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Emerging Asia: Decoupling or Recoupling

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Abstract

In this paper, we investigate the degree of real economic interdependence between emerging Asia and major industrial countries to shed light on the heated debate over the "decoupling" of emerging Asia. We first document the evolution of macroeconomic interdependence for emerging Asian economies through changing trade and financial linkages at both the regional and global levels. Then, by employing a panel vector auto-regression (VAR) model, we estimate the degree of real economic interdependence before and after the 1997/98 Asian financial crisis. Empirical findings show that real economic interdependence increased significantly in the post-crisis period, suggesting "recoupling", rather than decoupling, in recent years. Output shocks from major industrial countries have a significant positive effect on emerging Asian economies. More interestingly, the reverse is also true. Output shocks from emerging Asia (and the People's Republic of China [PRC]) have a significant positive effect on output in major industrial countries. The result suggests that macroeconomic interdependence between emerging Asia and industrial countries has become "bi-directional," defying the traditional notion of the "North–South relationship" as one of "uni-directional" dependence.

1.   Introduction

The economies of emerging Asia[1] are becoming increasingly interdependent. Foremost among the drivers of regional integration is intra-regional trade. The share of intraregional trade as a percentage of emerging Asia's total trade increased significantly over the last decade. Emerging Asian economies are also increasingly integrated through direct investment, financial flows, and other forms of economic interaction. And intensifying regional economic integration provided a backdrop for the hypothesis of "decoupling" which attracted much attention in the years prior to the current crisis.[2]

The global financial crisis of 2008-09 has reshaped the debates of "decoupling". It is no longer about the question of whether emerging Asia can weather a US slowdown or global recession. Precipitous falls in exports and production across emerging Asia in response to a sharp decline in demand in major industrial countries was a solemn reminder that the region's rapidly integrating economy remains strongly tied to the fate of the global economy. Nevertheless, the issue of decoupling remains highly contentious. In a narrow scope, it is now a question of whether emerging Asia can manage an independent recovery from the impact of the global financial crisis and recession. But in a broader sense, it is relevant to the changing nature of macroeconomic interdependence between emerging Asia and the rest of the world as Asia's economic prowess grows and regional integration progresses. In particular, with the region's large economies, especially China, continuing to grow positively on relatively resilient domestic demand, the question is whether emerging Asia's positive growth can help facilitate the global recovery and, if so, how much.

The rise of emerging Asia is changing the landscape of the world economy. On the back of strong growth and rapidly integrating regional trade and production linkages, emerging market economies in Asia as a group have become a key player in the global economy. The region now exerts significant influence in global markets as a producer of manufacturing goods and consumer of many primary commodities. Rapid financial globalization is another force behind ever-rising economic interdependence between emerging Asia and the world. The growing influence of Asia and the PRC, tightening intra- and inter-regional trade linkages, and the globalization of financial markets are making fundamental changes to the nature of macroeconomic interdependence and economic spillovers between emerging Asia and major industrial countries.

Emerging Asia accounted for 18% of total world gross domestic product (GDP) in 2007 (on a purchasing power parity basis), compared to 9% in 1990 (Figure 1). Over the past several decades, emerging Asia has shown remarkable economic progress and has had a profound impact on the world economy. In the aftermath of the 1997/98 Asian financial crisis, emerging market economies in Asia have maintained an average annual growth rate of 7.5% over the period 2000–2007. Underpinning this performance has been

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[1]   Throughout this paper, emerging Asia refers to nine selected economies in East and South East Asia. The nine Asian economies include China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; the Philippines; Singapore; Taipei,China; and Thailand.

[2]   See survey in section 2.

dynamic growth in the PRC, which has contributed more than four percentage points per annum to Asian growth during the same period.

The emergence of the PRC has been one of the most important features reshaping the world economy. The PRC is now the sixth largest economy in the world (at market exchange rates) and the fourth-largest global trader. The Chinese economy has accounted for about one fifth of incremental demand in the world economy in recent years. Given the prominent economic role played by emerging Asia, particularly the PRC, the impact of emerging Asian economies on the global business cycle is of particular interest.

The purpose of this paper is to investigate the evolution and nature of macroeconomic interdependence between emerging Asia and major industrial countries such as the group of seven (G7) economies. With increasing economic integration and the growing influence of emerging Asia in the world economy, the pattern of global macroeconomic interdependence is evolving. The macroeconomic interdependence and growth spillovers between emerging Asia and major industrial countries appear to have become "bi-directional", rather than "uni-directional". In addition, if Asian shocks are positively transmitted to global shocks, Asian shocks can be another source of positive co-movement between emerging Asia and major industrial countries. In other words, emerging Asia and major industrial countries can be "recoupling", with positive spillovers from emerging Asia to major industrial countries. It would be interesting to investigate whether the direction and magnitude of growth spillovers between emerging Asia and the world reflect such changes.

To shed light on such issues, we first document changes in inter-regional and intra-regional economic linkages, such as trade and financial market linkages, and report various business cycle co-movement statistics between emerging Asia and major industrial countries. To assess the evolution of macroeconomic interdependence and to measure bi-directional macroeconomic impacts between emerging Asia and G7 economies, we employ a panel vector auto-regression (VAR) model. To the best of our knowledge, there has been no systematic empirical research addressing the level of bi-directional macroeconomic interdependence between emerging Asia and the global economy.

This paper is organized as follows. Section 2 presents a concise literature survey on the issues of decoupling and global business cycle synchronization. Section 3 examines the evolution of global macroeconomic interdependence through changing trade and financial linkages at both regional and global levels, and investigates the role of emerging Asia in shaping these changes and the rapidly changing global financial landscape that is being driven by financial technology and innovation. Section 4 employs a VAR model to evaluate the impact of ongoing changes in bi-directional linkages between emerging Asia and major industrial economies in terms of growth spillovers and business cycle synchronization. Concluding remarks follow in Section 5.

2. Economic Integration and the Decoupling of Asia: Literature Survey

2.1. Economic Integration and Business Cycle Synchronization

Theoretically, the effect of economic integration on business cycle co-movement is ambiguous. In the literature of international business cycles, trade is emphasized as an important channel of output co-movement. Greater trade integration stimulates the spillover of aggregate demand shocks, thereby increasing output co-movement (Frankel and Rose, 1998). The spread of technology shocks through trade can also make business cycles more correlated across countries (Canova and Dellas, 1993). In addition, spillovers can occur through a change in relative prices of factors and products. As much as countries trade freely, a positive shock in one country that raises the relative price of labor-intensive goods may lead to higher wages and employment throughout the world (Kraay and Ventra, 2002).

On the other hand, as Krugman (1993) and Kose and Yi (2002) argue, more trade may encourage greater specialization of production, resulting in less synchronization of business cycles.[3] In this context, not just the magnitude of trade among countries, but also the similarity of production structures is considered to be important in explaining output co-fluctuations. Some studies found that when bilateral trade concentrates more on intra-industry trade, rather than inter-industry trade, the tendency of synchronizing output fluctuations strengthens (Imbs, 2004 and Shin and Wang, 2004).

While the theoretical predictions remain varied and conflicting, most empirical studies find that business cycles are more synchronized as trade integration deepens (Frankel and Rose, 1998; and Baxter and Kouparitsas, 2005).

The link between financial integration and output co-movement is also not unambiguous. Kalemli–Ozcan et al. (2001) argue that better income insurance attained through greater capital market integration may lead to higher specialization of production and, hence, less symmetric output fluctuations. Financial integration can also facilitate the transfer of resources across countries, for example, by moving capital from a country with a negative shock to one with a positive shock, implying a negative output correlation. On the other hand, if capital flows are correlated internationally, closer financial integration leads to greater output synchronization (Imbs 2004). With imperfect information and/or liquidity constraints, investors' herd behavior can cause them to withdraw capital from many countries simultaneously, contributing to positive output correlations, as observed during the 1997/98 Asian financial crisis. In fact, Kim, Kim, and Wang (2007) showed that shocks to capital flows generated positive business cycle correlations for Asia–Pacific countries.

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[3]   Several studies emphasize the similarity of production structures as an important determinant of co-movement of output. Industry-specific shocks can cause more business cycle synchronization among countries with similar production structures. Clark and van Wincoop (1999) and Imbs (2004) provide evidence that greater similarity in industry structure is associated with higher co-movement of output and employment. Imbs emphasizes that the effect of trade on business cycle synchronization is largely driven by intra-industry trade reflecting similar production structures.

Empirical evidence of the link between financial integration and business cycle co-movement is also conflicting. Several studies, including Kalemli–Ozcan et al. (2001) and Heathcote and Perri (2002), present evidence that higher financial integration leads to a decline in the correlation of output. However, Imbs (2004, 2006) finds that the business cycles of countries with strong financial links are significantly more synchronized, even though they also tend to be more specialized.

The effect of economic integration on business cycle co-movement also hinges on the broad macroeconomic policy environment. In an integrated region, policy makers can no longer pursue an optimal policy without taking account of neighbor countries' actions. For example, with a tightly integrated capital market and a hard peg exchange rate regime, a small open economy must delegate its monetary policy to an anchor country's central bank. In general, deeper integration necessitates further macroeconomic policy cooperation among policymakers in the integrated region in order to manage increasing macroeconomic interdependence more effectively.

It is, however, an open question whether increased macroeconomic policy cooperation would increase or decrease the extent of output co-movement. For example, when national autonomy over monetary policy is sacrificed for the sake of a fixed exchange rate regime, pegging countries are subject to common monetary policy shocks. And with a pegged regime, real shocks to an economy are transmitted across countries to a larger extent without being mitigated by exchange rate movements. In this context, closer exchange and monetary policy cooperation can contribute to greater co-movement of output. However, arguments also run in the opposite direction. Outputs might move more asymmetrically in a financially integrated region with a fixed exchange rate regime if idiosyncratic domestic shocks are not dampened by independent monetary policy.

2.2.   Empirical Studies on Output Co-movement in Asia

Empirical studies differ on the extent and nature of business cycle co-movement among Asian economies. It appears that the choice of empirical methodology and sample has a major impact on the analytical results.

While they vary, most empirical studies find that the degree of business cycle synchronization among Asian economies has been increasing, partly due to deepened trade integration. But, it is not conclusive whether the output of Asian economies has decoupled from, or become less interdependent with, the global economy.

ADB (2007, 2008) reports that the correlation coefficients of Asian business cycles, among emerging Asian economies and with G3 economies, increased after the Asian financial crisis and have remained high. The high synchronicity between Asian business cycles and the G3 cycle is interpreted as evidence refuting the view of Asia decoupling. But, the increased correlation is only indicative since correlation can be spurious without clearly distinguishing regional shocks from global shocks.

Several studies adopt dynamic factor models that can deconstruct an economy's output fluctuations into contributions by different factors, including global, regional, and country specific factors. Moneta and Ruffer (2006) estimate various specifications of a dynamic

factor model for the output of ten East Asian economies and find a significant common factor in their business cycles. Specifically, a considerable part of the common factor is the result of co-movement in exports, which, in turn, is attributed to a number of exogenous factors such as the price of oil price and JPY/USD exchange rate. But, they find Asian output is only weakly affected by developments in industrial countries.

The International Monetary Fund (IMF) (2007) and Kose et al. (2008) find that global and regional common shocks have accounted for a sizable percentage of business cycle fluctuations in both industrial countries and emerging market economies (including emerging Asia), but the relative importance of the global factors has decreased, while that of regional factors has increased. The result supports the theory of decoupling, or divergence, between the business cycles of industrialized countries and emerging Asian economies. But, since the analysis of the IMF (2007) and Kose et al. (2008), as well as Moneta and Ruffer (2006), focus on the patterns in Asia's business cycles over the past two decades, the 1997/98 Asian financial crisis must have increased the influence of common regional shocks.

Several studies adopt the VAR approach to disentangle the nature of shocks, and analyze output interdependence for East Asian economies. Kim and Lee (2008) find that the extent of output linkage increased substantially, both regionally and globally, after the 1997/98 Asian financial crisis. The increase in the degree of regional dependence is similar in magnitude to increase in the degree of global dependence. ADB (2008) and Takagi and Kozuri (2008) also provide similar evidence that Asia's output is responding significantly to both regional and global output shocks in the post-crisis period.

3.   Evolution and Nature of Macroeconomic Interdependence

3.1   Trends and Stylized Facts about Asian Business Cycles

Regional integration has gained momentum in recent decades through advances in trade, finance, and macroeconomic links (ADB, 2008). The effect of strengthened trade and financial linkages on business cycle co-movements remains inconclusive on the theoretical and empirical fronts. However, the process of regional integration continues to reshape the dynamics of regional economies, both among themselves and with the rest of the world. The evolution of Asia's business cycles will reflect these changes in intra- and inter-regional macroeconomic interdependence.

Figure 2 illustrates the movement of real GDP for Asian and G7 economies in terms of their growth rates. As Figure 2 shows, Asian business cycles are generally more volatile than their G7 counterparts, while the amplitude of Asian business cycles has dampened visibly over time.

Judging from the patterns of growth fluctuations, Asian business cycles appear to have changed quite significantly after the 1997/98 financial crisis. In the post-crisis period, the cyclical movements of Asian economies have become more distinctive, although they tend to have longer expansionary periods followed by relatively shorter, albeit much sharper, contractions compared to G7 economies. Such a pattern was much more

pronounced during most of the 1990s, when the Asian regional economy experienced an extended period of rapid growth prior to the 1997/98 Asian financial crisis. Although still exhibiting higher volatility than the G7, Asian business cycles have become much more stable in the post-crisis period. This may reflect the effects of post-crisis reforms and structural changes in the regional economy.[4]

The behavior of post-crisis Asian business cycles also resembles more closely that of the G7 cycles, in that they became more periodic in terms of upturns and downturns. A notable exception to this new pattern is the PRC. The Chinese economy appears to beat the business cycle with continued robust growth regardless of the ups and downs of the regional and international economy.

Tables 1 and 2 report the correlation coefficients of Asian business cycles with each other and with the global economy for the pre-crisis (1990–1996) and post-crisis (2000–2007) periods. The crisis period is omitted intentionally. A close look at the business cycle trend suggests significant differences in the co-movements of Asian business cycles—before and after the crisis—among themselves and with G7 economies. The 1997/98 Asian financial crisis was perhaps the most significant common shock for Asian economies, leading to positive correlations during the crisis period. But the same event is likely to have dampened the correlation between the Asian and G7 business cycles. In order to assess the synchronicity of Asian business cycles without the crisis effect, the correlations for the pre-crisis and post-crisis periods are reported separately.

Evidence based on the correlation analysis of business cycles supports the argument that there are higher degrees of both regional and international business cycle synchronization in the post-crisis period. The correlation analysis of the cyclical components shows that the correlations of Asian business cycles have increased markedly, both with each other and with the G7 cycles, when comparing the pre-crisis and the post-crisis periods.

Table 1 presents the average of the bilateral correlations between all the pairs of nine Asian economies in the sample over the pre-crisis and post-crisis periods. If the Asian business cycles co-move, then the average of the bilateral correlations would be high. A similar approach is taken to calculate the average correlations for the Asian economies excluding the PRC (AXC). For both Asia and AXC, the average correlations rose somewhat from the pre-crisis to the post-crisis period. This increased business cycle synchronization may reflect greater intra-regional integration. In both periods, the average correlation for AXC is higher than for Asia, suggesting that the PRC exhibits cyclical behavior that is relatively independent from the rest of the region. Interestingly, however, the average correlation grew faster among the Asian economies, including the PRC, than was the case with AXC. This suggests that the Chinese business cycle is increasingly moving in tandem with the rest of Asia's.

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[4]   Recent literature has noted a substantial decline in the magnitude of business cycle fluctuations in the developed world over the past two decades or so. Although much debate over the potential drivers of these changes is still ongoing, some studies suggest that the decline in volatility may be attributed to structural changes and economic reforms, particularly related to monetary policy regimes (Clarida, Galí, and Gertler, 2000) and the role of deeper financial markets in helping households and firms smooth out expenditures in the face of fluctuating incomes (Dynan, Elmendorf and Sichel, 2005).

Table 2 reports the correlations between Asian business cycles and the cycles of the G7, Japan, and the United States (US). Asian business cycles have generally been much more synchronized with G7 cycles in the post-crisis period. The only exception is the correlation between AXC and the G7, which decreased slightly from a relatively high pre-crisis level. Again, the correlation between AXC and the G7 is higher than that between Asia and the G7 in the pre-crisis period. The higher correlation between AXC and the G7 may be attributed to a Chinese business cycle that was generally independent from the G7 cycle in the pre-crisis period.

While similar patterns apply to the correlations for both Asia and AXC with the US and Japan, business cycle co-movements between Asia and Japan have increased substantially more than co-movements between Asia and the US. The results suggest that Japan's integration with the regional economy is an important driver behind the increase in inter-regional business cycle correlations. Given its geographical proximity, Japan is expected to be more integrated with the rest of Asia than any other G7 economy. But it appears that Japan is still less integrated with the rest of Asia than the US is integrated with Asia. Nonetheless, in the last decade, Japan has significantly increased its level of integration with the rest of Asia, particularly with the PRC.

The correlations of the PRC's business cycles with the cycles of the rest of Asia, the G7, Japan, and the US are shown separately in Table 3. This confirms that the PRC's cyclical behavior is quite different from both the regional and G7 business cycles. The correlations of the PRC's cycles with both regional and G7 cycles are relatively low, although they have increased significantly in the post-crisis period. The results also suggest that the Chinese economy is increasingly integrated with the rest of the region and Japan. The post-crisis correlations for the rest of Asia and Japan with the PRC are significantly higher than the pre-crisis correlations, while the increases in these correlations are greater than the increases in the correlations for the G7 and US with the PRC.

3.2   Trade Linkages

The Asian economy is generally more open than other groupings of countries in the world, and trade linkages within the region have been growing much more strongly in recent years. The total exports of emerging Asian economies grew from $419 billion in 1990 to $2,995 billion in 2007. The region's export-to-GDP ratio now reaches 50%, which is up from 34% in 1990. Total trade as a percentage of GDP grew from 69% to 95% over the same period, while the share of intra-regional trade in total GDP increased from 21% to 38%, reflecting the increasing economic and trade integration of emerging Asian economies (Figure 3).

Asia's increasing trade openness has been accompanied by significant progress in the diversification of its export base. Figure 4 shows the composition of Asian exports by destination. The share of intra-regional trade in total exports rose from about 31% in 1990 to 41% in 2007. The geographical composition of Asia's export market has become much more diversified. The share of exports to G7 markets has declined significantly, accounting for only 32% of Asia's total exports in 2007, which is down from 49% in 1990.

The share of exports to the US—emerging Asia's single largest market—fell to 15% from 22% over the same period.

The popular hypothesis of decoupling has also drawn on the idea that strengthening regional ties might help cushion emerging Asia amid a slowdown in the US and other major industrial economies. There is little doubt that emerging Asian economies are increasingly integrated through growing intra-regional trade, investment, and financial linkages. The rapid expansion of intra-regional trade suggests that the Asian economy has strengthened its regional economic ties. At the same time, the relative decline in its trade with the rest of the world suggests Asia's reliance on external trading partners might be diminishing.

However, changing demand conditions in the world's major economies, particularly the US, appear to represent a dominant factor behind Asia's export growth. Figure 5 demonstrates the tight relationship between US non-oil import growth and Asian exports. Although the share of the US market in terms of Asia's total exports is on the decline, Figure 5 indicates that the relationship has strengthened over time. The pre- and post-crisis correlations between the growth rates of US non-oil imports and Asian exports confirm that this linkage is significant and tighter in the post-crisis period.

Underlying this strong linkage is the nature of intra-Asian trade, a marked feature of which is that it is driven by vertical integration of production chains whose final output is exported outside the region. Figure 6 shows a breakdown of Asian exports between those destined for other countries within the region and those that leave the region. The information for Figure 6 was taken from the Global Trade Analysis Project (GTAP) database.[5] Intra-regional trade within Asia is then factored into the region's final demand, as well as what is used in the production process. A similar deconstruction is made for trade among the rest of the world. On both ends of Figure 6, total final demand by different regions is reported, taking into account the trade of intermediate goods in the production process. Based on this analysis, about 60% of all Asian exports are eventually consumed by G3 countries (instead of about 32% of total exports listed above). The results suggest that G7 countries still remain the main export destination for final goods departing from Asian ports when taking into account the share of intermediate goods that are traded for assembly and production within the region before being shipped out of the region.

This export dynamic is also confirmed by other sources. The Monetary Authority of Singapore (2003) estimated that only about 22% of total Asian exports are eventually absorbed by the region's domestic demand, based on the 1995 Asian Input–Output table (AIO table).[6] Meng et. al. (2006) showed that the dependence of Asian production on overseas markets has strengthened rather than weakened between 1995 and 2000,

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[5]   The GTAP database (version 7) corresponds to the world economy in 2004. The database provides "detailed bilateral trade characterizing economic linkages among regions, together with individual country input–output databases, which account for inter-sectoral linkages within regions" (Hertel 1998, p.2). This version disaggregates the world economy into 113 countries/regions (including all nine economies in East and Southeast Asia under this study) and 57 sectors.

[6]   Citibank (2006) updated the result based on the newly released 2000 AIO table and reported that only 11% of Asian exports are destined for regional demand.

based on the comparison of the 2000 AIO table with the 1995 AIO table. Pula and Peltonen (2008) also concluded that intra-regional trade (including Chinese markets) is responsible for only 7% of the region's overall GDP, using the country-level update of the AIO table for 2006, while G3 countries account for 16%.

Given that intra-Asian trade has been significantly bolstered by demand from outside the region, the growth of intra-regional trade's share in total Asian exports does not automatically lead to Asia's independence from the effects of an external demand shock. Contrarily, to the extent that intra-regional trade is dictated by intra-industry processing and assembly through vertically integrated production chains, the regional Asian economy can be highly sensitive to an external shock, particularly an industry-specific one that emanates from major demand destinations. The US slowdown in 2001/02 originated within the information technology (IT) industry and its ripple effects through the global IT industry, including Asian manufacturers, was a vivid example of such sensitivity.

3.3   Financial Spillovers

The recent US subprime turmoil and its ripple effects in global financial markets illustrate the advanced nature of financial globalization. Rapid financial innovation has also contributed to cross-border financial integration in recent years, which has gathered pace since the early 1990s along with financial deregulation and capital account liberalization.

Global financial market co-movement has increased significantly in recent years. Figure 7 shows stock market correlations for emerging Asia and the PRC with the US. Stock market correlations between emerging Asia and the US reached very high levels in the late 1990s through the mid-2000s. Given the predominant influence of the US stock market in the global financial system, emerging Asia's stock markets tend to track very closely with changes in the US market. On the other hand, stock market correlations between the PRC and the US were low until the mid-2000s before rising sharply in the past few years.

The strong rise in global market correlations can be attributed to greater financial openness since the 1990s. Capital flows to and from the region reached record highs in recent years (Figure 8). With the volume of cross-border capital flows also on the rise, cross-border holdings of financial assets increased sharply (Figure 9). The region's gross external assets and liabilities as a share of GDP reached 215% in 2006, up from 158% in 1990 (Lane and Milesi-Ferretti, 2006). The secular trend of cross-border financial holdings has been driven by some notable changes in global financial systems, including the spread of securitization, rise of hedge funds and institutional investors, and use of offshore special purpose vehicles by banks and non-bank financial institutions.

The process of cross-border financial integration has also accelerated at the regional level. Figure 10 shows the average of pairwise stock market correlations among emerging Asian economies, which illustrates the rise in regional stock market co-movements in recent years, especially with respect to the PRC. Similarly, Figure 11 shows the average standard deviation of government bond yields, indicating

convergence among regional bond yields. The region's portfolio investment in regional assets also rose significantly from about 15% of total assets in 2001 to about 28% in 2007, while G7 economies' account of the region's liabilities declined from about 68% to about 55% over the same period (Figure 12).

The level of regional financial integration in emerging Asia still lags behind Asian integration with global markets. For example, stock market correlations at the regional level are generally lower than those with the US. Furthermore, emerging Asia still allocates more of its portfolio investment in G7 economies than within the region's economies. This is despite the fact that regional authorities have made conscious efforts to strengthen regional financial links by removing barriers to the cross-border flow of capital and financial services, improving the cross-border information and communications flow, and promoting the harmonization of financial rules and standards.

Growing foreign participation in local capital markets also makes the region's financial markets vulnerable to changes in global financial market conditions, including sudden swings in investor sentiment. In a climate of heightened uncertainty, a sudden shift in the direction and magnitude of financial flows is a significant concern. Higher cross-border holdings of financial assets raise the level of vulnerability to sharp adjustments in the valuation of global financial assets. International institutional investors could unwind their positions in emerging markets when liquidity conditions deteriorate in their home countries. A sharp reversal in risk appetite could also trigger a sudden reversal of capital flows and, of particular concern, involve a potential unwinding of carry trades (Lee and Park, 2008).

There is little doubt that global financial turbulence, particularly from the US market, travels rapidly around the globe. In globalized finance, a swing in market sentiment could also hurt local companies' funding conditions and, hence, investment decisions. Tighter credit conditions—together with elevated funding costs—and increased financial market volatility could squeeze funding for corporate investment, particularly in the developing world where the business environment remains less friendly. Recently, risk premiums for emerging Asian debt and the cost of protecting against their corporate default rose sharply, reflecting heightened investor anxiety and financial uncertainty. A worsening of the situation in global financial markets could make the region's funding conditions more difficult, potentially dampening corporate profits and affecting broader economic activity.

The considerable differences in the degree of financial integration and asset and liability positions at the regional and global levels imply that the effects of financial transmission on regional and global business cycles may be quite dubious. Nevertheless, it is plausible to expect that generally stronger global financial market integration could drive global, rather than regional, business cycle co-movements.

3.4   The Rise of Asia and its Impact on the World

With Asia's share of world output growing rapidly, the region plays an increasingly important role in global trade, finance, and economic output. While trade and financial flows are important factors for macroeconomic interdependence, the direction and magnitude of these flows is changing rapidly with the rise of emerging Asia.

Emerging Asia's rapid economic and structural transformation will also likely spur competition in trade and investment, which in turn affects global business cycles. The level and composition of international trade mirrors changing economic and industrial structures in emerging Asia (ADB, 2007). A closer look at trade flows reveals that Asian economies are undergoing a transformation with respect to their position in the world economy. Rapid economic development in relatively resource poor countries accompanied a change in export composition from agricultural products to manufactures. Along with a rise in the availability of skilled labor, the composition of manufactured exports is also shifting from labor-intensive to more skill-intensive products. These evolving structural changes in Asian economies are exerting considerable influence on world trade flows and global business cycles.

Fast-growing Asian economies, with their potentially large spending power, are providing additional sources of global demand. Per capita income is an important variable for demand in global markets. Proponents of the theory of decoupling have argued that these new sources of demand coming from emerging Asia may help the global economy weather the adverse consequences of a US slowdown. Figure 13 illustrates the growing importance of emerging Asian economies, particularly the PRC, as destinations for G7 and US exports. Although the G7's export reliance on emerging Asia remains relatively small, the share of G7 exports destined for the PRC has visibly increased since 2000.

Another important factor contributing to increased co-movements between Asian and G7 business cycles is the nature of Japan's integration with emerging Asia. Changing patterns of business cycles have accompanied greater co-movements between Japan and emerging Asia in recent years, particularly the PRC (Tables 2 and 3). Asia's trade with Japan in terms of the share of GDP has either been stable or declined modestly over the past few decades. However, trade patterns between Japan and emerging Asia have been changing rapidly, as Japanese firms build production and procurement networks across the region. Figure 14 shows the increase in foreign direct investment (FDI) flows from Japan to the PRC, reflecting this trend of setting up a local manufacturing base. Although the share of FDI flows from Japan has been relatively small in terms of total FDI flows to the PRC, it has been growing quite rapidly, and now outweighs the US share. For the rest of Asia, the size of FDI inflows is also quite significant relative to the size of the host economy. With the growing presence of Japanese firms' local manufacturing bases in emerging Asia, particularly in the PRC, bilateral trade between Japan and emerging Asia is declining. However, the sharing of production networks between Japan and emerging Asia leaves them exposed to the same industry or external demand shocks, thus leading to an increase in business cycle co-movements between Japan and the region.

Emerging Asia is also considered a major player in the global financial system based on high levels of regional savings. Since the 1997/98 Asian financial crisis, emerging Asia has accumulated massive foreign exchange reserves valued at over USD3 trillion. And on the back of such large reserve holdings, some countries in the region have established, or more actively managed, sovereign wealth funds in recent years. The pattern of global payment imbalances also suggests that emerging Asia finances a significant share of US current account deficits. Figure 15, for example, show a substantial rise in emerging Asia's holdings of US Treasuries.

There are also signs that emerging Asia exerts increasing influence on key prices in G7 economies, such as imported goods, wages, exchange rates, and interest rates. Shocks from emerging Asia can be transmitted to G7 economies through price changes, leading to the synchronization of business cycles between emerging Asia and G7 economies. For example, a positive supply shock in the PRC can lower the price of imported goods in G7 economies, leading to higher real wages and employment among the G7.

Technological advances and productivity growth, along with the industrialization process, are often important factors in business cycle patterns. Technological advances in an emerging economy can arise from innovation or from the imitation of existing technologies found elsewhere. For emerging Asian economies lacking indigenous technological innovation, the imitation and adaptation of advanced technologies developed in G7 countries has traditionally played a major role in technology growth. However, in recent years Asian economies have realized productivity gains through the creation of indigenous new technologies.[7] As a result, the vibrant and integrated Asian region is increasingly contributing to global productivity growth.

As the share of emerging Asia's economy in the world economy continues to increase, Asian economies are having greater influences on demand, technology, and price variables in G7 markets, leading to closer synchronization of business cycles between emerging Asia and G7 economies.

Asian economies have become the major source of additional demand for many primary commodities (Park and Zhai, 2007). In the past, commodity price fluctuations were dictated primarily by demand from major industrialized countries, which then caused spillover effects on the economic performance of developing countries. Driven by rapid income growth and economic development, however, emerging Asia has surfaced as a major demand force behind the price dynamics of primary commodities. The region is exerting increasing—and now considerable—influence on international commodity markets and prices.

Figure 16 illustrates evolving correlations between GDP growth rates of both G7 and emerging Asian economies and commodity price fluctuations. While the linkage between G7 growth and the global commodity price cycle gradually weakened, the linkage between developing Asia's growth and global commodity price fluctuations jumped beginning in the early 1990s. It can be inferred that strong growth in emerging Asia's demand was a major driver behind an upswing in commodity markets through the mid-1990s prior to the 1997/98 Asian financial crisis, while the crisis itself led to a slump in commodity markets in 1998/99.

Such trends are set to intensify as the region's economic growth and development continue to be tightly associated with rapid industrialization, urbanization, and massive infrastructure investments, which are all resource-intensive. And it is clear that the region's rapidly growing demand for resources will exert significant influence on global

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[7]   The available US patent ownership data, which is often used for international comparisons of innovative outputs, shows that emerging Asian economies, especially the Republic of Korea and Taipei,China, have substantially increased their share of global patents. See USPTO, "Patents counts by country/state and year - utility patents" at http://www.uspto.gov/go/oeip/catalog/products/tafstat.htm

commodity prices. However, at least in theory, in terms of global business cycle co-movements, the overall effect of higher correlations between Asian business cycles and global commodity prices remains ambiguous. For example, a boom in Asian economies will lead to higher commodity prices, which could slow economic activity globally. Again, deciphering the effect of growing Asian influence on the global business cycle is ultimately an empirical question.

4.   Empirical Analysis

4.1.   Panel VAR Model

To examine the issue, we use VAR models. VAR models can identify the relevant structural shocks, such as global and regional shocks, and analyze the effects of each shock on an individual variable in a systematic way. We use panel structure to increase the degree of freedom because sample periods under consideration are relatively short.

Let's assume that an economy, i (i=1,2,…,10), is described by the following structural form equation:

$$G(L)y_t^i = d^i + e_t^i \qquad (1)$$

where $G(L)$ is a matrix polynomial in the lag operator L, y_t^i is an m×1 data vector, d^i is an m×1 constant matrix, m is the number of variables in the model, and e_t^i denotes a vector of structural disturbances. By assuming that structural disturbances are mutually uncorrelated, $\mathrm{var}(e_t^i)$ can be denoted by Λ, which is a diagonal matrix where diagonal elements are the variances of structural disturbances. The individual fixed effect, d^i, is introduced to control for the country specific factors that are not included in the model. We are interested in examining the time-series relationship. Therefore, by including the individual fixed effect, we exclude the cross-sectional information in the estimation.

We pooled the data and estimated the following reduced form panel VAR with the individual fixed effects:

$$y_t^i = c^i + B(L)y_{t-1}^i + u_t^i, \qquad (2)$$

where c^i is an m×1 constant matrix, $B(L)$ is a matrix polynomial in the lag operator L, and $\mathrm{var}(u_t^i) = \Sigma.$

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 recursive zero restrictions on contemporaneous structural parameters by applying Cholesky decomposition to the reduced form residuals, Λ, as in Sims (1980).

4.2.   Empirical Model

To examine the relationship between global and Asian regional output, and their effects on the output of individual Asian economies, we constructed a three variable VAR model [log RY_W, log RY_A, log RYi] where the contemporaneously exogenous variables are ordered first: RY_W is the world aggregate output, RY_A is the East Asian aggregate output, and RYi is an individual output of an East Asian economy. The first two variables are included to examine the relationship between global and Asian regional output. The last variable is included to examine the effects of global and Asian regional output on the output of individual East Asian economies. The ordering of the variables can be regarded as a natural one. World aggregate output is treated as contemporaneously exogenous to regional aggregate output and individual country output. Regional aggregate output is treated as contemporaneously exogenous to individual country output.

The world aggregate is constructed as the aggregate of G7 countries. The Asian aggregate is constructed as the aggregate of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines, Singapore, Taipei,China; and Thailand), while excluding each country's own economy.

We also construct a three-variable system in order to examine the role of the PRC. The variables are log RY_W, log RY_C, and log RYi. The contemporaneously exogenous variables are ordered first and RY_C is the Chinese output. Again, the ordering of the variables can be regarded as a natural one. World aggregate output is treated as contemporaneously exogenous to Chinese output and individual country output. Chinese output is treated as contemporaneously exogenous to other individual country outputs since the Chinese economy is far larger than other emerging Asian economies. The world aggregate is constructed as the aggregate of G7 countries. The Asian aggregate is constructed as the aggregate of eight emerging Asian economies (excluding the PRC)

We use quarterly data and estimate the model for two sample periods: the period before the 1997/98 Asian financial crisis (1st quarter 1990–4th quarter 1996) and the period after the crisis (1st quarter 2000–2nd quarter 2007). A constant term and two lags are assumed. As the measure of output, real GDP is used. Since we are interested in business cycle phenomenon, we exclude the trend from data by applying an H-P filter for each sub-period.

4.3.   Results

Figures 17 and 18 report the impulse responses for 16 quarters—for the pre-crisis and post-crisis periods, respectively—with 90% probability bands in the case of [log RY_W, log RY_A, log RYi. The responding variables are denoted at the far left of each row of graphs, while the names of shocks are denoted at the top of each column of graphs. The numbers show percentage changes.

Impulse responses show that the effects of global shocks on the Asian aggregate and individual economies increased substantially in the 2000s. While the effects are minor in

the 1990s, the effects become significantly stronger in the 2000s. In the 2000s, in response to global shocks, G7 output increases about 0.35% on impact, decreases over time, and returns to the initial level in 3 years. This reveals the nature of global shocks. In response to global shocks, the Asian aggregate output and individual output increase 0.2%–0.3% on impact, decreases over time, and returns to the initial level in 2–3years.

The effects of emerging Asian shocks on the global economy also increased substantially in the 2000s. While the effects are small and much delayed in the 1990s, the effects are far larger in the 2000s when, in response to Asian aggregate shocks, the Asian aggregate increases about 0.4% on impact, decreases over time, and returns to the initial level in 5 years. Compared to the global shocks, Asian aggregate shocks are larger and more persistent. In response to Asian aggregate shocks, G7 output increases over time. The peak increase of about 0.3% is realized in 2 years before returning to the initial level in 7 years. Individual output increases about 0.2% on impact and decreases back to the initial level in 5 years. It is particularly interesting that Asian aggregate shocks have such strong effects on the global economy in the 2000s.

To infer the role of global and regional shocks in output fluctuations, forecast error variance decomposition is reported in Figures 19 and 20. The graphs in each row show the percentage contribution of three shocks to fluctuations in each variable. The point estimate and 90% error bands are reported. From the graphs, we can infer that the role of global shocks in explaining Asian aggregate output and individual country output increased substantially in the 2000s, as did the role of Asian aggregate shocks in explaining global and individual output. The contribution of global shocks to Asian aggregate output fluctuations increases from less than 10% in the 1990s to about 20% in the 2000s. The contribution of global shocks in explaining individual Asian output was less than 5% in the 1990s, but over 10% in the 2000s. The contribution of Asian aggregate shocks in explaining global output fluctuations (at medium- and long-term horizons) increases from less than 20% in the 1990s to about 50% in the 2000s. The contribution of Asian aggregate shocks in explaining individual output fluctuations also increases from less than 5% to over 20%.

It is quite striking that the proportion of Asian aggregate output shocks in explaining global output fluctuations is huge (about 50%) in the 2000s, which is far larger than the proportion of global shocks in explaining Asian aggregate output fluctuations (about 20%). Also, the proportion of Asian aggregate output shocks in explaining individual country output fluctuations is larger than that of global shocks. However, this does not necessarily imply that the Asian economy influences the global economy far more than the other way around. From the impulse responses, we can see that the size and persistence of Asian aggregate shocks are larger than those of global shocks. If the nature of the global shocks and Asian aggregate shocks are the same, the effect of Asian aggregate shocks on the global economy may not be far larger than the effect of global shocks on the Asian economy. To some extent, the fact that Asian aggregate shocks were larger and more persistent than global shocks may explain the finding that the contribution of Asian aggregate shocks to global and individual output fluctuations is far larger than that of global shocks to Asian aggregate and individual output fluctuations. Even after considering this difference in the nature of shocks, the huge effect of Asian aggregate shocks on the global economy is still quite interesting.

Figures 21 and 22 show the impulse responses for the model with the PRC included. The results are qualitatively similar to the previous model with Asian aggregate shocks in that the positive effects of global shocks on Chinese and individual Asian economies, and the positive effects of Chinese shocks on global and individual Asian economies, are larger in the 2000s than in the 1990s. Also, Chinese shocks are larger and more persistent than global shocks.

Figures 23 and 24 show the results of forecast error variance decomposition. The results are again qualitatively similar to the previous model with Asian aggregate shocks. The contribution of global shocks on the PRC and individual Asian economies, and the contribution of Chinese shocks on global and individual Asian economies, are far larger in the 2000s than in the 1990s.

Our empirical finding of the huge effects of the PRC and Asian economies on the global economy may depend on how to construct the global aggregate. Especially interesting is whether to include Japan in the global aggregate because the PRC and Asian economies may have a relatively stronger effect on Japan than other major industrial countries. To examine such a possibility, we also construct the model with a "G6" aggregate (i.e., the G7 countries excluding Japan).

Figures 25, 26, 27, 28, 29, 30, 31, and 32 show impulse responses for the 1990s and the 2000s using the G6 aggregate. As in the model with the G7 aggregate, the (positive) effects of global shocks on the Asian aggregate and Chinese output are larger in the 2000s than in the 1990s. In addition, the (positive) effects of the Asian aggregate and Chinese shocks on the global economy tend to be larger in the 2000s than in the 1990s.

From impulse responses in the 2000s, the (positive) effect of global shocks on Asian aggregate output is larger in this model than in the model with the G7 aggregate. But the effect of Asian aggregate shocks and Chinese shocks on global output is smaller in the 2000s. As a result, in this model the variance decomposition for the 2000s shows a larger role for global shocks in explaining Asian and Chinese output fluctuations than in the model with the G7 aggregate, and a smaller role for Asian and Chinese output shocks in explaining global output fluctuations. In this model, global shocks explain a large degree of Asian aggregate output, but Asian aggregate shocks explain only a small degree of global output fluctuations (less than 10%). For the model with Chinese output, such a tendency is also found, albeit a weaker one than in the previous G7 model.

To summarize, the effects of global shocks on the PRC and emerging Asian economies increased substantially in the 2000s to the point that global shocks explain a substantial part of fluctuations in the Chinese and Asian economies during this period, ranging from 20% to 40%, depending on the model specifications. The effects of the Chinese and emerging Asian economies on the global economy also increased in the 2000s. The exact effect depends largely on whether Japan is included as a part of the global economy. With Japan, the effects are huge, surpassing the effects of global shocks on the Chinese and emerging Asian economies. Without Japan, the effects become smaller than the effects of global shocks on the Chinese and emerging Asian economies.

5. Concluding Remarks

Traditionally, the macroeconomic relationship between developing and developed countries was characterized by uni-directional dependence—often dubbed the "North–South relationship"—with cyclical fluctuations and growth in the South (developing countries) being determined primarily by the developments in the North (developed countries). But, with the growing influence of emerging Asia, the North–South relationship between emerging Asia and industrialized countries is likely to take on a new pattern of bi-directional interdependence. Heated debates on decoupling also center on the notion that emerging Asia, on the back of the rapidly growing regional economy, should be able to provide a new engine of global growth and challenge the old paradigm of the North–South relationship.

This paper has explored the nature and evolution of macroeconomic interdependence between emerging Asian and G7 economies. We have found that while the effects of global shocks on emerging Asian and Chinese economies increased substantially, the effects of the Chinese and emerging Asian economies on the global economy also increased in the 2000s.

It is undeniable that Asia has made remarkable progress in regional economic, trade, and financial integration. But the process of economic integration within Asia is also tightly linked to global integration, rather than signaling a departure from it. The analysis of business cycle co-movements, both within Asia and between Asia and G7 countries, generally affirms the global nature of the regionalization of economic activities in Asia.

As shocks from emerging Asian economies have a greater positive influence on global economies, emerging Asia and G7 economies have been recoupling, rather than decoupling, with each other. The growing influence of Asia and the PRC, tightening intra- and inter-regional trade linkages, and the globalization of financial markets are combining to make fundamental changes to the nature of macroeconomic interdependence and growth spillovers between emerging Asia and the industrial countries of the G7.

Increasing macroeconomic interdependence between emerging Asian and major industrial economies has far-reaching implications for the region as well as the global economy. Greater economic interdependence and tighter trade linkages among Asian economies, as well as between Asia and the world, require greater cooperation in trade, finance, and exchange rate policies at both the regional and global levels.

As economic and financial shocks travel rapidly from a country to its trading partners through increased trade and financial linkages at the regional level, it is in the common interest of all Asian countries to maintain sound macroeconomic conditions and prudent economic management at the national level. Synchronization of real growth and inflation in the region should also generate regional common interests to ensure close cooperation in macroeconomic and exchange rate policies.

Greater global integration also necessitates closer policy cooperation at the global level to respond more effectively to shocks and crises in global and regional markets. The

growing influence of the PRC and Asia necessitates an amplification of Asia's voice in global forums and institutions. Asia will likely exercise increasing leadership in global decision making, while also being asked to be a cooperative and responsible partner in the global community.

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Figure 1: GDP, in PPP (as % of World)
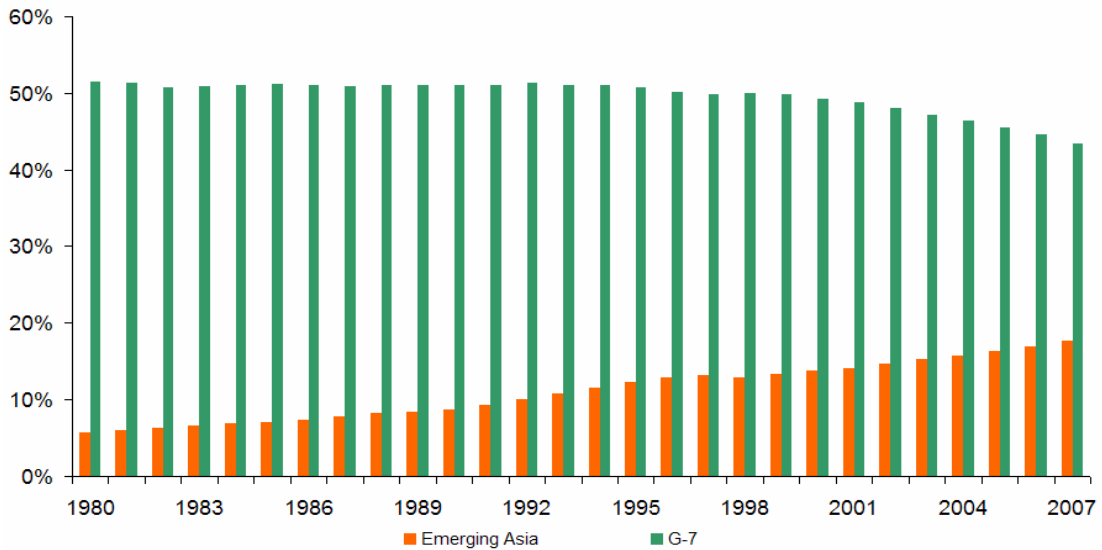
GDP = gross domestic product, PPP = purchasing power parity.
Note: Emerging Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Source: International Monetary Fund's (IMF) *World Economic Outlook* database.

Figure 2: GDP Growth (%)
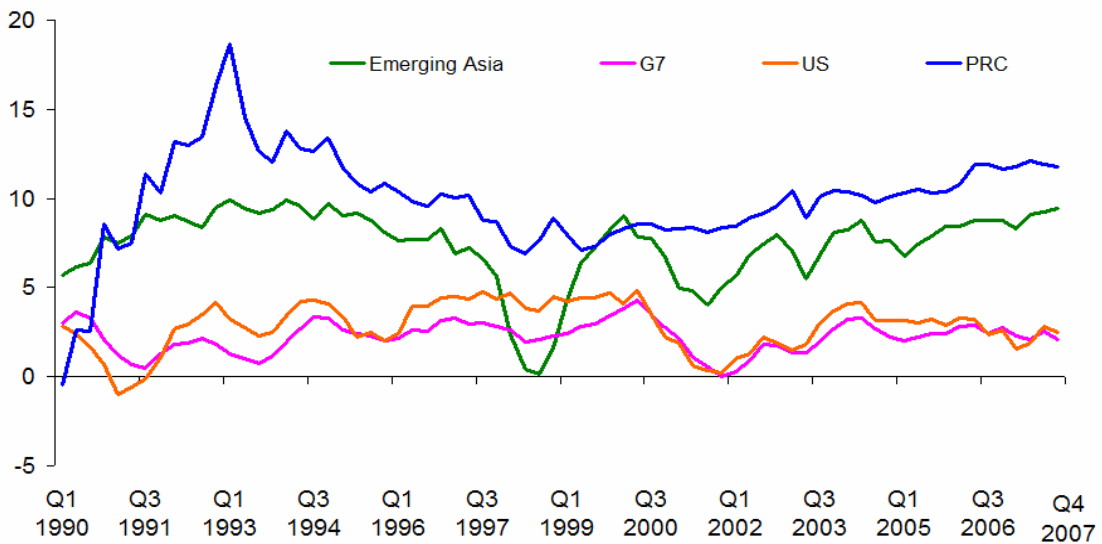
GDP = gross domestic product, PRC = People's Republic of China, US = United States.
Note: Emerging Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Source: Oxford Economics, *Quarterly Model*, August 2008.

Figure 3: Trade of Emerging Asia (% of GDP)

GDP = gross domestic product, US = United States.
Note: Emerging Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Sources: International Monetary Fund's (IMF) *Direction of Trade Statistics* and *World Economic Outlook* databases.
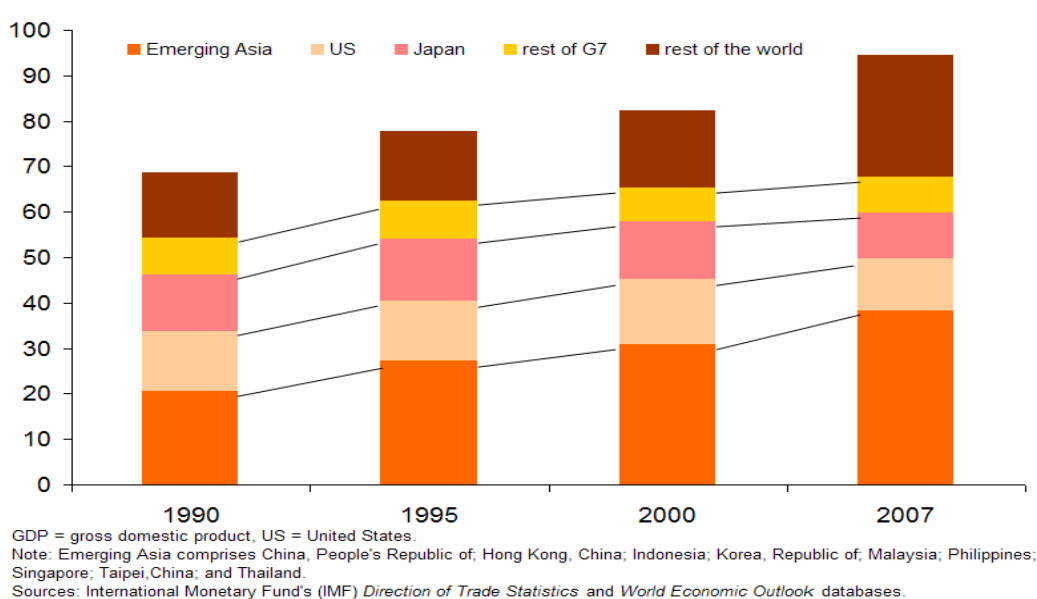
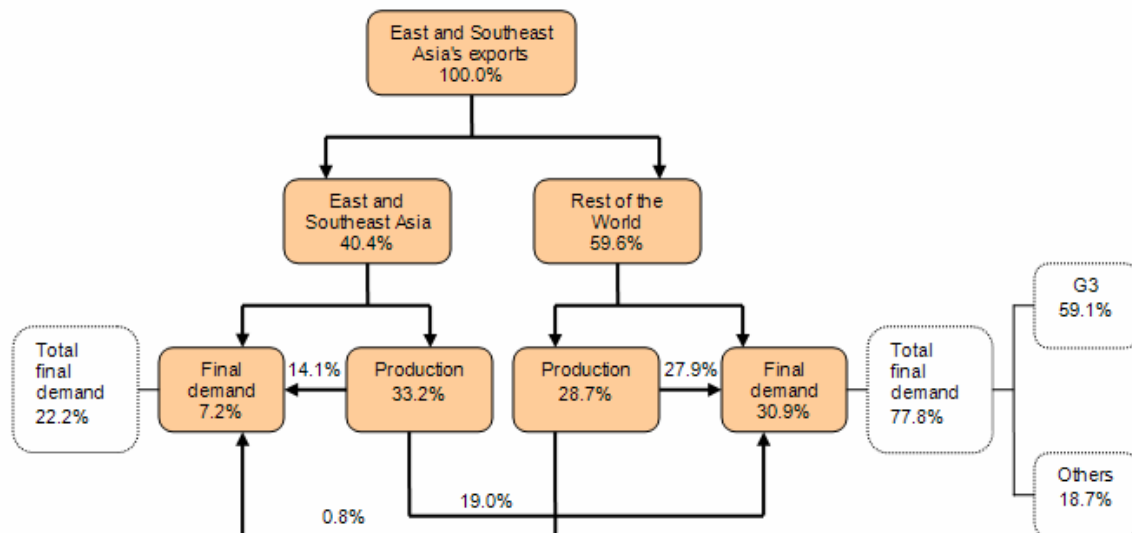## Figure 4: Destination of Emerging Asia's Exports (% of Total Exports)

US = United States.
Note: Emerging Asia comprises People's Republic of China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Sources: International Monetary Fund (IMF), Direction of Trade Statistics and CEIC for Taipei,China.
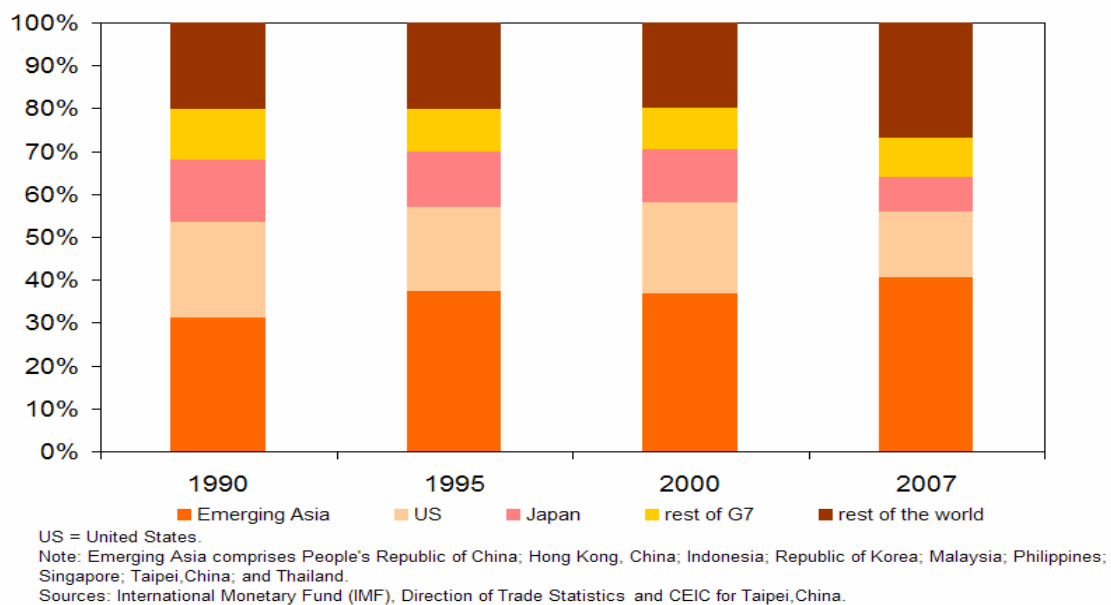
**Figure 5: Correlation between Growth in Emerging Asian
Intra-regional Exports and US Non-oil Imports**
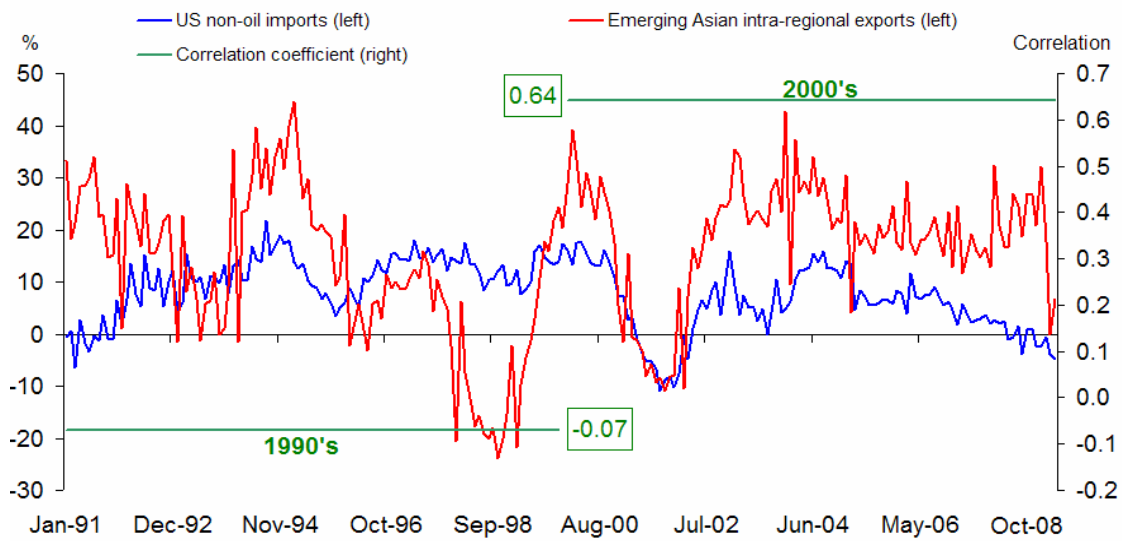
Note: Emerging Asia comprises People's Republic of China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; and Thailand.
Sources: International Monetary Fund (IMF) Direction of Trade Statistics and Datastream.

Figure 6: Breakdown of Emerging Asia's Exports

Note: Emerging Asia comprises People's Republic of China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Source: Author's calculation based on the Global Trade Analysis Project (GTAP) database (version 7)

Figure 7: Stock Returns Correlations (Two-year Rolling)

PRC = People's Republic of China, US = United States.
Notes: Emerging Asia comprises People's Republic of China; Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand. Stock returns are computed as log difference of grouped and individual country indexes.
Sources: Morgan Stanley Capital International (MSCI) Barra and Bloomberg.

Figure 8: Emerging Asia's Financial Account (% of GDP)

Notes: Emerging Asia comprises China, People's Republic of (PRC); Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Taipei,China; Thailand; and Singapore. "Other Investment" includes financial derivatives.
Sources: Data sourced from the International Monetary Fund's (IMF) *International Financial Statistics* and national sources.
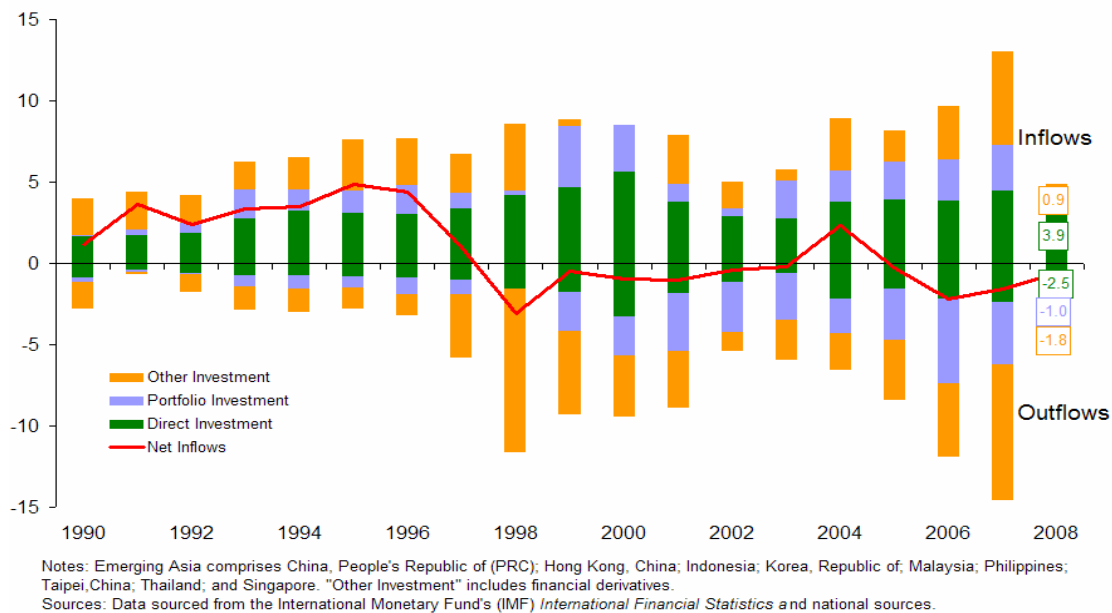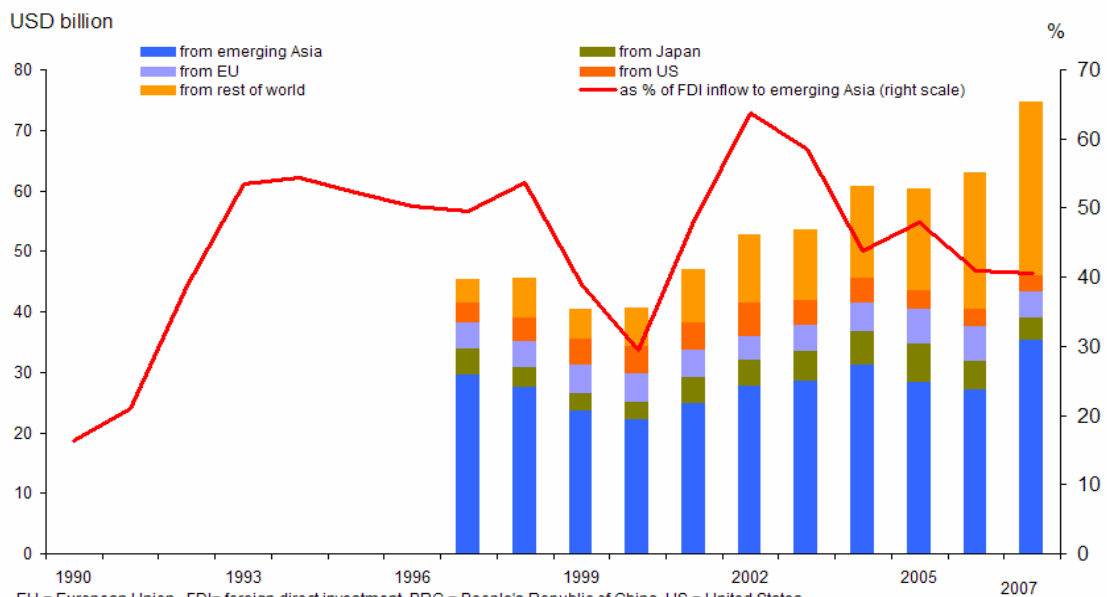
Figure 9: Emerging Asia's Foreign Assets and Liabilities (% of GDP)

Note: Emerging Asia comprises China, People's Republic of (PRC); Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Taipei,China; Thailand; and Singapore.
Source: Lane, P.R. and G.M. Milesi-Ferretti. 2007. The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities. *Journal of International Economics*, November 2007.

Figure 10: Average Pair-wise Correlation of Stock Returns (Two-year Rolling)

PRC = People's Republic of China.
Note: Emerging Asia comprises Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; PRC; Singapore; Taipei,China; and Thailand. PRC data begin in 1992. Data represent average pairwise correlations of stock returns, which are computed as log difference of individual country indexes.
Source: Bloomberg.
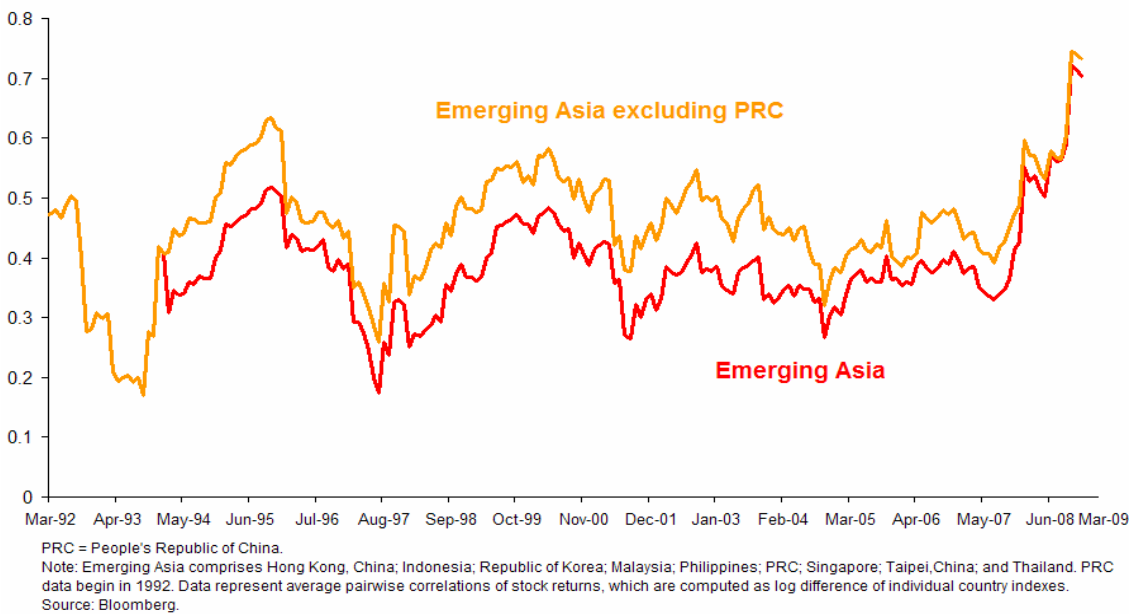
**Figure 11: Average Standard Deviation of Asian Government
Bond Yield Spreads over US Treasuries**
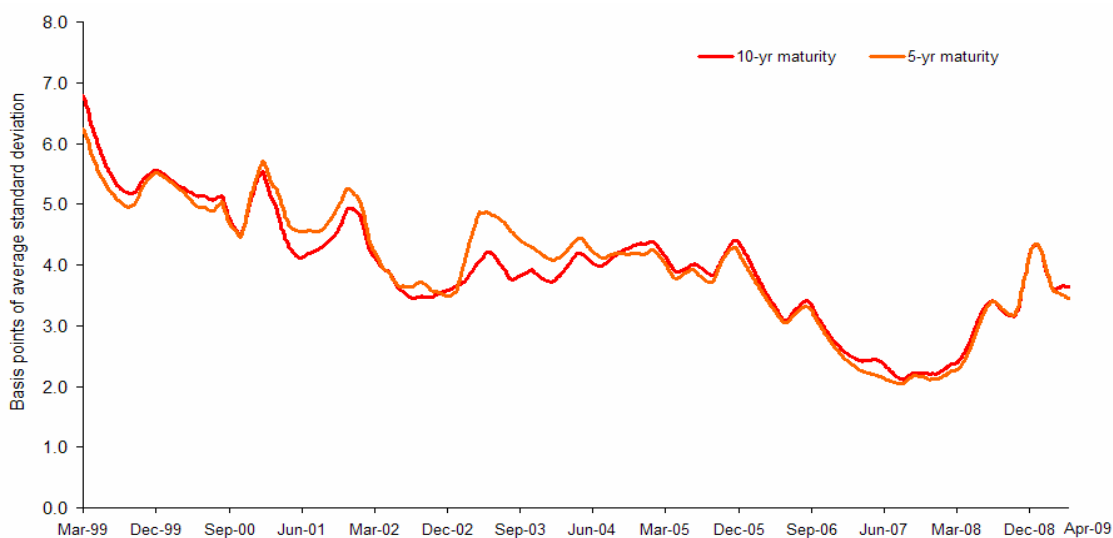
Note: Average standard deviation (61-day) of government bond spreads with US treasuries of nine emerging Asia countries including China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Source: Bloomberg.

**Figure 12: Emerging Asia's Portfolio Investment
(% of Total Foreign Assets and Liabilities)**
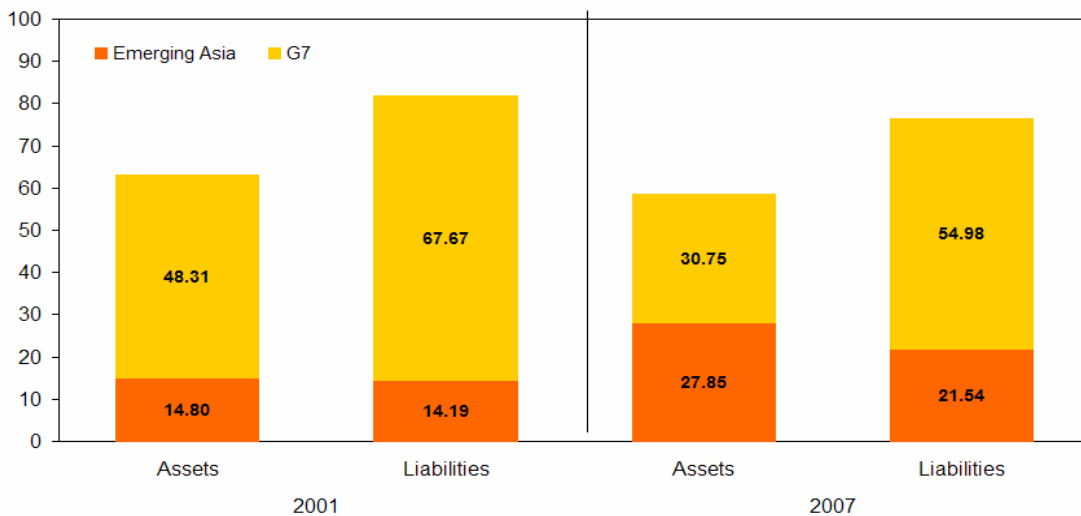
Notes: Emerging Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.
Source: International Monetary Fund (IMF), *Coordinated Portfolio Investment Survey*.

Figure 13: G7 Exports to Emerging Asia (% of Total Exports)
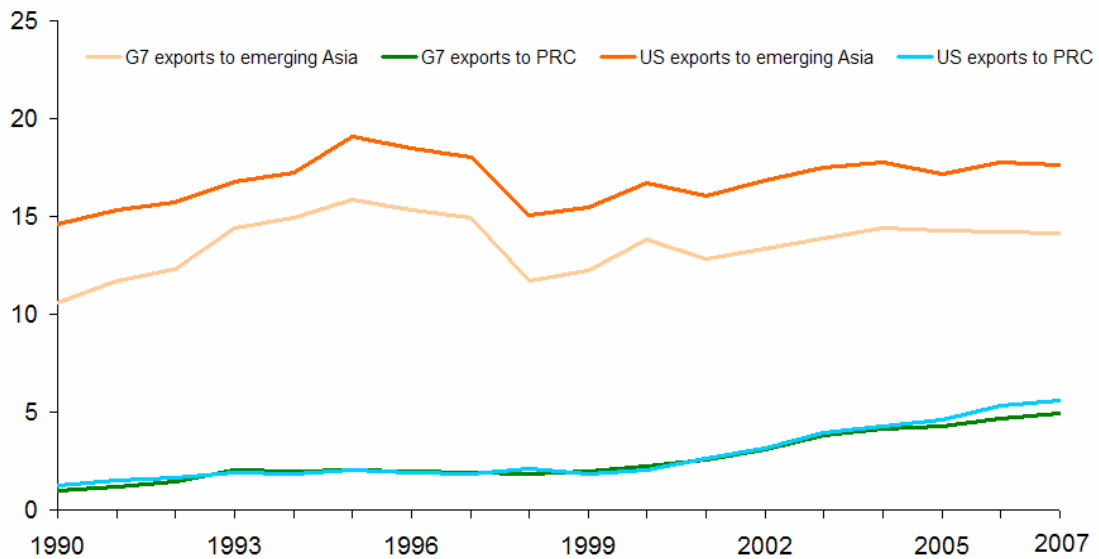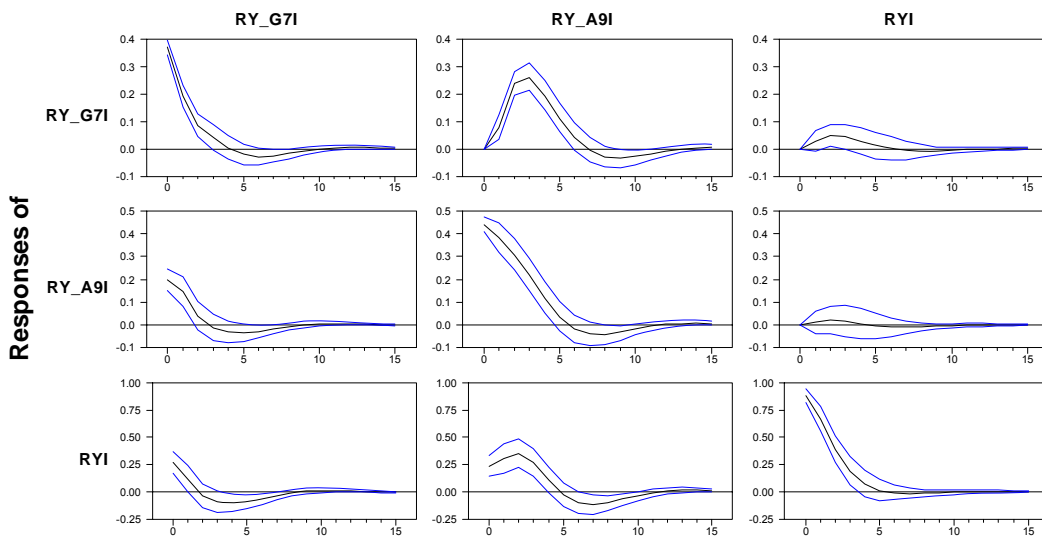

PRC = People's Republic of China
Note: Emerging Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines;
Singapore; Taipei,China; and Thailand.
Sources: International Monetary Fund (IMF), *Direction of Trade Statistics*; and CEIC for Taipei,China.

Figure 14: Foreign Direct Investment to the People's Republic of China

EU = European Union, FDI= foreign direct investment, PRC = People's Republic of China, US = United States.
Note: Emerging Asia comprises Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; PRC; Singapore; Taipei,China; and Thailand.
Sources: National Bureau of Statistics, *China Statistical Yearbook*, various issues; and UNCTAD's *World Investment Report 2008*.

Figure 15: East Asian US Treasuries Holdings (US$ Billion)

PRC = People's Republic of China.
Source: US Department of Treasury.
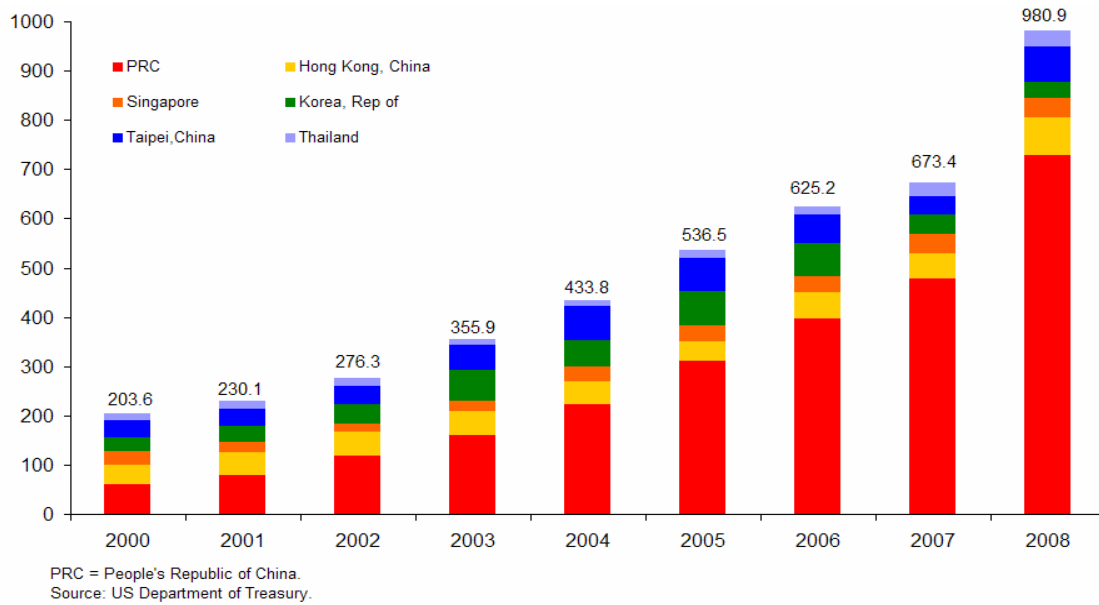
Figure 16: Correlation between Real Commodity Price Inflation and Growth
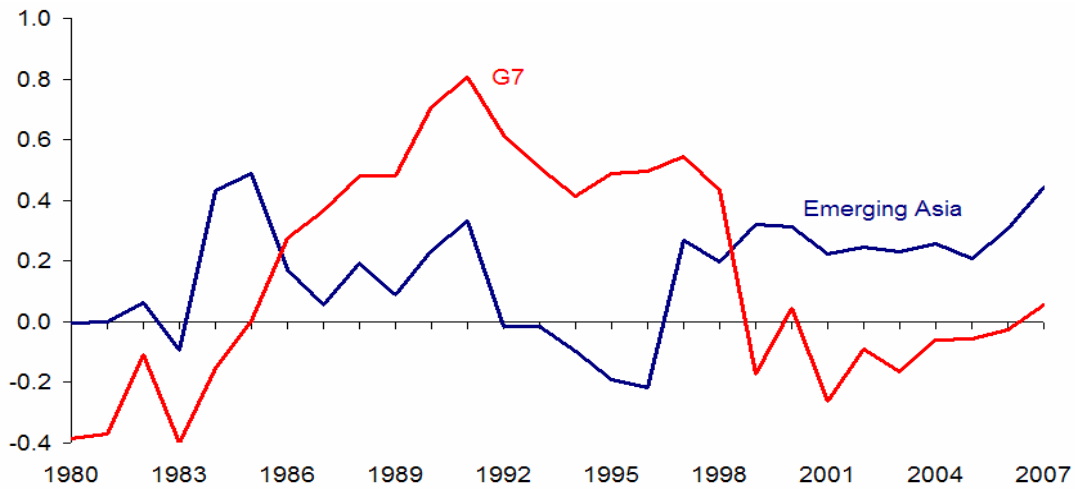
Note: Emerging Asia comprises China, People's Republic of China; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; and Thailand.
Sources: Bloomberg, CEIC, International Monetary Fund's (IMF) *International Financial Statistics Online*, and World Bank's *World Development Indicators* database.

Figure 17: Impulse Responses, the Model with Asian Aggregate (1990–1996)
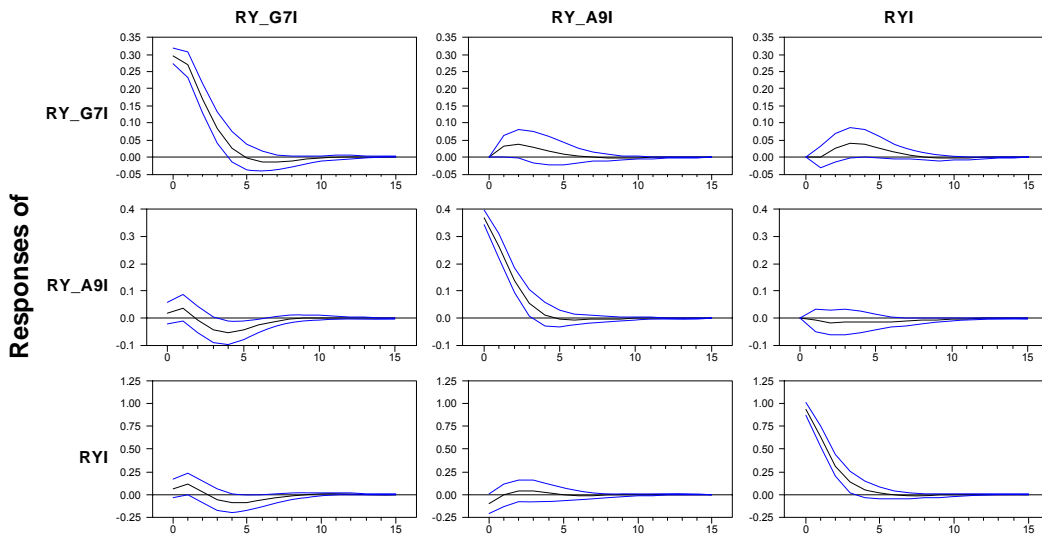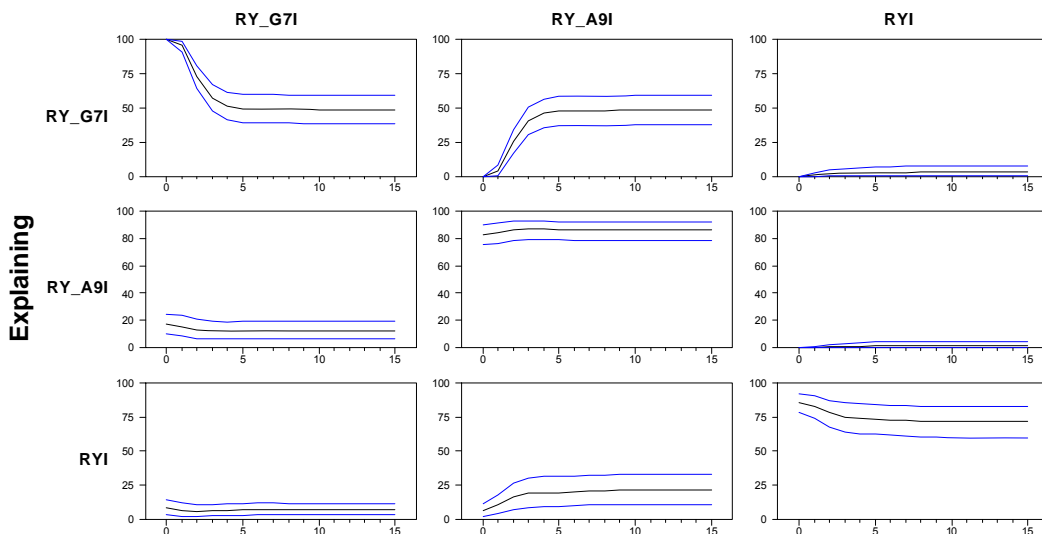

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

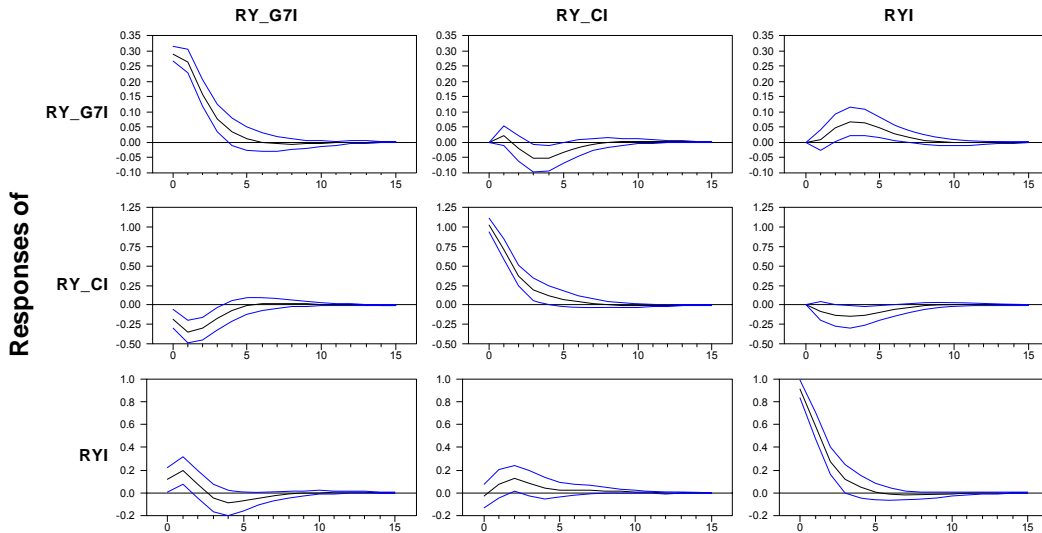**Figure 18: Impulse Responses, the Model with Asian Aggregate (2000–2H2007)**

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 19: Forecast Error Variance Decomposition, the Model with Asian Aggregate (1990–1996)
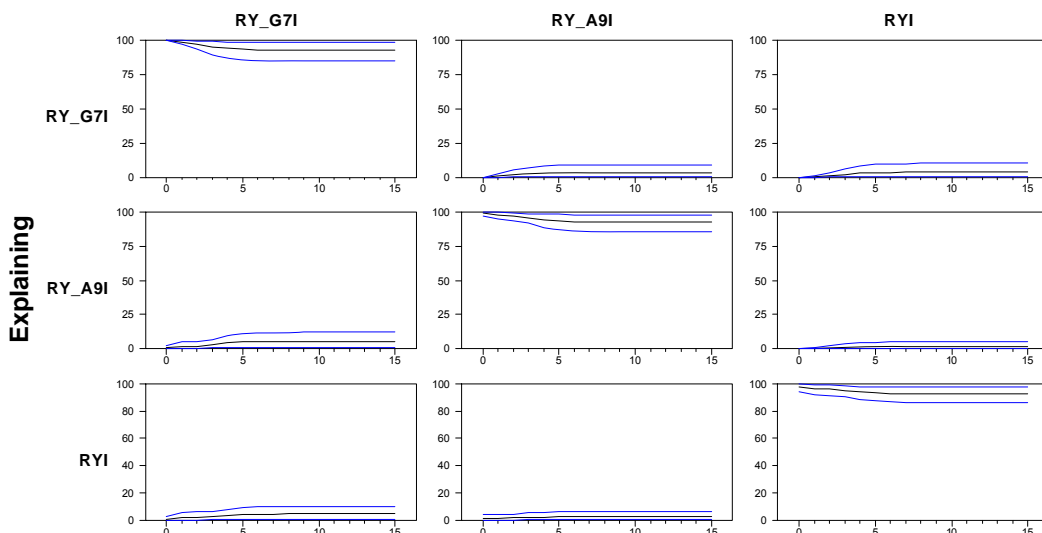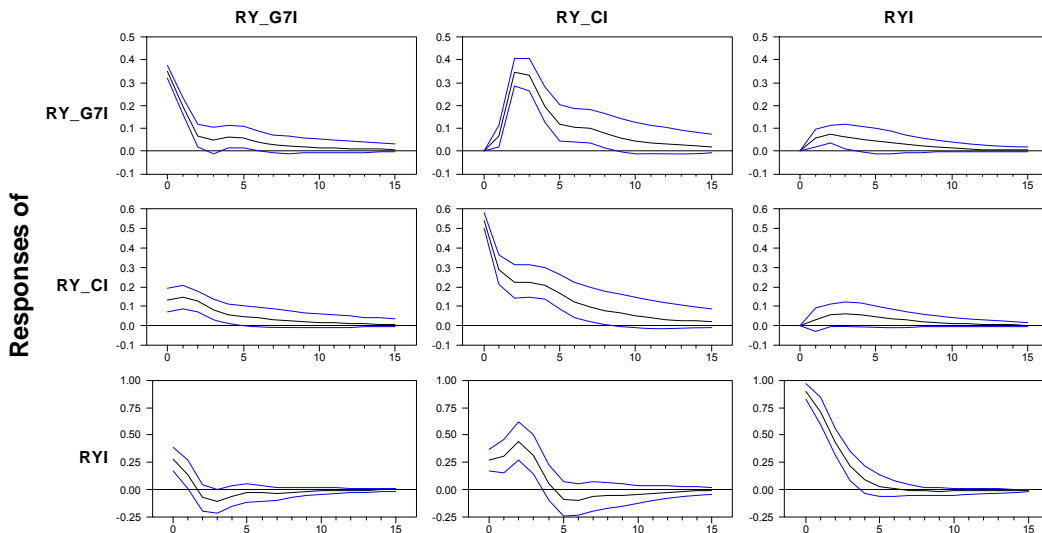

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 20: Forecast Error Variance Decomposition, the Model with Asian Aggregate (2000–2H2007)

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

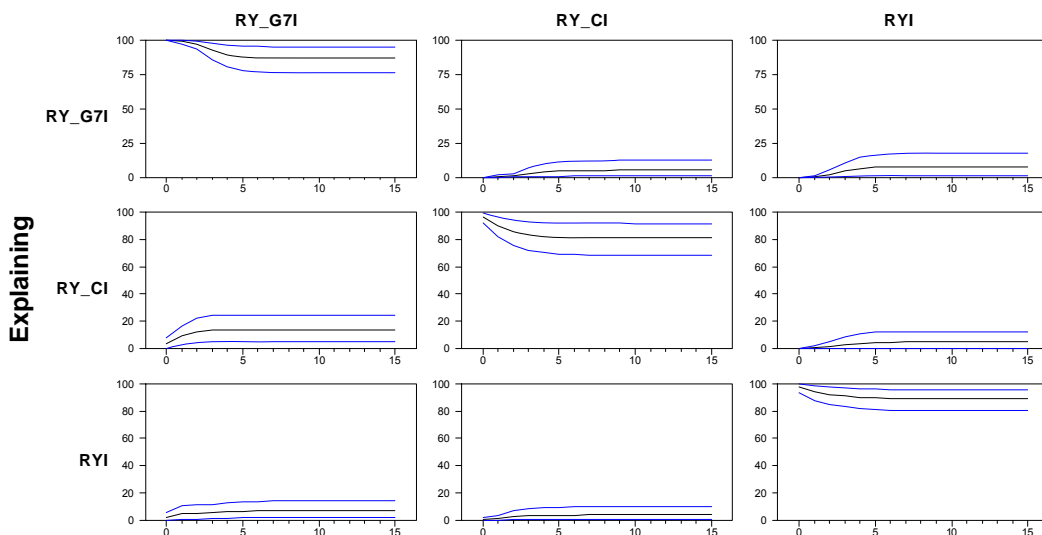**Figure 21: Impulse Responses, the Model with the PRC (1990–1996)**
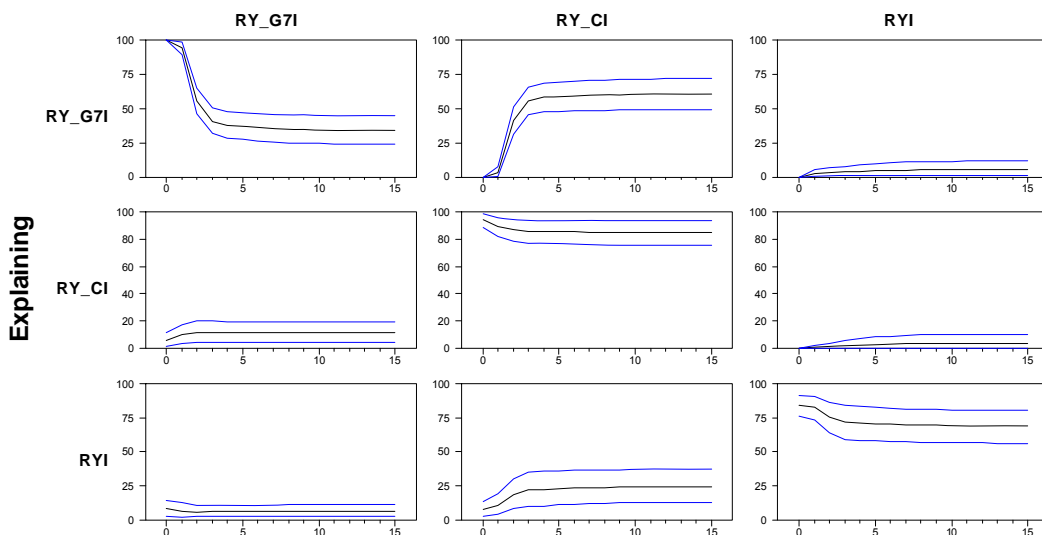

PRC = People's Republic of China
RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 22: Impulse Responses, the Model with the PRC (2000–2H2007)

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 23: Forecast Error Variance Decomposition, the Model with the PRC (1990–1996)
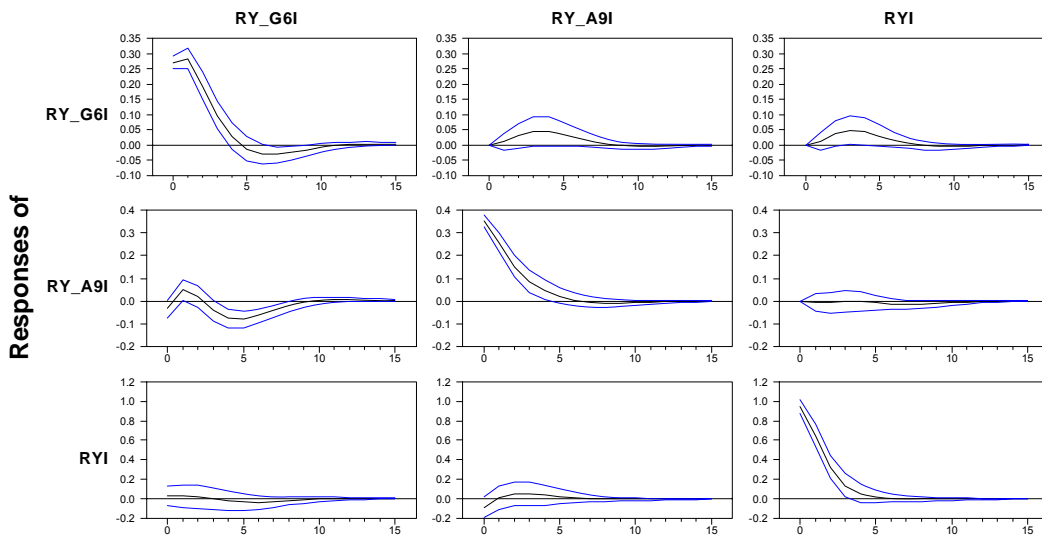

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 24: Forecast Error Variance Decomposition, the Model with the PRC (2000–2H2007)
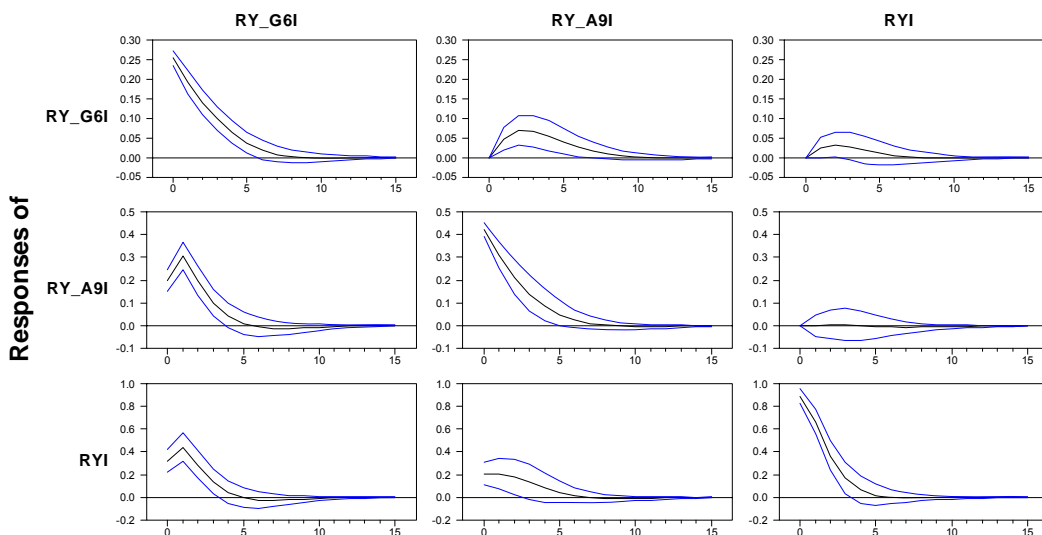

RY_G7I = aggregate output of G7 (Canada, France, Germany, Italy, Japan, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 25: Impulse Responses, the Model with Asian Aggregate and the G6 (1990–1996)
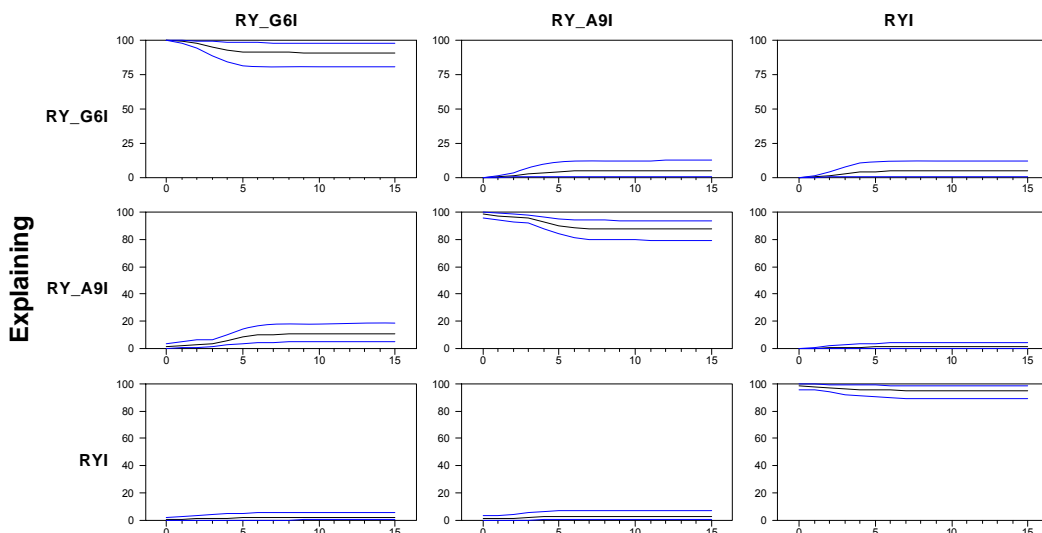

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 26: Impulse Responses, the Model with Asian Aggregate and the G6 (2000–2H2007)
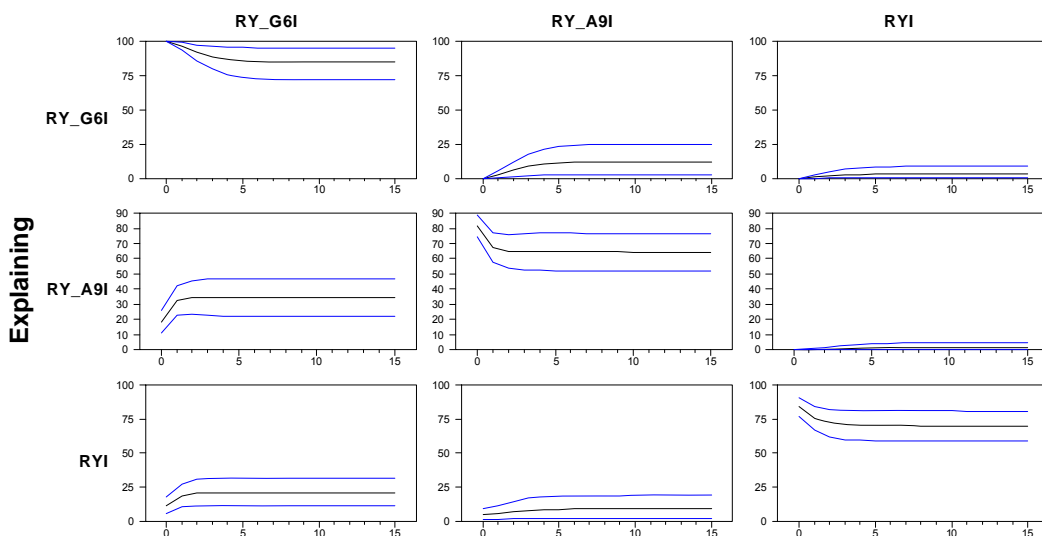

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 27: Forecast Error Variance Decomposition, the Model with Asian Aggregate and the G6 (1990–1996)

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 28: Forecast Error Variance Decomposition, the Model with Asian Aggregate and the G6 (2000–2H2007)
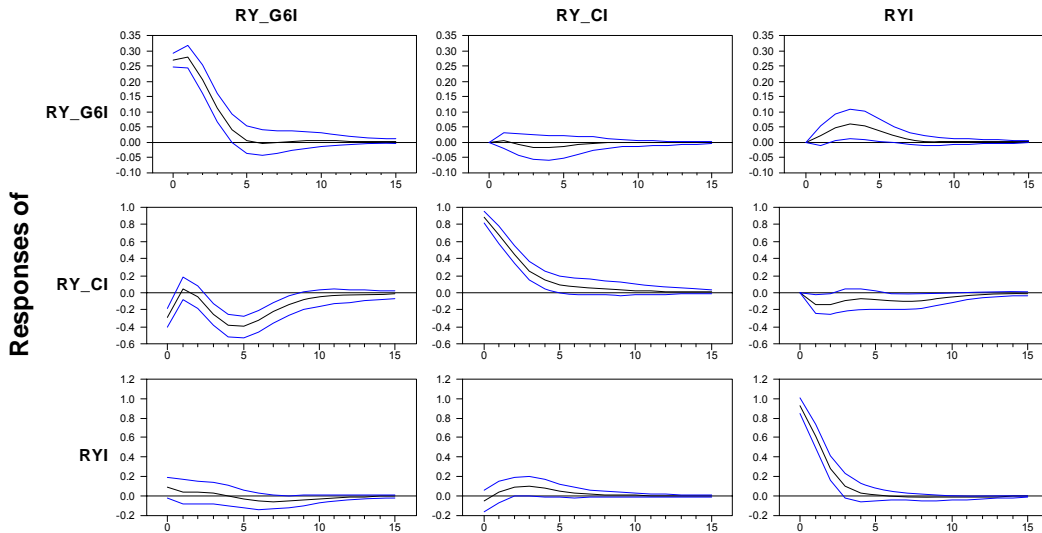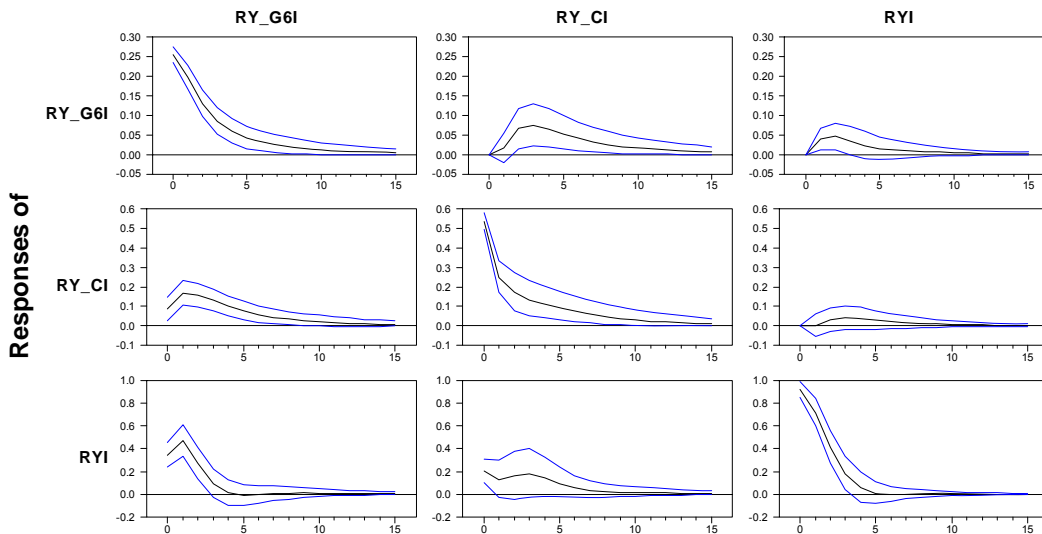

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_A9I = aggregate output of nine emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand); RYI = output of individual emerging Asian economies.

Figure 29: Impulse Responses, the Model with the PRC and the G6 (1990–1996)

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

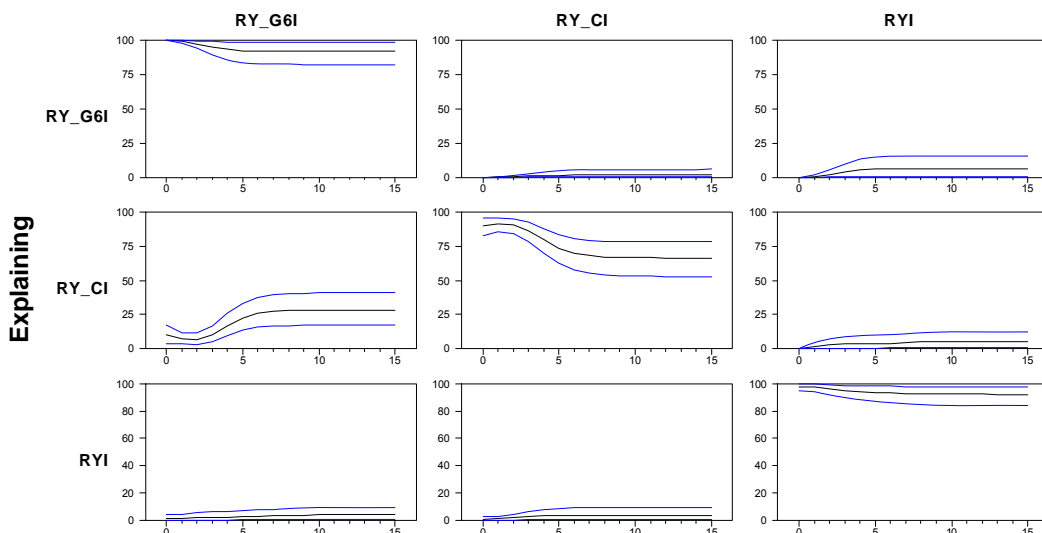**Figure 30: Impulse Responses, the Model with the PRC and the G6 (2000–2H2007)**

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 31: Forecast Error Variance Decomposition, the Model with the PRC and the G6 (1990–1996)

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Figure 32: Forecast Error Variance Decomposition, the Model with the PRC and the G6 (2000–2H2007)
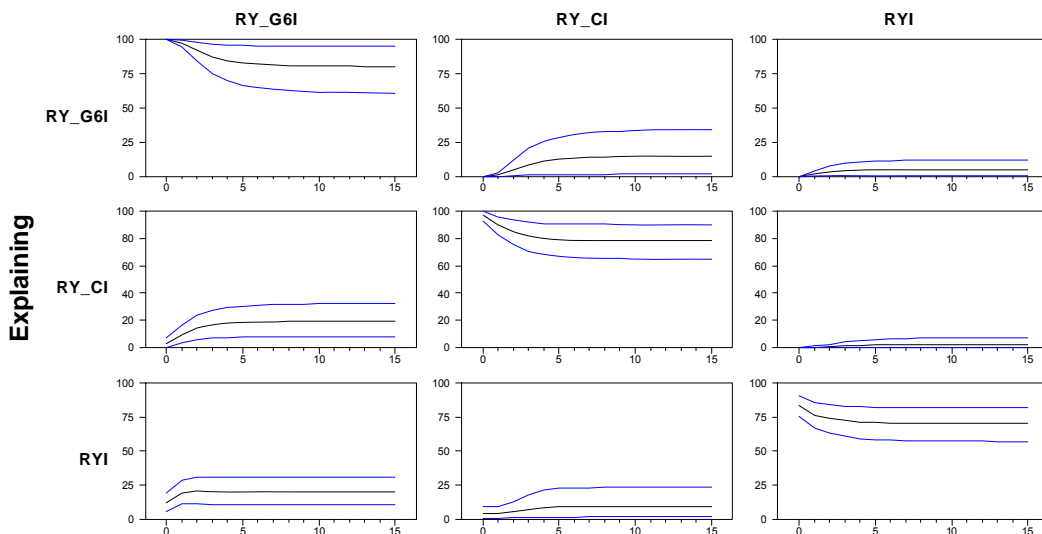

RY_G6I = aggregate output of G6 (Canada, France, Germany, Italy, United Kingdom, and United States); RY_CI = output of the PRC; RYI = output of individual emerging Asian economies (China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand).

Table 1: Intra-regional Business Cycle Correlations[1]

	Pre-crisis[2]	Post-crisis[3]
Asia	0.000	0.448
Asia excluding PRC[4]	0.007	0.446

Table 2: Inter-regional Business Cycle Correlations

	Pre-crisis	Post-crisis
Asia-G7	0.084	0.611
Asia-US	0.233	0.715
Asia-Japan	-0.618	0.647
Asia excluding PRC-G7	0.619	0.537
Asia excluding PRC-US	-0.345	0.724
Asia excluding PRC-Japan	0.033	0.659

Table 3: Business Cycle Correlations with the People's Republic of China

	Pre-crisis	Post-crisis
Asia excluding PRC	-0.379	0.549
G7	-0.304	0.580
US	0.490	0.517
Japan	-0.633	0.477

PRC = People's Republic of China, US = United States.

Note: Asia comprises China, People's Republic of; Hong Kong, China; Indonesia; Korea, Republic of; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.

[1] GDP cyclical component–calculated by applying the Hodrick-Prescott filter method on the natural log of real GDP in local currency–was used to compute the business cycle correlations.

[2] Pre-crisis period= 1990Q1–1996Q4.

[3] Post-crisis period= 2000Q1–2007Q2.

Source: Oxford Economics, *Quarterly Model,* August 2008.

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Emerging Asia: Decoupling or Recoupling

In this paper, Soyoung Kim, Jong-Wha Lee and Cyn-Young Park investigate the degree of real economic interdependence between emerging Asia and major industrial countries to shed light on the debate of "decoupling" in emerging Asia. They find real economic interdependence between emerging Asia and industrial countries increased significantly in the post-crisis period, suggesting recoupling rather than decoupling.

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