Finance-Growth-Crisis Nexus in Asian Emerging Economies: Evidence from VECM and ARDL Assessment

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Abstract

This paper examines the causal relationship between financial development, economic growth and financial crisis in the five Asian emerging economies (India, Indonesia, South Korea, Malaysia and Thailand) during the period 1982 to 2007. All of these countries are known as emerging economies with well known financial crisis episodes (i.e., India's 1991 crisis and the Asian 1997 crisis). The summary indicators of financial development, financial crisis and financial repression are constructed through the principal component approach. The cointegration and Granger causality analysis are conducted by using two techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). The main findings are: (1) the direction of the finance-growth nexus is country-specific; (2) deeper financial development can lead to financial crisis; and (3) financial crisis has a negative impact on economic growth (except Korea for the last two). On policy implication, we ascertain that the growth effect of financial deepening should be appraised with the view that financial deepening could gravitate toward financial crisis.

Keywords: Finance-growth nexus, financial crisis, Asia, VECM, ARDL

JEL Classification: E44, O16, O53

1.   Introduction

Since the seminal works of McKinnon (1973) and Shaw (1973) were published, the finance-growth nexus—how financial development and economic growth interact with each other—has been extensively assessed but the results are inconclusive and the issue remains debatable. On the other hand, as more economies—in particularthose known as emerging economies—have been increasingly exposed to severe financial disturbances over the last few decades, financial crisis has emerged as one of the hottest topics in the literature,

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highlighting crucial damages on crisis-hit economies. This paper attempts to integrate these two subjects or to examine the "finance-growth-crisis" nexus in five Asian emerging economies (India, Indonesia, South Korea (hereafter Korea), Malaysia and Thailand). All countries of our sample are known as emerging economies with rapid financial deepening, high economic growth and financial crisis episodes. Since the Chakravarty Committee Report (Report of the Committee to Review the Working of the Monetary System) (Reserve Bank of India, 1985) was announced in April 1985, India was in the process of (partial) financial liberalisation and experiencing credit boom and high GDP growth over the late 1980s. Then, the severe crisis hit that country in early 1991. As described by the term "East Asian miracle" (World Bank, 1993), the high economic achievements of Indonesia, Korea, Malaysia and Thailand has been praised. Their success stories, however, were suddenly terminated by the Asian 1997 crisis[1]. These profiles prompt us to examine the finance-growth-crisis nexus in the five countries.

The motivation of this study is to address the following inherent problems observedin the literature. First, although the relationship between financial deepening and economic growth potentially relates to the incidence of financial crisis, the trivariate linkage of financial development, economic growth and financial crisis has not been deliberated yet, especially in the framework of cointegration and Granger causality. Second, in the empirical literature of finance-growth nexus, the leading evidence—finance exhibits a positive impact on growth—has been drawn from cross-country and panel data models. These models, however, implicitly presume homogeneity in different countries' growth patterns and thus mask country-specific factors in estimation (Demetriades and Hussein, 1996; Luintel and Khan, 1999).

The goal of this paper is to shed light on the "finance-growth-crisis" nexus in the five Asian emerging economies. Our contributions to the literature are given as follows. First, we provide country-by-country estimates of the five Asian countries by using the techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). Evidence from our study that takes into account country-specific conditions will be more plausible than that from a cross-country and panel data study that looks for a single generalized result by averaging and pooling sample countries' data.Both VECM and ARDL, which are based on different concepts of cointegration (i.e., Johansen, 1988; Pesaran et al., 2001), is an inventionthat helps attach robustness to our analysis[2]. Second, and more importantly, we extend the finance-growth nexus—the empirical results on this topic have not been reconciled yet—to the finance-growth-crisis nexus. By doing so, more accurate estimates on finance-growth nexus will be detected because the interaction between finance, growth and crisis must be crucial to determine the effect of finance or growth on each of them. Additionally, we are also concerned with how both finance and

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[1] See, Joshi and Little (1996) for India's 1991 crisis and the World Bank (1998) for the Asian 1997 crisis.

[2] Using both VECM and ARDL techniques, Enisan and Olufisayo (2009) examined the causal link between stock market development and economic growth in African countries.

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growth influence crisis (finance→crisis and growth→crisis). In particular, assuming that financial boom typically precedes crisis, we predict that the increasing level of financial development crucially causes financial crisis.

The remainder of the present paper is structured as follows. In Section 2, the relevant literature is outlined. In Section 3, those underlying variables of the economic indicator (EG) and three summary indicators are described. Econometric models and procedures are provided in Section 4. The empirical findings are reported and discussed in Section 5, and concluding remarks are given together with policy implications in Section 6. For this study, we used the data from the IMF's International Financial Statistics (IFS), the World Bank's Financial Structure Dataset (FSD) and World Development Indicators (WDI), and the publication of the Reserve Bank of India (in case of India).

2.   Literature Review

Advanced by theoretical achievements of McKinnon (1973) and Shaw (1973) and the endogenous growth literature (e.g., Greenwood and Jovanovic 1990; Bencivenga and Smith, 1991), it has been a general concept that financial development is vital to attain higher economic growth. That is, financial institutions utilize productive resources to facilitate capital formation and thus play a crucial role in mobilizing saving and in allocating thus collected resources efficiently to productive sectors. On the other hand, there is a sceptical view on the role of financial development in economic growth, as given by Robinson's (1952) argument that ''where enterprise leads, finance follows''. Since the increasing demand for financial services is brought by economic growth, it is economic growth that is the chief driving force behind financial deepening and the growth effect of finance is overstressed (Lucas, 1988). Thus, the assertion that financial development promotes economic growth is a persuasive but unqualified assumption yet, so that there is a need for empirical confirmation. One way of performing empirical analysis is based on the following regressions:

$$Y_{it} = f\left(FD_{it}, X_{it}\right) \tag{1}$$

$$FD_{it} = f\left(Y_{it}, X_{it}\right) \tag{2}$$

where Y_{it} is the growth rate of country i, FD_{it} is an indicator of financial depth, and X_{it} is a set of controlled variable. In the multi-country assessment of finance-growth nexus, there has been a methodological controversy between cross-country and panel data studies and time series studies. Indeed, there is a conceptual difference in these two. The school of cross-country and panel data analysis was pioneered by King and Levine (1993)[3]. Initially, due to the lack of sufficient time series data for developing countries, empirical research on the finance-growth nexus was dominated by cross-country and panel data models. These studies consistently show a positive relationship of finance→growth while seeking a

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[3] Recently, the generalized method of moments (GMM) panel data analysis has been common.

single generalized estimate by averaging and pooling the data of multiple countries. Such a procedure, which is implicitly based on the assumption of a homogenous, balanced growth path across countries, not only provides a clear single result but also does not allow different countries to exhibit different patterns of causality[4].One feature of cross-country and panel data analysis is that, it addresses Equation 1 only with economic growth is the dependent variable. The school of time series analysis was pioneered by Demetriades and Hussein (1996). In contrast, the time series approach estimates both Equations 1 and 2, and tests for the Granger causality between finance and growth. Thus, it enables us to carry out a country-by-country assessment in which different countries can exhibit different estimates, reflecting country-specific conditions in the results. Nonetheless, the time series evidence of finance-growth nexus in each country, particularly for causal direction, has been mixed, that is, either finance→growth or growth→finance or finance↔growth (bilateral) (see, Demetriades and Hussein, 1996; Luintel and Khan, 1999; Fase and Abma, 2003; Rousseau and Vuthipadadorn, 2005).

Finally, among several topics in the vast financial crisis literature, we highlight the emergence of the New Financial Architecture (NFA) which relates most to this study. The NFA refers to:

"the global integration of modern financial markets that is based on light government regulation of financial intermediaries" (Crotty, 2009, p. 564).

Under such a global environment, financial liberalisation was initiated, or the extent of financial repression was lessened by deregulating or removing interest rate ceilings, lowering reserve requirements and reducing the volume of directed credit, especially in those called emerging economies over the last two decades. In addition, some countries also promoted stock market development byallowing foreign financial intermediaries into their financial (both credit and stock) markets. The financial profiles of our sample countries typically follow this NFA argument. Although financial development contributes to higher economic growth in these countries, its favourable effects have been questioned due to increasing financial fragility and resultant financial crisis (i.e., India's 1991 crisis and the Asian 1997 crisis) that severely affected emerging economies.

3.   Data

3.1   Use of Quarterly Data

An important aspect of this study is the use of quarterly data[5].In performing time series analysis, more observations provide better statistically acceptable estimates. However, data for developing countries like in our sample is very limited. Their annual data series cover only a limited span and thus provide fewer observations. As discussed below in *Financial*

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[4] Quah (1993) discusses these procedures of the cross-country analysis.

[5] It has been pointed out that quarterly frequency data are usually associated with short-run cyclical fluctuations of the economy. Hence, if a series exhibits a prominent seasonality, it is removed from that series through proper statistical procedures.

C*risis* I*ndicator*, the quarterly volatility in each elementary variable is calculated to produce the financial crisis indicator (FC). We contend that quarterly frequency observations are better in handling volatility in estimation. The weakness of monthly volatility is that it is too constantly fluctuating. Likewise, if annual volatility is computed, it is less fluctuating, or it is actually a pulse dummy highlighting the year of a crisis.

3.2 Disaggregation Procedure for GDP Series

Except for Korea, other countries in our sample countries do not provide the quarterly data on GDP for the intended period of study, i.e., 1982 to 2007. Korea's quarterly GDP series, however, exhibited a strong seasonality that is not properly erased through the seasonal decomposition procedure. Hence, we disaggregate the five countries' annual nominal- and real per capita GDP (nominal GDP deflated by the GDP deflator and the population) series to quarterly ones through the method developed by Chow and Lin (1971), and use this estimated quarterly figures for our estimation. The nominal GDP series are used as a deflator in calculating several elementary variables of financial development and financial repression, and the volatility in nominal GDP is measured as one of the elementary variables of financial crisis (see, Table A1, A2, A4, in Appendix). Likewise, we compute quarterly real per capita GDP and take its logarithm as the economic growth indicator (EG).

In conducting the disaggregation through the Chow and Lin method, we need to take actually measured quarterly data series―as the indicator(s)―into calculation; those indicators are necessary to give proper fluctuations to quarterly GDP series. For this end, we choose and use such related series as: export volume (IFS line 70) for Indonesia, Malaysia and Thailand; and both industrial production (IFS line 66) and export volume for India and Korea[6]. Through such procedures, we calculated the five countries' nominal GDP and EG series, and present their EG plots in Figure A1 to A5, in Appendix. As illustrated, India's EG shows prominent fluctuations around the crisis year 1991, whereas those of four countries show a clear change around the period 1997 to 1998.

3.3 Summary Indicators

In subsequent discussion, we sketch three summary indicators of the financial development indicator (FD), financial crisis indicator (FC) and financial repression indicator (FR), respectively, through the principal component approach. The use of the principal component approach in the construction of summary indicators was pioneered by Demetriades and Luintel (1997) and followed by Ang and McKibbin (2007)[7]. The plots of the five countries' summary indicators are provided in Figure A1 to A5, in Appendix.

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[6] The combinations of indicators (industrial production and export volume) are different among the sample countries. Here, we empirically confirm that each of those combinations is important to avoid autocorrelation in each country's estimation.

[7] To conserve space, the description on the construction of the summary indicators is not presented but is available upon request.

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3.3.1 Financial Development Indicator

One issue in the empirical literature is that there is no single indicator that sufficiently captures all aspects of financial deepening. As a result, most studies—including pioneering works of King and Levine (1993) and Demetriades and Hussein (1996) and recent ones—separately examine the relationship between economic growth (mostly real per capita GDP) and each of several financial development variables (e.g., liquidity liabilities (M3) and domestic credit provided to the private sector). Another issue is that banking and stock market—two major components of financial development—have been independently assessed in the literature. Such studies as Levine and Zervos (1998) and Arestis et al. (2001) investigated the effect of stock market development on economic growth. Meanwhile, there are few studies that consider financial development as an integrated phenomenon consisting of banking and stock market, despite the increasing proportion of the latter in a financial system. Taking into account these issues, we argue that financial development—as a single phenomenon—should be measured by combining several elements. And five elementary variables of financial development, which are commonly used in the empirical literature, are combined to make the financial development indicator (FD) (see, Table A1 in Appendix)[8]. The ratio of money supply to GDP (MTG) is picked up to estimate the degree of financial depth in the simplest manner. We are also concerned with the financial size and activity (liquidity) measures (BATG, PCTG, SKTG and SVTG) as suggested by Beck et al. (1999). With these measures, the impact of two financial channels (banking sector and stock market) and their two aspects (size and activity) are approximated.

3.3.2 Financial Crisis Indicator

In creating the financial crisis indicator (FC), we contend the following two points. First, financial crisis should be measured by a rich set of macroeconomic indicators. The rationale is that although financial crises are generally classified into currency and banking crises, we consider financial crisis as a combined macroeconomic phenomenon consisting of both currency and banking crises (Kaminsky and Reinhart, 1999). Indeed, each type of crisis is influenced by several macroeconomic factors[9]. Second, obtaining a hint from the ongoing debate in the macroeconomic volatility literature, we consider that, while financial fragility—as a continuous phenomenon—can be measured as changing volatility in an economy, financial crisis is identified as an extreme volatility in that process[10,11].

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[8] In this article, a summary "indicator" is made of severalelementary variables.

[9] For selecting the elementary variables of financial crisis, we reviewed the "leading indicators of crisis" or early warning system (EWS) literature pioneered by Kaminsky et al. (1998).

[10] The macroeconomic volatility literature initially concerns the link between economic growth and volatility (e.g., Ramey and Ramey, 1995) and recently was extended to studying that linkage in terms of globalization, that is, growing international trade and financial integration (e.g., Kose et al., 2006).

[11] "Many of these (emerging) economies have experienced rapid growth but have also been subject to high volatility, most prominently in the form of severe financial crises that befell many of them during the last decade and a half" (Kose et al., 2006, p. 177).

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Based on these arguments, we calculate the volatility in each of 16 elementary variables of financial crisis (see, Table A2 in Appendix) by the squared returns. In case of real exchange rate (ER), for example, its volatility is computed as: $X_t^2 = \left[\log\left(ER_t/ER_{t-1}\right)\right]^2$. Next, we compute a 4-quarter rolling average of X_t^2 because the volatility values in level are too uneven, to search for more correlations among the financial crisis variables in constructing the FC. Since the availability of financial crisis variables and the results of the principal component analysis differ for each of the five countries, we have created the FCs that consist of different numbers and combinations of financial crisis variables (see, Table A3 in Appendix). Finally, as described in Figure A1 to A5 in Appendix, the plots of the five countries' FCs exhibit the peak or extreme volatility over the crisis periods (i.e., the period 1990 to 1991 for India and the period 1997 to 1998 for the other four countries).

3.3.3 Financial Repression Indicator

Inspired by the fact that financial systems in our sample countries are controlled and regulated to various extents, we are also concerned with financial repression. Financial repression takes the form of such financial distortions as interest rates controls (ceilings), reserve requirements and directed credit. McKinnon (1993, p. 11) defines financial repression as:

> "When governments tax (through reserve requirements) and otherwise distort their domestic capital markets (through interest controls and directed credit), the economy is said to be financially repressed".

Another argument is that a high degree of financial repression is associated with high inflation or seigniorage (Bencivenga and Smith, 1992). Moreover, we assume that, as the volume of credit provided to the government increases crowding out the credit provided to the private sector, the extent of financial repression is intensified. Based on these arguments, we select eightelementary variables of financial repression (see, Table A4 in Appendix).

4.   Methodology

4.1   Hypothesis Testing

The basic models of this study are given as follows:

$$EG_i = f(FD_i, FC_i, FR_i) \tag{3}$$

$$FD_i = f(EG_i, FC_i, FR_i) \tag{4}$$

$$FC_i = f(EG_i, FD_i, FR_i) \tag{5}$$

where *EG* is the economic growth indicator as measured by the logarithm of real per capita GDP, and *FD*, *FC* and *FR* are the financial development, financial crisis and financial repression indicators, respectively. Through Equations 3 and 4, the issue on the finance-

growth nexus is addressed, that is, whether the causation runs from finance to growth or growth to finance or bilaterally. Likewise, we are also concerned with the impact of financial crisis and financial repression on economic growth and financial development. Another vital issue is represented by Equation 5, through which the linkage between financial crisis and other variables is investigated. Importantly, these hypotheses are investigated through two different concepts of cointegration: VECM requesting all underlying variables to be $I(1)$ and ARDL accepting either $I(0)$ or $I(1)$.

4.2   Vector Error Correction Models

We formulate the following VECMs for EG, FD and FC as the dependent variables, respectively:

$$\Delta EG_t = \alpha_1 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{11}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{12}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{13}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{14}\Delta FR_{t-j}$$
$$+ \theta_{15}SGD_t + \theta_{16}PCD_t + \theta_{17}SBGD_t + inpt + u_{1t} \tag{6}$$

$$\Delta FD_t = \alpha_2 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{21}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{22}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{23}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{24}\Delta FR_{t-j}$$
$$+ \theta_{25}SGD_t + \theta_{26}PCD_t + \theta_{27}SBGD_t + inpt + u_{2t} \tag{7}$$

$$\Delta FC_t = \alpha_3 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{31}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{32}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{33}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{34}\Delta FR_{t-j}$$
$$+ \theta_{35}SGD_t + \theta_{36}PCD_t + \theta_{37}SBGD_t + inpt + u_{3t} \tag{8}$$

where *ECT* is the error-correction term—for example, in Equation 6, $ECT = \beta_{11}EG_{t-1} + \beta_{12}FD_{t-1} + \beta_{13}FC_{t-1} + \beta_{14}FR_{t-1}$ in which β_{ij}'s are the elements of the cointegrating vector —whose coefficient (α) is expected to have a negative sign[12]. Here, dummy variables included are briefly elucidated. First of all, to avoid autocorrelation, we allocate SGD (the shock in economic growth dummy), which takes the value of one for negative EG growth periods otherwise zero. Although SGD is initially allocated, if SGD alone does not circumvent autocorrelation, we properly add such dummies as: SFD (the shock in financial development dummy), which is one for negative FD growth periods, otherwise zero; and SFCD (the shock in financial crisis dummy), which takes the value of one for positive FC growth periods otherwise zero. Unless SGD is needed, we exclude it and instead take either/both of SFD or/and SFCD only. Moreover, PCD is the pre-crisis dummy that takes the value of one for 1990Q1 to 1990Q4 and zero for other periods in India's analysis. For the other four countries, PCD is not included. Finally, the allocation of SBGD (the structural break in economic growth dummy) is discussedbelow in *Bai and Perron test*. For

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[12] Since the dummy variables included are different across the countries (see Table 2), Equations 6 to 11 are India's VECM and ARDL models.

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giving interference, two types of the causality test are conducted. The first test is the weak exogeneity test in which the null of H_0: $\alpha_j = 0$. Indeed, the weak exogeneity test presents the evidence of long-run causality. The second test is the strong exogeneity test that imposes the strongest restriction of H_0: all θ_{ij}'s $= \alpha_j = 0$ in each VECM and thus indicates the overall causality in the system (see, Charemza and Deadman, 1997). These two tests are based on chi-square statistics from the Wald test.

4.3   Autoregressive Distributed Lag Models

Subsequently, the ADRL frameworks are presented by the following error correction models (ECMs):

$$\Delta EG_t = \alpha_4 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{41}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{42}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{43}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{44}\Delta FR_{t-j}$$
$$+ \theta_{45}\Delta SGD_t + \theta_{46}\Delta PCD_t + \theta_{47}\Delta SBGD_t + inpt + u_{4t} \tag{9}$$

$$\Delta FD_t = \alpha_5 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{51}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{52}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{53}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{54}\Delta FR_{t-j}$$
$$+ \theta_{55}\Delta SGD_t + \theta_{56}\Delta PCD_t + \theta_{57}\Delta SBGD_t + inpt + u_{5t} \tag{10}$$

$$\Delta FC_t = \alpha_6 ECT_{t-1} + \sum_{j=1}^{p-1}\theta_{61}\Delta EG_{t-j} + \sum_{j=1}^{p-1}\theta_{62}\Delta FD_{t-j} + \sum_{j=1}^{p-1}\theta_{63}\Delta FC_{t-j} + \sum_{j=1}^{p-1}\theta_{64}\Delta FR_{t-j}$$
$$+ \theta_{65}\Delta SGD_t + \theta_{66}\Delta PCD_t + \theta_{67}\Delta SBGD_t + inpt + u_{6t} \tag{11}$$

The ECT in Equation 9, for example, takes the form of: $ECT = \beta_{41}EG_t + \beta_{42}FD_t + \beta_{43}FC_t + \beta_{44}FR_t + \beta_{45}SGD_t + \beta_{46}PCD_t + \beta_{47}SBGD_t + inpt$. The ARDL estimation provides $(p+1)^k$ number of regressions, where p is the maximum number of lags to be used and k is the number of variables in the ARDL equation. Since this study uses quarterly series, the maximum lag is initially set at $p = 4$. At the first stage, we need to conduct the bounds test that computes F-statistics to confirm the existence of long-run cointegrating relationships between the underlying variables irrespective of whether those variables are $I(0)$ or $I(1)$ (Pesaran and Pesaran, 2009). At the second stage, the optimal lag order for each variable is set. We look for the optimal lags by referring either to the Akaike information criteria (AIC) or to the Schwartz–Bayesian criteria (SBC). Finally, two types of the causality test, which are suggested in the VECM analysis, are carried out for each ARDL model.

4.4   Bai and Perron Test

Since the structural break literature emerged, it has been generally agreed that a structural break exists in time series data[13]. In fact, visually checking the EG (real per capita

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[13] For a comprehensive review of the structural break literature, see Perron (2006).

GDP) plots in Figure A1 to A5 in Appendix, India seems to have a break around 1991, whereas the other four countries have a prominent break over the period 1997 to 1998. We therefore consider it important to take the element of structural break into our analysis for obtaining more plausible estimates. For this end, the structural break in economic growth dummy (SBGD) is allocated by estimating structural break(s) in each country's EG series through the test developed by Bai and Perron (1998; 2003) (hereafter the BP test)[14]. The BP test specifies multiple structural changes in a linear regression model estimated by least squares, treating the dates of structural breaks as unknown and endogenous events. Thus, the rationale for performing the BP test is that it allows us to determine break points statistically and objectively not setting the break dates based on *a priori* information. We conduct the BP test through the following unrestricted vector autoregression model (EG-VAR) where EG is the dependent variable:

$$EG_t = \sum_{j=1}^{p} \alpha_{11} EG_{t-j} + \sum_{j=1}^{p} \alpha_{12} FD_{t-j} + \sum_{j=1}^{p} \alpha_{13} FC_{t-j} + \sum_{j=1}^{p} \alpha_{14} FR_{t-j}$$
$$+ \alpha_{15} SGD_t + \alpha_{16} PCD_t + inpt + u_{11t}$$

(12)

To eliminate autocorrelation in our estimation, we include dummies in each EG-VAR as follows: SGD and PCD for India; SGD and SFD for Indonesia; SFD and SFCD for Korea; SGD and SFCD for Malaysia; and SGD, SFD and SFCD for Thailand[15]. As reported in Table 2, the sample periods differ across the five countries due to data availability or data truncation in the process of constructing the summary indicators. Subsequently, we check the lag order selection statistics of each EG-VAR, and set three lags for Korea, Malaysia and Thailand and four lags for India and Indonesia[16].

Based on the break dates reported in Table 1, different SBGDs are formed and included ineach country's estimation. The results show that for both India and Indonesia, the one break result is the best (1990Q1 for India and 1997Q4 for Indonesia), whereas for Thailand, the two-break result (1997Q2 and 2003Q1). Here, the selection mainly depends on whether the SBGD allocation provides a single cointegration ($r = 1$) and/or no autocorrelation in estimation. Nonetheless, SBGDs are not essential for both Korea and Malaysia. For Korea, instead of the BP test, we perform the Zivot and Andrew (1992) test and detect a single structural break in 1997Q4[17]. With this single break result, we allocate a zero-one dummy, which is named the Zivot and Andrew dummy (ZAD), in Korea'sestimation. On the other hand, for Malaysia, any dummy allocations ― specified either by the BP test or by the ZA test ― do not produce better estimates so that no SBGD is contained in Malaysia's analysis.

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[14] We refer to Verma and Wilson (2005) who detected a structural break in India's annual GDP series around 1989 with the test suggested by Perron and Vogelsang (1992) and allocate zero and one dummies assuming the year 1989 as the break point.

[15] Equation 12 is for India's estimation.

[16] Since the space is limited, all the results of the BP test are not reported but are given on request.

[17] The Zivot and Andrew test is an autoregressive structural break test that specifies a single unknown break as an endogenousevent.

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Finally, Table 2 shows the combinations of dummy variables that are included in the five countries' assessments.

Table 1: Bai and Perron Test Results

Country	Number of Break(s)			
	1	2	3	4
India	1990Q3	1990Q3 1997Q1	1998Q3; 1994Q2 1999Q3	—
Indonesia	1997Q4	1997Q1 2002Q2	1987Q1; 1997Q1 2002Q1	—
Korea	1998Q3	1996Q4 2001Q4	1988Q3; 1996Q4 2001Q4	1987Q4; 1992Q4 1997Q4; 2002Q4
Malaysia	1997Q1	1993Q2 2000Q2	1988Q1; 1995Q1 2000Q2	—
Thailand	1997Q3	1997Q2 2003Q1	1994Q1; 1998Q3 2003Q1	—

Source: Authors' own estimation.

Table 2: Sample Periods and Dummy Variables Included

Country	Sample period	Dummy variables
India	1982Q1 to 2007Q4	SGD; SBGD (one break: 1990Q3); PCD
Indonesia	1982Q1 to 2007Q4	SGD; SFD; SBGD (one break: 1997Q4)
Korea	1983Q1to 2007Q4	SFD; SFCD; ZAD (1997Q4)
Malaysia	1982Q1 to 2007Q4	SGD; SFCD
Thailand	1986Q1 to 2007Q4	SGD; SFD; SFCD; SBGD (two breaks: 1997Q2 & 2003Q1)

Source: Authors' own estimation.

5. Empirical Results

The total of 24 models is estimated for the five Asian countries, and the sample periods of these countries are the same as those in the BP test (see, Table 2). The number of observations ranges from 89 to 104 among the sample countries. While some models indicate the evidence of heteroscedasticity, non-normality and functional form problem, all models are free from autocorrelation at the 10% significance level or better (see, Table A5 in Appendix).

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5.1   Unit Root and Cointegration Tests

The order of integration of variables in this study is determined by the ADF and PP unit root tests. To keep the accuracy in unit root statistics, both the two tests are exposed to (exogenous) structural break(s) whose dates are given in Table 2[18]. The results in Table 3 fairlyidentify that all the five countries' EG, FD, FC and FR are non-stationary in their levels (except the PP result of Indonesia's FR) but become stationary after taking the first difference[19]. Thus, all the underlying variables are confirmed as $I(1)$ even with the presence of structural break[20].Next, the Johansen (1988) cointegration test (with unrestricted intercepts and no trends) is conducted treating FR as an exogenous $I(1)$ variable in the cointegrating vector[21]. It is important to determine the lag order prior to the cointegration test, as the Johansen test is highly depended on the choice of lag length. The appropriate lag length chosen is three for Korea, Malaysia and Thailand and four for India and Indonesia. Based on trace statistics, the results in Table 4 indicate a single cointegration relationship ($r = 1$) among EG, FD and FC at the 10% level or better in all the countries.

Table 3: Results of Unit Root Test with Structural Break(s) ($k = 4$)

Panel A	India		Indonesia		Korea	
	One break (1990Q3)		One break (1997Q4)		One break (1997Q4)	
	ADF	PP	ADF	PP	ADF	PP
EG	-0.395	-0.122	-1.934	-1.490	-2.129	-2.057
ΔEG	-3.639*	-11.692*	-3.757*	-3.517*	-4.948*	-9.141*
FD	0.192	-0.137	-2.045	-2.411	-2.340	-2.156
ΔFD	-3.680*	-15.584*	-5.315*	-16.019*	-3.528*	-11.081*
FC	-2.052	-1.835	-2.914	-2.379	-2.135	-1.756
ΔFC	-5.780*	-7.086*	-4.939*	-7.653*	-4.580*	-6.046*
FR	-0.708	-1.649	-2.943	-4.386*	-2.881	-2.676
ΔFR	-4.579*	-14.758*	-5.752*	-17.343*	-3.519*	-13.403*

[18] For the ADF and PP unit root tests with exogenousstructural break, see Pesaran and Pesaran (2009).

[19] As mentioned in Section 4.4, although SBGD is not taken into estimation, Malaysia's unit root tests are exposed to one break (1997Q1).

[20] The standard ADF and PP tests either of intercept and no trend or of intercept and liner trend also confirm that all the underlying variables are I(1). The results are given on request.

[21] For details, see, Pesaran et al. (2000).

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| Panel B | Malaysia | | Thailand | |
| | One break (1997Q1) | | Two breaks (1997Q2 & 2003Q1) | |
	ADF	PP	ADF	PP
EG	-1.947	-1.687	-2.354	-2.159
ΔEG	-4.515*	-7.029*	-2.931	-5.917*
FD	-2.208	-2.077	-1.596	-1.660
ΔFD	-4.285*	-10.568*	-3.064	-8.479*
FC	-2.603	-2.486	-2.405	-2.485
ΔFC	-4.828*	-9.263*	-5.958*	-5.725*
FR	-2.258	-1.843	-1.940	-2.582
ΔFR	-4.339*	-9.728*	-4.654*	-10.084*

Source: Authors' own estimation.

Notes: *denotes statistical significance at the 5% level.

Table 4: Johansen Cointegration Test Results (Trace Statistics)

Null	Alternative	India	Indonesia	Korea	Malaysia	Thailand
$r = 0$	$r = 1$	47.57*	61.36*	59.20*	37.86**	56.72*
$r \le 1$	$r = 2$	17.12	20.12	16.21	12.5	13.8
$r \le 2$	$r = 3$	2.92	0.93	0.97	2.48	4.43

Source: Authors' own estimation.

Notes: * and ** denote statistical significance at the 5 and 10% levels, respectively.

5.2   ARDL Procedures

The bounds test is implemented with maximum lag order of four for India and Indonesia, and three for Korea, Malaysia and Thailand. The test statistics in Table 5 reveal that, there is cointegration relationship in: all EG, FD and FC for Korea; FD and FC for India and Malaysia; and only FC for Indonesia and Thailand. Although several *F*-statistics in Table 5 are judged as inconclusive in the bounds test, the presence of cointegration has been detected through the conventional unit root tests (i.e., the ADF and PP tests)[22]. Next, while we seek the lag length of each underlying variable, both AIC and SBC give us only the lag selections that seem to cause autocorrelation in both India and Indonesia's models. Hence, the orders of the two countries are manually set as presented in Table 5. For the rest of three countries, Korea's models are selected by SBC and Malaysia and Thailand's models by AIC, respectively.

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[22] For the bounds test procedures, see Pesaran and Pesaran (2009).

Table 5: Bounds Test Results and Selected Orders

	EG	FD	FC
India	0.899	3.526; (2, 4, 2, 2)	3.225; (4, 1, 4, 0)
Indonesia	2.395	1.451	5.362; (4, 2, 2, 0)
Korea	5.427; (1, 3, 1, 0)	2.880; (3, 1, 0, 0)	6.323; (2, 0, 0, 0)
Malaysia	2.552	3.936; (1, 0, 0, 3)	2.836; (3, 0, 0, 0)
Thailand	0.627	1.180	8.342; (3, 3, 1, 3)

Source: Authors' own estimation.
Notes: 5% bounds 3.23 to 4.35 and 10% bounds 2.72 to 3.77. In parentheses, the sequence is (EG, FD, FC, FR) for EG model, (FD, EG, FC, FR) for FD model and (FC, EG, FD, FR) for FC model. The sequence is given to the results statistical significant at the 10% level or better.

5.3   Finance-Growth Nexus

Table 6 contains the relevant findings on the finance-growth nexusin the five Asian countries. Both "Yes" and "No" results are based on the strong exogeneity statistics from both VECM and ARDL. The "Yes" means significant at the 10% level or better, and the weak exogeneity is significant at the 10% level or better and marked by "§". We observe that the finance and growth are positively related to each other in all countries irrespective of the level of significance. In case of India and Malaysia, their finance-growth causality is identified as bilateral within the VECM framework, whereas their ARDL estimates reject the cointegrating relationship in EG-ARDL, suggesting the causal link of growth→finance. This leads us to conclude that the finance-growth nexus is primarily bidirectional but tipping more towards growth→finance. For Korea's finance-growth nexus, while the VECM results support the causal link of growth→finance, the ARDL results demonstrate the bilateral causality. Although the weak exogeneity test results are insignificant in Korea's EG-ARDL and FD-ARDL, we detect stronger evidence of finance→growth causal link from Korean's VECM outcomes. In cases of Indonesia and Thailand, their finance-growth nexus cannot be investigated through ARDL as the bounds test results reject their long-run causality between finance and growth. Nonetheless, the VECM estimates clearly show that the causality runsfinance→growth in Indonesian and growth→finance in Thailand.

The conclusions of the five Asian countries' finance-growth nexus are summarized in Table 7. As we can see, a variation across countries is observed even though the same variables and approach are used. The demand-leading hypothesis ― economic growth leads to higher financial development but not vice versa ― is supported by Thailand's results. Although their finance-growth nexus is concluded as bilateral, both India and Malaysia's estimates are partially supported the demand-leading hypothesis. On the other hand, the supply-leading hypothesis (finance→growth) is validated by the results for Indonesia and

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Korea. Finally, Table 8 shows time series evidence from several empirical studies that assessed the finance-growth nexus in India, Indonesia, Korea, Malaysia and Thailand using standard techniques (mainly VECM). As we can see, the results are mixed within each country.

Table 6: Finance-Growth Nexus (1)

Country	Finance→Growth		Growth→Finance	
	VECM	ARDL	VECM	ARDL
India	Yes**	—	Yes* §	Yes* §
Indonesia	Yes**§	—	—	—
Korea	Yes*§	Yes*	No	Yes*
Malaysia	Yes** §	—	Yes* §	Yes* §
Thailand	—	—	Yes*** §	—

Source: Authors' own estimation.

Notes: *, ** and *** denote statistical significance at the 1, 5 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. In all the five countries, both finance and growth positively relate to each other.

Table 7: Finance-Growth Nexus (2)

Country	Result
India	Finance↔Growth but more inclining toward Growth→Finance
Indonesia	Finance→Growth
Korea	Finance→Growth
Malaysia	Finance↔Growth but more inclining toward Growth→Finance
Thailand	Growth→Finance

Source: Authors' own estimation.

Table 8: Time Series Evidence on Finance-Growth Nexus

(a) India	
Finance→Growth	Bhattacharya & Sivasubramanian (2003); Rousseau & Vuthipadadorn (2005)
Growth→Finance	Our ARDL; Kassimatis and Spyrou (2001) Arestis et al. (2002); Fase & Abma (2003)
Finance↔Growth	Our VECM; Demetriades & Hussein (1996); Demetriades & Luintel (1997) Luintel & Khan (1999); Singh (2008); Fukuda & Dahalan (2011)
(b) Indonesia	
Finance→Growth	Our VECM; Fukuda & Dahalan (2011)
Growth→Finance	—
Finance↔Growth	Rousseau & Vuthipadadorn (2005)
No causality	Majid&Musnadi (2010)
(c) Korea	
Finance→Growth	Our VECM; Kassimatis and Spyrou (2001); Fase & Abma (2003) Rousseau & Vuthipadadorn (2005); Yang & Yi (2008)
Growth→Finance	Arestis et al. (2002)
Finance↔Growth	Our ARDL; Demetriades & Hussein (1996); Luintel & Khan (1999)
(d) Malaysia	
Finance→Growth	Ansari (2002); Fase & Abma (2003); Rousseau & Vuthipadadorn (2005) Majid&Musnadi (2010)
Growth→Finance	Our ARDL; Ang & McKibbin (2007)
Finance↔Growth	Our VECM; Luintel & Khan (1999)
(e) Thailand	
Finance→Growth	Fase & Abma (2003) (1 lag); Rousseau & Vuthipadadorn (2005)
Growth→Finance	Our VECM; Demetriades & Hussein (1996) (LD) Arestis et al. (2002); Fase & Abma (2003) (2 lags)
Finance↔Growth	Demetriades & Hussein (1996) (LM); Luintel & Khan (1999)

Source: Authors' own estimation.

Notes: Demetriades and Hussein (1996) used two financial development indicators: the ratio of bank deposit liabilities to GDP (LM) and the ratio of bank claims on the private sector to GDP (LD), both of which take the form of the logarithm.

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5.4   Financial Repression

As described in Table 9, the impact of financial repression either on finance or on growth are different among the five Asian countries. The causal direction of financial repression is confirmed by the sign of FR coefficient in the cointegrating space of each ECM. In India, financial repression is positive to growth and negative to finance. All the Korean models uniformly suggest the negative causality of repression→growth rejecting a significant causal link of repression→finance. Interesting is Malaysia, where financial repression exhibits a negative influence on growth and a positive one on finance as demonstrated by both VECM and ARDL. For Indonesia and Thailand, any significant results are not detected. Thus, diverse effect of financial repression on financial development and economic growth are revealed. This variation can be attributed to the institutional factors (e.g., the quality of prudential regulation) that differ considerably across the five countries. One interesting argument given by Arestis et al. (2002) is that, financial restraints (repression) can play a prudential role in preventing moral hazard behaviours in financial transactions so that financial repression exhibits a positive impact on financial development. In this context, the positive causality of repression→finance, which is found to be significant in Malaysia, is evidence of increased confidence in the financial system. In India, on the other hand, the link is negative and significant; and the causality of repression→growth is positive but insignificant. Hence, in promoting economic growth and establishing confidence in the financial system, financial policies in India are viewed as still inefficient and retarded.

Table 9: Financial Repression

Country	Repression→Growth		Repression→Finance	
	VECM	ARDL	VECM	ARDL
India	Yes(+)***	—	Yes(-)*§	Yes(-)*§
Indonesia	No(+)§	—	—	—
Korea	Yes(-)*§	Yes(-)*	No(+)	No(+)
Malaysia	Yes(-)**§	—	Yes(+)*§	Yes(+)*
Thailand	—	—	No(+)§	—

Source: Authors' own estimation.

Notes: *, ** and *** denote statistical significance at the 1, 5 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. + and - indicate positive and negative links (the direction of financial repression is confirmed by its sign in the cointegrating vector).

5.4   Finance-Growth-Crisis Nexus

Table 10 documents the effect of financial crisis either on growth or on finance. The results are summarized as: (1) crisis→finance(+) in India; (2) no significant estimate for Indonesia; (3) different estimates are detected through VECM and ARDL in Korea; (4) crisis→finance(+) and crisis→growth(-) in Malaysia; and (5) crisis→finance(+) in Thailand. Likewise, Table 11 reports how financial crisis is caused by finance, growth and repression. We identify growth→crisis(-) and finance→crisis(+) in all the countries except for Korea where growth→crisis(+) and finance→crisis(-). As far as the impact of repression on crisis is concerned, it is repression→crisis(+) in all the countries except for Thailand where repression→crisis(-).

Looking at the results in Tables 10 and 11, we infer a positive bilateral causality of finance↔crisis in India, Malaysia and Thailand. This causation might be due to financial boom that can remarkably increase the volume of credit and/or encourage stock market activities in an economy irrespective of real sector condition. Therefore, the causality of finance↔crisis(+) implies that if the government or monetary authority adopts a policy that simply increases volatility in an economy, the extent of financial deepening rises further. However, such volatility-led policy implication is obviously adverse and dangerous, leading to financial fragility and ultimately to financial crisis. This process coincides with our initial prediction that financial boom ends up with financial crisis. For Korea, a positive bilateral causality of growth↔crisis is observed, though a uniformed result is not found for the causality between finance and crisis. Thus, our analysis indicates that Korea's transmission mechanism to financial crisis differs from those in the other countries. As we can see, a bilateral link of growth↔crisis is reported to be negative in India, Indonesia and Malaysia. While the evidence of crisis→growth is relatively weak, that of growth→crisis is strongly confirmed by both the VECM and ARDL assessments (including Thailand). It thus might be argued that higher economic growth can reduce the risk of financial crisis.

Table 10: Finance-Growth-Crisis Nexus (1)

Country	Crisis→Growth		Crisis→Finance	
	VECM	ARDL	VECM	ARDL
India	No(-)	—	Yes(+)*	No(+)§
Indonesia	No(-)§	—	—	—
Korea	Yes(+)*§	No(+)	No(-)	Yes(+)*
Malaysia	Yes(-)*§	—	Yes(+)*§	Yes(+)*
Thailand	—	—	Yes(+)***§	—

Source: Authors' own estimation.

Notes: * and *** denote statistical significance at the 1 and 10% levels, respectively. § shows that the weak exogeneity test result is significant at the 10% level or better. + and - indicate positive and negative links (the causal direction of financial repression is confirmed by its sign in the cointegrating vector).

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Table 11: Finance-Growth-Crisis Nexus (2)

Country	Growth→Crisis		Finance→Crisis		Repression→Crisis	
	VECM	ARDL	VECM	ARDL	VECM	ARDL
India	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(+)*	Yes(+)*
Indonesia	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(+)*	Yes(+)*
Korea	Yes(+)*	Yes(+)*	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*
Malaysia	No(-)	Yes(-)*	No(+)	Yes(+)*	No(-)Ŧ	Yes(+)*
Thailand	Yes(-)*	Yes(-)*	Yes(+)*	Yes(+)*	Yes(-)*	Yes(-)*

Source: Authors' own estimation.

Notes: * denotes statistical significance at the 1% level. Ŧ shows that the weak exogeneity test result of Malaysia's VECM is insignificant, whereas those of all others are significant at the 10% level or better. + and - indicate positive and negative links. The causal direction of financial repression is confirmed by its sign in the cointegrating vector.

Subsequently, the casual link between crisis and repression is discussed. As given in Table 11, it is repression→crisis(+) in India, Indonesia, Korea and Malaysia; and repression→crisis(-) in Thailand. While a high degree of financial repression seems to cause financial crisis in four countries, it is reversed in Thailand where the low degree of financial repression is observed immediately before the Asian crisis (see, Figure A5 in Appendix) hits the country. For other countries except Thailand, we argue that an extremely high degree of financial repression in a boom period attracted more speculative funds (rather than contained a credit boom). This further increases the volatility in those economies where the financial market is progressively liberalized but not well-regulated and controlled. Such a mechanism might have worked in India, Indonesia, Korea and Malaysia before these countries are severely hit by financial crisis. For Thailand, on the other hand, an expansionary financial trend―as approximated by the low degree of FR― might have typically created a financial boom led by investment opportunities that are rapidly increasing but are not properly hedged.

6. Conclusion and Policy Implications

This paper examines the cointegration and Granger causality between financial development, economic growth and financial crisis in the five Asian countries (India, Indonesia, Korea, Malaysia and Thailand) through the techniques of vector error correction model (VECM) and autoregressive distributed lag (ARDL). As far as the estimates of the finance-growth nexus are concerned, although the same variables and methodology are employed, different causal directions (i.e., either finance→growth or growth→finance or finance↔growth) have been detected across the five Asian countries. The findings support the validity of country-by-country analysis employing time series techniques over the cross-country and panel data analysis that seeks a single generalized result by pooling

and averaging several countries' data. Besides, our findings are more plausible than those from a simple bivariate model because financial crisis, financial repression and structural break—which exhibit vital background effects on the finance-growth nexus—are taken into our estimation. Moreover, the use of both VECM and ARDL add more robustness to the analysis, as the long-run relationship has been confirmed through two different concepts of cointegration test.

Extending the topic of "finance-growth nexus" to a new dimension of "finance-growth-crisis nexus", we present the following policy implications. First, the positive impact of finance on growth should be evaluated with the view that deeper financial development can lead to financial crisis. Although the positive impact of finance→growth is confirmed, we must be aware of the adverse effect due to the positive bilateral causality of finance↔crisis — as the substantial cost of financial deepening — would lead to a crisis. To plan and develop a financial system for higher economic growth, policy makers need to be vigilant of the two conflicting causalities and thus thenet effect of financial deepening. Second, based on the findings of the linkage between financial crisis and financial repression, we argue that the priority in implementing the financial policy measures by the monetary authority is to reduce the threat of financial crisis whose impact is economically and socially enormous. Considering the complexity of the issue, efforts must be made to build a more robust financial system through regulatory reform. In this context, introducing some preventive measures will strengthen the resilience of the financial system that could help reduce the probability of systemic crisis at some point in the future. While this paper assumes that financial crisis in each sample country is caused by domestic factors, it is also observed that a financial crisis occurring in one country can bring about those in other countries as seen in the Asian 1997 crisis and the recent Euro crisis. Future studies should address the issue ofcris is contagion while looking at whether/how financial crisis can spill over across several countries.

Acknowledgment

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Appendix

Table A1: Elementary Variables of Financial Development

Definition (Name)	Source
Money supply/GDP (MTG)	Line 35L (for money supply) and 99B (for GDP)
Deposit money bank assets/GDP (BATG)	All categories of line 22 (for deposit money bank assets) and line 99B
Private credit by deposit money banks/ GDP (PCTG)	Line 32D (for private credit) and 99B
Stock market capitalization/GDP (SKTG)	FSD
Stock market total value/GDP (SVTG)	FSD

Notes: All the "lines" refer to those of the International Financial Statistics (IFS). Annual series of SKTG and SVTG are disaggregated to quarterly ones by the Boot et al. (1967) method. FSD = Financial Structure Dataset.

Table A2: Elementary Variables of Financial Crisis

Definition (Name)	Source
Exchange rate (ER)	ER = NER * (USCPI / SCPI) where NER is nominal exchange rate (line RF), and USCPI and SCPI are US and sample country's consumer price indexes, respectively.
Money supply / foreign exchange reserve (MTF)	MTF = NM / (FER * NER) where NM is nominal money supply (line 35L), and FER is foreign exchange reserve (line 1D).
External debt (ED)[§]	ED = (NED * NER) / CPI where NED is nominal external debt (WDI).
Trade volume (TV)	TV = [(X + I) * NER] / CPI where X + I is exports + imports (lines 70 and 71).
Oil price (OP)	OP = (NOP * NER) / CPI where NOP is nominal oil price (line 76AA).
Fiscal deficit (FCD)[§]	FCD = NFCD / CPI where NFCD is nominal fiscal deficit (Reserve Bank of India) (for India).
Gov. consumption expenditure (GCE)[§]	GCE = NGCE / CPI where NGCE is nominal government consumption expenditure (line 91) (for Indonesia, Korea, Malaysia and Thailand).
Share price (SP)	SP = NS / CPI where NSP is nominal share price (line 62).
Inflation rate (IR)	IR = [(CPI – CPI(-1)) / CPI(-1)] * 100
Real interest rate (RR)	RR = NR – IR where NR is nominal interest rate (discount rate) (line 60).

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GDP (GDP)§	GDP = NGDP / CPI where NGDP is nominal GDP (line 98B).
Money supply (MS)	MS = NM / CPI
Total domestic deposit (TD)	TD = NTD / CPI where NTD is the sum of demand- and time deposits (lines 24 and 25).
Deposit money bank assets (BA)	BA = NBA / CPI where NBA is nominal bank assets (all categories of line 22).
Private credit by deposit money banks (PC)	PC = NPC / CPI where NPC is nominal private credit (line 32D).
Stock market capitalization / GDP (SKTGV)§	FSD
Stock market total value / GDP (SVTGV)§	FSD

Notes: All the "lines" refer to those of the International Financial Statistics (IFS). § indicates that annual series are disaggregated to quarterly ones by the Boot et al. (1967) method except GDP that is by the Chow and Lin (1971) method. WDI = World Development Indicators. FSD = Financial Structure Dataset.

Table A3: Asian Countries' Selected Elementary Variables of Financial Crisis

| Country	Financial Crisis Variables
India	ER; MTF; ED; TV; OP; FCD; SP; IR; GDP; MS; TD; SKTGV
Indonesia	ER; MTF; ED; TV; OP;GCE; IR; MS; TD; BA; PC
Korea	ER; MTF; TV;SP; IR; GDP; MS; TD; SKTGV; SVTGV
Malaysia	ER; ED; TV; GCE; SP; IR; SKTGV
Thailand	ER; MTF; ED; TV; GCE; IR; GDP; MS; TD; SKTGV

Source: Authors' own estimation.

Table A4: Elementary Variables of Financial Repression

| Definition (Name)	Source
Nominal interest rate (NR)	Line 60 (for bank rate)
Com. bank reserve / m. supply (CRTM)	Lines 20 (for CB reserves) and 35L (for m. supply)
Com. bank reserve / GDP (CRTG)	Lines 20 and 99B (for GDP)
Com. bank reserve / total deposit (CRTD)	Lines 20 and 24 and 25 (for total deposit)
Claims on the gov. / m. supply (GTM)	Lines 32AN (for claim on the government) and 35L
Claims on the gov. / GDP (GTG)	Lines 32AN and 99B
Claims on the gov. / total domestic credit (GTD)	Lines 32AN and 32 (for total domestic credit)
Inflation tax (Seigniorage) (IT)	Change in reserve money (line 14) / GDP (line 99B)

Notes: All the "lines" refer to those of the International Financial Statistics (IFS).

Figure A1: India's EG and Summary Indicators

(a) EG

(b) FD

(c) FC

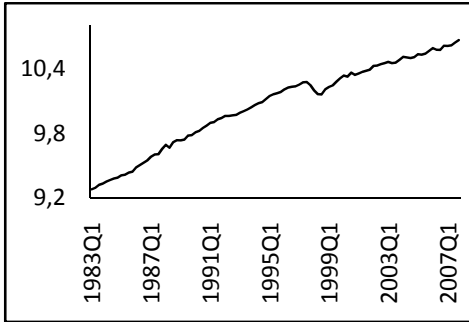(d) FR

Source: Authors' own estimation.

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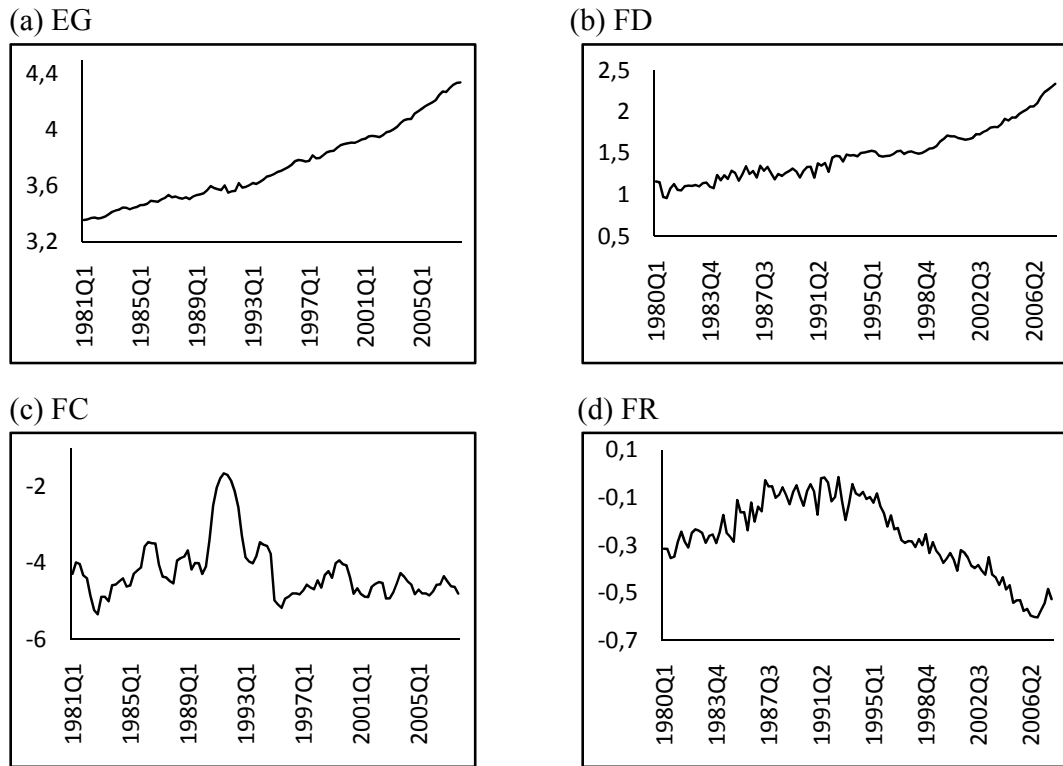
Figure A2: Indonesia's EG and Summary Indicators
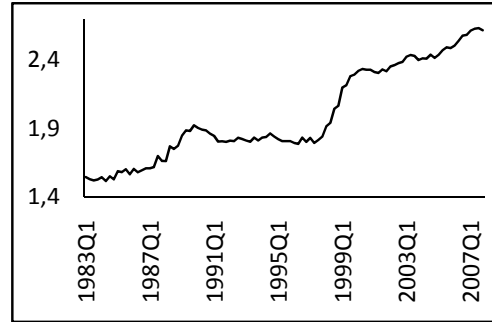
(a) EG

(b) FD

(c) FC

(d) FR
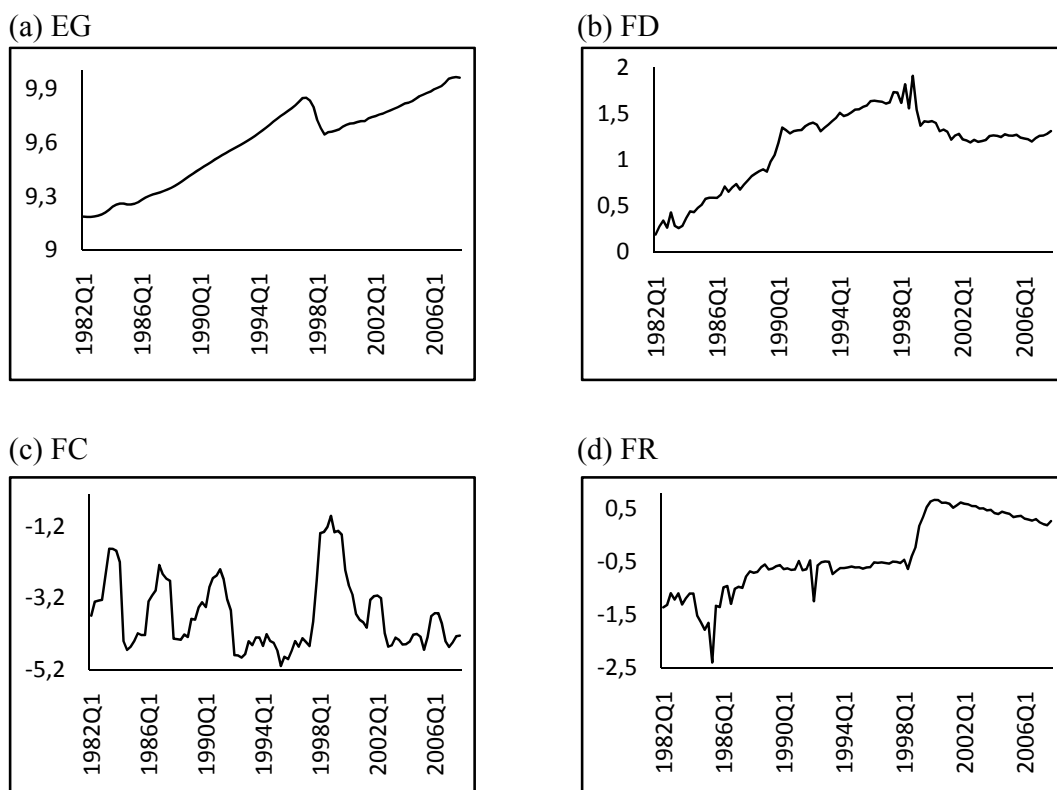
Source: Authors' own estimation.

Figure A3: Korea's EG and Summary Indicators

(a) EG

(b) FD

(c) FC

(d) FR

Source: Authors' own estimation.

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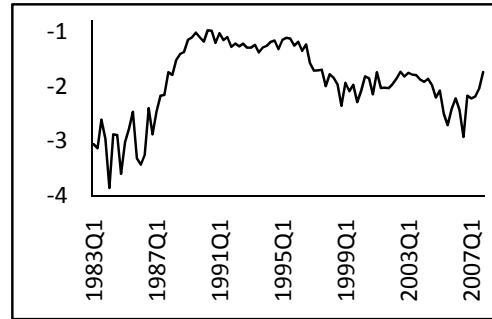
Figure A4: Malaysia's EG and Summary Indicators

(a) EG

(b) FD

(c) FC

(d) FR
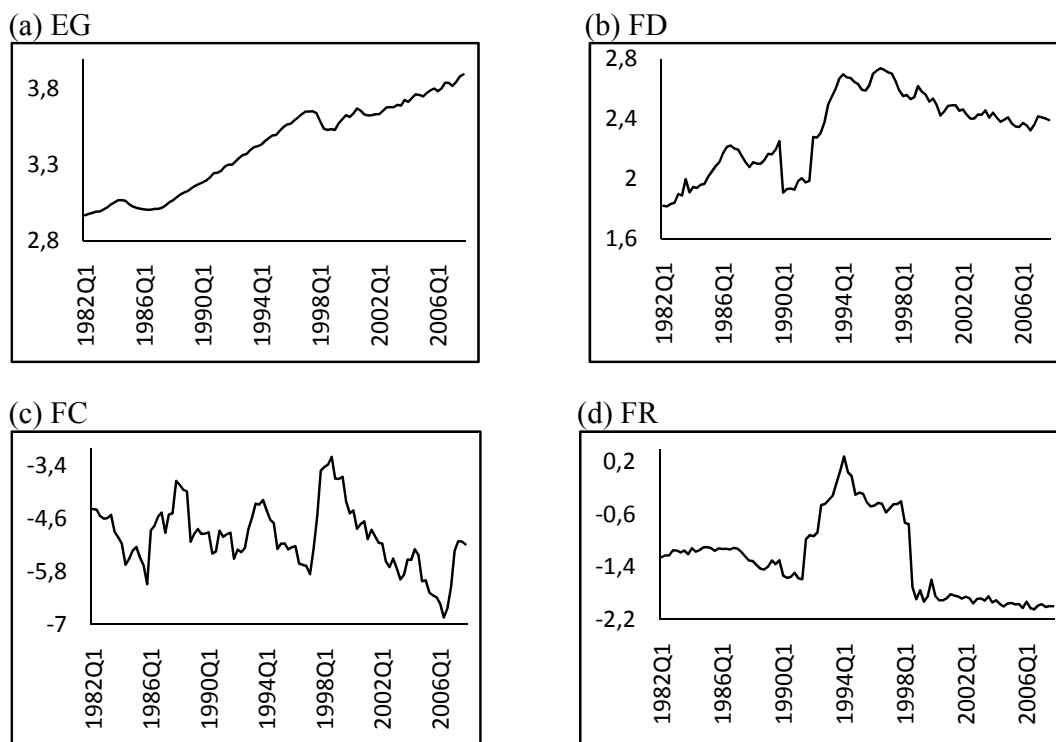
Source: Authors' own estimation.

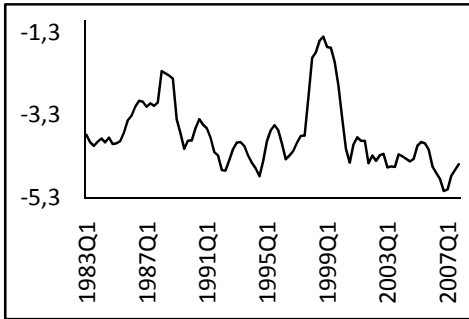**Figure A5: Thailand's EG and Summary Indicators**

(a) EG

(b) FD

(c) FC

(d) FR

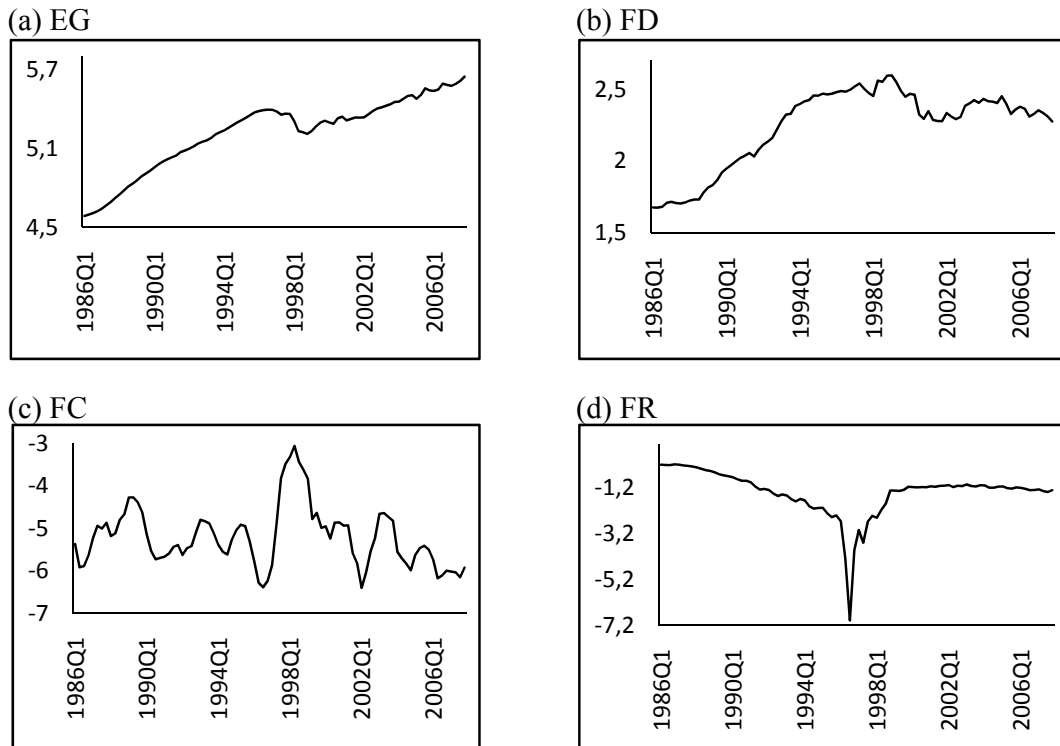**Source:** Authors' own estimation.

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Table A5: Diagnostic Tests Results (LM Version)

(a) India

Panel A

Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 5.651 [.227]	CHSQ(4) = 2.357 [.670]	CHSQ(4) = 6.397 [.171]
Functional Form	CHSQ(1) = 0.035 [.851]	CHSQ(1) = 0.125 [.724]	CHSQ(1) = 0.547 [.460]
Normality	CHSQ(2) = 14.85 [.001]	CHSQ(2) = 5.278 [.071]	CHSQ(2) = 120.9 [.000]
Heteroscedasticity	CHSQ(1) = 14.90 [.000]	CHSQ(1) = 0.001 [.893]	CHSQ(1) = 0.011 [.915]

Panel B

Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	CHSQ(4) = 4.616 [.329]	CHSQ(4) = 8.449 [.076]
Functional Form	—	CHSQ(1) = 3.029 [.082]	CHSQ(1) = 11.33 [.001]
Normality	—	CHSQ(2) = 7.052 [.029]	CHSQ(2) = 85.01 [.000]
Heteroscedasticity	—	CHSQ(1) = 9.207 [.002]	CHSQ(1) = 0.313 [.576]

(b) Indonesia

Panel A

Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 2.331 [.675]	CHSQ(4) = 5.621 [.229]	CHSQ(4) = 7.664 [.105]
Functional Form	CHSQ(1) = 13.42 [.000]	CHSQ(1) = 4.551 [.033]	CHSQ(1) = 2.255 [.133]
Normality	CHSQ(2) = 394.6 [.000]	CHSQ(2)=163.3 [.000]	CHSQ(2) = 66.38 [.000]
Heteroscedasticity	CHSQ(1) = 19.39 [.000]	CHSQ(1) = 2.811 [.094]	CHSQ(1) = 13.66 [.000]

Panel B

Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	—	CHSQ(4) = 8.886 [.064]
Functional Form	—	—	CHSQ(1) = 6.978 [.008]
Normality	—	—	CHSQ(2) = 49.36 [.000]
Heteroscedasticity	—	—	CHSQ(1) = 2.439 [.118]

(c) Korea

Panel A

Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 6.956 [.138]	CHSQ(4) = 7.045 [.134]	CHSQ(4) = 5.429 [.246]
Functional Form	CHSQ(1) = 1.301 [.254]	CHSQ(1) = 9.408 [.002]	CHSQ(1) = 0.319 [.572]
Normality	CHSQ(2) = 0.482 [.786]	CHSQ(2) = 59.76 [.000]	CHSQ(2) = 2.630 [.269]
Heteroscedasticity	CHSQ (1) = 0.936 [.333]	CHSQ(1) = 27.43 [.000]	CHSQ(1) = 22.56 [.000]

Panel B

Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	CHSQ(4) = 5.553 [.235]	CHSQ(4) = 7.203 [.126]	CHSQ(4) = 4.189 [.381]
Functional Form	CHSQ(1) = 0.601 [.438]	CHSQ(1) = 0.700 [.403]	CHSQ(1) = 1.233 [.267]
Normality	CHSQ(2) = 1.696 [.428]	CHSQ(2) = 24.05 [.000]	CHSQ(2) = 13.145 [.001]
Heteroscedasticity	CHSQ(1) = 1.064 [.302]	CHSQ(1) = 0.926 [.336]	CHSQ(1) = 9.173 [.002]

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(d) Malaysia

Panel A

Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 4.353 [.360]	CHSQ(4) = 2.205 [.698]	CHSQ(4) = 4.542 [.338]
Functional Form	CHSQ(1) = 3.714 [.054]	CHSQ(1) = 12.386 [.000]	CHSQ(1) = 0.319 [.573]
Normality	CHSQ(2) = 0.681 [.712]	CHSQ(2) = 1675.2 [.000]	CHSQ(2) = 63.29 [.000]
Heteroscedasticity	CHSQ(1) = 4.455 [.035]	CHSQ(1) = 1.994 [.158]	CHSQ(1) = 2.316 [.128]

Panel B

Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	CHSQ(4) = 2.134 [.711]	CHSQ(4) = 4.765 [.312]
Functional Form	—	CHSQ(1) = 1.454 [.228]	CHSQ(1) = 0.001 [.975]
Normality	—	CHSQ(2) = 694.0 [.000]	CHSQ(2) = 39.213 [.000]
Heteroscedasticity	—	CHSQ(1) = 0.465 [.495]	CHSQ(1) = 0.287 [.592]

(e) Thailand

Panel A

Test Statistics	EG-VECM	FD-VECM	FC-VECM
Serial Correlation	CHSQ(4) = 7.376 [.117]	CHSQ(4) = 1.584 [.811]	CHSQ(4) = 7.784 [.100]
Functional Form	CHSQ(1) = 6.163 [.013]	CHSQ(1) = 3.435 [.064]	CHSQ(1) = 0.037 [.847]
Normality	CHSQ(2) = 7.166 [.028]	CHSQ(2) = 77.44 [.000]	CHSQ(2) = 33.28 [.000]
Heteroscedasticity	CHSQ(1) = 19.07 [.000]	CHSQ(1) = 3.861 [.049]	CHSQ(1) = 1.171 [.279]

Panel B

Test Statistics	EG-ARDL	FD-ARDL	FC-ARDL
Serial Correlation	—	—	CHSQ(4) = 6.702 [.153]
Functional Form	—	—	CHSQ(1) = 0.321 [.571]
Normality	—	—	CHSQ(2) = 14.59 [.001]
Heteroscedasticity	—	—	CHSQ(1) = 3.011 [.083]

Source: Authors' own estimation

Notes: In "EG-VECM", for example, EG refers to the dependent variable, and VECM is the used technique.

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