

Asian Trade and Global Linkages

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In the run-up to the 2008 global financial crisis, many thought that Asia would be exempt from economic shocks from Europe or North America. These arguments were largely based on the rapid expansion of intraregional trade in Asia. This paper examines the trade linkages among Asian countries and between Asia and other regions, paying particular attention to the role of production sharing processes diversified across geographically diffuse networks. Little or no evidence is found of Asia decoupling from the business cycles of the G-3 economies (United States, European Union, and Japan). Instead, there is a substantial linkage between growth in the G-3 and Asia, particularly since the 1997–1998 Asian financial crisis, because production networks in Asia expanded in response to G-3 demand for final products. The critical factor is the role of the People’s Republic of China as an assembly center in the vertical production integration.

I. INTRODUCTION

The current global economic crisis has many observers looking to Asia for a different pattern and magnitude of effects than in other regions. Asia’s reemergence, as manifested in its growing share of global economic power, has attracted attention to the possibility of the region decoupling from the fluctuations of business cycles in other parts of the world—particularly North America. An accompanying rising sense of self-reliance has been reinforced by the rise of intraregional trade within Asia’s export profile. At the same time, the region’s growing share of world trade, the importance of trade to Asia’s growth, and the close connection between globalization and the region’s participation in geographically fragmented production chains have strengthened trade links between developing Asia and the G-3 economies (United States, European Union, and Japan). The opposition of these two influences has called their relative balance into question.

This paper looks at ways in which Asia’s international trade linkages have changed in recent decades. It focuses first on the macroeconomic linkages where trade enters most economic models: primarily through a line or two in the balance of payments. It then explores changes in the

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microeconomic foundations of trading patterns to see how demand patterns, changes in product characteristics, transportation technology, and the general trading environment influence the transmission mechanisms through which macroeconomic trade linkages operate. Two particular factors with great importance for Asia—the resurgence of the People’s Republic of China (PRC), and production fragmentation—are then discussed in greater detail. Little or no evidence is found of Asia decoupling from G-3 business cycles. Instead, there is a substantial linkage between growth in the G-3 and Asia, particularly since the region’s 1997–1998 financial crisis, because production networks in Asia expanded in response to G-3 demand for final products. The critical factor is the role of the PRC as an assembly center in the vertical production integration.

II. MACROECONOMIC TRADE LINKAGES AND BUSINESS CYCLE SYNCHRONICITY

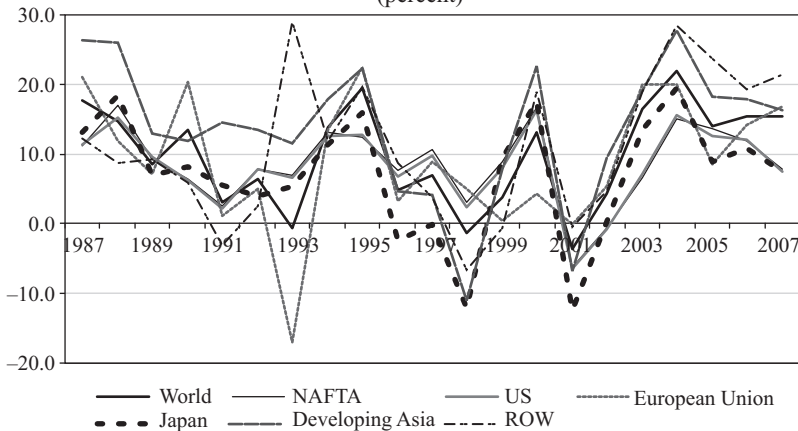
While trade can play a crucial role in linking economies and transmitting disturbances, the impact of trade linkages on the degree of business-cycle synchronization is ambiguous (Kose et al. 2003, Shin and Wang 2004, Baxter and Kouparitsas 2005, Rana 2007) and depends on characteristics of the trade. On one hand, specialization may mitigate co-movements between economies. When countries are more specialized in industries of their comparative advantage, higher trade openness may lead to decreased business-cycle correlation if shocks are sector-specific. On the other hand, trade may act as a conduit for the transmission of shocks that affect all industries, which, in turn, strengthens the links among economies and correlations among business cycles (Baxter and Kouparitsas 2005). Furthermore, intra-industry trade (vertical specialization) as a result of production sharing or outsourcing may increase international business cycle co-movements (Frankel and Rose 1998, Shin and Wang 2004, Burstein et al. 2008). Finally, trade spillovers across countries and resulting policy coordination or competition can cause business cycles across countries to move more or less closely.

A. Recent Trends of Aggregate Trade and Openness

Figure 1 shows the actual growth rates of trade in different regions in recent decades. World trade grew, on average, 9.9 percent annually, over three times the average annual growth of real gross domestic product (GDP) (around 3 percent). Of the regions included, developing Asia achieved the highest average annual growth rate, over 13 percent, while Japan had the

lowest, around 7 percent. During 1987–1993, the growth rate of world trade decreased, but then jumped to near 20 percent in 1995. As is clear in the figure, the 1997 Asian financial crisis strongly affected trade of Asian countries. Both Japan and developing Asia had negative growth rates of trade in 1998, around -12 percent and -11 percent, respectively. During 1996–1999, the average growth rates of trade were -1.3 percent and 1.4 percent for Japan and developing Asia, respectively, while the average growth rate for world trade was 3.5 percent. Subsequently, in 2001 the burst of the information technology bubble reduced trade in every region and world trade decreased by around 3.6 percent. However, the impact varied across different regions: Japan had the largest decrease, over 12.3 percent, while the European Union (EU) had the smallest drop, around 0.1 percent.

Figure 1. Trade Growth Rates, 1987–2007
(percent)



NAFTA = North American Free Trade Agreement; ROW = rest of the world;
US = United States.

Note: NAFTA includes US, Canada, and Mexico; European Union includes its 27 member countries; developing Asia includes 36 countries, i.e., developing Asia under the International Monetary Fund definition plus Kazakhstan, Kyrgyz Republic, Turkmenistan, and Uzbekistan.

Data source: International Monetary Fund. 2008. Direction of Trade Statistics online database.

Table 1 presents the correlation coefficients between trade changes in each region and the world average, and between trade changes in each region and United States (US) trade. During 1987–2007, the correlations between changes in trade in the EU and North American Free Trade Agreement (NAFTA) members and the world average were at or above 0.70. In the period from 2002 to 2007, the correlation between each region and the world average became very high, around 0.95 (except for the EU, where it was slightly lower). As for the correlations with changes in US trade, the EU had

the highest correlation coefficient (0.49) during 1987–2007. A sharp increase since 2002 is also evident in the correlations with US trade for all regions except for NAFTA and the EU.

Table 1. Correlations of Trade Growth Rates with World Average and the US

	World				
	1987–1991	1992–1996	1997–2001	2002–2007	1987–2007
US	0.98	0.73	0.66	0.93	0.69
NAFTA	0.98	0.60	0.70	0.96	0.70
European Union	0.98	0.87	0.96	0.87	0.76
Japan	0.78	0.75	0.66	0.98	0.57
Developing Asia	0.62	0.05	0.57	0.96	0.40
ROW	0.26	0.49	0.66	0.99	0.51
	US				
	1987–1991	1992–1996	1997–2001	2002–2007	1987–2007
US					
NAFTA	1.00	0.99	1.00	1.00	0.99
European Union	0.95	0.44	0.74	0.66	0.49
Japan	0.69	0.27	–0.13	0.96	–0.03
Developing Asia	0.54	0.08	–0.08	0.83	0.11
ROW	0.33	–0.01	0.16	0.96	0.26

NAFTA = North American Free Trade Agreement; ROW = rest of the world; US = United States.

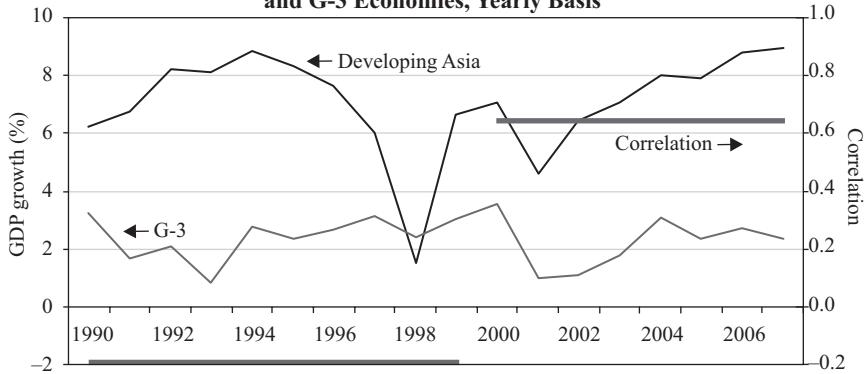
Source: International Monetary Fund 2008. Direction of Trade Statistics online database.

Using a standard model of international business cycles, Kose and Yi (2001 and 2006) showed that trade had a very small effect on overall GDP correlations between countries given the small shares of trade in GDP for most countries. But as a result of rapid growth in trade and slower growth for GDP during the past two decades, trade openness has increased globally, especially in developing Asia and the EU. This has led to expanded global economic interdependence and increased the possibility of synchronized business cycles across and within regions. For developing Asia, the total trade volume rose from around 46 percent of GDP in 1986 to 88 percent in 2006. The growing openness of Asian trade reflects increasing regional integration and expanding PRC trade.

Asian business cycles appeared to have experienced a decoupling from those of the G-3 during the rapid growth before the 1997–1998 Asian financial crisis, but cyclical co-movements between Asia and the G-3 have strengthened since the crisis. Decadal correlations between GDP growth in developing Asia and in the G-3 economies show increasing linkages. After maintaining a negative value throughout the 1990s, the correlation switched to positive 0.64 in the years 2000–2007 (Figure 2). The relationship grew even stronger in the first three quarters of 2008, when the correlation reached 1.0

(Figure 3). This implies that the business cycle of developing Asia is becoming more synchronized with that of the G-3 economies.

Figure 2. GDP Growth Rates and Correlation between Developing Asia and G-3 Economies, Yearly Basis

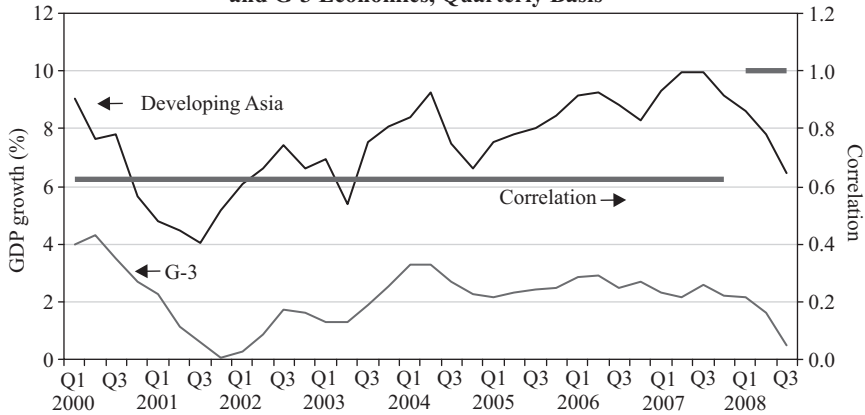


GDP = gross domestic product.

Note: Correlations: 1990–1999: -0.19; 2000–2007: 0.64.

Source: World Bank, *World Development Indicators* online database, downloaded 23 January 2009.

Figure 3. GDP Growth Rates and Correlation between Developing Asia and G-3 Economies, Quarterly Basis



GDP = gross domestic product.

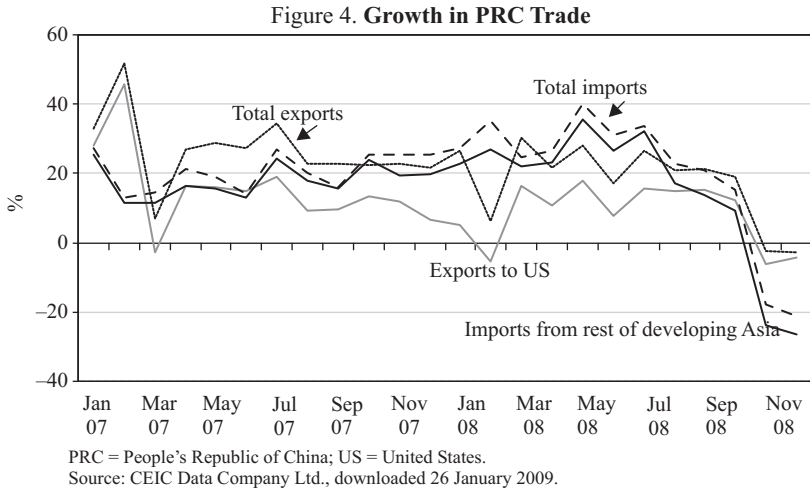
Note: Correlations: Q1 2000–Q4 2007: 0.62; Q1–Q3 2008: 1.00.

Sources: CEIC Data Company Ltd., downloaded 26 January 2009; World Bank, *World Development Indicators* online database, downloaded 23 January 2009.

Comparison of the periods before and after the 1997–1998 financial crisis reveals dramatic increases in the explanatory power and statistical significance of the direction of cyclical influence from G-3 to Asia. Movements in the G-3 cycle “Granger-cause” movements in the Asian business cycle at 2- and 3-year lags (but not the other way around) (ADB 2007). This suggests that Asian business cycles have become more responsive to the cyclicity of the G-3 in the postcrisis period.

Business cycle synchronicity among Asian economies has weakened in the postcrisis period. Between the PRC and the rest of Asia, however, clear evidence points to increasing business cycle synchronization. Between 2000 and 2007, as production networks proliferated across the region, exports of both the PRC and the rest of developing Asia to the G-3 economies began to move in tandem, implying that drivers of exports from the region are interrelated. Moneta and Ruffer (2006) also found evidence of increased synchronization within East Asia (except for the PRC and Japan), with the synchronization reflecting primarily export synchronization and common disturbances, including oil prices and the yen–dollar exchange rate.

In 2008, as the financial crisis worsened, regional exports to the G-3 economies, particularly to the US, began to significantly deteriorate. Coming off double-digit growth rates in most of the first 10 months of 2008, PRC exports to the US contracted in November and December (Figure 4). Singapore and Taipei, China have also been severely affected, with exports to the US either slowing or contracting since 2007, when the subprime crisis erupted. Just as intraregional trade within developing Asia was boosted in the past by vertical supply chains, these very same networks are responsible for the massive decline in intraregional trade in recent months. Across many regional economies, exports to the PRC have been weakening as well. In the last two months of 2008, when PRC exports to the US declined by about 5 percent, PRC imports from the rest of developing Asia declined by a heftier 25 percent (Figure 4).



B. Trade Balance

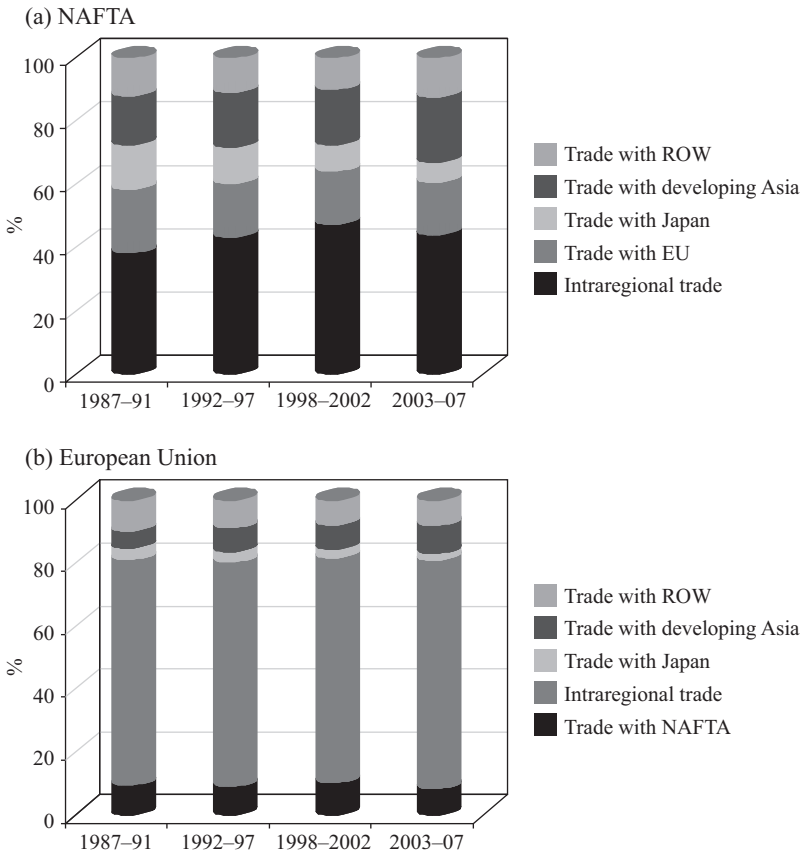
Given the weight of the US in world trade and the global economy, an important feature of past US recessions has been that US imports were strongly procyclical, reflecting the relatively high import share of cyclically sensitive components of domestic final demand such as consumer durables and investment goods. Not surprisingly, countries with the greatest export exposure to the US suffered the largest declines in output gaps (IMF 2007).

To explain the magnitude of the US current account deficit and patterns of global imbalance, Eichengreen (2006) identified four competing hypotheses: deficient US savings, the new economy view emphasizing the attractiveness of the US for investment, the global savings glut, and Sino-American codependency. Regardless of which cause accounts for the trade imbalance, it affects global linkages and business cycles through three major channels. First, trade (im)balances (or net exports) are a component of aggregate demand for domestically produced goods and therefore directly contribute to GDP growth. In this regard, fluctuations in trade imbalances clearly link economies. Second, trade (im)balances can affect capital flows through trade transactions and the expectation of exchange rate movements. A large trade surplus or deficit in a country may trigger the market to reassess that country's currency and form expectations of exchange rate appreciation or depreciation, in turn inducing short-term capital flows. Finally, trade imbalances can transmit macroeconomic policies from some countries—especially growth engines—to other countries.

C. Trade Intensity and Interdependence

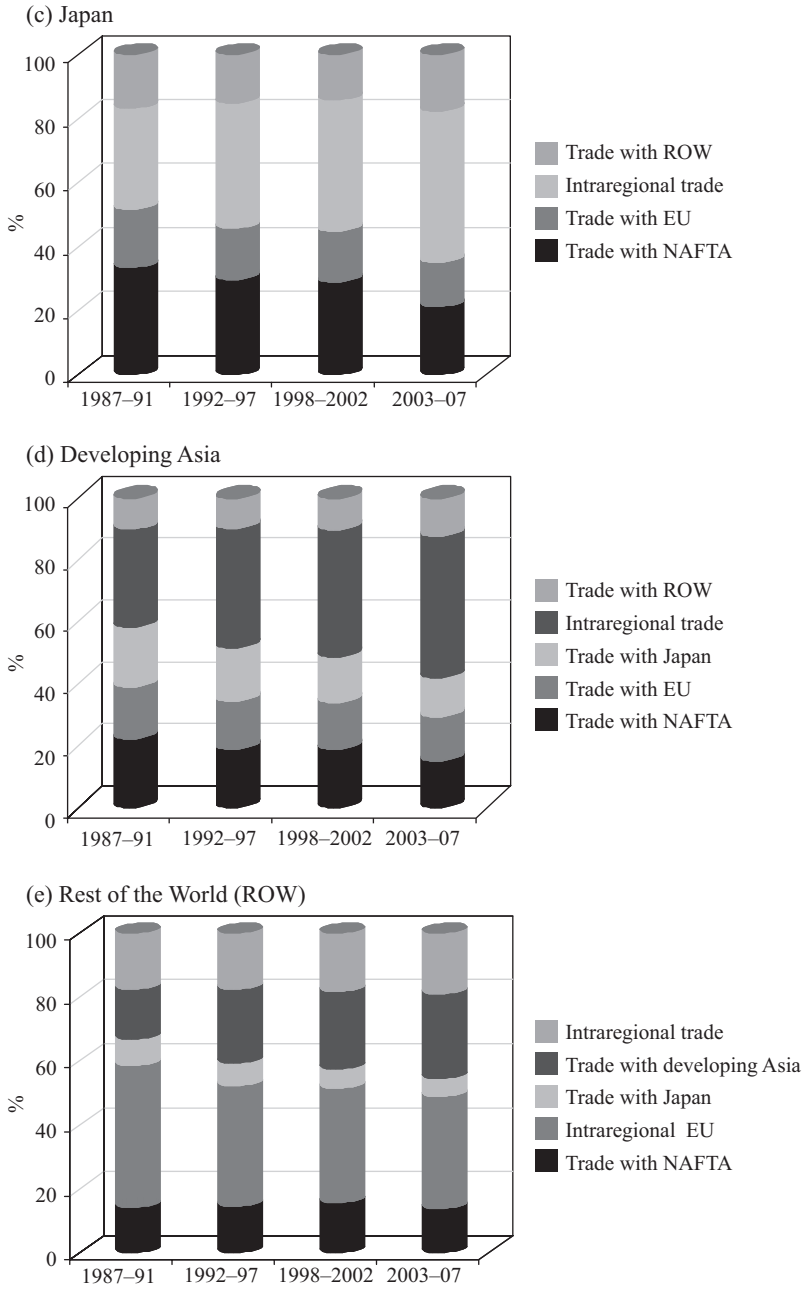
Figure 5 shows changes in trade patterns by destination during recent periods. A common trend is that intraregional trade has been increasing and has become the most important part in the total trade of each region depicted. Among all the regions, the share of intraregional trade in the EU has been the largest, above 70 percent of its total trade.

Figure 5. Trade Structure



Continued

Figure 5—Continued



EU = European Union; NAFTA = North American Free Trade Agreement; ROW = rest of the world.
 Note: Intraregional trade for Japan is the trade between Japan and Developing Asia.
 Data source: International Monetary Fund. 2008. Direction of Trade Statistics online database.

Shin (2008) examined how export and import intensities have evolved in Europe and East Asia. The results were similar for both European and East Asian economies; the results for most East Asian economies are shown in Table 2. The export intensity index also shows that intraregional trade occupied the highest share in the trade of all the East Asian economies shown. The intraregional trade share was around 60 percent for Hong Kong, China; Indonesia; Malaysia; Singapore; and Taipei, China, and still near 50 percent for PRC, Japan, and Republic of Korea in the 2003–2006 period.

To a large extent, the increased intraregional trade is due to regional production chain fragmentation, especially in East Asia. Table 3 shows trade structure in machinery and transport equipment and suggests that trade in parts and components (either exports or imports) occupies almost half of total trade in many regions. From a dynamic viewpoint, developing East Asia and the ASEAN Free Trade Area (AFTA) achieved fast growth in the share of parts and components in total trade during the period from 1989/1990 to 2005/2006. The share of parts and components in total exports increased by 4.3 percentage points in developing East Asia and 11.7 percentage points in AFTA. In terms of imports, developing East Asia, especially the PRC, has dramatically increased its share of parts and components.

Regional trade integration need not take place at the cost of extraregional trade. Most emerging economies still depend largely on the industrial countries, especially the US, for final demand. Around 61 percent of total Asian exports are eventually consumed in US, Japan, and EU and intraregional trade dynamics are tightly associated with the US non-oil import cycle (ADB 2007). The IMF (2007) found that if a country's total trade with the US rises by 10 percentage points of GDP, then the impact of a 1 percentage point increase in US growth on domestic growth rises by about 0.1 percentage point. There is also some evidence that the magnitude of spillovers from US growth is significantly larger in countries that are more financially integrated with the US. Spillovers have become larger with increased trade and financial integration, and while developing Asia is affected significantly by US growth, it is (perhaps surprisingly) not so influenced by growth in Japan.

Table 2. Trade Intensity of East Asian Economies

Economy	Period	Trade (Export) Integration with			Trade (Import) Integration with		
		US	EU	EA	US	EU	EA
China, People's Republic of	1	0.14	0.11	0.60	0.12	0.15	0.46
	2	0.21	0.14	0.47	0.10	0.14	0.44
	3	0.21	0.16	0.49	0.08	0.11	0.47
Hong Kong, China	1	0.23	0.15	0.46	0.08	0.10	0.79
	2	0.23	0.13	0.50	0.07	0.08	0.85
	3	0.17	0.12	0.58	0.05	0.07	0.85
Indonesia	1	0.14	0.13	0.61	0.12	0.20	0.48
	2	0.14	0.13	0.57	0.10	0.13	0.51
	3	0.12	0.11	0.60	0.06	0.09	0.59
Japan	1	0.29	0.17	0.37	0.23	0.14	0.31
	2	0.30	0.15	0.40	0.19	0.13	0.39
	3	0.23	0.13	0.46	0.14	0.11	0.42
Korea, Republic of	1	0.22	0.12	0.40	0.22	0.13	0.38
	2	0.21	0.13	0.44	0.18	0.10	0.42
	3	0.16	0.13	0.48	0.12	0.10	0.46
Malaysia	1	0.19	0.14	0.56	0.16	0.14	0.57
	2	0.21	0.13	0.54	0.17	0.11	0.59
	3	0.19	0.11	0.54	0.14	0.11	0.61
Philippines	1	0.37	0.17	0.38	0.19	0.10	0.49
	2	0.28	0.18	0.50	0.20	0.08	0.57
	3	0.19	0.16	0.61	0.19	0.08	0.59
Singapore	1	0.20	0.14	0.47	0.16	0.13	0.54
	2	0.17	0.13	0.57	0.16	0.11	0.55
	3	0.11	0.11	0.58	0.12	0.11	0.50
Taipei, China	1	0.27	0.14	0.44	0.22	0.12	0.47
	2	0.23	0.14	0.51	0.18	0.10	0.54
	3	0.16	0.11	0.61	0.12	0.08	0.55
Thailand	1	0.21	0.29	0.43	0.11	0.14	0.53
	2	0.21	0.21	0.46	0.11	0.11	0.53
	3	0.16	0.15	0.49	0.08	0.09	0.55
EA Average	1	0.23	0.16	0.47	0.16	0.13	0.50
	2	0.22	0.15	0.49	0.15	0.11	0.54
	3	0.17	0.13	0.54	0.11	0.10	0.56
EA Weighted Average	1	0.24	0.15	0.44	0.17	0.13	0.48
	2	0.23	0.14	0.47	0.15	0.11	0.52
	3	0.19	0.13	0.50	0.10	0.10	0.53

EA = East Asia; EU = European Union; US = United States.

Note: Period 1: 1990:I–1996:IV; Period 2: 1999:I–2002:IV; Period 3: 2003:I–2006:IV.

Source: Shin (2008).

Table 3. World Trade in Machinery and Transport Equipment
(1989/1990 and 2005/2006)

	Regional/Country Composition (%)						Share of Parts and Components in Total Trade (%)	
	Total Trade		Parts and Components		Final Goods			
	1989/1990	2005/2006	1989/1990	2005/2006	1989/1990	2005/2006	1989/1990	2005/2006
Exports								
NAFTA	22.4	18.1	24.5	19.7	21.0	16.7	44.9	48.4
EU-15	35.3	35.4	32.5	31.1	37.3	38.9	37.9	38.9
Japan	19.1	11.4	17.8	11.3	19.9	11.5	38.5	43.9
Developing East Asia	15.4	26.1	16.5	28.4	14.7	24.2	43.9	48.2
Korea, Republic of	2.4	4.3	2.9	4.1	2.1	4.4	49.0	42.8
Taipei, China	3.3	3.8	3.6	5.4	3.1	2.5	45.0	63.8
China, People's Republic of	2.3	9.3	1.4	7.3	3.0	10.9	24.5	34.8
Hong Kong, China	1.0	0.7	1.4	1.0	0.8	0.5	55.6	60.4
AFTA-6	6.3	8.0	7.2	10.5	5.7	6.0	46.7	58.4
South Asia	0.1	0.2	0.1	0.3	0.1	0.2	49.5	53.0
World (%)	100	100	100	100	100	100	41.1	44.3
(US\$ billion)	1,379	3,110	567	1,378	812	1,732		
Imports								
NAFTA	27.2	25.2	28.2	22.3	26.5	27.5	42.6	39.2
EU-15	33.7	35.4	33.1	32.0	34.2	38.2	40.4	40.0
Japan	3.4	3.7	3.5	4.2	3.3	3.3	42.0	49.9
Developing East Asia	21.3	22.6	24.0	32.4	19.3	14.8	46.5	63.5
Korea, Republic of	2.4	2.2	2.9	3.0	2.0	1.6	49.5	59.7
Taipei, China	2.4	2.0	3.2	2.8	1.8	1.4	55.3	62.1
China, People's Republic of	3.5	7.2	2.5	9.8	4.2	5.1	29.0	60.4
Hong Kong, China	3.9	4.0	3.8	5.7	3.9	2.7	40.3	62.5
AFTA-6	9.2	7.2	11.7	11.2	7.4	4.0	52.6	68.8
South Asia	0.5	0.8	0.6	0.6	0.4	0.9	47.2	36.0
World (%)	100	100	100	100	100	100	41.1	44.3
(US\$ billion)	1,379	3,110	567	1,378	812	1,732		

AFTA = ASEAN Free Trade Area; ASEAN = Association of Southeast Asian Nations; EU = European Union; NAFTA = North American Free Trade Agreement; US = United States.

Note: AFTA-6 includes Indonesia, Malaysia, Philippines, Singapore, Thailand, and Viet Nam.

Source: Compiled from UN Comtrade database by Athukorala and Hill (2008).

Shin (2008) also showed that the two largest economies in East Asia (Japan and the PRC) depend heavily on the US as an export market, for 23.3 percent and 21.2 percent of their exports, respectively. Overall, Asia's reliance on external demand remains strong. The export-to-GDP ratio has continued to trend upward, reaching nearly 55 percent of GDP in 2005 compared with the world average of 29 percent, and the incremental export-to-GDP ratio has also been on an upward trend. Although the share of G-3 markets in Asia's total exports is on a decline, the relationship in growth rates rather than levels has strengthened over time. Thus, the dependence of Asian production on overseas markets strengthened rather than weakened.

Although production sharing arrangements across Asia have given a strong impetus to regional integration since the 1990s (see below), such integration is structurally linked to the business networks of multinational corporations (MNCs). Decomposition of changes in trade shows that more than 70 percent of intra-Asian trade consists of intermediate goods used in production, and of this, half is driven by final demand outside Asia. Consequently, about 61 percent of total Asian exports (instead of 43 percent of total exports as indicated by the more aggregated data) is eventually consumed in G-3 countries (ADB 2007).

III. ASIA'S TRADE AND THE SIGNIFICANCE OF THE PEOPLE'S REPUBLIC OF CHINA

This section first examines changes in the direction of trade flows and then turns to factors influencing their composition, which influence economic linkages. Asia's trade volumes have been growing rapidly, and PRC's export and import growth rates are particularly striking (Table 4). The PRC's exports grew over 20 percent per year on average from 1987 to 2007, while 9 of the 10 largest Asian exporters experienced double-digit export growth rates. Similarly, growth in PRC imports averaged over 18 percent per year and 8 of the 10 economies showed double-digit import growth rates. In those 2 decades Indian trade increased 17 times, and PRC trade increased over 30 times—with PRC becoming the largest trader in Asia. The other leading Asian exporters also increased trade at rates well above the annual averages of 6.0 percent and 2.7 percent for global trade and GDP growth, respectively.

Table 4. **Trade Growth in 1987–2007**
(US\$ billion at 2000 constant price unless specified)

Economies	Exports			Imports			Export Share to PRC (2007, %)	Annual Growth in Exports to	
	1987	2007	Annualized Growth Rate (%)	1987	2007	Annualized Growth Rate (%)		PRC %	World Less PRC %
China, People's Rep. of	33.3	1,464.0	20.8	37.2	1,109.7	18.5			
Japan	297.4	739.9	4.7	172.8	898.6	8.6	15.3	12.5	4.0
Hong Kong, China	40.9	420.0	12.3	41.7	429.6	12.4	48.3	16.5	10.2
Taipei,China	83.3	361.1	10.3	79.9	262.3	8.3	33.6	22.8	7.8
Korea, Rep. of	51.6	289.5	10.1	27.9	421.6	16.3	22.1	25.3	8.7
Singapore	35.2	272.8	10.8	30.4	283.9	11.8	9.7	18.4	10.4
Malaysia	15.1	211.8	14.1	10.9	170.5	14.7	8.8	24.4	13.7
Thailand	9.8	184.6	15.8	11.2	166.9	14.5	9.7	22.1	15.4
India	10.2	175.4	15.3	14.8	253.8	15.3	6.5	40.7	14.9
Indonesia	14.5	137.2	11.9	10.6	86.4	11.0	8.5	20.3	11.5

PRC = People's Republic of China.

Note: For Republic of Korea, first year data is 1989. For Taipei,China, first year data is 1992.

Source: UN Comtrade database.

The importance of the PRC in regional trade may be most easily seen by comparing Asian trade with and without it. The far right columns of Table 4 report the share of the PRC in exports for each economy in 2007, as well as the growth in exports to the PRC and to the rest of the world. While the PRC is the destination for less than 10 percent of exports from the less developed economies, it accepts much more from the developed economies—over 15 percent of Japan's exports, 22 percent for Republic of Korea, over a third for Taipei,China, and almost half for Hong Kong, China. Note that the export values from the more developed Asian economies are also larger, so these are larger shares of larger export flows. Even so, they grew very rapidly, with annual growth even above 25 percent for the Republic of Korea. Asia's trade with the PRC is thus important at the aggregate level although its importance varies by country.

Roughly a quarter of world trade takes place between countries sharing a common border and half of world trade occurs between partners less than 3,000 kilometers apart (Berthelon and Freund 2004). Table 5 presents the export value and shares of intraregional and extraregional trade for East Asia and regional trade agreements in other regions. The EU and NAFTA experienced slightly lower growth rates (6.1 percent and 6.9 percent, respectively) than the annual growth rate (7.7 percent) of world exports from 1990 to 2005. All regions in the table experienced an increasing dependence

Table 5. **Intraregional Trade of Major Regions in 1990–2005**

Group	Total Exports (US\$ billion)				Share of Regional Exports to World (%)				World Market Share Change (%)	Annual Growth Rate (%)
	1990	1995	2000	2005	1990	1995	2000	2005	1990–2005	1990–2005
East Asia (16) to World	704.7	1313.3	1,673.1	2,731.5	100.0	100.0	100.0	100.0	5.9	9.5
Intraregional Trade	284.0	646.2	797.8	1389.5	40.3	49.2	47.7	50.9	5.3	11.2
Extraregional Trade	420.7	667.1	875.3	1342.0	59.7	50.8	52.3	49.1	0.6	8.0
EU (15) to World	1,476.8	2,010.3	2,196.2	3,585.5	100.0	100.0	100.0	100.0	–9.4	6.1
Intraregional Trade	972.6	1,247.5	1,342.7	2,140.8	65.9	62.1	61.1	59.7	–8.4	5.4
Extraregional Trade	504.2	762.7	853.5	1,444.7	34.1	37.9	38.9	40.3	–1.0	7.3
NAFTA (3) to World	546.1	853.6	1,223.6	1,478.7	100.0	100.0	100.0	100.0	–1.9	6.9
Intraregional Trade	225.8	392.9	681.6	824.4	41.3	46	55.7	55.8	1.4	9.0
Extraregional Trade	320.4	460.7	542.1	654.3	58.7	54	44.3	44.2	–3.3	4.9
MERCOSUR (4) to World	46.4	70.5	84.8	161.3	100.0	100.0	100.0	100.0	0.2	8.7
Intraregional Trade	4.1	14.5	17.7	21.1	8.9	20.5	20.9	13.1	0.1	11.5
Extraregional Trade	42.3	56.0	67.0	140.2	91.1	79.5	79.1	86.9	0.1	8.3
ASEAN (10) to World	141.3	311.3	420.9	607.6	100.0	100.0	100.0	100.0	1.8	10.2
Intraregional Trade	26.8	77.4	96.7	155.6	19.0	24.9	23.0	25.6	0.7	12.4
Extraregional Trade	114.5	234.0	324.2	452.0	81.0	75.1	77.0	74.4	1.0	9.6
WORLD EXPORTS	3,224.8	4,853.9	6,233.1	9,859.0	—	—	—	—	—	7.7

— means data not available.

ASEAN = Association of Southeast Asian Nations; EU = European Union; MERCOSUR = Common Market of the South; NAFTA = North American Free Trade Agreement;

UN = United Nations; US = United States.

Note: East Asia (16) is Brunei Darussalam; Cambodia; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Lao People's Democratic Republic; Malaysia; Mongolia; Myanmar; Philippines; Singapore; Taipei, China; Thailand; and Viet Nam.

Source: Calculated from UN Comtrade data (S2, items-total).

on intraregional trade except the EU-15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom), which saw a slight decline in the share of intraregional trade in its total exports.¹

Intraregional trade in East Asia accounted for 50.9 percent of its exports in 2005, and increased more rapidly than extraregional trade. Its annual growth rate from 1990 to 2005 was 11.2 percent versus 8.0 percent for extraregional trade. The growth rate for intraregional trade in East Asia also far exceeded growth of intraregional trade for NAFTA (9.0 percent), EU-15 (5.4 percent), and was close to that of MERCOSUR (11.5 percent).

Focusing on Asia's manufacturing trade, however, the intraregional share of final manufacturing exports in developing Asia actually *declined* from 35.8 percent to 31.8 percent between 1992/1993 and 2005/2006 (Athukorala 2008). This decline was driven by the PRC, whose intraregional export share declined sharply from 42.9 percent to 25.8 percent in this period, reflecting its rising role as a final goods assembler for extraregional markets. Most other Asian countries exhibit a mild increase in intraregional trade, but still rely on extraregional markets for more than 50 percent of their final manufacturing exports. While the difference between intraregional shares of total trade and final goods trade is observable for both exports and imports, the magnitude of the difference is much larger on the export side. The difference in magnitude between regional trade shares estimated in gross and net terms is much larger for countries in Southeast Asia than for the entire region. Unlike in East Asia (or developing East Asia and AFTA), intraregional trade shares for NAFTA, EU, and the other regional groupings are remarkably resilient to including or excluding trade in components.

Estimates for different developing Asian subregions show that intraregional trade within Southeast Asia (ASEAN) is rather low compared to the average figure for broader Asia (including or excluding Japan). In 2005/2006, of total manufacturing exports of Association of Southeast Asian Nations (ASEAN) members only 19.4 percent were to markets in the subregion. The comparable figure for imports was 28.5 percent. Among the six major ASEAN countries, Viet Nam has the lowest intraregional trade share. Even the three newer ASEAN member countries (Myanmar, Cambodia, and Lao People's Democratic Republic), appear to rely heavily on extraregional markets for both export and import trade, despite their strong cross-border trade flows with Thailand. In 2005/2006, trade within ASEAN

¹MERCOSUR also saw a decline in its intraregional share during 2000–2005.

accounted for only 26.7 percent and 37.2 percent of their total non-oil exports and imports, respectively.²

A comparison of intraregional import and export shares reveals a startling asymmetry in the degree of measured trade integration among developing Asian countries. Unlike in the EU and NAFTA, in East Asia the increase over time in the intraregional trade ratio has resulted largely from the rapid increase in intraregional imports; intraregional export expansion has lagged consistently behind (Athukorala 2008). In 2005/2006 intraregional import flows amounted to 58.6 percent of total manufacturing imports of developing Asia, up from 41.5 percent in 1992/1993. The intraregional share in total regional exports was, however, significantly lower, 37.7 percent in 1992/1993 and 40.0 percent in 2005/2006. In other words, the region is much more heavily dependent on extraregional trade for its growth dynamism than is suggested by the total regional trade share, and this dependence has stayed the same for the last decade. The magnitude of this asymmetry remains virtually unchanged when parts and components are removed from total trade. In other words, the widely reported aggregate (export plus import) intraregional trade shares deflect attention from the continuing importance of extraregional trade for growth dynamism in East Asia.

These macroeconomic studies indicate that East Asia depends on the US and European markets, especially through the PRC as a base for assembling intermediate goods from the rest of East Asia. In short, regionalization of economic activities has gained strong momentum through progress in sharing production processes across the region. Increased vertical specialization and the rise in intra-industry trade have led to strong ties among many regional economies, but this regional integration remains structurally linked to final demand from major industrialized countries.

A. Recent Patterns in Asia's Trade Characteristics

Key characteristics of Asia's trade are changing over time, with implications for the strength of shock transmission and the mechanisms through which that transmission operates. Notable among these characteristics are the trade content, costs (as influenced by length in time, distance, and their interaction), and reliability of delivery. The role of production fragmentation and the significance of the PRC in this process have important implications.

Closely related to changes in the composition of trade have been changes in transportation technology, most notably in air freight and

²Unofficial trade between neighboring countries may equal or exceed official trade, particularly between developing countries.

containerization. Multimodal shipping and improvements in logistics services have facilitated trade expansion to more destinations in less time, often at lower monetary cost (Brooks and Hummels 2009). Hummels (2007) estimated that increasing the share of trade that is containerized lowers shipping costs from 3 to 13 percent. However, these savings were outweighed in the 1970s by sharp increases in fuel and port costs, and again in recent years by increasing fuel costs and port congestion in countries with rapidly growing trade volumes.

Following changes in technology, production, and consumption, the balance of trade between merchandise and services is shifting. More generally, the weight-to-value ratio of trade is declining, both within merchandise trade and in trade more generally. The telecommunications and Internet revolution has led to growing trade in information and communications technology, in services outsourcing, and in migration of highly skilled professionals. The declining weight-to-value-of-trade ratio is a primary factor influencing transport modal choice, length and destination of trade flows, and production processes.

B. Distance and Destination

For air shipping, advances in technology have propelled a sharp decline in costs: average revenue per ton-kilometer shipped dropped by a factor of 10 between 1955 and 2004 (Hummels 2007). As the level of air transport costs drops relative to the level of ocean transport, long distance trade becomes relatively more attractive, and diversification of export destinations becomes broader. As the weight-to-value ratio of traded goods becomes lower, and similarly for the ad valorem share of trade costs in delivered goods prices, this pattern is reinforced.

Asia's trade is expanding at both the extensive and intensive margins. Consider PRC exports, where the number of shipments and mean shipment size are growing rapidly, as are ninetieth percentile shipments, but median shipment sizes are falling. While the PRC has experienced tremendous growth in new shipments, individually these shipments tend to be very small. At the same time, established flows that were already sizeable in 1995 have grown larger still, increasing the mean shipment size. The pattern across other countries is similar—median shipment sizes are falling while mean shipment sizes are rising (or in some cases, both are falling but medians are falling faster) (Hummels 2009). Diversification is rising at the extensive margin, but fragility to shocks is not necessarily declining due to the growth at the intensive margin.

Still, the development of new, small trade flows is encouraging. Besedes and Prusa (2003 and 2004) used survival analysis to show that new trade flows suffer high failure rates, but those that do survive go on to increasing trade shares.

C. Production Fragmentation

As discussed above, greater trade is positively correlated with greater synchronization of business cycles. But when trade is indirect, involving multiple countries in the production of a final good, the relationship becomes more complex. Recent decades have seen rapid growth in international vertical specialization, a process by which firms separate the stages of production (research and development, component production, assembly) across countries according to comparative advantage. This production sharing accounts for more than one third of world export growth between 1970 and 1995 (Hummels et al. 2001) and may deepen the linkages between economies.

In an examination of US–Mexico trade involving maquiladora production fragmentation, Burstein et al. (2008) focused on manufacturing industries, which have higher trade shares, and showed that increasing trade has a bigger impact on GDP correlations in the presence of production sharing trade. They found business cycles to be more synchronized between pairs of countries with a higher share of international trade in inputs utilized in the production of vertically integrated goods, than between pairs of countries where trade is dominated by inputs used to produce horizontally differentiated goods. They interpreted the difference between these two correlations as evidence that firms engaging in production sharing exhibit a lower elasticity of substitution between home and foreign inputs relative to other firms. This complementarity in the production of the vertically integrated good dampens substitution effects stemming from aggregate shocks to relative costs across countries.

Trade-related quantity effects are accompanied by changes in relative prices, but as might be expected, the effects are not symmetric. Bergin et al. (2007) demonstrated the higher volatility of production sharing industries in host, relative to source, economies.

Developing Asia's rapid growth of intraregional trade over the past decade or so, driven largely by trade in parts and components within regional production networks, takes place mostly among the high-performing economies in the region (and feeds back into that high performance), with much of it linked to the PRC (Athukorala 2008).

For all East Asian countries, the shares of components in intraregional exports and imports have increased at a much faster rate than in extraregional exports and imports. These patterns are in sharp contrast to those observed for NAFTA and the EU-15 (as well as total global trade). In both those regions, the shares of intraregional trade in total manufacturing trade (on both the export and import sides) and in component trade imports remain broadly similar in magnitude.

Athukorala (2008) demonstrated East Asia's heavy reliance on international exchange based on production fragmentation. In 2005/2006, intraregional exports accounted for 40 percent of total manufacturing exports. The comparable figure for intraregional component exports was 60 percent of total component exports. The intraregional share in component imports is even larger. These component import and export shares are much higher than those in NAFTA and the EU-15 (as well as in overall global trade). Moreover, the intraregional shares in total component imports and exports grew faster between 1992/1993 and 2005/2006 than those in total imports and exports. The increase in component intensity has been particularly noticeable in Southeast Asia's trade with the other developing East Asian economies, the PRC in particular. The Republic of Korea and Taipei, China are also involved in sizable cross-border trade with other countries in the region.

Kimura et al. (2007) found that geographical distance penalizes machinery parts and components trade much less in East Asia than in Europe. This implies that service link costs for fragmentation are substantially lower in East Asia than in Europe, contributing to large differences between the two regions in the development of international production and distribution networks, and differences in the transmission of business cycle influences.

IV. IMPLICATIONS OF TRADE DEVELOPMENTS FOR FUTURE LINKAGES

Countries that engage in production sharing are more likely to experience common shocks because they specialize in similar industrial sectors. Technological shocks may also be more easily transmitted from one country to another when firms operate transnationally. If production sharing tends to be concentrated in sectors that are more affected by cyclical fluctuations such as consumer goods or auto parts and production, the transmission will be amplified. Burstein et al. (2008) found that the extent of US–Mexico production sharing and its connection to the business cycle highlighted three noticeable effects. First, trade flows associated with production sharing are more correlated with US manufacturing output than are trade flows that are not associated with production sharing. Second, for a large

cross-section of countries that host US affiliates, those with larger production sharing trade links to the US also have higher manufacturing output correlations with the US. Third, for those countries, the extent of production sharing in trade is at least as important as the total volume of trade in accounting for a positive bilateral synchronization of manufacturing output between countries.

In the case of Asia, the importance of production sharing, largely connected with the PRC, suggests higher intraregional correlations than in other regions. It also points to growing transmission linkages between the PRC and other Asian countries, particularly those in Southeast Asia. Roughly 9.5 percent of PRC exports in 2000 consisted of imported inputs, up from 2.2 percent in 1980. The importance of vertical specialization is greatest for Malaysia, Philippines, Singapore, Taipei, China, and Thailand, whose exports include from 26 to 37 percent foreign content (Hummels 2009).

While production fragmentation-related business cycle synchronization between developing Asia and the G-3 has strengthened, the relationship between Asia's private domestic demand and Asian imports has weakened, despite rising intraregional trade. ADB (2007) showed that the correlation between Asia's private demand and its imports has trended downward. The value added in production sharing therefore appears to be strengthening linkages through exports to shock-affected markets, while weakening shocks passing through the import transmission mechanism. More recent data including oil and other commodity price volatility may help to test this dichotomy.

A. Timing

Some trading linkages have their full effect within a typical business cycle. Others, influenced by fixed costs, irreversible investments, or liberalizing policy reforms, play out over a longer horizon. Changes in the duration of these impacts and the transmission mechanisms by which they operate may affect the synchronization of business cycles. For example, air shipments arriving within a few days (or even overnight) may transmit shocks (and conversely, transmit mitigating influences) much more quickly than sea shipments averaging several weeks and frequently involving much greater variability in duration.

As the composition of trade has shifted from commodities to more complex manufacturing and services, sensitivity to the length of time for delivery has increased, as has pressure on manufacturers to quickly adapt production patterns and processes. Some factors, such as the location of plants and assembly lines, do not respond to shocks at business cycle frequencies,

maintaining production chain reliance on inputs from a particular source. Other factors prominent in fragmented production, such as the adaptation of production processes and substitutability of local for imported inputs, are more likely to be responsive in the medium term. When shocks are large and persistent (for example, during trade liberalization reforms or changes in taxation of foreign corporations), footloose multinationals may shift their production operations to other countries. These relocations are mostly at lower frequencies, at which shocks are more easily managed, mitigating (or in some cases, compounding) higher-frequency business cycle synchronization between countries.

Rising flexibility in the time involved for these substitution effects (timing in shipping, locating, and adapting production) to operate can imply that an increase in international trade may lead to lower international business cycle correlations. The exact extent of (de)coupling will depend on the nature of the shock, the degree and nature of production sharing between the economies involved, the responsiveness of economic agents to market signals and other information, and the flexibility in adjustments.

As fragmented production processes respond to and provoke changes in spatial and temporal relations, business cycle transmission mechanisms between economies and over time are affected. Similarly, the need to respond to uncertainty in a timely way creates an important force for agglomeration, locating firms producing industrial inputs near the downstream firms that use those inputs. Increased use of air freight to avoid uncertainties in sea shipment and port congestion is affecting the balance of agglomeration and fragmentation. Location and relocation effects are also influencing trends at the regional level. In Asia, the huge market and production platform of the PRC has had an especially strong effect since its openness to external markets and suppliers has increased.

B. PRC Mediation

In the two decades from 1985 to 2005, the PRC's exports grew from US\$27 billion to US\$762 billion and its imports from US\$43 billion to US\$660 billion. The basic pattern of PRC trade can be characterized as increasing exports to the global economy while increasing imports of intermediate goods from the rest of Asia. Both before and after the Asian crisis, the average output correlation for countries within Asia excluding the PRC is higher than that for Asia including the PRC, reflecting the PRC's relative independence from the cyclical behavior of the rest of the region. Interestingly, however, the average correlation grew much faster for Asia including the PRC than excluding it. The shrinking gap between the two

averages indicates that the PRC business cycle is evolving to increasingly move in tandem with the rest of Asia (ADB 2007).

Asian business cycles became much more synchronized with those of the G-3 in the period following the 1997–1998 crisis than preceding it. To the extent that the PRC functions as an assembly and production center for the rest of Asia, the trade linkages are more direct and stronger between the PRC and the economies of the rest of Asia than between those economies. Indeed, for the 5-year period 2002–2006, the average correlation for Asia including the PRC is higher than that for Asia excluding the PRC. The correlations of the PRC cycle with both regional and international economies are low, although both correlations have become positive in the postcrisis period, reflecting the increasing integration of the PRC with the regional and global economies.

Hummels (2009) found that most, but far from all, PRC export growth between 1995 and 2005 came from an increase in the number of unique shipments, rather than from an increase in average value per shipment. He compared this mixed growth with Thailand and Malaysia, where almost all growth arose from an increase in the number of shipments rather than an increase in the average shipment value. Conversely, almost all growth for Hong Kong, China and Japan came through an increase in average shipment size rather than an increase in the number of unique shipments. Thus, while the average PRC export shipment is rising in value, and even more so in Hong Kong, China and Japan, raising the potential for strengthened international transmission of financial shocks, the same may be less true for Thailand or Malaysia.

The role of the PRC in assembling components imported from other parts of Asia and exporting the final products to G-3 markets places it in a unique position to intermediate shocks emanating from the G-3 toward developing Asia. Exchange rate policy and use of foreign reserves are commonly discussed channels for such action, but trade and production adjustments to the structural linkages may have more lasting effects.

V. CONCLUSION

Rapid intraregional trade growth in Asia has raised the hope that the region's own growing demand may help it weather future adverse consequences of a US slowdown and ease the impacts of global downturns. Trade is growing, and growing lighter; exports are expanding primarily by reaching new markets with smaller shipments; and fragmented production networks are becoming the norm. All of these changes put a premium on

speed, on flexibility, and on information, increasing the potential for transmission of shocks between trading partners.

Much intra-Asian trade is conducted by MNCs and their affiliates in the form of intrafirm and intra-industry trade that involves fragmentation of production. The production networks in Asia respond to demand from consumers outside the region rather than being independent of them. Therefore, the G-3 economies are still an important source of external demand for Asia, and Asia remains vulnerable to shocks from major trading partners. Analysis of business cycle co-movements, both within Asia and between the G-3 and Asia, and examination of production fragmentation structures generally affirms the linkage between growth in the G-3 and Asia.

There is clear evidence pointing to increasing business cycle co-movements among Asian economies, particularly between the PRC and the rest of Asia. But there is no mutual exclusivity between inter- and intraregional economic integration. In fact, deepening regional integration appears to reinforce Asia's integration into the world economy. For this reason, Asia remains exposed to cyclical downturns in other regions.

Recent years have raised little or no evidence that Asia has decoupled from G-3 business cycles. In the postcrisis period, strengthening regional ties appear to reinforce business cycle co-movements between Asia and the G-3, despite the fact that intraregional trade and financial linkages have, in general, risen more rapidly than extraregional ones. Underlying this regional interdependence is the structure of rising intra-Asian trade, which is centered on the PRC as a production platform. At the center of MNCs' regional supply networks, the PRC is important in boosting both intra- and interregional trade. This central role has had the dual effect of deepening economic interdependence between the PRC and the rest of Asia as well as between the PRC and G-3.

An important task for future research is to assess the robustness of these observations using detailed data on production sharing, including -length transactions, and with more information on the extent of substitutability between production processes and inputs from alternative sources. Greater analysis of the extent to which shock transmission occurs asymmetrically between import and export channels may also help to enhance our understanding of how Asian trade affects global linkages.

REFERENCES

- ADB. 2007. "Uncoupling Asia: Myth and Reality." In *Asian Development Outlook 2007*. Asian Development Bank, Manila.
- Athukorala, P.-C. 2008. "Recent Trends in Asian Trade and Implications for Infrastructure Development." Background paper prepared for the ADB/ADBI Flagship Study, Infrastructure and Regional Cooperation.
- Athukorala, P.-C., and H. Hill. 2008. Asian Trade and Investment: Patterns and Trends. Research Workshop Program on Emerging Trends and Patterns of Trade and Investment in Asia. Ninth Global Development Network Conference, Brisbane.
- Baxter, M., and M. A. Kouparitsas. 2005. "Determinants of Business Cycle Comovement: A Robust Analysis." *Journal of Monetary Economics* 52:113–57.
- Bergin, P. R., R. C. Feenstra, and G. H. Hanson. 2007. Outsourcing and Volatility. NBER Working Paper No. 13144, National Bureau of Economic Research, Cambridge, MA.
- Berthelon, M., and C. Freund. 2004. On the Conservation of Distance in International Trade. World Bank Policy Research Working Paper No. 3293, Washington, DC.
- Besedes, T., and T. Prusa. 2003. On the Duration of Trade. NBER Working Paper No. 9936, National Bureau of Economic Research, Cambridge, MA.
- . 2004. Surviving the US Import Market: The Role of Product Differentiation. NBER Working Paper No. 10319, National Bureau of Economic Research, Cambridge, MA.
- Brooks, D. H., and D. Hummels, eds. 2009. *Infrastructure's Role in Lowering Asia's Trade Costs: Building for Trade*. Cheltenham, UK: Edward Elgar Publishing.
- Burstein, A., C. Kurz, and L. Tesar. 2008. Trade, Production Sharing, and the International Transmission of Business Cycles. NBER Working Paper No. 13731, National Bureau of Economic Research, Cambridge, MA.
- Eichengreen, B. 2006. The Blind Men and the Elephant. *Issues in Economic Policy 1*. The Brookings Institution, Washington, DC.
- Frankel, J. A., and A. K. Rose. 1998. "The Endogeneity of the Optimum Currency Area Criteria." *The Economic Journal* 108:1009–25.
- Hummels, D. 2007. "Transportation Costs and International Trade in the Second Era of Globalization." *Journal of Economic Perspectives* 21:131–54.
- . 2009. "Trends in Asian Trade: Implications for Transport Infrastructure and Trade Costs." In D. H. Brooks and D. Hummels, eds., *Infrastructure's Role in Lowering Asia's Trade Costs: Building for Trade*. Cheltenham, UK: Edward Elgar Publishing.
- Hummels, D., J. Ishii, and K.-M. Yi. 2001. "The Nature and Growth of Vertical Specialization in World Trade." *Journal of International Economics* 51:75–96.
- IMF. 2007. "Decoupling the Train? Spillovers and Cycles in the Global Economy." *World Economic Outlook*. International Monetary Fund, Washington, DC.
- Kimura, F., Y. Takahashi, and K. Hayakawa. 2007. "Fragmentation and Parts and Components Trade: Comparison between East Asia and Europe." *North American Journal of Economics and Finance* 18:23–40.

- Kose, M. A., E. S. Prasad, and M. E. Terrones. 2003. "How Does Globalization Affect the Synchronization of Business Cycles?" *American Economic Review* 93:57–62.
- Kose, M. A., and K.-M. Yi. 2001. "International Trade and Business Cycles." *American Economic Review* 91:371–5.
- . 2006. "Can the Standard International Business Cycle Model Explain the Relation between Trade and Comovement?" *Journal of International Economics* 68:267–95.
- Moneta, F., and R. Ruffer. 2006. Business Cycle and Synchronisation in East Asia. ECB Working Paper No. 671, European Central Bank, Frankfurt.
- Rana, P. B. 2007. "Economic Integration and Synchronization of Business Cycles in East Asia." *Journal of Asian Economics* 18:711–25.
- Shin, K. 2008. Global and Regional Shocks: Challenges to Asian Economies. ADBI Working Paper No. 120, Asian Development Bank Institute, Tokyo.
- Shin, K., and Y. Wang. 2004. "Trade Integration and Business Cycle Synchronization in East Asia." *Asian Economic Papers* 2:1–20.