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Department of Economics  
Tufts University  
Medford, MA 02155  
(617) 627 – 3560  
<http://ase.tufts.edu/econ>

# **International Capital Flows and Boom-Bust Cycles in the Asia Pacific Region<sup>+</sup>**

**Soyoung Kim<sup>\*</sup>**

University of Illinois at Urbana-Champaign and Korea University

**Sunghyun H. Kim<sup>\*\*</sup>**

Tufts University

**Yunjong Wang<sup>\*\*\*</sup>**

SK Research Institute

## **Abstract**

This paper documents evidence of business cycle synchronization in selected Asia Pacific countries in the 1990s. We explain business cycle synchronization by the channel of international capital flows. Using the VAR method, we find that most Asian countries experience boom-bust cycles following capital inflows, where the boom in output is mostly driven by consumption and investment. Empirical evidence shows that capital flows in the region are highly correlated, which supports the conclusion that capital market liberalization has contributed to business cycle synchronization in Asia. We also find that business cycles in the Asian crisis countries are highly synchronized with those in Japan.

JEL Classification: F02, F36, F41

Key words: business cycle synchronization, capital flows, boom-bust cycles, financial integration.

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<sup>\*</sup> Department of Economics, University of Illinois at Urbana-Champaign, DKH, 225b, 1407 W. Gregory Drive, Urbana, IL 61801.

<sup>\*\*</sup> Corresponding Author. Department of Economics, Tufts University, Medford MA 02155. Tel: 617-627-3662, Fax: 617-627-3917, E-mail: Sunghyun.Kim@tufts.edu.

<sup>\*\*\*</sup> SK Research Institute, 14<sup>th</sup> Floor, Seoul Finance Center, 84 Taepyungro 1-ga, Seoul 100-101, Korea.

## 1. Introduction

Over the past decade, a number of Asia Pacific countries have liberalized their financial markets to foreign capital by reducing restrictions on inward and outward capital flows. Increased capital flows due to financial integration can generate substantial effects on business cycles. Large capital inflows following financial market liberalization can generate an initial surge in investment and asset price bubbles followed by capital outflows and recession, the so-called boom-bust cycles. In worst cases, the boom-bust cycles can end with a sudden reversal of capital flows and financial crises.<sup>1</sup> On the other hand, by allowing domestic residents to engage in international financial asset transactions, financial market opening can reduce the volatility of some macroeconomic variables such as consumption through risk-sharing.<sup>2</sup>

What are the macroeconomic effects of capital flows, in particular on business cycle fluctuations? Do business cycles become less volatile and more synchronized across countries as the degree of financial integration increases? Understanding the business cycle implications of capital flows is important as it can also reveal a great deal about the welfare implications of financial market liberalization policies as well as international monetary arrangements.

This paper focuses on the effects of capital flows due to financial market liberalization on business cycles, in particular co-movements across countries.<sup>3</sup> We aim to shed some light on this issue by providing detailed stylized facts on capital flows and business cycles in the Asia Pacific region and by empirically analyzing the relationship between capital flows and business cycles. For empirical analysis, we adopt the VAR (Vector Auto-regression) method. We, first, identify the capital flow shocks and then examine their effects on cyclical movements of key macroeconomic variables in each country. We also examine whether these effects are consistent with the boom-bust cycle theory. By further analyzing the cross-country correlation of capital flow shocks, we try to infer the role of capital flows in explaining business cycle synchronization.

Economic theory does not provide a unanimous prediction on the effects of capital flows on co-movements of business cycles. Financial market integration can increase business cycle co-movements as macroeconomic effects of capital flows in different countries follow similar

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<sup>1</sup> Although other fundamental domestic problems contribute to financial crises, capital account liberalization and the resulting lending booms sometimes end in twin currency and banking crises.

<sup>2</sup> Domestic residents can reduce fluctuations in income stream and consumption by borrowing from abroad during recessions or lending to foreign countries during booms. International portfolio diversification enables consumers and firms to achieve risk-sharing gains by diversifying risks associated with country-specific shocks.

<sup>3</sup> We do not focus on the effects of capital flows on business cycle volatility. See Buch, Dopke and Pierdzioch (2002) and Kose, Prasad, and Terrones (2003a, 2003b) on this issue.

patterns through various channels of contagion and common shocks.<sup>4</sup> However, co-movements of output can decrease as allocation of capital becomes more efficient, allowing production to become more specialized.<sup>5</sup> Other variables also affect the relationship between capital flows and business cycles, including monetary and fiscal policies, the nature of underlying shocks in the economy, etc.<sup>6</sup>

Using the data of twelve Asia Pacific countries, we find the following stylized facts of business cycles. First, business cycles in the five Asian crisis countries are highly synchronized and follow business cycles in Japan, while they differ from cycles in Australia and New Zealand. On the other hand, greater China, including Hong Kong and Taiwan, show similar cyclical movements. Second, in general, business cycles in the 1990s are more synchronized across countries than those in the 1980s, which supports the view that financial and trade integration increases business cycle synchronization in Asia.

Using the VAR method, we find empirical evidence that positive capital flow shocks (capital inflows) affect output, consumption, and investment positively in most countries, which is consistent with the story of boom-bust cycles. In addition, capital flow shocks are highly correlated across the crisis countries. These two results imply that capital flow shocks can explain business cycle synchronization among the crisis countries to some extent.

The remaining sections of this paper are organized as follows. Section 2 provides literature survey on the relationship between financial integration and business cycles. In section 3, we analyze trends and stylized facts of business cycles in the region. In particular, we investigate how the volatility of business cycles in each country has changed over time and whether we can find any evidence of business cycle synchronization in the region. We examine the following twelve countries in the Asia Pacific region: five Asian crisis countries (Indonesia, Korea, Malaysia, the Philippines, and Thailand), China, Singapore, Taiwan, Hong Kong, Japan, Australia and New Zealand. Section 4 provides an empirical analysis of the relationship between capital flows and business cycles. We use the VAR method to analyze how capital flow shocks affect various macroeconomic variables and investigate whether capital flow shocks generate boom-bust cycles in the region. We also analyze the properties of capital flow shocks identified

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<sup>4</sup> See Kim, Kose and Plummer (2001) for a detailed explanation on financial contagion.

<sup>5</sup> See Heathcote and Perri (2002), Imbs (2003), and Kalemli-Ozcan et al. (2001).

<sup>6</sup> Another important issue in the literature is trade integration and its impact on business cycles. Trade integration can generate synchronized business cycles if countries mostly engage in intra-industry trade, while trade integration can decrease the degree of co-movements if trade promotes inter-industry specialization and countries are subject to industry-specific shocks. See Frankel and Rose (1998), and Shin and Wang (2004).

in our models. In particular, we investigate whether the estimated capital flow shocks are driven by exogenous economic events and correlated across countries. Section 5 concludes the paper.

## 2. Theoretical Overview

This section explains different theories on the effects of economic integration on the symmetry of business cycles and documents empirical studies on this issue.<sup>7</sup> Financial market integration can decrease co-movements of output by increasing industrial specialization (Kalemli-Ozcan et al. 2001). Countries with integrated international financial markets can ensure against country-specific shocks through portfolio diversification; therefore such countries can afford to have a specialized production structure. That is, financial market integration allows firms to take full advantage of comparative advantage and engage in production specialization, which in turn increases the asymmetry of output as long as industry-specific shocks exist.

Heathcote and Perri (2002) analyzed the same issue from a different angle. They noted a significant drop in the cross-country correlation of output in the 1990s and argued that the drop was due to a decrease in cross-country correlation of productivity shocks combined with increased financial market integration. Degree of financial market integration endogenously and positively responds to the correlation of shocks. That is, as productivity shocks become less correlated, potential welfare gains from portfolio diversification increase, as does the degree of financial market integration.

However, countries with liberalized capital accounts can be significantly more synchronized, even though they are more specialized (Imbs, 2003). A large body of literature on contagion argues that capital flows in different countries, in particular developing countries in the same region, are synchronized through various channels of financial contagion including herd behavior, information asymmetry, etc. (Calvo and Mendoza, 2000; Mendoza, 2001). International investors may classify different countries in a single group and make region-based investment decisions. In addition, capital flows can be highly synchronized if shocks that determine capital flows are positively correlated or spill over across countries, or if developing countries go through a financial liberalization process at the same time. Since capital inflows have significant effects on business cycles (so-called “boom-bust” cycles), if capital flows are

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<sup>7</sup> Note that we focus on the effects of financial market integration on output co-movements, not cross-country consumption correlation which is expected to increase as consumers in different countries receive a similar income stream through portfolio diversification and consumption smoothing.

highly correlated and have similar effects on business cycles, then financial integration can contribute to synchronization of business cycles.

### **3. Trends and Stylized Facts of Business Cycles**

In this section, we document the main characteristics of business cycles of the selected countries in the Asia Pacific region.<sup>8</sup> We use the data from the International Financial Statistics (IFS) and examine volatility (measured by standard deviation) and co-movements (measured by cross-country correlation) of output, consumption and investment in these countries. The sample period is from 1980 to 2001 and all the data are Hodrick-Prescott filtered (with filtering parameter = 100). Since we are interested in changes in business cycle statistics as financial markets liberalize, we examine business cycles in different sub-sample periods: 1980-1989 and 1990-2001. For the second period, we use the data with and without the Asian crisis period because the data for that period may distort the statistics.

We focus on two aspects of business cycles related to financial market liberalization and examine whether the stylized facts derived from the data support the theoretical predictions studied in the previous section. First, we investigate how much the volatility of business cycles has changed over time. As financial markets develop over time, volatility of consumption is likely to decrease through consumption smoothing and risk sharing channels unless output volatility increases substantially. However, the impact on volatility of output is more ambiguous as argued in the previous section. Second, we focus on the degree to which business cycles in the region are synchronized and the changes in the degree of business cycle synchronization over time. We expect that business cycles in this region become more synchronized due to the region's trade integration and high portion of intra-industry trade. However, the effects of financial integration on business cycle co-movements are ambiguous as argued in the previous section.

#### ***3.1. Volatility of Business Cycles***

Table 1 presents volatility of output, relative volatility of consumption and investment in four different periods - the whole period, the 1980s, and the 1990s with and without the Asian crisis period. The output volatility is relatively low with a standard deviation ranging from 1.93 to

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<sup>8</sup> See Kim, Kose and Plummer (2003) for a detailed analysis of stylized facts of business cycles in Asia and the G-7 countries.

2.46 in more developed countries in the region: Japan, Australia and New Zealand. On the other hand, less developed countries in the region exhibit higher volatility: 5.60 in Thailand, 4.69 in Indonesia and 4.71 in Malaysia. Developed countries tend to have more stable industrial structures and output streams. Small countries that depend on natural resources for their main products tend to have volatile output streams due to volatile prices (terms of trade) of primary goods. Moreover, the share of agricultural activity is higher and the shares of the industry and service sectors are lower in the less developed countries. The agricultural sector output is highly variable since it is heavily affected by extremely volatile productivity and price shocks.

Comparing output volatility in the two periods, the results are mixed. Five countries show significant increases (Korea, Indonesia, Malaysia, Thailand and Japan), one country shows a significant decrease (the Philippines), and the remaining countries do not experience significant changes over time. Except for the Philippines, the five Asian crisis countries show higher volatility of output in the 1990s compared to the 1980s. This result is consistent even when the crisis period is excluded. On the other hand, greater China (China, Hong Kong, and Taiwan) and Singapore do not experience a rise in output volatility in the 1990s, as well as Australia and New Zealand.

According to the consumption smoothing property in the inter-temporal current account model, consumption should be less volatile than output (Obstfeld and Rogoff, 1996). Countries, when facing positive shocks, lend to foreign countries in order to smooth the consumption stream over time, and vice versa. However, in the table, we observe that this is not the case in many countries.<sup>9</sup> The table shows that consumption volatility is significantly less than output volatility in only five countries including more developed countries (Japan, Australia, and New Zealand) in the region. Developed countries can smooth their consumption by using various risk-sharing instruments. As financial markets develop, developing countries should be able to gain access to these risk-sharing instruments and reduce the volatility of their consumption stream. There is no significant change over time in consumption volatility and no explicit pattern is detected in the table.

Investment is three to four times more volatile than output in the table, which is the typical result in other empirical and simulation studies (Baxter and Crucini 1995; Kim, Kose and Plummer 2001). Investment volatility in China, Singapore and Japan is among the lowest with a relative standard deviation of less than or around three, while investment in the five Asian crisis

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<sup>9</sup> We should note that the volatility of consumption changes depending on the specific consumption data. It is known that the volatility of durable goods consumption is two to four times higher than that of nondurables consumption (see Backus, Kehoe and Kydland, 1995).

countries is quite volatile with a relative standard deviation higher than four. There are no significant patterns of change in investment volatility in the 1980s and 1990s. For some countries (Indonesia and Japan), it significantly decreases, while other countries do not display any notable pattern.

Including the crisis period in the data for the 1990s does not significantly change the statistics for all three variables. No systematic patterns of change in volatility result from including or excluding this period in the data. In sum, we found that output volatility increases in the 1990s in many countries and consumption smoothing is not realized as consumption volatility is higher than output volatility in most countries.

### ***3.2. Co-movements of Business Cycles***

Table 2 shows cross-country correlation of output to illustrate the degree to which business cycles are synchronized across countries. The first panel shows the results from the entire sample period. A significant and positive correlation is exhibited across most countries, except for Australia, New Zealand and China. The business cycles of Australia and New Zealand are negatively correlated with those of most other Asian countries: specifically 7 and 5 cases of negative correlation, respectively. Australia and New Zealand each have a positive (but not strongly positive) output correlation with China, Hong Kong and Taiwan. This is no surprise because the industrial structures of those two countries are totally different from the typical structure in Asian countries. China's business cycles are also negatively correlated with other economies except Taiwan and Hong Kong. This can be explained by the fact that the three economies—China, Hong Kong and Taiwan, known together as Greater China—are in the same economic zone.<sup>10</sup> A high correlation between Malaysia and Singapore can be explained in the same context.

The seven Asian crisis countries (including Singapore and Hong Kong) show positive correlation with each other and they are positively correlated with business cycles in Japan as

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<sup>10</sup> Since its recent economic reform, China has embarked upon a process of financial and real integration with Hong Kong and Taiwan. Even before Hong Kong's return to China's sovereignty in 1997, it had achieved a high degree of integration with the mainland. With respect to trade, for instance, Hong Kong intermediates a lion's share of China's external trade via re-exports and offshore trade. Regarding financial activity, a substantial amount of the international capital (in the forms of foreign direct investment, equity and bond financing and syndicated loans) financing China's economic expansion is raised via Hong Kong. Economic links between China and Taiwan have also proliferated since the 1990s. According to official statistics (although the official statistics under-represent the overall economic interest of Taiwan in China), China is the largest recipient of Taiwan's overseas investment and Taiwan is China's third-largest source of foreign direct investment (Cheung, Chinn and Fujii, 2002).



well. This indicates that Japan has been leading business cycles in the region. McKinnon and Schnabl (2002) showed that the yen/dollar exchange rate significantly affects business cycles in the East Asian countries through trade and FDI channels. For example, depreciation of the yen in 1995 slowed East Asian export expansion significantly, while yen appreciation accelerates Japanese FDI into the East Asian countries. Bayoumi and Eichengreen (1999) find that the correlation of supply shocks in the region is especially high for two groups, with Japan and Korea in one group and Indonesia, Malaysia, and Singapore in the other. Loayza, Lopez and Ubide (2001) examine common patterns in aggregate demand and supply shocks with a different methodology. They find strong co-movements for two groups: Japan, Korea and Singapore make up one group, and Indonesia, Malaysia and Thailand, another group. These results indicate that there are two different business cycles in the region, even though the East Asian countries show relatively strong co-movements as a whole.

Comparing the data of the 1980s and 1990s proves that business cycles are more synchronized in the 1990s. We examine this property by comparing the number of negative cross-country correlations of output in the two periods. We observe a negative correlation in 17 country pairs during the 1980s, while the number decreases to 10 in the 1990s. Moreover, in the 1990s, without Australia, only two country pairs display a negative correlation. Out of a total of 66 pairs, 41 cases show that correlation increases from the 1980s to the 1990s.<sup>11</sup> In fact, correlation coefficients are significantly positive in most of the 41 cases; only four pairs exhibit a correlation coefficient of less than 0.4.

The empirical results for this region support the view that business cycles become more synchronized as financial markets liberalize. Empirical results on business cycle co-movements in previous studies are mixed, depending on sample countries and periods. Some document that the correlation of output decreases over time, in particular in the 1990s. Heathcote and Perri (2002) showed that output correlation among the U.S., Europe, Canada and Japan dropped from 0.76 to 0.26. On the other hand, Kose et al. (2003a), using the data for 21 industrial and 55 developing countries, showed that output correlation in general increased in the 1990s from the previous periods. This is mostly due to the industrial countries in the sample.

In conclusion, we can summarize the main characteristics of the business cycle co-movements as follows. First, business cycles in Australia and New Zealand are different from those in the East Asian countries. Second, business cycles in the five Asian crisis countries are highly synchronized and follow business cycles in Japan. Third, the countries in Greater China,

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<sup>11</sup> This case is indicated by bold and italic numbers in the table. We do not report the case excluding the crisis period but the results are similar.

which encompasses Hong Kong and Taiwan, show similar cyclical movements. Finally, business cycles in general are more synchronized across countries in the 1990s than in the 1980s, which supports the view that financial integration increases business cycle synchronization.

#### 4. Capital Flows and Business Cycles: Empirical Studies

In this section, we investigate how capital flow shocks affect the business cycle dynamics of the Asia Pacific countries, for example, whether capital flows generate boom-bust cycles, and whether capital flows help explain the synchronization of the business cycles in the Asian countries. Capital flows, especially after the financial market liberalization, may increase the volatility of business cycles by creating boom-bust cycles, in particular fluctuations in investment, consumption, exchange rate, and other asset prices. Further, if capital flows are positively correlated across countries, due to simultaneous capital market liberalization in Asian countries or due to the herd behavior of international investors or due to common shocks, the boom-bust cycles in each country may imply the synchronization of the business cycles.

For empirical methodology, we adopt the VAR estimation method to extract the shocks to capital flows, to analyze how shocks to capital flows affect the various macroeconomic variables in each country, and to examine how the shocks to capital flows are correlated across countries.<sup>12</sup>

##### 4.1. Vector Auto-Regression Model

We assume that the economy is described by a structural form equation

$$G(L)y_t = e_t \tag{1}$$

where  $G(L)$  is a matrix polynomial in the lag operator  $L$ ,  $y_t$  is an  $n \times 1$  data vector, and  $e_t$  is an  $n \times 1$  structural disturbance vector.<sup>13</sup> We assume that  $e_t$  is serially uncorrelated and  $\text{var}(e_t) = \Lambda$ , which is a diagonal matrix where the diagonal elements are the variances of structural disturbances. That is, structural disturbances are assumed to be mutually uncorrelated.

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<sup>12</sup> A similar empirical methodology was used in Kim, Kim and Wang (2002) to analyze the boom-bust cycles in Korea. Tornell and Westermann (2002) also examined the boom-bust cycles by using a sample of 39 countries.

<sup>13</sup> For simplicity, we present the model without the vector of constants. Alternatively, we can regard each variable as a deviation from its steady state.

We can estimate a reduced form equation (VAR)

$$y_t = B(L)y_{t-1} + u_t, \quad (2)$$

where  $B(L)$  is a matrix polynomial in lag operator  $L$  and  $\text{var}(u_t) = \Sigma$ .

There are several ways of recovering the parameters in the structural-form equation from the estimated parameters in the reduced-form equation. The identification schemes under consideration impose restrictions on contemporaneous structural parameters only. Let  $G_0$  be the contemporaneous coefficient matrix in the structural form, and let  $G^0(L)$  be the coefficient matrix in  $G(L)$  without the contemporaneous coefficient  $G_0$ . That is,

$$G(L) = G_0 + G^0(L). \quad (3)$$

Then, the parameters in the structural-form equation and those in the reduced-form equation are related by

$$B(L) = -G_0^{-1} G^0(L). \quad (4)$$

In addition, the structural disturbances and the reduced-form residuals are related by

$$e_t = G_0 u_t, \quad (5)$$

which implies

$$\Sigma = G_0^{-1} \Lambda G_0^{-1}. \quad (6)$$

In the method proposed by Sims (1980), identification is achieved by Cholesky decomposition of the reduced-form residuals,  $\Lambda$ . In this case,  $G_0$  becomes triangular so that a recursive structure, that is, the Wold-causal chain, is assumed. In a general non-recursive modeling strategy suggested by Blanchard and Watson (1986) and Sims (1986), maximum likelihood estimates of  $\Lambda$  and  $G_0$  can be obtained only through the sample estimate of  $\Sigma$ . The right-hand side of the equation (6) has  $n \times (n+1)$  free parameters to be estimated. Since  $\Sigma$  contains  $n \times (n+1)/2$  parameters, by normalizing  $n$  diagonal elements of  $G_0$  to 1's, we need at least  $n \times (n-$

1)/2 restrictions on  $G_0$  to achieve identification. In this generalized structural VAR approach,  $G_0$  can be any structure (non-recursive). In this paper, recursive modeling is used.

#### ***4.2. Basic Model and Effects on Output***

We construct a basic model to examine the effects of capital flow shocks on output. The basic model includes three variables,  $\{\text{CUR}, \text{RGDP}, \text{CAP}\}$ , where CUR is the current account (as the ratio to the trend GDP), RGDP is the log of real GDP, and CAP is the capital account (as the ratio to the trend GDP).<sup>14</sup> A constant term and complete seasonal dummies are included. Four lags are assumed.<sup>15</sup> CAP and RGDP are included in the model since they are primary variables of interest; we examine the effects of capital flows or capital account on the real GDP. CUR is included to control the capital account movements that depend on current account movements since some capital account movements are often related to the financing of current account imbalances and we are interested in extracting autonomous capital flows.

The basic model uses a recursive structure, in which the ordering of the variables is  $\{\text{CUR}, \text{RGDP}, \text{CAP}\}$ , where the contemporaneously exogenous variables are ordered first. With this ordering, the shocks to capital flows are extracted by conditioning on the current and lagged CUR and RGDP, in addition to their own lagged variables. We condition on the current (and lagged) CUR since current account imbalances are often financed by capital account. We exclude such endogenous movements of capital flows from the shocks to capital flows. In addition, we condition on the current (and lagged) real GDP since changes in the real GDP may affect the capital account. For example, an increase in the real GDP may attract more capital, and improve the capital account. We exclude the endogenous movements of capital flows due to the real GDP changes from the shocks to capital flows since we would like to infer the effects of capital flow shocks to real GDP.<sup>16</sup>

The sample period is 1990-2001, during which capital account was liberalized in these Asian-Pacific countries (Grenville 1998; de Brouwer 1999, 2001). We consider two samples, one

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<sup>14</sup> We use an exponential trend on the GDP level (or a linear trend on the log level of GDP). When constructing the ratio, we use all variables in terms of U.S. dollars.

<sup>15</sup> We adopt the Bayesian inference, which is not subject to conventional criticism in the presence of unit root and co-integration. See Sims (1988) and Sims and Uhlig (1991). We also experimented with the log level of the variables but results were qualitatively unchanged.

<sup>16</sup> Note that the effects of CAP shocks on CUR and RGDP are invariant to the ordering between CUR and RGDP. On the other hand, capital flows might affect CUR and RGDP within a quarter, and the CUR and RGDP shocks may reflect some part of (exogenous) CAP shocks. However, even in such cases, CAP shocks still represent the shocks to CAP that are not endogenous to CUR and RGDP changes since they do

with the crisis period and the other without it (dropping 1997:3-1998:2). We relate the capital flow shocks identified in the model to the financial market liberalization and the global common shocks under a more liberalized financial market. If the capital account had been tightly controlled (i.e., China), the shocks to capital flows in our model or autonomous capital flows would have been very small since the capital account should have been directed to finance the current account imbalances (note that our model identifies capital flow shocks, by controlling for the current account movement). Therefore, by examining the effects of autonomous capital account shocks during the sample period, we can infer the consequences of capital account liberalization.

We use quarterly data for the estimation since monthly data is not available for most countries. We consider nine countries for which quarterly data series are available for most of the sample period. They are Korea, Japan, Indonesia, Thailand, the Philippines, Singapore, Taiwan, Australia, and New Zealand.<sup>17</sup> Data sources are *International Financial Statistics*, *ADB Database*, and *Bloomberg*.

The impulse responses to CAP shocks over three years are reported in Figure 1 for the sample including the crisis period and Figure 2 for the sample dropping the crisis period. Dotted lines are one standard error bands. The scale represents percentage changes. At the top of each column, the country names are denoted. At the far left of each row, the name of each responding variable is reported.

First, we explain the results for the sample including the crisis period. In response to positive CAP shocks, the real GDP tends to increase in all countries, except for Singapore. In Singapore, capital inflows did not generate a boom in the economy. This can be explained by the fact that Singapore serves as an intermediary of international capital flows, not as a final destination of foreign capital, which means that real economic activities in Singapore have little relationship to capital flows in and out of the country.<sup>18</sup> The positive effect of capital inflows is significant in most countries, including all crisis countries under consideration, and quite persistent in many countries. The positive effects last for more than three years in most countries.

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not result from endogenous responses to CUR and RGDP, although CUR and RGDP shocks may include (exogenous) shocks to CAP in addition to shocks to CUR and RGDP.

<sup>17</sup> The estimation period for Thailand is from 1993 since the data series are available only from 1993.

<sup>18</sup> Although Singapore as a regional financial center has relatively more open financial markets vis-à-vis other East Asian economies, it maintained strong economic fundamentals and well-functioning financial systems. Singapore was a creditor country before the crisis, having no external debt. Furthermore, when neighboring countries were hit, Singapore was able to manage the contagion by floating its currency. Like Singapore, Hong Kong had financially sound and economically healthy fundamentals as well as mature institutions, but it still became a victim of the crisis because its firm commitment to the pegged exchange

For example, in New Zealand and the Philippines, the positive effects are different from zero with more than 68 percent probability at least for two and a half years. Although the positive effects after two years are less significant in most other countries, the point estimates show that the effects are positive for more than three years in all countries but Korea, Thailand, and Singapore. The results for the sample excluding the crisis period, reported in Figure 2, are not much different except for Indonesia. The negative effects of capital outflows during the crisis period were so dominant in Indonesia that the boom-bust cycles disappear when this period is excluded.

### ***4.3. Effects on Other Macro Variables***

We modify the basic model to examine the effects of capital flow shocks on other macroeconomic variables. The modified model uses a recursive structure, in which the ordering of the variables is {CUR, X, CAP}, where X denotes the variable in interest. With this ordering, the shocks to capital flows are extracted by conditioning on the current and lagged CUR and X, in addition to their own lagged variables. We condition on the current (and lagged) CUR and X as before. First, the current account imbalances are often financed by capital account, and we would like to exclude such endogenous movements of capital flows from the shocks to capital flows. Second, we condition on the current (and lagged) X since changes in X may affect the capital account.<sup>19</sup>

We include (real) consumption, (real) investment, the price level, and the real exchange rate as X. Each variable is used as a log form. To construct real consumption and real investment, nominal data are deflated by using a GDP deflator. As the price level, we used the GDP deflator. The real exchange rate is constructed by a nominal exchange rate against the U.S. dollar and the GDP deflators of each country and the U.S. Note that an increase in the real exchange rate is a real exchange rate appreciation.<sup>20</sup>

Figures 3 and 4 report the results. We did not report the results for consumption and investment for Taiwan and consumption for Singapore since quarterly data series are not

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rate system invited speculative attacks. Hong Kong weathered a series of attacks at the expense of its overall macroeconomic performance.

<sup>19</sup> As in the basic model, we order X before CAP. By doing so, CAP shocks represent the shocks to CAP that are not endogenous to CUR and RGDP changes since they do not result from endogenous responses to CUR and X, although CUR and X shocks may include (exogenous) shocks to CAP, in addition to shocks to CUR and RGDP.

<sup>20</sup> For Taiwan, CPI is used since a GDP deflator is not available.

available.<sup>21</sup> The first two rows report the responses of consumption (“CONS”) and investment (“INV”); consumption and investment increase in almost all countries. The increase in consumption and investment is especially significant in all the Asian crisis countries. When we exclude the crisis period, the positive effects of capital inflows on consumption and investment become weaker in the Asian crisis countries, especially in Indonesia. This is because, among the crisis countries, Indonesia experienced the most serious and prolonged damage. From this analysis, we can easily infer that the increase in output following capital flow shocks is mostly due to the increase in consumption and investment because the current account negatively responds to capital flow shocks (Figures 1 and 2).

The third and the fourth rows report the responses of the price level (“PGDP”) and the real exchange rate (“RER”). The price level responses are mixed, depending on the country and the sample. For real exchange rate, we expect to observe real appreciation following capital inflows. The graphs show that real exchange rate appreciates in most countries except for Thailand. This is actually due to the inclusion of the crisis period, as Figure 4 without the crisis period shows a real appreciation in Thailand as well. For Indonesia and Korea, the exchange rate initially depreciates and starts to appreciate with some time lag (2 quarters).

#### ***4.4. Properties of Estimated Capital Flow Shocks***

The validity of the VAR results in the previous section depends on the identification of shocks, whether capital account shocks represent exogenous changes in capital flows, for example, due to capital account liberalization or due to abrupt changes in the behavior of international investors as in the financial crisis or due to global common shocks. In this part, we examine whether the estimated capital flow shocks actually represent such shocks by plotting cumulative capital flow shocks for each country and relating them to economic events occurred.

Figure 5 plots identified cumulative capital account shocks in each country.<sup>22</sup> For Asian crisis countries (Korea, Indonesia, the Philippines and Thailand), we observe positive capital flow shocks in 1994-96 period when these countries actively embarked on financial market deregulation and opening (Furman and Stiglitz 1998, de Brouwer 1999, Kim, Kim and Wang 2002). For example, Korea allowed nonresidents to directly purchase stocks of Korean companies

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<sup>21</sup> Note that the data for Indonesian investment and consumption are only available from 1993, so the results are for the period of 1993-2001.

<sup>22</sup> We plot cumulative capital flows shocks because capital account shocks themselves are very volatile.

up to 3% per individual in 1992 and this share increased to 23% in May 1997. As a result, the external debt in these crisis-hit countries increased dramatically for three years from 1994 to 1996.

This period also coincides with low world interest rate and the appreciation of Yen. Yen appreciation increased Japanese overseas direct investment in East Asia. Low interest rates in the industrial countries including Japan produced the portfolio flows to the East Asian economies. On the other hand, the graphs show negative capital flow shocks during the crisis period 1997-98 as large current account deficits turned into surpluses.

Australia and New Zealand recorded persistent current account deficits throughout the 1990s. For Australia, we observe positive capital flow shocks from the mid-1990s when the country persistently marked current account deficits. For New Zealand, the capital inflows continued until 1997 and the capital account reversed into deficits during 1998-2000. In contrast, Taiwan experienced current account surpluses and net capital outflows before the Asian crisis. Thus, for Taiwan, we observe negative capital flow shocks in 1995-96.

#### ***4.5. Synchronization of Capital Flows and Business Cycles***

In the previous parts, we show that a positive shock to capital flows increases output in most countries, and the increase in output is mostly due to a boom in consumption and investment. The findings, especially for the case of the full sample including the crisis period, is consistent with the “boom-bust” cycle following the financial market liberalization. In our model, a big surge in capital inflows after the financial market liberalization can be captured as a positive shock to capital flows, and such a positive shock leads to a boom. Later, when capital flows are reversed, capital outflows can be captured as a negative shock to capital flows in our model, and such a negative shock leads to a bust stage.

However, the evidence alone is not enough to support the hypothesis that capital flow shocks or the financial market liberalization process increases business cycle synchronization in the Asia Pacific region. Only when capital flow shocks are highly correlated across countries in the region, can they increase co-movements of business cycles. Otherwise, capital flow shocks may not contribute to business cycle synchronization.

In this regard, we calculate the cross-country correlations of the capital flow shocks identified in our model. We use two measures. First, we use the capital flow shocks themselves. Second, we use the cumulative capital flow shocks. The capital flows shocks in our model typically have a persistent effect on output, so the cross-country correlation of cumulative capital



shocks may be more relevant measures regarding their effects on synchronization of business cycles.

Tables 3 reports the results for cumulative capital flow shocks, for the period with and without the crisis. For both sample periods, we find positive correlations of capital flow shocks among the crisis countries. As shown in the previous section, since capital flow shocks have similar effects on business cycles, we can conclude that capital flow shocks contribute to business cycle synchronization among the crisis countries. Table 4 reports the results for (non-cumulative) capital flow shocks. Positive correlations among crisis countries are found in most cases.

We suggest two possible reasons to explain why capital flow shocks among the crisis countries are positively correlated. First, the timing of financial market liberalization in those countries was similar, and each country experienced a boom-bust cycle after the liberalization. Thus, the financial market liberalization process itself contributes to the synchronization of the business cycles. Second, given some extent of openness in the financial markets, contagion through financial channels contributed to similar capital flows in these countries. Due to information cascade, international investors classify these countries in the same group and apply a single investment decision for the whole group. Combined with herd behavior, financial contagion contributed to the synchronization of capital flows and eventually of business cycles.

We also find two interesting observations. First, there is a positive correlation of capital flow shocks between the crisis countries and Japan. All correlations for capital flow shocks and cumulative capital flow shocks, with and without the crisis period, are positive, except for only two cases. This result suggests that capital flow shocks can explain the synchronization of the business cycles of Japan and the crisis countries. Second, we may not observe synchronized business cycles among the crisis countries in the future. Since the Asian Crisis, foreign investors have started to differentiate Korea from the other four Asian crisis countries. Korea is the only country that has net capital inflows in the post-crisis period. Therefore, considering that capital flows have been generating similar boom-bust cycles in the crisis countries, business cycles in Korea may follow a different path from the other four countries in the future.

## **5. Conclusion**

The relationship between financial integration and co-movements of business cycles is not unambiguous, both theoretically and empirically. In this paper, we first document business cycle synchronization in a number of the Asia Pacific countries and try to explain the phenomenon by examining financial market liberalization and capital flows. We find that

business cycle synchronization among the Asian crisis countries in the 1990s can be at least partially explained by synchronization of capital flows and the ensuing boom-bust cycles after the financial market liberalization. Therefore, the results imply that financial market liberalization is likely to synchronize business cycles across a group of countries. This is an interesting finding since recent studies using data from developed countries often conclude the opposite.

Understanding the effects of capital flows on business cycle co-movements has important implications for various issues. First, potential welfare gains from international risk sharing highly depend on the degree of business cycle synchronization across countries. When countries follow similar business cycles, it is less efficient to share risks across countries. If financial market liberalization and capital flows increase business cycle co-movements, then potential welfare gains from financial market liberalization would be lower than the level calculated from the existing level of business cycle co-movements. Therefore, potential welfare gains from financial market liberalization might be over-estimated.

Second, the findings of this paper can have implications for financial market liberalization policies. In implementing financial market liberalization policies, policymakers should consider the effects of the speed and sequencing of such policies on business cycles and eventually on welfare. Finally, our results have implications for regional monetary and financial integration in terms of optimum currency area criteria. For example, one of the conditions for an optimum currency area is the presence of similar business cycle movements in the potential candidate countries.

When most emerging East Asian countries started to liberalize their financial markets in the early 1990s, no regional risk-sharing mechanism existed. Although Japan still remained an important source country for external financing before the crisis, Western investors outside the region also played an important role. Since the crisis, however, most East Asian countries have become net providers of international capital due to their current account surpluses. While receiving inflows of foreign direct and portfolio investment on a net basis, these countries have repaid large sums of bank loans for the past several years. Looking to the future, whether countries in the Asia Pacific region have similar patterns of capital flows will be an empirical question. However, until a regional risk-sharing mechanism for integrating the financial markets in the region is fully developed, most East Asian countries are likely to become more integrated into the global financial markets.

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**Table 1. Volatility of Business Cycles**

**Standard deviation of output**

	1980-2001	1980-89	1990-2001	1990-2001 (w/o crisis)
Korea	2.81	1.50	3.52	2.52
Indonesia	4.69	1.28	6.23	5.38
Malaysia	4.71	3.14	4.94	4.31
Philippines	3.88	5.49	2.13	2.05
Thailand	5.60	3.38	6.38	6.30
Japan	1.93	0.98	1.71	1.50
China	3.51	3.24	2.82	2.97
Singapore	3.71	3.61	3.40	3.66
Taiwan	2.39	2.51	1.97	2.03
Hong Kong	2.98	2.87	3.07	2.68
Australia	1.99	1.87	1.84	1.95
New Zealand	2.46	2.23	1.89	1.94

**Relative standard deviation of consumption**

Korea	1.30	0.72	1.28	1.17
Indonesia	1.19	2.37	1.02	1.20
Malaysia	1.33	1.38	1.26	1.16
Philippines	0.75	0.69	0.62	0.45
Thailand	0.85	0.64	0.83	0.75
Japan	0.76	0.82	1.00	1.11
China	1.09	0.87	0.73	0.73
Singapore	0.98	1.05	1.01	0.76
Taiwan	1.31	1.51	1.04	1.09
Hong Kong	1.01	0.84	1.20	1.30
Australia	0.51	0.45	0.64	0.56
New Zealand	0.85	0.86	1.12	1.15

**Relative standard deviation of investment**

Korea	4.60	3.42	4.47	3.72
Indonesia	4.17	7.44	4.07	4.08
Malaysia	4.32	4.82	4.19	4.28
Philippines	4.82	4.55	4.37	3.84
Thailand	3.48	3.14	3.42	3.16
Japan	3.13	5.60	2.24	2.26
China	2.22	2.32	2.59	2.70
Singapore	2.76	2.44	2.92	2.73
Taiwan	4.84	5.84	4.34	4.25
Hong Kong	3.99	4.71	3.64	3.85
Australia	4.09	3.57	3.55	3.54
New Zealand	4.41	4.07	5.01	5.15

**Table 2. Cross-country Correlation of Output**

**(1980-2001)**

	Korea	Indonesia	Malaysia	Philippines	Thailand	Japan	China	Singapore	Taiwan	Hong Kong	Australia
Indonesia	0.66										
Malaysia	0.47	0.87									
Philippines	0.24	0.27	0.41								
Thailand	0.70	0.86	0.81	0.41							
Japan	0.57	0.53	0.39	0.31	0.67						
China	0.10	0.20	0.01	<u>-0.55</u>	<u>-0.01</u>	<u>-0.22</u>					
Singapore	0.18	0.43	0.73	0.44	0.59	0.10	<u>-0.15</u>				
Taiwan	0.45	0.14	<u>-0.03</u>	0.02	0.21	0.39	0.35	<u>-0.07</u>			
Hong Kong	0.76	0.51	0.30	0.21	0.49	0.36	0.28	0.14	0.58		
Australia	<u>-0.03</u>	<u>-0.37</u>	<u>-0.51</u>	<u>-0.11</u>	<u>-0.33</u>	<u>-0.06</u>	0.15	<u>-0.32</u>	0.35	0.17	
New Zealand	0.29	0.16	<u>-0.04</u>	<u>-0.02</u>	<u>-0.02</u>	<u>-0.20</u>	0.57	<u>-0.06</u>	0.43	0.57	0.44

**(1980-1989)**

	Korea	Indonesia	Malaysia	Philippines	Thailand	Japan	China	Singapore	Taiwan	Hong Kong	Australia
Indonesia	0.05										
Malaysia	<u>-0.13</u>	0.53									
Philippines	0.26	0.48	0.63								
Thailand	0.35	0.64	0.57	0.77							
Japan	0.18	0.49	0.29	0.32	0.82						
China	0.30	<u>-0.47</u>	<u>-0.65</u>	<u>-0.78</u>	<u>-0.38</u>	0.06					
Singapore	<u>-0.06</u>	0.53	0.99	0.69	0.56	0.23	<u>-0.71</u>				
Taiwan	0.80	0.29	<u>-0.30</u>	<u>-0.01</u>	0.33	0.33	0.46	<u>-0.28</u>			
Hong Kong	0.78	0.43	<u>-0.01</u>	0.33	0.34	0.14	0.05	0.09	0.74		
Australia	0.15	0.45	<u>-0.17</u>	<u>-0.16</u>	0.43	0.77	0.41	<u>-0.24</u>	0.59	0.29	
New Zealand	0.68	0.31	<u>-0.11</u>	<u>-0.03</u>	0.11	0.05	0.32	<u>-0.04</u>	0.74	0.83	0.30

**(1990-2001)**

	Korea	Indonesia	Malaysia	Philippines	Thailand	Japan	China	Singapore	Taiwan	Hong Kong	Australia
Indonesia	<b><i>0.82</i></b>										
Malaysia	<b><i>0.83</i></b>	<b><i>0.97</i></b>									
Philippines	0.21	0.24	0.19								
Thailand	<b><i>0.83</i></b>	<b><i>0.95</i></b>	<b><i>0.94</i></b>	0.01							
Japan	<b><i>0.64</i></b>	<b><i>0.85</i></b>	<b><i>0.83</i></b>	0.24	0.72						
China	<b><i>0.42</i></b>	<b><i>0.75</i></b>	<b><i>0.79</i></b>	<u>-0.17</u>	<b><i>0.82</i></b>	<b><i>0.51</i></b>					
Singapore	<b><i>0.40</i></b>	0.41	0.53	<u>-0.17</u>	<b><i>0.60</i></b>	0.17	<b><i>0.69</i></b>				
Taiwan	0.36	<b><i>0.46</i></b>	<b><i>0.63</i></b>	<b><i>0.12</i></b>	<b><i>0.45</i></b>	<b><i>0.49</i></b>	<b><i>0.57</i></b>	<b><i>0.58</i></b>			
Hong Kong	<b><i>0.86</i></b>	<b><i>0.85</i></b>	<b><i>0.87</i></b>	0.03	<b><i>0.87</i></b>	<b><i>0.66</i></b>	<b><i>0.62</i></b>	<b><i>0.49</i></b>	0.36		
Australia	<u>-0.23</u>	<u>-0.50</u>	<u>-0.49</u>	<b><i>0.49</i></b>	<u>-0.54</u>	<u>-0.58</u>	<u>-0.60</u>	<u>-0.09</u>	<u>-0.32</u>	<u>-0.30</u>	
New Zealand	0.46	<b><i>0.54</i></b>	<b><i>0.49</i></b>	<b><i>0.56</i></b>	<b><i>0.51</i></b>	<b><i>0.14</i></b>	<b><i>0.44</i></b>	<b><i>0.40</i></b>	0.08	0.40	0.21

Note: Negative coefficients are underlined. Bold and Italic numbers in the bottom panel indicate that correlation coefficients increase in the second period.

**Table 3. Cross-country Correlation of Cumulative Capital Flows Shocks**

***(Including the Crisis Period)***

	Korea	Indonesia	Philippines	Thailand	Japan	Sing	Taiwan	Australia
Indonesia	0.43							
Philippines	0.51	0.48						
Thailand	0.53	0.30	0.68					
Japan	<u>-0.17</u>	0.04	0.13	0.18				
Singapore	<u>-0.29</u>	0.13	<u>-0.14</u>	<u>-0.32</u>	<u>-0.10</u>			
Taiwan	<u>-0.42</u>	<u>-0.29</u>	<u>-0.62</u>	<u>-0.27</u>	<u>-0.16</u>	<u>-0.10</u>		
Australia	0.61	0.07	0.29	0.18	<u>-0.51</u>	<u>-0.37</u>	<u>-0.08</u>	
New Zealand	0.59	0.50	0.74	0.59	<u>-0.32</u>	<u>-0.10</u>	<u>-0.28</u>	0.31

***(Without the Crisis Period)***

	Korea	Indonesia	Philippines	Thailand	Japan	Sing	Taiwan	Australia
Indonesia	0.11							
Philippines	0.43	0.23						
Thailand	0.46	0.01	0.58					
Japan	0.46	<u>-0.11</u>	0.49	0.76				
Singapore	<u>-0.51</u>	0.17	<u>-0.08</u>	<u>-0.26</u>	<u>-0.46</u>			
Taiwan	0.18	<u>-0.26</u>	<u>-0.44</u>	<u>-0.41</u>	<u>-0.40</u>	<u>-0.33</u>		
Australia	0.22	<u>-0.14</u>	<u>-0.16</u>	0.03	0.14	<u>-0.52</u>	0.15	
New Zealand	0.18	<u>-0.05</u>	0.07	0.47	0.00	<u>-0.08</u>	0.03	<u>-0.03</u>

**Table 4. Cross-country Correlation of Capital Flows Shocks**

***(Including the Crisis Period)***

	Korea	Indonesia	Philippines	Thailand	Japan	Sing	Taiwan	Australia
Indonesia	0.57							
Philippines	0.37	0.34						
Thailand	0.12	0.06	0.15					
Japan	0.23	0.10	0.12	0.23				
Singapore	0.23	0.11	<u>-0.18</u>	<u>-0.02</u>	0.02			
Taiwan	<u>-0.14</u>	<u>-0.01</u>	<u>-0.11</u>	0.19	<u>-0.36</u>	0.08		
Australia	<u>-0.21</u>	<u>-0.03</u>	<u>-0.21</u>	0.00	<u>-0.10</u>	<u>-0.07</u>	<u>-0.02</u>	
New Zealand	0.14	0.11	0.21	0.34	0.11	<u>-0.10</u>	0.14	<u>-0.05</u>

***(Without the Crisis Period)***

	Korea	Indonesia	Philippines	Thailand	Japan	Sing	Taiwan	Australia
Indonesia	<u>-0.07</u>							
Philippines	0.24	<u>-0.03</u>						
Thailand	0.02	0.24	0.03					
Japan	0.05	0.03	0.07	0.36				
Singapore	0.06	0.14	<u>-0.34</u>	0.07	0.00			
Taiwan	0.02	<u>-0.01</u>	<u>-0.10</u>	0.08	<u>-0.48</u>	0.10		
Australia	<u>-0.27</u>	<u>-0.36</u>	<u>-0.32</u>	<u>-0.17</u>	0.04	<u>-0.14</u>	<u>-0.05</u>	
New Zealand	0.34	<u>-0.04</u>	0.09	0.32	0.02	<u>-0.05</u>	0.20	<u>-0.02</u>



Figure 1. Effects of Capital Flows Shocks: Sample Including Crisis Period

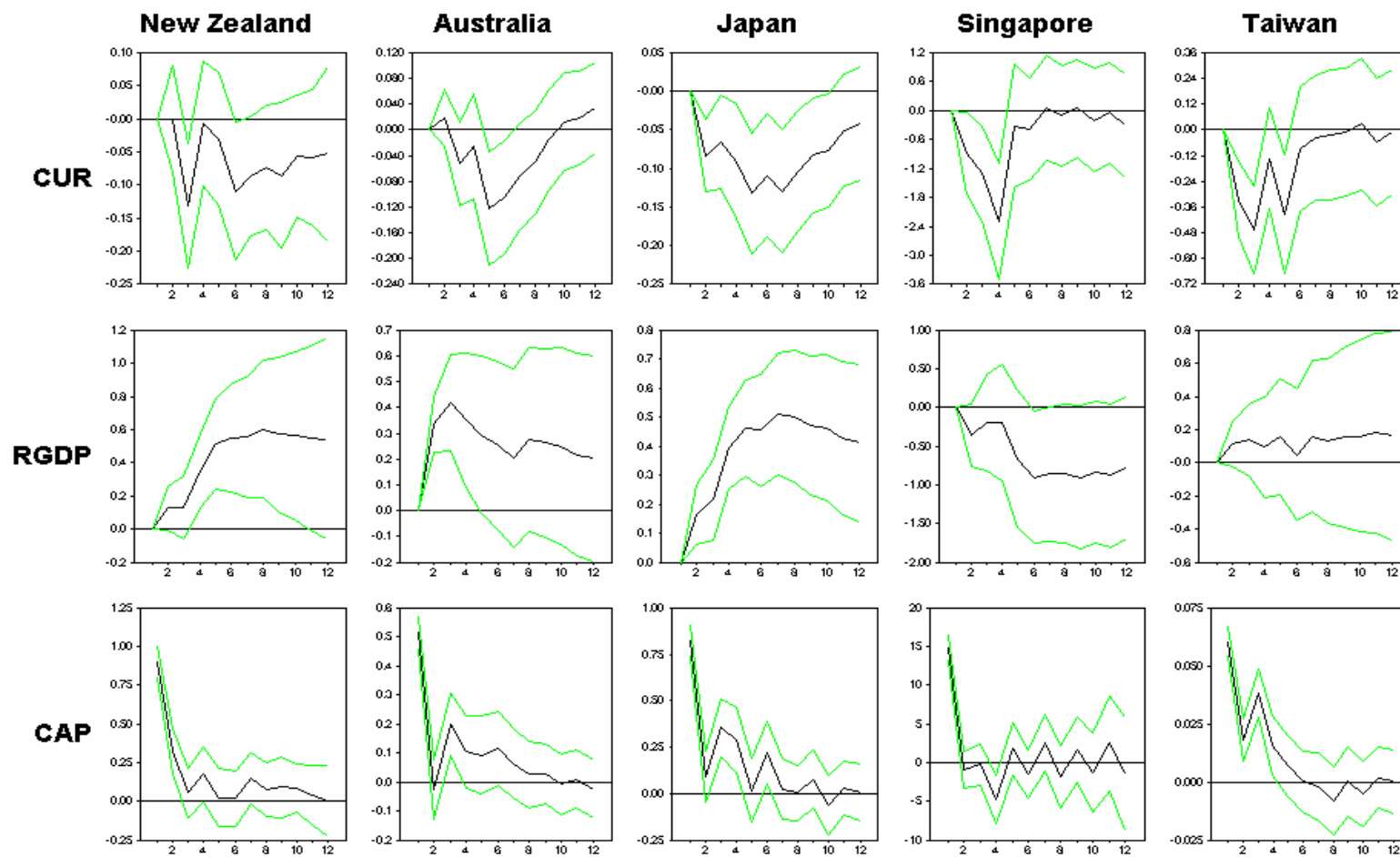


Figure 1. Continues

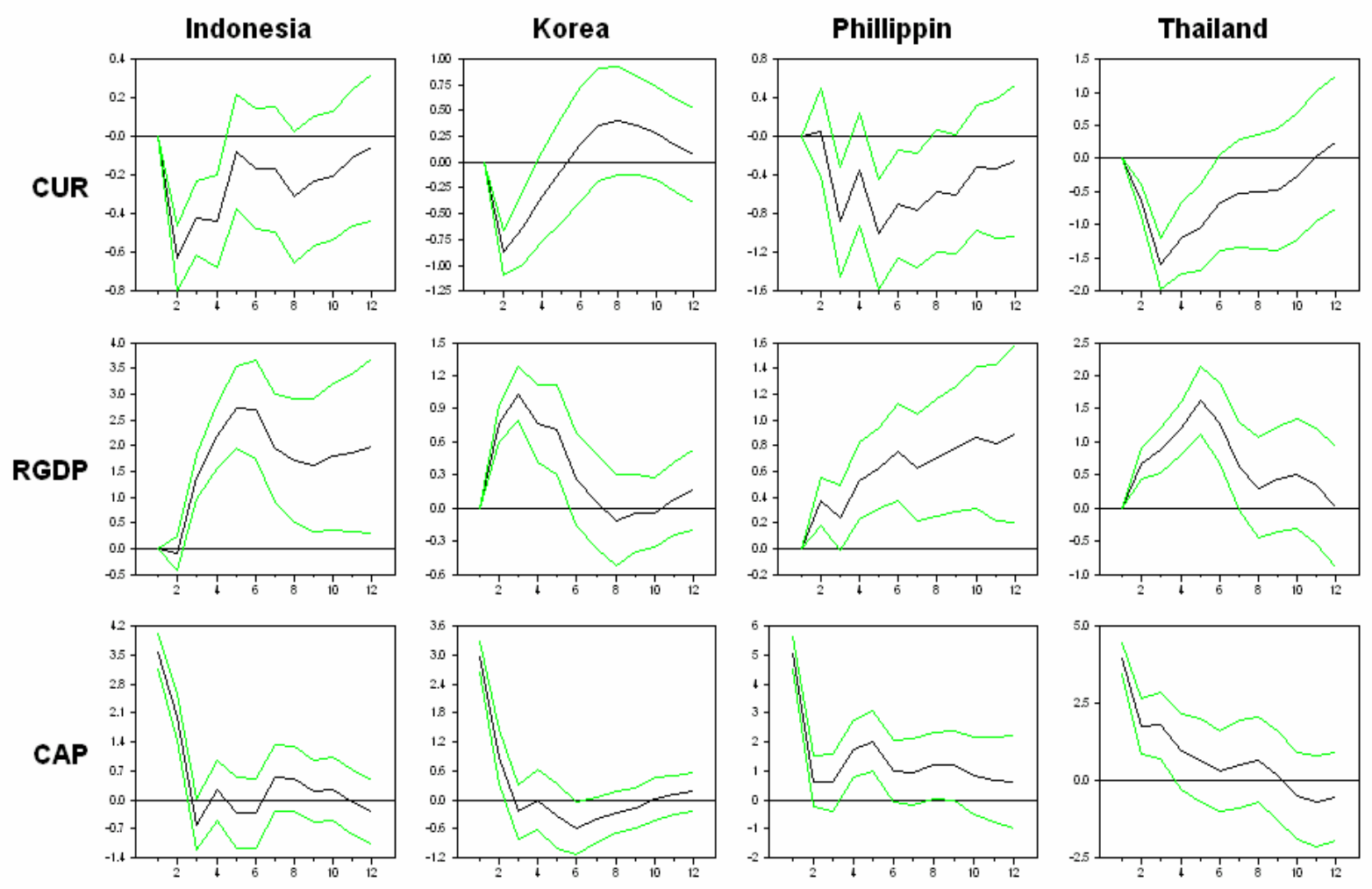


Figure 2. Effects of Capital Flows Shocks: Sample Without Crisis Period

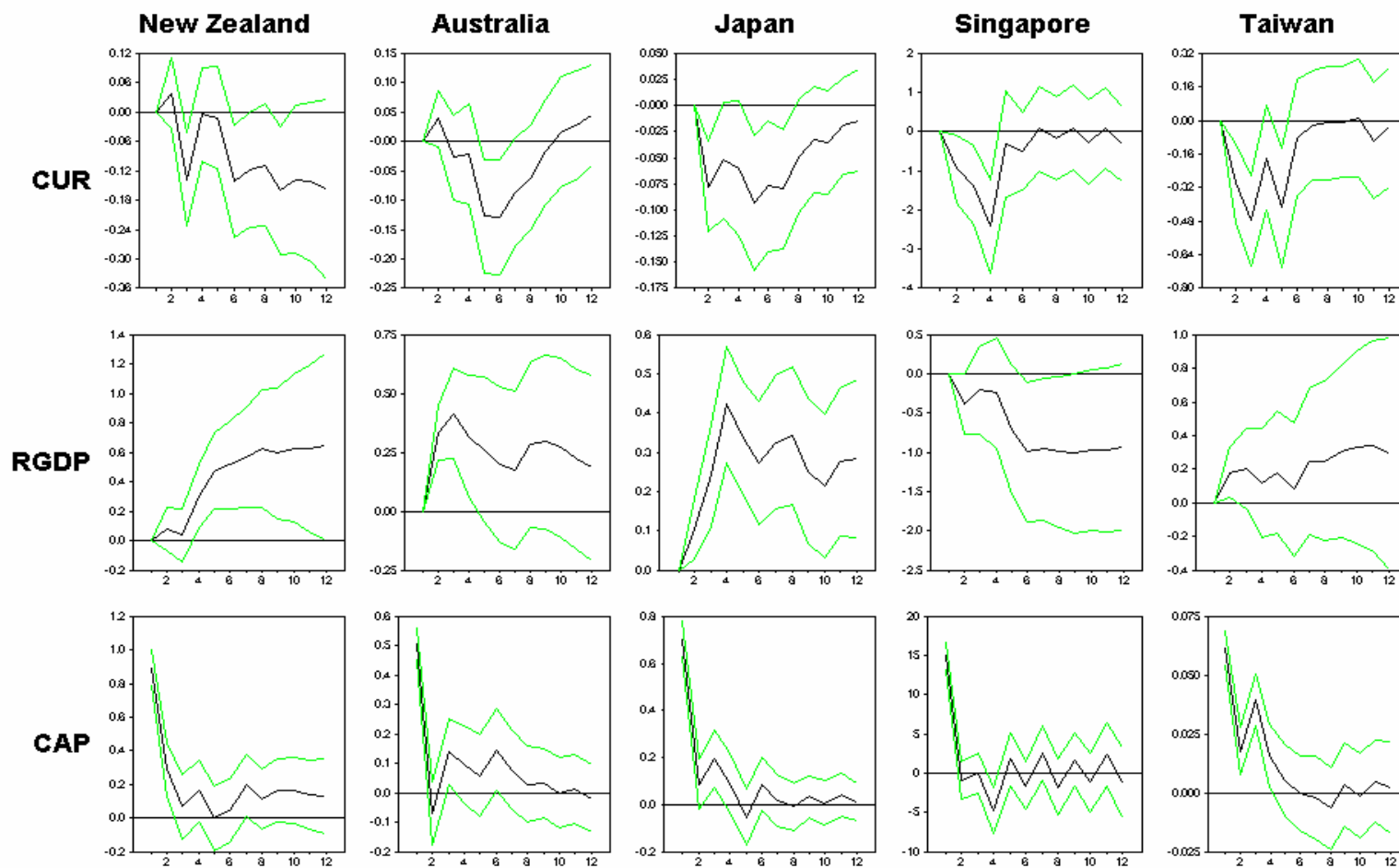


Figure 2. Continues

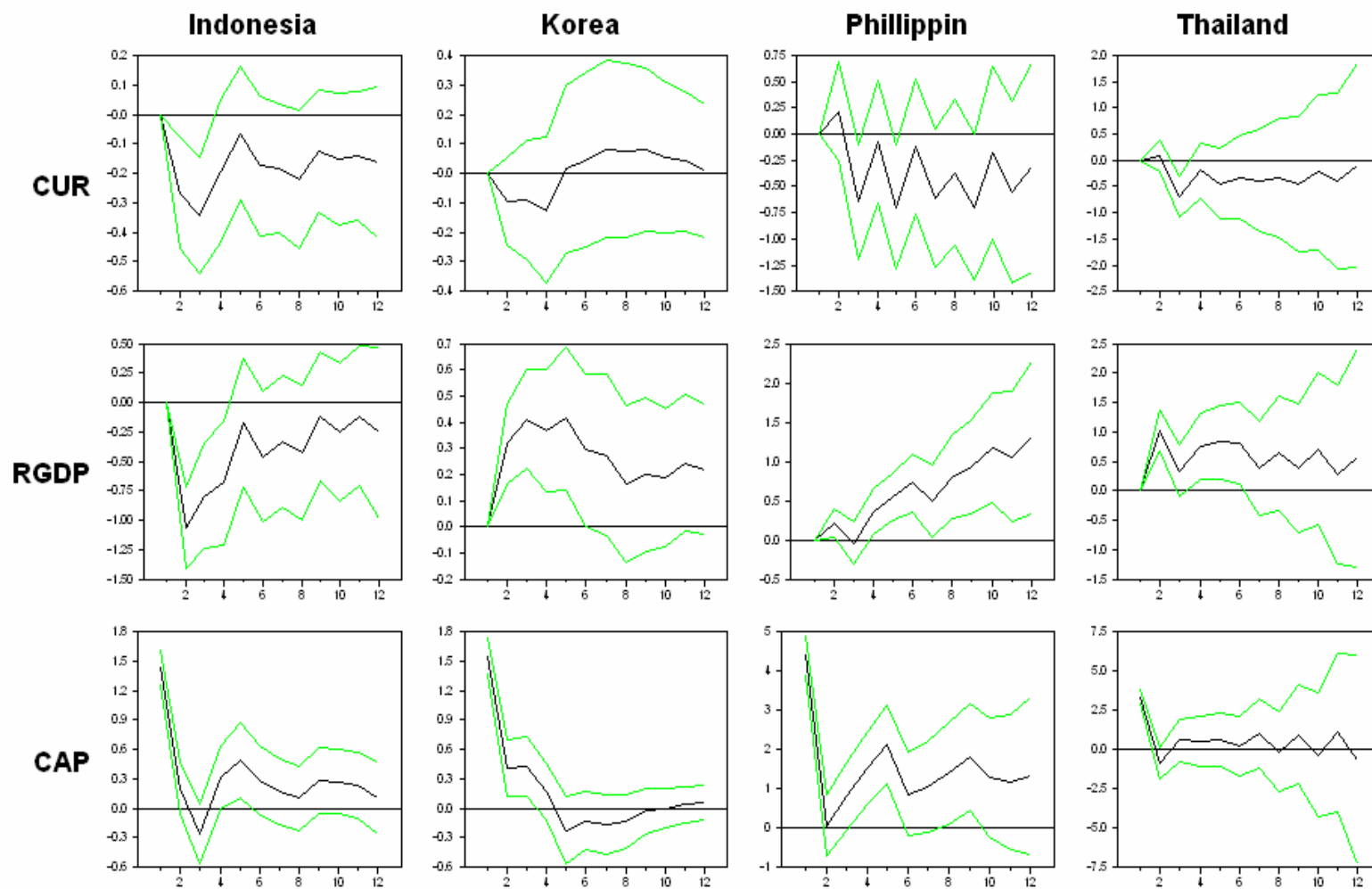


Figure 3. Effect of Capital Flows Shocks on Various Macroeconomic Variables: Sample Including Crisis Period

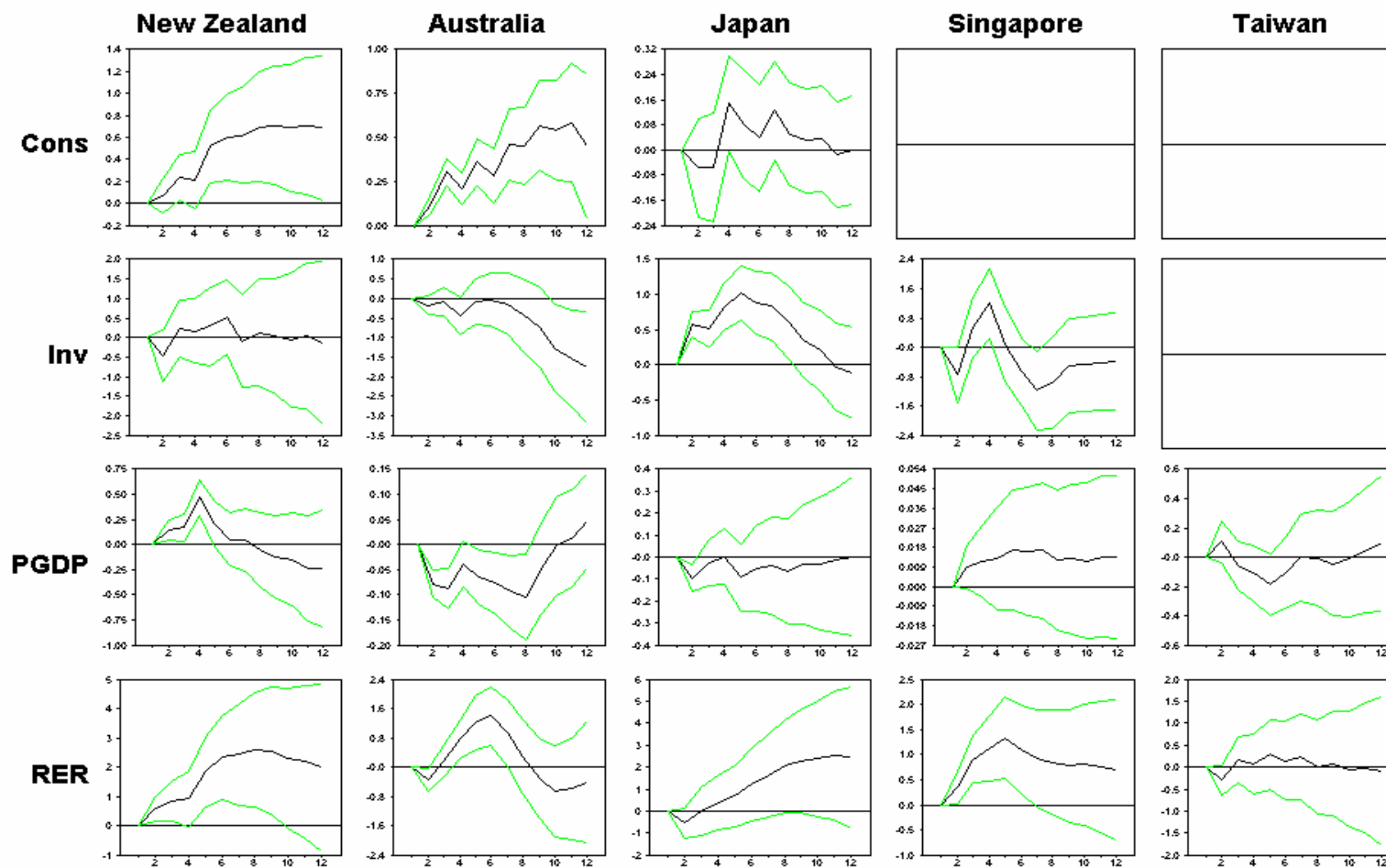


Figure 3. Continues

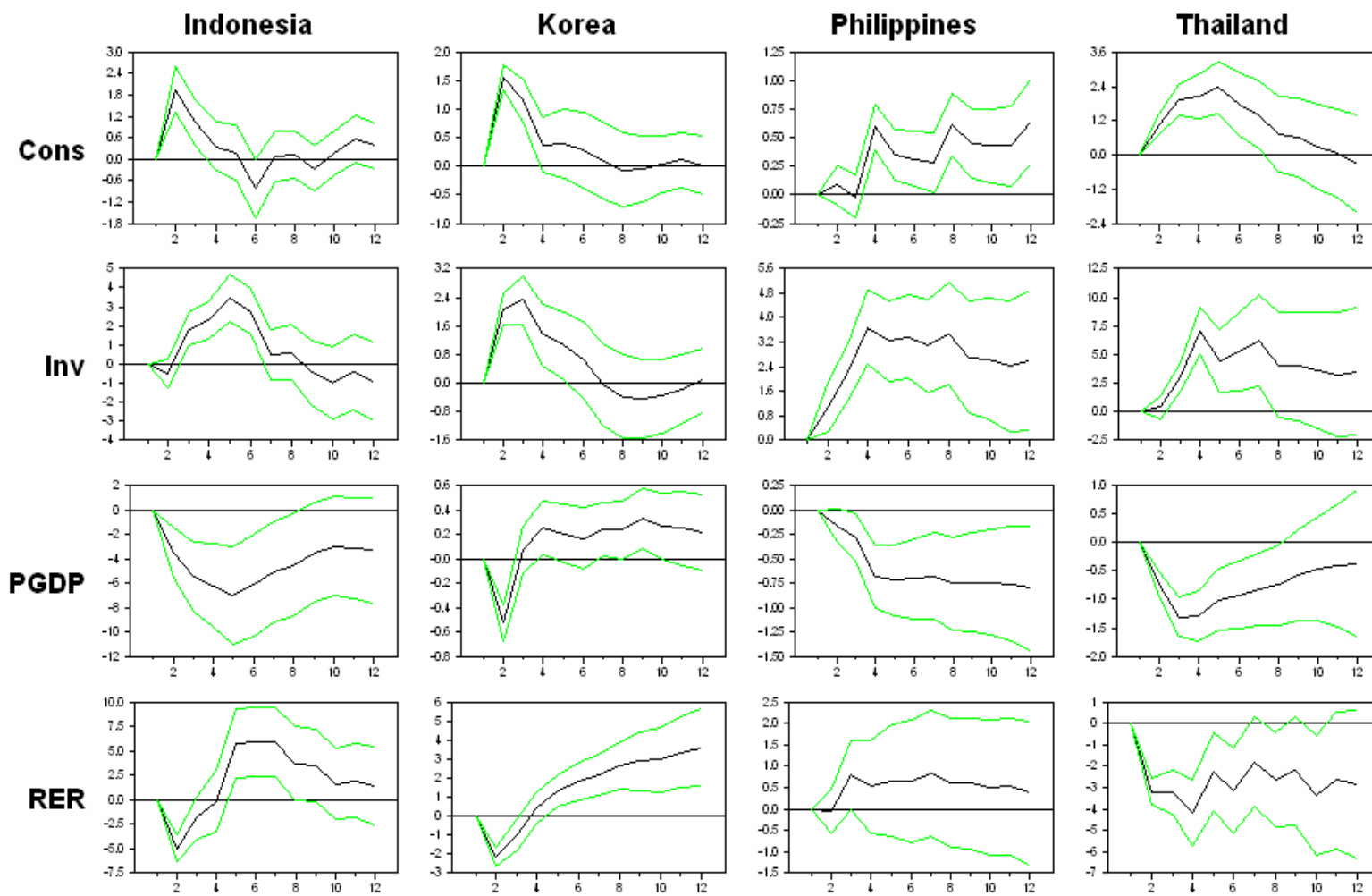


Figure 4. Effect of Capital Flows Shocks on Various Macroeconomic Variables: Sample Dropping Crisis Period

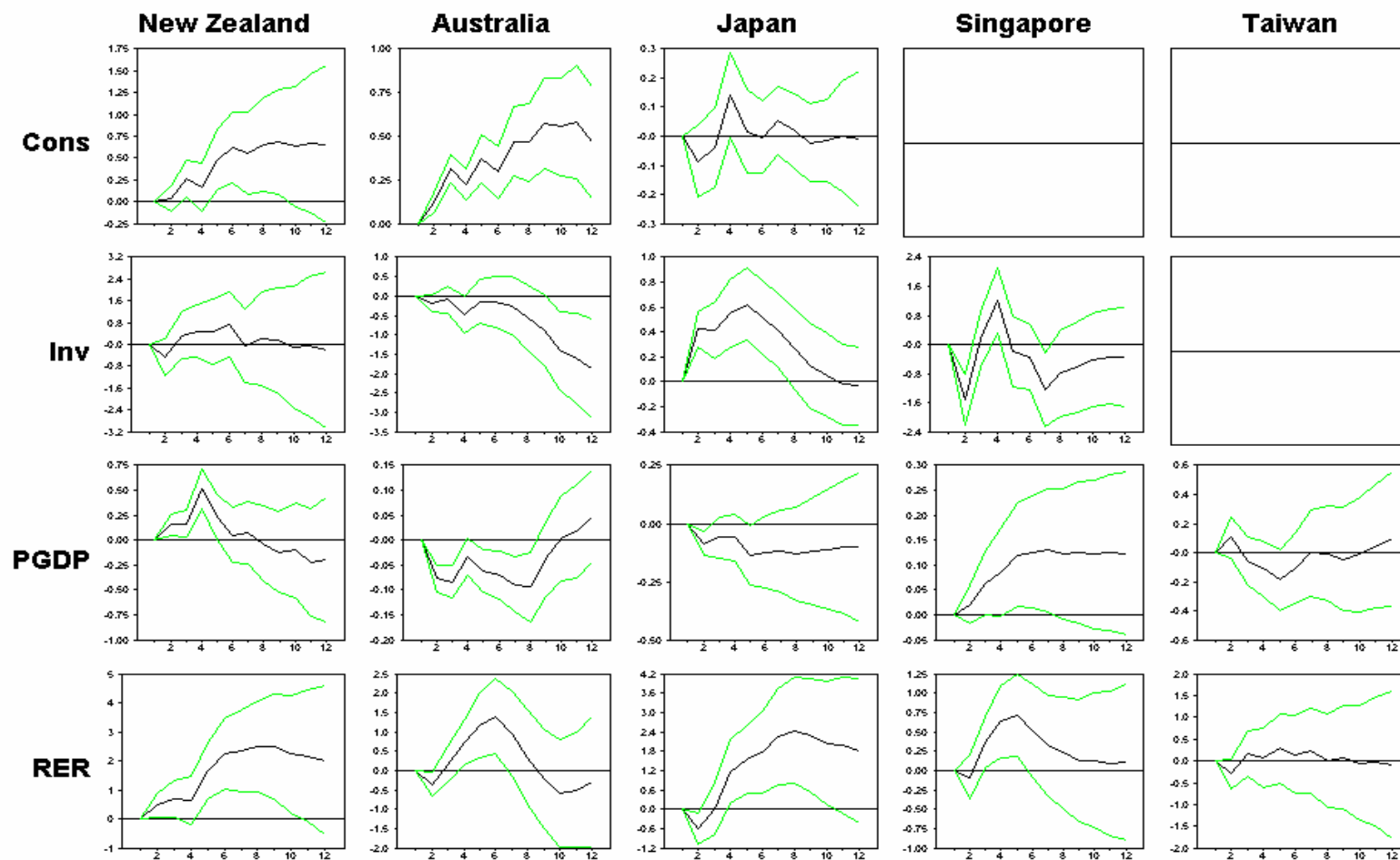


Figure 4. Continues

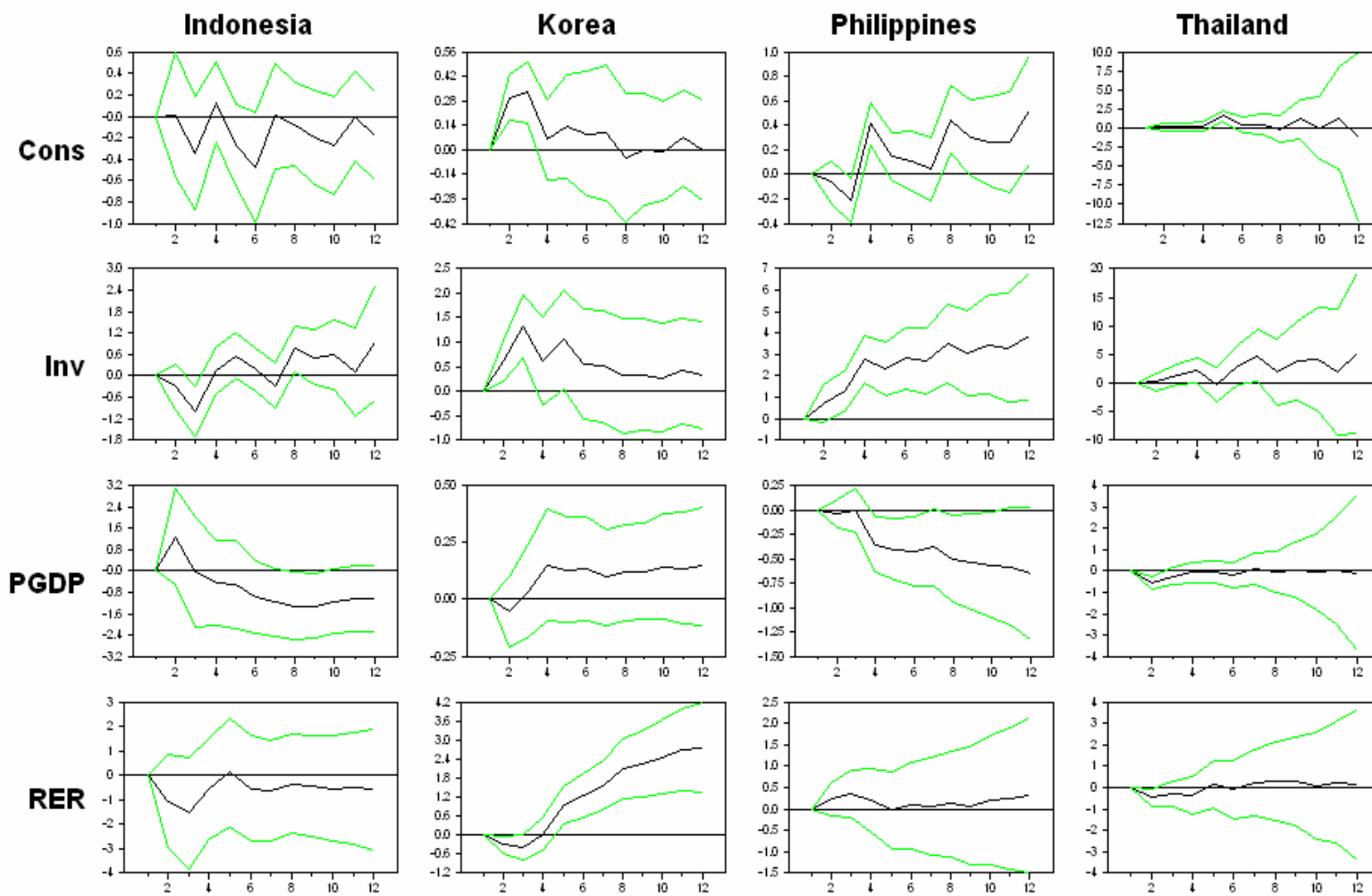
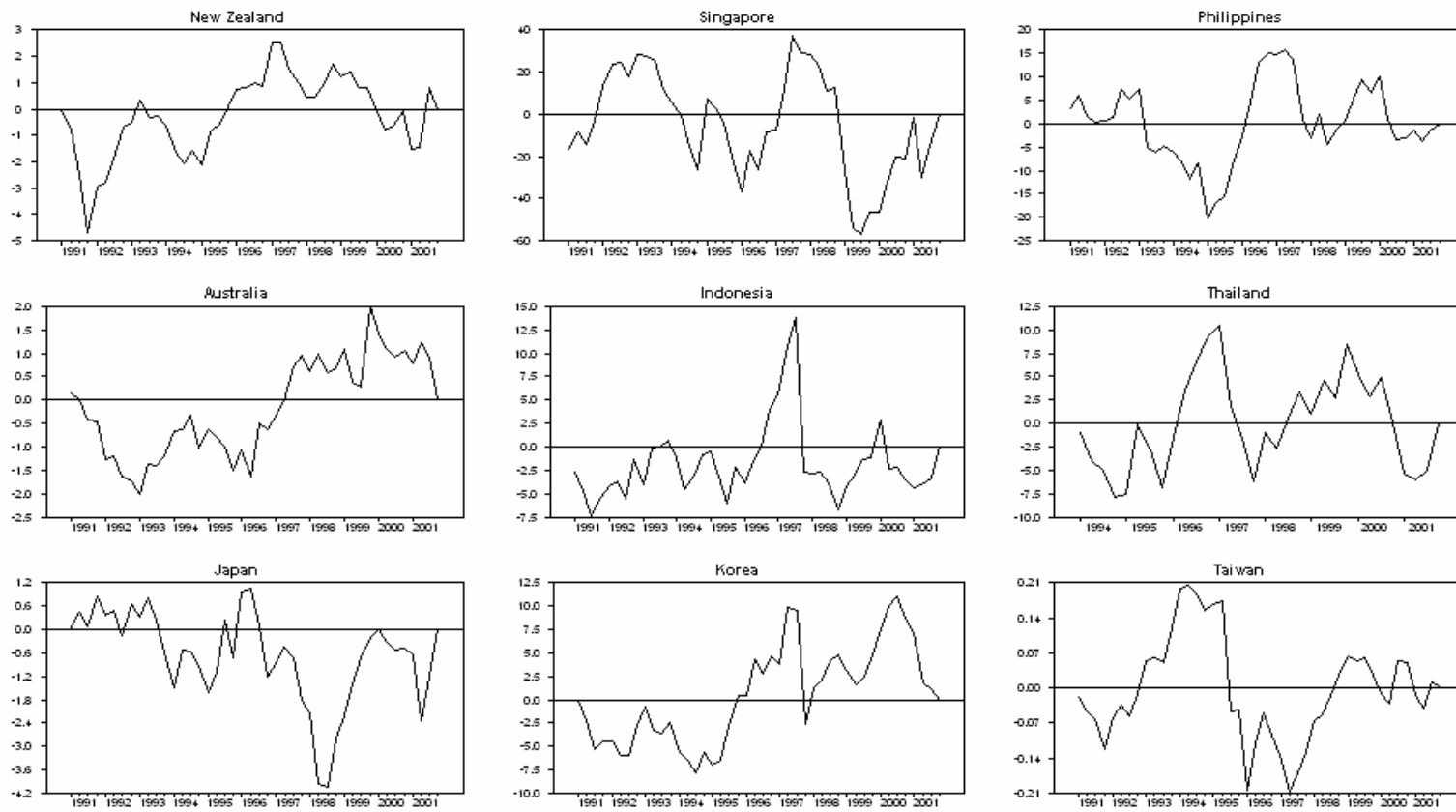




Figure 5. Cumulative Capital flows shocks

## Cumulative KAY shocks



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