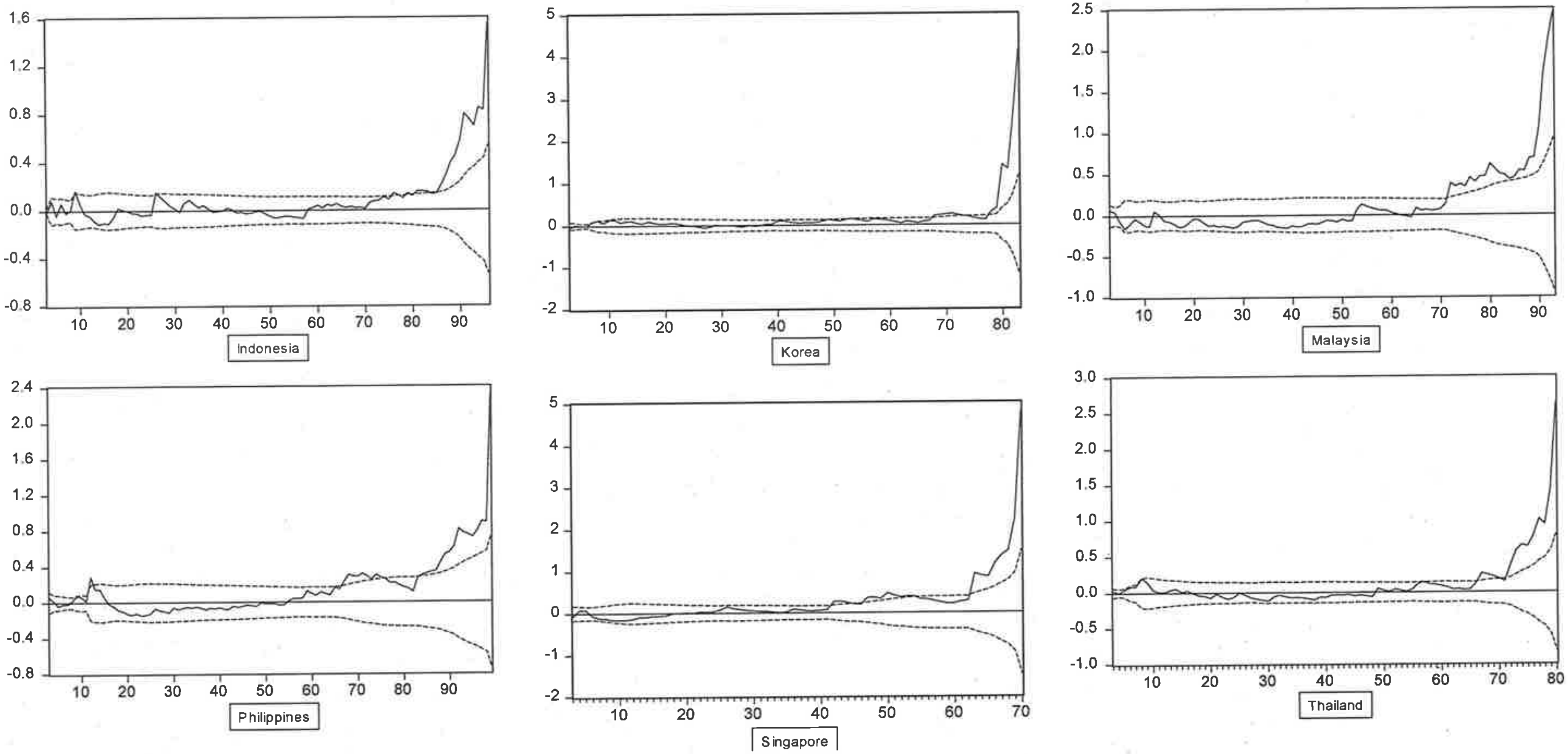


Figure 2.11

Recursive Residuals for Latin America using KLR as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate

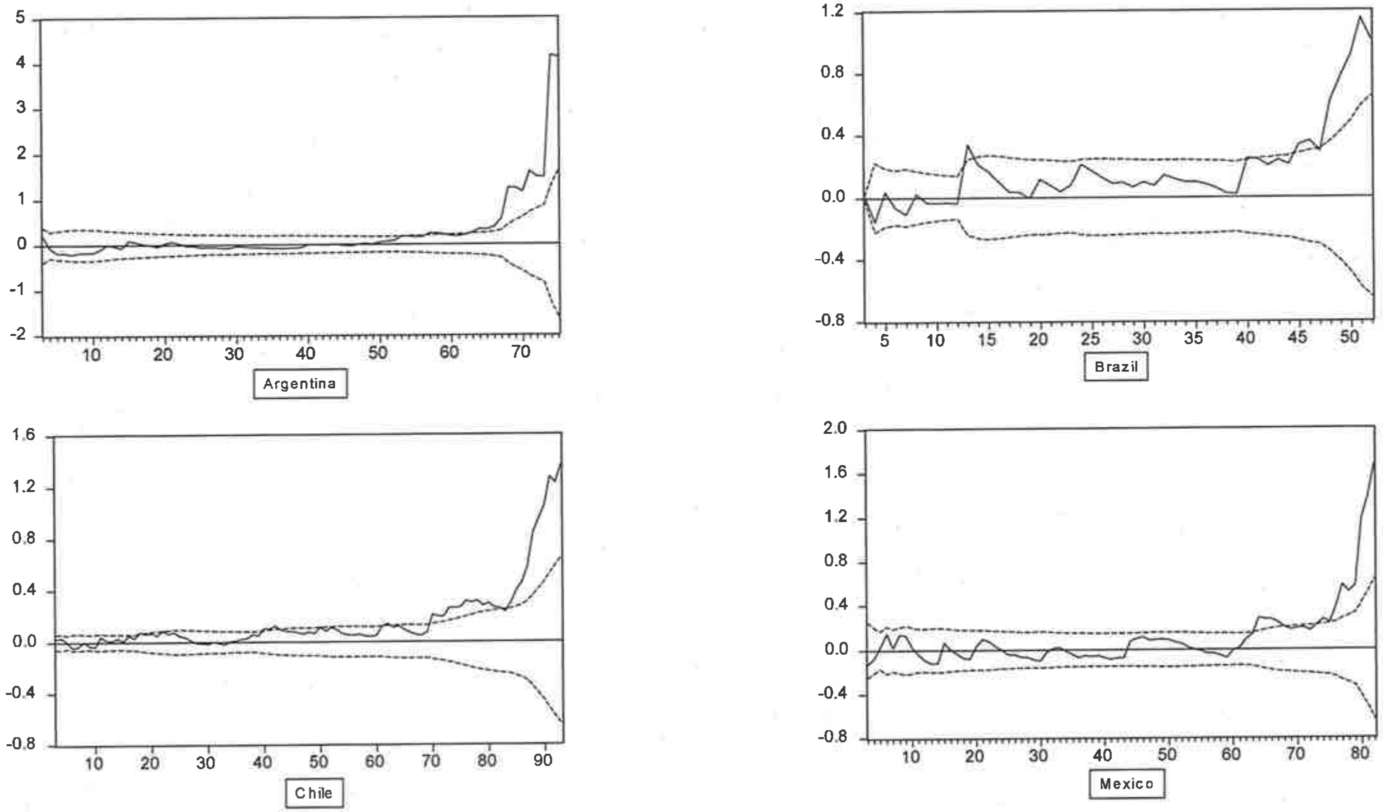


Figure 2.12

Recursive Residuals for East Asia using STV as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate

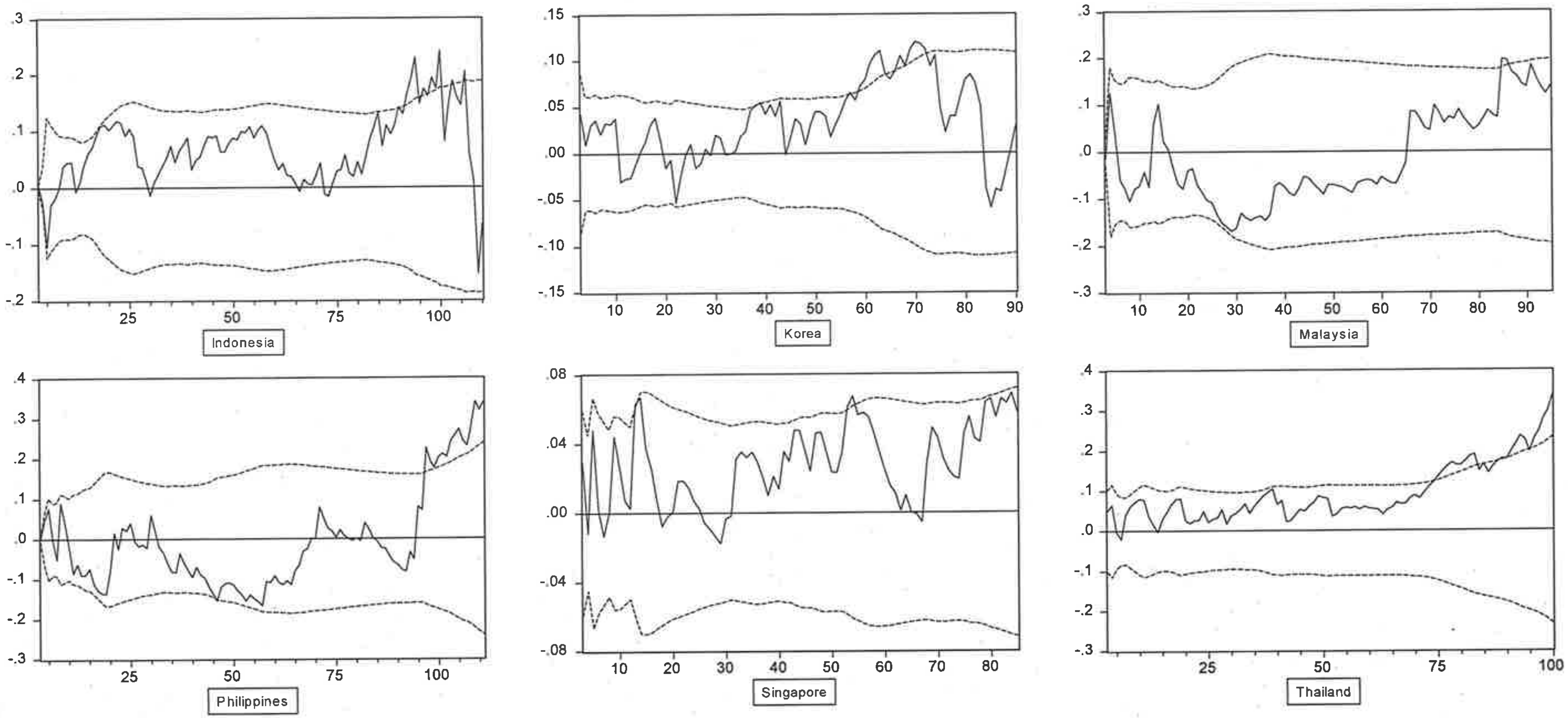
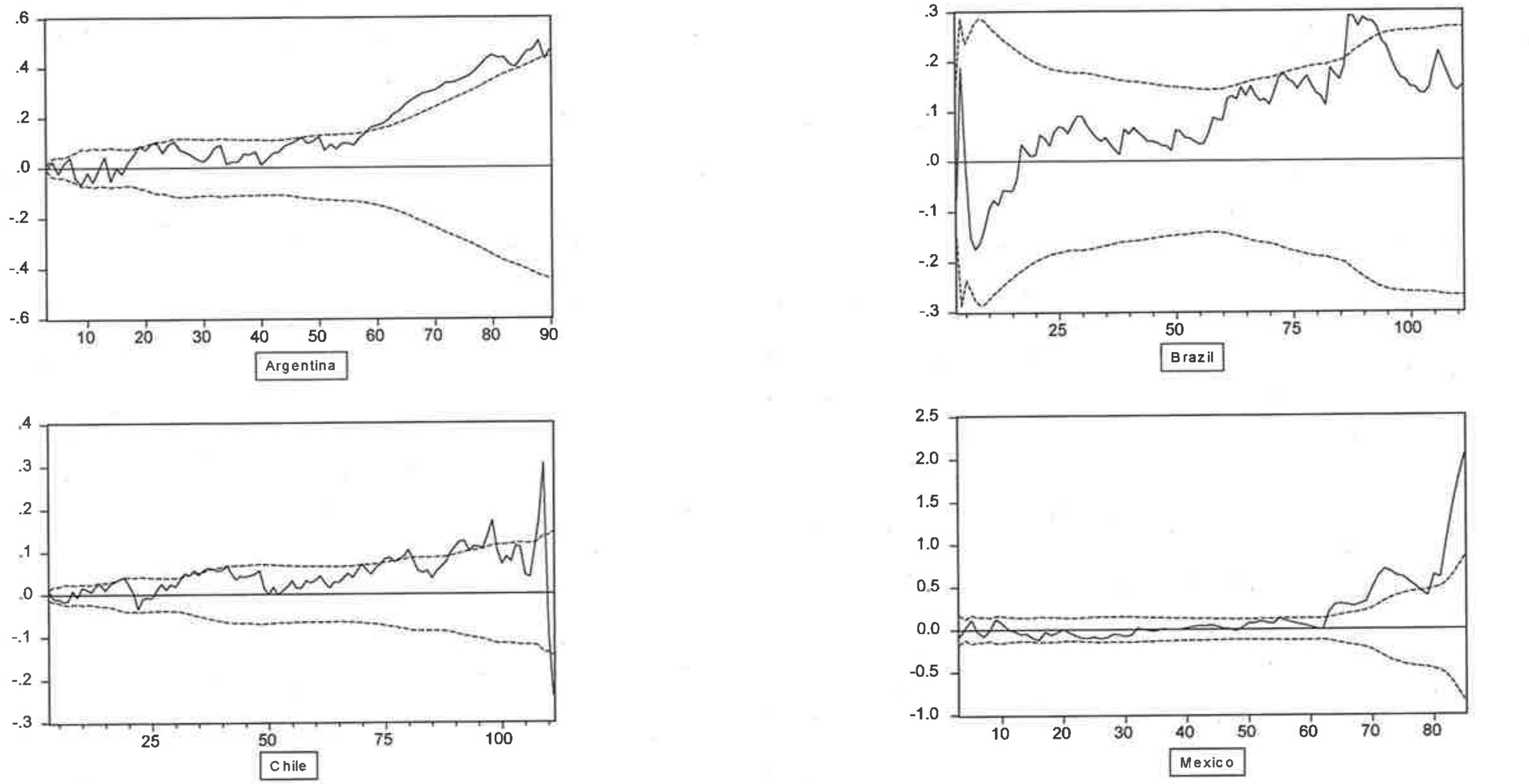


Figure 2.13

Recursive Residuals for Latin America using STV as the EMP Measure

(a) with $e_{i,t}$ measured as the real exchange rate



2.6 Results and Analyses

Prior to identifying the crisis episodes according to EVT, Tables 2.9 to 2.11 report the crisis incidence for each country in each region over the period 1985 to 2003 using the conventional method of selecting an arbitrary threshold or 'cut-off' for the values of the three EMP indices. In addition, as is customarily done in currency crises studies, three-month and six-month exclusion windows are adopted in order to examine the sensitivity of the results and to avoid counting the same crisis more than once, due to the fact that crisis often last for over a month and more crises occur in successive months. Noting that the incidence of crisis (or high market pressure) is calculated as the percentage of the number of crisis episodes over the total sample (n), some key observations can be made from these tables.

First, a comparison of the incidence of crisis episodes for each country varies depending on the EMP index that one uses. Second, the individual EMP indices indicate that the number and incidence of crises episodes are sensitive to the arbitrary choice of the threshold and to the length of the exclusion window, i.e., a relatively lower threshold and short exclusion window represent higher incidences of crisis episodes, vice-versa.

Table 2.9
Number and Proportion of crises episodes according to the ERW-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu + 1.5\sigma$				$\mu + 2.0\sigma$				$\mu + 2.5\sigma$				$\mu + 3.0\sigma$			
		3-month		*6-month*		*3-month*		*6-month*		*3-month*		*6-month*		*3-month*		*6-month*	
	n	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*
East Asia																	
Indonesia	222	3	1.4	2	0.9	3	1.4	1	0.5	2	0.9	1	0.5	2	0.9	1	0.5
Korea	222	3	1.4	3	1.4	1	0.5	1	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Malaysia	222	7	3.2	5	2.3	3	1.4	2	0.9	3	1.4	2	0.9	2	0.9	2	0.9
Philippines	222	9	4.1	8	3.6	8	3.6	7	3.2	6	2.7	5	2.3	4	1.8	4	1.8
Singapore	222	5	2.3	5	2.3	3	1.4	3	1.4	2	0.9	2	0.9	1	0.5	1	0.5
Thailand	222	6	2.7	5	2.3	4	1.8	3	1.4	3	1.4	2	0.9	1	0.5	1	0.5
Latin America																	
Argentina	222	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	1	0.5	1	0.5
Brazil	222	3	1.4	3	1.4	3	1.4	3	1.4	2	0.9	2	0.9	2	0.9	2	0.9
Chile	222	5	2.3	4	1.8	5	2.3	4	1.8	2	0.9	1	0.5	1	0.5	1	0.5
Mexico	222	6	2.7	6	2.7	4	1.8	4	1.8	3	1.4	3	1.4	1	0.5	1	0.5

Notes: $e_{i,t}$ is measured as the real exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (*n*) and then multiplying by 100.

Table 2.10
Number and Proportion of crises episodes according to the KLR-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu + 1.5\sigma$				$\mu + 2.0\sigma$				$\mu + 2.5\sigma$				$\mu + 3.0\sigma$			
	n	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia																	
Indonesia	223	5	2.2	4	1.8	4	1.8	3	1.3	2	0.9	1	0.4	2	0.9	1	0.4
Korea	224	6	2.7	6	2.7	2	0.9	2	0.9	1	0.4	1	0.4	1	0.4	1	0.4
Malaysia	225	6	2.7	4	1.8	4	1.8	3	1.3	3	1.3	2	0.9	3	1.3	2	0.9
Philippines	225	9	4.0	8	3.6	6	2.7	6	2.7	4	1.8	4	1.8	2	0.9	2	0.9
Singapore	225	4	1.8	4	1.8	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4	1	0.4
Thailand	225	6	2.7	5	2.2	5	2.2	4	1.8	2	0.9	2	0.9	1	0.4	1	0.4
Latin America																	
Argentina	225	2	0.9	2	0.9	2	0.9	2	0.9	1	0.4	1	0.4	1	0.4	1	0.4
Brazil	225	4	1.8	4	1.8	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4	1	0.4
Chile	225	7	3.1	5	2.2	3	1.3	2	0.9	2	0.9	2	0.9	1	0.4	1	0.4
Mexico	225	7	3.1	7	3.1	5	2.2	5	2.2	1	0.4	1	0.4	1	0.4	1	0.4

Notes: $e_{i,t}$ is measured as the real exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table 2.11
Number and Proportion of crises episodes according to the STV-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu + 1.5\sigma$				$\mu + 2.0\sigma$				$\mu + 2.5\sigma$				$\mu + 3.0\sigma$			
	n	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia																	
Indonesia	223	4	1.8	3	1.3	4	1.8	3	1.3	4	1.8	3	1.3	4	1.8	3	1.3
Korea	224	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4	1	0.4	1	0.4	1	0.4
Malaysia	225	9	4.0	6	2.7	5	2.2	3	1.3	2	0.9	2	0.9	2	0.9	2	0.9
Philippines	225	8	3.6	7	3.1	7	3.1	6	2.7	7	3.1	6	2.7	5	2.2	4	1.8
Singapore	225	8	3.6	7	3.1	3	1.3	2	0.9	1	0.4	1	0.4	1	0.4	1	0.4
Thailand	225	5	2.2	4	1.8	3	1.3	2	0.9	2	0.9	1	0.4	2	0.9	1	0.4
Latin America																	
Argentina	226	3	1.3	3	1.3	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9
Brazil	225	3	1.3	3	1.3	3	1.3	3	1.3	3	1.3	3	1.3	3	1.3	3	1.3
Chile	225	9	4.0	8	3.6	6	2.7	5	2.2	4	1.8	3	1.3	4	1.8	3	1.3
Mexico	226	7	3.1	7	3.1	5	2.2	5	2.2	1	0.4	1	0.4	1	0.4	1	0.4

Notes: $e_{i,t}$ is measured as the real exchange rate.

Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (*n*) and then multiplying by 100.

Tables 2.12 to 2.14 present the identification of crises according to EVT for the individual EMP indices, and for comparative purposes, we also include the results using the conventional method where we include the threshold that has the most number (incidence) of identified crisis episodes from tables 2.9 to 2.11 (this is at one and a half standard deviations above the mean). The third column of tables 2.12 to 2.14 also report the optimal *k* values which were derived from the recursive residuals discussed earlier, and the reported values clearly show the contrast in the number of extreme right-tail observations, or in the number of crises which occurred prior to imposing an exclusion window for individual countries and across each EMP indices.

It is clear that using an alternative approach such as an EVT leads to more incidence of crises episodes identified compared to the standard approach in the literature. This finding holds across each individual EMP indices for all country-specific cases and at the regional-level irrespective of the length of the exclusion or crisis window used. Take, for instance, the case of Indonesia. The EVT approach is able to capture between three to four times as many episodes of crises than the conventional method based on the 3-month exclusion window. Meanwhile, in the case of Argentina, the result was even sharper. As much as between four to almost eleven times as many episodes of crisis were captured by the EVT approach as against the conventional method. Hence, we can confidently conclude that the HKKP-modified Hill estimator method is a more powerful tool in identifying crises events than the conventional approach of mean and standard deviation.

Table 2.12
Number of monthly episodes of crises and incidence of crises using the extreme value theory and ERW-EMP

		Extreme Value Theory (EVT)					*Conventional Method Country-Specific Standard Deviation and Mean $\mu + 1.5\sigma$*			
	n	*Optimal k*	*No. of Crises Episodes 3-month window*	*Incidence*	*No. of Crises Episodes 6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1332		102	7.7	82	6.2	33	2.5	27	2.0
Indonesia	222	19	13	5.9	11	5.0	3	1.4	1	0.5
Korea	222	30	21	9.5	17	7.7	3	1.4	3	1.4
Malaysia	222	25	19	8.6	13	5.9	7	3.2	5	2.3
Philippines	222	21	14	6.3	11	5.0	9	4.1	8	3.6
Singapore	222	25	18	8.1	15	6.8	5	2.3	5	2.3
Thailand	222	25	17	7.7	15	6.8	6	2.7	5	2.3
Latin America	888		66	7.4	51	5.7	16	1.8	15	1.7
Argentina	222	39	21	9.5	15	6.8	2	0.9	2	0.9
Brazil	222	18	12	5.4	10	4.5	3	1.4	3	1.4
Chile	222	20	16	7.2	13	5.9	5	2.3	4	1.8
Mexico	222	25	17	7.7	13	5.9	6	2.7	6	2.7

Notes: $e_{i,t}$ is measured as the real exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table 2.13
Number of monthly episodes of crises and incidence of crises using the extreme value theory and KLR-EMP

		Extreme Value Theory (EVT)					*Conventional Method*			
							Country-Specific Standard Deviation and Mean $\mu + 1.5\sigma$			
	n	*Optimal k*	*No. of Crises Episodes 3-month window*	*Incidence*	*No. of Crises Episodes 6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1347		91	6.8	74	5.5	36	2.7	31	2.3
Indonesia	223	26	16	7.2	13	5.8	5	2.2	4	1.8
Korea	224	14	12	5.4	11	4.9	6	2.7	6	2.7
Malaysia	225	21	15	6.7	12	5.3	6	2.7	4	1.8
Philippines	225	35	21	9.3	15	6.7	9	4.0	8	3.6
Singapore	225	29	18	8.0	16	7.1	4	1.8	4	1.8
Thailand	225	15	9	4.0	7	3.1	6	2.7	5	2.2
Latin America	900		60	6.7	50	5.6	20	2.2	18	2.0
Argentina	225	21	12	5.3	11	4.9	2	0.9	2	0.9
Brazil	225	41	20	8.9	15	6.7	4	1.8	4	1.8
Chile	225	20	15	6.7	13	5.8	7	3.1	5	2.2
Mexico	225	21	13	5.8	11	4.9	7	3.1	7	3.1

Notes: $e_{i,t}$ is measured as the real exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table 2.14
Number of monthly episodes of crises and incidence of crises using the extreme value theory and STV-EMP

		Extreme Value Theory (EVT)					*Conventional Method Country-Specific Standard Deviation and Mean $\mu + 1.5\sigma$*			
	n	*Optimal k*	*No. of Crises Episodes 3-month window*	*Incidence*	*No. of Crises Episodes 6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1347		93	6.9	76	5.6	37	2.7	30	2.2
Indonesia	223	25	15	6.7	13	5.8	4	1.8	3	1.3
Korea	224	31	19	8.5	14	6.3	3	1.3	3	1.3
Malaysia	225	13	8	3.6	6	2.7	9	4.0	6	2.7
Philippines	225	21	12	5.3	10	4.4	8	3.6	7	3.1
Singapore	225	34	22	9.8	19	8.4	8	3.6	7	3.1
Thailand	225	21	17	7.6	14	6.2	5	2.2	4	1.8
Latin America	901		63	7.0	48	5.3	22	2.4	21	2.3
Argentina	226	31	15	6.6	11	4.9	3	1.3	3	1.3
Brazil	225	26	12	5.3	8	3.6	3	1.3	3	1.3
Chile	225	33	23	10.2	18	8.0	9	4.0	8	3.6
Mexico	225	20	13	5.8	11	4.9	7	3.1	7	3.1

Notes: $e_{i,t}$ is measured as the real exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Once the crisis incidence episodes have been computed, it is now easy to appropriately date the timing of the currency pressure (crises). Accordingly, Tables 2.15 and 2.17 summarised the dates of the attack episodes captured by the conventional method and by the EVT, respectively. In Appendix A.2, the last, but interesting task that I conducted in this study is to associate the dates listed in Tables 2.15 to 2.17 with the important economic and political events, local or international, that may explain or contribute to the extreme increase in the EMP levels of the countries that I examined here. As expected, the EVT list a more comprehensive dating of actual episodes of currency crises for the countries investigated during the time period covered by the data (1985-2003).

According to table 2.17, across the three EMP indices, the EVT is able to capture the debt crisis of the 1980s involving the four Latin American countries. Meanwhile, with respect to the crisis episodes of the 1990s, the three EMP indices are also able to capture the so-called Mexican peso crisis of 1994-1995; the East Asian currency crises of 1997-98 involving Indonesia, Korea, the Philippines, Malaysia, and Thailand; the Brazilian crisis of 1999; and, more recently, the 2001 crisis in Argentina. Furthermore, as is evident in tables 2.15 to 2.17, both methods are also able to capture periods of high market pressures against the listed currencies other than those of full-blown crisis periods. For example, Singapore was also 'stressed' during the height of the East Asian currency crisis for all three EMP indices.

Table 2.15
Crisis Episodes According to Conventional Method (East Asian and Latin American sample)

Index	East Asia						Latin America			
	Indonesia	Korea	Malaysia	Philippines	Singapore	Thailand	Argentina	Brazil	Chile	Mexico
ERW	July 1997 July 1998	Feb. 1989 June 1991 Nov. 1997	Feb.1985 April 1986 Jan. 1989 May, Dec. 1997	March 1985 Feb. 1986 March 1987 January, Sept. 1990 March 1995 July 1997 Nov. 2000	Sept. 1985 July 1988 Jan. 1991 Oct. 1997 May 1998	Feb. 1985 Sept. 1990 Jan. 1995 Feb., Sept. 1997	Jan. 1989 Feb. 1990	Jan., Dec. 1989 July 1994	March 1985 April 1989 March 1992 Jan. 1998	Aug. 1985 Dec. 1987 April, Dec. 1994 Nov. 1995 Sept. 1998
KLR	Dec. 1986 Aug. 1997 July 1998 Feb. 2001	March 1985 Jan. 1986 June 1991 Aug. 1996 March, Nov. 1997	Feb.1985 April 1986 May, Dec. 1997	March 1985 Feb. 1986 March 1987 Jan., Sept. 1990 March 1995 July 1997 Nov. 2000	Sept. 1985 Oct. 1997 May 1998 Oct. 1999	Feb.1985 Jan. 1995 Feb., Sept. 1997 June 1998	Jan. 1989 Feb. 1990	Jan. 1989 Feb. 1990 July 1994 Sept. 1998	March 1985 April 1989 April 1991 March 1993 Jan. 1998	Aug. 1985 Jan. 1988 March 1990 April, Dec. 1994 Nov. 1995 Sept. 1998
STV	Sept. 1986 Aug. 1997 May 1998	July 1986 Jan. 1988 Dec. 1997	March 1986 Oct. 1988 Dec. 1990 Dec. 1993 May, Dec. 1997	April 1985 Feb., Dec. 1986 Aug. 1990 March 1995 Aug. 1997 Nov. 2000	May 1987 Jan. 1990 June 1995 March, Oct. 1997 May 2000 Oct. 2001	Dec. 1985 July 1997 June 1998 Sept. 1999	April, Dec. 1989 Feb. 2002	Jan. 1989 Jan. 1990 May 1994	Feb., Dec. 1985 Dec. 1988 Nov. 1989 Oct. 1990 Nov. 1991 July 2001 Jan. 2003	Aug. 1985 Jan. 1988 March 1990 April, Dec. 1994 Nov. 1995 Sept. 1998

Notes: $e_{i,t}$ is measured as the real exchange rate.

The actual dates of the crisis episodes were based on a 6-month exclusion window using 1.5 standard deviations above the mean.

Table 2.16
Crisis Episodes According to Extreme Value Theory (East Asian Sample)

Index	East Asia					
	Indonesia	Korea	Malaysia	Philippines	Singapore	Thailand
ERW	March, Dec. 1986 July 1988 June 1989 Dec. 1992 Feb. 1995 Aug. 1997 April 1998 Dec. 1999 Dec. 2000 Dec. 2001	March 1985 January 1986 December 1987 December 1988 Sept. 1989 Sept. 1990 June 1991 Dec. 1992 Aug. 1994 Aug. 1996 March, Nov. 1997 Sept. 1998 January 2001 Sept. 2001 March 2003	Feb., Nov. 1985 Aug. 1986 Feb. 1988 Jan. 1989 Jan. 1990 Aug. 1991 Dec. 1992 Jan. 1994 Jan., Sept. 1995 May, Dec. 1997	March, Oct. 1985 March 1987 Jan. 1990 Sept. 1990 May 1992 Oct. 1993 March 1995 July 1997 July 1998 Nov. 2000	Feb. 1985 Sept. 1985 May 1987 July 1988 April 1989 Jan. 1990 Jan. 1991 Jan. 1992 June 1995 Aug. 1997 May 1998 Jan. 1999 Dec. 1999 March 2001 Nov. 2001	Feb. 1985 Oct. 1985 Jan. 1987 April 1990 Dec. 1990 Dec. 1991 Dec. 1992 Dec. 1993 Jan. 1995 Feb., Dec. 1996 July 1997 June 1998 Oct. 1999 March 2003
KLR	Feb., Sept. 1985 Nov. 1986 June 1987 July 1988 June 1989 April 1990 April 1994 Sept. 1995 Aug. 1997 April 1998 Feb., Nov. 2001	March 1985 Jan. 1986 March, Dec. 1987 Feb. 1989 April 1990 June 1991 Aug. 1994 Aug. 1996 March, Nov. 1997	Feb., Nov. 1985 Aug. 1986 Feb., Sept. 1988 Dec. 1992 Dec. 1994 Sept. 1995 April, Nov. 1997 June 1998 March 2001	March, Oct. 1985 Sept. 1987 Oct. 1988 July 1989 March, Nov. 1990 May 1992 May 1993 Feb. 1995 July 1997 July 1998 July 2000 April 2001 March 2003	Feb., Sept. 1985 May, 1986 June 1988 March 1990 March 1991 March 1992 March 1994 March 1996 Oct. 1997 May 1998 Feb., Oct. 1999 July 2000 March 2001 Jan. 2002	Feb., Oct. 1985 April 1990 Jan. 1995 Feb., Sept. 1997 June 1998
STV	Sept. 1986 June 1987 March 1988 June 1990 March 1991 Dec. 1996 Aug. 1997 May 1998 Jan., Aug. 1999 May 2000 Feb., Sept. 2001	Sept. 1985 April 1986 Nov. 1987 Aug. 1988 March 1989 Oct. 1989 June 1991 Nov. 1992 June 1993 June 1994 May 1996 March, Dec. 1997 Dec. 2000	March 1986 Oct. 1988 Dec. 1990 Dec. 1993 July 1997 June 1998	April 1985 Feb., Dec. 1986 Sept. 1989 Aug. 1990 Sept. 1992 Oct. 1993 March 1995 July 1997 Oct. 2000	Feb., Sept. 1985 May 1986 May 1987 Jan. 1990 March 1991 Jan. 1992 April, Nov. 1993 June 1995 Jan. 1996 Feb., Oct. 1997 May 1998 Dec. 1999 Sept. 2000 Oct. 2001 Sept. 2002 June 2003	Feb., Sept 1985 Dec. 1986 Dec. 1989 Jan. 1991 April 1992 March 1993 May 1994 Jan., Aug. 1995 July 1997 June 1998 Sept. 1999 July 2000

Notes: *$e_{i,t}$* is measured as the real exchange rate.
The actual dates of the crisis episodes were based on a 6-month exclusion window.

Table 2.17

Crisis Episodes According to Extreme Value Theory (Latin American Sample)

Latin America			
Argentina	**Brazil**	**Chile**	**Mexico**
June 1985 Nov. 1986 Jan. 1989 Sept. 1989 Feb. 1991 Jan. 1993 Jan. 1994 Oct. 1994 July 1995 Oct. 1998 July 1999 March 2001 Nov. 2001 June 2002 March 2003	April 1986 Dec. 1987 Jan., Nov. 1989 July 1994 Oct. 1997 Sept. 1998 Dec. 1999 Dec. 2001 Aug. 2002	March 1985 Aug. 1987 April 1989 April 1990 Nov. 1991 Aug. 1992 March 1993 Feb. 1995 Sept. 1995 Dec. 1997 July 2001 June 2002 June 2003	July 1985 June 1986 Dec. 1987 Nov. 1988 Oct. 1989 Aug. 1991 Nov. 1993 Nov. 1994 Oct. 1995 Nov. 1996 Nov. 1997 Sept. 1998 June 2002
Jan. 1989 Feb. 1990 Feb. 1991 Sept. 1992 Jan., Oct. 1995 March 1999 Aug. 2000 March, Oct. 2001 May 2002	Jan., Aug. 1986 Jan. 1989 Feb. 1990 March 1991 July 1994 March 1995 April, Nov. 1997 June 1998 March, Oct. 1999 Oct. 2001 Aug. 2002 April 2003	March 1985 July 1986 Nov. 1988 April 1989 April 1991 March 1993 Sept. 1995 Dec. 1997 July 1998 June 1999 Sept. 2000 April 2001 June 2003	July 1985 June 1986 Dec. 1987 Sept. 1988 May 1989 March 1990 Nov. 1993 Nov. 1994 Oct. 1995 Nov. 1997 Sept. 1998
April 1985 Oct. 1987 May 1988 Feb., Dec. 1989 Dec. 1990 June 1995 Dec. 1996 June 2000 Sept. 2001 May 2002	May 1987 Jan., Dec. 1989 Dec. 1991 Oct. 1992 July 1993 Feb. 1994 June 2002	Feb., Dec. 1985 Oct. 1986 May 1987 April, Dec. 1988 Oct. 1989 July 1990 Nov. 1991 June 1992 May 1993 Aug. 1995 Oct. 1999 May 2000 March, Oct. 2001 June 2002 Jan. 2003	July 1985 July 1986 Dec. 1987 Sept. 1988 May 1989 March 1990 Nov. 1993 Nov. 1994 Oct. 1995 Nov. 1997 Sept. 1998

Notes: $e_{i,t}$ is measured as the real exchange rate.

The actual dates of the crisis episodes were based on a 6-month exclusion window.

Concerning the last point made above, this should not come as a surprise since the notion of an EMP index is supposed to capture both successful attacks, i.e., events that have been well recognised and acknowledged as major crises by the relevant economic authorities, market participants and multilateral organisations, and unsuccessful attacks, i.e., those events accompanied by sharp fall (increase) in reserves (interest rates), and may have only been exclusively or privately known by market participants (traders, dealers) and the country's monetary authority. On this aspect, Pozo and Dorantes (2003) argued the following:

> ...As is the case for all other approaches used to identify currency crisis periods, our approach may not provide an unambiguous standard that can be used to verify that what we identify as a currency crisis is indeed a currency crisis. There is no formal definition of currency crisis derived from theory, and multilateral organisations do not systematically categorise crisis countries or crisis periods. Hence, there is no way to 'grade' the accuracy of these multiple approaches (pp. 607).[24]

2.7 Brief Conclusion

This chapter has addressed two key points that are worth noting for formulating crisis indicators. First, it is highly recommended that we adopt a range of indices to ensure the robustness and conclusiveness of our results. This emanates from the finding in this chapter that the three sets of EMP indices do report different numbers of crisis episodes or periods of speculative attack against a currency. One possible explanation here lies in the different weighting schemes attached to each component of EMP index (foreign exchange reserves, interest rate and exchange rate). As shown in this chapter, the identification of the crisis is sensitive to the choice of the weighting scheme for the three key variables (foreign exchange reserves, interest rate and nominal/real exchange rate).

[24] Recently, an attempt has been made in this direction by the IMF to date periods of high market pressures on the equity and housing prices cycles in its World Economic Outlook (WEO) of April 2003.

Lastly, despite the numerous findings that any financial price series such as exchange rates, interest rates, stock prices do not exhibit distributions that are normal, this crucial piece of information about the distribution of speculative/financial price series is, usually, assumed 'away' or takes lesser importance compared to other issues, e.g., search for more powerful econometric methods. Consequently, this has largely been the source of weakness of the conventional measure that use thresholds based on the mean and the standard deviation. For instance, as observed by Edison (2003), once an original sample is extended with the availability of more recent data, the previously identified crises are no longer identified by the conventional measure. Edison notes, in particular, the case of Malaysia where prior to 1997, five crises were identified, but these disappear once the data is extended up to 1999, in which case, only one crisis is identified, that is, the 1997 East Asian crisis.

To address the shortcoming of the conventional method and thus avoid any arbitrary choices in setting the threshold or cut-off in defining currency crises, this study applies an alternative statistical procedure—the HKKP-Extreme Value Theory approach. The HKKP-Extreme Value Theory approach takes into account the basic statistical properties of an EMP index and thus, directly estimates the shape of the distribution of the right-tail where the frequency of extreme events, such as currency crises are concentrated. In doing so, the conventional method in the literature is substantially improved by identifying or capturing more crises episodes, regardless of whatever standard weighting schemes that one uses in the construction of the EMP index.

Chapter 3

A Re-examination of the Evidence of Post-Crisis Dollar-Peg Reversion In the East Asia-5 Using Regime Switching ARCH

3.1 Introduction

In recent years, there has been a great deal of effort expended on developing behavioural classifications of exchange rate regimes across countries by either looking exclusively at the behaviour of nominal exchange rates, e.g., Reinhart and Rogoff (2004), or considering both the behaviour of nominal exchange rates and reserves data, e.g., Levy-Yeyati and Sturzenegger (2004). These efforts in developing so-called *de-facto* classifications were mainly motivated by the crucial recognition that, until recently, the IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions, which is usually the main initial source of information about the official or *de-jure* exchange rate policies pursued by member countries, takes at face value what countries say and not what they actually do in practice.[1] In other words, member countries' declaration of their exchange rate policies, where the IMF's classification is based, often differs greatly from the actual policies that these countries pursue. Thus, the alternative *de-facto* classifications aim to describe what member countries actually do rather than what they say that they do.

The evidence in general suggests that many countries that declared as pegged have in fact allowed frequent and sometimes substantial adjustments of their exchange rates (Ghosh, et al. 1997).[2] In contrast, as observed by Calvo and Reinhart (2002), many countries claim to allow their exchange rates to float, but tightly

[1] The IMF, itself, moved to a *de-facto* classification in 1999. The IMF's version combines available information on the exchange rate and monetary policy framework and authorities' formal or informal policy intentions with data on actual exchange rate and reserves movements to reach a judgment about the actual exchange rate regime (Rogoff, et al. 2003).

[2] This is referred to by von Hagen and Zhou (2002, 2004) as 'fear of pegging'.

managed their exchange rates through frequent interventions in their foreign exchange and money markets in order to avoid large swings on their currencies.[3,4]

When we confine our attention to East Asia alone, the evidence indicates that pretensions to float were quite endemic especially for the crisis-hit countries in East Asia before the crisis.[5] More specifically, before the crisis, with the exception of Thailand, the crisis-hit East Asian countries announced as their official exchange rate regime an arrangement akin towards a flexible-type arrangement (see table 3.1). However, numerous studies that assessed the actual or *de-facto* exchange rate arrangements in place in East Asia up until the time of the crisis in July 1997 unanimously support the existence of a 'quasi' or 'soft-U.S. dollar peg'.[6]

Table 3.1
De Jure Exchange Rate Regime Classification

East Asian Country	Officially-declared Classification
Indonesia	Managed floating (Dec. 1983-July 1997)
Korea	Managed floating (June 1982-Nov. 1997)
Malaysia	Managed floating (June 1993-Sep. 1998)
Philippines	Independently floating (Nov. 1984-)
Singapore	Managed floating (Dec. 1987-)
Thailand	Peg to other currency composite (Nov. 1984-June 1997)

Sources: International Monetary Fund, Exchange Arrangements and Exchange Restrictions.

[3] This is referred to as the infamous 'fear of floating' from the paper of Calvo and Reinhart (2002) with the same title.
[4] In a related paper, Calvo and Reinhart (2000), enumerate several justifiable reasons why many countries, including developing countries are wary of large movements in their currencies—devaluations are generally viewed as contractionary because of adverse balance sheet effects, a high pass-through from exchange rate to inflation, detrimental impact to trade and investment flows, loss of access to international capital markets, and the lack of credibility in financial markets.

[5] For the entirety of this chapter, East Asia, in particular, the crisis-hit East Asian countries refer to Indonesia, Korea, Philippines, Singapore, and Thailand.
[6] Refer to section 3.2 for examples of studies that assessed the actual or de-facto exchange rate arrangements in East Asia up until the time of the 1997 crisis.

But there is more to the issue of pre-crisis exchange rate policy in East Asia, apart from its obscurity. Among other factors, the pre-crisis exchange rate regimes of the countries in this region have been implicated of how these countries got themselves into trouble in mid-1997. Though, there was no explicit commitment on the part of the monetary authorities of these countries for the currency peg, the rates had been stable long enough to provide an implicit guarantee for domestic firms to undertake unhedged foreign-currency debt, as suggested by some studies (Eichengreen, 1999; McKinnon and Pill, 1999). Eventually, when the currency pegs collapsed in mid-1997, undoubtedly, the large accumulated foreign-currency debt and the devaluations that ensued in 1997-98 both contributed to the depth of the economic crisis that befell most of the countries in this region (Frankel, 2004).

Arguably, soon after the crisis, it is not unthinkable that the pre-crisis soft-dollar peg policy can re-appear in the menu of exchange rate regime choices of the crisis-hit East Asian countries.[7] Earlier evidence provided by McKinnon (2000, 2001), Ogawa (2001) and McKinnon and Schnabl (2002) indicate that the crisis-hit East Asian countries had reverted towards a *de-facto* post-crisis U.S. dollar peg. Furthermore, the earlier evidence that the crisis-hit East Asian countries had reverted towards a *de-facto* post-crisis U.S. dollar peg appears consistent with the contention that the proximate cause of the widening of the U.S. current account deficit is due to the willingness of countries in East Asia to finance them by accumulating an unlimited amount of dollar reserve assets in order to keep exchange rates undervalued

[7] For example, Malaysia officially pegged the ringgit at RM3.8 per U.S. dollar on September 1, 1998.

and promote an 'export-led growth' strategy.[8] Thus, it will be interesting to see whether this has indeed been the case using more recent data.

The goal of this chapter is quite simple. The chapter seeks to robustly ascertain whether there is some basis to believe the claim that a reversion to a post-crisis U.S. dollar peg indeed occurred in the crisis-hit countries of East Asia. In order to address this, we construct monthly indices of intervention for five East Asian countries, namely, Indonesia, Korea, Philippines, Singapore and Thailand. The index is constructed using information on the respective conditional volatilities of the changes in nominal exchange rate, foreign exchange reserves and interest rates. In doing so, the intervention index should provide the opportunity of gauging the relative degree of exchange rate flexibility before and after the crisis, as any rise in the said index implies greater intervention activity on the part of monetary authorities and its commitment to exchange rate stabilisation.

The empirical approach adopted in this chapter departs in two respective respects from previous work that has constructed similar measures of indices of exchange rate flexibility, and, conversely, indices of intervention. First, the Markov-switching ARCH or SWARCH model introduced by Hamilton and Susmel (1994) was applied in order to arrive at the conditional probabilities that the conditional volatilities of the three variables (changes in exchange rates, reserves and interest rates) are in a high volatility state.[9] In doing so, the SWARCH model provides an objective way of tracing how the volatilities of each of the variables evolve over time without the need to distinguish or create arbitrary sub-samples, say, pre-crisis and post-crisis periods, as is usually done in most previous studies. Similarly, a

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[8] For instance, Dooley et al. (2003, 2004) named the current situation as a 'revived Bretton Woods system' where East Asian countries peg to the centre's currency, the U.S. dollar, as the European countries did under Bretton Woods.

[9] The Markov-switching ARCH (SWARCH) was also used by Bautista (2005) to examine the degree of volatilities in East Asian stock markets using a sample from 1988 to 2003.

particularly attractive feature of the SWARCH model is that, unlike traditional ARCH models, it can successfully capture structural shifts in the data that are caused by low probability events, such as the East Asian crisis of 1997 (Edwards and Susmel, 2003).

Second, unlike previous studies that constructed indices based on volatility ratios using the unconditional variance or standard deviations, the probabilities of the conditional variances were used instead.[10] This is because the problem with using a parametric measure of volatility such as the variance or standard deviation is that it is a form of averaging, which makes it highly prone to outliers, or discrete breaks in the data.[11] Whereas, the advantage with using results derived from applications of the SWARCH model is that it allows for discrete jumps in conditional volatility.[12]

The rest of the chapter is structured as follows. Section 3.2 discusses the motivation for this study by reviewing the relevant literature. Section 3.3 draws briefly again on the concept of the exchange market pressure in order to relate the idea of movements in exchange rates and intervention. The SWARCH model as well as the index of intervention used in this chapter are described in Section 3.4. Section 3.5 gives details about the data and presents the empirical results. Section 3.6 presents documented evidence gathered mostly from official sources that can provide some support to the empirical results. Section 3.7 concludes.

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[10] Some examples of studies that constructed similar indices based on volatility ratios of unconditional variances and standard deviations were: Bayoumi and Eichengreen (1998), Glick, et al. (1995), Glick and Wihlborg (1997), Hausmann et al. (2001), Hernandez and Montiel (2001), Baig (2001), Calvo and Reinhart (2002).

[11] A related point was made by Nitithanprapas and Willett (2002) regarding the inappropriateness of using the variance or standard deviation as measures of volatility, though, they specifically cited the case of failing to account for trends in the data. In addition, as likewise noted by Nitithanprapas and Willett (2002), footnote 5 (p. 384) of Calvo and Reinhart (2002) also noted the point we have just made regarding outliers in the data.

[12] Calvo and Reinhart (2002) similarly worked with probabilities of the same three variables, however, they computed the probabilities based on a frequency distribution of the changes in the three variables within a certain particular period of the exchange arrangement.

3.2 Literature Review

Previous studies that examined the actual or *de-facto* exchange rate arrangements in place in most of the countries in East Asia have proceeded in two ways. One approach is to test if the countries assigned weights either to a specific currency or to a basket of currencies using a simple regression model. Originally developed and applied by Frankel and Wei in a series of studies (1993, 1994, 1995), the regression model estimates an equation of the form:

$$\Delta e_t^j = \alpha + \beta_1 \Delta e_t^{USD} + \beta_2 \Delta e_t^{DM} + \beta_3 \Delta e_t^{JY} + \beta_4 \Delta e_t^{FF} + \beta_5 \Delta e_t^{UKP} + u_t \qquad (3.1)$$

where Δe_t^j is the monthly change in the log exchange rate of currency *j* in month *t*, α is a constant term, β_k (k = 1, 2, ...) is the coefficient on the monthly change in the log exchange rate of currency *k*, and u_t is the residual term. The superscripts *USD, DM, JY, FF,* and *UKP* refer to the dollar, the deutschemark, the yen, the French franc, and the U.K. pound, respectively.[13] All exchange rates are expressed in terms of a certain numeraire currency, usually the Swiss franc. The intuition behind the model is that the coefficient estimates can be interpreted as the weights assigned by the respective authorities to the corresponding currencies in their exchange rate policies (Kawai and Akiyama, 2000). In doing so, one can then identify to which specific currency or to a basket of currencies that monetary authorities have tended to stabilise their exchange rates.

The overwhelming weight accorded to the U.S. dollar (close to unity) based on coefficient estimates of numerous studies using the Frankel-Wei model that assessed the actual exchange rate arrangements in place in most of East Asia up until the time of the crisis in July 1997, unanimously support the existence of an informal 'soft-

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[13] Alternatively, in order to assess the roles of the tripolar currencies (U.S. dollar, Japanese yen, and the euro) in East Asian exchange rates, the deutschemark (DM), French franc (FF), and the U.K. pound (UKP), can be collectively replaced in the right-hand side of the equation by the euro.

dollar peg'.[14] This has led McKinnon (2000, 2001) and Ohno (1999), in evaluating pre-crisis East Asian exchange rate policy, to refer to East Asia as being in a 'dollar standard' (EADS) and 'soft dollar zone', respectively.

A slightly different version of the Frankel-Wei regression model is by Gan (2000) who estimated a much simpler regression equation of the following form:

$$\Delta \log e_{kt} = \alpha + \beta \Delta \log e_{Yt} + u_t \qquad (3.2)$$

where e_k refers to the number of units of a k regional currency to one U.S. dollar and e_Y is the number of yen per U.S. dollar. The intuition behind this is that when a regional currency is closely pegged to the dollar, the movement of its exchange rate relative to the dollar would be independent of the movement of the yen-dollar exchange rate (estimated value of β is approximately zero). Conversely, if a regional currency is closely pegged to the yen, then its exchange rate against the dollar would closely reflect the movement in the yen-dollar exchange rate (estimated value of β is close to one). Nonetheless, Gan's β estimates were approximately zero up until the eve of the crisis, which reinforced the close link of the East Asian currencies to the U.S. dollar before the crisis.

Following the major devaluations and forced floatation of most of East Asian currencies beginning in July 1997, it appears that interpretations vary with regard to available evidence on post-crisis *de-facto* exchange arrangements in most of the East Asian countries. While, the Malaysian case is the most explicit, with the decision to peg the ringgit at RM3.8 per US dollar on September 1, 1998, the actual exchange rate policies of the other five countries involve somewhat more complexity.

On the one hand, using data until 1999, early or late 2000, coefficient estimates obtained by Kawai and Akiyama (2000), McKinnon (2000, 2001), and

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[14] Kawai and Akiyama (1998, 2000); Ohno (1999); McKinnon (2000, 2001); McKinnon and Schnabl (2002); Baig (2001); Kawai (2002); Esaka (2003).

Ogawa (2001) using the Frankel-Wei model indicate a *de-facto* post-crisis reversion or return toward an exchange arrangement akin to the pre-crisis *de-facto* soft-dollar peg.

On the other hand, once longer time series data were used, based on coefficient estimates by Kawai (2002), one can neither conclude that most of the East Asian countries have reverted to their pre-crisis soft-dollar peg, or, with the exception of Indonesia, that they have shifted to freely floating exchange rates. Indeed, "their exchange rates are more flexible than in the pre-crisis period, but more stable than those of a typical free-floating industrial country" (Kawai, p. 188). Baig (2001) using 1999/2000 data in defining the post-crisis period, reached a somewhat similar conclusion when he noted the following:

> …the coefficient estimates of the …countries are seen to return close to their pre-crisis magnitudes, but the standard error of the estimates are uniformly much larger. The larger standard errors, as well as substantially lower adjusted R-squared results, suggest that the degree to which the currencies are linked to the dollar is relatively less than in the pre-crisis period (p. 18).

More recent estimates by McKinnon and Schnabl (2002) using data up to July 2002 introduced a somewhat further dimension into the debate on the actual post-crisis exchange arrangements of the East Asian countries. Except for Indonesia, they argued that the post-crisis reversion of the other East Asian countries to the *de-facto* peg could be measured or observed on a day-to-day or week-to-week basis, rather than on month-to-month or quarter-to-quarter frequencies. They referred to this as pegging on a high-frequency level as compared to pegging on a low-frequency level. Consequently, as McKinnon and Schnabl (2002) have also noted, whether we can observe an eventual return to low-frequency pegging in the post-crisis among East Asian exchange rates in the near future is a promising area of empirical scrutiny which requires the availability of longer and more recent time series data.

Studies that have used the Frankel-Wei model and arrived at the conclusion that both before and after the crisis, the East Asian countries were de-facto peggers to the U.S. dollar do not come without its criticisms. First, McCauley (2001) pointed out that the high estimated coefficients (weights) for the U.S. dollar does not follow that these currencies were pegging to the U.S. dollar. The conclusion that does follow is that the East Asian currencies belong and remain to the U.S. dollar bloc, "or at least that they have not slipped from the dollar bloc into the euro bloc" (McCauley, p. 47). McCauley's basis for this distinction between bloc membership and de-facto pegging (the latter being the preferred interpretation of McKinnon and among others) is that "currencies can float freely and yet belong to a bloc" (p. 46). The cases of the Australian and Canadian dollar were cited as "typically sharing the U.S. dollar's movement against the euro or yen but also show volatility against the U.S. dollar. If belonging to the dollar bloc is taken to be the same as being pegged to the dollar, then the Canadian and Australian dollars must be considered pegged to the U.S. dollar" (p. 46).

The second criticism has something to do with the choice of the numeraire currency. The practice of recent studies that assessed the issue usually expressed the relevant regional currency and the major currencies as exogenous variables in the equation in terms of a numeraire (neutral) currency, and, as mentioned a while ago, the Swiss franc is the preferred choice. The problem with this empirical strategy is that the numeraire currency should not be linked to any of the currencies in the basket, otherwise, "one of the exogenous variables has a small variance…" (Benassy-Quere and Coeure (2000), p.14). For instance, when the DM/euro is included as one of the exogenous variables, the Swiss franc has a link to the DM/euro as well as the Pound sterling (linked to the DM/euro and the U.S. dollar) or the Australian dollar (linked to the U.S. dollar) (Benassy-Quere and Coeure, 2000)[15].

The alternative approach is to assess the degree of commitment by countries to exchange rate stabilisation by arriving at a statistical descriptive measure of observed volatilities in exchange rates, stock of foreign exchange reserves and interest rates. The basic idea behind this approach is that exchange rate stabilisation is not observed through movements alone (or the lack of it) in the nominal exchange rate, but also through interventions in the foreign exchange market and monetary policy actions which moderate or suppressed supposed movements in the nominal exchange rate.

Only a few studies, e.g. Baig (2001) and Hernandez and Montiel (2003), have directly used this approach.[16] These two studies reinforced findings earlier mentioned from Frankel-Wei regressions regarding the pre-crisis stability of bilateral exchange rates against the U.S. dollar of the East Asian countries, when measured against a comparator set of acknowledged 'clean' floaters, e.g., United States, Germany, Japan, Mexico, Chile. However, contrary to findings by McKinnon and others, that after the crisis there has been reversion to a *de-facto* U.S. dollar peg similar to the one suggested before the crisis, initial assessment by Hernandez and Montiel (2003) suggest that a fundamental change in *de-facto* exchange rate regimes had taken place in these countries post-crisis and, with the exception of Malaysia, the shift in revealed preferences in these countries has been towards greater exchange rate flexibility. Nonetheless, these countries have not moved to the extreme pole of clean floating, as these countries still intervene substantially in their respective foreign exchange and domestic securities markets. As noted by Hernandez and Montiel (2003):

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[15] In one of the earlier Frankel-Wei (1995) papers, they also used the Swiss franc as the numeraire, but this was all right as they only had the U.S. dollar and the Japanese yen as the exogenous variables.
[16] McKinnon and Schnabl (2002) can also be added to these two studies, however, they only looked at exchange rate volatility, which is quite common in studies that assess the degree of commitment to exchange rate stabilisation.

> Contrary, to the views of some observers …, there has indeed been a change in *de-facto* exchange rate regimes in all five of these countries between the pre- and post-crisis periods. While none of them have adopted "soft pegs" with unfettered capital movements, neither have they moved to the extreme corner solutions of "hard pegs or clean floats. In other words, all of them have continued to manage their exchange rates in an active manner, and have thus occupied the supposed "hollow middle" of exchange rate policy (p. 347).

However, the two studies that used this approach also have their own limitations. First, these studies used as their measure of volatility, the standard deviation, which is the commonly used parametric measure of volatility. However, any standard deviation measure is a form of averaging and is only as appropriate with the underlying conformity of the data to conventional parametric assumptions needed to employ such a method.[17] In fact, as early as the 1960s, the non-normality of any speculative price series such as the exchange rate and the interest rate has already been clearly recognised.[18] Second, as earlier mentioned, it is customary practice of these studies to compare the observed volatility outcomes of the East Asian countries' exchange rates, stock of foreign exchange reserves, and interest rates across a benchmark or comparator set of acknowledged 'clean' floaters, which are also mostly developed countries with more advanced and well-developed financial markets. However, this approach rests on the strong implicit assumption that the shocks experienced by all these countries were uniform over time and across countries, which most likely is not the case.[19]

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[17] Hernandez and Montiel (2003) used, aside from the standard deviation, the range and mean absolute change of the respective changes in exchange rate, stock of foreign exchange reserves and interest rate, while, Baig (2001) used only the standard deviation of the changes of the same three series.

[18] See, for example, the collection of papers by Mandelbrot (1963, 1964, 1967), Fama (1965, 1970) among others.

[19] Nonetheless, this argument was also recognized by Hernandez and Montiel. In cases, where the said assumption appears not to hold, they also examined the relative volatilities of the three variables (exchange rates, foreign exchange reserves, and interest rates). They believe that, in principle, by looking at their relative volatilities it will be independent of the environment (p. 345).

3.3 Exchange Market Pressure and Exchange Rate Policy

As noted in the previous chapter, the concept of the exchange market pressure can also be utilised on how observed outcomes in exchange rates, stock of foreign exchange reserves and interest rates can shed light on the degree of exchange rate stabilisation pursued by monetary authorities.[20] For example, with some minor modifications of the early seminal work of Girton and Roper (1977), the analysis proceeds as follows. Assuming an exponential specification of the demand for money function, the monetary equilibrium condition for any country *i* can be written as:

$$H_i = F_i + D_i = P_i Y_i^{\beta} \exp(-\alpha_i i_i) \qquad (3.3)$$

where H_i = supply of monetary base issued by the central bank of country i
F_i = monetary base created against the purchase of foreign assets
D_i = monetary base created by domestic credit expansion
P_i = price level
Y_i = real income
i_i = domestic interest rate
β_i = income elasticity
α_i = interest rate coefficient

Next, according to equation (3.4) a distinction is made between the foreign currency value of foreign assets and the quantity of domestic money created against the purchase of those assets:

$$F_i(t) = \int_{-\infty}^{t} E_i(\tau) R_i^{'}(\tau) d\tau \qquad (3.4)$$

where: $R_i(t)$ = stock of international reserves held by country *i* in time t;
$R_i^{'}(t)$ = time derivative of R_i (net purchases at time t);
$E_i(t)$ = parity or *i* currency value at time t

Equation (3.4) makes it clear that a country's parity or price of foreign exchange is important only at the time foreign assets are purchased. Differentiating equation (3.3), then substituting this into the time derivative of equation (3.4) and expressing the results in per cent changes yields equation (3.5):

[20] See footnote 17, page 24 of Chapter 2.

$$h_i = r_i + d_i = \pi_i + \beta y_i - \alpha_i i_i \qquad (3.5)$$

where $h_i = H_i'/H_i$ $d_i = D_i'$

$i_i'(t) = di_i/dt$ $\pi_i = P_i'/P_i$

$r_i = E_i R_i'$ $y_i = Y_i'/Y_i$

Using purchasing power parity, i.e., $\pi = \pi^* - e$, to substitute the rate of change in the exchange rate (e) for the domestic inflation rate, and rearranging terms, we can re-write equation (3.5) as:

$$e_i + r_i + i_i = -d_i + \pi^* + \beta y_i + (1+\alpha)i_i \qquad (3.6)$$

Finally, equation (3.6) is the modified version of the Girton-Roper model. Focusing exclusively on the left-hand side of equation (3.6), under a clean float, if the monetary authority of this country refrained from intervention, i.e., r_i, $i_i = 0$, the left-hand-side would be reduced to the percent change of e_i, i.e., the exchange rate depreciates if the authority is not willing to lose reserves (r_i) or to raise interest rates (i_i) to defend the currency. Conversely, if the monetary authority is determined to maintain a fixed parity or band, it will be ready to sell reserves or even increase interest rates to deter the outflow of reserves, i.e., $e_i = 0$.

Thus, in cases of intermediate regimes such as managed or 'dirty' floats, the composite variable on the left-hand side of equation (3.6), i.e., $e_i + r_i + i_i$, is what is familiarly referred to previously as the exchange market pressure. In other words, apart from its original design of capturing the total excess demand or supply for the relevant foreign currency, another benefit of using the exchange market pressure is that by controlling for the size of shocks, and how this is reflected in the behaviour of its various components (not just from the behaviour of the exchange rate alone), one can also crucially describe the degree of flexibility (or the lack of it) pursued by the concerned monetary authority, from an intervention angle.[21]

3.4 Markov-Regime Switching ARCH (SWARCH)

Hamilton and Susmel (1994) proposed an extension to the standard ARCH model which can incorporate regime shifts. In their model, the parameters of the ARCH process are allowed to switch between a discrete number of states, with the transitions between states governed by a finite-order Markov process. Hamilton and Susmel called this the switching ARCH or, simply, SWARCH model. The SWARCH model can be described by the following system of equations:

$$\Delta r_t = \phi_0 + \phi_1 \Delta r_{t-1} + \varepsilon_t, \qquad \varepsilon_t | I_{t-1} \sim N(0, h_t) \tag{3.7}$$

$$\varepsilon_t = u_t \sqrt{g(s_t)} \tag{3.8}$$

$$u_t = \sigma_t v_t; \qquad v_t \sim N(0,1) \tag{3.9}$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i u_{t-i}^2 \tag{3.10}$$

Equation (3.7) assumes that the return (r_t) follows a first-order autoregressive scheme. The returns innovations (ε_t) are assumed to follow an ARCH process with conditional variance σ_t^2 where σ_t^2 depends linearly on q past squared errors, i.e., u_{t-i}^2. In standard ARCH models, the parameters are constant across regimes. In the SWARCH model, however, the ARCH parameters are allowed to switch endogenously between a number of discrete states (K). The move from one state to

[21] Some earlier studies already employed the concept of the exchange market pressure from an intervention angle, and these were: Bayoumi and Eichengreen (1998), Glick, et al. (1995), Glick and Wihlborg (1997), Baig (2001) and Calvo and Reinhart (2002), however, as earlier mentioned, these studies only used the conventional measure of volatility— unconditional variance and standard deviation. Moreover, with the exception of Calvo and Reinhart (2002), these studies exclude the interest rate from their construction of the exchange market pressure.

another represents a change in the scale of the volatility process. This is represented above by $g(s_t)$ as the constant switching or variance factor, which depends on the state variable, $s_t = 1,2,\ldots K$. In this representation, a normalization is imposed such that $g(1) = 1$ and $g(s_t) \geq 1$ for $s_t = 2,\ldots.K$. Hence, state 1 may be viewed as the low volatility state. For $s_t \neq 1$, $g(s_t)$ therefore indicates the magnitude of volatility at s_t relative to the low volatility state.

Following Hamilton and Susmel (1994), s_t is assumed to follow an unobserved first-order K-Markov process, which can be described by transition probabilities, $P(s_t = j \mid s_{t-1} = i) = p_{ij}$. Each probability number, p_{ij}, is the probability that state i is followed by state j. For purposes of this chapter, it is assumed that there are only two volatility states: low volatility (state 1) and high volatility state (state 2). Hence, for the two state case, the transition probabilities are:

$$
\begin{aligned}
&p[s_t = 1| \, s_{t-1} = 1] = p \\
&p[s_t = 2| \, s_{t-1} = 1] = 1 - p \qquad (3.11) \\
&p[s_t = 2| \, s_{t-1} = 2] = q \\
&p[s_t = 1| \, s_{t-1} = 2] = 1 - q
\end{aligned}
$$

One of the objectives of the SWARCH model is to predict the probability of occurrence of a state for each period, where it was shown by Hamilton and Susmel (1994) to be a by-product of a nonlinear Markov-switching filter. For example, the inference that is based on information available or observed at time t is called the 'filter probability', while, alternatively, the inference using all sample observations is called the 'smoothed probability'.

3.4.1 Smoothed Probabilities and the Index of Intervention

Recall from the above that the full-sample smoothed probability represents the probability that the conditional variance was in state s_t at date t, given all sample returns observations. And, as illustrated by the seminal idea of Hamilton (1989) in dating business cycles, inferences from the smoothed probabilities provide a relatively objective method of dating shifts in conditional volatility. Accordingly, we can utilise the crucial piece of information that we just learned regarding the usefulness of smoothed probabilities to shed light on the issue of post-crisis exchange rate policies for the five East Asian countries examined here. Specifically, we can combine the information gathered from the individual smoothed probabilities of the exchange rates, reserves, and interest rates of the five individual countries to formulate an adequate characterisation of the degree of exchange rate flexibility in terms of a certain monthly intervention index for country i as:

$$\text{Index of Intervention (IoI)} = \frac{p^H_{reserves} + p^H_{\text{int}\,r}}{p^H_{exr} + p^H_{reserves} + p^H_{\text{int}\,r}} \qquad (3.12)$$

where $p^H_{exr}, p^H_{reserves}, p^H_{\text{int}\,r}$ are the smoothed probabilities that the conditional variance of the changes in exchange rates, reserves, and interest rates, respectively, are in a high-volatility state at date t. At the outset, notice that we do not rely solely on the smoothed probability of the conditional volatility of changes in exchange rates. This is because in analysing exchange rate policy, examining only the behaviour of the exchange rate offers us a partial picture, as exchange rate volatility can be low because of government policy actions manifested through monetary policy and interventions in the foreign exchange market, or because there are relatively few shocks. Thus, at the minimum, to produce an appropriate description of a country's exchange rate policy, we need to look both at the information conveyed by exchange rate changes and intervention (Willett, 2004). In the absence of publicly available information on intervention in the foreign exchange market, we follow Calvo and Reinhart (2002) in using changes in reserves as the imperfect measure of foreign exchange intervention, while intervention in money-markets is measured by changes in interest rates.[22]

The rationale for using IoI as an indicator of the degree of intervention, or, otherwise, the degree of exchange rate flexibility, is that if ($p^H_{reserves} + p^H_{\text{int}\,r}$) is high relative to ($p^H_{exr} + p^H_{reserves} + p^H_{\text{int}\,r}$) (and therefore IoI is comparatively high) the monetary authorities are intervening relatively heavily to offset total 'market forces' (and therefore less exchange rate flexibility), and vice-versa.[23,24] Since the basis for the construction of the index is expressed through the probabilities of the conditional variance being at state 2 (the high-volatility state) instead of the actual conditional variance estimates, the index is in effect constrained between 0 and 1. As a result, it becomes relatively easy to make inferences about the regime's propensity to intervene over a certain period, and thus the regime's flexibility as when IoI is close to one

[22] Actually, as will be mentioned in section 3.5, line 11 of the IMF-IFS was used as the measure of the stock of foreign exchange reserves instead of line 1Ld (international reserves data). The advantage of using line 11 is that it includes borrowed money, which can be used for foreign exchange intervention, while, line 1Ld may change due to a host of other reasons not entirely connected to intervention such as, fluctuations in valuations, accrual of interest earnings, and money in the IMF that can or cannot be used. I thank Charles Wyplosz for pointing this out.

[23] The denominator ($p^H_{exr} + p^H_{reserves} + p^H_{\text{int}\,r}$) is interpreted as the probability of a high exchange market pressure on the currency, or it captures the probability of the 'total' pressure put by macroeconomic shocks on the exchange rate, given by the sum of the probabilities of the actual high variability in exchange rate (p^H_{exr}) and the 'incipient' high exchange rate variability ($p^H_{reserves} + p^H_{\text{int}\,r}$) (Glick and Wihlbourg, 1997).

[24] Notice though from the above formulation that a high intervention index can also be the outcome of a relatively stable or tranquil market environment, that is, the probability of a high exchange market pressure on the currency ($p^H_{exr} + p^H_{reserves} + p^H_{\text{int}\,r}$) is low, in which case, the numerator of the index ($p^H_{reserves} + p^H_{\text{int}\,r}$) is also low. However, this limitation is not endemic to this study alone, but also applies to previous studies that constructed similar formulations of such an index. Most importantly, a closer inspection of the estimated probabilities reveals that this particular outcome only occurs in a very brief period of time for one country (Indonesia).

(zero) suggest that there is a high (low) propensity to intervene, and thus suggesting a rigid (flexible) exchange rate regime.[25]

3.5 Data Description and Preliminary Results

The data used in this chapter consists of monthly time series of nominal exchange rates expressed in local currency per U.S. dollar, overnight money market rates as the measure of domestic interest rates, and foreign assets of monetary authorities as the measure of foreign exchange reserves, for Indonesia, Korea, Philippines, Singapore and Thailand. The sample covers the period from January 1985 to December 2003. The data were gathered from the IMF International Financial Statistics. In Table 3.2, summary statistics are presented for the monthly percentage changes of exchange rates and foreign exchange reserves, and first-differences of the interest rates. More specifically, this table contains information on the mean, standard deviation, skewness coefficient, kurtosis coefficient, Jarque-Bera normality test (JB), and Ljung-Box (LB) test. All three series for the five countries show non-normality (note the JB test results), and the kurtosis coefficient indicates fat-tailedness, which is also behind the rejection of normality. The Ljung-Box (LB) statistics suggest significant autocorrelation with the exceptions of Indonesia (reserves), Korea (reserves), and Philippines (interest rates). The Ljung-Box (LBS) statistics, for the squared levels, are also significant, with the exceptions of Indonesia (exchange rate,

[25] Notice also from the formulation of IoI that independent analyses of the changes in exchange rates, reserves and interest rates will be conducted in the empirical section of this chapter. Treating the three key variables this way is in line with the idea of a model-independent definition of the exchange market pressure, where I do not depend on a prior economic structure and linkages among a certain set of macroeconomic fundamentals to obtain estimates of the intervention index ala Weymark (1995, 1997). To be more specific, the framework presented in section 3.3 follows that of Eichengreen et al. model-independent definition of the exchange market pressure where we exclusively focus on the left-hand side of equation (3.6) in order to justify the separate treatment of the changes in exchange rates, reserves and interest rates in the empirical section. I return to this point in chapter five.

reserves), Korea (exchange rate) and Singapore (reserves). This is largely taken as evidence for an ARCH-type process for the conditional variance.

Table 3.2
Univariate Statistics on Exchange Rates (EXR), Reserves and Interest Rates (INT)

	Mean	Std. Dev.	Skewness	Kurtosis	JB Normality Test	LB(24)	LBS(24)
Indonesia							
EXR	1.202	8.723	6.563	68.593	42323.16**	53.36**	15.16
Reserves	2.071	10.644	4.257	37.329	11831.79**	30.15	11.36
INT	-0.02	5.246	2.715	42.83	15283.63**	43.12**	41.88**
Korea							
EXR	0.214	3.606	8.573	105.007	101197.8**	70.43**	6.68
Reserves	2.274	7.296	0.833	8.161	278.215**	27.97	87.24**
INT	-0.02	1.156	1.122	11.878	793.152**	38.94*	37.06*
Philippines							
EXR	0.497	2.202	1.937	13.701	1225.113**	67.57**	75.42**
Reserves	2.718	13.907	3.660	25.181	5160.34**	44.41**	64.90**
INT	-0.12	1.676	1.266	15.428	1514.84**	34.04	38.70*
Singapore							
EXR	-0.10	1.334	0.252	7.042	156.954**	35.70*	126.73**
Reserves	0.868	1.06	0.118	4.061	11.172**	79.0**	26.34
INT	-0.02	0.571	0.216	16.898	1828.664**	27.47**	58.45**
Thailand							
EXR	0.202	2.815	2.602	24.63	4681.083**	54.12**	222.35**
Reserves	1.517	4.552	0.085	12.291	816.69**	111.6**	315.41**
INT	-0.05	2.155	0.35	12.728	899.658**	61.72**	104.58**

Notes: EXR and Reserves in percentage changes and INT in first-differences.
JB-normality test: Jarque-Bera test, which is distributed χ^2_2.
LB(24): Ljung-Box test for EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.
LBS(24): Ljung-Box test for square of EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.
**, * significant at the 1 and 5 percent level, respectively.

Next we proceed in using the (SWARCH) model of Hamilton and Susmel (1994) and the results of the SWARCH model for each of the three series for the individual countries are shown in Tables 3.3-3.5. A number of interesting results can be noted from the tables. First, the coefficient estimates are statistically significant with the exceptions of the Singapore dollar and reserves (α_1) (tables 3.3 and 3.4), and Philippine interest rate (α_0) (table 3.5). Second, the estimated transition probabilities, i.e., p_{11} and p_{22}, are statistically significant and are close to one. These estimates imply that the states are highly persistent. More specifically, from the estimates, one can compute the expected duration of each volatility state as $1 / (1 - p_{ii})$. For example, state 1 (the low volatility state) for the Indonesian rupiah in table 3.3 is expected to last on average for $(1 - 0.95)^{-1} = 20$ months, while state 2 (the high volatility state) can be expected to last on average for 14 months.

Third, the estimated switching parameters (the variance factors), the g_is, are significantly different than one in all series. That is, for each of the three individual series and for each of the five countries, it is possible to distinguish a 'low' and a 'high' volatility state. Taking again the example of the Indonesian rupiah in table 3.3, the second state is 787 times more volatile than state 1. The magnitude of this difference alone for the case of the Indonesian rupiah and for the rest of the results of the switching parameters in tables 3.3-3.5 underscores the need for a model of conditional variance that allows for regime switches. Fourth, a conventional likelihood ratio test suggests that the null hypothesis of no regime switching can, indeed, be rejected. For example, the estimated SWARCH(2,2) in the case of the Indonesian rupiah in table 3.3 would have as its nested model an ARCH(2). The usual likelihood ratio test is then computed as: $-2(292.67 - 599.83) = 614.32$, which rejects the ARCH(2) model in favour of the SWARCH model.[26] Finally, as a diagnostic test,

[26] A word of caution is necessary in interpreting this result. In Markov switching models, the usual regularity conditions justifying the use of classical tests such as the likelihood ratio test are violated. This is because, under the null hypothesis of only one state, the transition probabilities are not identified, implying that the sample likelihood function is flat with respect to these parameters. As in Hamilton and Susmel (1994), the likelihood ratio test results mentioned here should be treated more as a descriptive summary than formal statistical tests.

Ljung-Box Q-statistics were tested for the standardised residuals, LB(24), and for the squared standardised residuals, LBS(24). Noticed that by using the SWARCH model, autocorrelation was clearly reduced or eliminated.

3.6 Results and Analyses

The estimated index of intervention for each of the five countries are presented in figures 3.1-3.5, and in the discussion below for the respective countries, an attempt is made to correspond the estimated index of intervention after the crisis with officially available statements and publications of the respective individual country central banks.[27]

3.6.1 Indonesia

The estimated index of intervention during the pre-crisis presented in figure 3.1 is, in large measure, in conformity with some documented claims of a crawling-band for the rupiah throughout the 1990s until this was abolished at the height of the East Asian crisis in August 1997. Indeed, it was also clearly documented that before this date, there were eight times in the 1990s and six times altogether, within the period of January 1994 to September 1996 that Bank Indonesia (henceforth BI) cautiously widened this band (Williamson, 1998; Djiwandono, 2000).

[27] Parts of this section also rely on independent country studies and reports housed within the IMF as these studies, when available, arguably, rely on information provided by individual country central banks.

Table 3.3

2-state regime switching ARCH regressions for percentage changes in exchange rates

	Rupiah Normal SWARCH (2,2)	**Won Student *t* SWARCH (2,1)**	**Peso Normal SWARCH (2,1)**	**Singapore dollar Normal SWARCH (2,1)**	**Thailand baht Normal SWARCH (2,2)**
ϕ_0	0.21^{**} (0.01)	-0.0003 (0.04)	0.10^{*} (0.04)	-0.13^{*} (0.06)	-0.01 (0.04)
ϕ_1	0.34^{**} (0.02)	0.58^{**} (0.06)	0.36^{**} (0.09)	0.3^{**} (0.07)	0.24^{**} (0.07)
α_0	0.01^{**} (0.002)	0.20^{**} (0.07)	0.13^{**} (0.03)	0.64^{**} (0.10)	0.15^{**} (0.03)
α_1	1.22^{**} (0.29)	0.58^{**} (0.25)	0.41^{*} (0.17)	0.16 (0.12)	0.36^{**} (0.12)
α_2	0.32^{*} (0.16)	---	---	---	0.3^{**} (0.11)
p_{11}	0.95^{**} (0.02)	0.99^{**} (0.006)	0.92^{**} (0.03)	0.97^{**} (0.02)	0.99^{**} (0.008)
p_{22}	0.93^{**} (0.03)	0.99^{**} (0.006)	0.90^{**} (0.04)	0.81^{**} (0.1)	0.97^{**} (0.03)
g_2	787.33^{++}(283.10)	19.92^{++} (0.96)	39.67^{++} (10.61)	9.69^{++} (3.63)	64.15^{++} (18.53)
Log-likelihood	-292.67	-316.7	-356.21	-333.66	-316.04
Log-likelihood (no regime switching)	-599.83	-339.38	-432.70	-353.77	-417.76
LR test	614.32^{**}	45.36^{**}	152.98^{**}	40.22^{**}	203.44^{**}
df	---	3.61^{**} (0.96)	---	---	---
LB(24)	7.27	27.49	28.99	15.92	11.75
LBS(24)	0.22	31.73	2.70	9.25	0.31

Notes: Standard errors in parentheses.

LR test: Likelihood ratio test which test the null hypothesis of no regime switching, which is distributed χ^2_r.

LB(24): Ljung-Box test for EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

LBS(24): Ljung-Box test for square of EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

**, * significant at the 1 and 5 percent level, respectively.

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 3.4
2-state regime switching ARCH regressions for percentage changes in reserves

	Indonesia Normal SWARCH (2,1)	**Korea Normal SWARCH (2,1)**	**Philippines Normal SWARCH (2,1)**	**Singapore Normal SWARCH (2,1)**	**Thailand Normal SWARCH (2,1)**
ϕ_0	1.22** (0.33)	1.68** (0.33)	1.59** (0.35)	0.69** (0.09)	1.34** (0.19)
ϕ_1	0.04 (0.07)	-0.04 (0.08)	0.06 (0.11)	0.20** (0.07)	0.01 (0.06)
α_0	13.91** (2.4)	12.72** (1.83)	11.92** (2.72)	0.58** (0.10)	4.57** (0.64)
α_1	0.44** (0.13)	0.2* (0.1)	0.47** (0.18)	0.14 (0.10)	0.22* (0.10)
p_{11}	0.97** (0.02)	0.99** (0.01)	0.99** (0.009)	0.98** (0.03)	0.99** (0.008)
p_{22}	0.85** (0.09)	0.97** (0.03)	0.99** (0.01)	0.95** (0.06)	0.92** (0.07)
g_2	18.19++ (5.17)	9.01++ (2.45)	6.28++ (1.75)	3.09+ (0.89)	24.17+ (11.03)
Log-likelihood	-741.17	-697.78	-653.07	-316.72	-559.30
Log-likelihood (no regime switching)	-816.97	-739.22	-674.00	-325.86	-576.12
LR test	151.6**	82.88**	41.86**	18.28**	33.64**
LB(24)	30.04	21.88	20.97	43.3**	42.43**
LBS(24)	34.19	26.66	10.12	22.72	13.29

Notes: Standard errors in parentheses.

LR test: Likelihood ratio test which test the null hypothesis of no regime switching, which is distributed χ^2_r.

LB(24): Ljung-Box test for EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

LBS(24): Ljung-Box test for square of EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

**, * significant at the 1 and 5 percent level, respectively.

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 3.5
2-state regime switching ARCH regressions for first-difference in interest rates

	Indonesia Normal SWARCH (2,1)	**Korea Normal SWARCH (2,1)**	**Philippines Normal SWARCH (2,1)**	**Singapore Normal SWARCH (2,1)**	**Thailand Normal SWARCH (2,2)**
ϕ_0	0.02 (0.07)	-0.001 (0.01)	-0.06 (0.05)	0.0006 (0.01)	-0.04 (0.03)
ϕ_1	-0.05 (0.06)	0.22** (0.05)	0.38** (0.04)	0.08** (0.02)	0.09 (0.07)
α_0	0.82** (0.19)	0.007** (0.001)	0.18 (0.10)	0.006** (0.002)	0.06** (0.02)
α_1	0.48** (0.19)	0.38** (0.11)	0.80* (0.40)	0.62** (0.21)	0.63** (0.22)
α_2	---	---	---	---	0.24* (0.11)
p_{11}	0.96** (0.02)	0.91** (0.03)	0.93** (0.03)	0.66** (0.09)	0.99** (0.01)
p_{22}	0.84** (0.07)	0.95** (0.02)	0.75** (0.12)	0.83** (0.06)	0.92** (0.01)
g_2	87.92++ (25.06)	174.31++ (42.48)	40.11++ (15.26)	36.81++ (10.08)	51.38++ (18.12)
Log-likelihood	-480.76	-210.15	-331.87	-135.83	-347.38
Log-likelihood (no regime switching)	-587.39	-338.49	-417.56	-192.99	-423.63
LR test	213.26**	256.68**	171.38**	114.32**	152.5**
LB(24)	23.72	21.14	12.21	21.80	18.21
LBS(24)	5.52	1.51	0.51	48.68**	31.76

Notes: Standard errors in parentheses.

LR test: Likelihood ratio test which test the null hypothesis of no regime switching, which is distributed χ^2_r.

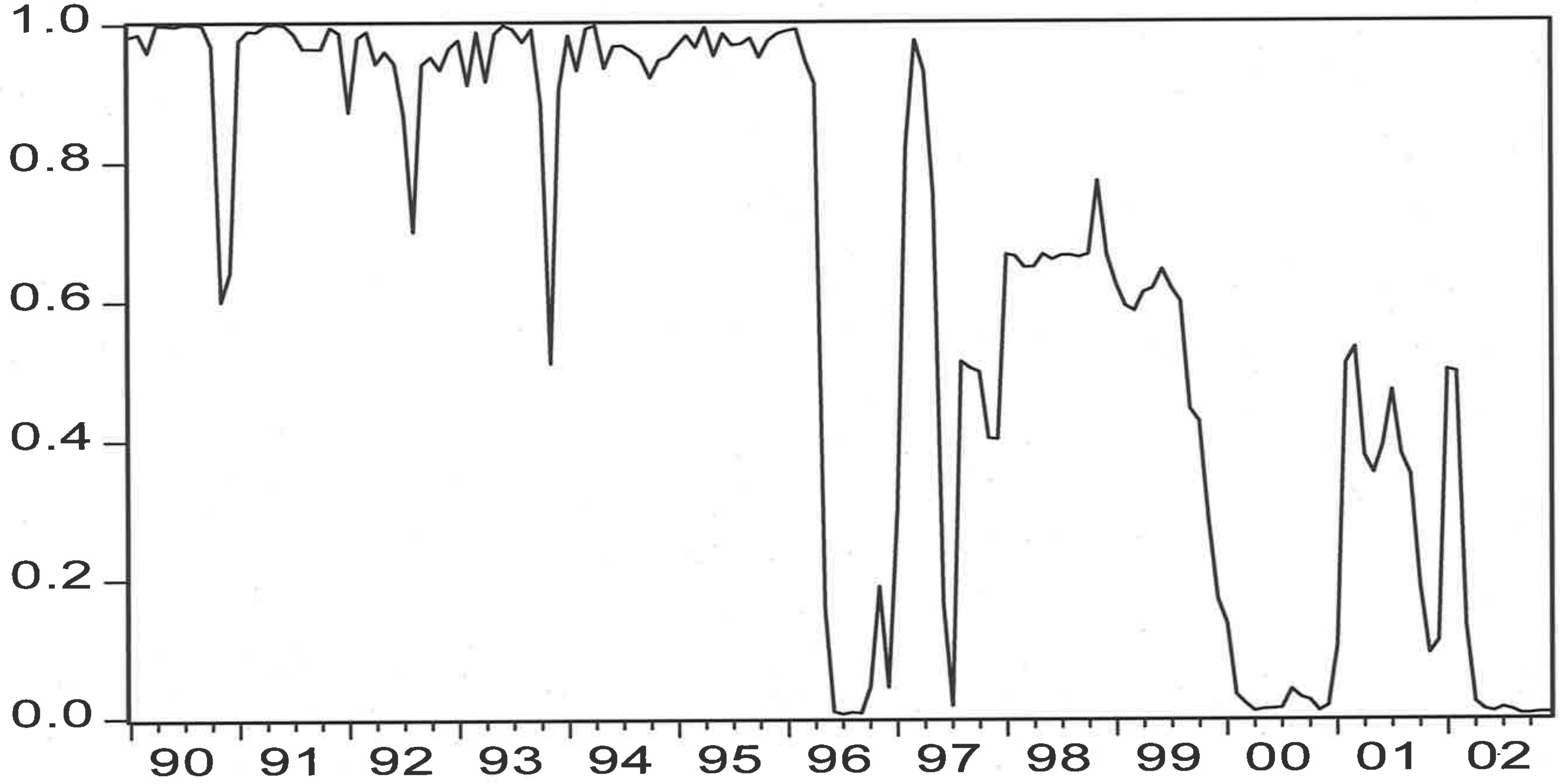
LB(24): Ljung-Box test for EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

LBS(24): Ljung-Box test for square of EXR, Reserves and INT with 24 lags, which is distributed χ^2_{24}.

**, * significant at the 1 and 5 percent level, respectively.

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Figure 3.1
Index of Intervention Estimates for Indonesia



According to its website, after the crisis, BI described its exchange rate policy as a free float exchange rate since August 1999. In addition, the BI further adds "in order to maintain a stable exchange rate, BI performs sterilization (intervention) in foreign exchange market at a certain period of time, especially during an irregular fluctuation of the exchange rate".[28] However, this statement alone makes it inconsistent with the standard textbook definition of a clean float. Though, since December 2001 to the present, the BI had changed from an independent float to a managed float based on the IMF's official classification, distinguishing between a managed float and an independent float is not that clear.[29]

To be sure, according to estimates of the index of intervention in figure 3.1, and substantiated by official publications released by the BI,[30] the BI resorted to a prolonged defence of the rupiah since early 1999, which moderated somewhat for most of 2000, which again resumed in 2001, while, in 2002 until the end of the sample period, Indonesian monetary authorities had allowed some greater flexibility to the rupiah. In view of these results, and insofar as the distinction between a managed float and an independent (free) float, it seems that, on average, Indonesian post-crisis exchange rate policy resembles more of a managed float rather than a free-float. Whether this is further indicative of Kawai's (2004) description of post-crisis Indonesian exchange rate policy of a managed float and with a wide (unknown) band against the U.S. dollar, or, instead, a reflection of the inability of the BI to restore order in its exchange rate regime, despite interventions is a bit uncertain.

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[28] Likewise, in the IMF's own classification of exchange arrangement until end-of-March 2001, Indonesia is classified as an independent float. The IMF defines an independent float as an arrangement where "the exchange rate is market-determined, with any foreign exchange intervention aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate, rather than establishing a level for it." (various IMF Annual Reports).

[29] The IMF defines a managed float as "the authorities influence exchange rate arrangements through interventions to counter the long-term trend of the exchange rate, without specifying a predetermined path, or without having a specific exchange rate target. For the IMF definition of an independent float, see footnote 19.

[30] On this refer to Chapter 3 of the 2000, 2001, 2002, 2003 Annual Reports of the Bank of Indonesia.

A related important issue that the above analysis raises is whether the exchange rate must be managed to attain its inflation target in view of Indonesia's introduction of the inflation targeting framework in January 2000 as one of the three conditions that were imposed on Indonesian monetary authorities under the IMF program. A rapid depreciation of the rupiah has implications for the achievement of its inflation target. However, BIs failure to achieve its announced inflation target for both years in 2000 and 2001 despite interventions suggests that other factors apart from the exchange rate have key influences on the Indonesian inflation rate (Ito and Hayashi, 2004).[31, 32]

3.6.2 Korea

Starting in 1990, Korean monetary authorities adopted a system (the so-called market-average system (MARS)) where the won/U.S. dollar exchange rate is only allowed to fluctuate within a specified band of the basic rate which was revised daily (Dornbusch and Park (1999)). When this system was first introduced, the won/U.S. dollar was allowed to vary within a very narrow ± 0.4 per cent of the basic rate. Since then, sometime in the mid-1990s the band was gradually widened to ±2.25 per cent, and at the peak of the East Asian currency crisis, this daily fluctuation limit reached 10 per cent either way on 20th November 1997, until it was finally abolished on the 16th of December 1997.

[31] BI set the inflation target for the year 2000 as 3-5 per cent but the actual inflation rate was 5.9 per cent. For the year 2001, the target was set at 4-6 per cent but the actual inflation rate was 12.5 per cent. In 2002, the BI switched to headline CPI on the belief that it was more easily recognised by the public and a 9-10 per cent target was set for the year. The actual inflation rate in 2002 was 10.0 per cent, just exactly within the upper end of the target band (Ito and Hayashi, 2004).

[32] For instance, Ramakrishnan and Vamvakidis (2002) found that the exchange rate as well as foreign inflation rates are key influences on Indonesian inflation rate. BIs failure in achieving both its inflation targets in 2000 and 2001 may also suggests otherwise that interventions for both these years were not enough to limit their impact on the inflation rate and that much larger interventions could have been justified to limit speculative attacks (Ito and Hayashi, 2004).

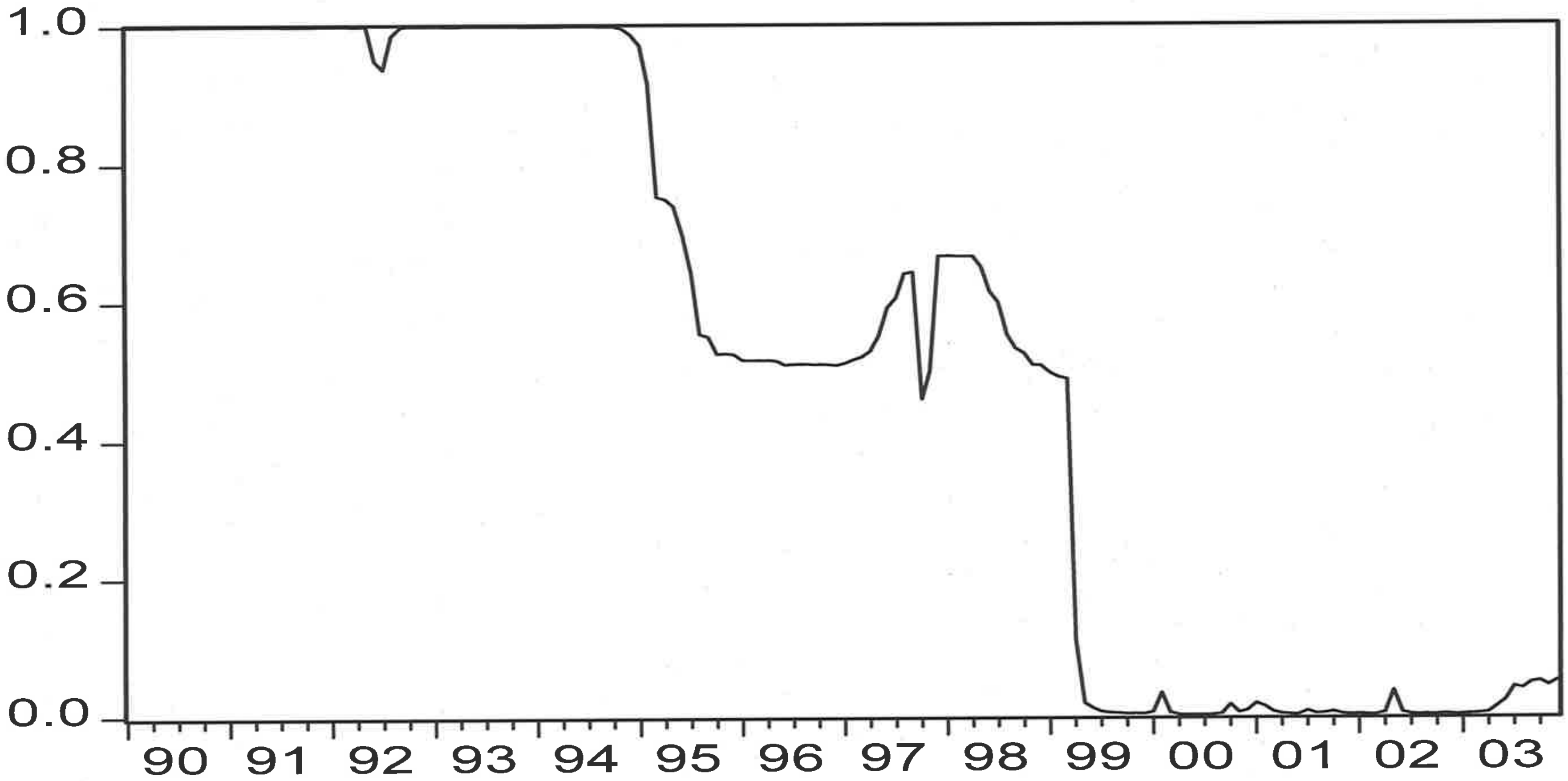
The estimated index of intervention in figure 3.2, particularly in the early part of the 1990s, is strongly suggestive of this descriptive characterisation of pre-crisis Korean exchange rate policy. Though there is a gradually decreasing persistence to intervene on the part of Korean monetary authorities sometime in the mid-90s, the estimated index is still comparatively high and can be a reflection of the widening of the daily fluctuation limit of the won-U.S. dollar exchange rate around this time. To be sure, upon the outbreak of the currency crisis, Korean monetary authorities tried desperately to stabilise the won-U.S. dollar exchange rate, in particular dramatically raising its market intervention rate. For instance, the 1998 Annual Report of Bank of Korea (henceforth BOK) describes vividly its monetary-cum exchange rate stance around the time of the crisis:

> ...the Bank had dramatically raised its market intervention rate....to 35 per cent in order to engineer a rapid stabilization of the exchange rate. Thus, major market interest rates had increased to 30-40 per cent at the end of 1997 and they remained at around the 20 per cent until the March of the year under review. This high interest rate policy was the only viable option in order to secure foreign currency liquidity and to stabilize the exchange rate, in the face of the surge in capital outflows due to the loss of international confidence (p. 15).

In the aftermath of the crisis, the results indicate that Korea's monetary authorities have allowed relatively more flexibility in the won-U.S. dollar exchange rate backed by an inflation target as compared to before the crisis (figure 3.2). Various official publications released by the BOK support this outcome. For instance, according to consecutive Annual Report publications by the BOK from 2000 to 2003, its description of its foreign exchange rate policy always consistently resonates to the effect that while it stands ready to undertake appropriate measures to avoid abrupt fluctuations in its exchange rate, in principle, the exchange rate of the won was allowed to fluctuate freely according to demand and supply conditions in the local foreign exchange market. Moreover, as mentioned above, in step with this regime shift after the crisis of allowing more flexibility in the won-U.S. dollar exchange rate, the BOK has adopted much of the apparatus of inflation targeting complete with a Monetary Policy Report to the National Assembly and its experience with inflation targeting have succeeded in maintaining a relatively stable and moderate rate of inflation (Eichengreen, 2004).

This suggests that the balance of evidence is consistent with the notion that Korean monetary authorities place less weight on the won-dollar exchange rate in the formulation of monetary policy after the crisis, in the sense that movements in the rate are becoming less closely tied to the ultimate objectives of monetary policy. However, at the same time, movements in the rate are not regarded with an attitude of benign neglect.

Figure 3.2
Index of Intervention Estimates for Korea



3.6.3 Philippines

Arguably, the Philippines can be considered a late convert (sometime only in the mid-90s) among the five East Asian countries examined here to an arrangement akin to a soft-dollar peg before the crisis. This argument is in line with the establishment of a daily 'volatility exchange rate band' in late 1995 in which the peso-U.S. dollar rate was allowed to fluctuate by only 1.5 percent on either side of the opening rate (BSP, 2001; Arora, 2000; Kumakura, 2004).[33] In doing so, the 'volatility band' kept the peso-U.S. dollar exchange rate effectively fixed by the Philippine central bank, or, equivalently, ushered Philippine exchange rate policy into a virtual *de-facto* peg to the U.S. dollar (Debelle and Lim, 1998; Arora, 2000). Indeed, as indicated in figure 3.3, the high estimated index of intervention starting sometime in the middle of 1995 clearly coincided with the implementation of the said 'volatility band' by the BSP (Central Bank of the Philippines).

However, this does not imply that before the establishment of the band, the BSP was not engaged in an active defence of the peso. On the contrary, several studies indicate that the BSP was, indeed, already engaged in the heavy management of its exchange rate as early as the start of the 1990s (see figure 3.3) (Houben, 1997; Arora (2000)). However, any revealed attachment toward exchange rate stability for Philippine monetary authorities became a difficult objective for most of the early 1990s as various combinations of domestic and external shocks, e.g., political instability, energy crisis, Gulf war, the capital inflows boom of 93-94, which, aside from the use of its policy instruments, also made the exchange rate to absorb most of these shocks (see figure 3.3). This has led some authors to describe Philippine

[33] The opening rate is the PDS (Philippine Dealing System) weighted average rate of the previous day.

exchange rate policy around this time as a managed float (Cororaton, 1997; Arora, 2000).

The subsequent lifting of the 'volatility band' by Philippine monetary authorities in March 1998 as one of its several monetary measures implemented at the onset of the crisis in July 1997 effectively signalled the adoption of a 'crisis float' for the peso.[34] With the exception of some intermittent bouts of domestic shocks triggered mostly by political events in the Philippines, on average, it is safe to conclude that in the aftermath of the crisis, Philippine monetary authorities have allowed greater flexibility in the peso-U.S. dollar rate compared to before the crisis (see figure 3.3).[35,36]

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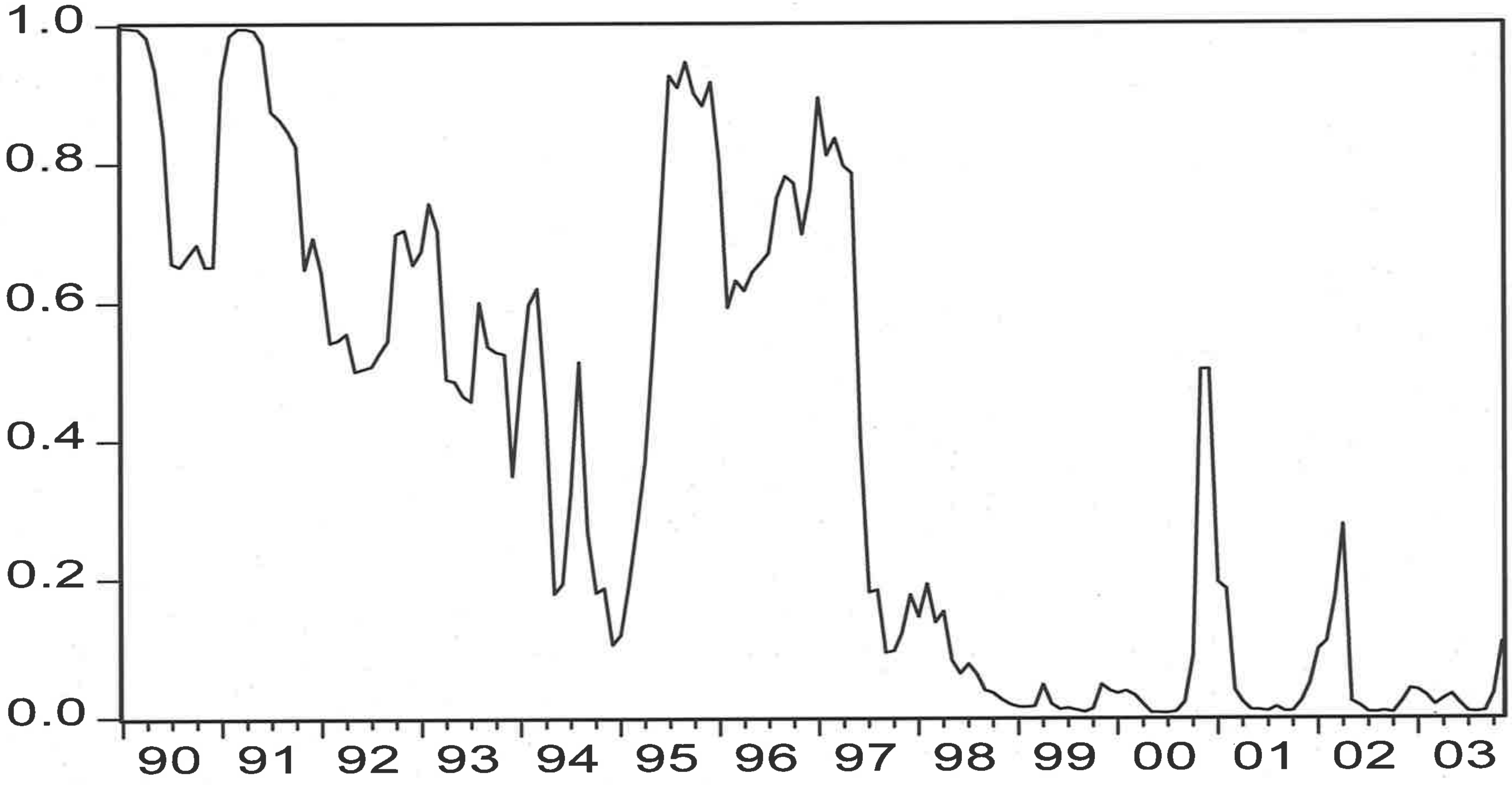
[34] On 11 July 1997, the band was invoked by the Bankers Association of the Philippines (BAP) and entailed a suspension of trading for two hours whenever the rate moved more than 1.5 per cent on either side of the opening rate. The band was again reintroduced in October 1997, and involved the suspension of trading for half an hour, one hour, and the rest of the day respectively, whenever the exchange rate moved 2 per cent, 3 per cent, and 4 per cent away from a central rate (Arora, 2000).

[35] These domestic political events were the long-drawn impeachment trial against President Estrada starting in 2000 and his eventual overthrow in early 2001.

[36] The Philippines only formally introduced an inflation targeting framework in January 2002, after two years of preparation. Even as the design of the new framework was relatively well considered, it is too early to evaluate its performance, in particular, the role of the peso-U.S. dollar exchange rate in the new framework, since it has only been in operation for such a short time in relation to the sample period considered in this chapter. However, according to its website, apart from a large set of macroeconomic variables, movements in exchange rates under the new framework is monitored by the BSP in making decisions regarding the appropriate stance of monetary policy. This importantly suggests that movements in the rate is not regarded with an attitude of benign neglect either on the part of Philippine monetary authorities.

Figure 3.3
Index of Intervention Estimates for Philippines



3.6.4 Singapore

The estimated index of intervention presented in figure 3.4 in the case of Singapore from the beginning of 1990 to end-1996, strongly depict the pre-crisis behaviour of making the exchange rate the centrepiece of monetary management with monetary policy playing a complementary role in Singapore (MAS, 1999).[37] Indeed, during this period, the Monetary Authority of Singapore (henceforth MAS) periodically intervened in the foreign exchange market with the extent of the foreign exchange intervention determined by the exchange rate target, which is bounded by an undisclosed band (MAS, 1999, 2001, 2003).[38]

As can also be observed from the estimated index of intervention in figure 3.4, during the crisis, Singapore, unlike the other East Asian countries examined here, did not resist much of the downward pressure on the Singapore dollar. For instance, as noted by Yip (2003):

> …at the beginning of the Asian financial crisis, the market was still wondering whether the Singapore government would intervene and was waiting for the government's announcement of intention. After deciding that it would be better to let the Singapore dollar depreciate, the Finance Minister then announced its intention to let market forces decide the value of the Singapore dollar, thus giving the market the green light to push the Singapore dollar further down (p. 204, footnote 8).

Nonetheless, in order to prevent the Singapore dollar from falling sharply below the band, there were still some periods during the crisis that the MAS intervened to support the Singapore dollar (MAS, 2001).

Soon after the crisis, the exchange rate band was narrowed back again to its pre-crisis level (MAS, 2000). When economic conditions subsequently started to deteriorate by more than was expected, i.e, slowdown in the U.S. economy, global

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[37] This means that changes in the money supply are endogenous to the exchange rate and interest rates are largely determined by world rates.

[38] This target is based on a heavy weight for domestic prices relative to foreign prices such that it can be considered an unusual managed float.

electronics slowdown, and punctuated by the September 11 terrorist attack, the MAS intervened in the foreign exchange market and decided in late 2001, to widen the exchange rate band (MAS, 2002, 2004). However, this was quickly restored in mid-2002 back to its narrower band when financial market conditions were believed to have stabilised (MAS, 2002).

3.6.5 Thailand

Finally, we consider the case of Thailand and figure 3.5 depicts the corresponding index of intervention estimates. The figure clearly captures the U.S. dollar peg of the Thai baht up until the eve of the speculative attack on the Thai baht on July 1997 when it was forced to abandon the U.S. dollar peg. In the aftermath of the crisis, the Bank of Thailand (henceforth BOT) described its exchange rate policy as a managed or 'dirty' float on its website, and described its occasional intervention operations as only "when necessary to stabilise the rate within an undisclosed band" (Nitithanprapas, et al., (2002), p. 32); "required to smooth out fluctuations in the foreign exchange market, but not to change the trend" (Hataiseree (2001), p. 7). Apart from the sacking of the then central bank governor in mid-2001 over a disagreement with the Thai Prime Minister on interest rate policy, the results indicate that the Thai monetary authorities had moved to greater exchange rate flexibility relative to the pre-crisis period.[39]

This result is consistent with the switch by the BOT from a monetary targeting to an inflation targeting framework in May 2000. According to BOT officials, under

[39] Though the Thai government unanimously stressed that the sacking was due to lack of coordination and cooperation, and not on disagreement with interest rate policy, according to Thai press reports, it was alleged that the sacking of BOT governor M.R. Chatumongol Sonakul in late May was due to a disagreement with the Thaksin government on whether or not to put on hold any rise in the interest rates. Governor Sonakul was replaced by M.R. Pridiyathorn Devakula, an experienced banker and regarded as to be more accommodative of the government's policy stance on interest rates (Bangkok Post, 2001).

the new framework, BOT decisions to sterilise take into account the impact of changes in money balances on the inflation target but that the exchange rate is determined by the market. This is notwithstanding actual estimates from the BOT that a 10 per cent depreciation of the baht against the U.S. dollar has the effect of increasing core inflation (defined as headline inflation excluding raw food and energy items) by around a 0.9 per cent. In this regard, whether exchange rate fluctuations have a considerable effect on the inflation target indicator is a matter of interpretation, nonetheless, the balance of evidence suggests that the BOT has place less weight on the baht-dollar exchange rate in the formulation of monetary policy after the crisis.

Figure 3.4
Index of Intervention Estimates for Singapore

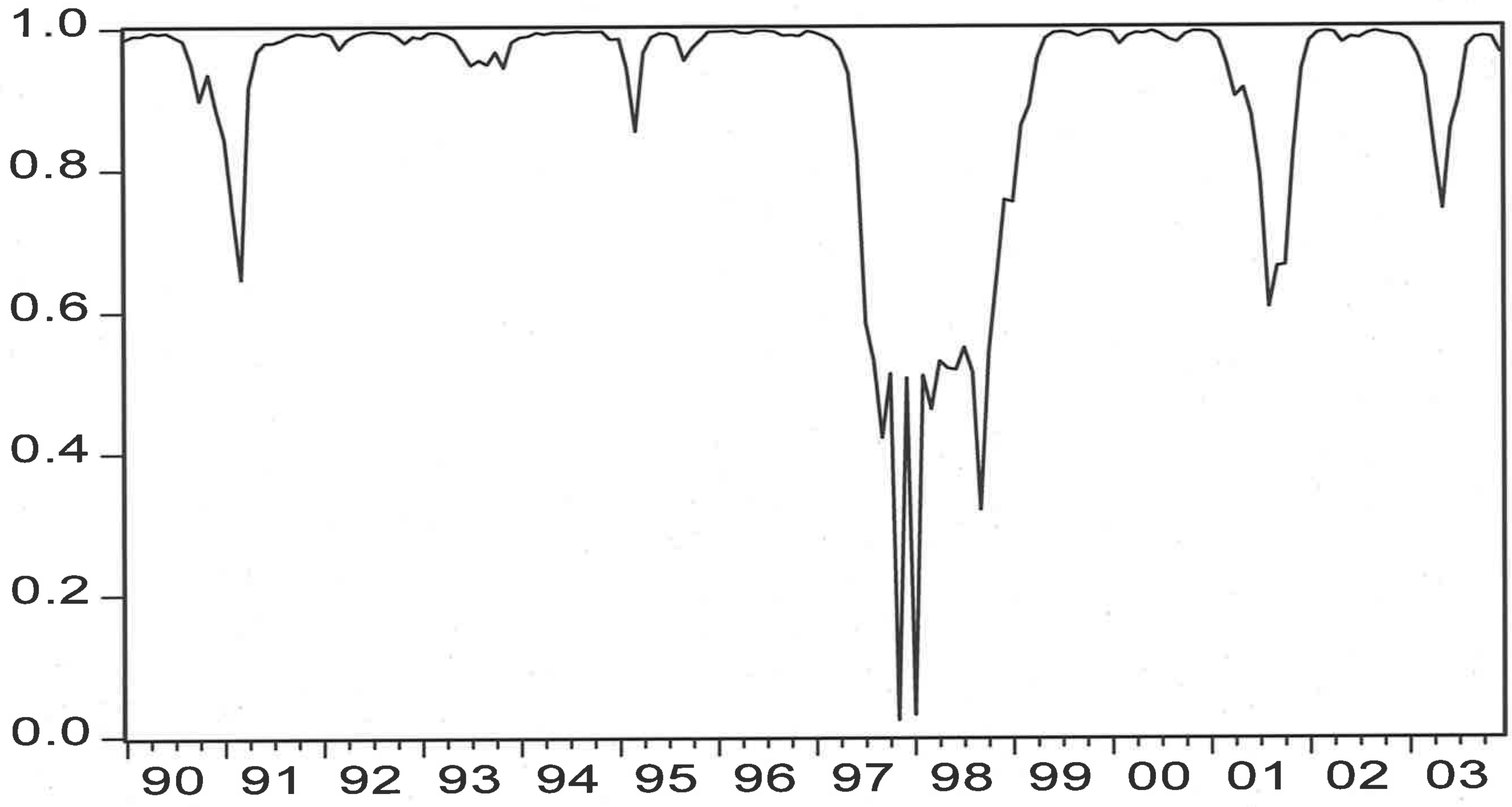
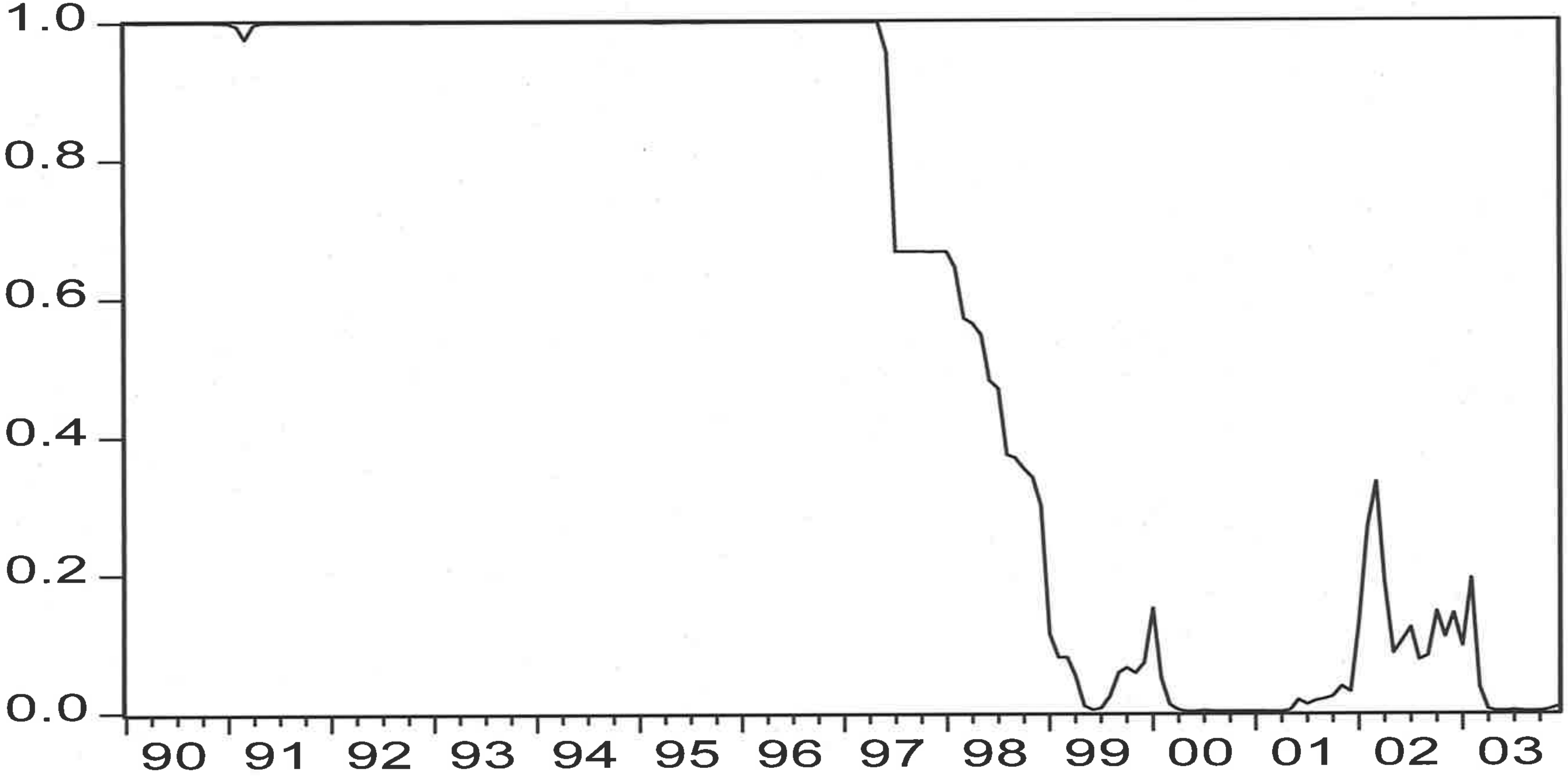


Figure 3.5
Index of Intervention Estimates for Thailand



3.7 Brief Conclusion

This chapter sets out to examine how the conduct of exchange rate policy among the five crisis-hit countries of Indonesia, Korea, Philippines, Singapore and Thailand changed before and after the crisis. To achieve this, monthly indices of intervention for the five countries mentioned were constructed via a statistical method known as the Markov Regime-Switching ARCH (SWARCH). As earlier emphasised, there are two main advantages of using the SWARCH as compared to standard unconditional volatilities in constructing such type of indices. First, it is considered robust to any low probability events such as that occurred in East Asia in mid-97. This offers the advantage of precluding the need to create arbitrary sub-samples, which, in turn, has the important direct implication on previous studies that examined the issue of pre-and post-crisis exchange rate policy in East Asia where, unlike before, one has to arbitrarily decide on when the actual post-crisis period start, such that one can come up with sub-periods of pre- and post-crisis before any actual statistical testing can begin.

A second related point is that the SWARCH method can account for discrete jumps or changes in the data unlike volatility-averaging measures such as the variance or standard deviation. As correctly pointed out by Nitithanprapas and Willett (2002), this is especially important for countries that are actually pursuing adjustable pegs.

Our analysis had shown that with the lone exception of Singapore, which had continued to expressly target its exchange rate as its centrepiece of monetary management, the monetary authorities of the other four crisis-hit countries, on average, have tended to manage their exchange rate more flexibly after the crisis as compared to before the crisis. This conclusion is consistent with the fact that in recent years a number of countries in the region – Korea (1998), Thailand (2000), Indonesia

(2000) and the Philippines (2002) – have established institutions and mechanisms around an inflation objective by making price stability as the primary goal of monetary policy.[40] As a result, the chapter finds it hard to believe the claim by some studies of a post-crisis reversion to a U.S. dollar peg similar to the one that existed before the crisis. And, more importantly, we find no evidence for most of these group of East Asian countries to support the claim that in order to promote an 'export-led growth' strategy after the crisis, these same group of East Asian tend to preserve undervalued exchange rates through active intervention both foreign exchange and money markets.

The chapter has also made every attempt to gather officially available statements from the individual country central banks in order to lend some substance to the results. While this may seem to run counter to the issue raised earlier regarding these countries of saying one thing but doing another before the crisis, it can also be argued on the other hand that when one carefully observes the current circumstances of these countries, this problem should not be as serious now than they were before the crisis. Arguably, a hardheaded pursuit of saying one thing but doing another is not the right way of re-building credibility, especially when a country is coming-off from a severe currency crisis. In fact, what these countries now need is not to further damage their credibility but to enhance it (Eichengreen, 2004). This is simply in agreement with the adoption of inflation targeting frameworks for most of these countries, where a transparent communication of its policy strategy to the public and market participants is an essential element.

[40] This makes Singapore as the lone exception which has not (yet) adopted an inflation targeting framework. Although, it should be mentioned at this point that according to Ho and McCauley (2003), Singapore presents as a rather unusual case of inflation targeting where managing the exchange rate is the means to managing inflation. Due to the high openness of Singapore's economy as well as the high pass-through in order to stabilize inflation requires the management of the NEER around a rate which varies according to the gap between global and desired inflation.

Chapter 4

A Regime Switching Approach to Correlation-based Test of Contagion : The Case of the East Asia-7

4.1 Introduction

During currency and financial crises such as that of the Mexican, East Asian and Russian/Long-Term Capital Management (LTCM) crises, asset price comovements across markets tend to increase visibly compared with more tranquil periods. The size of these comovements and the processes that generated them, have driven the literature to ask exactly on whether tranquil periods and crisis are to be interpreted as different regimes in the international transmission of financial shocks: that is, whether there are breaks or discontinuities in cross-market linkages.

The transmission of crises from one country to another (or from one market to another) is loosely termed contagion, but precise definitions are many.[1] Contagion as opposed to interdependence conveys the idea that there are breaks in the international transmission mechanism owing to crisis-contingent mechanisms such as multiple equilibria driven by a change in investors' expectations or beliefs, market illiquidity and political factors. As there is no consensus about what exactly contagion is, several authors have proposed empirical tests in an attempt to address the issue of contagion versus interdependence purely on empirical grounds.

The debate starts with the pioneering study of King and Wadhawani (1990), where they define contagion as a significant change in the correlation coefficient. Subsequent studies that followed which test for a shift or break in the way shocks are transmitted across countries overwhelmingly favour the existence of contagion. More

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[1] See section 4.2 for the various ways on how the literature defines contagion.

recently, however, Forbes and Rigobon (2002) -- henceforth, F-R -- asserted the strong result that there is 'no contagion, only interdependence', once one properly corrects for the so-called heteroscedasticity bias, which accounts, in turn, for the significantly large cross-market correlation coefficients during crises periods as found by earlier studies. Indeed, as evident from table 4.1, which reproduces the F-R results based solely on the same East Asian sample they examined, the null of no contagion is clearly accepted in all cases, suggesting interdependence. However, this strong result did not go unchallenged. In a subsequent paper, Corsetti, et al. (2002) demonstrated that the 'no contagion, only interdependence' conclusion of F-R is quite dubious, as it is grounded on arbitrary assumptions regarding the variance of the noise in the country where the crisis is believed to have originated. The F-R study, as a result, was biased towards the null of interdependence (Kleimeier, et. al., 2003). Indeed, the issue of whether there is a shift or break in the way shocks are transmitted across countries remains open and far from settled.

Table 4.1
1997 East Asian Crisis: Unconditional Correlation Coefficients

The table reports unconditional cross-market correlation coefficients for Hong Kong and each country in the sample. The stable period is defined as January 1, 1996, through October 16, 1997. The turmoil period is defined as one month starting on October 17, 1997. The full period is the stable period plus the turmoil period. The test statistics are for one-sided *t*-tests examining if the cross-market correlation coefficient during the full period is significantly greater than during the turmoil (high volatility) period.

Country	Turmoil (ρ)	Full Period (ρ)	Test Statistic	Contagion?
Indonesia	0.399	0.428	-0.10	N
Korea	0.380	0.173	0.69	N
Malaysia	0.200	0.288	-0.26	N
Philippines	0.388	0.323	0.22	N
Singapore	0.343	0.348	-0.02	N
Thailand	0.171	0.082	0.25	N

Source: Forbes and Rigobon (2002).

In this chapter, I provide empirical evidence that the strong conclusion of 'no contagion, only interdependence suffer from another major drawback—*sample selection bias*. In fact, almost all other studies that have worked on this strand of literature are beset with this bias. The bias occurs because prior to proceeding with the formal test of contagion as opposed to interdependence, almost all these studies adopt a pre-determined or *ad-hoc* split or separation of the sample into subperiods of tranquillity and crisis based on some event-based, chronology of news with regards to the onset of the crisis. The problem with this approach is that it requires, *a priori*, the exact or correct timing of the crisis. In practice, however, this is not usually the case. Because test conclusions depend on the choice of the tranquil and crisis periods, such practices may lead to spurious results.

In observance of this important caveat, the present chapter accordingly uses the Markov regime switching approach that allows the timing of the changes in volatility to be data-driven or endogenously determined for a sample of seven East Asian countries, namely, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, and Thailand, instead of being exogenously assigned. An additional advantage of utilising the regime switching method is that it deals directly with well-established, stylised facts about many financial variables, in particular, that the time-series behaviour of these same variables undergo dramatic shifts or changes due, in large measure, to low-probability events such as currency crises. More importantly, this highlights another of the limitations of previous studies that worked on this strand of literature on contagion, as these studies have consistently employed linear and time-invariant tests of contagion.

The testing strategy adopted in the present chapter is not intended to replace existing tests, but to complement the standard approach of F-R by integrating regime switching into the estimation of cross-market correlation coefficients. Hardly any studies have applied this empirical strategy in testing for contagion. An exception is Mandilaras and Bird (2004), who looked into the contagion implications of the 1992-93 ERM crisis in most of Western Europe via a constructed measure of an exchange market pressure index. However, I would argue that the testing strategy employed in this chapter is more detailed and judicious in its approach that that used by Mandilaras and Bird.

The structure of the chapter is organised as follows. The next section briefly elaborates on the definition of contagion used in this chapter. Section 4.3 presents a brief discussion of the theoretical literature on contagion, and the subsequent section gives a brief summary of the traditional econometric strategies as well as recent methods used to test for contagion. Section 4.5 discusses where the approach used in this chapter stands with respect to the existing literature on the existence of contagion. Section 4.6 describes the empirical method used. Section 4.7 presents details about the data and some preliminary estimation results. Section 4.8 highlights the central empirical results of the chapter and attempts to draw on some important policy implications from the results. Finally, section 4.9 concludes.

4.2 Defining Contagion

There is no general consensus in the profession on what is contagion, as it has been defined in many different ways in several studies. There are according to Pericolli and Sbracia (2003), five commonly used definitions, which may well be representative of the enormous literature on contagion.

1. Contagion is a significant increase in the probability of a crisis in one country, conditional on a crisis occurring in another country.

2. Contagion occurs when volatility of asset prices spills over from the crisis country to other countries.

3. Contagion occurs when cross-country comovements of asset prices cannot be explained by fundamentals.

4. Contagion is a significant increase in comovements of prices and quantities across markets, conditional on a crisis occurring in one market or group of markets.

5. Shift-contagion occurs when the transmission channel intensifies or, more generally, changes after a shock in one market.

The definition of contagion employed here is akin to definition (5) above, though as Pericolli and Sbracia suggest, and as we will see later on, definitions (3) and (4) are also somewhat similar to definition (5).[2,3] Just as in F-R, according to definition (5), shift-contagion exists once there is a significant increase in cross-market linkages after a shock to an individual country (or group of countries). This implies, then, that if two markets are highly correlated after a crisis or shock, this is not necessarily contagion. It is only shift-contagion if the correlation between the two markets increases significantly. If, on the other hand, the comovement does not increase significantly, then any continued high market correlation suggests strong linkages or *interdependence* between two economies that exists in all states or regimes of the world (F-R).

F-R distinguished two advantages from this definition of contagion. First, while cross-market linkages can be measured in a number of different ways, e.g., correlation in asset returns, changes in the probability of currency crises, changes in the transmission of shocks or volatility, this narrow definition of contagion can be translated into a straightforward empirical method of testing whether contagion exists. This method involves comparing, say, cross-market correlation coefficients between

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[2] In what may be considered as one of the earlier authoritative surveys on contagion, Dornbusch, et al. (2000), also used this definition of contagion.

[3] In regard to definition (4), there is no reason why shift-contagion can only be measured in terms of comovements in prices alone. Depending on the availability of data, it can also be measured in terms of quantities or volume across markets.

two markets or economies during a relatively tranquil or stable period with linkages during a relatively high-volatility or crisis period. Contagion occurs once there is a significant or marked increase in cross-market linkages (or, cross-market correlation coefficients) after the relatively high-volatility or crisis period.

The second advantage of the above definition of contagion is that it can also provide straightforward evidence as to which alternative theory or group of theories—those predicting a change in cross-country linkages after a shock or crisis (collectively classified as crisis-contingent theories) as against those based on the continuation of the same cross-country linkages that exists in all states or regimes of the world (collectively classified as non-crisis contingent theories)—were most important during crises. In other words, the above definition of contagion can distinguish between alternative explanations on how shocks or crises are propagated across markets or economies. Since the above definition of contagion avoids taking a stance on how this shift occurs, it avoids the extreme difficulty of having to directly measure and differentiate between the various propagation mechanisms.

4.3 Brief Theoretical Literature on the International Transmission Mechanisms

4.3.1 Crisis-Contingent versus Non-Crisis Contingent Theories

There is by now an extensive literature on how shocks or crises are propagated across markets or economies, which have been well discussed in a number of earlier papers and need not be repeated here in detail.[4] This section follows F-R in broadly dividing the literature on this topic into two sets—crisis-contingent and non-crisis contingent theories. According to the group of crisis-contingent theories, there are three very different channels on how shocks are transmitted internationally: (i) multiple equilibria; (ii) endogenous liquidity; (iii) political economy of exchange rate

[4] See, for example, Dornbusch, et al. (2000); Forbes and Rigobon (2002); and Forbes (2004).

regimes. Each of these theories or channels can explain why cross-market linkages increase after a crisis or shock.

According to the first mechanism or channel, multiple equilibria occur when a crisis in one country is used as a sunspot for other countries and is driven by a change in investors' expectations or beliefs that are self-fulfilling and not by any fundamental linkage. This mechanism qualifies as a crisis-contingent theory because when investors change their expectations, the shock is transmitted through a propagation mechanism that does not exist during relatively calmer periods. Formal analytical models of multiple equilibria have been developed, for example, by Jeanne (1997) and Masson (1998), however, such models are not easy to test empirically because the jump or shift from a good to a bad equilibrium can be triggered by many factors, which may also appear as fundamental factors (Dornbusch et al, 2000).

In the second channel, endogenous liquidity, a crisis in one market induces investors to sell off securities in other markets, most of which are not affected by the initial crisis, in order to continue operating in that market. As a result, equity and other asset markets in a range of markets also lose their value. In these models, the liquidity shock leads to an increased correlation in asset prices. Importantly, this transmission mechanism also does not occur during stable periods but arises only after the initial shock. In the third and final channel, political factors may play a role in the transmission mechanism of a crisis. According to this channel, exchange rate crises may be bunched together, with the increased correlation accounted for via a reduction in the political costs associated with other countries abandoning their respective fixed exchange rate regimes once one country (can be interpreted as these countries belong to some kind of a fixed(quasi) exchange rate mechanism) abandons its own exchange rate peg. Once again, the transmission of shock occurs through a mechanism that did not exist before the initial shock or crisis.

In contrast, the remainder of the theories on transmission mechanisms do not generate shift-contagion. In other words, these non-crisis contingent theories assume that cross-market linkages do not increase after a shock. Instead, any large cross-market correlations after a shock are considered a continuation of normal linkages or interdependence that existed before the crisis. This interdependence means that shocks can be transmitted via 'real linkages' since many of these linkages are based on economic fundamentals. For instance, if two countries share a common set of trading partners then real linkages may be related to competitiveness where, for example, a shock in one country's export revenues may be transmitted to the other country. Another potentially important mechanism cites random aggregate or global shocks. For example, an increase in the international interest rate, or a contraction in the international supply of capital, may simultaneously affect the fundamentals of several countries. This may become even more dramatic in the case of countries which are similar in economic structure and economic status, and are located within the same geographic region, e.g., emerging markets.

4.4 Some Empirical Evidence on the International Transmission Mechanisms

At the time of writing, at least seven surveys on the topic of contagion have been published.[5] In retrospect, six major tests for evidence of contagion have been utilised: correlation of asset returns, GARCH models, cointegration, logit and probit models, and, more recently, Markov-switching models and multivariate extreme value theory. It is beyond the scope of this section to discuss in detail the respective papers

[5] Dornbusch, et al. (2000); Edwards (2000); Pericolli and Sbracia (2003); Kaminsky, et al. (2003); Dungey and Tambakis (2003); Karolyi (2003); Dungey, et al. (2004).

for each major test; but rather, papers that can be regarded as representative of each method will be outlined.

The method of cross-market correlation of asset returns is the most straightforward approach to test for contagion. The first influential paper to use this approach was King and Wadhwani (1990) who tested for an increase in stock market correlations between the United States, the United Kingdom, and Japan, and found that cross-market correlations increased significantly after the US stock market crash of 1987. Subsequent studies by Lee and Kim (1993), who extended their analysis to 12 major markets, Calvo and Reinhart (1996), and Baig and Goldfajn (1999) tested for contagion after the 1994 Mexican peso crisis and the 1997 East Asian crisis, respectively, also found that correlations were higher in more volatile periods. The apparent pattern of a marked increase in cross-market correlations in times of financial stress has come to be known in the literature as correlation breakdown.

The second method uses the ARCH or GARCH framework to model price volatility spillovers across countries. Representative papers that use this approach include, among others, Hamao, et al. (1990), Lin, et al. (1994), and Edwards (1998). In general, these studies have found significant evidence of volatility spillover across countries. The third method tests for changes in the cointegrating vector between markets over long periods of time. For instance, Longin and Solnik (1995) examined seven OECD stock markets from 1960 to 1990, and found that the correlation has followed an upward trend. In addition, they also found that correlation is positively related to the level of volatility.

The fourth method controls for the role of fundamentals and examines how different factors affect a country's vulnerability to financial crises via conditional probabilities rather than through cross-market correlations. The seminal approach to this type of analysis was made by Eichengreen, et al. (1996), who used a probit model to test the probability of a crisis occurring in a panel of 20 industrial countries covering the period from 1959 to 1993. They found that the probability of a currency crisis increased if a speculative attack occurred in other countries at the same time.

In the last few years, there has been a great deal of interest in modelling discontinuities or regime-shifts in the data generating process based on the Markov switching model developed by Hamilton (1988, 1989) and, later, by others.[6] While recent related studies using the Markov switching method have adopted this strategy in the context of directly testing for multiple equilibria, an exception is a recent paper by Fratzscher (2003), who built a model that includes a set of fundamentals in one country along with a measure of contagion, that is, a high degree of real (trade linkages) and financial integration with other countries.[7] Interestingly, Fratzscher (2003) found that once both measures of contagion were included in the estimation, regime-switching was ruled out, and, more importantly, the degree of financial interdependence and real integration among emerging markets were crucial not only in explaining past crises but also in predicting the transmission of future crises.

In a similar vein, over the last few years there has been a revival of interest in the examination of extreme asset price changes, due to the seminal works of Mandelbrot (1963), Fama (1965), and others.[8] However, only a few recent studies have looked at the specific issue of contagion, and, in particular, at the coincidence of extreme price changes across different markets. Longin and Solnik (2001) examined the joint distribution of monthly returns on stock indexes of the G-5 countries between 1959 and 1996, and found that the correlation of 'co-crashes' (large negative returns) was much higher than typically expected from a multivariate normal

[6] For example, the multivariate version of the Markov switching method developed by Krolzig (1997).
[7] See, for instance, Jeanne (1997), Jeanne and Masson (2000).
[8] Press (1967), Roll (1970).

distribution. Hartmann et al. (2001) studied asset return linkages during periods of stress across stock and bond markets in the G-5 countries, and found that, while market crashes were rare occurrences, once one market crashed, the conditional probability of having a crash in another market was considerably higher. Bae et al. (2003) also focused on extreme asset returns and controlled for economic fundamentals, but applied a multinomial logistic regression, rather than extreme value theory. They found that contagion could be explained by interest rates, changes in exchange rates, and conditional stock return volatility. Finally, Chan-Lau et al. (2004) introduced global extreme contagion measures constructed from bivariate extremal dependence measures. Their results suggested that contagion patters differed significantly within regions and across regions, with Latin America showing a secular increase in contagion not matched by other regions or countries.

On balance, then, the findings weigh overwhelmingly in favour of the conclusion that contagion exists, and occurred during the crisis period under investigation. Thus, arguably, most shocks are transmitted through crisis-contingent channels.

4.5 Tie-Up to the Existing Empirical Literature

In this section, we recall one of the main approaches used in testing for evidence of contagion, the cross-market correlation of asset returns, in order to establish the contribution of the method adopted in this chapter within the context of the existing empirical literature. As mentioned earlier, tests using the cross-market correlation of asset returns consider as evidence of contagion any significant increase in correlations among different markets or economies. As clearly shown in Table 4.2, all but one of the various studies that employed the cross-market correlation test of asset returns share the conclusion that during various periods of well-recognised episodes of turmoils or crises, contagion, or to be more exact, shift-contagion, occurred.

Table 4.2
Summary of Empirical Evidence on Contagion versus Interdependence Using The Cross-Market Correlation of Returns As Their Testing Methodology

Study	Turmoil Period	Market(s)	Finding
King and Wadhwani (1990)	US Crash	US, UK, Japan	contagion
Lee and Kim (1993)	US Crash	12 countries	contagion
Calvo and Reinhart (1996)	Mexican peso crisis	Asia, Latin America	contagion
Frankel and Schmukler (1996)	Mexican peso crisis	Asia, Latin America	contagion
Valdez (1997)	Mexican peso crisis	Latin America	contagion
Agenor, Aizenman, and Hoffmaister (1999)	US crash, Mexican peso crisis, Asian crisis	Argentina	contagion
Forbes and Rigobon (2002)	US crash, Mexican peso crash, Asian crisis	18 developed and emerging markets	no contagion
Corsetti, Pericolli and Sbracia (2002)	Asian crisis	17 emerging markets	some contagion

Source: Kleimeier, Lehnert, and Verschoor (2003).

However, these findings that shift-contagion occurred, have not gone unchallenged. Several papers, in particular Boyer et al. (1999), Loretan and English (2002), Corsetti et al. (2002), and F-R, have argued that the presence of heteroscedasticity in market returns could have a significant impact on estimates of cross-market correlation coefficients, due to what is sometimes known as *heteroscedasticity bias*. That is, during times of crises, market volatility also increases and, as a result, cross-market correlation coefficients will also tend to increase. This may, suggest that shift-contagion has occurred, even if there is no change in the underlying transmission mechanism between markets. The above-mentioned authors go further by correcting the computed cross-market correlations for the increase in volatility. For instance, F-R assume a linear relationship between stock market returns in two markets x (denoting the market or country in which the crisis is believed to have originated) and y (denoting the market or country the crisis may or may not have been transmitted to) as:

$$y_t = \alpha + \beta x_t + \varepsilon_t \qquad (4.1)$$

where they also assume that the correlation between x_t and ε_t is equal to zero, and the variance of ε_t to be equal to a constant c. That is,

$$E[\varepsilon_t] = 0, \qquad (4.2)$$

$$E[\varepsilon_t^2] = c < \infty \qquad (4.3)$$

$$E[x_t \varepsilon_t] = 0 \qquad (4.4)$$

Then the correlation coefficient correction or adjustment formula can be derived as:[9,10]

$$\rho = \frac{\rho^*}{\sqrt{1 + \delta[1 - (\rho^*)^2]}} \qquad (4.5)$$

where ρ^* is the conditional correlation coefficient, ρ is the unconditional correlation coefficient, and δ is the relative increase in the variance of the shock-originating market:

$$\delta = \frac{\sigma_{xx}^h}{\sigma_{xx}^l} - 1 \qquad (4.5b)$$

More importantly, in F-R, once the above formula (4.5) was applied to the estimated cross-market correlation coefficients, evidence of contagion disappeared in almost all cases, which led the authors to strongly conclude with the well-known phrase, 'no contagion, only interdependence' (see also Table 4.2).[11] However, this

[9] F-R, in Appendix A of their paper, present the formal proof of equation (4.5a).

[10] It should be mentioned at this point that Boyer et al. (1999), and Loretan and English (2000) derive the same correction or adjustment in the correlation coefficient as do F-R.

[11] To be more specific, in the main results of their paper, F-R reported only one evidence of contagion, transmitted from Hong Kong (the source or host market) to Italy.

evidence is not universally accepted. In particular, Dungey and Zhumabekova (2001), emphasised that the above correction formula (4.5) used by F-R suffers from low power when typically dealing with a relatively small crisis sample.

Apart from the recognition that when comparing cross-market correlation coefficients, one needs to correct for the bias due to differences in variance of the returns across sub-samples, a common feature of studies that rely on a sample-splitting approach, including that of tests based on the comparison of cross-market correlation coefficients, is the arbitrary or ad-hoc selection of the tranquil and high-volatility or crisis periods. However, in doing so, standard analyses is subject to *sample selection bias,* to the extent that the threshold for volatility is exogenously determined. In addition, Billio and Pelizon (2003) clearly documented that inferences based on heteroscedasticity-adjusted conditional correlation coefficients, with the choice of the crisis and tranquil windows exogenously determined, are highly sensitive to varying lengths of the tranquil and crisis windows.

In light of this problem, Dungey and Tambakis (2003) succinctly put forward the view that "research progress on endogenising the process of separating crisis from non-crisis data in the sample would be a substantial step forward" (Dungey and Tambakis, p. 5). In fact, Boyer et al. (1999) cautioned against using the sample-splitting approach, and concluded by explicitly recommending an alternative strategy that allows structural breaks to be integrated as part of the data generating process, such as via a Markov regime switching model.[12]

In view of this caveat, the contribution of this chapter is primarily methodological. That is, I follow the analysis of F-R, but, at the same time, model the cross-market correlation coefficients as a Markov process through a multivariate

[12] See, Boyer et al. (1999), page 15, par. 2.

version of the Markov regime switching method. Arguably, aside from the important caveat emphasised above, this can be considered a substantial contribution on several grounds. First, as clearly documented from earlier empirical studies, tests for evidence of contagion have utilised both methods, i.e., comparison of cross-market correlation coefficients and Markov regime switching, as distinct and separate.[13] In effect, the two distinct approaches are integrated as one complementary set of tests. Second, unlike earlier papers which modelled asset returns of one country as linearly dependent on another country, and, accordingly, focused on time invariant linear models, the assimilation of a Markov regime switching method in the estimation of the cross-market correlation coefficients directly takes into account the well-known complexity in the time series properties of asset returns, namely, (i) the distribution of asset returns are non-normal and display fat tails, (ii) asset returns display nonlinearities in the form of regime shifts in the conditional moments, and (iii) time-varying volatility such as ARCH/GARCH effects.

Finally, the earlier cited evidence found by Billio and Pelizon (2003) is an important one, as this implies that it is not always clear, *a priori*, what the correct timing of crises should be. More importantly, these findings discourage the exogenous assigning of timing based on an *ex post* dating of crises and, accordingly, lend support to methods, such as the Markov regime switching method, that endogenously estimate the states or regimes.

4.6 Method

4.6.1 The Markov Switching VAR

[13] As indicated previously, with the exception of Fratzscher (2003), earlier related studies, which applied the Markov regime switching method, have been more in the context of currency crises, rather than directly in the context of contagion. On this, see, for instance, Jeanne and Masson (2000), Cerra and Saxena (2002), Martinez-Peria (2003), Abiad (2003), and others.

The Markov Switching VAR, or simply, MS-VAR, developed by Krolzig (1997) is a multivariate version of the univariate Markov regime switching model introduced by Hamilton (1988, 1989). The general idea behind the MS-VAR is that the parameters θ of a VAR process may not be time-invariant, as assumed by linear models, but are time-varying. More precisely, θ may be time-invariant as long as a particular regime prevails, but change once the regime changes.

The regime-generating process determining which regime s_t prevails at any point in time, is assumed to follow an ergodic Markov chain with a constant transition probability p_{ij} of the form:

$$p_{ij} = \Pr(s_{t+1} = j \mid s_t = i), \qquad \sum_{j=1}^{2} p_{ij} = 1 \qquad \forall i, j \in \{1,2\} \tag{4.6}$$

At the same time, the data generating process of the MS-VAR process can be considered as a generalisation of the basic finite order VAR model of order p, and can be written in its general form as:

$$y_t = \upsilon(s_t) + A_1(s_t)y_{t-1} + \ldots + A_p(s_t)y_{t-p} + \Sigma(s_t)u_t \tag{4.7}$$

The parameter shift functions $v(s_t)$, $A_1(s_t),\ldots,A_p(s_t)$, and $\Sigma(s_t)$ describe the dependence of the parameters on the realised regime s_t, for example:

$$\upsilon(s_t) = \begin{cases} v_1 & \text{if } s_t = 1, \\ \cdot & \\ \cdot & \\ \cdot & \\ v_k & \text{if } s_t = K \end{cases} \tag{4.8}$$

In other words, regime switches can have four separate origins: shifts in the intercepts (v), in the autoregressive coefficients A, in the mean, and in the error variance Σ (for heteroscedastic errors). For empirical applications, it is often useful to use a model where only some of the parameters are conditioned on the state of the Markov chain, while the other parameters are regime-invariant (Krolzig, 1997).

Here, asset returns, specifically, stock market returns are modelled as switching in intercepts $v(s_t)$, with the variance-covariance matrix also regime dependent $\Sigma(s_t)$. The general form of the MS-VAR model used in the present study is:[14]

$$y_t = v(s_t) + A_1 y_{t-1} + ... + A_p y_{t-p} + B_0 x_t + B_1 x_{t-1} + ... + B_r x_{t-r} + \Sigma(s_t) u_t \qquad (4.9)$$

$$y_t = \{y_t^h, y_t^j\}' \qquad (4.9a)$$

$$x_t = \{i_t^h, i_t^j, i_t^{US}\}' \qquad (4.9b)$$

where y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the U.S., respectively. In effect, equation (4.7) is simply extended in order to include short-term interest rates that serve to control for any aggregate shocks and/or monetary policy coordination.[15] Thus, the linear VAR formulation of F-R can be modified to include a VAR with regime shifts, i.e., an MS(*K*)-VARX(*p*) model, which conforms to the important caveats raised earlier regarding this strand of literature on contagion. The estimation of the MS-VAR model of equation (4.9) was implemented using the MSVAR module developed by Krolzig (1998), and programmed in OX.

4.6.2 Causality Tests Using the Markov Switching VAR

In this chapter, in contrast to F-R, no strong exogeneity assumptions are made regarding the source or direction of the contagion prior to applying the test based on

[14] See also Krolzig (1997).

[15] As F-R point out, interest rates are an imperfect but good proxy for policies that affect stock market performance.

estimates of the MS-VAR model of equation (4.9).[16] More specifically, Granger causality tests are conducted (using the MS-VAR model in equation (4.9)) in order to determine the significant presence or absence of any feedback from each country in the sample to an initial crisis country. One interesting aspect of the Granger causality tests implemented here is that Granger causality tests are usually conducted using the linear VAR model, however, in this instance, I naturally allow for shifts in regimes as captured by the MS-VAR model.[17]

To test for Granger causality from an initial market where the crisis is believed to have originated to another market in the sample, the null hypothesis of non-causality is:

$$H_0\text{: } A_i\text{'s of } y_t^h \text{ and } B_0,\ B_i\text{'s of } i_t^h \text{ are all equal to zero} \qquad (4.10)$$

In testing H_0, the restrictions in (4.10) are imposed and the respective log likelihood of the restricted (L_R) and unrestricted (L_U) MS-VAR models are obtained from equation (4.9). A standard likelihood ratio test is conducted using the formula $LR = 2(L_U - L_R)$.[18]

4.7 Data and Preliminary Results

In principle, the method presented in the previous section can be applied to any pair of assets. In this chapter, daily returns for stock markets of Indonesia, Hong Kong, Korea, Malaysia, Philippines, Singapore, and Thailand are examined. The stock market returns of the respective markets are based on U.S. dollar returns and are

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[16] Though the period directly after the Hong Kong crash was used as their base analysis, F-R nonetheless clearly admitted twice in their paper that "one difficulty in testing for contagion during the East Asian crisis is that there is no single event acting as a clear catalyst driving this turmoil" (pages 2238 and 2243).

[17] Towards the end of their paper, F-R also cited the importance of using the Granger causality test to determine any strong feedback effect from the second country to the crisis country (see footnote 28, page 2259). However, as their tests were conducted using the linear VAR model, understandably, they were denoting causality tests in a linear sense.

[18] See also, for instance, Kanas (2005).

computed by taking natural logs, differencing, and multiplying by 100 to convert to percentages. All of the data were obtained from Datastream. While the overall period covers daily stock market returns from 1 January 1994 through 31 December 2003 yielding a total of 2588 observations, a sequential procedure with respect to the length of the sample period was utilised in the estimation of the MS-VAR model of equation (4.9) and, subsequently, in testing for evidence of contagion. To illustrate, daily stock market returns running from 1 January 1994 to 31 December 1998 were used as the first sample period, a sample running from 1 January 1994 to 31 December 1999 was used as the second sample period, and so forth, until the full period was covered.

To expand on an issue discussed in section 4.5, in comparison with an exogenous splitting beforehand of a particular sample period into subperiods of tranquility and crisis, the benefit that a sequential procedure affords is that it directly complements the Markov regime switching method used here. As the MS-VAR approach endogenously identifies regimes of tranquility and crisis for that particular sample period, it is more than likely that this said approach will also pick-up or identify high-volatility episodes, in addition to well-known or officially recognised crisis episodes. This benefit is obviously ruled out when one starts from an arbitrary separation beforehand of subperiods of tranquillity and crisis.

Table 4.3 presents descriptive statistics for the daily returns. With the exception of the returns for Indonesia, the returns for the remaining East Asian markets are positively skewed. The returns for all East Asian markets have kurtosis in excess of 3.0, implying fatter tails than a normal distribution. According to the Jarque-Bera test, the null hypothesis of normality is strongly rejected for all series.

Table 4.3
Descriptive Statistics of Stock Returns in East Asia, January 1994-December 2003

	Mean	Standard Deviation	Skewness	Kurtosis	JB
Indonesia	-0.022	1.281	-1.570	35.481	114832.6*
Hong Kong	0.001	0.768	0.099	12.244	9218.1*
Korea	-0.008	1.111	0.219	15.368	16516.6*
Malaysia	-0.017	0.860	0.691	26.724	60899.9*
Philippines	-0.027	0.780	0.936	18.538	26411.0*
Singapore	-0.004	0.660	0.268	12.884	10564.6*
Thailand	-0.023	0.896	0.394	8.101	2872.9*

Notes: JB denotes the Jarque-Bera normality test. * denotes rejection of the null of normality.
The East Asian stock markets examined here are the following: Jakarta Composite Index (Indonesia); Hang Seng Index (Hong Kong); Kospi Index (Korea); Kuala Lumpur Stock Exchange Index (Malaysia); Philippine Stock Exchange Index (Philippines); Strait Times Index (Singapore); Bangkok Stock Exchange Index (Thailand).

The starting point in estimating an MS-VAR model is to formally test the null hypothesis of no regime switching (linear VAR) against the alternative of regime switching. The standard likelihood ratio test is usually applied, and is asymptotically χ^2 (r)-distributed with r degrees of freedom. As shown in Table 4.4, for all possible pairs of East Asian stock market returns (first column) and for every sample period considered (first row), the test statistic exceeds the critical value, that is, the null hypothesis can be rejected at high significance levels. Thus, the rejection of the null hypothesis is equivalent to the rejection of the linear VAR in favour of the alternative MS-VAR model.[19]

[19] However, the results presented in table 4.4 should be treated with some caution as the null hypothesis of linearity against the alternative of Markov regime switching cannot be tested directly using a standard likelihood ratio (LR) test. This is due to the fact that standard regularity conditions for likelihood-based inference are violated under the null hypothesis of linearity, as some parameters are unidentified, e.g., transition probabilities, and scores are identically zero.

Table 4.4
Test for Regime Switching: Linear VAR versus Markov Switching VAR

Country Pairs	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia-Malaysia	3144.2**	3044.1**	3056.7**	3248.2**	3596.0**	4051.0**
Indonesia-Philippines	2585.6**	2505.3**	2555.9**	2679.8**	2871.0**	3116.3**
Indonesia-Singapore	2818.7**	2732.6**	2674.8**	2719.3**	2836.3**	3034.8**
Indonesia-Korea	3219.5**	3032.9**	2948.7**	2973.2**	3095.2**	3342.9**
Indonesia-Thailand	2627.6**	2556.9**	2527.5**	2564.4**	2732.5**	3003.3**
Indonesia-Hong Kong	2632.2**	2516.7**	2467.3**	2523.0**	2685.8**	2959.2**
Malaysia-Philippines	1540.4**	1609.1**	1807.4**	2081.2**	2417.6**	2747.2**
Malaysia-Singapore	1822.3**	1806.7**	1856.1**	2040.7**	2319.9**	2601.2**
Malaysia-Korea	2066.2**	1968.3**	1958.7**	2136.0**	2388.4**	2704.6**
Malaysia-Thailand	1503.2**	1495.7**	1576.5**	1801.0**	2121.7**	2475.1**
Malaysia-Hong Kong	1574.4**	1536.7**	1606.6**	1813.9**	2134.5**	2493.7**
Philippines-Singapore	1092.4**	1118.2**	1243.9**	1364.5**	1477.4**	1528.5**
Philippines-Korea	1497.7**	1394.9**	1465.1**	1580.4**	1670.2**	1777.2**
Philippines-Thailand	1051.6**	1060.2**	1215.3**	1370.9**	1513.5**	1653.9**
Philippines-Hong Kong	1006.7**	1021.0**	1126.1**	1230.0**	1368.5**	1503.1**
Singapore-Korea	1758.6**	1639.0**	1644.4**	1693.2**	1744.7**	1815.9**
Singapore-Thailand	1158.9**	1131.0**	1153.9**	1217.9**	1314.4**	1392.5**
Singapore-Hong Kong	1043.1**	975.6**	989.7**	1043.5**	1112.3**	1194.0**
Korea-Thailand	1568.6**	1462.8**	1456.9**	1506.4**	1584.9**	1714.9**
Korea-Hong Kong	1552.0**	1393.6**	1384.0**	1396.8**	1475.8**	1628.4**
Thailand-Hong Kong	1049.2**	975.9**	991.3**	1049.4**	1183.2**	1351.9**

Notes: The likelihood ratio tests the null of a linear VAR against the alternative of a Markov switching VAR. The value in square brackets below that of the computed LR is the corresponding p-value. ** indicate rejection of the null at the 1%.

Next, the importance of shifts in the variance (regime-dependent heteroscedasticity) is tested against the null hypothesis of a regime invariant variance. As before, the standard likelihood ratio test is applied and is also asymptotically χ^2 (r)-distributed with r degrees of freedom. As presented in table 4.5, for all possible pairs of East stock market returns and for every sample period considered, the test statistic again exceeds the critical value, that is, the null hypothesis can be rejected at high significance levels. The rejection of the null hypothesis provides evidence that, in the estimation of the MS-VAR model, the assumption that the regime shift does not alter the variance of the innovation u_t is restrictive. In equivalent terms, the test results support the estimation of an MSIH(2)-VARX(p) instead of the more restrictive, MSI(2)-VARX(p).[20]

The results from the Granger causality tests with regime shifts are reported in table 4.6. All possible combinations of country pairs are reported in the first column of table 4.6, and testing of the null hypothesis of no Granger causality is implied. For example, in the relevant row between the stock market returns of Indonesia and Malaysia, the null hypotheses that stock market returns of Indonesia (x_t) does not 'Granger cause' stock market returns of Malaysia (y_t), and, conversely, the null hypothesis that stock market returns of Malaysia (x_t) does not 'Granger cause' stock market returns of Indonesia (y_t) are both tested. In this particular country-pair case, and, in fact, with all other possible country pair cases, the null hypotheses are clearly rejected, which indicates that the causation is bi-directional. Furthermore, this outcome holds true for every sample period considered.

[20] The notation I and H stands for Markov switching in intercept and heteroscedasticity in variance.

Table 4.5
Test for Regime-dependent Heteroscedasticity

Country Pairs	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia-Malaysia	3144.3**	3044.2**	3056.8**	3248.2**	3596.1**	4051.1**
Indonesia-Philippines	2585.7**	2505.4**	2556.0**	2679.9**	2871.1**	3116.5**
Indonesia-Singapore	2818.8**	2732.7**	2674.9**	2719.4**	2836.4**	3035.0**
Indonesia-Korea	3219.6**	3033.0**	2948.8**	2973.4**	3095.4**	3343.0**
Indonesia-Thailand	2627.7**	2557.0**	2527.6**	2564.6**	2732.7**	3003.5**
Indonesia-Hong Kong	2632.3**	2516.8**	2467.5**	2523.3**	2686.1**	2959.5**
Malaysia-Philippines	1560.5**	1609.2**	1807.5**	2081.3**	2417.7**	2747.3**
Malaysia-Singapore	1822.3**	1806.7**	1856.1**	2040.8**	2320.0**	2601.3**
Malaysia-Korea	2066.3**	1968.3**	1958.7**	2136.1**	2388.4**	2704.7**
Malaysia-Thailand	1503.2**	1495.7**	1576.6**	1801.0**	2121.7**	2475.2**
Malaysia-Hong Kong	1574.5**	1536.8**	1606.8**	1814.1**	2134.7**	2493.9**
Philippines-Singapore	1092.4**	1118.2**	1244.0**	1364.6**	1477.6**	1528.6**
Philippines-Korea	1497.8**	1395.1**	1465.2**	1580.5**	1670.4**	1777.4**
Philippines-Thailand	1051.7**	1060.3**	1215.4**	1371.0**	1513.7**	1654.0**
Philippines-Hong Kong	1006.8**	1021.1**	1126.2**	1230.2**	1368.7**	1503.3**
Singapore-Korea	1758.7**	1639.1**	1644.5**	1693.4**	1744.9**	1816.1**
Singapore-Thailand	1159.0**	1131.1**	1154.0**	1218.1**	1314.5**	1392.6**
Singapore-Hong Kong	1043.2**	975.7**	989.9**	1043.6**	1112.5**	1194.2**
Korea-Thailand	1568.7**	1463.0**	1457.1**	1506.6**	1585.1**	1715.1**
Korea-Hong Kong	1552.1**	1393.7**	1384.2**	1397.1**	1481.9**	1628.7**
Thailand-Hong Kong	1049.4**	976.1**	991.5**	1049.6**	1183.3**	1352.1**

Notes: The likelihood ratio tests the null hypothesis that $\sigma_l^2 = \sigma_h^2$. The value in square brackets below that of the computed LR is the corresponding *p*-value. ** indicate rejection of the null hypothesis at the 1%.

Table 4.6 Granger Causality Test Using the MS-VAR Model

Direction of Causality	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia → Malaysia	2427.1**	3478.4**	4318.3**	5038.5**	5636.0**	6089.4**
Malaysia → Indonesia	2671.3**	3390.3**	3895.1**	4241.0**	4449.6**	4593.4**
Indonesia→Philippines	2462.2**	3481.4**	4320.3**	5039.6**	5615.8**	6067.3**
Philippines→Indonesia	2530.0**	3066.7**	3607.8**	4165.7**	4530.5**	4912.0**
Indonesia →Singapore	2391.2**	3332.2**	4155.3**	4874.2**	5476.2**	5904.1**
Singapore→ Indonesia	1804.2**	2335.8**	2877.9**	3343.0**	3753.1**	4125.3**
Indonesia → Korea	2621.3**	3610.1**	4450.3**	5134.5**	5724.3**	6163.0**
Korea → Indonesia	2937.6**	3867.8**	4802.2**	5537.3**	6243.6**	6839.6**
Indonesia → Thailand	2546.9**	3487.9**	4286.9**	5037.8**	5634.1**	6091.6**
Thailand → Indonesia	3020.9**	3748.6**	4401.7**	4896.2**	5462.6**	5879.3**
Indonesia→ Hong Kong	2573.2**	3517.0**	4308.3**	5009.3**	5603.4**	6067.3**
Hong Kong→ Indonesia	2663.9**	3269.0**	3921.2**	4472.4**	4886.5**	5219.6**
Malaysia→Philippines	2692.4**	3322.2**	3821.8**	4135.7**	4333.1**	4481.7**
Philippines→Malaysia	2516.0**	2995.6**	3532.4**	4059.2**	4434.1**	4822.5**
Malaysia → Singapore	2349.4**	2989.4**	3510.1**	4021.2**	4004.3**	4116.9**
Singapore → Malaysia	1518.2**	2081.1**	2656.0**	3287.5**	3467.6**	3834.0**
Malaysia → Korea	2902.7**	3552.7**	4116.9**	4417.6**	4629.1**	4777.6**
Korea → Malaysia	2974.8**	3898.4**	5361.4**	5617.9**	6334.8**	6950.2**
Malaysia → Thailand	2669.9**	3303.4**	3792.8**	4100.3**	4293.9**	4431.4**
Thailand → Malaysia	2899.7**	3652.1**	4800.2**	4846.2**	5308.8**	5715.1**
Malaysia→Hong Kong	2624.6**	3257.7**	3720.8**	4017.9**	4196.3**	4338.5**
Hong Kong→Malaysia	2471.0**	3097.8**	4226.3**	4278.4**	4665.7**	4986.8**
Philippines→Singapore	2429.2**	2869.4**	3389.1**	3945.2**	4298.4**	4674.2**
Singapore→Philippines	1774.4**	2287.6**	2824.4**	3288.0**	3660.6**	4050.6**
Philippines → Korea	2802.4**	3321.2**	3869.6**	4337.3**	4709.7**	5086.3**
Korea → Philippines	3050.8**	3993.5**	4934.1**	5614.1**	6314.3**	6918.1**
Philippines → Thailand	2475.3**	2945.7**	3418.8**	3953.4**	4332.0**	4711.1**
Thailand → Philippines	2881.5**	3621.1**	4246.1**	4775.8**	5245.8**	5654.1**
Philippines→Hong Kong	2516.3**	2950.1**	3453.7**	3990.6**	4359.4**	4754.9**
Hong Kong→ Philippines	2539.1**	3116.8**	3779.2**	4327.6**	4727.7**	5062.4**
Singapore → Korea	2050.4**	2570.9**	3072.9**	3441.6**	3784.4**	4126.5**
Korea → Singapore	2953.8**	3825.0**	4702.1**	5375.6**	6026.8**	6582.0**
Singapore → Thailand	1746.9**	2232.4**	2707.9**	3150.4**	3502.3**	3881.8**
Thailand → Singapore	2807.9**	3489.5**	4100.1**	4630.0**	5053.9**	5448.3**
Singapore → Hong Kong	1494.2**	1958.2**	2377.4**	2714.6**	3025.7**	3330.8**
Hong Kong → Singapore	2171.9**	2706.7**	3267.6**	3708.9**	4031.8**	4262.0**
Korea → Thailand	2994.3**	3858.3**	4747.1**	5446.5**	6139.4**	6740.2**
Thailand → Korea	3152.0**	3861.4**	4510.0**	4992.1**	5448.6**	5851.3**
Korea → Hong Kong	3024.8**	3909.7**	4748.0**	5428.4**	6093.3**	6661.8**
Hong Kong → Korea	2799.2**	3404.1**	4010.0**	4488.7**	4857.0**	5137.5**
Thailand → Hong Kong	2935.7**	3652.2**	4260.1**	4787.6**	5238.1**	5652.1**
Hong Kong → Thailand	2552.4**	3143.6**	3758.2**	4302.2**	4692.7**	5016.6**

Notes: → implies the null of no Granger causality. A significant value rejects the null of no causation at the 1% level.

In light of the testing strategy adopted, there are two important outcomes from tables 4.5 and 4.6. The former indicates that regime-shifts do indeed alter the variance-covariance matrix and, in turn, affect the contemporaneous correlations of the cross-country asset returns. The latter indicates that simply assigning exogenously the market or country where the shock originates, in relation to the adjustment of the conditional correlation coefficient in equation (4.5), is not appropriate in this case. Instead, when the adjustment of the computed conditional correlation coefficients in (4.5) is conducted, one has to control for the presence of a significant feedback (two-way interaction) between each pair of East Asian stock markets, and treat each of the East Asian stock market returns equally as initial sources or host markets.

4.8 Results and Analyses

The first step in the estimation of the MS-VAR model is to determine the lag length *l*. The Akaike information criteria (AIC) and the Schwarz criterion (SC) were employed to assist in choosing the appropriate lag length and, on this basis, a lag length of 1 was chosen to estimate model (4.9).[21] Based on earlier results, model (4.9) was estimated as a MSIH(2)-VARX(1), with each East Asian stock market considered as the crisis country (*h*). Tables 4.7a – 4.12(g) report the estimated results for the MS-VAR model. These tables show the intercept for the two regimes, i.e., $v(s=1)$ for regime 1 or the tranquil period and $v(s=2)$ for the crisis period. We can see from these tables that in almost all cases, the switches in the intercept are not significant. The tables also report the estimated standard deviations across the two regimes, and from these estimated standard deviations a variance-ratio statistic can be taken which is distributed as *F*.[22] We see from the tables that in all cases the computed *F*-statistic is

[21] Models of up to 6 lags were estimated in order to arrive at the appropriate lag length.
[22] Strictly speaking, taking the ratio of two variances test for the null hypothesis whether the ratio of the two variances is exactly to one as opposed to the alternative that the ratio is greater than one.

highly significant. Thus, the fact that the ratio of the high and low variance is significant in all cases suggest that the specification of switches in the intercept does not affect this ratio. More importantly, this also justifies the allowance for a regime-dependent error variance in the estimation of equation 4.9.

From the regime-dependent variance-covariance estimates of this model, the regime-dependent conditional cross-market correlation coefficients between each pair of East Asian stock market returns in the sample were calculated. In turn, two conditional correlation coefficients were computed; one during the regime or state of high-volatility or turmoil (ρ_c^h), and the other during the regime of low-volatility or stable (ρ_c^l). Subsequently, the computed conditional correlation coefficients, in particular, during the high-volatility or turmoil regime was adjusted using equation (4.5a) and, in turn, a measure of unconditional correlation coefficient during the regime or state of high-volatility or turmoil (ρ_u^h) was derived. To test whether there was a significant increase in the unconditional correlation coefficient during the high-volatility or turmoil regime (ρ_u^h), the standard Fisher *z*-transformation was implemented.[23] Finally, this process was repeated for the various sample periods considered in this chapter.

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[23] The test statistic for the Fisher *z*-transformation is $T = \dfrac{z_h - z_l}{\mathrm{var}(z_h - z_l)}$, where $z_h = \dfrac{1}{2}\ln\dfrac{(1+\rho_u^h)}{(1-\rho_u^h)}$ and $z_l = \dfrac{1}{2}\ln\dfrac{(1+\rho_c^l)}{(1-\rho_c^l)}$ and var($z_h - z_l$) = sqrt[1/(N_h – 3) + 1/(N_l – 3)] with *h* and *l* denoted as the high and low volatility regimes, respectively. The test statistic is approximately normally distributed and is fairly robust to non-normality of correlation coefficients. Dungey and Zhumabekova (2001), Basu (2002), Corsetti et. al. (2002), Dungey et. al. (2004a) have employed this test.

Table 4.7(a) MS-VAR Estimation Results, 1994-98 (Host: Indonesia)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.02 (0.03)	0.08** (0.03)	0.18** (0.02)	0.05** (0.02)	0.10** (0.03)	0.05* (0.02)
y_{t-1}^j	----	0.12** (0.03)	0.10** (0.03)	0.12** (0.03)	0.13** (0.03)	0.09** (0.03)	-0.01 (0.03)
i_t^h	----	-0.01 (0.01)	-0.0 (0.01)	-0.0 (0.01)	-0.0 (0.00)	-0.01 (0.01)	-0.01 (0.01)
i_{t-1}^h	----	0.01 (0.01)	-0.00 (0.01)	0.00 (0.01)	0.00 (0.00)	-0.00 (0.01)	0.01 (0.01)
i_t^j	----	-0.02 (0.02)	0.00 (0.01)	-0.11 (0.08)	0.02 (0.02)	-0.03* (0.02)	-0.15** (0.04)
i_{t-1}^j	----	-0.01 (0.02)	-0.00 (0.01)	0.13 (0.08)	-0.04* (0.02)	0.04* (0.02)	0.15** (0.04)
i_t^{US}	----	-0.12 (0.38)	0.44 (0.34)	0.27 (0.38)	-0.18 (0.27)	-0.02 (0.4)	-0.61 (0.4)
i_{t-1}^{us}	----	0.11 (0.38)	-0.43 (0.34)	-0.26 (0.38)	0.19 (0.26)	0.01 (0.4)	0.66 (0.4)
v(s=1)	----	0.51* (0.25)	0.13 (0.23)	-0.39 (0.32)	-0.03 (0.16)	0.02 (0.25)	-0.41 (0.23)
v(s=2)	----	0.37 (0.20)	-0.02 (0.20)	-0.32 (0.28)	0.00 (0.15)	-0.0 (0.21)	-0.31 (0.21)
σ(s=1)	----	2.11	1.90	1.25	1.16	1.58	1.34
σ(s=2)	----	0.52	0.46	0.52	0.36	0.57	0.54
F-test	----	16.46++	13.35++	5.78++	10.38++	7.68++	6.16++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(b) MS-VAR Estimation Results, 1994-98 (Host: Korea)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.03 (0.03)	0.07^{**} (0.02)	0.06 (0.02)	0.06^{*} (0.03)	0.07^{**} (0.03)
y_{t-1}^j	0.25^{**} (0.03)	----	0.14^{**} (0.03)	0.20^{**} (0.03)	0.14^{**} (0.03)	0.12^{**} (0.03)	0.01 (0.03)
i_t^h	-0.00 (0.01)	----	0.01 (0.02)	0.02 (0.02)	0.01 (0.01)	0.02 (0.02)	0.02 (0.02)
i_{t-1}^h	-0.00 (0.01)	----	-0.02 (0.02)	-0.03 (0.02)	-0.02 (0.01)	-0.02 (0.02)	-0.02 (0.02)
i_t^j	-0.01^{**} (0.00)	----	0.00 (0.01)	-0.13 (0.08)	0.02 (0.01)	-0.04^{**} (0.02)	-0.17^{**} (0.04)
i_{t-1}^j	0.01 (0.00)	----	-0.01 (0.01)	0.14 (0.08)	-0.04^{*} (0.01)	0.04^{**} (0.02)	0.178^{**} (0.04)
i_t^{US}	0.01 (0.26)	----	0.42 (0.35)	0.33 (0.39)	-0.23 (0.28)	-0.05 (0.4)	-0.62 (0.4)
i_{t-1}^{us}	0.02 (0.26)	----	-0.43 (0.35)	-0.31 (0.39)	0.23 (0.28)	0.05 (0.4)	0.66 (0.4)
v(s=1)	-0.29 (0.23)	----	0.10 (0.21)	-0.23 (0.29)	0.11 (0.16)	0.02 (0.22)	-0.25 (0.23)
v(s=2)	-0.19 (0.14)	----	0.07 (0.25)	-0.28 (0.33)	0.06 (0.18)	0.04 (0.25)	-0.36 (0.25)
$\sigma(s=1)$	2.98	----	0.47	0.54	0.38	0.55	0.54
$\sigma(s=2)$	0.36	----	1.99	1.30	1.20	1.57	1.40
F-test	68.52^{++}	----	17.93^{++}	5.80^{++}	9.97^{++}	8.15^{++}	6.72^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(c) MS-VAR Estimation Results, 1994-98 (Host: Malaysia)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.13** (0.02)	0.03 (0.03)	----	0.18** (0.03)	0.05 (0.02)	0.05 (0.03)	0.05** (0.03)
y_{t-1}^j	0.18** (0.03)	0.13** (0.03)	----	0.13** (0.03)	0.13* (0.03)	0.10** (0.03)	-0.00 (0.03)
i_t^h	-0.00 (0.01)	-0.01 (0.01)	----	-0.01 (0.02)	0.00** (0.01)	-0.01 (0.02)	0.01 (0.01)
i_{t-1}^h	-0.00 (0.01)	-0.00 (0.01)	----	0.01 (0.02)	-0.01 (0.01)	-0.02 (0.02)	0.01 (0.01)
i_t^j	-0.00 (0.01)	-0.01 (0.02)	----	-0.16* (0.08)	0.01 (0.02)	-0.05** (0.02)	-0.14** (0.04)
i_{t-1}^j	0.01 (0.01)	-0.01 (0.02)	----	0.17* (0.08)	-0.04* (0.02)	0.05** (0.02)	0.13** (0.04)
i_t^{US}	-0.16 (0.25)	-0.10 (0.37)	----	0.07 (0.42)	-0.22 (0.26)	0.16 (0.5)	-0.35 (0.41)
i_{t-1}^{us}	0.19 (0.25)	0.09 (0.37)	----	-0.09 (0.42)	0.22 (0.26)	-0.15 (0.5)	0.39 (0.42)
v(s=1)	-0.49* (0.21)	0.42* (0.22)	----	-0.00 (0.26)	0.02 (0.16)	-0.04 (0.22)	-0.32 (0.26)
v(s=2)	-0.25 (0.13)	0.47 (0.26)	----	-0.11 (0.27)	-0.00 (0.17)	-0.06 (0.23)	-0.42 (0.25)
$\sigma(s=1)$	2.85	0.50	----	0.44	0.35	0.52	0.46
$\sigma(s=2)$	0.34	2.15	----	1.21	1.17	1.55	1.34
F-test	70.26++	18.49++	----	7.56++	11.17++	8.88++	8.49++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(d) MS-VAR Estimation Results, 1994-98 (Host: Philippines)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.07^{**} (0.02)	-0.00 (0.03)	0.05 (0.03)	----	0.04 (0.02)	0.07^{*} (0.03)	0.05^{**} (0.03)
y_{t-1}^j	0.22^{**} (0.03)	0.13^{**} (0.03)	0.11^{**} (0.03)	----	0.15^{**} (0.03)	0.10^{**} (0.03)	0.03 (0.03)
i_t^h	-0.06 (0.06)	-0.10 (0.08)	-0.13 (0.08)	----	-0.10 (0.06)	-0.21^{*} (0.09)	-0.13 (0.08)
i_{t-1}^h	0.06 (0.06)	0.09 (0.08)	0.15 (0.08)	----	0.10 (0.06)	0.22^{**} (0.09)	0.14 (0.08)
i_t^j	-0.00 (0.01)	-0.01 (0.02)	0.01 (0.02)	----	-0.01 (0.02)	-0.04^{**} (0.02)	-0.13^{**} (0.04)
i_{t-1}^j	0.00 (0.01)	-0.01 (0.02)	0.00^{*} (0.02)	----	-0.03 (0.02)	0.04^{*} (0.02)	0.12^{**} (0.04)
i_t^{US}	0.02 (0.25)	0.20 (0.37)	-0.11 (0.43)	----	-0.12 (0.29)	0.02 (0.5)	-0.32 (0.43)
i_{t-1}^{us}	0.01 (0.25)	0.18 (0.37)	-0.09 (0.43)	----	0.10 (0.28)	-0.02 (0.5)	0.36 (0.43)
v(s=1)	-0.65^{*} (0.26)	0.52 (0.29)	-0.15 (0.25)	----	0.24 (0.21)	-0.18 (0.30)	-0.38 (0.28)
v(s=2)	-0.31 (0.19)	0.56 (0.35)	-0.35 (0.27)	----	0.21 (0.23)	-0.27 (0.31)	-0.31 (0.28)
$\sigma(s=1)$	2.81	0.51	0.40	----	0.34	0.49	1.23
$\sigma(s=2)$	0.34	2.04	1.71	----	1.03	1.48	0.44
F-test	68.31^{++}	16.0^{++}	18.28^{++}	----	9.18^{++}	9.12^{++}	7.81^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(e) MS-VAR Estimation Results, 1994-98 (Host: Singapore)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.13^{**} (0.03)	0.06 (0.04)	0.09^{*} (0.04)	0.26^{**} (0.04)	----	0.19^{**} (0.04)	0.01^{**} (0.03)
y_{t-1}^j	0.21^{**} (0.03)	0.13^{**} (0.03)	0.11^{**} (0.03)	0.12^{**} (0.03)	----	0.06^{*} (0.03)	0.03 (0.03)
i_t^h	-0.02 (0.02)	-0.04 (0.03)	0.08^{**} (0.03)	-0.04 (0.02)	----	0.00^{*} (0.03)	0.01 (0.08)
i_{t-1}^h	0.06 (0.02)	0.03 (0.03)	-0.10^{**} (0.03)	0.03 (0.02)	----	-0.04 (0.03)	-0.04 (0.08)
i_t^j	-0.01^{*} (0.00)	-0.02 (0.02)	0.00 (0.01)	-0.16^{*} (0.07)	----	-0.04^{**} (0.02)	-0.11^{**} (0.04)
i_{t-1}^j	0.01^{*} (0.00)	0.00 (0.02)	-0.00 (0.01)	0.17^{*} (0.07)	----	0.05^{**} (0.02)	0.11^{**} (0.04)
i_t^{US}	-0.11 (0.25)	-0.21 (0.38)	0.44 (0.34)	0.25 (0.37)	----	0.34 (0.4)	-0.25 (0.43)
i_{t-1}^{us}	0.13 (0.25)	0.18 (0.38)	-0.44 (0.33)	-0.25 (0.37)	----	-0.35 (0.4)	0.29 (0.43)
v(s=1)	-0.36^{*} (0.21)	0.55^{**} (0.21)	0.07 (0.21)	-0.13 (0.27)	----	0.15 (0.23)	-0.19 (0.28)
v(s=2)	-0.17 (0.14)	0.59^{*} (0.26)	-0.01 (0.23)	-0.26 (0.28)	----	0.05 (0.24)	-0.29 (0.28)
$\sigma(s=1)$	2.84	0.51	0.43	0.43	----	0.49	0.45
$\sigma(s=2)$	0.34	2.11	1.90	1.18	----	1.49	1.31
F-test	69.77^{++}	17.12^{++}	19.52^{++}	7.53^{++}	----	9.25^{++}	8.47^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(f) MS-VAR Estimation Results, 1994-98 (Host: Thailand)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea** (y_t^j)	**Malaysia** (y_t^j)	**Philippines** (y_t^j)	**Singapore** (y_t^j)	**Thailand** (y_t^j)	**Hong Kong** (y_t^j)
Thailand (y_{t-1}^h)	0.11** (0.02)	0.03 (0.03)	0.06* (0.03)	0.16** (0.03)	0.06** (0.02)	----	0.07* (0.03)
y_{t-1}^j	0.23** (0.03)	0.14** (0.03)	0.10** (0.03)	0.14** (0.03)	0.13** (0.03)	----	-0.01 (0.03)
i_t^h	-0.01 (0.01)	0.01 (0.01)	-0.00 (0.01)	-0.01 (0.01)	-0.00 (0.01)	----	0.00 (0.01)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.01)	0.02 (0.01)	0.00 (0.01)	0.01 (0.01)	----	0.00 (0.01)
i_t^j	-0.01* (0.00)	-0.01 (0.02)	-0.00 (0.02)	-0.19* (0.08)	0.00 (0.02)	----	-0.18** (0.04)
i_{t-1}^j	0.01** (0.00)	-0.01 (0.02)	-0.00 (0.02)	0.20** (0.08)	-0.04 (0.02)	----	0.17** (0.04)
i_t^{US}	-0.12 (0.24)	-0.15 (0.36)	0.60 (0.37)	0.02 (0.39)	-0.10 (0.27)	----	-0.28 (0.38)
i_{t-1}^{us}	0.14 (0.24)	0.13 (0.36)	-0.61 (0.37)	-0.00 (0.38)	0.10 (0.27)	----	0.32 (0.38)
v(s=1)	-0.27* (0.21)	0.42* (0.20)	-0.08 (0.20)	-0.22 (0.26)	0.01 (0.16)	----	-0.27 (0.24)
v(s=2)	-0.24 (0.12)	0.44 (0.24)	-0.23 (0.22)	-0.28 (0.27)	-0.03 (0.17)	----	-0.33 (0.23)
$\sigma(s=1)$	2.77	0.48	0.44	0.43	0.34	----	0.45
$\sigma(s=2)$	0.33	1.96	1.77	1.20	1.06	----	1.23
F-test	70.46++	16.67++	16.18++	7.79++	9.72++	----	7.47++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.7(g) MS-VAR Estimation Results, 1994-98 (Host: Hong Kong)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.07** (0.02)	0.03 (0.03)	0.07* (0.03)	0.12** (0.03)	0.08** (0.03)	0.09* (0.03)	----
y_{t-1}^j	0.24** (0.03)	0.13** (0.03)	0.11** (0.03)	0.18** (0.03)	0.11** (0.03)	0.09**(0.03)	----
i_t^h	-0.04 (0.04)	-0.09 (0.05)	-0.07 (0.05)	-0.13** (0.04)	-0.07 (0.04)	-0.14**(0.05)	----
i_{t-1}^h	0.03 (0.04)	0.08 (0.05)	0.02 (0.05)	0.12** (0.04)	0.07 (0.04)	0.12*(0.05)	----
i_t^j	-0.01* (0.00)	-0.01 (0.02)	0.00 (0.01)	-0.20** (0.07)	-0.00 (0.02)	-0.04** (0.02)	----
i_{t-1}^j	0.01** (0.00)	-0.01 (0.02)	-0.00 (0.01)	0.21** (0.07)	-0.03 (0.02)	0.04** (0.02)	----
i_t^{US}	-0.05 (0.25)	-0.17 (0.39)	0.70 (0.42)	0.12 (0.42)	-0.18 (0.31)	0.34 (0.4)	----
i_{t-1}^{us}	0.08 (0.25)	0.16 (0.39)	-0.67 (0.41)	-0.12 (0.42)	0.18 (0.31)	-0.32 (0.4)	----
v(s=1)	-0.44* (0.21)	0.53* (0.23)	0.01 (0.04)	-0.23 (0.28)	0.10 (0.21)	-0.06 (0.25)	----
v(s=2)	-0.20 (0.14)	0.61* (0.27)	-0.04 (0.08)	-0.10 (0.28)	0.07 (0.21)	-0.09 (0.24)	----
$\sigma(s=1)$	2.86	0.51	0.42	1.18	0.34	0.47	----
$\sigma(s=2)$	0.34	2.15	1.81	0.44	1.08	1.47	----
F-test	70.76^{++}	17.77^{++}	18.57^{++}	7.19^{++}	10.09^{++}	9.78^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(a) MS-VAR Estimation Results, 1994-99 (Host: Indonesia)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.02 (0.03)	0.05^* (0.02)	0.16^{**} (0.02)	0.05^{**} (0.02)	0.09^{**}(0.02)	0.05^*(0.02)
y_{t-1}^j	----	0.11^{**} (0.03)	0.10^{**} (0.03)	0.11^{**} (0.03)	0.12^{**} (0.03)	0.08^{**} (0.03)	-0.01 (0.03)
i_t^h	----	-0.01 (0.01)	-0.0 (0.00)	-0.0 (0.01)	-0.0 (0.00)	-0.01 (0.01)	-0.0 (0.00)
i_{t-1}^h	----	0.01 (0.01)	-0.00 (0.01)	0.00 (0.01)	0.00 (0.00)	0.01 (0.01)	0.01 (0.00)
i_t^j	----	-0.02 (0.02)	0.00 (0.01)	-0.12 (0.07)	0.01 (0.02)	-0.04^* (0.02)	-0.14^{**} (0.04)
i_{t-1}^j	----	0.01 (0.02)	-0.01 (0.01)	0.14 (0.07)	-0.05^* (0.02)	0.04^* (0.02)	0.13^{**} (0.04)
i_t^{US}	----	-0.21 (0.42)	0.39 (0.34)	0.27 (0.36)	-0.17 (0.27)	-0.08 (0.4)	-0.63 (0.4)
i_{t-1}^{us}	----	0.19 (0.42)	-0.38 (0.34)	-0.27 (0.36)	0.17 (0.26)	0.07 (0.4)	0.68 (0.4)
v(s=1)	----	0.42^* (0.22)	0.10 (0.21)	-0.30 (0.25)	0.02 (0.16)	0.04 (0.22)	-0.37 (0.21)
v(s=2)	----	0.39 (0.21)	0.01 (0.20)	-0.20 (0.24)	0.07 (0.15)	0.02 (0.21)	-0.28 (0.20)
$\sigma(s=1)$	----	1.82	1.65	1.11	1.04	1.43	1.19
$\sigma(s=2)$	----	0.54	0.46	0.51	0.37	0.57	0.54
F-test	----	11.36^{++}	12.87^{++}	4.74^{++}	7.90^{++}	6.29^{++}	4.86^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^+$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(b) MS-VAR Estimation Results, 1994-99 (Host: Korea)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.02 (0.02)	0.05** (0.02)	0.05**0.02)	0.06* (0.03)	0.07** (0.02)
y_{t-1}^j	0.23** (0.03)	----	0.12** (0.03)	0.20** (0.03)	0.13** (0.03)	0.11** (0.03)	0.00 (0.03)
i_t^h	-0.00 (0.01)	----	0.01 (0.01)	-0.00 (0.02)	0.02 (0.01)	0.01 (0.01)	0.00 (0.01)
i_{t-1}^h	-0.00 (0.01)	----	-0.01 (0.02)	-0.01 (0.02)	-0.02*(0.01)	-0.01 (0.01)	-0.01 (0.01)
i_t^j	-0.01** (0.00)	----	-0.00 (0.01)	-0.18 (0.08)	0.02 (0.02)	-0.04** (0.02)	-0.15** (0.04)
i_{t-1}^j	0.01 (0.00)	----	-0.01 (0.01)	0.20 (0.08)	-0.05* (0.02)	0.04* (0.02)	0.14** (0.04)
i_t^{US}	0.04 (0.27)	----	0.40 (0.35)	0.42 (0.39)	-0.10 (0.28)	-0.03 (0.4)	-0.66 (0.4)
i_{t-1}^{us}	-0.01 (0.27)	----	-0.41 (0.34)	-0.41 (0.39)	0.10 (0.28)	0.03 (0.4)	0.70 (0.4)
v(s=1)	-0.19 (0.18)	----	0.05 (0.20)	-0.16 (0.29)	0.11 (0.15)	0.06 (0.21)	-0.21 (0.22)
v(s=2)	-0.18 (0.13)	----	0.07 (0.21)	-0.20 (0.33)	0.06 (0.16)	0.08 (0.22)	-0.27 (0.22)
$\sigma(s=1)$	2.52	----	0.47	0.49	0.38	0.55	0.54
$\sigma(s=2)$	0.36	----	1.79	1.24	1.11	1.43	1.29
F-test	49.0++	----	14.5++	6.4++	8.53++	6.76++	5.71++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(c) MS-VAR Estimation Results, 1994-99 (Host: Malaysia)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11** (0.02)	0.04 (0.03)	----	0.17** (0.02)	0.06 (0.02)	0.07*(0.03)	0.07** (0.03)
y_{t-1}^j	0.19** (0.03)	0.12** (0.03)	----	0.12** (0.03)	0.13* (0.03)	0.08**(0.03)	-0.01 (0.03)
i_t^h	-0.00 (0.01)	-0.01 (0.01)	----	-0.01 (0.02)	0.00** (0.01)	-0.01 (0.02)	0.01 (0.01)
i_{t-1}^h	-0.00 (0.01)	-0.00 (0.01)	----	0.01 (0.02)	-0.01 (0.01)	-0.02 (0.02)	0.00 (0.01)
i_t^j	-0.01 (0.00)	-0.02 (0.02)	----	-0.18* (0.08)	0.01 (0.02)	-0.05** (0.02)	-0.10** (0.04)
i_{t-1}^j	0.01 (0.00)	0.00 (0.02)	----	0.19* (0.08)	-0.05**(0.02)	0.05** (0.02)	0.10** (0.04)
i_t^{US}	-0.05 (0.27)	-0.02 (0.42)	----	0.10 (0.39)	-0.11 (0.27)	-0.02 (0.5)	-0.65 (0.43)
i_{t-1}^{us}	0.02 (0.27)	0.00 (0.42)	----	-0.13 (0.39)	0.11 (0.27)	0.03 (0.5)	0.67 (0.43)
v(s=1)	-0.31* (0.18)	0.46* (0.22)	----	-0.06 (0.24)	0.10 (0.16)	0.00 (0.23)	-0.19 (0.25)
v(s=2)	-0.25 (0.14)	0.45 (0.24)	----	-0.05 (0.25)	0.08 (0.17)	-0.00 (0.23)	-0.28 (0.24)
$\sigma(s=1)$	2.53	0.54	----	0.44	0.37	0.55	0.51
$\sigma(s=2)$	0.35	1.97	----	1.19	1.15	1.50	1.31
F-test	52.25^{++}	13.31^{++}	----	7.31^{++}	9.66^{++}	7.44^{++}	6.60^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(d) MS-VAR Estimation Results, 1994-99 (Host: Philippines)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Philippines (y_{t-1}^h)	0.07** (0.02)	-0.01 (0.03)	0.04 (0.03)	----	0.04 (0.02)	0.09**(0.03)	0.04** (0.03)
y_{t-1}^j	0.21** (0.03)	0.13** (0.03)	0.10** (0.03)	----	0.13** (0.03)	0.09** (0.03)	0.02 (0.03)
i_t^h	-0.06 (0.06)	-0.14 (0.08)	-0.16*(0.08)	----	-0.12*(0.06)	-0.21**(0.09)	-0.15 (0.08)
i_{t-1}^h	0.07 (0.06)	0.13 (0.08)	0.17*(0.08)	----	0.12*(0.06)	0.23** (0.09)	0.15 (0.08)
i_t^j	0.00 (0.01)	-0.03 (0.02)	-0.00 (0.02)	----	-0.00 (0.02)	-0.04** (0.02)	-0.09** (0.04)
i_{t-1}^j	-0.00 (0.01)	0.01 (0.02)	0.00* (0.02)	----	-0.04*(0.02)	0.04**(0.02)	0.08** (0.04)
i_t^{US}	0.19 (0.26)	0.06 (0.37)	-0.26 (1.02)	----	-0.02 (0.29)	-0.12 (0.5)	-0.56 (0.41)
i_{t-1}^{us}	-0.15 (0.26)	-0.09 (0.37)	-0.28 (1.02)	----	-0.01 (0.29)	0.12 (0.5)	0.58 (0.40)
v(s=1)	-0.47* (0.24)	0.58 (0.29)	0.03 (0.24)	----	0.35 (0.20)	-0.19 (0.31)	-0.18 (0.26)
v(s=2)	-0.43*(0.19)	0.59 (0.35)	-0.07 (0.26)	----	0.30 (0.20)	-0.24 (0.31)	-0.12 (0.26)
σ(s=1)	2.49	0.55	0.42	----	0.36	0.52	1.22
σ(s=2)	0.35	1.91	1.66	----	1.01	1.45	0.48
F-test	50.61++	12.06++	15.62++	----	7.87++	7.78++	6.46++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(e) MS-VAR Estimation Results, 1994-99 (Host: Singapore)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea** (y_t^j)	**Malaysia** (y_t^j)	**Philippines** (y_t^j)	**Singapore** (y_t^j)	**Thailand** (y_t^j)	**Hong Kong** (y_t^j)
Singapore (y_{t-1}^h)	0.11^{**} (0.03)	0.09^{*}(0.04)	0.08^{*} (0.04)	0.24^{**} (0.04)	----	0.21^{**} (0.04)	0.06^{**} (0.03)
y_{t-1}^j	0.20^{**} (0.03)	0.11^{**} (0.03)	0.11^{**} (0.03)	0.12^{**} (0.03)	----	0.05 (0.03)	0.00 (0.03)
i_t^h	-0.02 (0.02)	-0.06 (0.03)	0.06^{**} (0.03)	-0.05 (0.02)	----	0.01 (0.03)	0.01 (0.03)
i_{t-1}^h	0.03 (0.02)	0.04 (0.03)	-0.08^{**} (0.03)	0.03 (0.02)	----	-0.06^{*}(0.03)	-0.04 (0.03)
i_t^j	-0.01^{*} (0.00)	-0.03 (0.02)	0.00 (0.01)	-0.18^{*} (0.07)	----	-0.04^{**} (0.02)	-0.08^{**} (0.04)
i_{t-1}^j	0.01^{*} (0.00)	0.01 (0.02)	-0.00 (0.01)	0.19^{*} (0.07)	----	0.05^{**} (0.02)	0.08^{**} (0.04)
i_t^{US}	0.03 (0.26)	-0.02 (0.42)	0.48 (0.34)	0.39 (0.37)	----	0.15 (0.4)	-0.43 (0.40)
i_{t-1}^{us}	-0.00 (0.26)	-0.02 (0.42)	-0.49 (0.33)	-0.40 (0.37)	----	-0.17 (0.4)	0.46 (0.40)
v(s=1)	-0.28^{*} (0.18)	0.66^{**} (0.21)	0.09 (0.21)	-0.10 (0.27)	----	0.21 (0.23)	-0.12 (0.26)
v(s=2)	-0.25 (0.14)	0.65^{**}(0.23)	0.06 (0.23)	-0.21 (0.28)	----	0.14 (0.23)	-0.21 (0.25)
$\sigma(s=1)$	2.50	0.54	0.45	0.43	----	0.52	0.48
$\sigma(s=2)$	0.34	1.92	1.81	1.15	----	1.45	1.23
F-test	54.07^{++}	12.64^{++}	16.18^{++}	7.15^{++}	----	7.78^{++}	6.57^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(f) MS-VAR Estimation Results, 1994-99 (Host: Thailand)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Thailand (y_{t-1}^h)	0.09^{**} (0.02)	0.04 (0.03)	0.04 (0.02)	0.15^{**} (0.02)	0.06^{**} (0.02)	----	0.06^{**}(0.02)
y_{t-1}^j	0.21^{**} (0.03)	0.13^{**} (0.03)	0.11^{**} (0.03)	0.13^{**} (0.03)	0.13^{**} (0.03)	----	-0.00 (0.03)
i_t^h	-0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)	----	-0.00 (0.01)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.01)	0.02 (0.01)	0.00 (0.01)	0.01 (0.01)	----	-0.00 (0.01)
i_t^j	-0.01^{*} (0.00)	-0.02 (0.02)	-0.00 (0.02)	-0.21^{**}(0.07)	0.00 (0.02)	----	-0.16^{**} (0.04)
i_{t-1}^j	0.01 (0.00)	-0.00 (0.02)	-0.01 (0.02)	0.23^{**} (0.07)	-0.05^{*}(0.02)	----	0.14^{**} (0.04)
i_t^{US}	-0.00 (0.25)	-0.11 (0.39)	0.62 (0.38)	0.14 (0.36)	-0.04 (0.28)	----	-0.35 (0.39)
i_{t-1}^{us}	0.02 (0.25)	0.09 (0.38)	-0.61 (0.37)	-0.13 (0.35)	0.04 (0.28)	----	0.41 (0.39)
v(s=1)	-0.21 (0.17)	0.49^{*} (0.19)	-0.08 (0.19)	-0.24 (0.25)	0.12 (0.16)	----	-0.31 (0.24)
v(s=2)	-0.21 (0.13)	0.50^{*}(0.21)	-0.13 (0.20)	-0.31 (0.26)	0.09 (0.16)	----	-0.33 (0.23)
$\sigma(s=1)$	2.45	0.49	0.44	0.42	0.36	----	0.48
$\sigma(s=2)$	0.34	1.75	1.66	1.14	1.02	----	1.16
F-test	51.92^{++}	12.76^{++}	14.23^{++}	7.37^{++}	8.03^{++}	----	5.84^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.8(g) MS-VAR Estimation Results, 1994-99 (Host: Hong Kong)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.06** (0.02)	0.07*(0.03)	0.04 (0.03)	0.12** (0.03)	0.08** (0.02)	0.09**(0.03)	----
y_{t-1}^j	0.20** (0.03)	0.12** (0.03)	0.11** (0.03)	0.17** (0.03)	0.11** (0.03)	0.09**(0.03)	----
i_t^h	-0.06 (0.03)	-0.05 (0.05)	-0.05 (0.04)	-0.08* (0.04)	-0.04 (0.03)	-0.11* (0.04)	----
i_{t-1}^h	0.03 (0.03)	0.06 (0.05)	0.00 (0.04)	0.06 (0.04)	0.04 (0.03)	0.09*(0.04)	----
i_t^j	-0.01* (0.00)	-0.03 (0.02)	0.00 (0.01)	-0.22** (0.07)	0.00 (0.02)	-0.04** (0.02)	----
i_{t-1}^j	0.01* (0.00)	-0.01 (0.02)	-0.01 (0.01)	0.23** (0.07)	-0.04* (0.02)	0.04* (0.02)	----
i_t^{US}	-0.06 (0.26)	-0.02 (0.45)	0.42 (0.39)	0.11 (0.39)	-0.20 (0.31)	0.14 (0.4)	----
i_{t-1}^{us}	-0.01 (0.26)	0.02 (0.45)	-0.39 (0.39)	-0.12 (0.39)	0.19 (0.31)	-0.12 (0.4)	----
v(s=1)	-0.34 (0.18)	0.59**(0.23)	0.01 (0.23)	-0.16 (0.24)	0.21 (0.21)	-0.07 (0.25)	----
v(s=2)	-0.28* (0.14)	0.60* (0.24)	-0.00 (0.23)	-0.05 (0.24)	0.17 (0.20)	-0.05 (0.24)	----
$\sigma(s=1)$	2.52	0.55	0.44	1.19	0.37	0.50	----
$\sigma(s=2)$	0.35	2.01	1.80	0.43	1.05	1.44	----
F-test	51.84^{++}	13.36^{++}	16.74^{++}	7.66^{++}	8.05^{++}	8.29^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(a) MS-VAR Estimation Results, 1994-00 (Host: Indonesia)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Indonesia (y_{t-1}^h)	----	0.03 (0.02)	0.03 (0.02)	0.13^{**} (0.02)	0.04^{*} (0.02)	0.08^{**}(0.02)	0.04^{*}(0.02)
y_{t-1}^j	----	0.09^{**} (0.02)	0.13^{**} (0.02)	0.13^{**} (0.02)	0.11^{**} (0.02)	0.07^{**} (0.02)	-0.00 (0.02)
i_t^h	----	-0.01 (0.01)	-0.0 (0.00)	-0.0 (0.01)	0.0 (0.00)	-0.01 (0.01)	-0.0 (0.01)
i_{t-1}^h	----	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)	0.01 (0.01)	0.01 (0.01)
i_t^j	----	-0.03^{*}(0.02)	0.00 (0.01)	0.11 (0.07)	0.01 (0.02)	-0.04^{*} (0.02)	-0.13^{**} (0.03)
i_{t-1}^j	----	0.02 (0.01)	-0.00 (0.01)	-0.10 (0.07)	-0.05^{**}(0.02)	0.04^{*} (0.02)	0.12^{**} (0.03)
i_t^{US}	----	-0.07 (0.41)	0.40 (0.34)	0.30 (0.34)	-0.15 (0.27)	-0.11 (0.4)	-0.59 (0.4)
i_{t-1}^{us}	----	0.04 (0.41)	-0.42 (0.34)	-0.31 (0.34)	0.15 (0.27)	0.10 (0.4)	0.62 (0.4)
$v(s=1)$	----	0.41 (0.21)	0.27 (0.18)	-0.11 (0.22)	0.06 (0.14)	0.09 (0.21)	-0.27 (0.20)
$v(s=2)$	----	0.47^{*}(0.19)	0.18 (0.17)	-0.02 (0.21)	0.12 (0.13)	0.09 (0.19)	-0.17 (0.18)
$\sigma(s=1)$	----	1.77	1.63	1.16	1.02	1.40	1.18
$\sigma(s=2)$	----	0.55	0.46	0.49	0.38	0.58	0.56
F-test	----	10.36^{++}	12.56^{++}	5.60^{++}	7.20^{++}	5.83^{++}	4.44^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country h, country j, and the United States, respectively; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(b) MS-VAR Estimation Results, 1994-00 (Host: Korea)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.03 (0.02)	0.06^{**} (0.02)	0.04^{**} (0.02)	0.06^{**}(0.02)	0.07^{**} (0.02)
y_{t-1}^j	0.19^{**} (0.02)	----	0.12^{**} (0.02)	0.19^{**} (0.03)	0.12^{**} (0.03)	0.10^{**} (0.02)	0.00 (0.02)
i_t^h	0.00 (0.01)	----	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)
i_{t-1}^h	-0.01 (0.01)	----	-0.01 (0.01)	-0.00 (0.01)	-0.02^{*}(0.01)	-0.01 (0.01)	-0.01 (0.01)
i_t^j	-0.01 (0.00)	----	-0.00 (0.01)	-0.01 (0.08)	0.02 (0.02)	-0.04^{**} (0.02)	-0.13^{**} (0.03)
i_{t-1}^j	0.01 (0.00)	----	-0.01 (0.01)	0.02 (0.08)	-0.05^{*} (0.02)	0.04^{**}(0.02)	0.12^{**} (0.03)
i_t^{US}	0.15 (0.27)	----	0.46 (0.31)	0.42 (0.32)	-0.20 (0.28)	-0.12 (0.4)	-0.55 (0.4)
i_{t-1}^{us}	-0.12 (0.27)	----	-0.48 (0.31)	-0.43 (0.32)	0.19 (0.28)	0.10 (0.4)	0.59 (0.4)
v(s=1)	-0.24 (0.16)	----	0.14 (0.18)	-0.15 (0.24)	0.26 (0.15)	0.18 (0.20)	-0.14 (0.20)
v(s=2)	-0.16 (0.13)	----	0.14 (0.20)	-0.08 (0.22)	0.22 (0.16)	0.17 (0.21)	-0.20 (0.21)
$\sigma(s=1)$	2.26	----	0.46	1.24	0.37	0.55	0.53
$\sigma(s=2)$	0.37	----	1.69	0.46	1.03	1.35	1.19
F-test	37.31^{++}	----	13.5^{++}	7.27^{++}	7.75^{++}	6.02^{++}	5.04^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(c) MS-VAR Estimation Results, 1994-00 (Host: Malaysia)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11^{**} (0.02)	0.05 (0.03)	----	0.14^{**} (0.02)	0.03 (0.02)	0.07^{*}(0.03)	0.06^{*} (0.03)
y_{t-1}^j	0.13^{**} (0.03)	0.12^{**} (0.02)	----	0.14^{**} (0.02)	0.12 (0.03)	0.06^{*}(0.03)	-0.00 (0.03)
i_t^h	0.00 (0.01)	-0.01 (0.01)	----	-0.02 (0.01)	0.00^{**} (0.01)	-0.00 (0.02)	0.01 (0.01)
i_{t-1}^h	0.00 (0.01)	0.00 (0.01)	----	0.02 (0.01)	-0.01 (0.01)	-0.02 (0.02)	0.00 (0.01)
i_t^j	-0.01 (0.00)	-0.02 (0.02)	----	0.01 (0.06)	0.02 (0.02)	-0.05^{**} (0.02)	-0.10^{**} (0.03)
i_{t-1}^j	0.01 (0.00)	0.00 (0.02)	----	0.00 (0.06)	-0.06^{**}(0.02)	0.05^{**} (0.02)	0.09^{**} (0.03)
i_t^{US}	0.17 (0.30)	-0.24 (0.42)	----	0.27 (0.32)	-0.31 (0.28)	-0.15 (0.4)	-0.68 (0.38)
i_{t-1}^{us}	-0.16 (0.30)	0.18 (0.42)	----	-0.31 (0.32)	0.28 (0.28)	0.12 (0.4)	0.70 (0.38)
v(s=1)	-0.28^{*} (0.18)	0.60^{**}(0.23)	----	0.16 (0.20)	0.27 (0.15)	0.22 (0.21)	-0.10 (0.21)
v(s=2)	-0.16 (0.14)	0.55^{*}(0.25)	----	0.06 (0.21)	0.23 (0.15)	0.19 (0.22)	-0.18 (0.21)
σ(s=1)	2.49	0.61	----	0.45	0.40	0.55	0.57
σ(s=2)	0.41	1.99	----	1.28	1.17	1.50	1.36
F-test	36.88^{++}	10.64^{++}	----	8.09^{++}	8.56^{++}	7.44^{++}	5.69^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(d) MS-VAR Estimation Results, 1994-00 (Host: Philippines)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Philippines (y_{t-1}^h)	0.08** (0.02)	-0.01 (0.03)	0.02 (0.03)	----	0.04 (0.02)	0.10**(0.03)	0.06* (0.03)
y_{t-1}^j	0.14** (0.02)	0.12** (0.02)	0.11** (0.03)	----	0.12** (0.03)	0.06* (0.03)	0.01 (0.02)
i_t^h	-0.03 (0.07)	-0.11 (0.08)	-0.14(0.07)	----	-0.16*(0.06)	-0.16*(0.08)	-0.17* (0.07)
i_{t-1}^h	0.03 (0.07)	0.10 (0.08)	0.14*(0.07)	----	0.15*(0.06)	0.17* (0.08)	0.17* (0.07)
i_t^j	0.00 (0.01)	-0.03 (0.02)	-0.01 (0.01)	----	-0.00 (0.02)	-0.04** (0.02)	-0.08* (0.03)
i_{t-1}^j	-0.00 (0.01)	0.02 (0.02)	0.01 (0.01)	----	-0.04*(0.02)	0.04*(0.02)	0.08* (0.03)
i_t^{US}	0.34 (0.27)	-0.00 (0.45)	0.54 (0.33)	----	-0.15 (0.29)	-0.22 (0.4)	-0.42 (0.41)
i_{t-1}^{us}	-0.30 (0.27)	-0.05 (0.45)	-0.58 (0.33)	----	0.11 (0.29)	0.18 (0.4)	0.43 (0.40)
v(s=1)	-0.44* (0.21)	0.62* (0.31)	0.31 (0.21)	----	0.40 (0.20)	0.19 (0.24)	-0.08 (0.24)
v(s=2)	-0.30 (0.18)	0.66* (0.28)	0.24 (0.23)	----	0.34 (0.20)	0.15 (0.25)	-0.02 (0.23)
$\sigma(s=1)$	2.39	1.87	0.45	----	0.38	0.53	1.21
$\sigma(s=2)$	0.38	0.60	1.66	----	1.00	1.42	0.50
F-test	39.56++	9.71++	13.61++	----	6.93++	7.18++	5.86++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(e) MS-VAR Estimation Results, 1994-00 (Host: Singapore)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Singapore (y_{t-1}^h)	0.09** (0.03)	0.11*(0.04)	0.07* (0.03)	0.22** (0.03)	----	0.21** (0.04)	0.08** (0.04)
y_{t-1}^j	0.16** (0.02)	0.10** (0.02)	0.11** (0.03)	0.13** (0.02)	----	0.03 (0.03)	-0.01 (0.03)
i_t^h	-0.03 (0.02)	-0.06 (0.03)	0.05* (0.02)	-0.04* (0.02)	----	0.01 (0.03)	0.00 (0.02)
i_{t-1}^h	0.04 (0.02)	0.04 (0.03)	-0.07** (0.02)	0.02 (0.02)	----	-0.06*(0.03)	-0.04 (0.02)
i_t^j	-0.01* (0.00)	-0.03 (0.02)	0.00 (0.01)	0.07 (0.06)	----	-0.04** (0.02)	-0.09** (0.03)
i_{t-1}^j	0.01* (0.00)	0.01 (0.02)	-0.00 (0.01)	-0.05 (0.06)	----	0.05** (0.02)	0.08** (0.03)
i_t^{US}	0.17 (0.27)	-0.06 (0.42)	0.53 (0.32)	0.36 (0.32)	----	0.06 (0.4)	-0.41 (0.40)
i_{t-1}^{us}	-0.14 (0.27)	0.00 (0.42)	-0.55 (0.32)	-0.39 (0.32)	----	-0.10 (0.4)	0.43 (0.40)
v(s=1)	-0.34* (0.17)	0.75** (0.20)	0.22 (0.17)	-0.11 (0.20)	----	0.38 (0.23)	0.00 (0.22)
v(s=2)	-0.23 (0.13)	0.69**(0.22)	0.21 (0.19)	-0.01 (0.21)	----	0.32 (0.23)	-0.10 (0.21)
σ(s=1)	2.31	0.54	0.46	0.42	----	0.52	0.49
σ(s=2)	0.36	1.81	1.77	1.16	----	1.39	1.18
F-test	41.17++	11.23++	14.81++	7.63++	----	7.15++	5.80++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(f) MS-VAR Estimation Results, 1994-00 (Host: Thailand)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.10^{**} (0.02)	0.04 (0.03)	0.02 (0.02)	0.14^{**} (0.02)	0.05^{*} (0.02)	----	0.06^{**}(0.02)
y_{t-1}^j	0.14^{**} (0.02)	0.11^{**} (0.02)	0.12^{**} (0.03)	0.13^{**} (0.02)	0.12^{**} (0.03)	----	-0.00 (0.03)
i_t^h	-0.02 (0.01)	0.02 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	----	-0.00 (0.02)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.02)	0.02 (0.01)	0.00 (0.01)	0.00 (0.01)	----	-0.00 (0.02)
i_t^j	-0.01^{*} (0.00)	-0.02 (0.02)	-0.00 (0.02)	0.04^{**}(0.07)	0.00 (0.02)	----	-0.13^{**} (0.04)
i_{t-1}^j	0.01 (0.00)	0.00 (0.02)	-0.01 (0.02)	-0.03^{**} (0.07)	-0.05^{*}(0.02)	----	0.11^{**} (0.04)
i_t^{US}	0.10 (0.27)	-0.03 (0.38)	0.65 (0.35)	0.16 (0.33)	-0.13 (0.28)	----	-0.28 (0.40)
i_{t-1}^{us}	-0.07 (0.27)	-0.01 (0.38)	-0.66 (0.35)	-0.18 (0.33)	0.12 (0.28)	----	0.31 (0.40)
v(s=1)	-0.27 (0.17)	0.57^{**}(0.19)	0.06 (0.17)	-0.02 (0.19)	0.19 (0.14)	----	-0.18 (0.20)
v(s=2)	-0.21 (0.13)	0.52^{**} (0.20)	0.01 (0.19)	-0.06 (0.20)	0.14 (0.15)	----	-0.23 (0.20)
$\sigma(s=1)$	2.29	0.51	0.46	0.42	0.37	----	0.51
$\sigma(s=2)$	0.37	1.72	1.64	1.17	0.99	----	1.16
F-test	38.31^{++}	11.37^{++}	12.71^{++}	7.76^{++}	7.16^{++}	----	5.17^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.9(g) MS-VAR Estimation Results, 1994-00 (Host: Hong Kong)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea** (y_t^j)	**Malaysia** (y_t^j)	**Philippines** (y_t^j)	**Singapore** (y_t^j)	**Thailand** (y_t^j)	**Hong Kong** (y_t^j)
Hong Kong (y_{t-1}^h)	0.06** (0.02)	0.06*(0.03)	0.01 (0.02)	0.10** (0.02)	0.05* (0.02)	0.09**(0.03)	----
y_{t-1}^j	0.15** (0.02)	0.10** (0.02)	0.13** (0.03)	0.17** (0.02)	0.12** (0.03)	0.07**(0.03)	----
i_t^h	-0.05 (0.03)	-0.05 (0.04)	-0.04 (0.03)	-0.06* (0.03)	-0.03 (0.03)	-0.08* (0.04)	----
i_{t-1}^h	0.01 (0.03)	0.04 (0.04)	-0.01 (0.03)	0.03 (0.03)	0.02 (0.03)	0.04*(0.04)	----
i_t^j	-0.01 (0.00)	-0.04* (0.02)	0.00 (0.01)	0.01 (0.07)	0.00 (0.02)	-0.04** (0.02)	----
i_{t-1}^j	0.01 (0.00)	0.02 (0.02)	-0.00 (0.01)	0.01 (0.06)	-0.04* (0.02)	0.04* (0.02)	----
i_t^{US}	0.22 (0.28)	-0.06 (0.44)	0.49 (0.33)	0.15 (0.36)	-0.26 (0.31)	-0.00 (0.4)	----
i_{t-1}^{us}	-0.16 (0.28)	0.02 (0.44)	-0.47 (0.33)	-0.16 (0.36)	0.25 (0.31)	0.01 (0.4)	----
v(s=1)	-0.38*(0.17)	0.64**(0.21)	0.12 (0.18)	-0.03 (0.21)	0.24 (0.17)	0.08 (0.21)	----
v(s=2)	-0.26* (0.13)	0.60**(0.23)	-0.13 (0.20)	0.07 (0.20)	0.19 (0.17)	0.11 (0.21)	----
$\sigma(s=1)$	2.41	0.54	0.47	1.22	0.37	0.51	----
$\sigma(s=2)$	0.38	1.86	1.85	0.42	1.01	1.43	----
F-test	40.22++	11.86++	15.49++	8.44++	7.45++	7.86++	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(a) MS-VAR Estimation Results, 1994-01 (Host: Indonesia)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.02 (0.02)	0.02 (0.02)	0.11** (0.02)	0.04* (0.01)	0.07**(0.02)	0.03*(0.02)
y_{t-1}^j	----	0.09** (0.02)	0.13** (0.02)	0.13** (0.02)	0.09** (0.02)	0.07** (0.02)	-0.00 (0.02)
i_t^h	----	-0.01 (0.01)	-0.0 (0.00)	-0.0 (0.01)	0.0 (0.00)	-0.01 (0.01)	-0.0 (0.01)
i_{t-1}^h	----	0.01 (0.01)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)	0.01 (0.01)	0.01 (0.01)
i_t^j	----	-0.02*(0.02)	0.00 (0.01)	0.08 (0.07)	0.02 (0.02)	-0.04* (0.02)	-0.12** (0.03)
i_{t-1}^j	----	0.01 (0.01)	-0.00 (0.01)	-0.07 (0.07)	-0.05**(0.02)	0.04* (0.02)	0.11** (0.03)
i_t^{US}	----	-0.04 (0.38)	-0.07 (0.25)	0.06 (0.28)	-0.06 (0.25)	-0.00 (0.3)	-0.59 (0.3)
i_{t-1}^{us}	----	0.01 (0.38)	0.04 (0.25)	-0.07 (0.28)	0.07 (0.25)	-0.02 (0.3)	0.62 (0.3)
v(s=1)	----	0.41* (0.17)	0.37** (0.14)	-0.17 (0.16)	-0.02 (0.11)	0.16 (0.16)	-0.27 (0.16)
v(s=2)	----	0.44** (0.15)	0.30** (0.11)	-0.08 (0.14)	0.05 (0.10)	0.18 (0.14)	-0.17 (0.14)
σ(s=1)	----	1.76	1.62	1.22	1.01	1.39	1.17
σ(s=2)	----	0.59	0.45	0.50	0.39	0.60	0.57
F-test	----	8.90++	12.96++	5.95++	6.71++	5.37++	4.21++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(b) MS-VAR Estimation Results, 1994-01 (Host: Korea)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.03 (0.02)	0.05^{**} (0.02)	0.04^{**} (0.01)	0.05^{*}(0.02)	0.06^{**} (0.02)
y_{t-1}^j	0.17^{**} (0.02)	----	0.12^{**} (0.02)	0.18^{**} (0.02)	0.11^{**} (0.02)	0.08^{**} (0.02)	0.00 (0.02)
i_t^h	0.01 (0.01)	----	0.01 (0.01)	0.00 (0.01)	0.02 (0.01)	0.01 (0.01)	0.02 (0.01)
i_{t-1}^h	-0.01 (0.01)	----	-0.01 (0.01)	-0.00 (0.01)	-0.02^{*}(0.01)	-0.01 (0.01)	-0.02 (0.01)
i_t^j	-0.01 (0.00)	----	-0.00 (0.01)	-0.04 (0.06)	0.02 (0.02)	-0.05^{**} (0.02)	-0.13^{**} (0.04)
i_{t-1}^j	0.01 (0.00)	----	-0.01 (0.01)	0.06 (0.06)	-0.05^{*} (0.02)	0.04^{**}(0.02)	0.12^{**} (0.03)
i_t^{US}	-0.18 (0.27)	----	0.11 (0.24)	0.35 (0.25)	0.06 (0.24)	0.27 (0.3)	-0.22 (0.4)
i_{t-1}^{us}	0.20 (0.27)	----	-0.13 (0.24)	-0.34 (0.26)	-0.05 (0.24)	-0.30 (0.3)	0.25 (0.4)
v(s=1)	-0.15 (0.14)	----	0.22 (0.11)	-0.22 (0.14)	0.09 (0.10)	0.23 (0.15)	-0.14 (0.31)
v(s=2)	-0.07 (0.11)	----	0.20 (0.14)	-0.28 (0.17)	0.04 (0.11)	0.25 (0.16)	-0.21 (0.31)
$\sigma(s=1)$	2.23	----	0.44	0.47	0.38	0.57	0.56
$\sigma(s=2)$	0.40	----	1.69	1.31	1.04	1.42	1.26
F-test	31.08^{++}	----	14.75^{++}	7.77^{++}	7.49^{++}	6.21^{++}	5.06^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(c) MS-VAR Estimation Results, 1994-01 (Host: Malaysia)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.12^{**} (0.02)	0.04 (0.03)	----	0.15^{**} (0.02)	0.04 (0.02)	0.07^{**} (0.03)	0.05^{*} (0.02)
y_{t-1}^j	0.10^{**} (0.02)	0.09^{**} (0.02)	----	0.13^{**} (0.02)	0.09 (0.03)	0.05^{*}(0.02)	-0.00 (0.02)
i_t^h	0.00 (0.01)	-0.00 (0.01)	----	-0.02 (0.01)	0.01^{**} (0.01)	-0.00 (0.02)	0.01 (0.01)
i_{t-1}^h	0.00 (0.01)	0.00 (0.01)	----	0.02 (0.01)	-0.00 (0.01)	-0.02 (0.02)	0.00 (0.01)
i_t^j	-0.01^{*} (0.00)	-0.01 (0.02)	----	0.02 (0.06)	0.03 (0.02)	-0.05^{**} (0.02)	-0.10^{**} (0.03)
i_{t-1}^j	0.01^{*} (0.01)	-0.00 (0.01)	----	-0.00 (0.06)	-0.06^{**}(0.02)	0.05^{**} (0.02)	0.08^{**} (0.03)
i_t^{US}	-0.40 (0.25)	-0.11 (0.37)	----	0.14 (0.25)	-0.18 (0.23)	0.08 (0.3)	-0.69^{*} (0.30)
i_{t-1}^{us}	0.40 (0.25)	0.05 (0.37)	----	-0.16 (0.25)	0.17 (0.23)	-0.10 (0.3)	0.70^{*} (0.31)
v(s=1)	-0.17^{*} (0.18)	0.55^{**}(0.17)	----	-0.08 (0.13)	0.14 (0.10)	0.26 (0.21)	-0.10 (0.15)
v(s=2)	-0.03 (0.14)	0.51^{**} (0.19)	----	-0.18 (0.15)	0.09 (0.11)	0.23 (0.22)	-0.17 (0.15)
$\sigma(s=1)$	2.48	0.66	----	0.46	0.42	0.61	0.58
$\sigma(s=2)$	0.45	1.98	----	1.32	1.16	1.50	1.32
F-test	30.37^{++}	9.0^{++}	----	8.23^{++}	7.63^{++}	6.05^{++}	5.18^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(d) MS-VAR Estimation Results, 1994-01 (Host: Philippines)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.06** (0.02)	0.02 (0.03)	0.01 (0.02)	----	0.03 (0.02)	0.09** (0.03)	0.04 (0.03)
y_{t-1}^j	0.14** (0.02)	0.10** (0.02)	0.12** (0.02)	----	0.10** (0.02)	0.05* (0.03)	0.01 (0.02)
i_t^h	-0.03 (0.07)	-0.13 (0.08)	-0.12 (0.06)	----	-0.16** (0.05)	-0.15* (0.08)	-0.15* (0.07)
i_{t-1}^h	0.03 (0.07)	0.13 (0.08)	0.12* (0.06)	----	0.16** (0.05)	0.16* (0.08)	0.15* (0.07)
i_t^j	-0.00 (0.01)	-0.01 (0.02)	-0.01 (0.01)	----	-0.00 (0.02)	-0.05** (0.02)	-0.08* (0.03)
i_{t-1}^j	0.01 (0.01)	0.01 (0.02)	0.01 (0.01)	----	-0.03* (0.02)	0.04** (0.02)	0.07* (0.03)
i_t^{US}	-0.20 (0.25)	0.03 (0.37)	-0.10 (0.28)	----	0.02 (0.23)	0.25 (0.3)	-0.29 (0.33)
i_{t-1}^{us}	0.21 (0.25)	-0.07 (0.37)	0.06 (0.29)	----	-0.02 (0.23)	-0.29 (0.3)	0.31 (0.33)
v(s=1)	-0.21 (0.17)	0.45* (0.19)	0.30* (0.12)	----	0.08 (0.12)	0.20 (0.17)	-0.11 (0.16)
v(s=2)	-0.05 (0.13)	0.43* (0.22)	0.22 (0.15)	----	0.01 (0.13)	0.17 (0.18)	-0.17 (0.17)
$\sigma(s=1)$	2.40	0.64	0.43	----	0.39	0.54	0.53
$\sigma(s=2)$	0.43	1.90	1.64	----	1.00	1.43	1.22
F-test	31.15++	8.81++	14.55++	----	6.57++	7.01++	5.30++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(e) MS-VAR Estimation Results, 1994-01 (Host: Singapore)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Singapore (y_{t-1}^h)	0.09^{**} (0.03)	0.10^{**} (0.04)	0.06^{*} (0.03)	0.20^{**} (0.03)	----	0.18^{**} (0.03)	0.06^{**} (0.03)
y_{t-1}^j	0.13^{**} (0.02)	0.08^{**} (0.02)	0.12^{**} (0.03)	0.13^{**} (0.02)	----	0.03 (0.02)	-0.00 (0.03)
i_t^h	-0.03 (0.02)	-0.06^{*} (0.03)	0.06^{**} (0.02)	-0.04 (0.02)	----	0.03 (0.03)	0.00 (0.02)
i_{t-1}^h	0.04 (0.02)	0.04 (0.03)	-0.08^{**} (0.02)	0.02 (0.02)	----	-0.07^{**} (0.03)	-0.04 (0.02)
i_t^j	-0.01 (0.00)	-0.02 (0.02)	0.00 (0.01)	0.06 (0.06)	----	-0.04^{**} (0.02)	-0.08^{**} (0.03)
i_{t-1}^j	0.01 (0.00)	0.00 (0.02)	-0.00 (0.01)	-0.04 (0.06)	----	0.05^{**} (0.02)	0.08^{**} (0.03)
i_t^{US}	-0.10 (0.27)	0.06 (0.37)	0.09 (0.25)	0.34 (0.25)	----	0.41 (0.3)	-0.20 (0.32)
i_{t-1}^{us}	0.11 (0.27)	-0.10 (0.37)	-0.12 (0.25)	-0.34 (0.25)	----	-0.44 (0.3)	0.23 (0.32)
v(s=1)	-0.18 (0.14)	0.56^{**} (0.20)	0.25^{*} (0.11)	-0.14 (0.14)	----	0.29^{*} (0.31)	-0.22 (0.15)
v(s=2)	-0.06 (0.11)	0.50^{**}(0.22)	0.21 (0.13)	-0.23 (0.15)	----	0.24 (0.31)	-0.13 (0.15)
$\sigma(s=1)$	2.26	0.58	0.44	0.42	----	0.53	1.19
$\sigma(s=2)$	0.39	1.80	1.74	1.19	----	1.38	0.51
F-test	33.58^{++}	9.63^{++}	15.64^{++}	8.03^{++}	----	6.78^{++}	5.44^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(f) MS-VAR Estimation Results, 1994-01 (Host: Thailand)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.10** (0.02)	0.04 (0.03)	0.03 (0.02)	0.12** (0.02)	0.05** (0.02)	----	0.05* (0.02)
y_{t-1}^j	0.13** (0.02)	0.09** (0.02)	0.12** (0.02)	0.14** (0.02)	0.10** (0.02)	----	-0.00 (0.02)
i_t^h	-0.02 (0.01)	0.02 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	----	0.00 (0.02)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.02)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	----	0.00 (0.02)
i_t^j	-0.01* (0.00)	-0.01 (0.01)	-0.00 (0.02)	0.03 (0.07)	0.01 (0.02)	----	-0.12** (0.04)
i_{t-1}^j	0.01 (0.00)	-0.01 (0.01)	-0.01 (0.02)	-0.01 (0.07)	-0.05** (0.02)	----	0.10** (0.03)
i_t^{US}	0.36 (0.26)	0.12 (0.34)	0.06 (0.24)	0.32 (0.24)	0.14 (0.23)	----	-0.15 (0.32)
i_{t-1}^{us}	0.37 (0.26)	-0.17 (0.34)	-0.09 (0.24)	-0.33 (0.24)	-0.14 (0.23)	----	0.17 (0.32)
v(s=1)	-0.14 (0.15)	0.58**(0.16)	0.23 (0.11)	-0.14 (0.14)	0.08 (0.10)	----	-0.13 (0.15)
v(s=2)	-0.06 (0.11)	0.54** (0.18)	0.16 (0.13)	-0.21 (0.15)	0.02 (0.11)	----	-0.18 (0.15)
$\sigma(s=1)$	2.29	0.60	0.44	0.43	0.38	----	0.55
$\sigma(s=2)$	0.41	1.81	1.63	1.22	1.00	----	1.19
F-test	31.20^{++}	9.10^{++}	13.72^{++}	8.05^{++}	6.93^{++}	----	4.68^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.10(g) MS-VAR Estimation Results, 1994-01 (Host: Hong Kong)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05** (0.02)	0.06*(0.03)	0.01 (0.02)	0.09** (0.02)	0.05* (0.02)	0.08**(0.03)	----
y_{t-1}^j	0.13** (0.02)	0.09** (0.02)	0.13** (0.02)	0.16** (0.02)	0.09** (0.03)	0.06* (0.02)	----
i_t^h	-0.05 (0.03)	-0.08 (0.05)	-0.03 (0.03)	-0.05 (0.03)	-0.01 (0.03)	-0.05 (0.04)	----
i_{t-1}^h	-0.00 (0.03)	0.08 (0.05)	-0.02 (0.03)	0.03 (0.03)	0.01 (0.03)	0.01 (0.04)	----
i_t^j	-0.01 (0.00)	-0.02 (0.02)	0.00 (0.01)	0.00 (0.06)	0.01 (0.02)	-0.04** (0.02)	----
i_{t-1}^j	0.01 (0.00)	0.01 (0.01)	-0.00 (0.01)	0.02 (0.06)	-0.04* (0.02)	0.04** (0.02)	----
i_t^{US}	-0.14 (0.26)	0.17 (0.36)	0.02 (0.25)	0.22 (0.27)	0.01 (0.25)	0.34 (0.3)	----
i_{t-1}^{us}	0.18 (0.26)	-0.23 (0.36)	-0.01 (0.25)	-0.23 (0.27)	-0.01 (0.25)	-0.34 (0.3)	----
v(s=1)	-0.27*(0.15)	0.56**(0.18)	0.15 (0.12)	-0.09 (0.14)	0.03 (0.12)	0.15 (0.15)	----
v(s=2)	-0.13* (0.12)	0.53**(0.20)	0.12 (0.14)	-0.19 (0.15)	0.09 (0.12)	0.18 (0.15)	----
$\sigma(s=1)$	2.35	0.62	0.44	0.43	1.03	0.54	----
$\sigma(s=2)$	0.41	1.97	1.78	1.27	0.38	1.47	----
F-test	32.85++	10.10++	16.37++	8.72++	7.35++	7.41++	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(a) MS-VAR Estimation Results, 1994-02 (Host: Indonesia)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Indonesia (y_{t-1}^h)	----	0.01 (0.02)	0.02 (0.02)	0.10^{**} (0.02)	0.02 (0.01)	0.07^{**}(0.02)	0.02^{*}(0.02)
y_{t-1}^j	----	0.09^{**} (0.02)	0.14^{**} (0.02)	0.14^{**} (0.02)	0.09^{**} (0.02)	0.06^{**} (0.02)	0.00 (0.02)
i_t^h	----	-0.01 (0.01)	-0.0 (0.02)	0.0 (0.00)	0.0 (0.00)	-0.01 (0.01)	-0.0 (0.00)
i_{t-1}^h	----	0.01 (0.01)	-0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)	0.01 (0.01)	0.00 (0.00)
i_t^j	----	-0.02 (0.02)	0.00 (0.00)	0.06 (0.07)	0.03 (0.02)	-0.04^{**} (0.02)	-0.13^{**} (0.03)
i_{t-1}^j	----	0.01 (0.02)	-0.00 (0.01)	-0.04 (0.07)	-0.05^{**}(0.02)	0.04^{**} (0.02)	0.12^{**} (0.03)
i_t^{US}	----	-0.01 (0.37)	-0.05 (0.24)	-0.04 (0.26)	0.05 (0.23)	-0.08 (0.3)	-0.59^{*} (0.3)
i_{t-1}^{us}	----	0.00 (0.37)	0.04 (0.24)	0.02 (0.26)	-0.03 (0.23)	0.06 (0.3)	0.61^{*} (0.3)
v(s=1)	----	0.15^{*} (0.13)	0.21^{*} (0.10)	-0.11 (0.10)	-0.11 (0.08)	0.15 (0.12)	-0.22 (0.12)
v(s=2)	----	0.18^{**} (0.09)	0.13^{*} (0.06)	-0.03 (0.07)	-0.08 (0.06)	0.15 (0.08)	-0.13 (0.09)
$\sigma(s=1)$	----	1.82	1.63	1.24	1.03	1.41	1.19
$\sigma(s=2)$	----	0.64	0.43	0.49	0.41	0.60	0.56
F-test	----	8.09^{++}	14.37^{++}	6.40^{++}	6.31^{++}	5.52^{++}	4.52^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(b) MS-VAR Estimation Results, 1994-02 (Host: Korea)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.02 (0.01)	0.05** (0.01)	0.02** (0.01)	0.05*(0.02)	0.05** (0.02)
y_{t-1}^j	0.16** (0.02)	----	0.13** (0.02)	0.17** (0.02)	0.10** (0.02)	0.08** (0.02)	0.00 (0.02)
i_t^h	0.01 (0.01)	----	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
i_{t-1}^h	-0.02 (0.01)	----	-0.01 (0.01)	-0.00 (0.01)	-0.01*(0.01)	-0.01 (0.01)	-0.02 (0.01)
i_t^j	-0.01* (0.00)	----	-0.00 (0.01)	-0.06 (0.06)	0.02 (0.02)	-0.05** (0.02)	-0.13** (0.03)
i_{t-1}^j	0.01 (0.01)	----	-0.01 (0.01)	0.07 (0.06)	-0.05* (0.02)	0.04**(0.02)	0.13** (0.03)
i_t^{US}	-0.25 (0.26)	----	0.10 (0.23)	0.23 (0.24)	0.18 (0.22)	0.13 (0.3)	-0.27 (0.3)
i_{t-1}^{us}	0.25 (0.26)	----	-0.11 (0.23)	-0.24 (0.24)	-0.16 (0.22)	-0.16 (0.3)	0.29 (0.3)
v(s=1)	-0.02 (0.12)	----	0.07 (0.05)	-0.03 (0.07)	-0.07 (0.06)	0.21** (0.08)	-0.09 (0.09)
v(s=2)	0.09 (0.07)	----	0.04 (0.09)	-0.09 (0.09)	-0.10 (0.07)	0.21* (0.10)	-0.16 (0.11)
$\sigma(s=1)$	2.30	----	0.42	0.47	0.39	0.56	0.56
$\sigma(s=2)$	0.45	----	1.66	1.31	1.04	1.43	1.28
F-test	26.12++	----	15.62++	7.77++	7.11++	6.52++	5.22++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(c) MS-VAR Estimation Results, 1994-02 (Host: Malaysia)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.12** (0.03)	0.04 (0.03)	----	0.14** (0.02)	0.04 (0.02)	0.07** (0.03)	0.05* (0.02)
y_{t-1}^j	0.11** (0.02)	0.08** (0.02)	----	0.13** (0.02)	0.09 (0.02)	0.05*(0.02)	-0.00 (0.02)
i_t^h	0.00 (0.01)	-0.00 (0.01)	----	-0.02 (0.01)	0.01** (0.01)	-0.00 (0.02)	0.01 (0.01)
i_{t-1}^h	0.00 (0.01)	0.00 (0.01)	----	0.02 (0.01)	-0.00 (0.01)	-0.02 (0.02)	0.00 (0.01)
i_t^j	-0.01* (0.01)	-0.01 (0.02)	----	0.02 (0.06)	0.03 (0.02)	-0.05** (0.02)	-0.10** (0.03)
i_{t-1}^j	0.01* (0.01)	0.01 (0.01)	----	0.00 (0.06)	-0.06**(0.02)	0.05** (0.02)	0.09** (0.03)
i_t^{US}	-0.40 (0.26)	-0.20 (0.37)	----	0.04 (0.24)	-0.11 (0.23)	-0.02 (0.3)	-0.73* (0.31)
i_{t-1}^{us}	0.39 (0.26)	0.17 (0.37)	----	-0.07 (0.24)	0.12 (0.23)	-0.00 (0.3)	0.74* (0.31)
v(s=1)	-0.08 (0.14)	0.20*(0.09)	----	-0.00 (0.06)	-0.03 (0.06)	0.20* (0.08)	-0.08 (0.09)
v(s=2)	0.07 (0.07)	0.17 (0.13)	----	-0.11 (0.09)	-0.06 (0.08)	0.15 (0.10)	-0.16 (0.10)
$\sigma(s=1)$	2.49	0.70	----	0.46	0.43	0.60	0.57
$\sigma(s=2)$	0.49	1.95	----	1.29	1.14	1.47	1.27
F-test	25.82^{++}	7.76^{++}	----	7.86^{++}	7.03^{++}	6.0^{++}	4.96^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(d) MS-VAR Estimation Results, 1994-02 (Host: Philippines)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.06* (0.02)	0.01 (0.03)	0.01 (0.02)	----	0.02 (0.02)	0.08** (0.03)	0.01 (0.02)
y_{t-1}^j	0.13** (0.02)	0.09** (0.02)	0.12** (0.02)	----	0.09** (0.02)	0.05* (0.02)	0.01 (0.02)
i_t^h	-0.08 (0.07)	-0.15 (0.08)	-0.12 (0.06)	----	-0.16** (0.05)	-0.14 (0.07)	-0.17* (0.07)
i_{t-1}^h	0.07 (0.07)	0.15 (0.08)	0.13* (0.06)	----	0.17** (0.05)	0.15* (0.07)	0.17* (0.07)
i_t^j	-0.01 (0.01)	-0.02 (0.02)	-0.01 (0.01)	----	-0.00 (0.02)	-0.05** (0.02)	-0.09** (0.03)
i_{t-1}^j	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	----	-0.03 (0.02)	0.04** (0.02)	0.09** (0.03)
i_t^{US}	-0.27 (0.26)	-0.06 (0.37)	-0.13 (0.23)	----	0.11 (0.22)	0.11 (0.3)	-0.39 (0.31)
i_{t-1}^{us}	0.27 (0.26)	0.04 (0.37)	0.11 (0.23)	----	-0.10 (0.22)	-0.15 (0.3)	0.40 (0.31)
v(s=1)	-0.13 (0.13)	0.14 (0.09)	0.05 (0.05)	----	-0.11 (0.06)	0.16* (0.08)	-0.09 (0.09)
v(s=2)	0.06 (0.07)	0.10 (0.13)	-0.04 (0.09)	----	-0.16 (0.07)	0.13 (0.10)	-0.15 (0.10)
σ(s=1)	2.42	0.68	0.41	----	0.40	0.54	0.53
σ(s=2)	0.47	1.90	1.61	----	1.00	1.41	1.21
F-test	26.51++	7.81++	15.42++	----	6.25++	6.82++	5.21++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(e) MS-VAR Estimation Results, 1994-02 (Host: Singapore)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.10** (0.03)	0.11** (0.04)	0.06** (0.02)	0.1820** (0.02)	----	0.17** (0.03)	0.06 (0.03)
y_{t-1}^j	0.12** (0.02)	0.07** (0.02)	0.12** (0.02)	0.13** (0.02)	----	0.03 (0.02)	-0.00 (0.02)
i_t^h	-0.03 (0.02)	-0.06* (0.03)	0.06** (0.02)	-0.04* (0.02)	----	0.03 (0.03)	-0.00 (0.02)
i_{t-1}^h	0.04 (0.02)	0.05 (0.03)	-0.08** (0.02)	0.02 (0.02)	----	-0.07** (0.03)	-0.03 (0.02)
i_t^j	-0.01* (0.00)	-0.02 (0.02)	0.00 (0.01)	0.05 (0.06)	----	-0.04** (0.02)	-0.09** (0.03)
i_{t-1}^j	0.01 (0.00)	0.01 (0.02)	-0.00 (0.01)	-0.03 (0.06)	----	0.05** (0.02)	0.09** (0.03)
i_t^{US}	-0.21 (0.25)	0.04 (0.35)	0.04 (0.26)	0.19 (0.24)	----	0.27 (0.3)	-0.26 (0.30)
i_{t-1}^{us}	0.20 (0.25)	-0.05 (0.35)	-0.04 (0.26)	-0.20 (0.24)	----	-0.28 (0.3)	0.29 (0.31)
v(s=1)	-0.04 (0.12)	0.21** (0.09)	0.05 (0.05)	-0.05 (0.06)	----	0.16* (0.29)	-0.14 (0.09)
v(s=2)	0.09 (0.07)	0.14 (0.11)	0.01 (0.09)	-0.14 (0.08)	----	0.12 (0.29)	-0.22* (0.09)
$\sigma(s=1)$	2.28	0.60	0.41	0.42	----	0.52	0.51
$\sigma(s=2)$	0.43	1.81	1.70	1.18	----	1.37	1.19
F-test	28.11++	9.10++	17.19++	7.89++	----	6.94++	5.44++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(f) MS-VAR Estimation Results, 1994-02 (Host: Thailand)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea** (y_t^j)	**Malaysia** (y_t^j)	**Philippines** (y_t^j)	**Singapore** (y_t^j)	**Thailand** (y_t^j)	**Hong Kong** (y_t^j)
Thailand (y_{t-1}^h)	0.10** (0.02)	0.04 (0.03)	0.03 (0.02)	0.12** (0.02)	0.05** (0.02)	----	0.04* (0.02)
y_{t-1}^j	0.12** (0.02)	0.08** (0.02)	0.12** (0.02)	0.14** (0.02)	0.09** (0.02)	----	0.00 (0.02)
i_t^h	-0.02 (0.01)	0.02 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	----	-0.00 (0.02)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.02)	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)	----	0.00 (0.02)
i_t^j	-0.01* (0.01)	-0.01 (0.01)	-0.00 (0.02)	0.03 (0.06)	0.01 (0.02)	----	-0.12** (0.03)
i_{t-1}^j	0.01 (0.01)	0.00 (0.01)	-0.01 (0.02)	-0.01 (0.06)	-0.05* (0.02)	----	0.11** (0.03)
i_t^{US}	0.43 (0.25)	0.02 (0.34)	0.06 (0.22)	0.16 (0.24)	0.22 (0.22)	----	-0.20 (0.30)
i_{t-1}^{us}	0.42 (0.25)	-0.04 (0.34)	-0.07 (0.22)	-0.18 (0.24)	-0.20 (0.22)	----	0.22 (0.30)
v(s=1)	-0.01 (0.13)	0.24** (0.09)	0.10 (0.06)	-0.03 (0.06)	-0.06 (0.06)	----	-0.09 (0.09)
v(s=2)	0.08 (0.07)	0.19 (0.12)	0.03 (0.09)	-0.10 (0.08)	-0.10 (0.07)	----	-0.15 (0.10)
σ(s=1)	2.32	0.64	0.41	0.43	0.39	----	0.53
σ(s=2)	0.46	1.82	1.59	1.21	0.99	----	1.16
F-test	25.44++	8.09++	15.04++	7.92++	6.44++	----	4.79++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.11(g) MS-VAR Estimation Results, 1994-02 (Host: Hong Kong)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05* (0.02)	0.06*(0.03)	0.02 (0.02)	0.08** (0.02)	0.04 (0.02)	0.07**(0.02)	----
y_{t-1}^j	0.13** (0.02)	0.08** (0.02)	0.14** (0.02)	0.16** (0.02)	0.09** (0.03)	0.06* (0.02)	----
i_t^h	-0.05 (0.03)	-0.08 (0.05)	-0.01 (0.03)	-0.05 (0.03)	-0.01 (0.03)	-0.05 (0.04)	----
i_{t-1}^h	-0.01 (0.03)	0.09* (0.05)	-0.02 (0.03)	0.03 (0.03)	0.02 (0.03)	0.01 (0.04)	----
i_t^j	-0.01 (0.00)	-0.02 (0.01)	0.00 (0.01)	-0.00 (0.06)	0.01 (0.02)	-0.04** (0.02)	----
i_{t-1}^j	0.01* (0.00)	0.01 (0.01)	-0.00 (0.01)	0.02 (0.06)	-0.04 (0.02)	0.04** (0.02)	----
i_t^{US}	-0.19 (0.25)	0.11 (0.36)	-0.01 (0.25)	0.08 (0.26)	0.12 (0.24)	0.20 (0.3)	----
i_{t-1}^{us}	0.23 (0.25)	-0.14 (0.36)	0.03 (0.25)	-0.09 (0.26)	-0.11 (0.24)	-0.19 (0.3)	----
$v(s=1)$	-0.21*(0.14)	0.24* (0.12)	-0.02 (0.07)	-0.05 (0.08)	-0.07 (0.07)	0.10 (0.15)	----
$v(s=2)$	-0.06* (0.09)	0.21 (0.14)	-0.05 (0.10)	-0.16 (0.09)	-0.11 (0.08)	0.12 (0.15)	----
$\sigma(s=1)$	2.39	0.67	0.41	0.44	0.40	0.53	----
$\sigma(s=2)$	0.45	2.03	1.70	1.27	1.03	1.43	----
F-test	28.21++	9.18++	17.19++	8.33++	6.63++	7.28++	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(a) MS-VAR Estimation Results, 1994-03 (Host: Indonesia)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	-0.00 (0.02)	0.02 (0.01)	0.10^{**} (0.02)	0.02 (0.01)	0.06^{**}(0.02)	0.02 (0.02)
y_{t-1}^j	----	0.08^{**} (0.02)	0.14^{**} (0.02)	0.14^{**} (0.02)	0.09^{**} (0.02)	0.06^{**} (0.02)	0.01 (0.02)
i_t^h	----	-0.01 (0.01)	-0.0 (0.00)	0.0 (0.00)	-0.00 (0.00)	-0.01 (0.01)	-0.0 (0.00)
i_{t-1}^h	----	0.01 (0.01)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	0.01 (0.01)	0.00 (0.00)
i_t^j	----	-0.02 (0.01)	0.00 (0.01)	0.06 (0.07)	0.03 (0.02)	-0.05^{**} (0.02)	-0.13^{**} (0.03)
i_{t-1}^j	----	0.01 (0.01)	-0.00 (0.01)	-0.05 (0.07)	-0.05^{**}(0.02)	0.04^{**} (0.02)	0.12^{**} (0.03)
i_t^{US}	----	0.00 (0.37)	-0.12 (0.25)	-0.05 (0.26)	-0.00 (0.23)	-0.02 (0.3)	-0.58^{*} (0.3)
i_{t-1}^{us}	----	-0.00 (0.37)	0.11 (0.25)	0.03 (0.26)	0.01 (0.23)	-0.01 (0.3)	0.60^{*} (0.3)
v(s=1)	----	0.07^{*} (0.11)	0.20^{*} (0.09)	-0.07 (0.10)	-0.05 (0.07)	0.21^{*} (0.11)	-0.15 (0.10)
v(s=2)	----	0.09^{**} (0.07)	0.12^{**} (0.04)	0.01 (0.07)	-0.02 (0.04)	0.20^{**} (0.06)	-0.07 (0.08)
$\sigma(s=1)$	----	1.85	1.61	1.25	1.05	1.43	1.20
$\sigma(s=2)$	----	0.67	0.41	0.49	0.43	0.59	0.55
F-test	----	7.62^{++}	15.42^{++}	6.51^{++}	5.96^{++}	5.87^{++}	4.76^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(b) MS-VAR Estimation Results, 1994-03 (Host: Korea)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.02 (0.01)	0.05** (0.01)	0.02 (0.01)	0.04*(0.02)	0.04** (0.02)
y_{t-1}^j	0.14** (0.02)	----	0.13** (0.02)	0.17** (0.02)	0.09** (0.02)	0.08** (0.02)	0.01 (0.02)
i_t^h	0.02 (0.01)	----	0.01 (0.01)	-0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.02 (0.01)
i_{t-1}^h	-0.02 (0.01)	----	-0.01 (0.01)	-0.00 (0.01)	-0.01*(0.01)	-0.01 (0.01)	-0.02 (0.01)
i_t^j	-0.01 (0.01)	----	-0.00 (0.01)	-0.04 (0.06)	0.02 (0.02)	-0.05** (0.02)	-0.14** (0.03)
i_{t-1}^j	0.01 (0.01)	----	-0.01 (0.01)	0.06 (0.06)	-0.05* (0.02)	0.05**(0.02)	0.13** (0.03)
i_t^{US}	-0.28 (0.26)	----	0.02 (0.23)	0.21 (0.24)	0.16 (0.22)	0.17 (0.3)	-0.25 (0.3)
i_{t-1}^{us}	0.28 (0.26)	----	-0.04 (0.23)	-0.23 (0.24)	-0.16 (0.22)	-0.20 (0.3)	0.26 (0.3)
v(s=1)	0.01 (0.11)	----	0.09* (0.04)	0.02 (0.05)	-0.01 (0.04)	0.23** (0.08)	-0.05 (0.09)
v(s=2)	0.12* (0.05)	----	0.05 (0.08)	-0.04 (0.08)	-0.04 (0.06)	0.23** (0.10)	-0.11 (0.11)
$\sigma(s=1)$	2.34	----	0.40	0.47	0.42	0.56	0.54
$\sigma(s=2)$	0.48	----	1.64	1.31	1.08	1.43	1.27
F-test	23.77^{++}	----	16.81^{++}	7.77^{++}	6.61^{++}	6.52^{++}	5.53^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(c) MS-VAR Estimation Results, 1994-03 (Host: Malaysia)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.12^{**} (0.03)	0.03 (0.03)	----	0.14^{**} (0.02)	0.03 (0.02)	0.09^{**} (0.03)	0.04^{*} (0.02)
y_{t-1}^j	0.11^{**} (0.02)	0.07^{**} (0.02)	----	0.13^{**} (0.02)	0.09^{**} (0.02)	0.05^{*}(0.02)	0.01 (0.02)
i_t^h	0.00 (0.01)	-0.01 (0.01)	----	-0.02 (0.01)	0.01 (0.01)	-0.00 (0.02)	0.01 (0.01)
i_{t-1}^h	0.00 (0.01)	0.00 (0.01)	----	0.02 (0.01)	-0.00 (0.01)	-0.02 (0.02)	0.00 (0.01)
i_t^j	-0.01 (0.01)	-0.01 (0.01)	----	0.03 (0.06)	0.03 (0.02)	-0.05^{**} (0.02)	-0.10^{**} (0.03)
i_{t-1}^j	0.01^{*} (0.01)	0.01 (0.02)	----	-0.01 (0.06)	-0.06^{**}(0.02)	0.05^{**} (0.02)	0.09^{**} (0.03)
i_t^{US}	-0.42 (0.27)	-0.22 (0.38)	----	0.01 (0.24)	-0.19 (0.23)	0.04 (0.3)	-0.78^{**} (0.30)
i_{t-1}^{us}	0.41 (0.27)	0.21 (0.38)	----	-0.05 (0.24)	0.19 (0.23)	-0.07 (0.3)	0.79^{**} (0.30)
v(s=1)	-0.02 (0.13)	0.13^{*}(0.07)	----	0.02 (0.04)	0.01 (0.04)	0.25^{**} (0.06)	-0.05 (0.09)
v(s=2)	0.11^{*} (0.05)	0.09 (0.11)	----	-0.08 (0.08)	-0.02 (0.07)	0.19^{*} (0.09)	-0.12 (0.10)
$\sigma(s=1)$	2.46	0.71	----	0.47	0.44	0.58	0.55
$\sigma(s=2)$	0.51	1.91	----	1.27	1.12	1.44	1.24
F-test	23.27^{++}	7.24^{++}	----	7.30^{++}	6.48^{++}	6.16^{++}	5.08^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(d) MS-VAR Estimation Results, 1994-03 (Host: Philippines)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.05* (0.02)	0.01 (0.03)	0.00 (0.02)	----	0.02 (0.02)	0.08** (0.02)	0.00 (0.02)
y_{t-1}^j	0.12** (0.02)	0.08** (0.02)	0.13** (0.02)	----	0.08** (0.02)	0.05** (0.02)	0.03 (0.02)
i_t^h	-0.13 (0.07)	-0.16* (0.08)	-0.14* (0.06)	----	-0.20** (0.05)	-0.14* (0.07)	-0.19** (0.07)
i_{t-1}^h	0.13 (0.07)	0.17* (0.08)	0.15* (0.06)	----	0.21** (0.05)	0.15* (0.07)	0.20** (0.07)
i_t^j	-0.01 (0.01)	-0.02 (0.01)	-0.01 (0.01)	----	-0.00 (0.02)	-0.05** (0.02)	-0.10** (0.03)
i_{t-1}^j	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	----	-0.03 (0.02)	0.04** (0.02)	0.09** (0.03)
i_t^{US}	-0.31 (0.26)	-0.07 (0.37)	-0.21 (0.21)	----	0.08 (0.22)	0.15 (0.3)	-0.37 (0.31)
i_{t-1}^{us}	0.31 (0.26)	0.06 (0.37)	0.18 (0.21)	----	-0.08 (0.22)	-0.19 (0.3)	0.38 (0.31)
v(s=1)	-0.08 (0.13)	0.07 (0.07)	0.06 (0.04)	----	-0.04 (0.04)	0.19** (0.08)	-0.05 (0.07)
v(s=2)	0.11* (0.05)	0.04 (0.11)	-0.02 (0.08)	----	-0.10 (0.06)	0.16 (0.10)	-0.11 (0.09)
$\sigma(s=1)$	2.44	0.69	0.39	----	0.41	0.54	0.51
$\sigma(s=2)$	0.49	1.90	1.58	----	1.00	1.41	1.21
F-test	24.80++	7.58++	16.41++	----	5.95++	6.82++	5.63++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(e) MS-VAR Estimation Results, 1994-03 (Host: Singapore)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Singapore (y_{t-1}^h)	0.11** (0.03)	0.13** (0.03)	0.06** (0.02)	0.17** (0.02)	----	0.17** (0.03)	0.06 (0.03)
y_{t-1}^j	0.11** (0.02)	0.06** (0.02)	0.12** (0.02)	0.12** (0.02)	----	0.03 (0.02)	0.00 (0.02)
i_t^h	-0.03 (0.02)	-0.07* (0.03)	0.07** (0.02)	-0.04* (0.02)	----	0.03 (0.03)	-0.00 (0.02)
i_{t-1}^h	0.03 (0.02)	0.05 (0.03)	-0.08** (0.02)	0.02 (0.02)	----	-0.07** (0.03)	-0.03 (0.02)
i_t^j	-0.01* (0.00)	-0.01 (0.02)	0.00 (0.01)	0.05 (0.06)	----	-0.04** (0.02)	-0.10** (0.03)
i_{t-1}^j	0.01 (0.00)	0.01 (0.02)	-0.00 (0.01)	-0.03 (0.06)	----	0.05** (0.02)	0.10** (0.03)
i_t^{US}	-0.27 (0.25)	0.05 (0.35)	-0.15 (0.26)	0.18 (0.24)	----	0.32 (0.3)	-0.31 (0.32)
i_{t-1}^{us}	0.26 (0.25)	-0.05 (0.35)	0.14 (0.26)	-0.20 (0.24)	----	-0.34 (0.3)	0.34 (0.32)
v(s=1)	0.02 (0.12)	0.09** (0.07)	0.05 (0.05)	-0.02 (0.05)	----	0.20** (0.29)	-0.08 (0.08)
v(s=2)	0.12* (0.05)	0.03 (0.10)	0.02 (0.09)	-0.11 (0.07)	----	0.15 (0.29)	-0.16* (0.08)
σ(s=1)	2.34	0.64	0.39	0.43	----	0.53	0.50
σ(s=2)	0.46	1.88	1.68	1.19	----	1.39	1.19
F-test	25.88++	8.63++	18.56++	7.66++	----	6.88++	5.66++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; ++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(f) MS-VAR Estimation Results, 1994-03 (Host: Thailand)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.08^{**} (0.02)	0.04 (0.02)	0.03 (0.02)	0.12^{**} (0.02)	0.05^{**} (0.02)	----	0.04 (0.02)
y_{t-1}^j	0.12^{**} (0.02)	0.07^{**} (0.02)	0.12^{*} (0.02)	0.14^{**} (0.02)	0.08^{**} (0.02)	----	0.01 (0.02)
i_t^h	-0.02 (0.01)	0.02 (0.02)	-0.01^{**} (0.01)	-0.01 (0.01)	-0.00 (0.01)	----	-0.00 (0.02)
i_{t-1}^h	0.02 (0.01)	-0.01 (0.02)	0.02 (0.01)	0.00 (0.01)	0.00 (0.01)	----	0.00 (0.02)
i_t^j	-0.01 (0.01)	-0.01 (0.02)	-0.00 (0.02)	0.03 (0.06)	0.00 (0.02)	----	-0.13^{**} (0.03)
i_{t-1}^j	0.01 (0.01)	0.00 (0.02)	-0.01 (0.02)	-0.02 (0.06)	-0.05^{*} (0.02)	----	0.11^{**} (0.03)
i_t^{US}	0.44 (0.26)	-0.01 (0.35)	-0.02 (0.25)	0.15 (0.24)	0.19 (0.22)	----	-0.18 (0.30)
i_{t-1}^{us}	0.43 (0.26)	-0.00 (0.35)	0.01 (0.25)	-0.17 (0.24)	-0.18 (0.22)	----	0.19 (0.30)
v(s=1)	0.02 (0.13)	0.13^{**}(0.07)	0.12^{**} (0.04)	-0.01 (0.06)	-0.02 (0.06)	----	-0.05 (0.09)
v(s=2)	0.11^{*} (0.07)	0.08 (0.10)	0.05 (0.08)	-0.07 (0.08)	-0.06 (0.07)	----	-0.11 (0.10)
$\sigma(s=1)$	2.36	0.66	0.39	0.44	0.42	----	0.52
$\sigma(s=2)$	0.49	1.83	1.55	1.20	1.00	----	1.15
F-test	23.20^{++}	7.69^{++}	15.80^{++}	7.44^{++}	5.67^{++}	----	4.89^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Table 4.12(g) MS-VAR Estimation Results, 1994-03 (Host: Hong Kong)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05^{**} (0.02)	0.06^{*}(0.03)	0.02 (0.02)	0.09^{**} (0.02)	0.04^{*} (0.02)	0.07^{**}(0.02)	----
y_{t-1}^j	0.12^{**} (0.02)	0.07^{**} (0.02)	0.14^{**} (0.02)	0.15^{**} (0.02)	0.08^{**} (0.02)	0.06^{**} (0.02)	----
i_t^h	-0.04 (0.03)	-0.08 (0.05)	0.00 (0.03)	-0.05 (0.03)	-0.03 (0.03)	-0.05 (0.04)	----
i_{t-1}^h	-0.01 (0.03)	0.09 (0.05)	-0.03 (0.03)	0.04 (0.03)	0.03 (0.03)	0.01 (0.04)	----
i_t^j	-0.01 (0.00)	-0.02 (0.02)	0.00 (0.01)	0.01 (0.06)	0.00 (0.02)	-0.04^{**} (0.02)	----
i_{t-1}^j	0.01^{*} (0.01)	0.01 (0.02)	-0.00 (0.01)	0.01 (0.06)	-0.04 (0.02)	0.04^{**} (0.02)	----
i_t^{US}	-0.23 (0.26)	0.08 (0.36)	-0.15 (0.24)	0.06 (0.26)	0.05 (0.27)	0.27 (0.3)	----
i_{t-1}^{us}	0.27 (0.26)	-0.09 (0.36)	0.17 (0.24)	-0.08 (0.26)	-0.04 (0.27)	-0.26 (0.3)	----
v(s=1)	-0.17^{*}(0.13)	0.14 (0.10)	-0.01 (0.06)	-0.02 (0.08)	-0.02 (0.06)	0.12 (0.15)	----
v(s=2)	-0.03^{*} (0.08)	0.12 (0.13)	-0.05 (0.09)	-0.13 (0.09)	-0.06 (0.07)	0.13 (0.15)	----
$\sigma(s=1)$	2.41	0.68	0.39	0.45	0.42	0.53	----
$\sigma(s=2)$	0.48	1.99	1.64	1.26	1.03	1.40	----
F-test	25.21^{++}	8.56^{++}	17.68^{++}	7.84^{++}	6.01^{++}	6.98^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; i_t^h, i_t^j, i_t^{US} are the short-term interest rates for the crisis country *h*, country *j*, and the United States, respectively; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively; $^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Tables 4.13-4.18 report and compare the calculated cross-market conditional and unconditional correlation coefficients for the stable and turmoil regimes, as well as corresponding Fisher test statistics for each of the various sample periods. In accordance with earlier analyses, each of the corresponding tables from 4.13 to 4.18 tests the hypothesis that there is no contagion coming directly from each of the host markets or countries in the first column to a single market in either the second, third, fourth, fifth, sixth, seventh and eighth columns.[24] Most of the results between pairs of countries in tables 4.13 to 4.18 do not indicate statistically significant evidence of an increase in correlation from stable, low-volatility regimes to high-volatility, turmoil regimes. In other words, based on F-R's interpretation, most of these stock markets are highly interdependent in all states or regimes of the world, as this interdependence does not change significantly during stable and turmoil regimes.

Interesting, however, is the evidence of contagion that we found from the Hong Kong stock market to the stock markets in the Philippines (see tables 4.13-4.18) and Singapore (see tables 4.15-4.18). This outcome holds true for all six sample periods considered in the case of the stock market of Hong Kong to the Philippine stock market, and in four of the six sample periods in the case of the Hong Kong stock market to the Singapore stock market. This finding of contagion from the Hong Kong stock market to both stock markets of the Philippines and Singapore contradicts the evidence of interdependence presented earlier for all other East Asian country-pair cases. This finding of contagion for both pairs of countries suggest that the cross-market linkages during high-volatility or turmoil periods for these pairs of countries are merely a continuation of strong transmission mechanisms that already existed in more stable periods.

[24] Dungey, et al. 2004b also employed this testing procedure.

Though the evidence of contagion for this class of asset is, arguably, not that strong, and contrary to what the international financial media may lead us to believe as regards the existence of contagion, the evidence presented here is a significant affirmation of an earlier study by Corsetti et al. (2002). Their study found that based on the same sample of East Asian stock market returns, they found evidence of significant transmission of shocks from the stock market of Hong Kong to the stock markets of the Philippines and Singapore. In light of the evidence presented in this chapter, in particular, the similar findings of contagion from the stock market of Hong Kong to the stock markets of the Philippines and Singapore suggest that we should, indeed, question the strong result of 'no contagion, only interdependence and as such consider it as dubious.

In Appendix B, results are reported from a sensitivity test in which no interest rate controls were included in the estimation of the MS-VAR model of equation (4.9). All of the above-mentioned analyses were repeated accordingly based on the same sample periods covered earlier. None of the results were significantly affected.

How, then, do the central results of this chapter bear on policy? One motivation underpinning the literature on contagion is to address how countries can reduce their vulnerability to external shocks during periods of heightened volatility. In general, if a shock is transmitted across markets largely through temporary channels that only appear during turbulent periods, i.e., crisis-contingent channels, then short-term or temporary strategies that are aimed to reduce the effect of the shock, such as capital controls, can be effective. On the other hand, if a shock is transmitted via permanent channels that exist in all states of the world, i.e., non-crisis contingent channels, then these same short-term or temporary strategies will only delay, and not prevent, the country from being affected by the shock (F-R, 2002).

Table 4.13
Contagion versus Interdependence: 1994-1998

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.018	-0.01	0.41	0.057	0.303	-4.1	0.058	0.298	-4.0	0.07	0.32	-4.3	0.053	0.226	-2.9	0.044	0.251	-3.4
Korea	0.037	-0.01	0.70				0.054	0.014	0.62	0.043	0.033	0.15	0.030	0.037	-0.1	0.059	0.065	-0.1	0.033	0.047	-0.2
Malaysia	0.118	0.303	-3.1	0.055	0.015	0.63				0.068	0.242	-3.1	0.162	0.519	-6.7	0.143	0.316	-3.1	0.109	0.339	-4.1
Philippines	0.201	0.298	-1.7	0.071	0.033	0.61	0.104	0.242	-2.4				0.239	0.233	0.10	0.156	0.212	-0.1	0.173	0.223	-0.9
Singapore	0.175	0.321	-2.5	0.039	0.037	0.03	0.209	0.519	-5.9	0.213	0.233	-0.4				0.233	0.364	-2.5	0.421	0.448	-0.6
Thailand	0.159	0.226	-1.14	0.085	0.065	0.33	0.196	0.316	-2.16	0.145	0.212	-1.19	0.199	0.364	-3.1				0.144	0.347	-3.8
Hong Kong	0.147	0.251	-1.73	0.053	0.047	0.10	0.164	0.339	-3.13	0.342	0.223	2.28*	0.454	0.448	0.12	0.165	0.347	-3.41			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Table 4.14

Contagion versus Interdependence: 1994-1999

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.023	-0.01	0.65	0.059	0.262	-3.9	0.064	0.260	-3.8	0.07	0.29	-4.3	0.057	0.221	-3.2	0.052	0.252	-3.8
Korea	0.047	-0.01	1.10				0.060	0.024	0.64	0.055	0.065	-0.2	0.043	0.081	-0.7	0.117	0.092	0.47	0.048	0.087	-0.7
Malaysia	0.117	0.262	-2.8	0.057	0.024	0.58				0.072	0.211	-2.6	0.157	0.467	-6.2	0.143	0.297	-3.0	0.112	0.311	-3.7
Philippines	0.210	0.260	-1.0	0.075	0.065	0.19	0.103	0.211	-2.1				0.237	0.205	0.64	0.164	0.207	-0.8	0.173	0.206	-0.6
Singapore	0.188	0.292	-2.1	0.053	0.081	-0.5	0.206	0.467	-5.3	0.230	0.205	0.50				0.247	0.343	-2.0	0.436	0.451	-0.3
Thailand	0.163	0.221	-1.14	0.099	0.092	0.13	0.198	0.297	-1.97	0.159	0.207	-0.94	0.211	0.343	-2.7				0.161	0.331	-3.5
Hong Kong	0.170	0.252	-1.60	0.072	0.087	-0.3	0.176	0.311	-2.56	0.353	0.206	3.03**	0.483	0.451	0.77	0.191	0.331	-2.90			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Table 4.15
Contagion versus Interdependence: 1994-2000

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.027	-0.01	0.82	0.068	0.193	-2.5	0.068	0.230	-3.3	0.08	0.26	-3.9	0.065	0.212	-3.1	0.056	0.230	-3.6
Korea	0.052	-0.01	1.33				0.070	0.056	0.27	0.066	0.057	0.17	0.069	0.097	-0.6	0.085	0.118	-0.7	0.077	0.092	-0.3
Malaysia	0.118	0.193	-1.5	0.062	0.056	0.11				0.075	0.192	-2.3	0.157	0.440	-5.8	0.149	0.278	-2.6	0.114	0.335	-4.2
Philippines	0.180	0.230	-1.1	0.076	0.057	0.39	0.098	0.192	-1.9				0.207	0.181	0.57	0.158	0.222	-1.4	0.160	0.190	-0.6
Singapore	0.189	0.263	-1.6	0.084	0.097	-0.3	0.210	0.440	-4.8	0.217	0.181	0.77				0.257	0.338	-1.9	0.446	0.431	0.4
Thailand	0.167	0.212	-0.96	0.117	0.118	-0.0	0.211	0.278	-1.39	0.166	0.222	-1.20	0.257	0.338	-1.8				0.170	0.319	-3.3
Hong Kong	0.169	0.230	-1.28	0.118	0.092	0.54	0.189	0.335	-2.82	0.345	0.190	3.41**	0.508	0.431	2.02*	0.207	0.319	-2.50			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Table 4.16
Contagion versus Interdependence: 1994-2001

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Tes Stat
Indonesia				0.031	-0.02	1.05	0.074	0.170	-2.0	0.070	0.209	-3.0	0.09	0.23	-3.1	0.070	0.167	-2.1	0.059	0.206	-3.2
Korea	0.058	-0.02	1.64				0.075	0.079	-0.1	0.074	0.069	0.12	0.086	0.153	-1.5	0.097	0.169	-1.6	0.093	0.197	-2.2
Malaysia	0.114	0.170	-1.2	0.059	0.079	-0.4				0.074	0.184	-2.3	0.155	0.400	-5.2	0.147	0.261	-2.4	0.112	0.323	-4.3
Philippines	0.159	0.209	-1.2	0.078	0.069	0.20	0.099	0.184	-1.8				0.191	0.178	0.29	0.145	0.201	-1.2	0.153	0.194	-0.9
Singapore	0.194	0.227	-0.7	0.099	0.153	-1.2	0.222	0.400	-3.8	0.206	0.178	0.63				0.260	0.313	-1.3	0.466	0.432	0.9
Thailand	0.168	0.167	0.03	0.118	0.169	-1.1	0.220	0.261	-0.87	0.156	0.201	-0.99	0.258	0.313	-1.3				0.175	0.293	-2.6
Hong Kong	0.166	0.206	-0.9	0.132	0.197	-1.3	0.199	0.323	-2.56	0.333	0.194	3.18**	0.537	0.432	2.97**	0.219	0.293	-1.67			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Table 4.17
Contagion versus Interdependence: 1994-2002

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.035	0.04	-0.1	0.081	0.169	-1.8	0.077	0.200	-2.7	0.09	0.21	-2.6	0.078	0.180	-2.3	0.065	0.199	-2.9
Korea	0.062	0.04	0.49				0.080	0.122	-0.9	0.079	0.097	-0.4	0.094	0.218	-2.8	0.106	0.198	-2.1	0.096	0.268	-3.6
Malaysia	0.108	0.169	-1.3	0.056	0.122	-1.4				0.070	0.183	-2.4	0.150	0.394	-5.4	0.141	0.264	-2.7	0.110	0.325	-4.6
Philippines	0.156	0.200	-1.0	0.078	0.097	-0.4	0.100	0.183	-1.8				0.184	0.198	-0.3	0.146	0.193	-1.1	0.151	0.213	-1.4
Singapore	0.194	0.206	-0.3	0.106	0.218	-2.6	0.231	0.394	-3.7	0.204	0.198	0.13				0.269	0.323	-1.4	0.476	0.458	0.5
Thailand	0.168	0.180	-0.3	0.120	0.198	-1.8	0.220	0.264	-1.0	0.157	0.193	-0.83	0.258	0.323	-1.6				0.175	0.298	-2.9
Hong Kong	0.163	0.199	-0.8	0.127	0.270	-3.0	0.200	0.325	-2.73	0.325	0.213	2.62**	0.532	0.458	2.20*	0.218	0.298	-1.93			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Table 4.18
Contagion versus Interdependence: 1994-2003

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.037	0.09	-1.3	0.084	0.188	-2.3	0.080	0.192	-2.5	0.098	0.235	-3.1	0.082	0.194	-2.5	0.068	0.211	-3.2
Korea	0.065	0.09	-0.6				0.083	0.150	-1.5	0.082	0.111	-0.6	0.097	0.282	-4.2	0.110	0.225	-2.7	0.099	0.307	-4.5
Malaysia	0.103	0.188	-1.8	0.054	0.150	-2.1				0.068	0.188	-2.7	0.145	0.388	-5.5	0.135	0.267	-3.1	0.107	0.327	-4.9
Philippines	0.157	0.192	-0.8	0.082	0.111	-0.6	0.103	0.188	-1.9				0.189	0.198	-0.2	0.150	0.196	-1.1	0.156	0.209	-1.2
Singapore	0.203	0.235	-0.7	0.109	0.282	-4.0	0.245	0.388	-3.3	0.215	0.198	0.43				0.283	0.333	-1.3	0.500	0.490	0.3
Thailand	0.164	0.194	-0.7	0.119	0.225	-2.5	0.217	0.267	-1.2	0.157	0.196	-0.92	0.256	0.333	-1.9				0.178	0.294	-2.9
Hong Kong	0.157	0.211	-1.2	0.144	0.271	-2.8	0.197	0.327	-2.99	0.324	0.209	2.79**	0.583	0.500	2.66**	0.212	0.294	-2.04			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

For East Asian countries, in particular, the evidence of 'some contagion' suggest that shocks can also be transmitted via permanent linkages between these countries. The important implication of this result is that strict prescription of a 'one size-fits all' policy for these countries in times of crisis, especially by international financial institutions, can be fraught with risk. This 'one size fits all' view emanates from the observation that heterogeneity of policy outcomes, whereby policies that are successful in one circumstance may prove a failure in another, cannot be considered a remote possibility (Dungey and Tambakis, 2003).

4.9 Conclusion

This chapter set out to investigate whether shift-contagion occurred using the returns of seven East Asian stock markets; namely, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand. To achieve this, the straightforward method of testing for contagion, cross market correlation of asset returns, was complemented by the method of Markov regime switching. Apart from its flexibility of providing a data coherent method that can capture the well-known complexity in the time series properties of asset returns such as skewness, leptokurtosis and, more importantly, regime-shifts, the incorporation of regime switches into usual tests of contagion is a convenient strategy of calculating contemporaneous correlations of cross-country asset returns without having to infer the contemporaneous correlations based on an *ad-hoc* or arbitrary conditioning of high-and low volatility sub-periods.

In the spirit of the Corsetti et. al. (2002) study, the test for contagion that is conducted here is not meant to replace existing tests in the empirical literature, but rather to cast doubts on the strong conclusion previously derived in the literature. On the other hand, the choice of employing the method of regime-switching was guided by an explicit recommendation made earlier within the same literature, that called for a testing strategy that allows for structural breaks to be modelled as part of the data generating process.

In accordance with the findings of the present chapter, avoiding a pre-determined split of the sample into high-and low volatility sub-periods based on some event-based, chronology of news about the onset of the crisis, and, instead, endogenising the process of separating crisis from non-crisis data in the sample such as via Markov regime switching, cast doubts on the strong result of 'no contagion, some interdependence' asserted earlier in the literature. Aside from eliminating exposure to sample-selection bias by using the data themselves to identify regimes or states, another closely related reason for using Markov regime switching is that it is not always clear what the correct timing of the crisis should be. Thus, it is not surprising that evidence of contagion is sensitive to different choices beforehand of crisis and tranquil windows.[25]

The evidence of contagion presented in this chapter, in particular from the stock market of Hong Kong to the stock markets of the Philippines and Singapore, offers us the important insight that the simultaneous occurrence of crises are not wholly confined to permanent transmission channels, such as the role of trade linkages and aggregate shocks. The evidence also suggests that short-term isolation strategies (borrowing from F-R's own terminology), like capital controls, can play a role in limiting the effects of a crisis that originated elsewhere. However, it is also important to note that a short-term isolation strategy, say, a policy of reducing long-run trade linkages, can be costly. On balance, then, attempting to develop policy without the benefit of correctly distinguishing which groups of transmission mechanisms dominate during times of market turbulence can have deleterious effects.

[25] As before, I refer to the Billio and Pelizon (2003) study.

The central results of this chapter are also relevant to the question: when does the provision of emergency liquidity assistance during times of crises become an appropriate response? The emerging consensus appears to be that liquidity assistance is only appropriate if the shock is transmitted through temporary channels that only arise during turbulent periods. In particular, if the shock or crisis is caused by an international illiquidity that triggers a self-fulfilling crisis, then emergency liquidity assistance is called for. On the other hand, if the shock is mainly transmitted via links that exist in all states of the world, emergency liquidity assistance might do more harm than good, as it may only delay the necessary adjustment. Dealing directly, then, with reform measures that seek to improve economic fundamentals might be warranted in this case.

Chapter 5

Conclusion : Policy Implications and Scope for Further Research

The crisis in East Asia represented something of a catalyst among national economic policymakers and international financial institutions to step-up reform efforts to collectively strengthen the international financial architecture in order to achieve macroeconomic and financial stability. In turn, architectural reform efforts have stressed two overlapping goals of crisis prevention and crisis management or resolution. Crisis prevention strategies, on the one hand, have dealt with efforts to identify vulnerable countries before they succumb to crises (the development of so-called early warning system models), efforts to fostering compliance among emerging markets to international standards and codes, efforts directed towards a re-thinking of the appropriate exchange rate regimes for emerging markets, among others. Crisis management strategies, on the other hand, have sought to find, for instance, the needed and appropriate balance between official rescue packages with that of the involvement of the private sector-creditors.

The three core chapters in this thesis have revisited or re-assessed prevailing conventional wisdom or recent empirical evidence on some key issues that have arisen in discussions/debates regarding reform efforts towards strengthening the international financial architecture. Chapter 2 focuses on speculative attacks and crises identification, one of the basic ingredients of early warning system models that seek to identify and measure the determinants of a country's vulnerability to crises. In particular, I avoid arbitrary choices in setting the threshold or cut-off in defining currency crises, and instead applies an alternative statistical procedure, the HKKP-Extreme Value Theory approach, which takes into account the basic statistical properties of an EMP index by directly estimating the shape of the distribution of the right-tail where the frequency of extreme events, such as currency crises are concentrated. The primary conclusions from this chapter are twofold: first, different variations of the weighting schemes of the EMP series would indicate diverging numbers of crises or speculative attack episodes. Second, a statistical method that avoids a-priori assumptions with regard to the underlying statistical distributions of any EMP series would dominate conventional or standard approaches of identifying speculative attacks or crises.

It should be noted as a caveat at this point that the application of the HKKP-Extreme Value Theory approach in this chapter regards this statistical approach as an ex-post method to identify crises. Nonetheless, as the HKPP-Extreme Value approach dominates conventional approaches to crises identification, we have identified a promising method to better measure speculative attacks and, hopefully, understand better the determinants, development and spreading of currency crises. More importantly, as conventional approaches tend to *under*-predict crises ex-post, it is no surprise that existing early-warning systems exhibit significant statistical errors in their forecast. In view of this, using a nonparametric method that dominates conventional approaches such as the HKPP-EVT suggest that a better method exist in order to come up with accurate forecasts or early warning of crises.

One suggestion for future research is to avoid resorting to a weighting scheme, which in the first place is also considered to be arbitrary and ad-hoc, for the three key variables of changes in exchange rates, foreign exchange reserves and interest rates, and, instead, resort to an alternative method that treats the three key variables separately, say, via a Markov switching framework. In such a framework, future research can more specifically distinguish between successful and unsuccessful speculative attack episodes, and can also further disentangle whether the variety of factors identified by the theoretical literature on currency crises as possible sources of vulnerability to crises might substantially differ between successful and failed episodes of speculative attacks.

Chapter 3 focuses on how the behaviour of exchange rate policy changed after the crisis in the countries of Indonesia, Korea, Philippines, Singapore, and Thailand. To achieve this, monthly indices of intervention for the five countries mentioned were constructed via a statistical method known as the Markov Regime-Switching ARCH (SWARCH) in order to arrive at the conditional probabilities that the conditional volatilities of the three variables (changes in exchange rates, reserves and interest rates) are in a high volatility state. In doing so, the SWARCH model provides an objective way of tracing how the volatilities of each of the variables evolve over time without the need to distinguish or create arbitrary sub-samples, say, pre-crisis and post-crisis periods. To be more specific, the monthly indices of intervention were constructed from one of the main estimation outputs of SWARCH known as the smoothed probabilities. As the smoothed probabilities represents the probability that the conditional variance was in state s_t at date t, given all sample returns observations, the information gathered from the individual smoothed probabilities of the changes in exchange rates, reserves, and interest rates for the five individual countries were then combined to construct the monthly indices of intervention for each country.[1]

[1] As noted in footnote 25, p. 85, the construction of the monthly indices of intervention were based on a separate/independent analyses of the changes in exchange rates, reserves, and interest rates. This interpretation of an index of intervention is not universally accepted. This is because the likely interaction among the three variables could bias the results. In future work, one way of handling the supposed bias is to estimate a structural VAR for a certain pre- and post-crisis sample where the aim here are the coefficient estimates in order to examine the magnitude of interactions among the three variables. However, at issue here with regards to estimations of structural VARs are on how one identifies the coefficient estimates, which even until now no consensus has been reached, as the conventional approach is to use arbitrary exclusion restrictions.

The balance of evidence suggests that the rupiah, won, peso, and baht to varying degrees are now fluctuating more freely than under the old pre-crisis regime. Whereas, the evidence presented in the case of the Singapore dollar is in conformity with the exchange rate-centred monetary policy strategy of the MAS before and after the crisis. This implies that when exchange rate regime choices are evaluated along a certain continuum, none of these countries have decided to jump or moved into the extreme corners, as what the bipolar view would suggest, and, as a result, after the crisis, the middle has not really become hollow. To put that in another way, the evidence indicate that these countries show evidence of a fear of completely free floating but not to the extent that such fear would drive these countries after the crisis to revert to the old pre-crisis regime of a soft U.S. dollar-peg.

A number of important future research possibilities emerge from chapter 3. The first is to uncover any possible link between the exchange rate policies pursued by these countries in the aftermath of the crisis and a certain measure of economic performance, for instance, economic growth. More specifically, future research can empirically examine on how substantial is the role or influence of the exchange rate policies adopted by these countries after the crisis with regards to the speed and strength of their recovery from the crisis.

Another area for future research is a closer examination of the possible implications of the exchange rate policies adopted by these countries after the crisis with respect to the composition and volatility of capital flows in these countries. As argued by Fischer (2003), one benefit of pursuing a flexible exchange rate system is that it can, in general, mitigate any excessive capital-flow volatility while, at the same time, sharply reduce short-term capital inflows. In accordance, whether this assertion also holds true, in general, for countries in East Asia that have pursued greater flexibility in their exchange rates post-crisis is, definitely, worth pursuing.

Given the implementation of inflation targeting frameworks in the region, particularly in Korea (1998), Thailand (2000), Indonesia (2000) and the Philippines (2002), a final suggestion for future research is to empirically looked at monetary policy rules for these countries. There have been some recent contributions that particularly investigated the role of the exchange rate in inflation targeting systems, however, few have looked into the specific circumstances of these East Asian countries as most of the empirical evidence to date have focused on industrial countries. One interesting facet of research that bears some relation to the central conclusions of this chapter is whether the monetary authorities in these countries have responded to volatilities in the exchange rate to such extent that exchange rate stabilisation has taken precedence over inflation targeting objectives. Obviously, if this has not been the case, this should further reinforce the primary conclusions of this chapter.

Chapter 4 provides a critique of recent empirical literature that test for the existence of contagion. Using a Markov-regime switching approach that implicitly adjusts for the problem of sample selection bias by allowing the regimes or states in the returns data be endogenously determined rather than arbitrarily chosen, the chapter is able to improve on the earlier obtained strong result of 'no contagion, some interdependence' by finding robust evidence of contagion from the Hong Kong stock market to the stock markets in the Philippines and Singapore. This evidence originates from an earlier important finding in this chapter that the incorporation of endogenous regime-shifts alter the variance-covariance matrix and, in turn, affect the contemporaneous correlations of the cross-country asset returns. As a result, with regards to the issue of contagion as opposed to interdependence, one can test for a significant change in the correlation coefficients without having to infer the contemporaneous correlations based on an *ad-hoc* or arbitrary conditioning of high- and low volatility sub-periods.

The evidence mentioned above indicates that not only non-crisis contingent or permanent transmission channels, on the one hand, are predominantly at work when crises simultaneously occur, but also, on the other hand, there is also some support for the role of crisis-contingent or temporary transmission channels. This implies that there is some justification for short-term liquidity provision at the international level in mitigating the adverse effects of the transmission of external shocks across markets.

Future research on this area will involve the following: first, in concentrating with the econometric problems that arise in dealing with the research issue of the existence of contagion, the approach used in this chapter can also be incorporated within the recently developed determinant of the change in covariance (DCC) matrix test by Rigobon (2003). In doing so, the combination of the DCC test and the Regime Switching method serve as a further technical enrichment that conveniently allow one to test for evidence of contagion, taking into account the all four econometric predicaments of simultaneous equations, omitted variables, heteroscedasticity and sample selection bias. Another technical enrichment that, this time, addresses the other important research question of *how* are shocks transmitted across countries or markets, is to incorporate also the Regime Switching method with another of the recently developed test by Rigobon (2003) called as the Identification through Heteroscedasticity test. As emphasised by Ehrmann, Fratzscher and Rigobon (2005), the procedure uses the information that financial variables are, in general, heteroscedastic, and as such, the form of the heteroscedasticity is of no particular concern. It could either be described as a GARCH or a Regime Switching model.

A further possibility for future research is to assess the simultaneous occurrence and transmission of crises that cut across different asset classes and across different countries let alone the potential contagion across different asset classes within a country. These issues are of crucial importance as, for instance, when crises are transmitted across different asset markets and borders simultaneously, diversification of international portfolios might fail to deliver what was its intended benefit in the first place (Dungey and Tambakis, 2003; Corsetti, et al., 2002). Accordingly, the approach used in this chapter as well as the above technical refinements to recently introduced time-series econometric techniques can be adopted to weigh on these crucial research issues.

Appendix A.1 : Sensitivity Test Results Using the Nominal Exchange Rate in the Construction of the EMP Indices (Appendix to Chapter 2)

Table A.1-1
Descriptive Statistics of Individual EMP Measures

	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Statistic
East Asia					
Indonesia					
ERW	0.07	1.36	1.32	18.58	2309.14*
KLR	-0.50	10.67	1.39	25.32	4701.17*
STV	0.84	5.71	5.66	54.42	25758.07*
Korea					
ERW	-0.09	1.97	2.14	22.23	3591.44*
KLR	-0.97	6.65	1.81	18.93	2491.43*
STV	0.27	1.68	6.33	68.18	41150.38*
Malaysia					
ERW	0.04	1.98	-1.09	15.84	1569.507*
KLR	-0.48	4.60	-0.66	17.13	1888.51*
STV	0.21	0.82	0.76	10.40	535.17*
Philippines					
ERW	0.04	2.04	0.26	11.28	636.04*
KLR	-0.09	4.43	-0.13	11.01	602.25*
STV	0.31	1.57	1.54	9.43	477.33*
Singapore					
ERW	-0.17	1.98	0.05	10.73	553.38*
KLR	-1.24	2.71	-0.15	7.21	167.34*
STV	0.21	0.54	-0.43	10.87	587.98*
Thailand					
ERW	-0.04	1.62	1.61	12.08	858.63*
KLR	-0.81	4.24	1.52	12.08	860.00*
STV	0.37	2.07	2.46	25.45	4953.01*

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
*The null hypothesis of a normally distributed EMP measure is rejected.

Table A.1-2
Descriptive Statistics of Individual EMP Measures

	Mean	Standard Deviation	Skewness	Kurtosis	Jarque-Bera Statistic
Latin America					
Argentina					
ERW	0.16	1.46	0.07	34.41	9127.36*
KLR	-1.49	36.23	-2.17	58.52	29074.88*
STV	8.72	34.88	3.27	29.70	7116.24*
Brazil					
ERW	0.04	1.76	3.18	36.43	10715.55*
KLR	-13377	35181.97	0.60	38.21	11635.06*
STV	11.42	29.54	-0.43	40.02	12852.29*
Chile					
ERW	0.30	1.54	-0.36	8.00	236.40*
KLR	-0.04	3.00	0.00	4.82	31.02*
STV	0.82	1.96	0.93	7.08	188.86*
Mexico					
ERW	0.29	2.12	1.48	16.21	1694.94*
KLR	0.70	9.13	1.36	17.66	2084.53*
STV	1.48	4.38	2.02	13.07	1108.46*

Note: $e_{i,t}$ is measured as the nominal exchange rate.
*The null hypothesis of a normally distributed EMP measure is rejected.

Table A.1-3
Normality Tests for the individual EMP measures

	Kolmogorov-Smirnov[a]	**Significance**	**Shapiro-Wilk**	**Signficance**
Indonesia				
ERW	0.120	0.00*	0.795	0.00*
KLR	0.182	0.00*	0.729	0.00*
STV	0.241	0.00*	0.537	0.00*
Korea				
ERW	0.095	0.00*	0.825	0.00*
KLR	0.125	0.00*	0.831	0.00*
STV	0.181	0.00*	0.595	0.00*
Malaysia				
ERW	0.180	0.00*	0.755	0.00*
KLR	0.163	0.00*	0.787	0.00*
STV	0.127	0.00*	0.856	0.00*
Philippines				
ERW	0.120	0.00*	0.875	0.00*
KLR	0.145	0.00*	0.857	0.00*
STV	0.157	0.00*	0.858	0.00*
Singapore				
ERW	0.059	0.06*	0.914	0.00*
KLR	0.065	0.02*	0.950	0.00*
STV	0.066	0.02*	0.917	0.00*
Thailand				
ERW	0.071	0.01*	0.907	0.00*
KLR	0.126	0.00*	0.950	0.00*
STV	0.160	0.00*	0.692	0.00*

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
[a] Liliefors Significance correction.
* the null hypothesis of normally distributed data is rejected.

Table A.1-4
Normality Tests for the Individual EMP Measures

	Kolmogorov-Smirnov[a]	**Significance**	**Shapiro-Wilk**	**Signficance**
Argentina				
ERW	0.263	0.00*	0.563	0.00*
KLR	0.299	0.00*	0.414	0.00*
STV	0.322	0.00*	0.432	0.00*
Brazil				
ERW	0.181	0.00*	0.633	0.00*
KLR	0.189	0.00*	0.663	0.00*
STV	0.197	0.00*	0.615	0.00*
Chile				
ERW	0.059	0.06*	0.945	0.00*
KLR	0.047	0.20	0.980	0.00*
STV	0.086	0.00*	0.932	0.00*
Mexico				
ERW	0.151	0.00*	0.764	0.00*
KLR	0.182	0.00*	0.740	0.00*
STV	0.185	0.00*	0.785	0.00*

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
[a] Liliefors Significance correction.
* the null hypothesis of normally distributed data is rejected.

Table A.1-5
Unit Root tests for the individual EMP measures

	ADF test[a] without trend	ADF test[a] with trend	DF-GLS[a] without trend	DF-GLS[a] with trend	KPSS test[b] without trend	KPSS test[b] with trend
East Asia						
Indonesia						
ERW	-13.634***	-13.612***	-3.548***	-13.057***	0.056	0.053
KLR	-14.521***	-14.491***	-2.973***	-13.985***	0.053	0.051
STV	-4.360***	-4.347**	-4.296***	-4.357***	0.101	0.096
Korea						
ERW	-11.292***	-11.269***	-10.725***	-11.088***	0.041	0.033
KLR	-10.090***	-10.070***	-10.065***	-10.087***	0.041	0.038
STV	-11.555***	-11.532***	-11.264***	-11.461***	0.037	0.034
Malaysia						
ERW	-13.948***	-13.933***	-1.473	-2.851*	0.053	0.043
KLR	-12.910***	-12.922***	-1.548	-2.974**	0.077	0.045
STV	-12.945***	-12.916***	-5.073***	-12.004***	0.049	0.047
Philippines						
ERW	-8.676***	-8.741***	-8.541***	-8.744***	0.120	0.046
KLR	-8.696***	-8.861***	-8.545***	-8.606***	0.236	0.051
STV	-11.766***	-11.742***	-1.132	-3.331**	0.041	0.040
Singapore						
ERW	-14.274***	-14.284***	-2.282***	-3.815***	0.119	0.063
KLR	-11.479***	-11.724***	-1.289	-8.990***	0.691**	0.154**
STV	-12.134***	-12.118***	-1.375	-10.816***	0.116	0.081
Thailand						
ERW	-15.883***	-15.954***	-1.875*	-3.303**	0.149	0.033
KLR	-9.481***	-9.834***	-0.790	-1.984	0.558**	0.086
STV	-16.134***	-16.117***	-3.939***	-14.964***	0.071	0.040

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
***, **, * indicate rejection of the null hypothesis at the 1%, 5% and 10%, respectively.
[a] The ADF/DF-GLS procedure test the null that H_0: $y_t \sim I(1)$ against the alternative H_a: $y_t \sim I(0)$.
[b] The KPSS procedure test the null that H_0: $y_t \sim I(0)$ against the alternative H_a: $y_t \sim I(1)$.

Table A.1-6
Unit Root tests for the Individual EMP Measures

	ADF test[a] without trend	ADF test[a] with trend	DF-GLS[a] without trend	DF-GLS[a] with trend	KPSS test[b] without trend	KPSS test[b] with trend
Latin America						
Argentina						
ERW	-6.586***	-6.770***	-6.406***	-6.781***	0.293	0.081
KLR	-17.441***	-17.441***	-15.497***	-16.720***	0.087	0.044
STV	-3.931***	-4.156***	-3.686***	-4.165***	0.590**	0.111
Brazil						
ERW	-15.629***	-15.609***	-15.361***	-15.639***	0.051	0.033
KLR	-12.845***	-13.331***	-12.864***	-13.076**	0.712**	0.194**
STV	-11.996***	-12.360***	-11.983***	-12.119***	0.750***	0.207**
Chile						
ERW	-14.344***	-14.440***	-1.451	-8.272***	0.349*	0.147**
KLR	-13.198***	-13.172***	-2.231**	-11.903***	0.138	0.128*
STV	-12.662***	-11.705***	-0.868	-3.425**	1.331***	0.079
Mexico						
ERW	-13.948***	-13.933***	-1.473	-2.851*	0.053	0.043
KLR	-14.496***	-14.671***	-7.625***	-14.446***	0.348*	0.116
STV	-8.749***	-9.164***	-8.360***	-8.568***	0.589**	0.124

Notes: $e_{i,t}$ is measured as the nominal exchange rate.

***, **, * indicate rejection of the null hypothesis at the 1%, 5% and 10%, respectively.

[a] The ADF/DF-GLS procedure test the null that H_0: $y_t \sim I(1)$ against the alternative H_a: $y_t \sim I(0)$.

[b] The KPSS procedure test the null that H_0: $y_t \sim I(0)$ against the alternative H_a: $y_t \sim I(1)$.

Table A.1-7
Ljung-Box Q-statistics for East Asian and Latin American Countries

	EMP Indices		
	ERW	**KLR**	**STV**
East Asia			
Indonesia	4.57	19.23	8.84
Korea	37.79*	52.66*	15.13
Malaysia	18.73	10.07	14.71
Philippines	10.30	11.64	19.96
Singapore	12.17	16.55	5.16
Thailand	7.44	3.47	7.53
Latin America			
Argentina	0.00	9.70	178.32*
Brazil	7.59	4.93	49.12*
Chile	10.87	19.02	10.80
Mexico	18.31	15.95	121.44*

Notes: The Q-statistic tests the null hypothesis of no autocorrelation at the relevant lag. An * denotes rejection of the null hypothesis.

Table A.1-8
Number and Proportion of crises episodes according to the ERW-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu + 1.5\sigma$				$\mu + 2.0\sigma$				$\mu + 2.5\sigma$				$\mu + 3.0\sigma$			
	n	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia																	
Indonesia	222	3	1.4	1	0.5	3	1.4	1	0.5	3	1.4	1	0.5	1	0.5	1	0.5
Korea	222	3	1.4	3	1.4	1	0.5	1	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Malaysia	222	7	3.2	5	2.3	3	1.4	2	0.9	3	1.4	2	0.9	2	0.9	2	0.9
Philippines	222	8	3.6	6	2.7	6	2.7	5	2.3	5	2.3	4	1.8	4	1.8	4	1.8
Singapore	222	5	2.3	5	2.3	3	1.4	3	1.4	1	0.5	1	0.5	1	0.5	1	0.5
Thailand	222	5	2.3	4	1.8	4	1.8	3	1.4	3	1.4	2	0.9	2	0.9	1	0.5
Latin America																	
Argentina	222	4	1.8	3	1.4	3	1.4	2	0.9	3	1.4	2	0.9	2	0.9	2	0.9
Brazil	222	3	1.4	3	1.4	3	1.4	3	1.4	3	1.4	3	1.4	2	0.9	2	0.9
Chile	222	8	3.6	7	3.2	4	1.8	3	1.4	3	1.4	2	0.9	2	0.9	1	0.5
Mexico	222	6	2.7	6	2.7	6	2.7	6	2.7	3	1.4	2	0.9	3	1.4	2	0.9

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (*n*) and then multiplying by 100.

Table A.1-9
Number and Proportion of crises episodes according to the KLR-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu+1.5\sigma$				$\mu+2.0\sigma$				$\mu+2.5\sigma$				$\mu+3.0\sigma$			
	n	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia																	
Indonesia	223	5	2.2	4	1.8	4	1.8	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4
Korea	224	7	3.1	7	3.1	1	0.4	1	0.4	1	0.4	1	0.4	1	0.4	1	0.4
Malaysia	225	7	3.1	5	2.2	4	1.8	3	1.3	3	1.3	2	0.9	3	1.3	2	0.9
Philippines	225	7	3.1	6	2.7	5	2.2	4	1.8	4	1.8	4	1.8	2	0.9	2	0.9
Singapore	225	6	2.7	6	2.7	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4	1	0.4
Thailand	225	6	2.7	5	2.2	6	2.7	5	2.2	3	1.3	2	0.9	1	0.4	1	0.4
Latin America																	
Argentina	225	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9
Brazil	225	3	1.3	3	1.3	2	0.9	2	0.9	2	0.9	2	0.9	1	0.4	1	0.4
Chile	225	8	3.6	7	3.1	4	1.8	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4
Mexico	225	7	3.1	7	3.1	6	2.7	6	2.7	2	0.9	2	0.9	2	0.9	2	0.9

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table A.1-10
Number and Proportion of crises episodes according to the STV-EMP

		Country-Specific Standard Deviation and Mean															
		$\mu + 1.5\sigma$				$\mu + 2.0\sigma$				$\mu + 2.5\sigma$				$\mu + 3.0\sigma$			
		3-month		*6-month*		*3-month*		*6-month*		*3-month*		*6-month*		*3-month*		*6-month*	
	n	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*	*window*	*Incidence*
East Asia																	
Indonesia	223	5	2.2	3	1.3	4	1.8	3	1.3	4	1.8	3	1.3	4	1.8	3	1.3
Korea	224	3	1.3	3	1.3	2	0.9	2	0.9	1	0.4	1	0.4	1	0.4	1	0.4
Malaysia	225	9	4.0	6	2.7	5	2.2	4	1.8	2	0.9	2	0.9	2	0.9	2	0.9
Philippines	225	9	4.0	7	3.1	7	3.1	6	2.7	7	3.1	6	2.7	3	1.3	2	0.9
Singapore	225	9	4.0	8	3.6	3	1.3	3	1.3	1	0.4	1	0.4	1	0.4	1	0.4
Thailand	225	4	1.8	2	0.9	2	0.9	1	0.4	2	0.9	1	0.4	2	0.9	1	0.4
Latin America																	
Argentina	226	3	1.3	2	0.9	3	1.3	2	0.9	2	0.9	2	0.9	2	0.9	2	0.9
Brazil	225	4	1.8	3	1.3	3	1.3	3	1.3	3	1.3	3	1.3	2	0.9	2	0.9
Chile	225	10	4.4	9	4.0	6	2.7	5	2.2	4	1.8	3	1.3	3	1.3	2	0.9
Mexico	226	7	3.1	6	2.7	6	2.7	6	2.7	3	1.3	3	1.3	2	0.9	2	0.9

Notes: $e_{i,t}$ is measured as the nominal exchange rate.

Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table A.1-11
Number of monthly episodes of crises and incidence of crises using the extreme value theory and ERW-EMP

		Extreme Value Theory (EVT)					*Conventional Method*			
							Country-Specific Standard Deviation and Mean $\mu + 1.5\sigma$			
	n	*Optimal k*	*No. of Crises Episodes 3-month window*	*Incidence*	*No. of Crises Episodes 6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1332		77	5.8	64	4.8	31	2.3	24	1.8
Indonesia	222	17	11	5.0	10	4.5	3	1.4	1	0.5
Korea	222	21	14	6.3	12	5.4	3	1.4	3	1.4
Malaysia	222	10	7	3.2	5	2.3	7	3.2	5	2.3
Philippines	222	18	12	5.4	10	4.5	8	3.6	6	2.7
Singapore	222	24	17	7.7	14	6.3	5	2.3	5	2.3
Thailand	222	23	16	7.2	13	5.9	5	2.3	4	1.8
Latin America	888		52	5.9	42	4.7	21	2.4	19	2.1
Argentina	222	9	5	2.3	4	1.8	4	1.8	3	1.4
Brazil	222	17	12	5.4	10	4.5	3	1.4	3	1.4
Chile	222	24	17	7.7	14	6.3	8	3.6	7	3.2
Mexico	222	36	18	8.1	14	6.3	6	2.7	6	2.7

Notes: $e_{i,t}$ is measured as the nominal exchange rate.
Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Table A.1-12

Number of monthly episodes of crises and incidence of crises using the extreme value theory and KLR-EMP

		Extreme Value Theory (EVT)					*Conventional Method* *Country-Specific Standard Deviation and Mean* $\mu + 1.5\sigma$			
	n	*Optimal k*	*No. of Crises Episodes* *3-month window*	*Incidence*	*No. of Crises Episodes* *6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1347		76	5.6	62	4.6	38	2.8	33	2.4
Indonesia	223	17	12	5.4	10	4.5	5	2.2	4	1.8
Korea	224	11	9	4.0	9	4.0	7	3.1	7	3.1
Malaysia	225	23	16	7.1	13	5.8	7	3.1	5	2.2
Philippines	225	29	18	8.0	13	5.8	7	3.1	6	2.7
Singapore	225	19	12	5.3	10	4.4	6	2.7	6	2.7
Thailand	225	15	9	4.0	7	3.1	6	2.7	5	2.2
Latin America	900		58	6.4	47	5.2	20	2.2	19	2.1
Argentina	225	19	12	5.3	11	4.9	2	0.9	2	0.9
Brazil	225	9	9	4.0	7	3.1	3	1.3	3	1.3
Chile	225	31	22	9.8	17	7.6	8	3.6	7	3.1
Mexico	225	28	15	6.7	12	5.3	7	3.1	7	3.1

Notes: $e_{i,t}$ is measured as the nominal exchange rate.

Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (*n*) and then multiplying by 100.

Table A.1-13

Number of monthly episodes of crises and incidence of crises using the extreme value theory and STV-EMP

		Extreme Value Theory (EVT)					Conventional Method: Country-Specific Standard Deviation and Mean $\mu + 1.5\sigma$			
	n	*Optimal k*	*No. of Crises Episodes 3-month window*	*Incidence*	*No. of Crises Episodes 6-month window*	*Incidence*	*3-month window*	*Incidence*	*6-month window*	*Incidence*
East Asia	1347		90	6.7	77	5.7	39	2.9	29	2.2
Indonesia	223	19	12	5.4	11	4.9	5	2.2	3	1.3
Korea	224	11	8	3.6	8	3.6	3	1.3	3	1.3
Malaysia	225	27	18	8.0	15	6.7	9	4.0	6	2.7
Philippines	225	36	20	8.9	17	7.6	9	4.0	8	3.6
Singapore	225	22	16	7.1	13	5.8	9	4.0	7	3.1
Thailand	225	24	16	7.1	13	5.8	4	1.8	2	0.9
Latin America	901		62	6.9	46	5.1	24	2.7	20	2.2
Argentina	226	25	10	4.4	7	3.1	3	1.3	2	0.9
Brazil	225	27	14	6.2	10	4.4	4	1.8	3	1.3
Chile	225	20	17	7.6	13	5.8	10	4.4	9	4.0
Mexico	225	45	21	9.3	16	7.1	7	3.1	6	2.7

Notes: $e_{i,t}$ is measured as the nominal exchange rate.

Incidence is calculated by dividing the number of crises episodes with the number of EMP observations (n) and then multiplying by 100.

Figure A.1 Histogram of Country ERW-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the nominal exchange rate

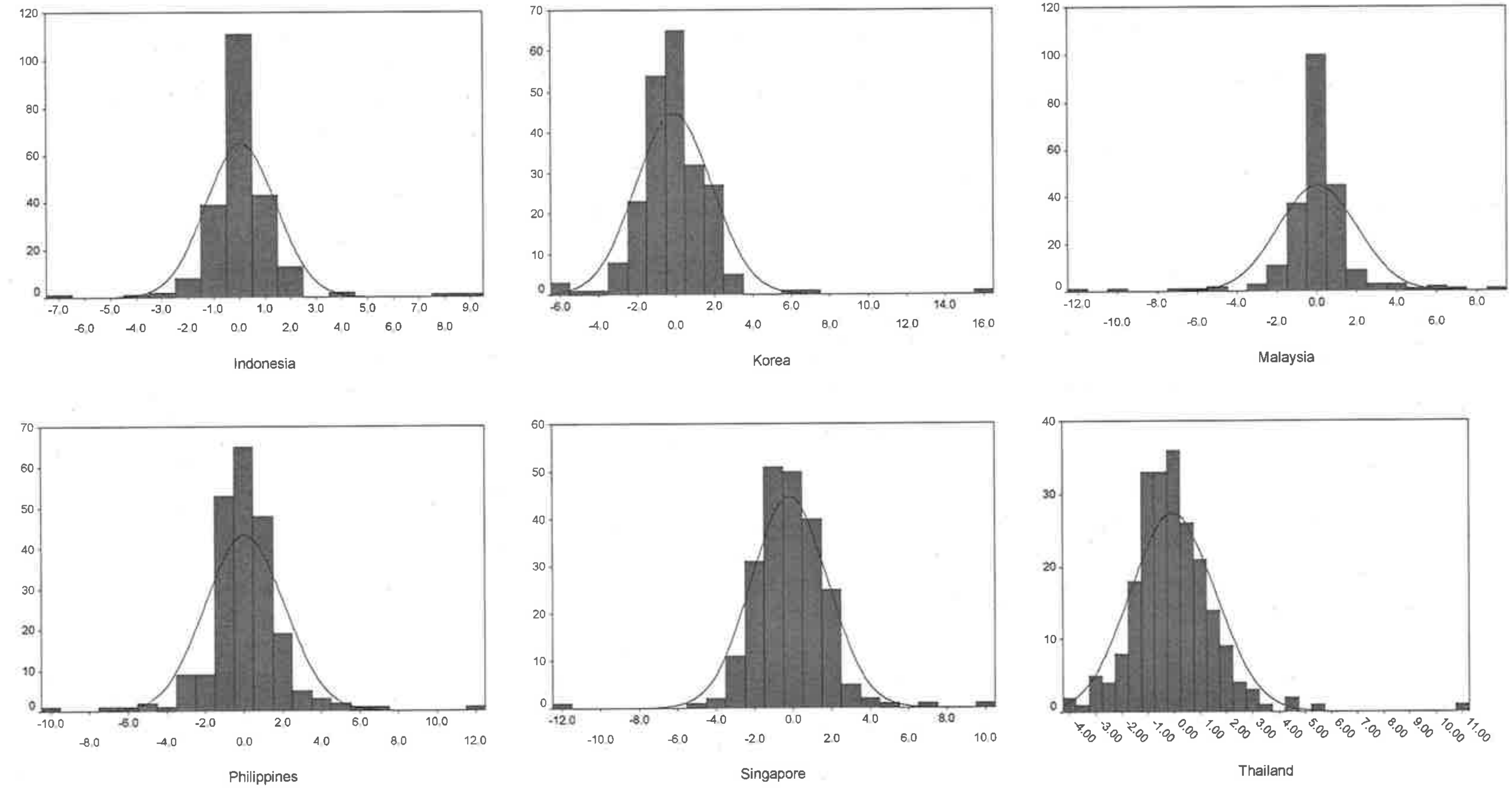


Figure A.1 Histogram of Country ERW-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with $e_{i,t}$ measured as the nominal exchange rate

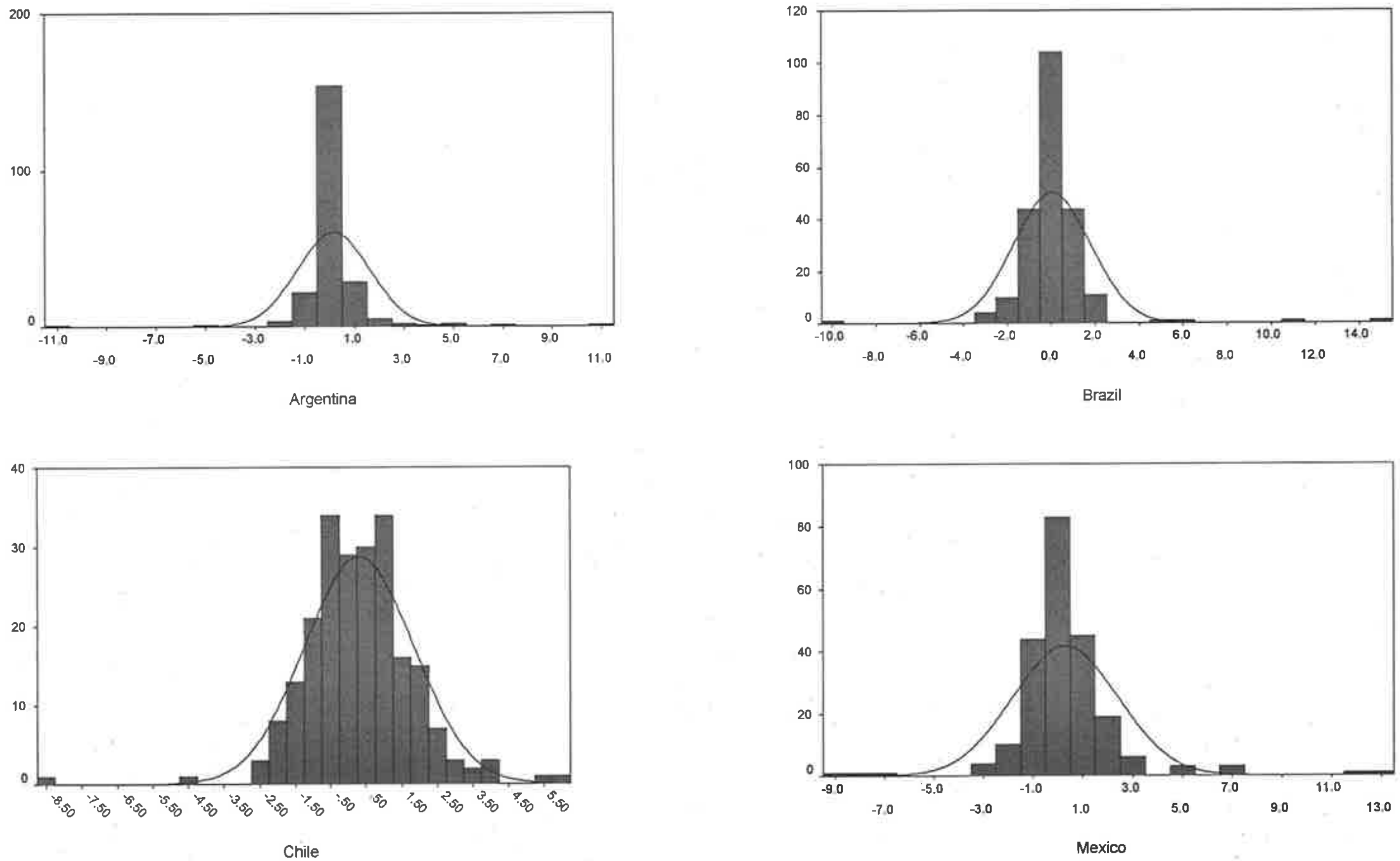


Figure A.2 Histogram of Country KLR-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the nominal exchange rate

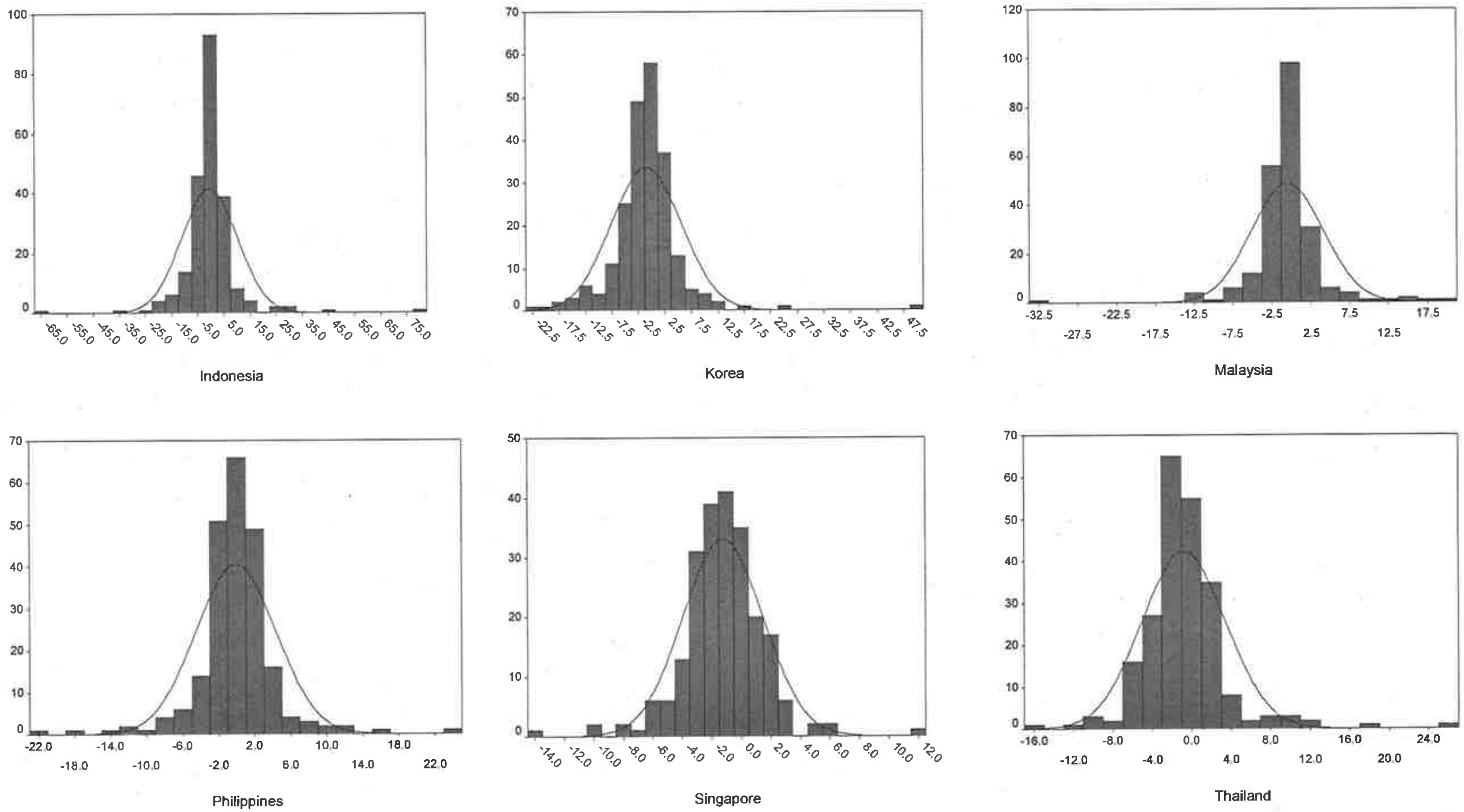


Figure A.2 Histogram of Country KLR-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with $e_{i,t}$ measured as the nominal exchange rate

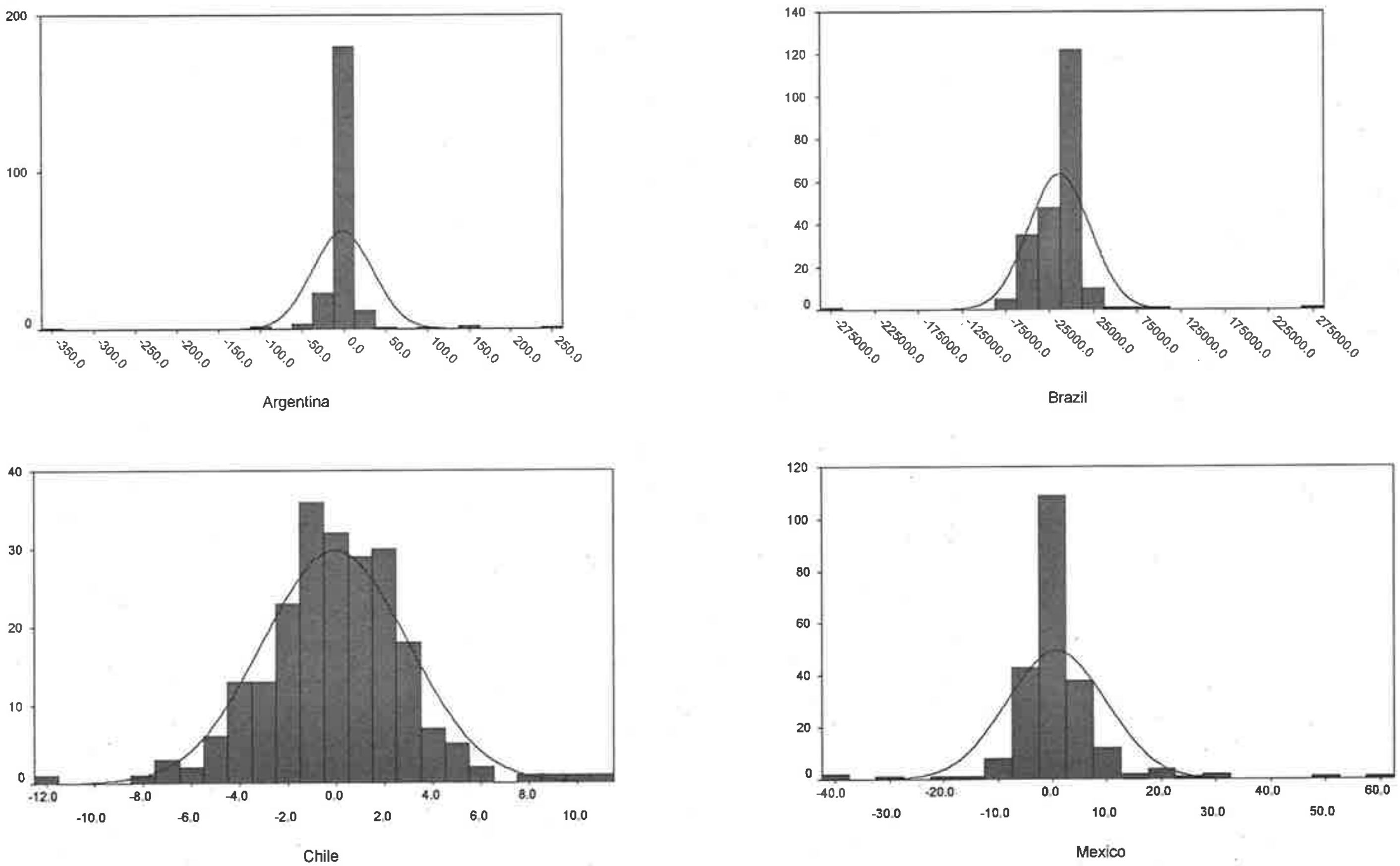


Figure A.3 Histogram of Country STV-EMP Measures and Corresponding Normal Probability Density Function (East Asia)

(a) with $e_{i,t}$ measured as the nominal exchange rate

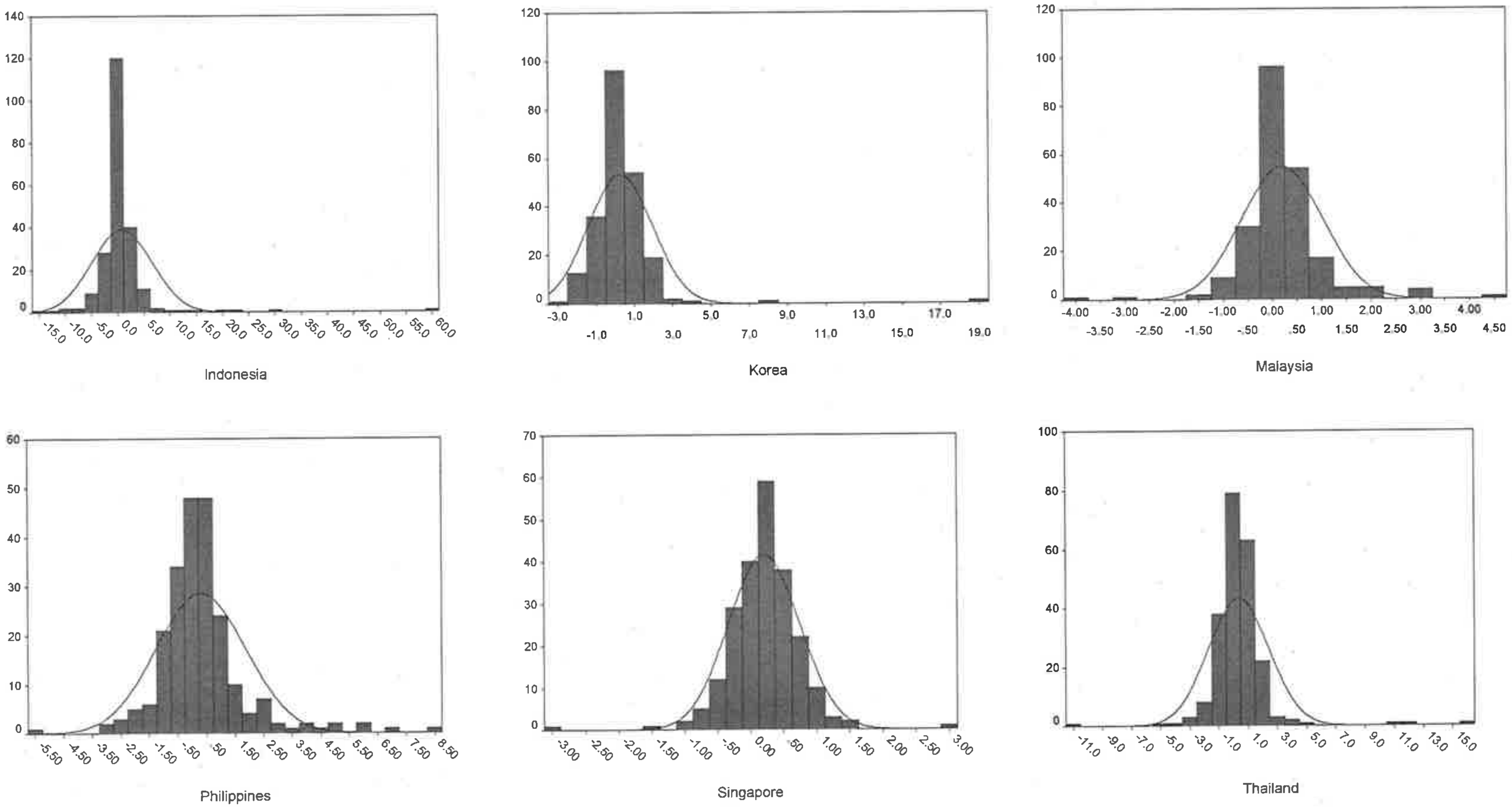


Figure A.3 Histogram of Country STV-EMP Measures and Corresponding Normal Probability Density Function (Latin America)

(a) with $e_{i,t}$ measured as the nominal exchange rate

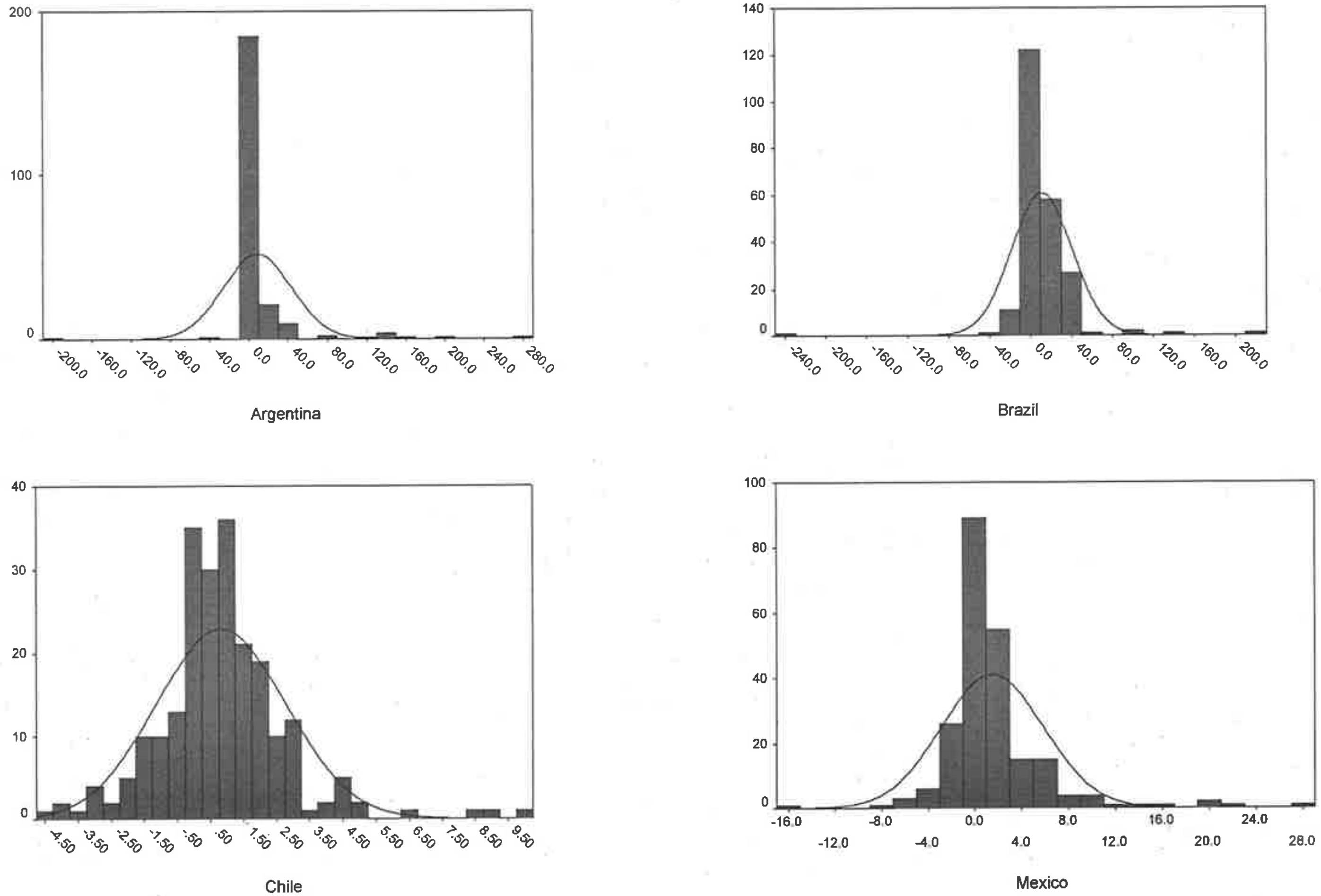


Figure A.4 Recursive Residuals for East Asia using ERW as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate

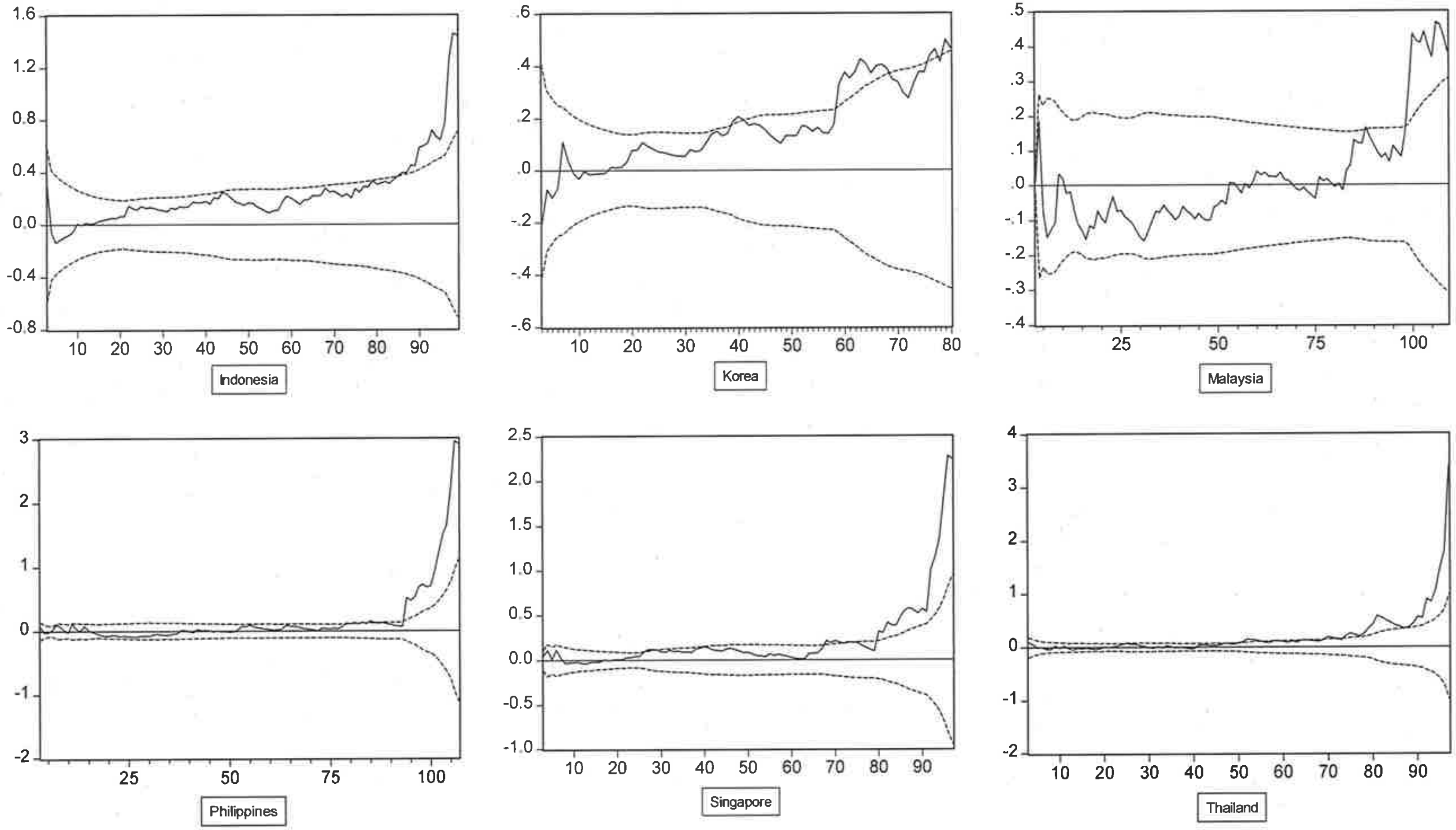


Figure A.4 Recursive Residuals for Latin America using ERW as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate

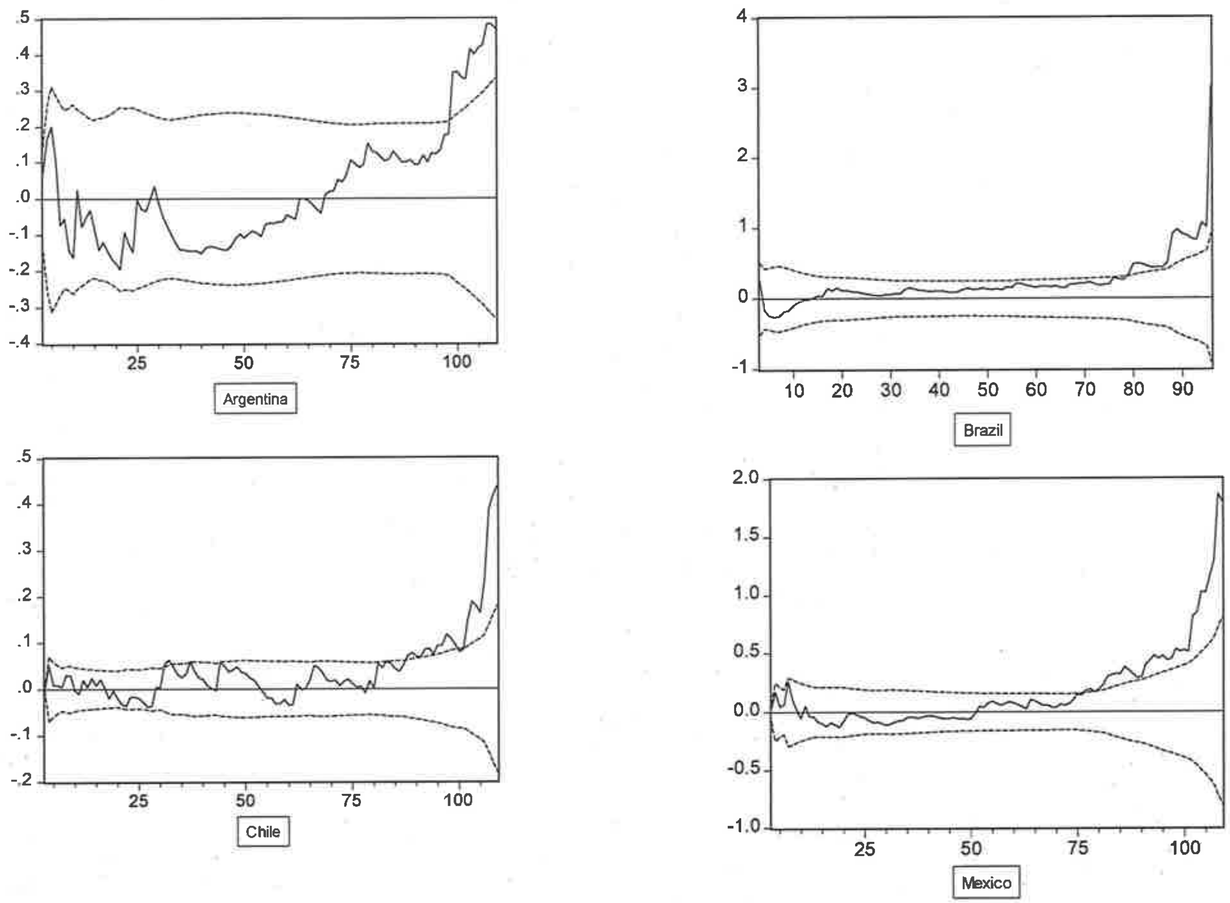


Figure A.5 Recursive Residuals for East Asia using KLR as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate

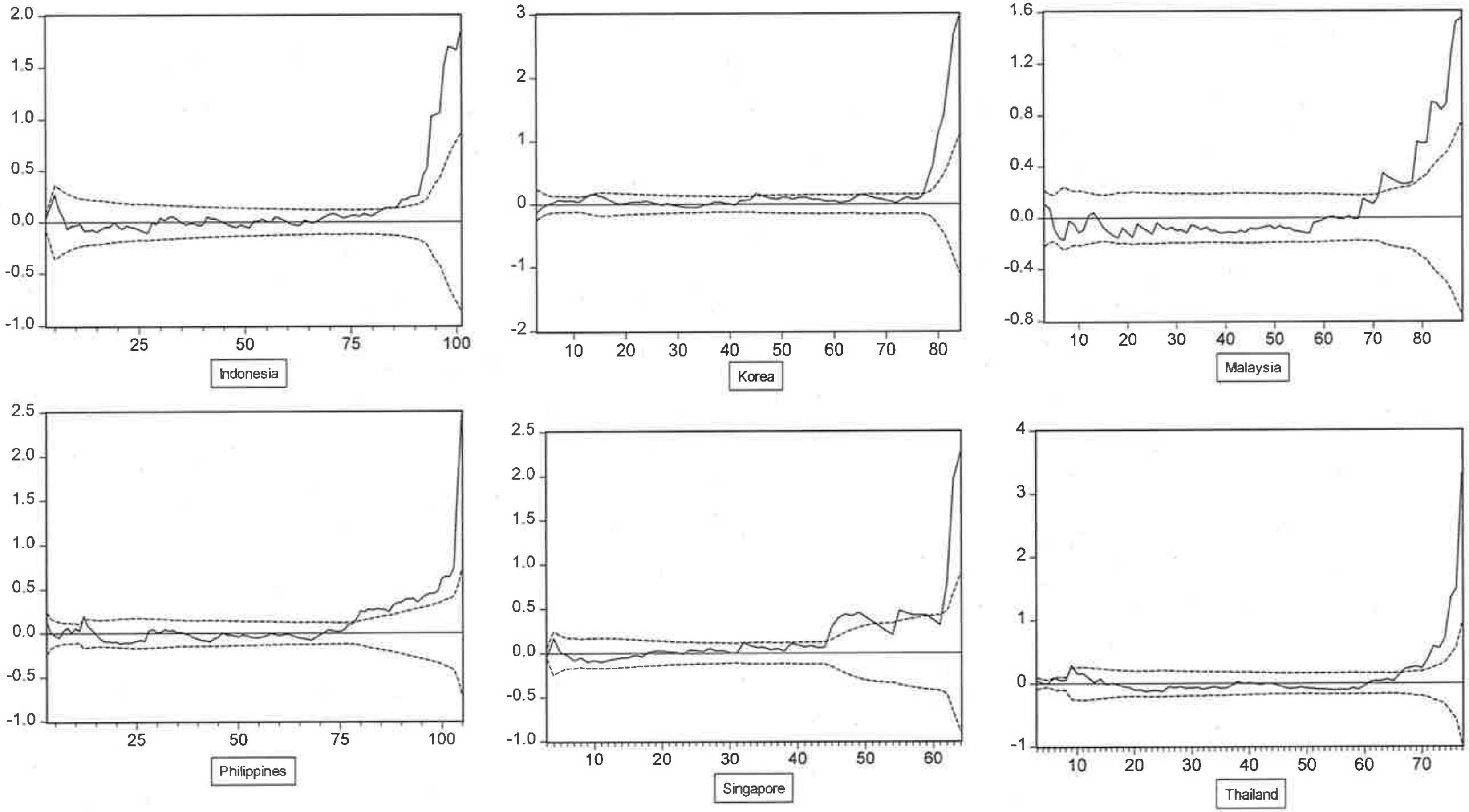


Figure A.5 Recursive Residuals for Latin America using KLR as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate

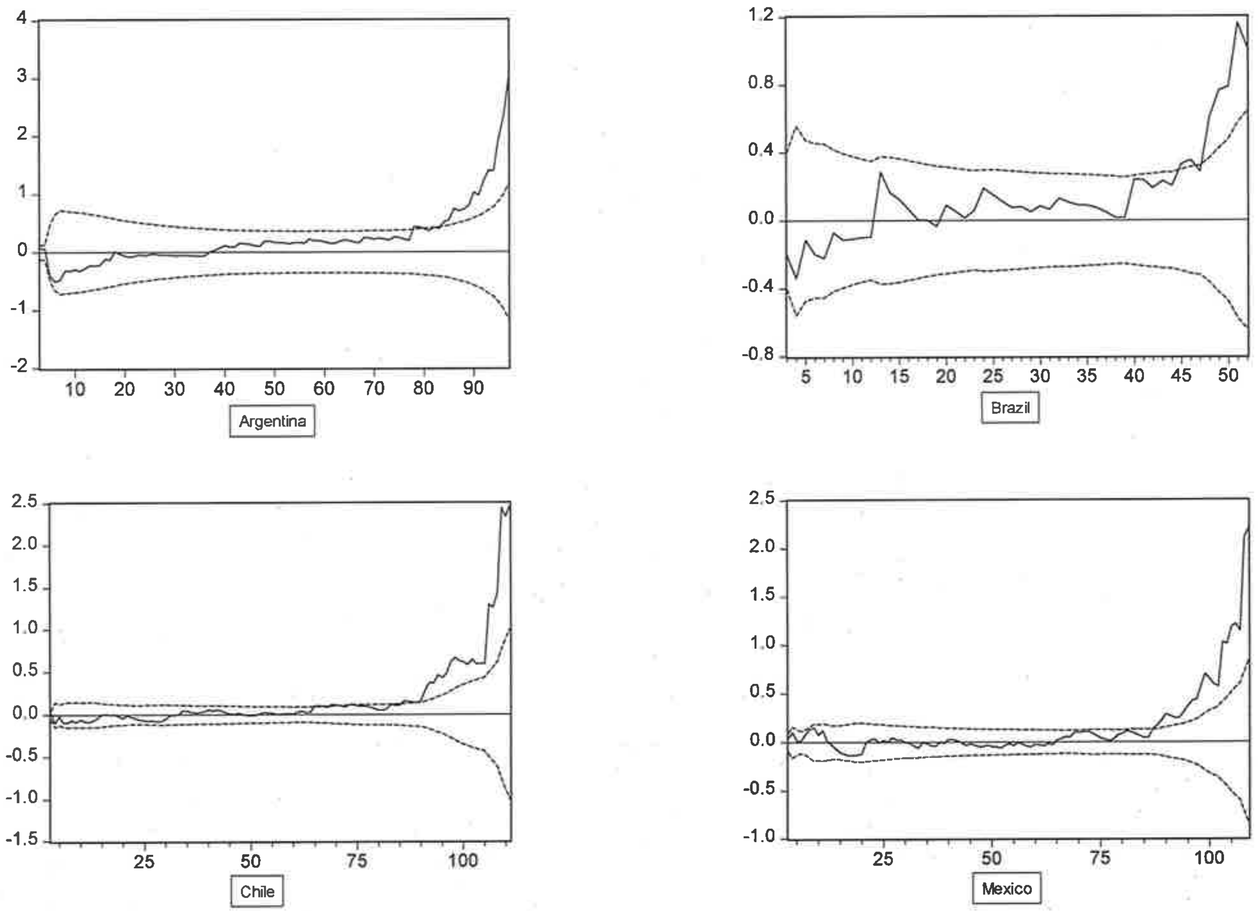


Figure A.6 Recursive Residuals for East Asia using STV as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate

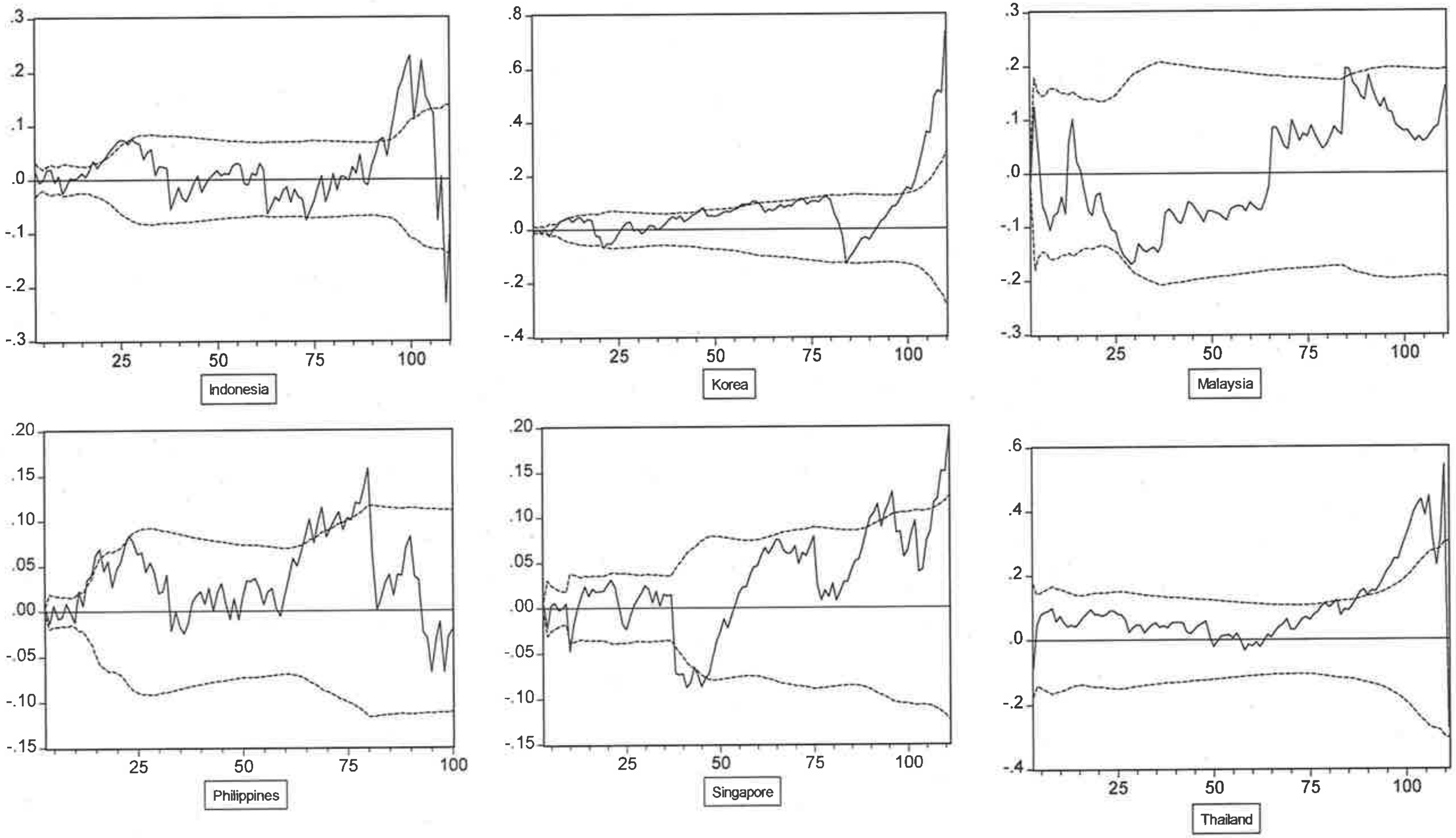
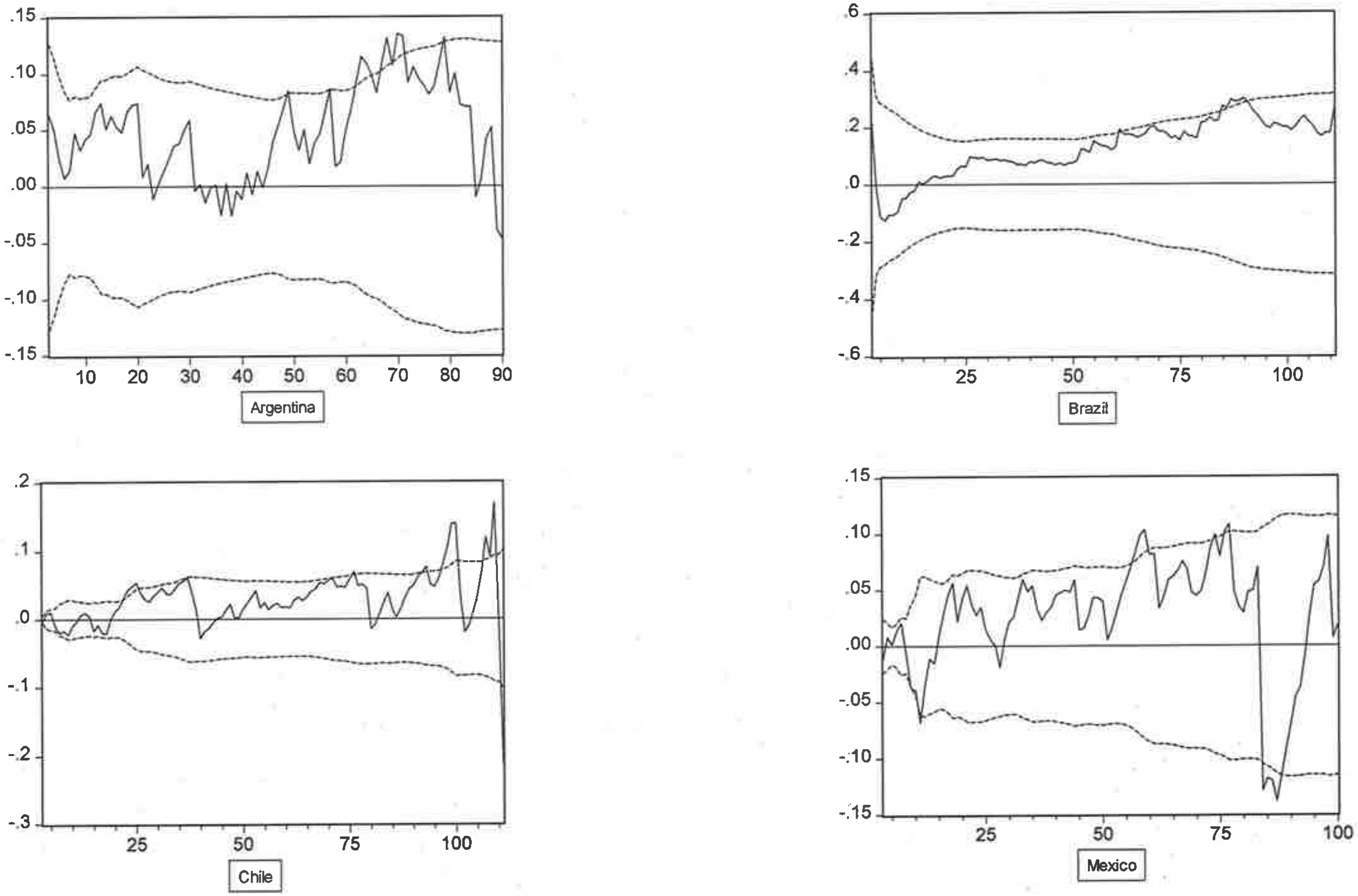


Figure A.6 Recursive Residuals for Latin America using STV as the EMP Measure

(a) with $e_{i,t}$ measured as the nominal exchange rate



Appendix A.2 : Crisis Episodes Identified by Conventional and EVT Approaches with Corresponding Chronologies of Political and Economic Events (Appendix to Chapter 2)

East Asian Sample

A.2.1 Indonesia

Crisis Episodes	Political and Economic Events
February*, September* 1985	Accelerated slump in world oil prices [KLR]
March*, September**, November*, December** 1986	Worsening trade balance and increase in external debt due to drastic drop in world oil prices [ERW, KLR, STV]
June* 1987	Capital flight precipitates monetary crisis, and first *Gebrakan Sumarlin* results in interbank rates of up to 45 per cent; foreign investment regulations liberalised; lingering slump in business confidence due to '86 devaluation; increased demand for foreign exchange due to recent trade liberalisation measures; rumours that government would impose foreign exchange controls [KLR, STV]
March*, July* 1988	Major financial sector reforms enacted—entry provisions liberalised, reserve requirements reduced, and a withholding tax on bank deposits imposed [ERW, KLR, STV]
June* 1989	Rumours that government would let the rupiah to float; limit set on the rupiah's depreciation [ERW, KLR]
April*, June* 1990	A further trade reform package; Bank Duta, one of the largest private banks, announces foreign exchange losses of $420 million [KLR, STV]
March* 1991	Second Gebrakan Sumarlin removes Rp 10 trillion of liquidity from the system; additional trade reforms introduced; decline in world oil prices due to Gulf war [STV]
December* 1992	Collapse of Bank Summa, a large private, which exposed weakness in the banking system [ERW]
April* 1994	Another scandal rocks the financial system, the Bapindo scandal; slowdown in the growth of non-oil/gas exports; eruption of labour unrest [KLR]
February*, September* 1995	Fallout from the Mexican peso crisis [ERW, KLR]
December* 1996	Concerns about President Suharto's health; Riot hits central Jakarta [STV]
August** 1997	Contagion effect from the depreciation of the Thai baht hits [ERW, KLR, STV]
April*, May**, July 1998	Signs new IMF letter of intent; President Suharto steps down and Vice President Habibie takes over, amidst violent protests; plans to implement currency board system; IMF threatens to cut funding if currency board system implemented [ERW, KLR, STV]

January*, August*, December* 1999	Political and social tensions; Fallout from the devaluation of the Brazilian real [ERW, STV]
May*, December* 2000	Growing political uncertainty and continuing social unrest; weakening monetary discipline [ERW, STV]
February**, September*, November**, December* 2001	Dismissal of Abdurrahman Wahid and sworning in of Megawati Sukarnoputri as President; continuing political uncertainty and serious security concerns [ERW, KLR, STV]

A.2.2 Korea

Crisis Episodes	Political and Economic Events
March**, September* 1985	Exiled opposition leader Kim Dae Jung returns home after a two-year exile in the U.S.; mounting labour disputes and strikes [ERW, KLR, STV]
January**, April*, July 1986	Widespread student protests over Chun Doo Hwan's government; reports that overseas construction and shipbuilding, former top industry foreign exchange earners are in chronic decline [ERW, KLR, STV]
March*, November*, December* 1987	Roh Tae Woo elected president amidst widespread protests of election fraud; widespread labour strife worsens [ERW, KLR, STV]
January, August*, December* 1988	Opposition victory in the national assembly election; start of inquiry into former President Chun Doo Hwan's illegal financial dealings [ERW, STV]
February*, March*, September*, October*, 1989	Signs of an impending economic crisis; Continued labour strikes; double-digit rise in wages; speculation that several foreign companies including foreign banks are planning to eliminate or drastically cut back their operations; Chun Doo Hwan, former military supporters, and relatives accused of a wide range of crimes, misrule, and corruption [ERW, KLR, STV]
April*, September* 1990	The won allowed to float on a narrow band; the Gulf War crisis hits [ERW, KLR]
June** 1991	The Hanbo scandal hits; further violent student riots; growing current account deficit [ERW, KLR, STV]
November*, December* 1992	Collapse of leading fashion retailer Nonno owing to huge local and foreign debts; top 30 chaebols registered large debt-equity ratios in excess of 400 per cent; initial financial liberalization package implemented in the foreign exchange market [ERW, STV]

June* 1993	Newly elected President Kim Young Sam massive anti-corruption campaign backfires with the sacking of five cabinet ministers following reports of alleged ill-gotten wealth; indications that President Kim Young Sam's 100 Day Economic Plan is not working [STV]
June*, August* 1994	Mounting opposition demands on President Kim Young Sam to replace his entire cabinet or step down himself [ERW, STV]
May*, August** 1996	Soaring current account deficit due to the so-called 'semiconductor shock'; mounting foreign debt; firing of Deputy Prime Minister and Minister of Finance and Economy [ERW, KLR, STV]
March**, November**, December**, 1997	Watered-down labour reform bill sparked nationwide protests; fall-out from the devaluation of the Thai baht hits [ERW, KLR, STV]
September* 1998	Government announcement that the economy had contracted to its steepest decline in 45 years [ERW]
December* 2000	President Kim Dae Jung reshuffles cabinet twice; Prime Minister Park Tae Joon resigns following allegations of tax evasion; Daewoo Motor Corp. declares bankruptcy; main opposition party boycotts parliament [STV]
January*, September* 2001	President Kim Dae Jung's government hit by a series of corruption scandal [ERW]
March* 2003	Political party funding scandal implicates main political parties and many businesses; President Roh Moo Hyun rejects government minister's offer to resigns, and calls for national referendum [ERW]

A.2.3 Malaysia

Crisis Episodes	Political and Economic Events
February**, November* 1985	Fall in most world commodity prices; bank runs on one of the largest bank, Public Bank; collapse of the Overseas Trust Bank; sacking of the entire top management of another large bank, Perwira Habib [ERW, KLR]
March**, April, August* 1986	Political uncertainty with the resignation of the deputy prime minister Datuk Musa Hitam; unprecedented fall in the prices of nearly all of the major export commodities continues [ERW, KLR, STV]
February*, September*, October**, 1988	Foreign exchange earnings from export commodities not being remitted back due to higher interest rates available outside Malaysia [ERW, KLR, STV]

January[**] 1989	The central bank takes over the Oriental Bank and First Malaysia Finance; central bank governor Tan Sri Jaffar Hussein applies to place Cooperative Central Bank under receivership, and petitioned for the liquidation of SEC Insurance; country's second largest bank Bumiputra Malaysia Finance lost its shareholders funds on bad loans for the second time in five years, and the state-owned oil giant, Petronas, recapitalises [ERW]
January[*], December[**] 1990	Gulf crisis hits; large capital outflows sparked by high-yielding returns abroad [ERW, STV]
August[*] 1991	Large scale outflows of ringgit-denominated profits into other currencies continues; BBMB Securities 'insider trading' scandal [ERW]
December[*] 1992	Public announcement by Prime Minister Mahathir that the ringgit is undervalued [ERW, KLR]
December[**] 1993	Admission by Bank Negara, the country's central bank that it had suffered a lost amounting to at least M$12.8 billion to its reserve and other funds through speculation in the foreign currency market [STV]
January[*], December[*] 1994	Central bank governor resigns after admission that bank Negara had racked up foreign exchange losses in its foreign exchange operations over two years; tax on capital inflows slapped [ERW, KLR]
January[*], September[*] 1995	Vulnerability in its huge current account deficit, the highest in Asia [ERW, KLR]
April[*], May[**], July[*], November[*], December[*] 1997	Central bank restrict loans to property and stocks to head off a crisis; fallout from the devaluation of the Thai baht [ERW, KLR, STV]
June[*] 1998	Deputy Prime Minister and Finance Minister Anwar Ibrahim, accused of sexual misconduct and sacked from government; pegs the ringgit at 3.8 to a U.S. dollar; demonstrations in Kuala Lumpur demanding the resignation of Prime Minister Mahathir [KLR, STV]
March[*] 2001	Highest court throws out former deputy prime minister Anwar Ibrahim's defamation suit against Prime Minister Mahathir; Finance minister Daim Zainuddin resigns, and Prime Minister Mahathir, in turn, assumes post of Finance Minister [KLR]

A.2.4 Philippines

Crisis Episodes	Political and Economic Events
March**, April**, October* 1985	Intensification of disenchantment with President Ferdinand Marcos and increased worries with the inevitable transfer of power [ERW, KLR, STV]
February**, December** 1986	Ferdinand Marcos toppled in a People Power Revolution and fled the country [STV]
March**, September* 1987	Worries about the political situation such as the first failed coup against the Corazon Aquino government and increased activity by communists insurgents [ERW, KLR]
October* 1988	Continued political weakness; huge debt overhang; effect of trade liberalisation measures [KLR]
January, July*, September* 1989	Another coup attempt against the Aquino administration; energy crisis; sharp rise in crude oil prices [KLR, STV]
January, March*, August**, September**, November* 1990	Worsening trade deficit; huge debt service burden; Gulf War crisis [ERW, KLR, STV]
May*, September* 1992	Severe energy crisis; large fiscal deficits [ERW, KLR, STV]
May*, October* 1993	Powerful lobby of exporters, politicians, and economists asked the Ramos government for a sharp depreciation of the peso; large capital outflows due to increased kidnapping of ethnic Chinese businessmen and the government crackdown on tax evaders [ERW, KLR, STV]
February*, March** 1995	Fallout from the Mexican peso crisis hits [ERW, KLR, STV]
July**, Aug 1997	Fallout from the devaluation of the Thai baht [ERW, KLR, STV]
July* 1998	Movie actor, Joseph Estrada becomes 13th Philippine President [ERW, KLR]
July*, October*, November** 2000	President Joseph Estrada impeached on charges of corruption [ERW, KLR, STV]
April* 2001	President Estrada ousted, charged with graft and economic plunder, arrested and jailed [KLR]
March* 2003	Fighting escalates with the MILF; mutiny in Manila against the Macapagal-Arroyo administration [KLR]

A.2.5 Thailand

Crisis Episodes	Political and Economic Events
February**, September*, October*, December 1985	Failed 15th coup attempt; declining world commodity prices; Gen. Arthit Kamlang-ek's emotional attack on TV against the government; collapse of several high-yielding pyramid fund schemes, e.g., Mae Chamoy [ERW, KLR, STV]

December* 1986	Two major scandals rocked the new government of Prime Minister Prem Tinsulanond [STV]
January* 1987	The very powerful Army Commander Gen. Chaovalit Yongchaiyut openly advocates a 'peaceful revolution' [ERW]
December* 1989	Gen. Chaovalit's attack on corruption, which led to the resignation of one of Prime Minister Chatichai Choonhavan's trusted and respected senior policy adviser Sukhumbhand Paribatra [STV]
April*, September, December* 1990	The Gulf crisis hits [ERW, KLR,]
January*, December* 1991	Successful military coup and the junta's installation of an impressive group of technocrats, led by Prime Minister Anand Panyarachun [ERW, STV]
April*, December* 1992	Popular opposition to continued military rule; several antigovernment demonstrators killed and injured; King Bhumibol Adulyadej steps in to stop the violence [ERW, STV]
March*, December* 1993	Forced admission by the central bank that it had bail out First City Finance, after an alleged stock manipulation scandal by First City; strong demands from the investing public for the resignations of the Securities and Exchange Commission (SEC) secretary-general, central bank governor, and Finance Minister [ERW, STV]
May* 1994	The Palang Dharma's reshuffle which led to the resignation of the Foreign Minister [STV]
January**, August*, December 1995	Fall out from the Mexican peso devaluation; ensuing capital flight of foreign investors from the Bangkok stock exchange [ERW, KLR, STV]
February*, December* 1996	Decline in export growth triggered rumours of devaluation; collapsed of the country's most unpopular elected administration of Banharn Silpa-archa [ERW]
February**, July**, September** 1997	Devaluation of the Thai baht triggered the start of the so-called East Asian currency crisis [ERW, KLR, STV]
June** 1998	Prime Minister Chuan Leekpai defeats parliamentary vote of no confidence [ERW, KLR, STV]
September**, October* 1999	Ruling coalition's image tarnished by allegation of aid fraud and poll rigging [ERW, STV]
July* 2000	Deputy Prime Minister and Interior Minister, Sanan Kachornprasart, resigns following inquiry into his personal wealth; Chavalit Yongchaiyudh, leader of main opposition party, leads mass resignation from lower house, in bid to force early general election [STV]

March* 2003	Prime Minister Thaksin shuffles cabinet [ERW]

Latin American Sample

A.2.6 Argentina

Crisis Episodes	**Political and Economic Events**
April*, June* 1985	Banking crisis; the central bank issued a list of debt service obligations refinanced under the Paris Club accord and announced that these obligations would be paid upon maturity, however, these obligations could not be settled on their due dates; Austral plan begins (price and wage controls, devaluation); Peso Argentino replaced at an exchange of 1,000 old Pesos for 1.00 Austral. A fixed exchange rate vis-à-vis the dollar was introduced [ERW, STV]
November* 1986	Main parts of Austral plan abandoned; Austral devalued and system of minidevaluations implemented; The central bank announced the mandatory rollover for a minimum period of one year of all commercial obligations of the private sector that are not included in the financing program [ERW]
October* 1987	Bank debt restructuring agreement; Alfonsin government implements steps to deregulate the financial sector [STV]
May* 1988	Begins accumulating interest arrears; Plan Primavera announced. Exchange rate system revised [STV]
January**, February*, April, December** 1989	Start of another banking crisis [ERW, KLR, STV]
February**, December* 1990	Currency made full convertible; ENTEL (Telecommunications) privatised [KLR, STV]
February* 1991	Crawling peg exchange rate system introduced; President Carlos Menem begins the process of liberalising Argentina's economy [ERW, KLR]
September* 1992	Austral replaced by peso [KLR]
January* 1993	Brady Plan agreement; Constitutional reforms related to presidential election process [ERW]
January*, October* 1994	Devaluation followed by a withdrawal of foreign investors from Latin American countries, leading to banking crisis: eight banks were suspended and three banks collapsed [ERW]
January*, June*, July*, October* 1995	Fallout from the devaluation of the Mexican peso [ERW, KLR, STV]
December* 1996	Economy Minister Domingo Cavallo ousted [STV]

October* 1998	Moody's described the financial sector as 'weak'; concerns about East Asian crisis; falling oil prices, sliding bond prices, and worries surrounding the Brazilian economy weakened the outlook for the economy [ERW]
March*, July* 1999	Fallout from the devaluation of the Brazilian real; Presidential candidate Eduardo Duhualde's declaration of his plan to impose a one-year moratorium on Argentine debt; President de la Rua, elected President ending President Carlos Menem's 10-year Peronist party rule [ERW, KLR]
June*, August* 2000	Allegations that a number of senators received bribes in exchange for backing the labour reform bill; Vice President Carlos Alvarez resigns [KLR, STV]
March*, September, October*, November* 2001	S&P lowered Argentina's sovereign rating to default status; IMF bailout; huge withdrawal of funds from the banking system; Economy Minister Domingo Cavallo and President de la Rua resigns [ERW, KLR, STV]
February, May*, June* 2002	Nationwide riots and demonstrations; President Eduardo Duhalde becomes President announces end to convertibility [ERW, KLR, STV]
March* 2003	Nestor Kirchner becomes President; President refuses to make concessions with the IMF in exchange for refinancing of Argentina's debt [ERW]

A.2.7 Brazil

Crisis Episodes	Political and Economic Events
January*, April*, August* 1986	Cruzado plan (price and wage controls); bank debt restructuring agreement; fixed nominal exchange rate abandoned [ERW, KLR]
May*, December* 1987	Major provisions of cruzado plan abandoned [ERW, STV]
January**, November*, December** 1989	Fernando Collor de Mello elected president; introduces radical economic reform known as the Collor Plan but failed to materialise; foreign debt payments suspended [ERW, KLR, STV]
February** 1990	Introduced a new currency and taxed stock market transactions heavily [KLR]
March*, December* 1991	Cruzeiro devalued amidst uncertainty with its debt obligations [KLR, STV]
October* 1992	President Collor impeached by Congress, resigns as his trial began, and replaced temporarily by his vice president, Itamar Augusto Franco [STV]
July* 1993	The minimum term for external borrowing was extended 1 year to 36 months; bank restructuring agreement [STV]

February*, May, July** 1994	Start of banking crisis: two large state banks and the seventh largest private bank were insolvent; licenses of 11 small banks were revoked [ERW, KLR, STV]
March* 1995	A new exchange rate band was introduced and the Real was devalued [KLR]
April*, October*, November* 1997	Asian crisis sparks pressure on the Brazilian Real [ERW, KLR]
June*, September** 1998	Moody's revises its sovereign rating on Brazilian bonds from stable to negative; government confirms discussions with the IMF, and Agreement on a Stand-By Arrangement announced; Letter of Intent published [ERW, KLR]
March*, October*, December* 1999	The central bank announced that the government would give up defence of the Real, so-called 'Real Plan'; the states of Minas Gerais and Rio Grande do Sul announced they would not make debt payments to the federal government [ERW, KLR]
October*, December* 2001	Central bank announces steady 'linear' intervention in the foreign exchange market; a series of corruption scandal undermine the governing coalition; energy crisis that led the government to order widespread cuts in electrical consumption [ERW, KLR]
June*, August* 2002	Financial markets panic and currency hits all time low over the prospect that left-winger Lula da Silva would win the October 2002 election [ERW, KLR, STV]
April* 2003	Landless Workers Movement launches fresh wave of farm occupations in an attempt to accelerate land reform [KLR]

A.2.8 Chile

Crisis Episodes	Political and Economic Events
February**, March**, December** 1985	Agreement with IMF. Full IMF conditionality; mini devaluation 7.8 per cent; import tariffs reduced to 20 per cent [ERW, KLR, STV]
July*, October* 1986	New banking law; opposition boycott of 1980 constitution continues [KLR, STV]
May*, August* 1987	Bank debt restructuring agreement; reprivatisation of banks and companies rescued in 1982-83 [ERW, STV]
April*, November*, December** 1988	Bank debt restructuring agreement (amendment to June 1987 agreement); Pinochet loses referendum whether he should in power until 1997 [KLR, STV]

April**, October*, November 1989	Patricio Aylwin Azocar, a member of the Christian Democratic Party who headed a coalition of 17 centre and left parties, was elected president by popular vote; Brady Plan (adjustment packages that combined debt relief and market-oriented reforms) [ERW, KLR, STV]
April*, July*, October 1990	After stepping down as head of state in 1989, Pinochet remains as commander-in-chief of the army; bank debt restructuring agreement (amendments to previous agreements) [ERW, STV]
April**, November** 1991	Import tariffs reduced to 11 per cent; to discourage short-term inflows and favour equity and long term financing a 20 per cent non-remunerated reserve requirement (RR) on new foreign borrowing is introduced [ERW, KLR, STV]
March, June*, August* 1992	Reduced reference rate by 5 per cent and doubled fluctuation band by 10 per cent each way; reserve requirements on foreign liabilities increased from 20 to 30 per cent [ERW, STV]
March**, May* 1993	Concertacion Frei elected for six-year term [ERW, KLR, STV]
February*, August*, September* 1995	Fallout from devaluation of the Mexican peso [ERW, KLR, STV]
December* 1997	Concerns on Brazilian real devaluation; concerns over the financial troubles in Asia's market, especially the collapse of the Yamaichi Securities in Japan; concerns that an economic slowdown in Asia will affect Chilean exports [ERW, KLR]
January, July* 1998	Pinochet stepped down as head of the army but made as a senator for life; Pinochet arrested in London and held for possible extradition to Spain; big terms of trade shock as price of copper plummets and recession settles in Asia; *encaje* reduced from 30 to 10 percent and later completely eliminated [KLR]
June*, October* 1999	The exchange rate band was abolished [KLR, STV]
May*, September* 2000	UK Home Secretary Jack Straw decided that Pinochet not fit to be extradited, and returns to Chile; Ricrado Lagos-Escobar elected president and becomes the first Socialist president since Allende; strong oil prices [KLR, STV]

March*, April*, July**, October* 2001	Court orders Pinochet to stand trial for human rights abuses committed during his dictatorship, but later on another court order suspends Pinochet's trial, raising the spectre that Pinochet will unlikely stand trial on any of the charges he faces; price of copper in the world market crashes [ERW, KLR, STV]
June* 2002	All charges against Pinochet are dropped after the Supreme Court upholds a verdict finding him mentally unfit to stand trial for human rights crimes. Days after the ruling, Pinochet resigns from his post as a lifelong senator [ERW, STV]
January**, June* 2003	Appeals court blocks attempt to force Pinochet to stand trial; judges vote against lifting his immunity from prosecution [ERW, KLR, STV]

A.2.9 Mexico

Crisis Episodes	Political and Economic Events
July*, August 1985	Bank debt restructuring agreement; earthquake hits Mexico City; official free market rate abolished. Exchange houses allowed to deal in the street or black market rate [ERW, KLR, STV]
June*, July* 1986	Falling world oil prices [ERW, KLR, STV]
December** 1987	Bank debt restructuring agreement (public and private sector debt); Pacto de Solidaridad Social (price stabilisation plan) initiated; announce willing to exchange $10 billion of debt for 20-year collateralised bonds [ERW, KLR, STV]
January, September*, November* 1988	Salinas de Gortari wins presidential election amidst charges of massive fraud; fixed exchange rate evidently not working [ERW, KLR, STV]
May*, October* 1989	Brady Plan (adjustment packages that combined debt relief and market-oriented reforms) [ERW, KLR, STV]
March** 1990	Another bank debt restructuring agreement; Moody announced first time rating of Ba2 on sovereign debt [KLR, STV]
August* 1991	Began NAFTA negotiations with Canada, U.S.; privatisation of several companies and banks [ERW]
November* 1993	Currency reform announced. Nuevo Peso introduced; parliament ratifies NAFTA agreement; peso crisis began and Bank of Mexico steps in to support the rate [ERW, KLR, STV]

April, November*, December 1994	Chiapas uprising; presidential candidate Luis Donaldo Colosio assassinated; market falls 10.2 per cent as investors dum stocks and cetes and plow into tesobonos. Interest on tesobonos now paid in dollars and not in pesos; Ernesto Zedillo wins election; Mexican peso permitted to float against U.S. dollar
October*, November 1995	U.S. bailout loan valued at $13.5 billion; start of banking crisis; former president Ricardo Salinas goes into exile after his brother Raul Salinas is connected with Colosio's murder [ERW, KLR, STV]
November* 1996	Guerrilla attack in Oaxaca brings about political uncertainty [ERW]
November* 1997	The NYSE suspends trading of Sidek's ADR and will ask the US SEC to delist the stock due to its failure to comply with listing criteria; The PRI suffers heavy losses in election and losses its overall majority in the lower house of parliament for the first time since 1929 [ERW, KLR, STV]
September** 1998	A weaker currency following signals by central bank governor Guillermo Ortiz about high inflation from looser monetary policy; oil price decreased to 12 year lows; Governor of Chiapas resigns. Peace talks with the rebels were reactivated but break down [ERW, KLR, STV]
June* 2002	Mexico affected by the economic slowdown in the U.S., an estimated 240,000 jobs were lost in the Maquiladoras; secret security files released shedding light on the torture and killing of political activists in the 60s and 70s, former president also implicated [ERW]

Notes: **$e_{i,t}$ is measured as the real exchange rate.**

****, episode both identified by conventional and EVT methods.**

***, episode only identified by EVT method.**

Episodes without an asterisk (*) only identified by conventional method.

Sources: Economist Intelligence Unit (EIU). Country Report published by The Economist (various years); Bulletin of Indonesian Economic Studies (various years); Hill, Hal. 2000. The Indonesian Economy. Cambridge University Press, U.K; http://www.encyclopedia.com; http://www.duke.edu/~charvey/Country_risk/couindex.htm; http://asiapacific.ca/data/chronology/index.cfm; Asia Yearbook published by the Far Eastern Economic Review (various years); http://news.bbc.co.uk/1/hi/world.default.stm; Caballero, Ricardo. 1999. Structural Volatility in Chile. Policy Report to IADB.

Appendix B : Sensitivity Test Results Without the Interest Rate Controls in the Estimation of the MS-VAR model (Appendix to Chapter 4)

Appendix B.1

Test for Regime Switching: Linear VAR versus Markov Switching VAR

Country Pairs	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia-Malaysia	3128.3 [0.00]**	3034.6 [0.00]**	3043.8 [0.00]**	3229.0 [0.00]**	3579.2 [0.00]**	4032.7 [0.00]**
Indonesia-Philippines	2582.9 [0.00]**	2505.5 [0.00]**	2579.7 [0.00]**	2703.6 [0.00]**	2891.3 [0.00]**	3136.0 [0.00]**
Indonesia-Singapore	2853.0 [0.00]**	2760.7 [0.00]**	2705.4 [0.00]**	2756.0 [0.00]**	2875.5 [0.00]**	3079.3 [0.00]**
Indonesia-Korea	3226.1 [0.00]**	3045.2 [0.00]**	2955.9 [0.00]**	2984.9 [0.00]**	3106.4 [0.00]**	3355.2 [0.00]**
Indonesia-Thailand	2623.5 [0.00]**	2554.1 [0.00]**	2523.3 [0.00]**	2559.5 [0.00]**	2726.1 [0.00]**	2992.7 [0.00]**
Indonesia-Hong Kong	2638.9 [0.00]**	2523.1 [0.00]**	2469.6 [0.00]**	2527.8 [0.00]**	2687.1 [0.00]**	2962.4 [0.00]**
Malaysia-Philippines	1533.6 [0.00]**	1609.6 [0.00]**	1822.8 [0.00]**	2091.1 [0.00]**	2429.8 [0.00]**	2759.7 [0.00]**
Malaysia-Singapore	1828.7 [0.00]**	1813.0 [0.00]**	1862.4 [0.00]**	2044.7 [0.00]**	2328.1 [0.00]**	2608.0 [0.00]**
Malaysia-Korea	2060.9 [0.00]**	1961.8 [0.00]**	1957.3 [0.00]**	2132.3 [0.00]**	2390.6 [0.00]**	2706.6 [0.00]**
Malaysia-Thailand	1497.1 [0.00]**	1491.6 [0.00]**	1572.8 [0.00]**	1796.1 [0.00]**	2116.8 [0.00]**	2465.8 [0.00]**
Malaysia-Hong Kong	1577.3 [0.00]**	1546.3 [0.00]**	1609.6 [0.00]**	1816.7 [0.00]**	2142.7 [0.00]**	2502.9 [0.00]**
Philippines-Singapore	1115.7 [0.00]**	1133.1 [0.00]**	1286.2 [0.00]**	1404.1 [0.00]**	1519.4 [0.00]**	1574.5 [0.00]**
Philippines-Korea	1496.7 [0.00]**	1387.8 [0.00]**	1475.3 [0.00]**	1590.9 [0.00]**	1683.7 [0.00]**	1792.7 [0.00]**
Philippines-Thailand	1051.1 [0.00]**	1057.6 [0.00]**	1228.3 [0.00]**	1376.6 [0.00]**	1518.2 [0.00]**	1655.2 [0.00]**
Philippines-Hong Kong	1038.5 [0.00]**	1055.1 [0.00]**	1170.9 [0.00]**	1270.6 [0.00]**	1408.2 [0.00]**	1546.2 [0.00]**
Singapore-Korea	1783.4 [0.00]**	1646.9 [0.00]**	1646.0 [0.00]**	1703.2 [0.00]**	1760.4 [0.00]**	1841.1 [0.00]**
Singapore-Thailand	1169.7 [0.00]**	1133.3 [0.00]**	1150.9 [0.00]**	1213.6 [0.00]**	1306.5 [0.00]**	1381.4 [0.00]**
Singapore-Hong Kong	1095.1 [0.00]**	1020.2 [0.00]**	1021.7 [0.00]**	1075.2 [0.00]**	1144.5 [0.00]**	1231.0 [0.00]**
Korea-Thailand	1560.8 [0.00]**	1450.1 [0.00]**	1442.4 [0.00]**	1495.2 [0.00]**	1574.2 [0.00]**	1700.6 [0.00]**
Korea-Hong Kong	1553.6 [0.00]**	1396.9 [0.00]**	1378.7 [0.00]**	1398.1 [0.00]**	1480.8 [0.00]**	1638.0 [0.00]**
Thailand-Hong Kong	1059.6 [0.00]**	987.6 [0.00]**	996.5 [0.00]**	1053.3 [0.00]**	1183.6 [0.00]**	1347.1 [0.00]**

Notes: The likelihood ratio tests the null of a linear VAR against the alternative of a Markov switching VAR. The value in square brackets below that of the computed LR is the corresponding *p*-value; ** indicate rejection of the null at the 1%.

Appendix B.2
Test for Regime-dependent Heteroscedasticity

Country Pairs	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia-Malaysia	3128.3 [0.00]**	3034.6 [0.00]**	3043.8 [0.00]**	3229.0 [0.00]**	3579.3 [0.00]**	4032.8 [0.00]**
Indonesia-Philippines	2583.0 [0.00]**	2505.7 [0.00]**	2579.8 [0.00]**	2703.8 [0.00]**	2891.5 [0.00]**	3136.2 [0.00]**
Indonesia-Singapore	2853.1 [0.00]**	2760.8 [0.00]**	2705.5 [0.00]**	2756.1 [0.00]**	2875.6 [0.00]**	3079.4 [0.00]**
Indonesia-Korea	3226.2 [0.00]**	3045.4 [0.00]**	2956.1 [0.00]**	2985.1 [0.00]**	3106.5 [0.00]**	3355.4 [0.00]**
Indonesia-Thailand	2623.6 [0.00]**	2554.3 [0.00]**	2523.5 [0.00]**	2559.7 [0.00]**	2726.3 [0.00]**	2992.9 [0.00]**
Indonesia-Hong Kong	2639.0 [0.00]**	2523.2 [0.00]**	2469.8 [0.00]**	2528.0 [0.00]**	2687.3 [0.00]**	2962.6 [0.00]**
Malaysia-Philippines	1533.7 [0.00]**	1609.7 [0.00]**	1822.8 [0.00]**	2091.2 [0.00]**	2429.8 [0.00]**	2759.7 [0.00]**
Malaysia-Singapore	1828.7 [0.00]**	1813.0 [0.00]**	1862.4 [0.00]**	2044.7 [0.00]**	2328.1 [0.00]**	2608.0 [0.00]**
Malaysia-Korea	2061.0 [0.00]**	1961.8 [0.00]**	1957.4 [0.00]**	2132.3 [0.00]**	2390.6 [0.00]**	2706.6 [0.00]**
Malaysia-Thailand	1497.1 [0.00]**	1491.6 [0.00]**	1572.8 [0.00]**	1796.1 [0.00]**	2116.8 [0.00]**	2465.9 [0.00]**
Malaysia-Hong Kong	1577.4 [0.00]**	1546.4 [0.00]**	1609.8 [0.00]**	1816.9 [0.00]**	2142.9 [0.00]**	2503.1 [0.00]**
Philippines-Singapore	1115.5 [0.00]**	1133.1 [0.00]**	1286.3 [0.00]**	1404.2 [0.00]**	1519.6 [0.00]**	1574.7 [0.00]**
Philippines-Korea	1496.8 [0.00]**	1387.9 [0.00]**	1475.5 [0.00]**	1591.0 [0.00]**	1683.9 [0.00]**	1792.9 [0.00]**
Philippines-Thailand	1051.2 [0.00]**	1057.8 [0.00]**	1228.4 [0.00]**	1376.8 [0.00]**	1518.4 [0.00]**	1655.4 [0.00]**
Philippines-Hong Kong	1038.6 [0.00]**	1055.2 [0.00]**	1171.1 [0.00]**	1270.8 [0.00]**	1408.4 [0.00]**	1546.4 [0.00]**
Singapore-Korea	1783.5 [0.00]**	1647.0 [0.00]**	1646.1 [0.00]**	1703.3 [0.00]**	1760.6 [0.00]**	1841.3 [0.00]**
Singapore-Thailand	1169.8 [0.00]**	1133.4 [0.00]**	1151.1 [0.00]**	1213.7 [0.00]**	1306.6 [0.00]**	1381.6 [0.00]**
Singapore-Hong Kong	1095.2 [0.00]**	1020.3 [0.00]**	1021.8 [0.00]**	1075.4 [0.00]**	1144.7 [0.00]**	1231.2 [0.00]**
Korea-Thailand	1560.9 [0.00]**	1450.2 [0.00]**	1442.5 [0.00]**	1495.3 [0.00]**	1574.4 [0.00]**	1700.8 [0.00]**
Korea-Hong Kong	1553.7 [0.00]**	1397.1 [0.00]**	1378.9 [0.00]**	1398.3 [0.00]**	1481.0 [0.00]**	1638.2 [0.00]**
Thailand-Hong Kong	1059.7 [0.00]**	987.7 [0.00]**	996.6 [0.00]**	1053.5 [0.00]**	1183.8 [0.00]**	1347.3 [0.00]**

Notes: The likelihood ratio test the null hypothesis that $\sigma_l^2 = \sigma_h^2$. The value in square brackets below that of the computed LR is the corresponding *p*-value. ** indicate rejection of the null hypothesis at the 1%.

Appendix B.3 Granger Causality Test Using the MS-VAR Model

Direction of Causality	1994-98	1994-99	1994-00	1994-01	1994-02	1994-03
Indonesia → Malaysia	2444.8**	3490.6**	4331.6**	5056.9**	5656.2**	6109.5**
Malaysia → Indonesia	2684.9**	3400.4**	3907.5**	4261.6**	4466.4**	4610.9**
Indonesia→Philippines	2529.5**	3484.8**	4327.6**	5041.4**	5620.9**	6077.3**
Philippines→Indonesia	2599.7**	3079.3**	3618.3**	4173.6**	4541.6**	4925.6**
Indonesia →Singapore	2402.9**	3344.0**	4166.1**	4883.6**	5487.8**	5918.7**
Singapore→ Indonesia	1808.4**	2360.7**	2902.3**	3364.4**	3773.1**	4143.9**
Indonesia → Korea	2625.0**	3617.0**	4459.1**	5137.4**	5731.9**	6176.2**
Korea → Indonesia	2949.7**	3879.6**	4818.1**	5551.6**	6256.7**	6852.0**
Indonesia → Thailand	2553.5**	3494.7**	4292.1**	5038.7**	5635.5**	6092.9**
Thailand → Indonesia	3032.0**	3760.1**	4411.9**	4999.1**	5477.7**	5901.3**
Indonesia→ Hong Kong	2585.5**	3639.2**	4283.1**	4785.3**	5167.7**	5444.2**
Hong Kong→ Indonesia	2684.9**	3400.4**	3907.5**	4261.6**	4466.4**	4610.9**
Malaysia→Philippines	2705.0**	3327.3**	3835.8**	4153.3**	4349.0**	4502.0**
Philippines→Malaysia	2535.0**	3012.0**	3550.6**	4080.9**	4459.5**	4848.9**
Malaysia → Singapore	2364.3**	2997.4**	3519.3**	3852.8**	4013.5**	4132.3**
Singapore → Malaysia	1539.7**	2104.3**	2679.6**	3128.9**	3488.6**	3856.2**
Malaysia → Korea	2910.9**	3560.8**	4118.0**	4420.7**	4628.9**	4782.3**
Korea → Malaysia	2985.5**	3913.6**	4901.1**	5630.1**	6343.5**	6956.7**
Malaysia → Thailand	2679.5**	3312.9**	3800.8**	4104.2**	4296.3**	4434.1**
Thailand → Malaysia	2917.8**	3668.5**	4344.7**	4860.0**	5328.4**	5741.1**
Malaysia→Hong Kong	2644.6**	3270.8**	3736.2**	4035.6**	4207.3**	4350.8**
Hong Kong→Malaysia	2503.9**	3122.2**	3784.7**	4307.1**	4695.9**	5016.2**
Philippines→Singapore	2442.7**	2890.9**	3416.5**	3971.0**	4327.4**	4709.9**
Singapore→Philippines	1788.0**	2313.2**	2861.9**	3319.6**	3692.1**	4086.8**
Philippines → Korea	2811.1**	3335.6**	3873.7**	4339.4**	4712.9**	5093.3**
Korea → Philippines	3055.7**	4003.8**	4942.0**	5621.3**	6317.0**	6920.8**
Philippines → Thailand	2485.8**	2962.4**	3429.6**	3965.9**	4345.0**	4724.5**
Thailand → Philippines	2894.1**	3633.3**	4258.6**	4794.1**	5266.5**	5684.6**
Philippines→Hong Kong	2531.0**	2967.6**	3465.4**	4001.2**	4374.1**	4771.7**
Hong Kong→Philippines	2560.2**	3134.3**	3799.0**	4345.2**	4752.1**	5090.2**
Singapore → Korea	2066.5**	2603.7**	3107.8**	3466.9**	3807.1**	4145.5**
Korea → Singapore	2965.7**	3849.6**	4730.7**	5400.2**	6046.6**	6596.1**
Singapore → Thailand	1757.8**	2254.6**	2735.8**	3172.3**	3526.9**	3907.2**
Thailand → Singapore	2820.8**	3503.4**	4119.3**	4651.9**	5083.8**	5490.4**
Singapore → Hong Kong	1498.9**	1969.9**	2388.8**	2725.3**	3035.2**	3339.1**
Hong Kong → Singapore	2965.7**	3849.6**	4730.7**	5400.2**	6046.6**	6596.1**
Korea → Thailand	3000.3**	3873.8**	4763.2**	5457.3**	6146.5**	6745.9**
Thailand → Korea	3164.1**	3876.6**	4523.9**	5003.6**	5464.0**	5878.5**
Korea → Hong Kong	3045.2**	3930.9**	3262.6**	5448.3**	6106.2**	6670.2**
Hong Kong → Korea	2829.9**	3429.5**	2527.9**	4510.4**	4880.2**	5161.1**
Thailand → Hong Kong	2950.9**	3665.5**	4272.3**	4802.8**	5258.1**	5684.1**
Hong Kong → Thailand	2571.8**	3161.2**	3776.9**	4318.5**	4714.6**	5042.5**

Notes: → implies the null of no Granger causality. A significant value rejects the null of no causation at the 1% level.

Appendix B.4.1(a) MS-VAR Estimation Results, 1994-98 (Host: Indonesia)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.02 (0.03)	0.08** (0.03)	-0.03** (0.02)	0.05** (0.02)	0.10** (0.03)	0.06* (0.02)
y_{t-1}^j	----	0.12** (0.03)	0.10** (0.03)	-0.01** (0.03)	0.13** (0.03)	0.10** (0.03)	-0.00 (0.03)
v(s=1)	----	-0.07 (0.11)	-0.08 (0.10)	-0.39 (0.07)	-0.04 (0.06)	-0.08 (0.08)	-0.08 (0.07)
v(s=2)	----	-0.01 (0.02)	-0.02 (0.02)	-0.32 (0.02)	0.00 (0.01)	-0.04* (0.02)	-0.03 (0.02)
$\sigma(s=1)$	----	2.09	1.88	1.25	1.17	1.56	1.36
$\sigma(s=2)$	----	0.52	0.46	0.52	0.36	0.57	0.54
F-test	----	16.15++	16.70++	5.78++	10.56++	7.49++	6.34++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(b) MS-VAR Estimation Results, 1994-98 (Host: Korea)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.03 (0.03)	0.07^{**} (0.02)	0.06^{**} (0.02)	0.06^{*} (0.03)	0.07^{**} (0.03)
y_{t-1}^j	0.26^{**} (0.03)	----	0.14^{**} (0.03)	0.20^{**} (0.03)	0.14^{**} (0.03)	0.12^{**} (0.03)	0.01 (0.03)
v(s=1)	-0.15 (0.16)	----	-0.03 (0.02)	-0.05 (0.07)	0.00 (0.02)	-0.05^{**} (0.02)	0.03 (0.02)
v(s=2)	-0.00 (0.01)	----	-0.07 (0.11)	-0.01 (0.02)	-0.05 (0.07)	-0.07 (0.08)	-0.09 (0.08)
$\sigma(s=1)$	2.96	----	0.47	1.30	0.38	0.55	0.54
$\sigma(s=2)$	0.36	----	1.98	0.54	1.21	1.57	1.42
F-test	67.60^{++}	----	30.25^{++}	5.80^{++}	10.14^{++}	8.15^{++}	6.91^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(c) MS-VAR Estimation Results, 1994-98 (Host: Malaysia)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.13** (0.02)	0.03 (0.03)	----	0.19** (0.03)	0.05* (0.02)	0.05 (0.03)	0.05 (0.03)
y_{t-1}^j	0.20** (0.03)	0.13** (0.03)	----	0.14** (0.03)	0.14** (0.03)	0.11** (0.03)	-0.00 (0.03)
v(s=1)	-0.15 (0.15)	-0.01 (0.02)	----	0.00 (0.02)	-0.00 (0.01)	-0.05* (0.02)	0.03 (0.02)
v(s=2)	0.00 (0.01)	-0.07 (0.12)	----	-0.06 (0.06)	-0.03 (0.06)	-0.07 (0.08)	-0.07 (0.07)
σ(s=1)	2.82	0.51	----	0.44	0.35	0.53	0.47
σ(s=2)	0.34	2.13	----	1.22	1.19	1.57	1.35
F-test	68.79++	17.44++	----	7.69++	11.56++	8.78++	8.25++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(d) MS-VAR Estimation Results, 1994-98 (Host: Philippines)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.07** (0.02)	-0.00 (0.03)	0.05 (0.03)	----	0.04 (0.02)	0.08* (0.03)	0.06 (0.03)
y_{t-1}^j	0.23** (0.03)	0.13** (0.03)	0.12** (0.03)	----	0.16** (0.03)	0.11** (0.03)	0.02 (0.03)
v(s=1)	-0.16 (0.15)	-0.08 (0.11)	0.00 (0.01)	----	0.00 (0.01)	-0.03 (0.02)	-0.05 (0.06)
v(s=2)	0.01 (0.01)	-0.01 (0.02)	-0.11 (0.08)	----	-0.04 (0.05)	-0.10 (0.07)	0.02 (0.02)
$\sigma(s=1)$	2.82	2.04	0.40	----	0.33	0.49	1.24
$\sigma(s=2)$	0.34	0.51	1.71	----	1.04	1.48	0.44
F-test	68.79++	16.0++	18.28++	----	9.93++	9.12++	7.94++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(e) MS-VAR Estimation Results, 1994-98 (Host: Singapore)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.13** (0.03)	0.06 (0.04)	0.10* (0.04)	0.27** (0.04)	----	0.20** (0.05)	0.03 (0.04)
y_{t-1}^j	0.21** (0.03)	0.13** (0.03)	0.11** (0.03)	0.12** (0.03)	----	0.07* (0.03)	0.03 (0.03)
v(s=1)	-0.17 (0.15)	-0.01 (0.02)	-0.02 (0.02)	0.01 (0.02)	----	-0.03 (0.02)	0.03 (0.02)
v(s=2)	0.01 (0.01)	-0.07 (0.12)	-0.09 (0.10)	-0.07 (0.05)	----	-0.11 (0.07)	-0.08 (0.06)
$\sigma(s=1)$	2.84	0.51	0.44	0.43	----	0.50	0.45
$\sigma(s=2)$	0.34	2.12	1.90	1.19	----	1.50	1.33
F-test	69.77++	17.28++	18.65++	7.66++	----	9.0++	8.74++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(f) MS-VAR Estimation Results, 1994-98 (Host: Thailand)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.11** (0.02)	0.03 (0.03)	0.06* (0.03)	0.17** (0.03)	0.07** (0.02)	----	0.07** (0.03)
y_{t-1}^j	0.23** (0.03)	0.14** (0.03)	0.11** (0.03)	0.15** (0.03)	0.13** (0.03)	----	-0.01 (0.03)
v(s=1)	-0.13 (0.14)	-0.01 (0.02)	-0.01 (0.02)	0.00 (0.02)	0.00 (0.01)	----	0.02 (0.02)
v(s=2)	0.00 (0.01)	-0.06 (0.10)	-0.09 (0.09)	-0.05 (0.06)	-0.03 (0.05)	----	-0.04 (0.06)
σ(s=1)	2.73	0.48	0.44	0.42	0.34	----	0.45
σ(s=2)	0.33	1.95	1.78	1.20	1.07	----	1.24
F-test	68.44++	16.50++	16.37++	8.16++	9.90++	----	7.59++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.1(g) MS-VAR Estimation Results, 1994-98 (Host: Hong Kong)

Sample Period : 1994 – 1998							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.07^{**} (0.02)	0.03 (0.03)	0.07^{*} (0.03)	0.12^{**} (0.03)	0.08^{**} (0.03)	0.08^{*} (0.03)	----
y_{t-1}^j	0.23^{**} (0.03)	0.14^{**} (0.03)	0.11^{**} (0.03)	0.20^{**} (0.03)	0.12^{**} (0.03)	0.10^{**}(0.03)	----
$v(s=1)$	-0.16 (0.15)	-0.01 (0.02)	-0.01 (0.02)	-0.08 (0.05)	-0.00 (0.01)	-0.04^{*} (0.02)	----
$v(s=2)$	0.00 (0.01)	-0.07 (0.12)	-0.11 (0.09)	0.01 (0.02)	-0.03 (0.05)	-0.09 (0.07)	----
$\sigma(s=1)$	2.85	0.52	0.42	1.20	0.34	0.47	----
$\sigma(s=2)$	0.34	2.15	1.81	0.44	1.10	1.47	----
F-test	70.26^{++}	17.10^{++}	18.57^{++}	7.44^{++}	10.47^{++}	9.78^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(a) MS-VAR Estimation Results, 1994-99 (Host: Indonesia)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.03 (0.03)	0.05* (0.02)	0.16** (0.02)	0.05** (0.02)	0.09**(0.02)	0.05*(0.02)
y_{t-1}^j	----	0.12** (0.03)	0.10** (0.03)	0.12** (0.03)	0.13** (0.03)	0.08** (0.03)	-0.01 (0.03)
v(s=1)	----	-0.01 (0.08)	-0.03 (0.07)	-0.04 (0.05)	-0.01 (0.05)	-0.05* (0.06)	-0.04* (0.05)
v(s=2)	----	-0.01 (0.02)	-0.02 (0.02)	-0.00 (0.02)	0.01 (0.01)	-0.04 (0.02)	0.03 (0.02)
$\sigma(s=1)$	----	1.81	1.64	1.12	1.04	1.43	1.20
$\sigma(s=2)$	----	0.55	0.46	0.51	0.37	0.57	0.54
F-test	----	10.83^{++}	12.71^{++}	4.82^{++}	7.90^{++}	6.29^{++}	4.94^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(b) MS-VAR Estimation Results, 1994-99 (Host: Korea)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.02 (0.02)	0.06** (0.02)	0.06** 0.02)	0.06* (0.02)	0.07** (0.02)
y_{t-1}^j	0.23** (0.02)	----	0.12** (0.03)	0.21** (0.03)	0.14** (0.03)	0.12** (0.03)	0.00 (0.03)
v(s=1)	-0.05 (0.11)	----	-0.03 (0.01)	-0.04 (0.06)	0.01 (0.01)	-0.05* (0.02)	0.03 (0.02)
v(s=2)	-0.01 (0.01)	----	-0.02 (0.09)	-0.01 (0.02)	-0.02 (0.05)	-0.04 (0.06)	-0.07 (0.07)
σ(s=1)	2.53	----	0.46	1.26	0.39	0.55	0.55
σ(s=2)	0.36	----	1.81	0.50	1.12	1.42	1.36
F-test	49.39++	----	15.48++	6.35++	8.25++	6.67++	6.11++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(c) MS-VAR Estimation Results, 1994-99 (Host: Malaysia)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11** (0.02)	0.05 (0.03)	----	0.18** (0.02)	0.06** (0.02)	0.08**(0.03)	0.07** (0.03)
y_{t-1}^j	0.20** (0.03)	0.13** (0.03)	----	0.13** (0.03)	0.14** (0.03)	0.08**(0.03)	-0.01 (0.03)
v(s=1)	-0.06 (0.11)	0.01 (0.02)	----	0.00 (0.01)	0.01 (0.01)	-0.04* (0.02)	0.04* (0.02)
v(s=2)	-0.00 (0.01)	-0.03 (0.10)	----	-0.06 (0.05)	-0.01 (0.06)	-0.05 (0.07)	-0.06 (0.06)
$\sigma(s=1)$	2.51	0.56	----	0.43	0.37	0.55	0.51
$\sigma(s=2)$	0.35	1.98	----	1.19	1.15	1.51	1.31
F-test	51.43^{++}	12.50^{++}	----	7.66^{++}	9.66^{++}	7.54^{++}	6.60^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(d) MS-VAR Estimation Results, 1994-99 (Host: Philippines)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.07** (0.02)	0.02 (0.03)	0.05 (0.03)	----	0.05* (0.02)	0.10** (0.03)	0.05 (0.03)
y_{t-1}^j	0.21** (0.03)	0.14** (0.03)	0.11** (0.03)	----	0.14** (0.03)	0.09** (0.03)	0.02 (0.03)
v(s=1)	-0.07 (0.11)	-0.04 (0.09)	-0.00 (0.01)	----	0.02 (0.01)	-0.03 (0.02)	-0.04 (0.05)
v(s=2)	-0.00 (0.01)	0.01 (0.02)	-0.06 (0.07)	----	-0.03 (0.04)	-0.06 (0.06)	0.03* (0.02)
$\sigma(s=1)$	2.50	1.95	0.42	----	0.37	0.52	1.23
$\sigma(s=2)$	0.35	0.57	1.66	----	1.02	1.45	0.47
F-test	51.02++	11.70++	15.62++	----	7.60++	7.78++	6.85++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(e) MS-VAR Estimation Results, 1994-99 (Host: Singapore)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.11** (0.03)	0.11** (0.04)	0.09** (0.04)	0.25** (0.03)	----	0.22** (0.04)	0.07 (0.04)
y_{t-1}^j	0.20** (0.03)	0.13** (0.03)	0.11** (0.03)	0.12** (0.03)	----	0.06* (0.03)	0.01 (0.03)
v(s=1)	-0.08 (0.11)	0.01 (0.02)	-0.02 (0.01)	0.00 (0.01)	----	-0.03 (0.02)	0.04* (0.02)
v(s=2)	0.00 (0.01)	-0.04 (0.09)	-0.04 (0.09)	-0.06 (0.05)	----	-0.08 (0.06)	-0.05 (0.06)
$\sigma(s=1)$	2.50	0.55	0.45	0.42	----	0.53	0.48
$\sigma(s=2)$	0.34	1.95	1.80	1.16	----	1.46	1.25
F-test	54.07++	12.57++	16.0++	7.63++	----	7.59++	6.78++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(f) MS-VAR Estimation Results, 1994-99 (Host: Thailand)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.10** (0.02)	0.04 (0.03)	0.04 (0.02)	0.15** (0.02)	0.06** (0.02)	----	0.06**(0.02)
y_{t-1}^j	0.21** (0.03)	0.14** (0.03)	0.11** (0.03)	0.14** (0.03)	0.14** (0.03)	----	-0.00 (0.03)
v(s=1)	-0.05 (0.10)	0.00 (0.02)	-0.02 (0.01)	0.01 (0.02)	0.02 (0.01)	----	0.03 (0.02)
v(s=2)	-0.00 (0.01)	-0.01 (0.07)	-0.04 (0.07)	-0.05 (0.05)	-0.02 (0.04)	----	-0.02 (0.05)
σ(s=1)	2.43	0.49	0.44	0.42	0.37	----	0.47
σ(s=2)	0.34	1.73	1.66	1.14	1.03	----	1.17
F-test	51.08++	12.47++	14.23++	7.37++	7.75++	----	6.20++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.2(g) MS-VAR Estimation Results, 1994-99 (Host: Hong Kong)

Sample Period : 1994 – 1999							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.06* (0.02)	0.07*(0.03)	0.04 (0.03)	0.12** (0.03)	0.08** (0.02)	0.09**(0.03)	----
y_{t-1}^j	0.20** (0.03)	0.14** (0.03)	0.11** (0.03)	0.18** (0.03)	0.12** (0.03)	0.09**(0.03)	----
v(s=1)	-0.07 (0.11)	-0.00 (0.02)	-0.01 (0.01)	-0.06 (0.05)	0.01 (0.01)	-0.04* (0.02)	----
v(s=2)	-0.00 (0.01)	-0.02 (0.11)	-0.06 (0.08)	0.00 (0.02)	-0.01 (0.05)	-0.05 (0.06)	----
$\sigma(s=1)$	2.51	0.59	0.44	1.20	0.37	0.50	----
$\sigma(s=2)$	0.35	2.08	1.78	0.43	1.06	1.43	----
F-test	51.43^{++}	12.43^{++}	16.37^{++}	7.79^{++}	8.21^{++}	8.18^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^+$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(a) MS-VAR Estimation Results, 1994-00 (Host: Indonesia)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.03 (0.02)	0.03 (0.02)	0.13** (0.02)	0.04* (0.02)	0.08**(0.02)	0.04*(0.02)
y_{t-1}^j	----	0.10** (0.02)	0.13** (0.02)	0.13** (0.02)	0.12** (0.02)	0.08** (0.02)	0.00 (0.02)
$v(s=1)$	----	-0.05 (0.07)	-0.03 (0.07)	-0.05 (0.05)	-0.02 (0.04)	-0.06 (0.05)	-0.05 (0.05)
$v(s=2)$	----	-0.00 (0.02)	-0.02 (0.01)	-0.01 (0.02)	0.01 (0.01)	-0.04* (0.02)	0.03 (0.02)
$\sigma(s=1)$	----	1.77	1.61	1.18	1.02	1.39	1.20
$\sigma(s=2)$	----	0.57	0.46	0.49	0.38	0.58	0.56
F-test	----	9.64^{++}	12.25^{++}	5.80^{++}	7.20^{++}	5.74^{++}	4.59^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(b) MS-VAR Estimation Results, 1994-00 (Host: Korea)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.03 (0.02)	0.06** (0.02)	0.04** (0.02)	0.06**(0.02)	0.07** (0.02)
y_{t-1}^j	0.19** (0.02)	----	0.12** (0.02)	0.19** (0.03)	0.14** (0.02)	0.10** (0.02)	0.00 (0.02)
$v(s=1)$	-0.09 (0.09)	----	-0.03 (0.01)	-0.01 (0.01)	0.01 (0.01)	-0.05* (0.02)	0.04* (0.02)
$v(s=2)$	-0.00 (0.01)	----	-0.02 (0.08)	-0.06 (0.05)	-0.02 (0.04)	-0.05 (0.05)	-0.05 (0.05)
$\sigma(s=1)$	2.28	----	0.46	0.47	0.38	0.55	0.53
$\sigma(s=2)$	0.37	----	1.71	1.26	1.04	1.35	1.23
F-test	37.97^{++}	----	13.82^{++}	7.19^{++}	7.49^{++}	6.02^{++}	5.39^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(c) MS-VAR Estimation Results, 1994-00 (Host: Malaysia)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11^{**} (0.02)	0.05 (0.03)	----	0.15^{**} (0.02)	0.04 (0.02)	0.07^{**} (0.03)	0.06^{*} (0.03)
y_{t-1}^j	0.13^{**} (0.03)	0.12^{**} (0.02)	----	0.14^{**} (0.02)	0.13^{**} (0.03)	0.06^{*} (0.03)	-0.00 (0.03)
v(s=1)	-0.10 (0.10)	-0.00 (0.02)	----	-0.01 (0.01)	0.00 (0.01)	-0.05^{**} (0.02)	0.03 (0.02)
v(s=2)	-0.00 (0.01)	-0.06 (0.09)	----	-0.06 (0.06)	-0.02 (0.05)	-0.05 (0.07)	-0.06 (0.07)
$\sigma(s=1)$	2.47	0.62	----	0.45	0.40	0.60	0.57
$\sigma(s=2)$	0.41	1.99	----	1.27	1.17	1.52	1.35
F-test	36.29^{++}	10.30^{++}	----	7.96^{++}	8.56^{++}	6.42^{++}	5.61^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(d) MS-VAR Estimation Results, 1994-00 (Host: Philippines)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.08** (0.02)	-0.02 (0.03)	0.03 (0.03)	----	0.05** (0.02)	0.11**(0.03)	0.06* (0.03)
y_{t-1}^j	0.15** (0.02)	0.13** (0.02)	0.12** (0.03)	----	0.13** (0.03)	0.07** (0.03)	0.01 (0.02)
v(s=1)	-0.11 (0.10)	0.01 (0.02)	-0.01 (0.01)	----	0.02 (0.01)	-0.04* (0.02)	-0.04 (0.05)
v(s=2)	0.00 (0.01)	-0.07 (0.08)	-0.06 (0.07)	----	-0.03 (0.04)	-0.06 (0.06)	0.03* (0.02)
$\sigma(s=1)$	2.41	0.61	0.45	----	0.38	0.53	1.22
$\sigma(s=2)$	0.39	1.90	1.65	----	1.01	1.42	0.50
F-test	38.19^{++}	9.70^{++}	13.44^{++}	----	7.06^{++}	7.18^{++}	5.95^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(e) MS-VAR Estimation Results, 1994-00 (Host: Singapore)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.09^{**} (0.03)	0.12^{**} (0.04)	0.08^{*} (0.03)	0.23^{**} (0.03)	----	0.22^{**} (0.04)	0.10^{**} (0.03)
y_{t-1}^j	0.16^{**} (0.02)	0.11^{**} (0.02)	0.12^{**} (0.03)	0.13^{**} (0.02)	----	0.04 (0.03)	-0.01 (0.03)
v(s=1)	-0.11 (0.09)	0.00 (0.02)	-0.02 (0.01)	-0.01 (0.01)	----	-0.04^{*} (0.02)	0.04^{*} (0.02)
v(s=2)	0.01 (0.01)	-0.06 (0.07)	-0.03 (0.08)	-0.06 (0.05)	----	-0.07 (0.05)	-0.05 (0.05)
$\sigma(s=1)$	2.31	0.55	0.46	0.41	----	0.53	0.49
$\sigma(s=2)$	0.36	1.82	1.77	1.17	----	1.40	1.19
F-test	41.17^{++}	10.95^{++}	14.81^{++}	8.14^{++}	----	6.98^{++}	5.90^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(f) MS-VAR Estimation Results, 1994-00 (Host: Thailand)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.11^{**} (0.02)	0.04 (0.03)	0.03 (0.02)	0.14^{**} (0.02)	0.05^{**} (0.02)	----	0.06^{**} (0.02)
y_{t-1}^j	0.14^{**} (0.02)	0.12^{**} (0.02)	0.12^{**} (0.03)	0.13^{**} (0.02)	0.13^{**} (0.03)	----	-0.00 (0.03)
v(s=1)	-0.08 (0.09)	0.00 (0.02)	-0.02 (0.01)	0.00 (0.01)	0.02 (0.01)	----	0.04^{*} (0.02)
v(s=2)	0.00 (0.01)	-0.04 (0.06)	-0.04 (0.07)	-0.06 (0.05)	-0.03 (0.04)	----	-0.04 (0.05)
σ(s=1)	2.28	0.52	0.46	0.41	0.37	----	0.51
σ(s=2)	0.37	1.71	1.65	1.17	1.01	----	1.17
F-test	37.97^{++}	10.81^{++}	12.87^{++}	8.14^{++}	7.45^{++}	----	5.26^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.3(g) MS-VAR Estimation Results, 1994-00 (Host: Hong Kong)

Sample Period : 1994 – 2000							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.06^{**} (0.02)	0.06^{*} (0.03)	0.01 (0.02)	0.10^{**} (0.02)	0.05^{*} (0.02)	0.09^{**}(0.03)	----
y_{t-1}^j	0.15^{**} (0.02)	0.12^{**} (0.02)	0.13^{**} (0.03)	0.18^{**} (0.02)	0.13^{**} (0.03)	0.08^{**}(0.03)	----
v(s=1)	-0.12 (0.10)	-0.0 (0.02)	-0.02 (0.01)	-0.07 (0.05)	0.01 (0.01)	-0.06^{**} (0.02)	----
v(s=2)	0.00 (0.01)	-0.06 (0.08)	-0.05 (0.09)	-0.01 (0.01)	-0.03 (0.04)	-0.05 (0.06)	----
$\sigma(s=1)$	2.41	0.57	0.46	1.23	0.37	0.52	----
$\sigma(s=2)$	0.38	1.90	1.82	0.42	1.02	1.42	----
F-test	40.22^{++}	11.11^{++}	15.65^{++}	8.58^{++}	7.60^{++}	7.46^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(a) MS-VAR Estimation Results, 1994-01 (Host: Indonesia)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.02 (0.02)	0.02 (0.02)	0.11** (0.02)	0.04*(0.01)	0.07**(0.02)	0.03* (0.02)
y_{t-1}^j	----	0.10** (0.02)	0.14** (0.02)	0.13** (0.02)	0.10** (0.02)	0.07** (0.02)	-0.00 (0.02)
v(s=1)	----	-0.04 (0.07)	-0.04 (0.07)	-0.06 (0.05)	-0.03 (0.04)	-0.07 (0.05)	-0.05 (0.05)
v(s=2)	----	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	0.01 (0.01)	-0.02 (0.02)	0.02 (0.02)
$\sigma(s=1)$	----	1.76	1.59	1.23	1.02	1.40	1.18
$\sigma(s=2)$	----	0.60	0.45	0.49	0.39	0.60	0.57
F-test	----	8.60++	12.48++	6.30++	6.84++	5.44++	4.29++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(b) MS-VAR Estimation Results, 1994-01 (Host: Korea)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.03^{*} (0.02)	0.05^{**} (0.02)	0.04^{**}(0.01)	0.05^{**}(0.02)	0.07^{**} (0.02)
y_{t-1}^j	0.17^{**} (0.02)	----	0.13^{**} (0.02)	0.19^{**} (0.02)	0.12^{**} (0.02)	0.09^{**} (0.02)	-0.00 (0.02)
v(s=1)	-0.09 (0.08)	----	-0.02 (0.01)	-0.02 (0.01)	0.00 (0.01)	-0.04^{**} (0.02)	0.02 (0.02)
v(s=2)	-0.00 (0.01)	----	-0.04 (0.07)	-0.04 (0.06)	-0.03 (0.04)	-0.04 (0.06)	-0.06 (0.06)
$\sigma(s=1)$	2.24	----	0.44	0.47	0.38	0.57	0.56
$\sigma(s=2)$	0.40	----	1.69	1.32	1.04	1.42	1.28
F-test	31.36^{++}	----	0.07^{++}	7.89^{++}	7.49^{++}	6.21^{++}	5.22^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(c) MS-VAR Estimation Results, 1994-01 (Host: Malaysia)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.12** (0.02)	0.05 (0.03)	----	0.15** (0.02)	0.04* (0.02)	0.08** (0.03)	0.05* (0.02)
y_{t-1}^j	0.10** (0.02)	0.10** (0.02)	----	0.14** (0.02)	0.10** (0.03)	0.06*(0.02)	-0.00 (0.02)
v(s=1)	-0.11 (0.10)	0.00 (0.02)	----	-0.02 (0.01)	0.00 (0.01)	-0.03* (0.02)	0.02 (0.02)
v(s=2)	-0.00 (0.01)	-0.05 (0.09)	----	-0.06 (0.06)	-0.03 (0.05)	-0.07 (0.06)	-0.06 (0.06)
σ(s=1)	2.45	0.66	----	0.47	0.42	0.61	0.58
σ(s=2)	0.45	1.98	----	1.31	1.16	1.51	1.32
F-test	29.64++	9.0++	----	7.77++	7.63++	6.13++	5.18++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(d) MS-VAR Estimation Results, 1994-01 (Host: Philippines)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.07** (0.02)	0.02 (0.03)	0.02 (0.02)	----	0.04 (0.02)	0.10**(0.03)	0.05 (0.03)
y_{t-1}^j	0.14** (0.02)	0.11** (0.02)	0.13** (0.02)	----	0.11** (0.02)	0.06** (0.02)	0.01 (0.02)
v(s=1)	-0.12 (0.10)	0.00 (0.02)	-0.00 (0.01)	----	0.01 (0.01)	-0.04* (0.02)	0.02 (0.02)
v(s=2)	0.00 (0.01)	-0.05 (0.08)	-0.07 (0.07)	----	-0.04 (0.04)	-0.05 (0.06)	-0.04 (0.05)
$\sigma(s=1)$	2.40	0.65	0.43	----	0.39	0.54	0.53
$\sigma(s=2)$	0.43	1.92	1.64	----	1.01	1.43	1.24
F-test	31.15^{++}	8.73^{++}	14.55^{++}	----	6.71^{++}	7.01^{++}	5.47^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(e) MS-VAR Estimation Results, 1994-01 (Host: Singapore)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Singapore (y_{t-1}^h)	0.09^{**} (0.03)	0.12^{**} (0.04)	0.06^{*} (0.03)	0.20^{**} (0.03)	----	0.19^{**} (0.03)	0.07^{*} (0.03)
y_{t-1}^j	0.13^{**} (0.02)	0.09^{**} (0.02)	0.12^{**} (0.02)	0.13^{**} (0.02)	----	0.04 (0.02)	-0.00 (0.03)
v(s=1)	-0.12 (0.08)	0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)	----	-0.04^{*} (0.02)	-0.05 (0.05)
v(s=2)	0.01 (0.01)	-0.05 (0.07)	-0.05 (0.08)	-0.06 (0.04)	----	-0.06 (0.05)	0.03 (0.02)
$\sigma(s=1)$	2.26	0.58	0.44	0.42	----	0.54	1.19
$\sigma(s=2)$	0.39	1.81	1.73	1.20	----	1.38	0.51
F-test	33.58^{++}	9.74^{++}	15.46^{++}	8.16^{++}	----	6.53^{++}	5.44^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(f) MS-VAR Estimation Results, 1994-01 (Host: Thailand)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.10^{**} (0.02)	0.04 (0.03)	0.03 (0.02)	0.13^{**} (0.02)	0.05^{**} (0.02)	----	0.05^{*} (0.02)
y_{t-1}^j	0.13^{**} (0.02)	0.10^{**} (0.02)	0.13^{**} (0.02)	0.14^{**} (0.02)	0.11^{**} (0.02)	----	-0.00 (0.02)
v(s=1)	-0.09 (0.09)	0.00 (0.02)	-0.03 (0.01)	-0.01 (0.01)	0.01 (0.01)	----	0.02 (0.02)
v(s=2)	0.00 (0.01)	-0.05 (0.07)	-0.06 (0.07)	-0.05 (0.05)	-0.04 (0.04)	----	-0.04 (0.05)
$\sigma(s=1)$	2.27	0.60	0.44	0.43	0.39	----	0.55
$\sigma(s=2)$	0.41	1.81	1.63	1.23	1.01	----	1.20
F-test	30.65^{++}	9.10^{++}	13.72^{++}	8.18^{++}	6.71^{++}	----	4.76^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.4(g) MS-VAR Estimation Results, 1994-01 (Host: Hong Kong)

Sample Period : 1994 – 2001							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05** (0.02)	0.05 (0.03)	0.01 (0.02)	0.09** (0.02)	0.05* (0.02)	0.08**(0.03)	----
y_{t-1}^j	0.13** (0.02)	0.10** (0.02)	0.13** (0.02)	0.17** (0.02)	0.10** (0.03)	0.06** (0.02)	----
v(s=1)	-0.12 (0.09)	-0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.04 (0.04)	-0.05** (0.02)	----
v(s=2)	0.00 (0.01)	-0.05 (0.09)	-0.07 (0.08)	-0.07 (0.05)	0.01 (0.01)	-0.04 (0.06)	----
$\sigma(s=1)$	2.34	0.62	0.44	0.43	1.03	0.54	----
$\sigma(s=2)$	0.41	1.98	1.76	1.28	0.38	1.47	----
F-test	32.57^{++}	10.20^{++}	16.0^{++}	8.86^{++}	7.35^{++}	7.41^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(a) MS-VAR Estimation Results, 1994-02 (Host: Indonesia)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	0.01 (0.02)	0.02 (0.02)	0.10^{**} (0.02)	0.03 (0.01)	0.07^{**} (0.02)	0.02 (0.02)
y_{t-1}^j	----	0.09^{**} (0.02)	0.14^{**} (0.02)	0.14^{**} (0.02)	0.10^{**} (0.02)	0.07^{**} (0.02)	0.00 (0.02)
v(s=1)	----	-0.04 (0.07)	-0.04 (0.07)	-0.06 (0.05)	-0.02 (0.04)	-0.07 (0.05)	-0.05 (0.05)
v(s=2)	----	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.02 (0.02)	-0.02 (0.01)
$\sigma(s=1)$	----	1.81	1.61	1.25	1.03	1.40	1.20
$\sigma(s=2)$	----	0.64	0.43	0.49	0.41	0.60	0.56
F-test	----	8.0^{++}	14.02^{++}	6.51^{++}	6.31^{++}	5.44^{++}	4.59^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(b) MS-VAR Estimation Results, 1994-02 (Host: Korea)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.02 (0.02)	----	0.02 (0.01)	0.05** (0.01)	0.02 (0.01)	0.05** (0.02)	0.05** (0.02)
y_{t-1}^j	0.16** (0.02)	----	0.13** (0.02)	0.18** (0.02)	0.10** (0.02)	0.09** (0.02)	-0.00 (0.02)
v(s=1)	-0.11 (0.09)	----	-0.01 (0.01)	-0.02 (0.01)	-0.00 (0.01)	-0.03 (0.02)	0.01 (0.01)
v(s=2)	0.01 (0.01)	----	-0.04 (0.07)	-0.05 (0.06)	-0.02 (0.04)	-0.05 (0.06)	-0.06 (0.06)
$\sigma(s=1)$	2.29	----	0.42	0.47	0.39	0.57	0.57
$\sigma(s=2)$	0.45	----	1.66	1.32	1.05	1.43	1.30
F-test	25.90++	----	15.62++	7.89++	7.25++	6.29++	5.20++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(c) MS-VAR Estimation Results, 1994-02 (Host: Malaysia)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11^{**} (0.03)	0.04 (0.03)	----	0.14^{**} (0.02)	0.04^{*} (0.02)	0.08^{**} (0.03)	0.05^{*} (0.02)
y_{t-1}^j	0.11^{**} (0.02)	0.08^{**} (0.02)	----	0.14^{**} (0.02)	0.09^{**} (0.02)	0.06^{*}(0.02)	-0.00 (0.02)
v(s=1)	-0.12 (0.10)	0.00 (0.02)	----	-0.01 (0.01)	-0.00 (0.01)	-0.02 (0.02)	0.01 (0.01)
v(s=2)	0.00 (0.01)	-0.05 (0.08)	----	-0.06 (0.05)	-0.02 (0.05)	-0.07 (0.06)	-0.05 (0.06)
$\sigma(s=1)$	2.46	0.70	----	0.47	0.43	0.60	0.57
$\sigma(s=2)$	0.49	1.95	----	1.29	1.15	1.47	1.28
F-test	25.20^{++}	7.76^{++}	----	7.53^{++}	7.15^{++}	6.0^{++}	5.04^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(d) MS-VAR Estimation Results, 1994-02 (Host: Philippines)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	Korea (y_t^j)	Malaysia (y_t^j)	Philippines (y_t^j)	Singapore (y_t^j)	Thailand (y_t^j)	Hong Kong (y_t^j)
Philippines (y_{t-1}^h)	0.06** (0.02)	0.02 (0.03)	0.02 (0.02)	----	0.03 (0.02)	0.09** (0.03)	0.02 (0.02)
y_{t-1}^j	0.13** (0.02)	0.09** (0.02)	0.13** (0.02)	----	0.10** (0.02)	0.06** (0.02)	0.01 (0.02)
$v(s=1)$	-0.13 (0.10)	0.00 (0.02)	-0.00 (0.01)	----	0.00 (0.01)	-0.02 (0.02)	0.01 (0.01)
$v(s=2)$	0.01 (0.01)	-0.04 (0.08)	-0.07 (0.07)	----	-0.03 (0.04)	-0.06 (0.05)	-0.04 (0.05)
$\sigma(s=1)$	2.43	0.68	0.41	----	0.40	0.54	0.53
$\sigma(s=2)$	0.47	1.92	1.60	----	1.01	1.41	1.23
F-test	26.73++	7.97++	15.23++	----	6.38++	6.82++	5.39++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(e) MS-VAR Estimation Results, 1994-02 (Host: Singapore)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.10^{**} (0.03)	0.12^{**} (0.04)	0.06^{**} (0.02)	0.18^{**} (0.02)	----	0.17^{**} (0.03)	0.07^{*} (0.03)
y_{t-1}^j	0.12^{**} (0.02)	0.07^{**} (0.02)	0.12^{**} (0.02)	0.13^{**} (0.02)	----	0.04 (0.02)	-0.00 (0.02)
$v(s=1)$	-0.12 (0.09)	0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)	----	-0.02 (0.02)	0.02 (0.01)
$v(s=2)$	0.01 (0.01)	-0.05 (0.07)	-0.05 (0.08)	-0.06 (0.04)	----	-0.06 (0.05)	-0.05^{*} (0.05)
$\sigma(s=1)$	2.28	0.61	0.42	0.42	----	0.53	0.51
$\sigma(s=2)$	0.43	1.83	1.70	1.19	----	1.38	1.20
F-test	28.11^{++}	9.0^{++}	16.38^{++}	8.03^{++}	----	6.78^{++}	5.54^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(f) MS-VAR Estimation Results, 1994-02 (Host: Thailand)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea** (y_t^j)	**Malaysia** (y_t^j)	**Philippines** (y_t^j)	**Singapore** (y_t^j)	**Thailand** (y_t^j)	**Hong Kong** (y_t^j)
Thailand (y_{t-1}^h)	0.10** (0.02)	0.04 (0.03)	0.03* (0.02)	0.12** (0.02)	0.05** (0.02)	----	0.04 (0.02)
y_{t-1}^j	0.12** (0.02)	0.08** (0.02)	0.13** (0.02)	0.14** (0.02)	0.09** (0.02)	----	0.00 (0.02)
v(s=1)	-0.11 (0.09)	0.01 (0.02)	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)	----	0.01 (0.01)
v(s=2)	0.01 (0.01)	-0.05 (0.07)	-0.06 (0.07)	-0.05 (0.05)	-0.03 (0.04)	----	-0.04 (0.05)
$\sigma(s=1)$	2.30	0.64	0.41	0.43	0.40	----	0.54
$\sigma(s=2)$	0.46	1.82	1.59	1.21	1.00	----	1.17
F-test	25.0^{++}	8.09^{++}	15.04^{++}	7.92^{++}	6.25^{++}	----	4.69^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.5(g) MS-VAR Estimation Results, 1994-02 (Host: Hong Kong)

Sample Period : 1994 – 2002							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05^{*} (0.02)	0.05 (0.03)	0.01 (0.02)	0.08^{**} (0.02)	0.04^{*} (0.02)	0.07^{**} (0.02)	----
y_{t-1}^j	0.13^{**} (0.02)	0.09^{**} (0.02)	0.14^{**} (0.02)	0.17^{**} (0.02)	0.09^{**} (0.03)	0.07^{**} (0.02)	----
$v(s=1)$	-0.13 (0.09)	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	-0.00 (0.01)	-0.03 (0.02)	----
$v(s=2)$	0.01^{*} (0.01)	-0.06 (0.09)	-0.07 (0.07)	-0.07 (0.05)	-0.03 (0.04)	-0.05 (0.06)	----
$\sigma(s=1)$	2.39	0.67	0.41	0.44	0.40	0.53	----
$\sigma(s=2)$	0.45	2.04	1.69	1.29	1.04	1.43	----
F-test	28.21^{++}	9.27^{++}	16.99^{++}	8.60^{++}	6.76^{++}	7.28^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market j; $v(s=1)$ and $v(s=2)$ are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as F.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(a) MS-VAR Estimation Results, 1994-03 (Host: Indonesia)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Indonesia (y_{t-1}^h)	----	-0.00 (0.02)	0.02 (0.01)	0.10** (0.02)	0.02 (0.01)	0.06**(0.02)	0.02 (0.02)
y_{t-1}^j	----	0.08** (0.02)	0.14** (0.02)	0.14** (0.02)	0.09** (0.02)	0.07** (0.02)	0.01 (0.02)
v(s=1)	----	-0.04 (0.07)	-0.04 (0.07)	-0.05 (0.05)	-0.03 (0.04)	-0.08 (0.06)	-0.05 (0.05)
v(s=2)	----	0.00 (0.02)	-0.01 (0.01)	-0.01 (0.01)	0.00 (0.01)	-0.00 (0.01)	0.02 (0.01)
$\sigma(s=1)$	----	1.84	1.59	1.26	1.05	1.41	1.21
$\sigma(s=2)$	----	0.66	0.41	0.49	0.43	0.59	0.55
F-test	----	7.77^{++}	15.04^{++}	6.61^{++}	5.96^{++}	5.71^{++}	4.84^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(b) MS-VAR Estimation Results, 1994-03 (Host: Korea)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Korea (y_{t-1}^h)	0.03 (0.02)	----	0.02 (0.01)	0.05^{**} (0.01)	0.02 (0.01)	0.04^{*}(0.02)	0.05^{**} (0.02)
y_{t-1}^j	0.14^{**} (0.02)	----	0.13^{**} (0.02)	0.18^{**} (0.02)	0.09^{**} (0.02)	0.09^{**} (0.02)	0.01 (0.02)
v(s=1)	-0.11 (0.09)	----	-0.01 (0.01)	-0.02 (0.01)	0.00 (0.01)	-0.01 (0.01)	0.02 (0.01)
v(s=2)	0.01^{*} (0.01)	----	-0.05 (0.07)	-0.04 (0.06)	-0.02 (0.04)	-0.05 (0.06)	-0.06 (0.06)
$\sigma(s=1)$	2.33	----	0.40	0.48	0.42	0.57	0.54
$\sigma(s=2)$	0.47	----	1.64	1.32	1.08	1.43	1.27
F-test	24.58^{++}	----	16.81^{++}	7.56^{++}	6.61^{++}	6.29^{++}	5.53^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(c) MS-VAR Estimation Results, 1994-03 (Host: Malaysia)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Malaysia (y_{t-1}^h)	0.11^{**} (0.03)	0.04 (0.03)	----	0.14^{**} (0.02)	0.04 (0.02)	0.09^{**} (0.03)	0.04 (0.02)
y_{t-1}^j	0.11^{**} (0.02)	0.07^{**} (0.02)	----	0.14^{**} (0.02)	0.09^{**} (0.02)	0.06^{**} (0.02)	0.01 (0.02)
v(s=1)	-0.11 (0.10)	0.01 (0.02)	----	-0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.02 (0.01)
v(s=2)	0.01 (0.01)	-0.05 (0.08)	----	-0.06 (0.05)	-0.03 (0.05)	-0.08 (0.06)	-0.05 (0.05)
σ(s=1)	2.43	0.71	----	0.47	0.44	0.59	0.55
σ(s=2)	0.51	1.91	----	1.27	1.13	1.44	1.25
F-test	22.70^{++}	7.24^{++}	----	7.30^{++}	6.60^{++}	5.96^{++}	5.17^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(d) MS-VAR Estimation Results, 1994-03 (Host: Philippines)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Philippines (y_{t-1}^h)	0.06* (0.02)	0.02 (0.03)	0.01 (0.02)	----	0.03 (0.02)	0.08**(0.02)	0.01 (0.02)
y_{t-1}^j	0.12** (0.02)	0.08** (0.02)	0.14** (0.02)	----	0.09** (0.02)	0.06** (0.02)	0.02 (0.02)
v(s=1)	-0.13 (0.10)	0.00 (0.02)	0.00 (0.01)	----	0.01 (0.01)	-0.00 (0.01)	0.01 (0.01)
v(s=2)	0.02 (0.01)	-0.03 (0.08)	-0.07 (0.06)	----	-0.03 (0.04)	-0.06 (0.05)	-0.04 (0.05)
$\sigma(s=1)$	2.45	0.69	0.39	----	0.41	0.54	0.52
$\sigma(s=2)$	0.49	1.92	1.58	----	1.01	1.41	1.23
F-test	25.0^{++}	7.74^{++}	16.41^{++}	----	6.07^{++}	6.82^{++}	5.60^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2/σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(e) MS-VAR Estimation Results, 1994-03 (Host: Singapore)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Singapore (y_{t-1}^h)	0.11^{**} (0.03)	0.13^{**} (0.03)	0.06^{**} (0.02)	0.18^{**} (0.02)	----	0.17^{**} (0.03)	0.07^{**} (0.03)
y_{t-1}^j	0.11^{**} (0.02)	0.06^{**} (0.02)	0.12^{**} (0.02)	0.13^{**} (0.02)	----	0.04 (0.02)	0.00 (0.02)
v(s=1)	-0.12 (0.09)	0.01 (0.02)	-0.00 (0.01)	-0.01 (0.01)	----	-0.00 (0.01)	0.02 (0.01)
v(s=2)	0.02 (0.01)	-0.05 (0.08)	-0.05 (0.07)	-0.05 (0.04)	----	-0.06 (0.05)	-0.05 (0.05)
σ(s=1)	2.33	0.65	0.40	0.43	----	0.54	0.51
σ(s=2)	0.46	1.90	1.68	1.20	----	1.40	1.20
F-test	25.66^{++}	8.54^{++}	17.64^{++}	7.79^{++}	----	6.72^{++}	5.54^{++}

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(f) MS-VAR Estimation Results, 1994-03 (Host: Thailand)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Thailand (y_{t-1}^h)	0.09** (0.02)	0.05 (0.02)	0.03* (0.02)	0.13** (0.02)	0.05** (0.02)	----	0.04* (0.02)
y_{t-1}^j	0.12** (0.02)	0.07** (0.02)	0.13** (0.02)	0.14** (0.02)	0.08** (0.02)	----	0.01 (0.02)
v(s=1)	-0.11 (0.09)	0.01 (0.02)	0.00 (0.01)	-0.01 (0.01)	0.01 (0.01)	----	0.02 (0.01)
v(s=2)	0.02 (0.01)	-0.05 (0.07)	-0.06 (0.06)	-0.05 (0.05)	-0.03 (0.04)	----	-0.04 (0.04)
σ(s=1)	2.33	0.66	0.39	0.44	0.42	----	0.52
σ(s=2)	0.49	1.82	1.55	1.21	1.01	----	1.16
F-test	22.61++	7.60++	15.80++	7.56++	5.78++	----	4.98++

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; *σ(s=1)* and *σ(s=2)* are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., (σ_1^2 / σ_2^2) which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

++, + significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.4.6(g) MS-VAR Estimation Results, 1994-03 (Host: Hong Kong)

Sample Period : 1994 – 2003							
	Indonesia (y_t^j)	**Korea (y_t^j)**	**Malaysia (y_t^j)**	**Philippines (y_t^j)**	**Singapore (y_t^j)**	**Thailand (y_t^j)**	**Hong Kong (y_t^j)**
Hong Kong (y_{t-1}^h)	0.05^{**} (0.02)	0.05^{*}(0.03)	0.02 (0.02)	0.09^{**} (0.02)	0.04^{*} (0.02)	0.07^{**}(0.02)	----
y_{t-1}^j	0.13^{**} (0.02)	0.08^{**} (0.02)	0.14^{**} (0.02)	0.16^{**} (0.02)	0.09^{**} (0.02)	0.07^{**} (0.02)	----
v(s=1)	-0.13 (0.10)	0.00 (0.02)	0.00 (0.01)	-0.01 (0.01)	0.01 (0.01)	-0.00 (0.01)	----
v(s=2)	0.02^{*} (0.01)	-0.05 (0.09)	-0.07 (0.07)	-0.07 (0.05)	-0.03 (0.04)	-0.06 (0.05)	----
$\sigma(s=1)$	2.40	0.67	0.39	0.45	0.42	0.53	----
$\sigma(s=2)$	0.48	1.97	1.63	1.28	1.04	1.40	----
F-test	25.0^{++}	8.65^{++}	17.47^{++}	8.09^{++}	6.13^{++}	6.98^{++}	----

Notes: Standard errors in parentheses.

y_t^h is the stock market return of the crisis country; y_t^j is the stock market return in another market *j*; *v(s=1)* and *v(s=2)* are the intercepts for regime 1 and 2, respectively; $\sigma(s=1)$ and $\sigma(s=2)$ are the standard errors for regime 1 and 2, respectively.

F-test: a variance-ratio test, e.g., $(\sigma_1^2 / \sigma_2^2)$ which test the null hypothesis that the two variances for the two regimes are the same, which is distributed as *F*.

**, * significant at the 1 and 5 percent level, respectively;

$^{++}$, $^{+}$ significantly different than 1 at the 1 and 5 percent level, respectively.

Appendix B.5.1

Contagion versus Interdependence: 1994-1998

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.018	-0.0	0.37	0.057	0.301	-4.1	0.059	0.298	-4.05	0.066	0.323	-4.3	0.053	0.220	-2.8	0.044	0.252	-3.4
Korea	0.038	-0.0	0.68				0.056	0.015	0.65	0.044	0.031	0.20	0.032	0.033	-0.0	0.060	0.059	0.01	0.034	0.051	-0.3
Malaysia	0.118	0.301	-3.1	0.056	0.015	0.64				0.070	0.247	-3.2	0.163	0.527	-6.8	0.144	0.317	-3.1	0.112	0.328	-3.8
Philippines	0.203	0.298	-1.6	0.073	0.031	0.67	0.106	0.248	-2.5				0.237	0.226	0.21	0.157	0.212	-1.0	0.179	0.222	-0.8
Singapore	0.173	0.323	-2.6	0.041	0.033	0.13	0.207	0.527	-6.1	0.213	0.226	-0.2				0.233	0.364	-2.5	0.432	0.450	-0.4
Thailand	0.159	0.220	-1.0	0.086	0.059	0.44	0.196	0.317	-2.2	0.146	0.212	-1.20	0.201	0.364	-3.1				0.149	0.343	-3.6
Hong Kong	0.147	0.252	-1.8	0.054	0.051	0.05	0.169	0.328	-2.82	0.360	0.222	2.64**	0.470	0.450	0.43	0.169	0.343	-3.28			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Appendix B.5.2

Contagion versus Interdependence: 1994-1999

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.023	-0.0	0.56	0.059	0.262	-3.9	0.065	0.259	-3.77	0.073	0.291	-4.3	0.058	0.218	-3.1	0.052	0.249	-3.8
Korea	0.048	-0.0	1.04				0.063	0.029	0.62	0.058	0.066	-0.2	0.045	0.087	-0.8	0.074	0.083	-0.2	0.049	0.101	-0.9
Malaysia	0.118	0.262	-2.8	0.057	0.029	0.51				0.073	0.222	-2.9	0.158	0.474	-6.3	0.144	0.296	-3.0	0.114	0.299	-3.5
Philippines	0.213	0.259	-0.9	0.078	0.066	0.21	0.104	0.222	-2.3				0.235	0.202	0.67	0.165	0.215	-1.0	0.178	0.201	-0.5
Singapore	0.185	0.291	-2.1	0.055	0.087	-0.6	0.205	0.474	-5.5	0.230	0.202	0.57				0.248	0.352	-2.2	0.448	0.450	-0.0
Thailand	0.163	0.218	-1.1	0.100	0.083	0.32	0.199	0.296	-1.9	0.159	0.215	-1.11	0.214	0.352	-2.9				0.165	0.332	-3.5
Hong Kong	0.169	0.249	-1.6	0.071	0.101	-0.5	0.181	0.299	-2.25	0.366	0.201	3.39**	0.496	0.450	1.12	0.191	0.342	-3.15			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Appendix B.5.3
Contagion versus Interdependence: 1994-2000

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.
Indonesia				0.027	-0.0	0.66	0.068	0.195	-2.6	0.067	0.231	-3.38	0.079	0.262	-3.9	0.065	0.210	-3.0	0.057	0.226	-3.5
Korea	0.053	-0.0	1.20				0.071	0.056	0.29	0.066	0.056	0.20	0.072	0.099	-0.6	0.086	0.114	-0.6	0.080	0.100	-0.4
Malaysia	0.119	0.195	-1.5	0.062	0.056	0.11				0.072	0.210	-2.8	0.158	0.446	-6.0	0.150	0.282	-2.7	0.116	0.327	-4.1
Philippines	0.173	0.231	-1.2	0.076	0.056	0.40	0.093	0.210	-2.3				0.195	0.187	0.18	0.152	0.229	-1.7	0.157	0.190	-0.7
Singapore	0.187	0.262	-1.6	0.086	0.099	-0.3	0.209	0.446	-5.0	0.207	0.187	0.43				0.259	0.345	-2.0	0.458	0.428	0.77
Thailand	0.167	0.210	-0.9	0.116	0.114	0.05	0.212	0.282	-1.4	0.161	0.229	-1.48	0.263	0.345	-1.9				0.174	0.318	-3.2
Hong Kong	0.169	0.226	-1.2	0.116	0.100	0.31	0.193	0.327	-2.64	0.342	0.190	3.34**	0.521	0.428	2.48*	0.209	0.318	-2.43			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Appendix B.5.4
Contagion versus Interdependence: 1994-2001

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Te Sta
Indonesia				0.031	-0.0	0.88	0.075	0.170	-2.0	0.069	0.212	-3.06	0.085	0.222	-3.0	0.071	0.165	-2.1	0.060	0.201	-3.
Korea	0.059	-0.0	1.48				0.075	0.082	-0.1	0.073	0.070	0.07	0.088	0.151	-1.4	0.097	0.172	-1.6	0.094	0.190	-2.
Malaysia	0.116	0.170	-1.2	0.059	0.082	-0.5				0.071	0.195	-2.6	0.156	0.409	-5.4	0.148	0.265	-2.5	0.114	0.320	-4.
Philippines	0.155	0.212	-1.2	0.078	0.070	0.17	0.096	0.195	-2.1				0.183	0.180	0.05	0.141	0.207	-1.5	0.151	0.195	-1.
Singapore	0.192	0.222	-0.7	0.101	0.151	-1.1	0.221	0.409	-4.1	0.198	0.180	0.40				0.260	0.322	-1.5	0.476	0.428	1.3
Thailand	0.169	0.165	0.08	0.117	0.172	-1.2	0.222	0.265	-0.9	0.152	0.207	-1.22	0.263	0.322	-1.4				0.177	0.293	-2.
Hong Kong	0.166	0.201	-0.8	0.132	0.190	-1.2	0.200	0.320	-2.46	0.331	0.195	3.10**	0.548	0.428	3.42**	0.220	0.293	-1.66			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Appendix B.5.5
Contagion versus Interdependence: 1994-2002

Hosts	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Tes Stat
Indonesia				0.034	0.049	-0.3	0.082	0.166	-1.8	0.075	0.203	-2.79	0.092	0.202	-2.5	0.078	0.180	-2.3	0.066	0.195	-2.8
Korea	0.061	0.049	0.29				0.079	0.124	-0.9	0.077	0.100	-0.5	0.096	0.215	-2.7	0.106	0.203	-2.2	0.097	0.267	-3.5
Malaysia	0.109	0.166	-1.2	0.056	0.124	-1.4				0.068	0.195	-2.8	0.150	0.404	-5.6	0.141	0.266	-2.8	0.111	0.322	-4.5
Philippines	0.153	0.203	-1.1	0.078	0.100	-0.5	0.097	0.195	-2.1				0.177	0.203	-0.6	0.142	0.199	-1.3	0.149	0.217	-1.5
Singapore	0.194	0.202	-0.2	0.108	0.215	-2.5	0.229	0.404	-3.9	0.197	0.203	-0.1				0.271	0.329	-1.5	0.487	0.455	0.9
Thailand	0.169	0.180	-0.25	0.119	0.203	-1.9	0.222	0.266	-1.0	0.154	0.199	-1.06	0.263	0.329	-1.6				0.179	0.295	-2.8
Hong Kong	0.163	0.195	-0.7	0.128	0.267	-2.9	0.201	0.322	-2.63	0.323	0.217	2.47*	0.544	0.455	2.64**	0.220	0.295	-1.80			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

Appendix B.5.6

Contagion versus Interdependence: 1994-2003

	Indonesia			Korea			Malaysia			Philippines			Singapore			Thailand			Hong Kong		
Hosts	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Test Stat.	ρ_h^u	ρ_l^c	Te Sta
Indonesia				0.036	0.099	-1.4	0.086	0.186	-2.2	0.078	0.196	-2.58	0.097	0.230	-3.1	0.082	0.196	-2.6	0.069	0.207	-3.
Korea	0.064	0.099	-0.8				0.082	0.152	-1.5	0.080	0.113	-0.7	0.098	0.281	-4.2	0.109	0.227	-2.7	0.101	0.304	-4.
Malaysia	0.104	0.186	-1.8	0.054	0.152	-2.1				0.066	0.197	-2.9	0.146	0.398	-5.7	0.136	0.270	-3.1	0.108	0.327	-4.
Philippines	0.153	0.196	-0.9	0.081	0.113	-0.7	0.100	0.197	-2.2				0.181	0.201	-0.5	0.146	0.202	-1.3	0.153	0.212	-1.
Singapore	0.202	0.230	-0.7	0.111	0.281	-3.9	0.241	0.398	-3.6	0.208	0.201	0.16				0.284	0.337	-1.4	0.512	0.485	0.8
Thailand	0.166	0.196	-0.69	0.119	0.227	-2.5	0.219	0.270	-1.2	0.154	0.202	-1.12	0.262	0.337	-1.9				0.182	0.290	-2.
Hong Kong	0.158	0.207	-1.1	0.125	0.304	-4.0	0.197	0.327	-2.98	0.322	0.212	2.63**	0.576	0.485	2.87**	0.214	0.290	-1.89			

Notes: ρ_h^u, ρ_l^c are the correlation coefficients in the crisis, high-volatility (unconditional) and stable, low-volatility period (conditional) periods, respectively. The reported test statistic column is the Fisher z-transformation statistic. **, *, indicate significance at the 1 and 5 per cent level, respectively.

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