

The Ties That Bind Asia, Europe, and the United States

Soyoung Kim⁺

Jong-Wha Lee⁺⁺

and

Cyn-Young Park⁺⁺⁺

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Abstract

In this paper, we investigate changes in East Asia's regional and global trade linkages and their influence on macroeconomic relationships among East Asia, Europe, and the United States (US). We first document changes in trade patterns of East Asia, Europe and the US and discuss stylized facts about East Asia's trade structure. Intra-Asian trade has expanded rapidly, largely driven by trade in intermediate goods based on regional production networks. The PRC has played a critical role as an assembly and production center in the region's vertical production integration. However, PRC's trade share in parts and components with Europe and US is rising while PRC's imports from East Asia is increasingly in final goods, suggesting that the region becomes gradually a part of the global business network. Empirical results from a panel Vector Auto-Regression (VAR) model generally confirm the positive effect of growing intra-Asian trade on both regional and global output co-movements, reflecting the nature of intra-Asian trade which is heavily driven by external demand. However, macroeconomic interdependence among East Asia, Europe, and the US is becoming more bi-directional, as shown by the positive effect of the East Asian aggregate output shock on both European and US outputs. The findings suggest a future role for East Asia as an increasingly important trade partner and balancing power in the world economy,

⁺ Department of Economics, Seoul National University, San 56-1, Sillim-Dong, Gwanak-Gu, Seoul 151-746, Korea. Tel.: +82-2-880-2689, E-mail: soyoungkim@snu.ac.kr.

⁺⁺ Office of Regional Economic Integration, Asian Development Bank, 6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines. Tel.: +63-2-632-4900, E-mail: jwlee@adb.org.

⁺⁺⁺ Office of Regional Economic Integration, Asian Development Bank, 6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines. Tel.: +63-2-632-5473, E-mail: cypark@adb.org.

1. Introduction

The 2008/09 global financial crisis proved to be a turning point for the debates of decoupling. In the run-up to the crisis, many argued that Asia would decouple from the United States (US) or Europe. However, precipitous drops in industrial production and exports across emerging Asia in the wake of the global crisis was a solemn reminder that the region's rapidly integrating economy remains strongly tied to the fate of the global economy.

As a group, East Asia accounts for 18% (on a purchasing power parity basis) of total world gross domestic product (GDP) in 2008, compared to 9% in 1990. The fast-growing Asian economy and its potentially large spending power was a ground for the hope that it might sustain robust growth despite adverse consequences of a US recession or global slowdown. It is undeniable that East Asia has made remarkable progress in regional economic and trade integration. Reflecting the rise in intraregional trade and investment flows, the economies of East Asia have also become increasingly interdependent.

The idea that emerging market economies in Asia could maintain an independent growth momentum was largely grounded in the rapid expansion of intraregional trade. Traditionally, East Asia¹ strong growth has been associated with trade openness. Exports grew from \$419.4 billion in 1990 to \$3.4 trillion in 2008. In percent of GDP, they grew from 33.7% to 47.6%. Accordingly, emerging Asia's exports now account for more than one fifth of global exports up from 12.3% in 1990. More importantly, growth in intraregional trade outpaced growth in total trade. The share of intra-regional trade in East Asia's total trade increased from 31.7% to 42.0% during the same period.

Another critical factor is the role of the People's Republic of China (PRC). The rise of the PRC has been spectacular. It is now the third largest economy (at purchasing power parity) and the largest trader in the world. Thus far, the PRC has played a critical role in the region's vertical production integration as an assembly center of the production sharing networks. With the PRC importing intermediate goods from the rest of East Asia and exporting the final assembly to destinations outside the region, the rise of intra-Asian trade has been structurally dependent on extra-regional demand.

The issue of decoupling is essentially about whether or not East Asia can attain a relatively independent business cycle that is driven by autonomous demand. The recent crisis highlighted vulnerability of East Asia's export-dependent growth. However, as the region's economic prowess grows, it is conceivable that its potentially large spending power will provide additional source of global demand.

The level and composition of international trade mirrors changing economic and industrial structures of emerging Asian economies. A close look at trade structures can reveal the true extent of regional demand and suggest the future direction. The evolution of trade structures in East Asian economies will exert considerable influence on dynamics of global business cycles. Particularly during the recent crisis, the region's large economies, namely the PRC, continue to grow positively on relatively resilient domestic demand, offering a hope that East Asia's positive growth may help facilitate the global recovery.

In this paper, we examine macroeconomic interdependence among East Asian economies and between East Asia and other regions, paying particular attention to the role of intra- and inter-regional trade linkages. The recent crisis has proved yet again that trade is a

¹ Throughout this paper, East Asia refers to nine selected countries in East and South East Asia. The nine Asian economies include China; Hong Kong,China; Indonesia; Korea; Malaysia; the Philippines; Singapore; Taipei,China; and Thailand.

potent channel of transmission of economic shocks. East Asia is a highly export-dependent region. Although the region's increasing trade openness has been accompanied by significant progress in the diversification of its export base, the pattern of trade suggests the economies of East Asia remain vulnerable to changes in the G3 business cycles. Despite the rapid expansion, intra-Asian trade has been driven primarily by external demand, rather than regional demand. Thus, the rise in intraregional trade does not necessarily imply that the regional economy relies less on developments in external demand conditions.

However, East Asia's increasing economic integration and growing influence on the world economy is bound to bring about changes in the pattern of global macroeconomic interdependence. The "bi-polar" world order, typically represented by the US and Europe, has been exposed to weaknesses given Europe's heavy reliance on the US economy. With the rise of emerging Asia, particularly the PRC, will there be a change in the old order? In other words, can East Asia add a balance? Then will a new world order which is based on the "tri-polar" economic systems—US, Europe, and Asia—provide more stability in the global economy?

To shed a light on such issues, we document the evolution of trade linkages and macroeconomic interdependence among Asia, Europe, and the US. We first document changes in trade patterns in East Asia, Europe, and the US. Then we examine the role of the PRC in bridging inter-regional and intra-regional trade linkages. Finally, we investigate whether the direction and magnitude of growth spillovers among East Asia, Europe, and the US have been affected in response to such changes. We employ a panel vector auto-regression (VAR) model to examine macroeconomic impacts between East Asia and Europe, as well as between East Asia and the US.

This paper is structured as follows. Section 2 briefly summarizes changes in trade patterns and some stylized facts about East Asia's trade. Section 3 investigates the role of the PRC in connecting East Asia's intra- and extra-regional trade by paying particular attention to its role as a hub in the region's production sharing networks. Section 4 employs a VAR model to evaluate the impact of East Asia's business cycle fluctuations on the United States and Europe and vice versa. Concluding remarks follow in Section 5.

2. East Asia's Trade Patterns and Global Linkages

2.1. Changes in Trade Patterns

East Asia has benefited from trade openness throughout its rapid industrialization and economic development process. Apart from expanding the market size, the region's trade openness has helped boost competition and promote technological advances and productivity growth. The importance of trade in the regional economy remains significant. Trade openness measured by the ratio of exports and imports to GDP has trended upwards, reaching more than 90% of GDP in 2008 compared to 67.8% in 1990. The region's export dependency is also strong, with the export-to-GDP ratio rising to 47.6%. The incremental export-to-GDP ratio, measured by the year-on-year increment in exports over that in GDP, is also high at 73.5% in 2008 up from 47.8% in 1990. Steady increases of these ratios illustrate importance of the export sector for the Asian economy.

Table 1 and 2 reports changes in export and import profiles by destination and origins, respectively, since 1990 for East Asia, Europe, Japan, and the US. A close look at the changes in trade patterns among these economies/regions provides some interesting points:

- ❖ East Asia's trade openness has been accompanied by significant progress in the diversification of its export base. Also noticeable in the region's export profile has

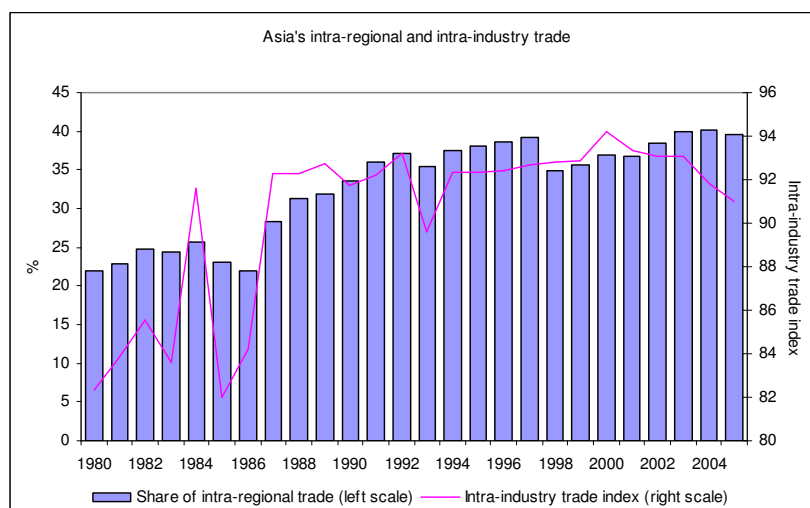
- been a visible increase in intraregional trade in recent decades. The share of intra-regional trade in total exports rose from about 31% in 1990 to 39% in 2008.
- ❖ The geographical base of East Asia's export market has become increasingly diversified, with the share of the single largest market, namely US, taking up only 14.2% in 2008, down from 22.5% in 1990. Japan and the European Union (EU27) now accounts for 8% and 15% of the region's total export market, respectively.
 - ❖ Together, Europe, Japan, and the US—namely, the G3 markets—account for only 37.8% of Asia's total exports, down from 52.9% nearly two decades ago. The share of the G3 markets in East Asia's imports has also significantly declined.
 - ❖ The share of the European market in total East Asia's exports has been on an upward trend since 1995, while the shares of Japan and US markets have decreased steadily since 1990.
 - ❖ East Asia's imports from its own increased, while broadening its supply base to the rest of the world as well.
 - ❖ In Europe, the share of intraregional trade is stable and high, although there has been a slight decline in imports within the region. East Asia's shares in both exports and imports of EU27 have steadily increased. Meanwhile, Europe's trade with Japan is on a decline in its total trade.
 - ❖ The shares of East Asia in Japan's total exports and imports are generally on a rise. Especially, East Asia has become an important market for Japanese exporters, accounting for nearly 50% of total exports.
 - ❖ The US continues to be a single largest economy to which East Asia exports. East Asia is an important supplier of goods and services for the US economy, while the shares of Japan and European goods in US imports have decreased.

2.2. Stylized Facts about East Asia's Trade

It has now become a stylized fact that a significant portion of trade among economies of East Asia is trade of intermediate goods. Many studies have pointed that rapid growth in intra-Asian trade is driven largely by trade of intermediate goods (Athukorala, 2008, and Brooks and Hua, 2009). Sharing of production processes across East Asia has given strong momentum to regional economic and trade integration since 1990s. However, as growth in intra-regional trade is driven by back and forth shipments of intermediate goods that are eventually consumed outside the region, the world's major industrial countries continue to claim a bulk of final demand for East Asian exports. As such, increased vertical specialization and the rise in intra-industry trade can explain the strong ties not only among the economies of East Asia but also between East Asia and other regions.

Figure 1 shows that intra-industry trade has been rising in East Asia' trade with the rest of the world, along with increasing intra-regional trade since the 1990s. ADB (2006) reports that strong growth in intra-firm and intra-industry trade through vertical supply networks of multinational companies has boosted Asian trade both intra-regionally and inter-regionally. It suggests that regional production sharing networks by multinational companies to take advantage of local specific conditions and low-cost labor might have been an underlying force behind the intra-regional trade of intermediate goods that are destined for final consumption outside the region.

Figure 1: East Asia's intra-regional and intra-industry trade

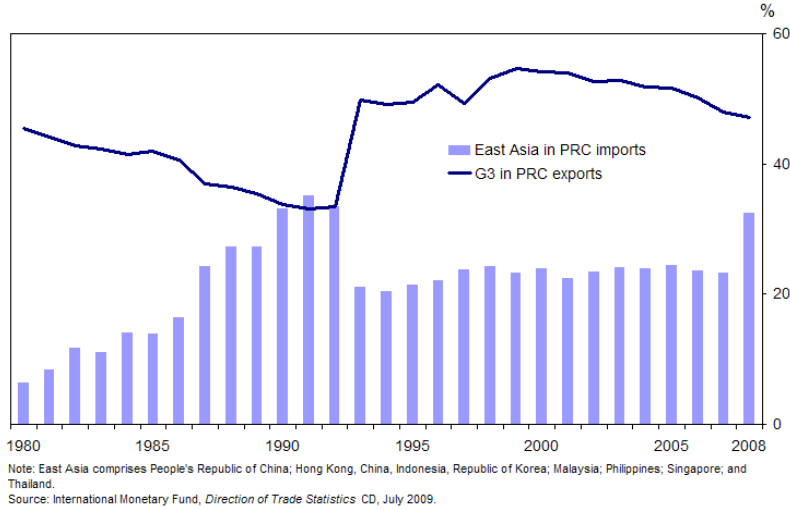


Source: UN Commodity Trade Database, downloaded 22 February 2007.

Trade of intermediate goods through intra-industry trade and global production sharing may provide a missing link between trade and business cycle fluctuations. It is rather well-documented that intra-industry trade as a result of vertical specialization and production sharing tends to lead to business cycle synchronization (Shin and Wang, 2004). Using industry level data, Ramanarayanan (2009) also shows that cross-country industry pairs with more trade intensity tend to be more synchronized than the pairs with less trade intensity.

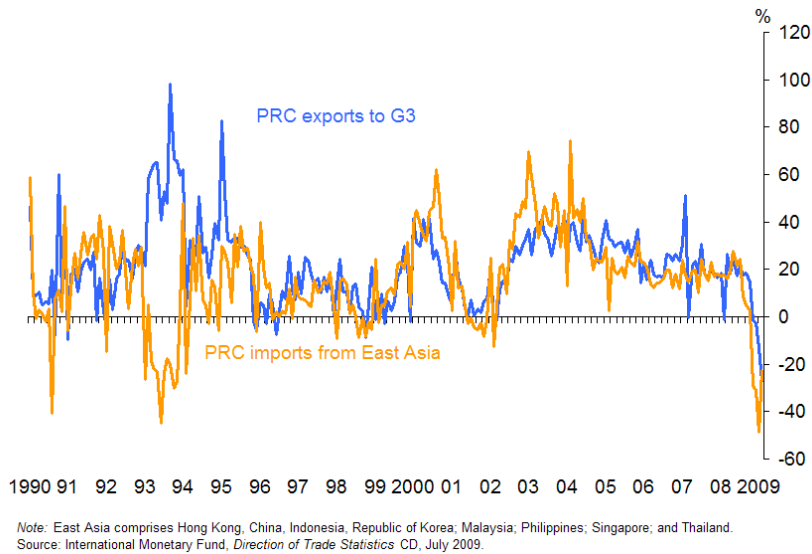
The role of the PRC as the region's main assembly and production center also seems to shape intra-regional trade flows and the region's trade dynamics with the rest of the world. Over the past decades, the PRC registered an explosive growth in terms of both exports and imports. Exports (imports) grew from \$18.1 (19.5) billion in 1980 to \$1.47 (1.21) trillion in 2008. During this period of rapid growth, the PRC's trade pattern has changed rather drastically (**Figure 2**). In the 1980s, the share of Asian neighbors in terms of the PRC's total exports rose steadily, while the share of G3 markets was declining similar to the export pattern of the rest of Asia. In the 1990s, the share of Asian neighbors in terms of the PRC's total exports rose steadily, while the share of G3 markets was declining similar to the export pattern of the rest of Asia. However, in the 1990s, the share of G3 markets started to increase in terms of total PRC exports, reaching about 47.4% by 2008. Meanwhile, the PRC continued to import more from the rest of Asia in the 1990s, notwithstanding the declining share of Asian neighbors in its total export markets. The basic pattern of the PRC trade since early 1990s, thus, can be characterized as increasing exports to the global economy, while importing more from the rest of Asia.

Figure 2: PRC's trade patterns



As the PRC emerges as an important nexus between intra- and inter-regional trades of the Asian economies, economic interdependence arises between the PRC and the rest of Asia as well as between the PRC and G3. **Figure 3** shows that the growth rates of the PRC exports to G3 are highly correlated with those of the PRC imports from the rest of Asia since the early 1990s. To the extent that the PRC imports a large share of the intermediate goods from the rest of Asia to serve final demand from G3, a slowdown in the G3 economy could have negative impact on the PRC exports, thus adversely affecting the PRC imports from the rest of Asia. This suggests that the Asian economy remain exposed to the G3 economic fluctuations via its exposure to the PRC economy.

Figure 3: Relationship between PRC's exports to G3 and imports from East Asia



3. PRC's Role in Future Regional and Global Trade Patterns

Using disaggregated trade data, this section examines the structure of PRC trade in more details to determine whether it continues to be driven largely by trade in parts and components.² It will also assess whether the role of PRC is gradually shifting from being a final assembler to a final consumer. The hypothesis is that PRC is slowly becoming a larger consumer of regional exports of final goods, while at the same time keeping its role as an assembler of final goods for export outside the region—particularly to the United States and Europe.

3.1. Data description

Merchandise trade data released on a monthly basis by PRC customs agencies are used for the analysis. Merchandise export and import data are decomposed into three categories: basic goods; parts and components; and final goods. The focus in the analysis here is on the last two categories, i.e., parts and components and final goods. Parts and components are considered intermediate goods that need to be further processed to produce final goods. In general, parts and components have no use until they are blended with other inputs to generate goods for final consumption. Final goods, in contrast, do not require any further transformation and can be used or consumed immediately.

Basic goods consist of food and beverages, natural resources, and raw materials. Construction materials, which consist basically of cement, are also categorized as basic goods. Classifying parts and components and final goods involves some degree of subjectivity and discretion particularly since the actual use of the good is no longer monitored as soon as it is imported. Data in this analysis is based on the International Harmonized Customs Classification.

3.2. Key findings

The analysis will be divided into three parts. First, an overview of PRC's trade structure will be presented. Here, the trend in the commodity composition of PRC's merchandise exports and imports, as well as the destinations of PRC's trade will be evaluated. Second, the structure of PRC's trade with the rest of developing Asia will be analyzed. A large and rising trade in parts and components will validate the findings of other studies that intra-Asian trade is driven mainly by parts and components for production of final goods exported outside Asia. Third, the structure of PRC's trade with the rest of the world will be investigated. A large final goods trade with the rest of the world will lend credence to the findings about PRC being a final assembler of goods for export outside the region.

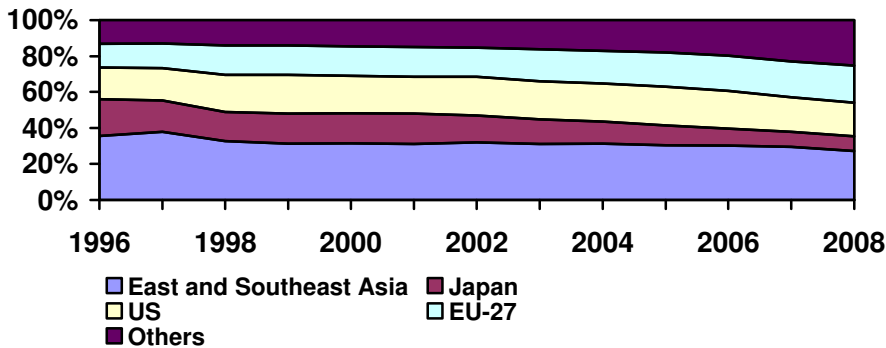
PRC's overall trade structure

Figure 4 provides a snapshot of PRC's major export partners. Between 1996 and 2008, the importance of East and Southeast Asia as a destination for PRC's exports has steadily declined. From 35.5% in 1996, East and Southeast Asia's share of PRC exports has fallen to 27.2% in 2008. Similarly, the share of exports to Japan have been falling, but the descent for Japan is much more pronounced than for East and Southeast Asia (20.4% down to 8.2%). Meanwhile,

² A part of this section is based on ADB (2009).

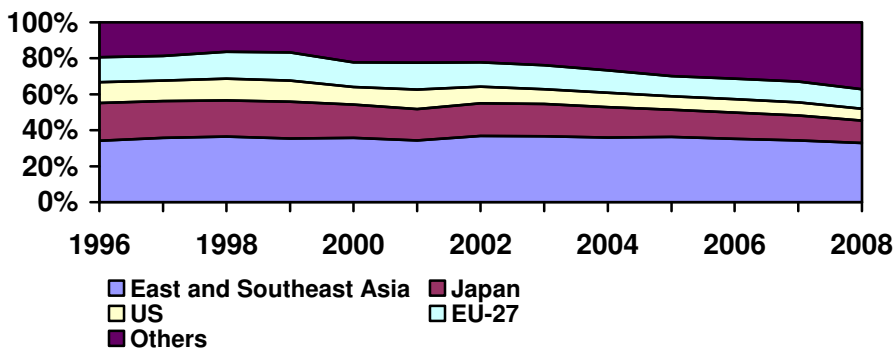
the share of PRC's exports to the United States (US) have remained relatively stable during the same period, averaging 20.2%, but those for the European Union (EU) and the rest of the world (EU) have been rising. EU's share has grown from 13.3% to 20.6%, while that for the rest of the world has increased from 13.1% to 25.4% during 1996-2008. This implies that PRC has increased its integration into the world economy, allowing its exports to gain more ground in EU and in the rest of the world.

Figure 4: Share of exports of PRC by economy/region



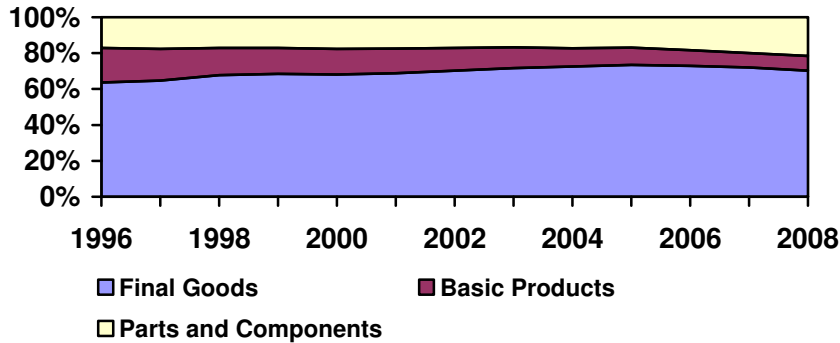
In contrast, **Figure 5** shows that while the share of PRC's imports from EU as well as East and Southeast Asia have stayed quite steady, those from Japan and US have gradually fallen. The share of imports from EU and East and Southeast Asia averaged 13.1% and 35.4%, respectively, between 1996 and 2008. The share of imports from Japan dropped from 21.0% in 1996 to 12.4% in 2008; the share from US declined from 11.6% to 6.7%. PRC's imports are thus increasingly being sourced from the rest of the world, with the share growing from 19.4% to 37.2% between 1996 and 2008. The growing share of the rest of the world in PRC's imports is perhaps due to the country's rising demand for resources. Overall, the PRC has maintained a positive gap between its export and import shares with the US and EU, and negative gaps with the East and Southeast Asia, Japan, and the rest of the world.

Figure 5: Share of imports of PRC by economy/region



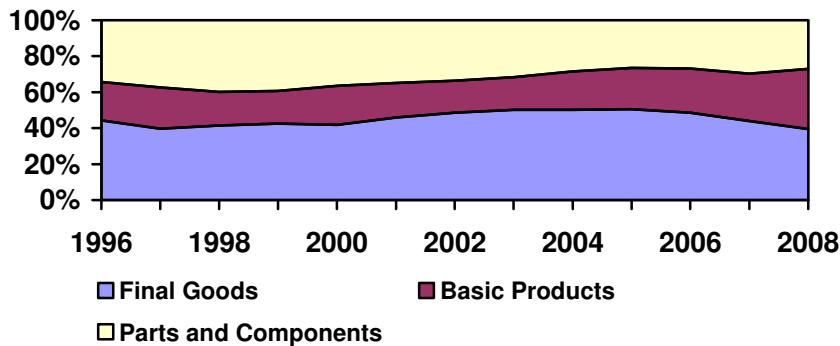
In terms of commodity classification, PRC's exports have been mostly final goods (**Figure 6**). From less than two thirds of total in 1996, the share of final goods exports have risen above 70% since 2002. The share of parts and components exports has also grown, but at a much slower pace, rising from about 17% in 1996 to 21.6% in 2008.

Figure 6: PRC exports by commodity classification



PRC's imports of basic products have grown the fastest, with its share rising from 21.3% to 33.5% between 1996 and 2008 (Figure 7). The share of PRC's final goods imports increased to about 50% in 2003-2005, but has since fallen to 39.5% as of 2008. Similarly, the share of parts and components has steadily diminished to 27.1% in 2008.

Figure 7: PRC imports by commodity classification



Between 1996 and 2008, the share of final goods in PRC's total exports (averaging 69.6%) has consistently been higher than in its total imports (averaging 45.2%). In contrast, the share of parts and components in PRC's total imports has consistently been larger than in its total exports (32.8% vs. 17.9% on average). This validates the view that the PRC acts as the world's factory, assembling imported intermediate goods for re-export to the rest of the world. Nevertheless, the gap between the export and import shares of PRC's parts and components trade has steadily turned less negative during the period (i.e., the gap is narrowing, meaning export shares are slowly catching up to import shares), and the gap in final goods trade has steadily risen (i.e., the gap is widening, meaning export shares are rising much faster than import shares).

Trade between PRC and East Asia

The general pattern of PRC's trade in parts and components with East and Southeast Asia is similar to PRC's total trade (Figures 8 and 9). During 1996-2008, PRC's import shares of parts and components from East and Southeast Asia have generally been larger than its export shares to the rest of the region (38.1% versus 24.4% on average). While these support the PRC as the world's factory thesis, it is worth noting that the gap in parts and components trade has also narrowed between 1996 and 2008.

Figure 8: PRC exports to East and Southeast Asia by commodity classification

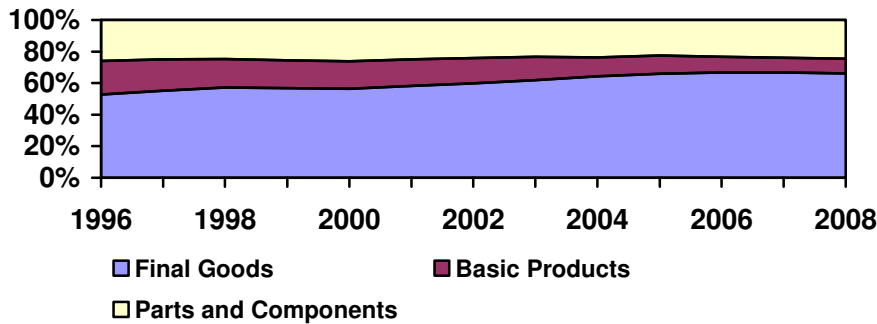
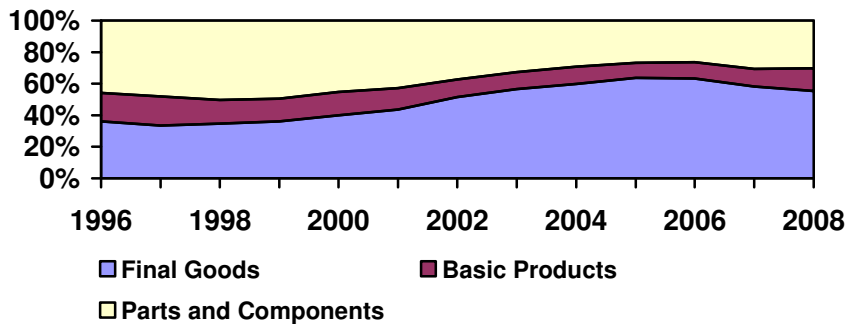


Figure 9: PRC imports from East and Southeast Asia by commodity classification



PRC's trade in final goods with East and Southeast Asia is likewise similar to PRC's trade with the world, i.e., export shares are generally larger than import shares. While the gap in PRC's final goods trade shares with East and Southeast Asia has been narrowing through 2005, it has begun to turn up in 2006 and has continued to widen through 2008. This evidence can be viewed as an indication of the PRC's growing integration with the rest of the East and Southeast Asian region.

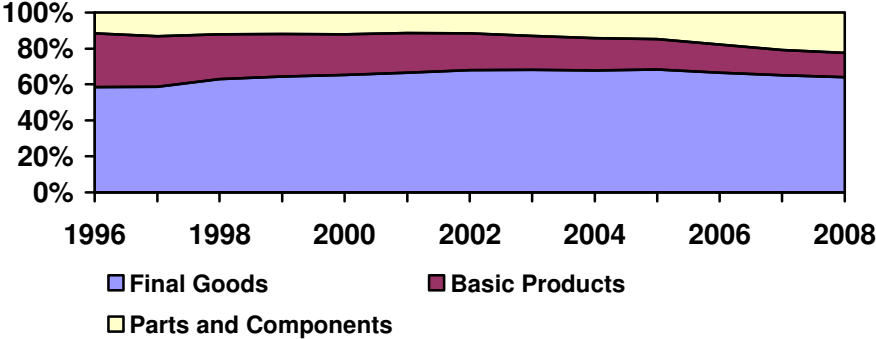
In particular, the share of final goods in PRC's trade with East and Southeast Asia has been rising rapidly. The export share has increased from 52.8% in 1996 to 66.1% in 2008, while the import share has grown from 36.1% to 55.4% during the same period. This implies that intra-regional (i.e., within East and Southeast Asia) in final goods trade has been growing stronger in the last decade. In fact, the PRC has steadily been exporting more final goods to East and Southeast Asia, while parts and components exports have been relatively stable. Meanwhile, the PRC has been importing more final goods from East and Southeast Asia and less parts and components.

Trade in parts and components within the East and Southeast Asian region has been gradually slowing, but has remained quite substantial, accounting for at least a quarter of total trade. Robust trade in parts and components is thus now being accompanied by healthy trade in final goods. Between 1996 and 2008, strong direct demand (final goods trade) has flourished alongside strong derived demand (parts and components trade) within East and Southeast Asia. These changes can be perceived as reflective of the PRC's transformation from the world's factory, increasingly toward the world's consumer.

Trade between PRC and Japan

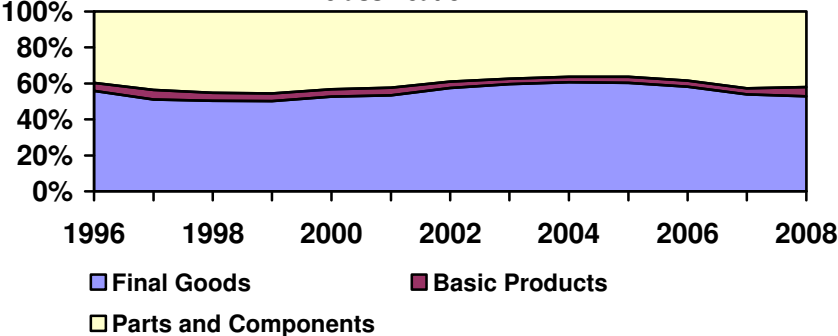
The share of PRC's final goods exports to Japan steadily gained until 2005, but have slowed through 2008 (**Figure 10**). The share of PRC's parts and components exports to Japan, meanwhile, has increased from 11.6% in 1996 to 22.3% in 2008. This suggests that the PRC is now gaining presence as supplier of intermediate inputs in Japan.

Figure 10: PRC exports to Japan by commodity classification



The share of PRC's imports of final goods from Japan averaged 55.1% between 1996 and 2008, while parts and components averaged 40.9% (**Figure 11**). There is very little variation in the shares of these two components over the past 12 years. Basic goods account for an extremely small share of PRC's imports from Japan.

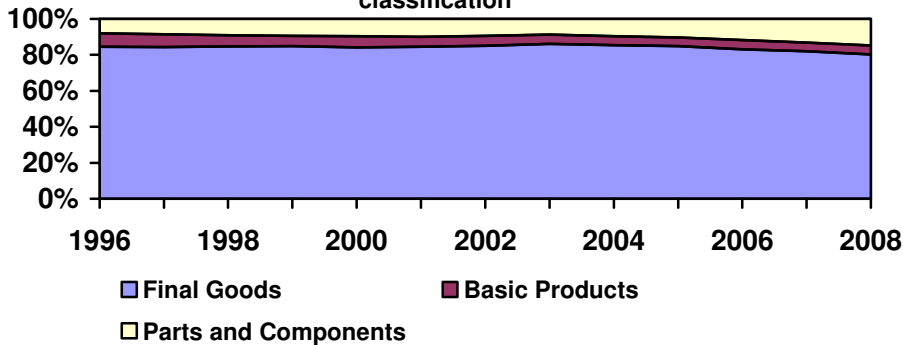
Figure 11: PRC imports from Japan by commodity classification



Trade between PRC and the United States

PRC exports to the US have largely been in final goods, with such goods accounting for more than four fifths of total (**Figure 12**). Between 1996 and 2008, there were slight variations in the share of final goods in PRC's exports to the US. There has, however, been a steady rise in the share of parts and components exports, from just 8.0% in 1996 to 14.8% in 2008.

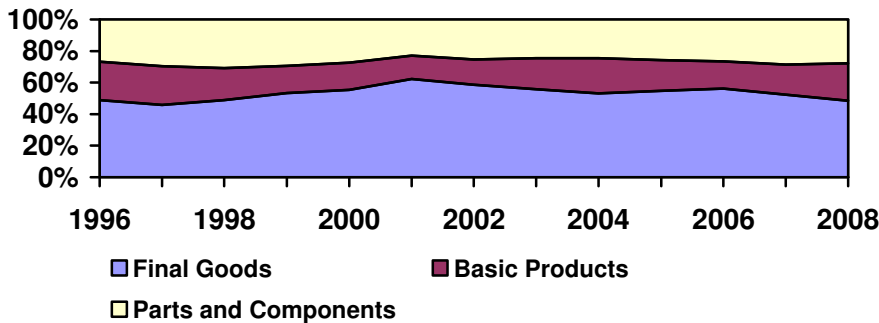
Figure 12: PRC exports to United States by commodity classification



Import patterns are also reflective of total PRC trade. Final goods dominate PRC's imports from the US, but its share is much smaller compared to exports (**Figure 13**). The share of final goods imports averaged 53.3% between 1996 and 2008, against 84.1% for final goods exports. Like exports, however, the share of final goods imports has remained quite steady during the period. This means that the relative importance of PRC trade in final goods with the US has stayed fairly stable from 1996 to 2008.

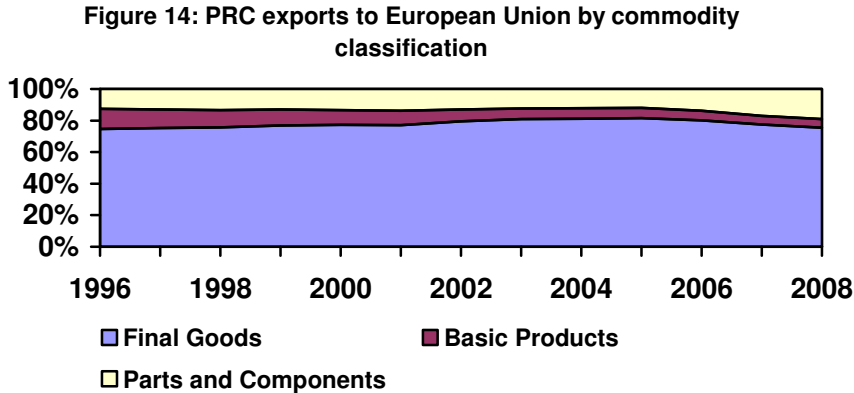
Similarly, the share of parts and components in PRC's total imports from the US has generally been even at about 26%. With rising export shares and steady import shares, PRC's parts and components trade is slowly making its way to US manufacturing operations as intermediate goods. This could be seen as PRC increasingly becoming the choice of US manufacturers as their supplier of intermediate inputs.

Figure 13: PRC imports from United States by commodity classification



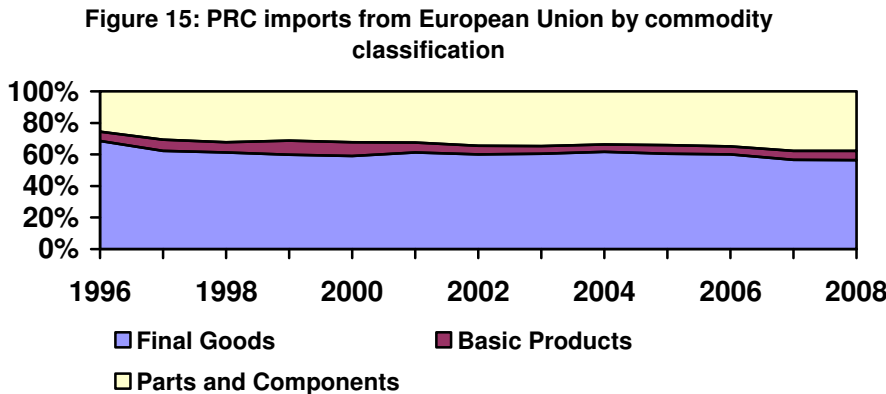
Trade between PRC and the European Union

As noted earlier, PRC's trade with EU has steadily risen between 1996 and 2008. The share of PRC's exports of parts and components and final goods to EU slightly increased during the period, while those for basic products declined (**Figure 14**). Final goods accounted for more than three fourths of total PRC exports to the EU, averaging 78.0%; parts and components averaged 13.7%.



PRC imports from the EU are increasingly shifting toward parts and components and away from final goods (**Figure 15**). From just 25.6% in 1996, the share of parts and components imports has risen to 37.7% in 2008. The share of final goods imports, meanwhile, declined from 68.6% to 56.3% during the same period. In contrast to the case of the US, it appears that the EU is progressively becoming a source of PRC's intermediate inputs.

PRC's export share of final goods to the EU is growing at a faster pace than its import share from the EU. The differential in trade shares has thus widened over the last 12 years. In terms of parts and components, import shares have generally outpaced export shares.



4. The Effect of Trade Linkages on Output Co-Movements

4.1. Theory and Literature

Changes in trade patterns between trade partners influence business cycle co-movements. For most economies, trade with any one trading partner explains only a small portion of economic activity. Also even for the economies where the size of total trade exceeds GDP, net exports contribute only little to their GDP. However, it is interesting to see that trade proves yet again a potent channel of transmission of business cycles during the global financial crisis.

On theoretical grounds, the effect of international trade linkages on business cycle co-movements is ambiguous. Trade integration is often emphasized as an important channel of output co-movement in the literature of international business cycles. Greater trade integration

stimulates the spillovers 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). Spillovers can also occur through the change in relative prices of factors and products. A positive shock in one country raises relative price of labor-intensive goods and thus, as much as they trade freely, leads to higher wage and employment throughout the world (Kraay and Ventra, 2002).

However, as Krugman (1993) and Kose and Yi (2002) argue, more trade may also encourage greater specialization of production, resulting in less synchronization of business cycles.³ In this context, not just the size of trade but also the similarity of trade structure is considered to be important in explaining output co-fluctuations. Some studies found that when bilateral trade concentrates more on intra-industry trade than inter-industry trade, the tendency of synchronizing output fluctuations strengthens (Imbs, 2004 and Shin and Wang, 2004). Ramanarayanan (2009) also argues that increasingly globalized production chains due to advances in transportation and communication technologies, as well liberalization of trade policies may be responsible for the magnified impact of trade links on business cycle synchronization.

Given the theoretical ambiguity, whether and to what extent trade integration leads to business cycle synchronization is ultimately an empirical question. Interestingly, many empirical studies find that business cycles are more synchronized as trade integration deepens (Frankel and Rose, 1998 and Baxter and Kouparitsas, 2005). In East Asia, where intraregional trade is driven by intra-industry trade based on vertical integration of production chains, it is expected to see some positive effects of trade integration on business cycle synchronization.

Empirical findings tend to differ on the extent and nature of business cycle co-movement for East Asian economies, depending on the choice of methodology and sample period. Recent studies, however, suggest that the degree of business cycles synchronization among Asian economies has been increasing, partly due to deepened integration in trade. Using a quantitative survey of the previous literature that analyzes the links between trade and business cycle synchronization, Rose (2009) conclude that Asian business cycle synchronization is likely to grow in conjunction with the rise in intra-Asian trade. Asian trade seems likely to continue to rise relative to GDP as transportation costs shrink and supply chains become ever more complex and integrated. There are many other factors such as monetary and financial integration and macroeconomic policy cooperation, which also seem to exert positive influence on business cycle co-movements.

ADB (2007) reports that the correlation coefficients of the Asian business cycles both with each other and with G3 have increased after the Asian financial crisis and remain high. Moneta and Ruffer (2006) also estimate various specifications of a dynamic factor model for output of ten East Asian economies and find a significant common factor in their business cycles. The evidence of synchronization draws primarily on the result of co-movement in export and common disturbances, such as oil price and the JPY-USD exchange rate. However, it remains unclear how rapid growth in intra-Asian trade affects the macroeconomic interdependence between East Asia and the world's major industrial countries.

³ Several studies emphasize the similarity in production structure as an important determinant of co-movements 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 more 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 structure.

4.2. Intra-Asian Trade and Decoupling

There is yet to be any conclusive evidence for Asia's decoupling from the world's major industrial economies. Especially when the intraregional trade is an indirect way of trading with other regions, its impact on East Asia's relationship with the other regions is subject to a debate, namely the "decoupling" debate.

Empirical findings in this area remain limited, although recent literature tends to refute the decoupling argument. For example, ADB (2008) and Takagi and Kozuru (2008) provide evidence that Asia's output is responding significantly to both regional and global output shocks in the post-crisis period. Kim, Lee, and Park (2009) also show that real economic interdependence between East Asia and the G7 economies increased significantly in the post-crisis period, suggesting "recoupling", rather than decoupling.

Evidence also suggests that buoyant demand from the world's major economies represent still a dominant factor behind East Asian export growth. **Figure 16** demonstrates a tight relationship between US non-oil import growth and that of East Asian exports. (The US non-oil imports account for nearly 50% of total G3 non-oil imports, while highly synchronized with movements of G3 non-oil imports). The decadal correlations between growth rates of US non-oil imports and Asian exports show that this linkage has strengthened rather than weakened despite strong growth in intra-Asian trade.

Figure 16: Correlation between Growth in East Asia's Intra-regional Exports and US Non-oil Imports

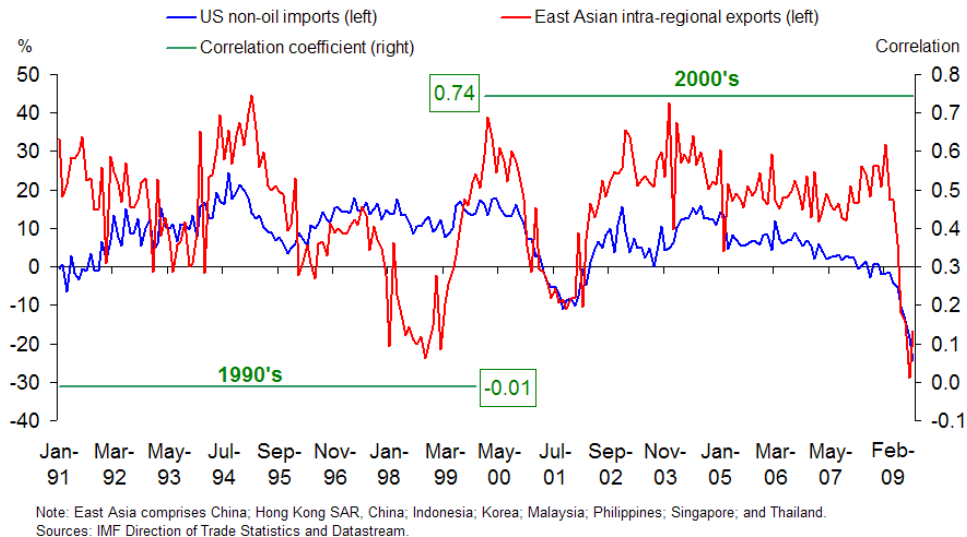
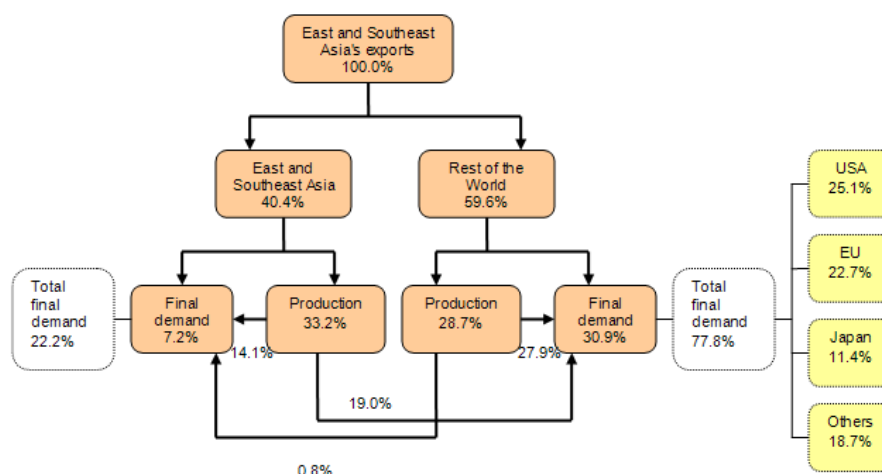


Figure 17 shows a breakdown of Asian exports to those destined for other countries within the region and those that leave the region based on the Global Trade Analysis Project (GTAP) database.⁴ Intra-regional trade within Asia is then factored into the region's final

⁴ 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

demand and what is used in the production process. A similar decomposition is made in the trade among the rest of the world. On both ends are reported total final demands by different regions/economies, which take into account the trade of intermediate goods in the production process for final demands. Based on this analysis, about 59% of total Asian exports (instead of about 37.8% of total exports shown above) are eventually consumed by G3 economies.

Figure 17: Breakdown of East Asia's Exports



Source: Data sourced from Global Trade Analysis Project (GTAP) version 7.

The results suggest that the world's major industrial countries still remain as main export destinations for final goods departing from East Asian ports, when taking into account the share of intermediate goods trade that is for assembly and production within the region but eventually shipped out of the region.⁵ Interestingly, Europe is nearly as big as the US in terms of the final demand for East Asia's products.

As intra-Asian trade is originated from demand outside the region, growth of intra-regional trade's share in total East Asian exports does not automatically lead to the region's independence from an external demand shock. On the contrary, to the extent that intra-regional trade is dictated by intra-industry processing and assembly through vertically integrated production chains, the Asian economy can be highly sensitive to a shock, particularly industry-specific, emanated from major demand destinations. The latest US slowdown in 2001-2002, originated from the information technology (IT) industry, and its ripple effects through the global IT industry to Asian manufacturers was a vivid example of such sensitivity.

the world economy into 113 countries and regions (including all nine economies in East and Southeast Asia under this study) and 57 sectors.

⁵ Other sources also confirm the similar results. 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). Citibank (2006) updated the result based on the newly released 2000 AIO table and reported that only 11% of Asian exports are destined for the regional demand. Meng et. al. (2006) showed that the dependence of Asian production on overseas markets have strengthened rather than weakened between 1995 and 2000 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%.

4.3. Panel VAR Model

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

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

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

where $G(L)$ is a matrix polynomial in the lag operator L , y_t^i is an $m \times 1$ data vector, d^i is an $m \times 1$ 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, $\text{var}(e_t^i)$ 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:

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

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

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).

Empirical Method

To examine the relationship between U.S., European, and Asian regional output, and their effects on the output of individual East Asian economies, we constructed a four variable VAR model [\log US, \log E, \log A, \log Ai] where the contemporaneously exogenous variables are ordered first: US is the US output, E is the European output, A is East Asian aggregate output,

and A_i is an individual output of an East Asian economy. The first three variables are included to examine the relationship among US, European, and East Asian regional output. The last variable is included to examine the effects of US, European, and East Asian regional output shocks on the output of individual East Asian economies.

Some orderings of the variables can be regarded as a natural one. US, European, and East Asian regional output are treated as contemporaneously exogenous to individual East Asian country's output as individual East Asian country's output is far smaller than US, European, and East Asian regional output. Then, US and European output are assumed to be contemporaneously exogenous to East Asian regional output as US and European output are larger than East Asian regional output. However, the ordering between US and European output is unclear, so we also construct the model that changes the ordering between US and European output as follows: $[\log E, \log US, \log A, \log A_i]$.

The East Asian aggregate is constructed as the aggregate of nine East Asian economies (PRC; Hong Kong, China; Indonesia; Korea; Malaysia; Philippines; Singapore; Taipei, China; and Thailand), while excluding each country's own economy. To check whether the results are similar, we also experiment with the following two models. First, we use Chinese output instead of East Asian aggregate, and consider only eight individual countries, excluding China. Second, we add Japan as an East Asian country; we include Japan in East Asian aggregate, and consider 10 individual countries, including Japan.

We use quarterly data and estimate the model for the period after the crisis (1st quarter 2000–2nd quarter 2007). A constant term and four 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.

Empirical Results

Figure 18 reports the impulse responses for the post-crisis period—in the case of the basic model ($[\log US, \log E, \log A_9, \log A_i]$). There are sixteen graphs in each figure. Each graph shows the impulse response of each variable to shocks to each variable. 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. For example, the graph in the fourth row and the second column shows the impulse responses of $\log E$ to shocks to $\log A_i$. The solid line in each graph shows the point estimate while the dotted lines show 90% probability bands. The numbers show percentage changes.

The results also show that the effects of US and European shocks on the East Asian aggregate and individual economies are quite substantial. In response to US shocks, US output increases about 0.25% on impact, decreases over time, and returns to the initial level in about 1 year. In response to US output shocks, the East Asian aggregate output and individual output increase 0.2%–0.3% on impact, decreases over time, and returns to the initial level in about one year. The impulse responses of European output and Asian aggregate and individual outputs to European output shocks are more complicated, but positive European output shocks have positive effect on Asian economies for a few quarters.

The positive effects of US and European shocks on East Asian economies are consistent with the trade pattern of East Asia. As illustrated in the previous sections, rapid growth in intra-Asian trade can be traced to the expansion of the region's production sharing network and thus remains structurally driven by global demand. This may explain significant and positive spillovers from the global output shocks onto the East Asian economies.

Interestingly, the reverse effect is also prominent. East Asia's aggregate shocks have positive effects on both the US economy and the European aggregate. In response to East Asian aggregate shocks, the peak responses of East Asian output, European output, and US output are about 0.3%, 0.1%, and 0.06%, respectively. The positive effects are estimated differently from zero with more than 95% probability. East Asia plays an increasingly important role as a supplier of intermediate goods for the advanced economies, while importing more of final goods from these economies. Such an increasingly globalized production network between East Asia and advanced countries such as Europe and the US may explain the positive influence of East Asian economies on Europe and the US.

On the other hand, it is interesting that the East Asian aggregate shocks have a larger (positive) effect on European output than the US output. It's also notable that a positive U.S. output shock has a positive effect on European output but a positive European output shock has a negative effect on U.S. output.

Finally, we find that aggregate and individual Asian output mostly move in the same direction to each shock. These patterns of impulse responses are consistent with the idea that growing intra-Asian trade has contributed to increased output co-movements in East Asia.

Figure 19 shows the results for the model with the alternative ordering between US output and European output. As the European output is assumed to be contemporaneously exogenous to the US output in this model, the role of European output tends to be greater than that in the basic model and the role of US output lower than that in the basic model. Besides that, the main results are qualitatively similar.

Impulse responses continue to show that the effects of both US and European shocks on the East Asian aggregate and individual economies also remain positive and quite substantial. Again, the East Asian aggregate output shocks have a positive effect on US and European outputs. In response to each shock, aggregate and individual Asian outputs mostly move in the same direction. The East Asian aggregate shocks have a larger (positive) effect on European output than the US output

Figure 20 illustrates the results for the model in which Chinese output is used instead of aggregate Asian output, and only eight individual countries are considered, excluding China. The results are again qualitatively similar to the basic model.

Figure 21 reports the results for the model where the East Asian aggregate includes Japan. Again, the main results are similar. On the other hand, the positive effect of the European output on the East Asian output is stronger in this model than in the basic model. Also, the positive effects of East Asian aggregate output shocks on Europe, the U.S. and individual East Asian country are stronger in this model than in the basic model. This may reflect a tighter connection between Japan and the individual East Asian countries, US, and Europe.

5. Concluding Remarks

This paper has explored the evolution of trade linkages and its influence on macroeconomic interdependence among East Asia, the US, and Europe. First, as suggested in previous literature, trade plays important role in linking economies and transmitting shocks, positively influencing business cycle co-movements. Evidence points to increasing business cycle synchronization and regional integration in East Asia, as intra-Asian trade expands. The VAR results generally confirm this, as East Asia's aggregate and individual outputs move mostly in the same direction in response to foreign and East Asian aggregate shocks. Rapid growth in

intra-Asian trade, particularly through production sharing arrangement across the region, appears to provide a strong impetus to regional integration.

Second, the rapid growth in intra-Asian trade has been deeply rooted in the region's production sharing network and hence remains heavily influenced by global demand. Empirical findings show that both US and European shocks exert significant and positive effects on the East Asian aggregate and individual economies in the 2000s. Moreover, the East Asian aggregate output shock has positive, and significant, effects on the US and European economies as well. Also interestingly, the East Asian aggregate output shocks have a larger (positive) effect on European output than the US output.

Third, changes in the trade structures among East Asia, Europe and the US point to the increasingly globalized production network. East Asia plays an increasingly important role as a supplier of intermediate goods for the advanced economies, while importing more of final goods from these economies. This change may explain why shocks from emerging Asian economies exert a significant and positive influence on global economies. As East Asia becomes more integrated into the global production network, output co-movements between East Asia and the US/European economies would likely increase. This is also consistent with our earlier findings of "recoupling" (see Kim, Lee, and Park, 2009).

One of the key factors driving these changes is the rise of the PRC. It may be too early to predict how the rise of PRC will shape Asia's trade linkages and macroeconomic relationships both within and outside the region. However, recent evidence suggests the role of PRC—connecting East Asia's intra- and extra-regional trade—is making fundamental changes in the nature of macroeconomic interdependence and growth spillovers among East Asia, Europe, and the US.

The changes in PRC's trade patterns offer interesting insights for the future. Firstly, on future directions of East Asia's relationship with the US and Europe. PRC's exports are gaining ground in EU. EU's share has grown from 13.3% to 20.6%, while that for the United States' share remains stable averaging at 20.2%. Greater trade linkages between Asia and Europe may help reduce excessive reliance of global trade on US consumers.

Secondly, the share of parts and components in PRC's trade has been declining, and the share of final goods trade rising, although PRC trade in parts and components remains substantial, implying that it is flourishing alongside vigorously expanding trade in final goods. Especially, PRC's trade with East Asia increasingly centers on final goods and become less reliant on parts and components. PRC is progressively integrating with East Asia, becoming a source for and destination of final goods in the subregions.

Thirdly, PRC's trade with EU is dominated by final goods, but imports of parts and components are rising, indicating that EU is progressively becoming a source of PRC's intermediate inputs. Meanwhile, PRC's trade with US and Japan is dominated by final goods, but parts and components exports are rising. PRC is becoming an important supplier of US and Japanese parts and components. Time will tell if and how these changes in PRC's trade patterns will help rebalance global trade flows and contribute to an orderly resolution of global imbalances.

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Figure 18: Impulse Responses, the Basic Model (2000–2007:2)

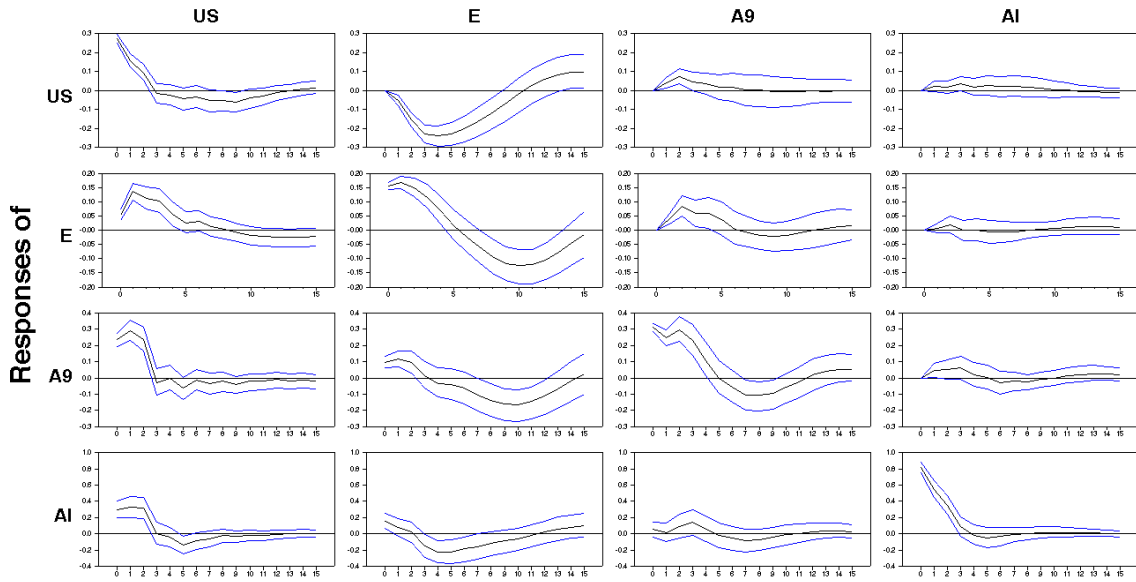


Figure 19: Impulse Responses, Alternative Ordering (2000–2007:2)

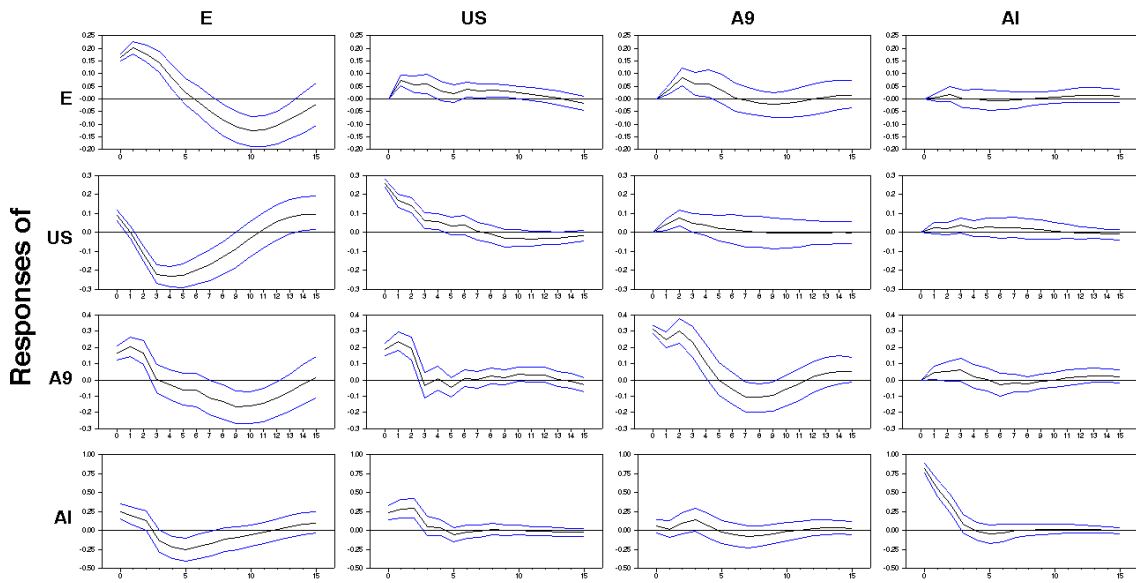


Figure 20: Impulse Responses, Chinese Output (2000–2007:2)

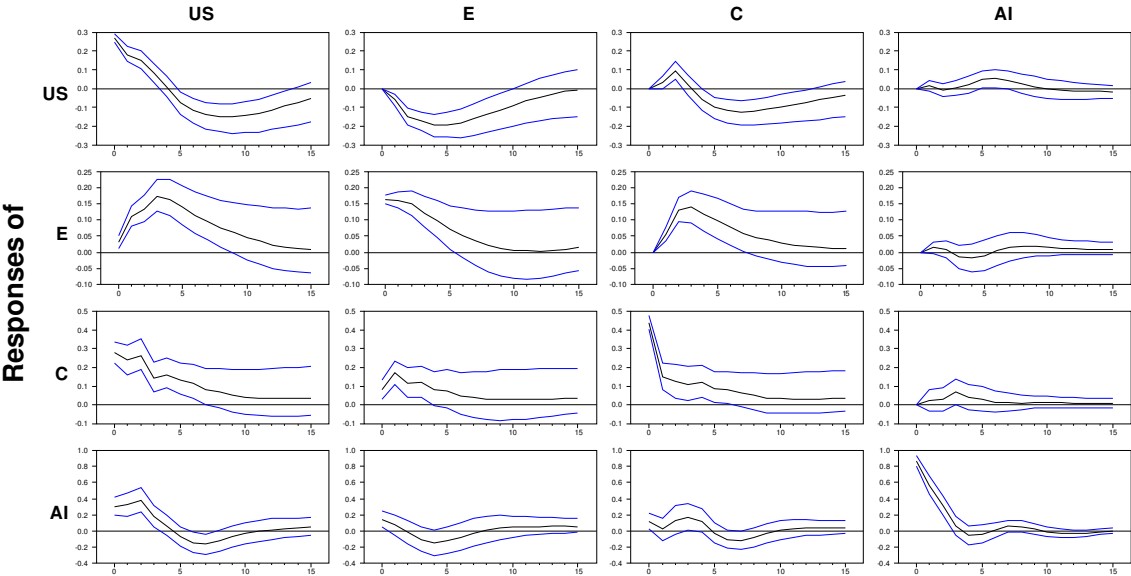


Figure 21: Impulse Responses, Including Japan (2000–2007:2)

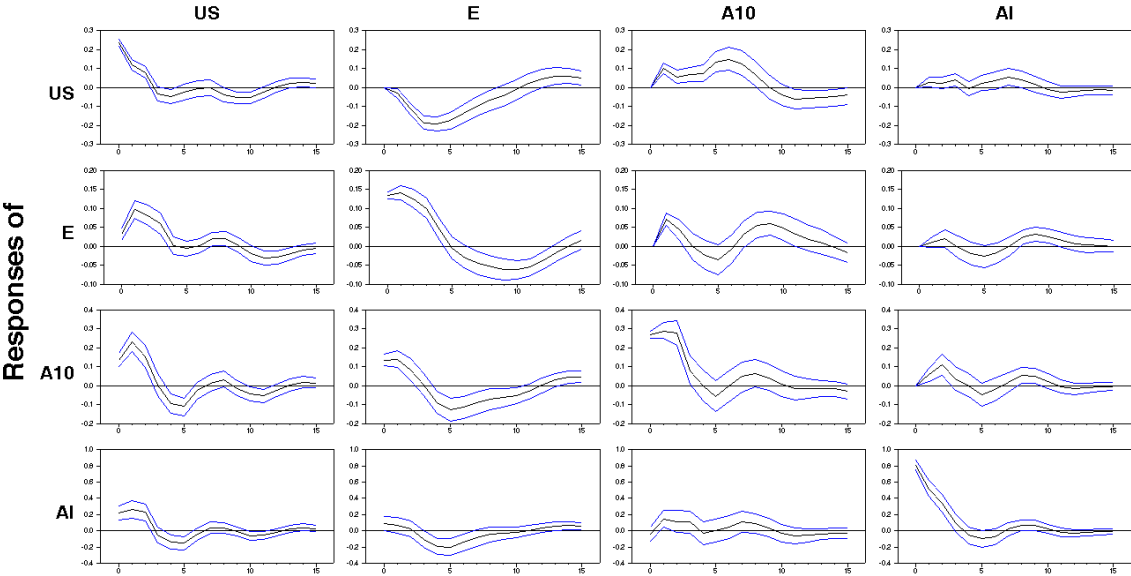


Table 1: Export profiles by destination**Exports of European Union 27 to**

	1990	1995	2000	2005	2008
East Asia	3.6	5.6	4.6	4.6	4.7
United States	6.9	6.5	9.0	7.8	6.2
Japan	2.0	2.1	1.7	1.3	1.1
European Union 27	67.2	66.4	67.7	67.4	67.2
Rest of the World	20.2	19.5	17.0	18.9	20.8
Total	100.0	100.0	100.0	100.0	100.0

Exports of United States to

	1990	1995	2000	2005	2008
East Asia	14.6	19.1	16.7	17.2	16.9
Japan	12.4	11.0	8.4	6.1	5.1
European Union 27	26.7	21.6	21.8	20.7	21.2
Rest of the World	46.4	48.3	53.1	56.0	56.8
Total	100.0	100.0	100.0	100.0	100.0

Exports of Japan to

	1990	1995	2000	2005	2008
East Asia	29.8	42.4	40.3	47.2	46.8
United States	31.6	27.5	30.1	22.9	17.8
European Union 27	20.8	16.1	16.8	14.6	14.1
Rest of the World	17.8	14.0	12.7	15.3	21.3
Total	100.0	100.0	100.0	100.0	100.0

Exports of East Asia to

	1990	1995	2000	2005	2008
East Asia	31.1	37.4	37.0	41.0	39.0
United States	22.5	19.6	21.3	17.1	14.2
Japan	14.4	12.7	12.2	9.5	8.0
European Union 27	16.0	14.4	15.3	15.4	15.6
Rest of the World	16.0	15.9	14.3	17.0	23.2
Total	100.0	100.0	100.0	100.0	100.0

East Asia includes: People's Rep. of China; Hong Kong, China, Indonesia, Rep. of Korea; Malaysia; Philippines; Singapore; Taipei, China; and Thailand.

Source: Direction of Trade Statistics, International Monetary Fund and CEIC database.

Table 2: Import profiles by origins

Imports of European Union 27 from

	1990	1995	2000	2005	2008
East Asia	4.4	6.1	7.9	9.1	9.2
United States	7.2	7.2	7.9	5.3	4.5
Japan	4.3	3.9	3.5	2.4	1.8
European Union 27	64.3	64.4	62.5	62.6	62.6
Rest of the World	19.8	18.3	18.2	20.6	21.9
Total	100.0	100.0	100.0	100.0	100.0

Imports of United States from

	1990	1995	2000	2005	2008
East Asia	18.5	22.6	22.8	25.3	25.0
Japan	18.0	16.5	12.1	8.2	6.6
European Union 27	20.2	18.1	18.6	18.5	17.4
Rest of the World	43.2	42.7	46.5	48.1	51.0
Total	100.0	100.0	100.0	100.0	100.0

Imports of Japan from

	1990	1995	2000	2005	2008
East Asia	26.5	34.0	39.3	41.7	37.5
United States	22.5	22.6	19.1	12.7	10.4
European Union 27	16.3	14.7	12.6	11.4	9.3
Rest of the World	34.7	28.7	29.0	34.1	42.9
Total	100.0	100.0	100.0	100.0	100.0

Imports of East Asia from

	1990	1995	2000	2005	2008
East Asia	29.0	32.5	39.2	40.7	40.0
United States	15.6	14.4	13.4	9.2	7.8
Japan	21.9	22.4	19.3	15.9	12.8
European Union 27	14.3	14.1	11.4	10.3	9.8
Rest of the World	19.2	16.6	16.7	24.0	29.5
Total	100.0	100.0	100.0	100.0	100.0

East Asia includes: People's Rep. of China; Hong Kong, China, Indonesia, Rep. of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.

Source: Direction of Trade Statistics, International Monetary Fund and CEIC database.