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Determinants of Export Performance in East and Southeast Asia

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DETERMINANTS OF EXPORT PERFORMANCE IN EAST AND SOUTHEAST ASIA

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FOREWORD

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ABSTRACT

This paper examines patterns and determinants of exports in nine East and Southeast Asian economies, with an emphasis on the increasing important role of parts and components in total exports. To see whether exports in parts and components are "special" and to allow comparisons, export equations are estimated for three different export categories: total merchandise exports, manufacturing exports, and exports of machinery and transport equipment (SITC 7). The analysis covers the period 1990–2006, during which parts and components trade burgeoned. The estimations reveal that the growing importance in the export composition of parts and components within vertically integrated cross-border production processes has tended to weaken the nexus between real exchange rate and export performance. Supply-side factors tend to become more crucial in determining export performance.

I. INTRODUCTION

Economic growth in East and Southeast Asia since the early 1980s has been underpinned by rapid expansion in manufacturing exports. The surge in exports of manufactured goods during this period has been accompanied by a shift in commodity composition. Although the speed of adjustment has varied, all countries in the region tended to start with a focus on technologically simple labor-intensive goods such as apparel and footwear, and then moved to a range of more capital-intensive, technologically sophisticated items, especially electrical and nonelectrical machinery.

Rapid advances in production technology and technological innovations in transportation and communications have allowed companies to "unbundle" the stages of production so that different tasks can be performed in different places. Also, trade liberalization and investment policy reforms in developing countries have greatly reduced barriers to trade and investment, thereby further encouraging expansion and dispersion of outward direct investment of multinational enterprises (MNEs). These dynamics have resulted in the increasing importance of international product fragmentation—the cross-border dispersion of component production/assembly within vertically integrated production processes[1]—and a shift in the composition of exports toward intermediate goods (parts and components).

These emerging patterns could have implications for the factors that influence export performance. Jones and Kierzkowski (2001) and Arndt and Huemer (2004) have argued that a surge in intermediate goods trade could dilute real exchange rate impacts as intermediate exports involve a high proportion of imported parts and components and high fixed costs in establishing the "service links." However, Obstfeld (2002) and Rauch and Trindade (2002) have argued that the increasing importance of product fragmentation and of trade in parts and components could induce stronger substitution responses as the presence of production facilities in different countries would allow firms to respond more nimbly to international price changes by shifting activities across borders.

This paper aims to examine the determinants of exports, with emphasis on the increasing important role of parts and components in total trade. To see whether trade in parts and components is "special" and to allow comparisons, export equations are estimated for three different export categories, which are total merchandise exports, manufacturing exports, and exports of machinery and transport equipment (SITC 7), largely consisting of parts and components exports. The analysis is conducted for nine economies in East and Southeast Asia[2] during 1990–2006, a period over which intermediate goods trade burgeoned. Though exports are now growing quickly in some countries of South Asia, it has not yet latched onto international production networks to the same degree as East and Southeast Asia. Besides, comparable data do not exist for South Asian countries.

[1] This phenomenon has gone under alternative names, such as "vertical specialization" (Hummels et al. 2001, Irwin 2002); "slicing the value chain" (Krugman 1995); "international production sharing" (Ng and Yeats 2001); "outsourcing" (Rangan and Lawrence 1999, Hanson et al. 2001); and "product fragmentation" (Jones 2000, Jones and Kierzkowski 2001, Baldwin 2001, Athukorala 2006).

[2] The nine economies in East and Southeast Asia are the People's Republic of China (PRC); Hong Kong, China; Indonesia; Republic of Korea; Malaysia; Philippines; Singapore; Taipei,China; and Thailand.

The organization of the paper is as follows. Section II provides an overview of the phenomenon of international production fragmentation. Changes in exports and trade composition over the past three decades are presented in Section III. Section IV looks at the analytical framework of export determination. Time series properties of data and the econometric procedures are described in Section V and VI, respectively. Section VII presents and discusses regression results. The final section summarizes key inferences.

II. INTERNATIONAL PRODUCT FRAGMENTATION: FIRST LOOK

International product fragmentation is the cross-border dispersion of component production/ assembly within vertically integrated production processes. Its expansion has been largely underpinned by three mutually reinforcing developments over the past few decades. First, rapid advancements in production technology have enabled industries to slice up the value chain into finer, portable components. Second, technological innovations in transportation and communications have collapsed the distance once separating the world's nations, improving the speed, efficiency, and economy of coordinating geographically dispersed production processes. This has facilitated establishment of "service links" to combine various fragments of the production process in a timely and cost-efficient manner (Jones and Kierzkowski 2001). Third, liberalization policy reforms in both home and host countries have considerably removed barriers to trade and investment (Athukorala 2006).

Production outsourcing practices were first employed by MNEs, starting from the late 1970s among Japanese, United States (US), and west European MNEs, but the procedure has been more pronounced since the late 1980s. More recently, MNEs from more advanced developing countries, notably East and Southeast Asia, have also joined this process of internationalization of production. In response to rapid domestic wage increases, the growing reluctance of domestic labor to engage in low-paid employment, and stringent restrictions on the importation of labor, firms in the electronics industry, and other durable consumer goods industries in the newly industrialized economies (NIEs) have begun to produce components and conduct subassembly activities in neighboring countries, where labor costs are still low.

In recent years, outsourcing practices have begun to spread beyond the domain of MNEs. Many companies that are not part of MNEs' networks now procure components globally through "arm's-length" trade. Technological innovations in communications have reduced costs of outsourcing, particularly through lower research costs. The process has also been facilitated by the standardization of some components. However, MNEs are still responsible for the bulk of fragmentation trade (Rangan and Lawrence 1999, Urata 2001, Athukorala 2006). Over time, the fragmentation process has also expanded to involve many countries in the assembly process at different stages, resulting in product fragments crossing many borders repeatedly before they are incorporated into the final product.

At the formative stage of international product fragmentation, outsourcing took predominantly the form of locating small fragments of the production process in low-cost countries and re-importing the assembled components to be incorporated in the final product. Over time, the fragmentation process has expanded to involve many countries in the assembly process at different stages, resulting in multiple border crossing of product fragments before getting incorporated in the final product.

Recent years have witnessed two other important developments in the process, setting the stage for rapid expansion in the share of fragmentation-based trade in world trade. First, some fragments of the production process in certain industries have become "standard fragments", which can be effectively used in multiple products. Examples include long-lasting batteries originally developed by computer producers and now widely used in cellular phones and electronic organizers; transmitters, which are used not only in radios but also in personal computers; and electronic chips, which have spread beyond the computer industry into consumer electronics and motor vehicle production (Jones and Kierzkowski 2001, Brown et al. 2003, Authokorala 2006).

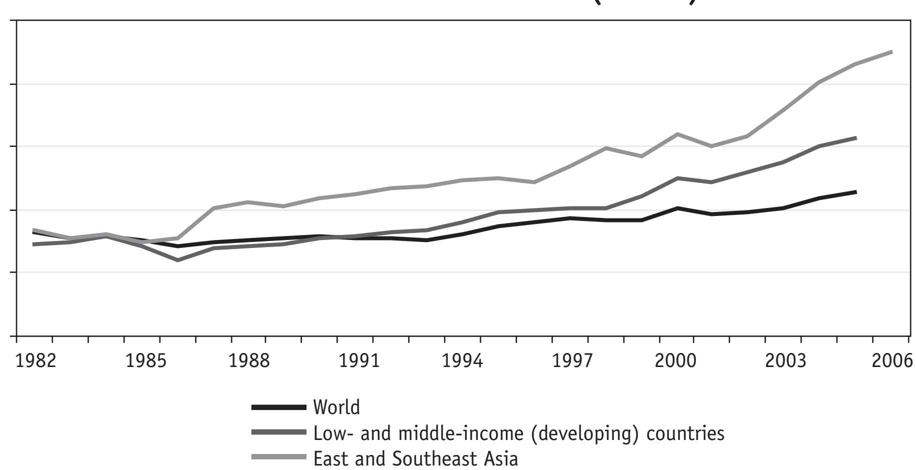
Second, the coverage of global assembly operations has seen noteworthy expansion from production and assembly of components to assembly of final products, such as computers, cameras, television sets, and motor cars. Given the heavy initial fixed costs, MNEs are hesitant to establish overseas plants in final assembly without considerable first-hand commercial experience in the host country.

Because of these two developments, overseas production units of MNEs involved in such final stage assembly are located in other industrialized countries or in more advanced NIEs. However, in recent years, the People's Republic of China (PRC) has emerged as an important location for final assembly in many product lines, largely because of the vast domestic market for these products, which naturally reduces the risks of covering the initial establishment costs (Borrus 1999, Authokorala 2006).

III. CHANGES IN EXPORTS AND TRADE COMPOSITION

Export-oriented industrialization has been a marked feature of growth and development in East and Southeast Asia since the 1970s or earlier. The share of exports in gross domestic product (GDP) in this region has grown continuously during this period and this rise has been even more pronounced since 2000 (Figure 1). Export shares relative to GDP began to diverge from developing-country and world averages in the early 1980s, and by 2005 these shares were some 1.5–2 times as high.

FIGURE 1
SHARE OF EXPORTS TO GDP (PERCENT)



Source: *World Development Indicators* online database (World Bank 2007), downloaded 11 June 2007.

The rise of exports in Asia has followed a distinctive pattern. After Japan's export success in the 1950s and 1960s, the NIEs began to enter export markets as Japan's industrial structure shifted away from labor-intensive to more sophisticated products. Policies supporting exporters then allowed the NIEs to expand their exports in the labor-intensive activities in which Japan was losing advantage. However, by the late 1980s, these economies were losing their edge in labor-intensive activities as a result of rising wage costs and attendant real currency appreciation. In addition, the imposition and gradual tightening of quantitative restrictions by industrial countries blunted penetration in textiles, garments, and footwear markets (Wells 1986). These factors encouraged a shift toward more capital-intensive industries and outward direct investment in countries where costs were lower. These trends were given added impetus by the 1985 Plaza Accord, which saw a sharp revaluation of the yen and a steady appreciation of NIE currencies.

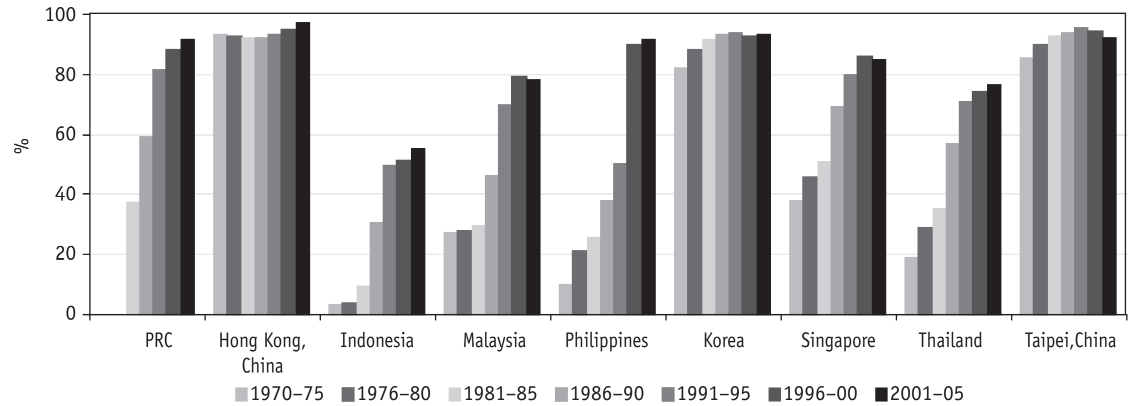
As profitability fell at home, producers from Japan and the NIEs began to move their production platforms to Southeast Asia. These countries were attractive to investors because of their relatively favorable macroeconomic conditions, and trade and investment policies. On the heels of direct inward investment, an export boom followed in labor-intensive manufacturing. At the same time, rapid advances in production technology created the opportunity for investors to redesign production processes in ways that accentuated task specialization, i.e., splitting up fabrication and assembly processes. By relocating some segments of the value chain rather than entire industries to lower-cost locations, industries reaped greater profits (Krugman 1995). This process occurred extensively in the electronics industry so that by the mid-1980s, Southeast Asian countries started exporting electronics and other more technologically sophisticated products.

Later, in the early 1990s, the PRC emerged as a fast-growing exporter of labor-intensive manufacturers. Product lines "migrated" to the PRC from other countries in East and Southeast Asia, attracted by its large pool of cheap labor, its rapidly improving infrastructure, and policies favoring exporters.

The evolution of export and trade patterns in the region can be traced using detailed trade data, specifically the United Nations Commodity Statistics Database, based on Revision 3 of the Standard International Trade Classification (SITC, Rev. 3); and Statistics Canada, World Trade Analyzer for Taipei,China. Figure 2 shows how the profile of manufacturing exports has changed over time.[3] During the past three decades, manufacturing exports from East and Southeast Asian economies have expanded rapidly and gained in relative importance in total merchandise exports. In Hong Kong, China; Republic of Korea (henceforth Korea); and Taipei,China, the proportion of manufacturing to total exports has been persistently high, at around 90% over the past three decades. Other than for Indonesia, the share of manufacturing exports has exceeded 80% during the post crisis period. The share has significantly increased in the Philippines, from 50% during 1991–1995 to more than 90% during 1996–2006, while it has climbed gradually in the other economies.

[3] Export data on manufactured goods for the PRC were not available prior to 1981.

FIGURE 2
PROPORTION OF MANUFACTURING EXPORTS TO TOTAL EXPORTS



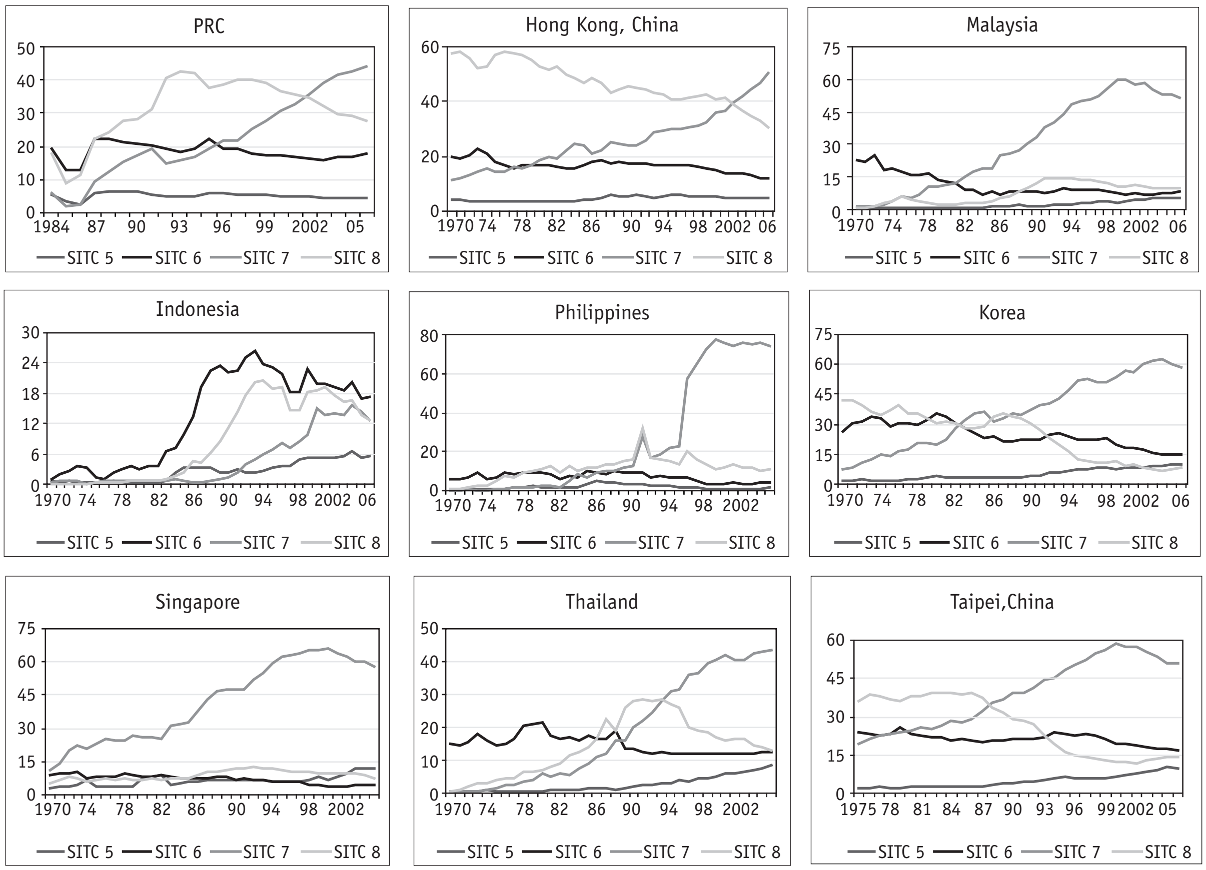
Sources: ADB Statistical Database System; CEIC Data Company, Ltd.; and United Nations Comtrade database, DESA/UNSD, all downloaded 16 July 2007.

Indonesia has had the slowest rise in manufacturing export shares, despite trade liberalization and export promotion policies from the late 1980s. At the end of the oil boom in the early 1980s, petroleum and petroleum and gas products accounted for almost three-quarters of total merchandise exports. The collapse of oil prices in 1982, followed by another precipitous fall in 1985–1986, therefore brought about a massive decline in total export earnings. But the Indonesian economy managed to regain export dynamism from about 1987 by shifting to non-oil exports, particularly manufacturing exports. By the mid-1990s, manufactured goods contributed around 50% of the country's total merchandise exports, compared with less than 10% at the beginning of the 1980s. But this share has barely moved since the early 1990s. This slow progress would seem to reflect "Dutch Disease", where the hydrocarbon and other natural resource-based export sectors tend to dominate other non-oil manufacturing exports.

Figure 3 provides a breakdown for the nine economies of the anatomy of exports within manufacturing.[4] The growing importance of SITC 7 in manufacturing exports in these economies reflects an important feature of international product fragmentation. It shows that exports of machinery and transport equipment (SITC 7) have expanded rapidly, dwarfing the traditional manufacturing duo of clothing and footwear (SITC 8). Indonesia is the only exception to this general pattern. For the PRC and Hong Kong, China, exports in SITC 7 began to really take off in the early 1990s, reflecting the dominant role of outsourcing activity in manufacturing. In the PRC, the share of SITC 7 in total merchandise exports more than tripled from less than 15% in 1992 to almost 45% in 2006, while in Hong Kong, China, it doubled from 25% to 50% during the same period. SITC 8 in Hong Kong, China declined continuously from 60% in 1970 to 30% in 2006, while in the PRC it rose during 1984–1993 but has since declined constantly. By 2006, the share of SITC 8 was less than 30% of total merchandise exports. The share of other manufacturing exports (chemicals—SITC 5, and basic manufacturing—SITC 6) has shown broad stability.

[4] Disaggregated data on manufactures for the PRC were unavailable prior to 1984. The data series for Taipei,China begins in 1975.

Figure 3
Percentage Share of Four Subcategories in Manufacturing Exports



Sources: ADB Statistics Database System; CEIC Data Company, Ltd.; United Nations Comtrade database, DESA/UNSA, all downloaded 16 July 2007.

The trends of SITC 7 exports for Korea and Taipei,China are similar. Both take off in the mid-1980s, becoming the most significant contributor to manufacturing and total exports by the early 1990s. Until then, textiles, clothing, and footwear in SITC 8 played an important role. By 2006, SITC 7 exports accounted for almost 60% of total exports in Korea and about 50% in Tapei,China. SITC 7 exports have also grown in Malaysia and Singapore. By 2006, the share in total exports had surpassed 50% in these two countries.

SITC 7 exports show expansion in both the Philippines and Thailand, with a more pronounced surge in the former. By 2000, SITC 7's share had climbed to almost 75% in the Philippines but was around 45% in Thailand, reflecting Thailand's broader export base and deeper industrial structure. For SITC 8, its export share rose from around 10% in the mid-1980s to almost 30% in the early 1990s before gradually declining back to almost the same level as in the mid-1980s.

The evolution of Indonesia's export structure is different from the broad drift toward SITC 7 that has occurred in other countries. Resource-base manufacturing, mostly mineral products (SITC 6) and miscellaneous manufacturing (SITC 8), predominantly clothing apparel and footwear, have accounted for almost two thirds of the country's manufactured exports. By 2006, SITC 6 exports contributed almost 20% of total merchandise exports, while SITC 8 contributed about 12%. SITC 7 contributes similar share as SITC 8 in 2006 but in Indonesia, SITC 7's share was far below that in other East and Southeast Asian economies.

A. Trade in Parts and Components

An important feature of international product fragmentation is the increasing significance of trade in parts and components. To gain better knowledge of the relative importance of such trade in these nine economies, the SITC 7 five-digit industries from United Nations Comtrade database are examined. The items within these classifications are separated into parts and components, and final products, according to the lists of parts and components in Athukorala (2006). The list contains 168 categories at the 5-digit level. Note that the data on the SITC 7 five-digit industries of Taipei,China are based on Athukorala (2006); also that imports are also investigated along with exports in this section to roughly demonstrate the degree of import content in these economies, to help understand the role of the real exchange rate in export performance.

Table 1 shows the proportion of parts and components in total manufacturing exports and imports during 1990–1996 and 2000–2006.[5] Malaysia, Philippines, Singapore, and Thailand stand out in East and Southeast Asia for their heavy dependence on parts and components for export dynamism. The share of parts and components in total manufacturing exports has increased rapidly in these four countries, reaching over 40% in Malaysia, Philippines, and Singapore, and about 30% in Thailand during 2000–2006. Between these two periods, the share of components in total manufacturing exports more than doubled in the PRC, from 6% to 14%. In Korea and Taipei,China, the relative importance of components in total manufacturing exports has increased over the year, contradicting the popular belief that these economies had shifted palpably from assembly activities to final goods production.

TABLE 1
SHARE OF PARTS AND COMPONENTS IN TOTAL MANUFACTURING

	Exports		Imports	
	1990–2006	2000–2006	1990–1996	2000–2006
China, People's Rep. of	5.7	13.9	14.5	31.4
Hong Kong, China	13.4	27.4	15.3	29.7
Indonesia	4.0	12.5	17.7	16.1
Korea, Rep. of	21.8	27.5	26.3	33.2
Malaysia	38.2	42.5	35.0	50.4
Philippines	30.4	60.3	26.2	57.8
Singapore	31.0	46.5	32.7	47.6
Taipei,China	24.5	39.9	32.3	38.7
Thailand	18.9	26.3	22.9	30.8

Source: United Nations Comtrade database, DESA/UNSD, downloaded 16 July 2007; Athukorala (2006) for Taipei,China.

[5] See ADB (2007) for a more detailed discussion of trends and patterns of East Asian trade in parts and components.

Even though the share of parts and components in Indonesia rose considerably during the same period, it was because of their initial low export base. In fact, their dollar value remained low relative to those of other economies in the region: in 2005, for example, the dollar value of parts and components exports from Indonesia in 2005 was about one fourth that of Thailand. The small weight of parts and components and SITC 7 in Indonesian manufacturing exports indicates that the country has been slower than others to integrate in cross-border production networks.

The share of parts and components in total manufacturing *imports* also exhibits an upward trend in the region, again with the exception of Indonesia. Manufacturing production relies heavily on imported inputs. The import share of parts and components has more than doubled in PRC; Hong Kong, China; and Philippines. In the PRC, the share of parts and components imports has expanded more quickly than its share in exports, suggesting an important role for assembly activities.

As argued in Athukorala (2006), while growth in fragmentation-based trade is now a global phenomenon, it is far more important and is growing more rapidly in East and Southeast Asia than elsewhere in the world. Significant differences in wages and other complementarities among the countries of the region have provided the basis for rapid expansion of an intraregional product-sharing system, giving rise to increased cross-border trade in parts and components. First movers also enjoy considerable benefits in the form of agglomeration economies, not just at an enterprise level, but also at the level of industries, cities, and regions (Barry and Bradley 1997, Ruane and Gorg 2001).

B. Export Destinations

The growing importance of international product fragmentation in these nine economies has been associated with the diversification of export destinations. Table 2 compares the composition of total, manufacturing, and SITC 7 exports between 1990–1995 and 2000–2005 in these economies by destination. The more heavily shaded cells indicate where export shares increased over the comparison period. It is clear that international product fragmentation taking place in this region has induced more intraregional trade over the past 15 years. In particular, the PRC has become one of the major export destinations for all economies in this region, particularly for SITC 7 exports. In Korea, Malaysia, Philippines, Singapore, and Thailand, export value to the PRC as a share of total exports increased almost five times during this period, at the expense of the US and the European Union (EU). It was only for the PRC that the US and EU have been increasingly important over the past 15 years. The US and EU markets accounted for 21% and 16%, respectively, of the PRC's total export market during 2000–2005, increasing from 16% and 11% in 1990–1995. In significant measure, the expansion of intraregional trade reflects the PRC's role as an assembly point and its greater reliance on demand from outside the region, the US and EU in particular. Through its forward linkages to the PRC, the rest of the region also remains dependent on external sources of final demand.

Table 2
Destination of Asian Exports (percent of total)

	Total Exports		Manufacturing		SITC 7	
China, People's Rep. of	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	15.8	20.8	18.0	22.1	18.5	22.1
Japan	17.1	13.1	14.0	11.9	10.9	10.3
EU-15	11.4	16.2	12.0	16.8	11.5	18.7
Other East Asia	33.5	23.3	35.0	22.9	35.4	25.4
Southeast Asia	6.1	7.0	5.1	6.5	8.0	8.0
Other Asia	1.8	2.3	1.6	2.2	2.6	1.6
Rest of the World	14.4	17.3	14.3	17.5	13.1	13.9
Hong Kong, China	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	22.1	17.9	23.6	18.7	17.2	11.7
Japan	5.4	5.2	5.4	5.4	3.6	4.8
EU-15	14.6	13.6	15.6	13.9	13.1	11.0
China, People's Rep. of	31.3	40.6	29.7	40.0	36.4	49.0
Other East Asia	4.4	4.5	3.9	4.3	5.9	6.1
Southeast Asia	6.4	5.9	6.1	5.8	9.6	7.3
Other Asia	1.0	1.3	1.0	1.3	0.6	0.6
Rest of the world	14.9	11.0	14.8	10.8	13.6	9.5
Indonesia	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	13.1	12.4	17.4	18.2	24.7	13.7
Japan	30.5	20.3	14.5	12.6	6.8	14.2
EU-15	12.3	12.7	17.6	16.7	13.5	12.8
China, People's Rep. of	3.5	5.7	3.5	3.9	1.3	1.9
Other East Asia	12.5	12.5	11.2	7.6	5.4	6.0
Southeast Asia	12.7	17.3	16.3	21.3	34.9	39.6
Other Asia	1.2	3.9	1.2	2.4	0.8	0.9
Rest of the world	14.2	15.2	18.3	17.1	12.7	10.9
Korea, Rep. of	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	22.5	16.5	23.9	17.3	27.1	19.4
Japan	14.8	8.9	12.8	7.2	8.0	5.6
EU-15	11.7	12.7	12.5	13.7	15.0	16.5
China, People's Rep. of	4.8	17.3	4.5	16.9	2.5	12.9
Other East Asia	10.2	9.6	9.7	9.3	7.1	9.4
Southeast Asia	11.7	9.9	11.3	9.6	12.5	9.0
Other Asia	2.4	2.6	2.4	2.6	1.6	2.5
Rest of the world	22.0	22.4	22.9	23.3	26.2	24.6
Malaysia	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	19.0	19.2	25.5	23.1	29.1	26.2
Japan	13.0	10.7	8.5	8.8	8.2	8.2
EU-15	12.8	11.9	14.1	12.8	14.0	13.4
China, People's Rep. of	2.4	5.4	1.4	4.6	0.5	4.3
Other East Asia	10.4	12.0	9.1	11.8	8.4	12.6
Southeast Asia	27.3	24.4	27.0	23.8	28.7	24.2
Other Asia	2.4	3.3	0.7	1.6	0.5	1.0
Rest of the world	12.7	13.1	13.7	13.6	10.5	10.0

continued next page.

Table 2. continued.

Philippines	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	36.3	21.4	38.9	22.4	36.7	16.9
Japan	16.1	15.5	12.2	15.4	16.3	15.9
EU-15	16.8	16.2	18.2	16.8	15.4	17.4
China, People's Rep. of	1.3	4.9	0.6	4.6	0.1	5.1
Other East Asia	9.8	16.1	9.5	14.8	12.3	17.4
Southeast Asia	9.2	15.6	8.9	15.9	11.4	17.4
Other Asia	0.6	0.3	0.6	0.3	0.2	0.2
Rest of the world	9.9	10.0	11.1	9.8	7.6	9.8
Singapore	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	18.8	12.7	22.8	14.7	25.8	16.0
Japan	7.4	6.1	5.9	6.2	5.9	5.7
EU-15	12.7	11.8	14.8	13.2	16.4	12.5
China, People's Rep. of	2.0	6.2	1.4	6.4	1.0	5.9
Other East Asia	14.6	16.6	13.1	16.4	12.9	17.8
Southeast Asia	24.5	28.3	23.7	27.5	21.5	27.2
Other Asia	3.2	3.6	2.4	3.1	1.6	2.5
Rest of the world	16.9	14.7	15.8	12.7	14.9	12.5
Taipei,China	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	27.5	20.1	25.3	18.3	25.0	18.1
Japan	10.8	8.6	6.7	7.0	5.5	7.7
EU-15	15.4	13.2	14.4	12.4	17.2	14.3
China, People's Rep. of	9.3	23.0	8.3	20.6	6.9	16.0
Other East Asia	14.1	12.0	12.5	10.9	9.7	11.4
Southeast Asia	11.6	10.1	9.6	8.9	10.2	9.2
Other Asia	0.8	0.8	0.6	0.7	0.3	0.4
Rest of the world	10.5	12.1	22.5	21.2	25.2	22.9
Thailand	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**	**1990–1995**	**2000–2005**
United States	20.3	17.6	22.7	18.9	24.3	16.3
Japan	16.8	14.0	13.3	13.3	14.4	13.9
EU-15	15.7	14.4	15.7	15.8	13.1	16.2
China, People's Rep. of	1.8	6.3	0.6	5.3	0.4	5.5
Other East Asia	8.4	8.9	8.1	9.3	7.4	9.5
Southeast Asia	16.9	20.3	19.3	19.6	30.0	21.9
Other Asia	1.4	2.0	1.4	2.1	0.6	1.4
Rest of the world	18.7	16.5	19.0	15.6	9.8	15.3

EU-15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Republic of Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom.
Note: For this table only, East Asia comprises: PRC; Hong Kong, China; Korea; Mongolia; and Taipei,China. Southeast Asia comprises: Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.
Sources: United Nations Comtrade database, DESA/UNSA, downloaded 16 July 2007; Statistics Canada (2007).

IV. ANALYTICAL FRAMEWORK OF EXPORT DETERMINATIONS

Intra-industry trade in parts and components has become a prominent feature of the region's export trade. As yet, there is no consensus about the implications for the determinants of exports, especially the role of real exchange rate. Some economists (e.g., Jones and Kierzkowski 2001, Arndt and Huemer 2004) have argued that surging intermediate goods trade may dilute the immediate impact of real exchange rates on export performance as intermediate exports involve a high proportion of imported parts and components. The depreciation (or revaluation) of a currency lowers (raises) the foreign currency price of exports but also increases (reduces) the home-currency prices of component imports. To the extent that import content costs rise (decline), this will offset any expansion in demand induced by depreciation (appreciation).

In addition, it has been argued that international product fragmentation requires the establishment of "service links" in order to connect the various fragments of a production process in a seamless, rapid, and cost-efficient manner. Thus, the locational decisions of MNEs conducting assembly activities within an international production network are strongly influenced by the presence of other key variables such as infrastructure, logistic capabilities, availability of skilled operators, and modern technical and managerial skills (Barry and Bradley 1997, Ruane and Gorg 2001). There is a general tendency for MNE affiliates to become increasingly embedded in host countries the longer they are present there and the more conducive the overall investment climate of the host country becomes over time. In these circumstances, real exchange rate changes are but one part of a far wider set of considerations about where to locate production facilities.

However, others (e.g., Obstfeld 2002, Rauch and Trindade 2002, Hahn 2007) have argued that the increasing importance of product fragmentation and of trade in parts and components induces stronger substitution responses, as the presence of production facilities in different countries allows firms to respond more nimbly to international price changes by shifting activities across borders. Hahn (2007) observes that the relatively high output response to relative prices of the intermediate goods sectors is likely to be particularly related to the relatively low degree of product differentiation and subsequently high degree of substitutability and competition between domestic and foreign production.

To see whether trade in parts and components is "special", export equations are estimated basing on the "imperfect substitution" model. The model is derived from the conventional equations of demand for and supply of exports. Suppose demand and supply equations have the following log-linear equilibrium relationships,

export demand:

$$X = \beta_0 - \beta_1 \left(P^X / P^W \right) + \beta_2 WD \quad (1)$$

export supply:

$$X = \alpha_0 + \alpha_1 \left(P^X / \bar{P}^d \right) + \alpha_2 Z \quad (2)$$

where

X = volume of exports

P^x = export price expressed in foreign currency

P^w = price of competing goods in the import markets expressed in foreign currency

$\bar{P}^d$ = P^d/e, P^d = price of exportables in the domestic market expressed in local currency

e = nominal exchange rate (local currency per a unit of foreign currency)

Z = domestic production capacity in the tradable sector

WD = real income in importing countries

α_i and β_i > 0

Equation 1 asserts that demand for exports is negatively related to the relative price of exports and of the competing goods in the import markets. All other things being equal, an increase in the price of exports lowers the demand for exports while a rise in the price of the competing goods would increase demand for exports.

Equation 2 presents the supply side of exports. Decisions of firms to export depend on their relative returns between domestic sales and exports given production capacity. The return in domestic sales is measured by the price of close substitute products in the domestic market, i.e., "exportables." An increase in the price of exportables lowers the supply of exports, other things being equal, as there would be larger profits in the local market. Conversely, a rise in export prices and production capacity would increase the supply of exports.

Ideally, equations (1) and (2) should be estimated simultaneously. However, such an approach tends to be constrained by data availability, which would be even more severe when conducting a disaggregated multi-country study. Therefore, a number of empirical studies in this research area (e.g., Goldstein and Khan 1985, Bushe et al. 1986, Arndt and Huemer 2004, Athukorala 2004, Chinn 2003 and 2005) examine export behavior using a single-equation approach where both demand and supply equations are solved together to yield an expression for the equilibrium volume of exports as illustrated in equation (3).

$$X = \delta_0 + \delta_1\left(P^W / \bar{P}^d\right) + \delta_2 WD + \delta_3 Z \quad (3)$$

where $\delta_0 = \frac{\alpha_0\beta_1 + \alpha_1\beta_0}{\alpha_1 + \beta_1}$, $\delta_1 = \frac{\alpha_1\beta_1}{\alpha_1 + \beta_1}$, $\delta_2 = \frac{\alpha_1\beta_2}{\alpha_1 + \beta_1}$, $\delta_3 = \frac{\alpha_2\beta_1}{\alpha_1 + \beta_1}$ and $\delta_1, \delta_2, \delta_3 > 0$.

In other words, the equilibrium exports under the single-equation approach can be rewritten as follows:

$$X = f\left(RER,\ WD,\ Z\right) \quad (4)$$

where

RER = real exchange rate, the relative prices of foreign to domestic goods expressed in a common currency

Note that under a small open economy in which firms are price-takers in export markets, equations (1) and (2) cannot be determined simultaneously as a system of equations. If a country is a true price taker, P^x and P^w would be perfectly, or at least very highly, collinear. In this case, the relative price variable would exhibit very little variability. Therefore, for a true small country, the coefficient on the relative price variable cannot be precisely estimated and it may turn out relatively low (statistically insignificant) even if its true value is high (Browne 1981, Riedel 1988, Athukorala and Riedel 1991). Thus, for a small open economy, equation (1) should be inversed and expressed in terms of P^x (referred to inverse demand function).

$$P^X = \gamma_0 + \gamma_1 X + \gamma_2 P^W + \gamma_3 WD \quad (5)$$

There are two caveats that should be taken into account in applying the single-equation approach as in equation (4). First, a single equation model is too simple to estimate structural parameters in the demand and supply functions, as the coefficients estimated are net effects of demand-supply interactions. Estimation of structural parameters requires a more complex multi-equations approach in which both demand and supply equations are estimated simultaneously. More and better data would be required to disentangle demand-supply effects. Second, the model is unable to capture the impacts that differences in market structure and/or pricing behavior of firms might make. However, given the dominant role of MNEs in the manufacturing trade of East and Southeast Asian economies over the period, it is unlikely that individual firms within developing countries are able to influence market structures or change pricing behavior within an industry (Hobday 1995 and 2000).[6] In addition, competition among MNEs in global markets could also limit changes in pricing behavior of firms.

V. DATA AND VARIABLE MEASUREMENT

The export equations in this study were estimated using quarterly data. According to the availability of export data, the period of coverage for the export equations varies from country to country. Table 3 summarizes the period of coverage for estimating the export equations in nine East and Southeast Asian economies. Export volume for total and subcategories is derived from adjusting export values by appropriate export price indices. The export value here refers only to domestic exports, i.e., excluding re-exports.

TABLE 3
PERIOD OF COVERAGE FOR ECONOMETRIC ANALYSIS OF THE EXPORT FUNCTIONS

ECONOMY	PERIOD COVERAGE
PRC	1993–2006
Hong Kong, China	1991–2006
Indonesia	1990–2006
Korea	1990–2006
Malaysia	1992–2006
Philippines	1991–2006
Singapore	1990–2006
Taipei,China	1994–2006
Thailand	1995–2006

The real exchange rate is measured as the ratio of the export-weighted producer price index of trading partner countries expressed in domestic currency relative to the domestic producer price index. Export share is used on the basis of its superiority in representing the country's competitiveness

[6] Most internationally traded manufactured goods are tailor-made, so that their manufacturing process tends to be complex and includes, in addition to assembly, research and development, product design, and marketing activities. Consequently, the role of MNEs in developing countries has become more important for export success. For many SITC 7 items, production technology per se is a proprietary asset, and world production and trade are conducted mainly by a handful of leading MNEs. For consumer manufactured goods, such as apparel and footwear, in which the production technology is likely to involve standard technology, the MNE network is still important in helping domestic firms to establish international marketing skills, quality control, and product design.

rather than other possible weights such as total trade share or import shares (Warr 1986). The rationale behind the choice of this measure among various proxy measures of the real exchange rate is discussed in Box 1. Note that the estimation outcome of alternative real exchange rate measures yielded virtually identical results so that only the estimates using the foreign and domestic producer price indices are reported herein.[7]

World demand is measured as the weighted average of the real incomes of key export partners, which together account for 80% of shipments of East and Southeast Asia to all trade partners. The production capacity of total, total manufacturing, and SITC7 is proxied by the trend of their real output using the Hodrick-Prescott filter method. Other methods, such as exponential smoothing and the Kalman filter, also provide virtually identical results but the Hodrick-Prescott filter is selected, as it has the best performance in terms of both explanatory power and as a diagnostic test in determining private export equations.

Data series of export value (total and subcategories), export prices, consumer price index, producer price index, and real GDP were compiled from CEIC Data Company Ltd. Nominal exchange rates were compiled from the International Monetary Fund's (IMF) *International Financial Statistics* and from CEIC DATA Company Ltd., all downloaded 16 July 2007. Table 4 summarizes variable measurement and data sources of all variables used for econometric analysis for nine economies.

Table 4
Variable Measurement and Data Sources Used for Econometric Analysis for Nine Economies

	Variable Measurement	**Data Sources**
Consumer price index (CPI)	Index (1990=100)	CEIC Data Company Ltd.
Producer price index (PPI)	Index (1990=100)	CEIC Data Company Ltd.
Real effective exchange rate (RER)	Ratio of export-weighted producer price index of trading partner countries expressed in domestic currency relative to the domestic producer prices.	Staff calculations
Nominal exchange rate	Bilateral exchange rate against the US dollar.	CEIC Data Company Ltd. and IMF International Financial Statistics
Nominal effective exchange rate (NEER)	Export-weighted bilateral exchange rate (domestic against foreign currencies).	Staff calculations
World demand (WD)	Weighted average of real income of key export partners. The weight covers 80% of total export partners.	CEIC Data Company Ltd.; staff calculations
Production capacity (Z) (total and subcategories)	Hodrick-Prescott filter of real output (total and subcategories) is applied. Other methods, such as exponential smoothing and the Kalman filter, also provide virtually identical results, but the Hodrick-Prescott filter is selected as it has the best performance for a diagnostic test.	CEIC Data Company Ltd.; staff calculations

continued next page.

[7] An exception is in the case of Singapore where the estimated coefficients corresponding to the real exchange rate are different among alternative measures. The real exchange rate coefficients based on CPI-CPI and PPI-CPI tend to provide virtually identical coefficients of real exchange rates but they tend to be higher than PPI-PPI-based real exchange rate measures. The differences in the coefficients are, on average, around 0.25.

Table 4. continued.

Export value (total and subcategories)	Domestic exports (i.e., excluding re-exports)	CEIC Data Company Ltd.
Export prices (total and subcategories)	Index (1995=100)	CEIC Data Company Ltd.
World producer price index	Export-weighted producer price index of trading partner countries	CEIC Data Company Ltd.; staff calculations

Note: All data were downloaded 16 July 2007.

VI. ECONOMETRIC PROCEDURE

In line with standard practice in time-series econometrics, the time series property of data was tested at the outset using the Augmented Dickey-Fuller test. Test results are reported in Table 5. According to the test results, the variables under consideration do not have the same order of integration in each country. For example, in the PRC, real exchange rate is stationary (I(0)) while other variables are nonstationary (I(1)); in Hong Kong, China generated production capacity is trend-stationary while other variables are nonstationary; in Thailand, total exports, exports in SITC 7, real exchange rate, and generated production capacity are stationary while others are nonstationary.

The fashionable cointegration econometric procedures, such as the two-step residual-based procedure adopted by Engle-Granger (1987), and the system-based reduced rank regression approach due to Johansen (1988 and 1991), which are appropriate for the variables in the system, being of equal order of integration, are not applicable in this case. The econometric analysis in this study is based on the general-to-specific modeling (GSM) procedure (Hendry et. al. 1984, Wickens and Breusch 1988, Hendry 1995, Pesaran et al. 2001). The GSM procedure is applicable when the set of variables includes series that are nonstationary, or a mixture of nonstationary and stationary variables. In the case of a finite sample and nonstationary data series, this procedure tends to provide more precise estimates than the Johansen procedure. In particular, the Johansen procedure, which is based on the full vector autoregression, tends to deteriorate significantly in small samples, generating estimates with "fat tails" (frequent outliers) and sometimes substantial mean bias (Hargreaves 1994). Therefore, GSM procedure is chosen for estimating the behavioral equations in this chapter.

The GSM approach embodies the relationship being investigated within a sufficiently complex dynamic specification, including lagged dependent and independent variables, so that a parsimonious specification of the model can be uncovered. Under this procedure, estimation begins with an autoregressive distribution lag (ADLs) specification of an appropriate lag order:

$$Y_t = \alpha + \sum_{i=1}^{m} A_i Y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{m} B_{ij} X_{j,t-i} + \mu_t \tag{6}$$

where α is a constant, Y_t is the endogenous variable, $X_{j,t}$ is the j^{th} explanatory variable and A_i and B_{ij} are the parameters.

Equation (6) can be rearranged by subtracting Y_{t-1} on both sides and turns the set of explanatory variables into terms of differences representing the short-run dynamics. The lagged levels of both

BOX 1
MEASUREMENT OF THE REAL EXCHANGE RATE

The real exchange rate (*RER*) is a broad summary measure of the prices of one country relative to the prices of another or to a group of countries, both expressed in a common currency. It can generally be expressed as:

$$RER = \frac{eP^*}{P} = \prod_{i=1}^{I} \frac{\left(e_i P_i^*\right)^{W_i}}{P_{i,D}}$$

where e is the nominal exchange rate defined as units of home currency to a unit of foreign currency, P^* denotes the foreign (world market) price level, P is the domestic price level and w_i is the weight ($\Sigma w_i=1$). An increase in the value of the *RER* indicates that foreign goods become more expensive relative to domestic goods so that international competitiveness improves. An increase (decrease) in the *RER* is referred to as depreciation (appreciation).

The *RER* is sometimes used to measure the internal relative price incentive in a particular economy for producing or consuming tradable as opposed to nontradable goods. In this case, the *RER* is defined as the relative prices of tradable to nontradable goods and is referred to as the *internal RER* (Hinkle and Nsengiyumva 1999). A rise in the *internal RER* (a real depreciation) means that the tradable sector has become more competitive in relation to the nontradable sector. Therefore, the incentive structure favors switching of resources from nontradable to tradable production, and demand moves from tradable to nontradable goods.

Even though, in fact, a movement of the *internal RER* can be used to reflect the country's international competitiveness, it is based on the restrictive assumption that the "law of one price" holds for tradable goods. When it holds, the domestic tradable price is set by international markets adjusted by a nominal exchange rate, so that the ability to improve a country's international competitiveness position depends on incentives and profitability in domestic production of the nontradable goods sector. However, when the law of one price does not hold, the internal real exchange rate may not accurately reflect the country's international competitiveness (Little et al. 1993, Hinkle and Nsengiyumva 1999).

Even though concepts of the RER are relatively straightforward, two key issues are involved in constructing the *RER*, which are choice of prices and country weights.

Choice of Prices

The most commonly used price series in constructing the *RER* for measuring international price competitiveness is the consumer price index (CPI). The CPI has the advantage of being timely, similarly constructed across countries and available for a wide range of countries over a long time span. CPI-based *RER* measures, however, tend to provide a good reflection of the purchasing power of the domestic currency instead of a country's international price competitiveness because of the fact that CPI baskets contain a high proportion of nontradables. This makes a CPI-based *RER* less than ideal for assessing competitiveness (Little et al. 1993, 262; Dornbush and Vogelsang 1991, 4).

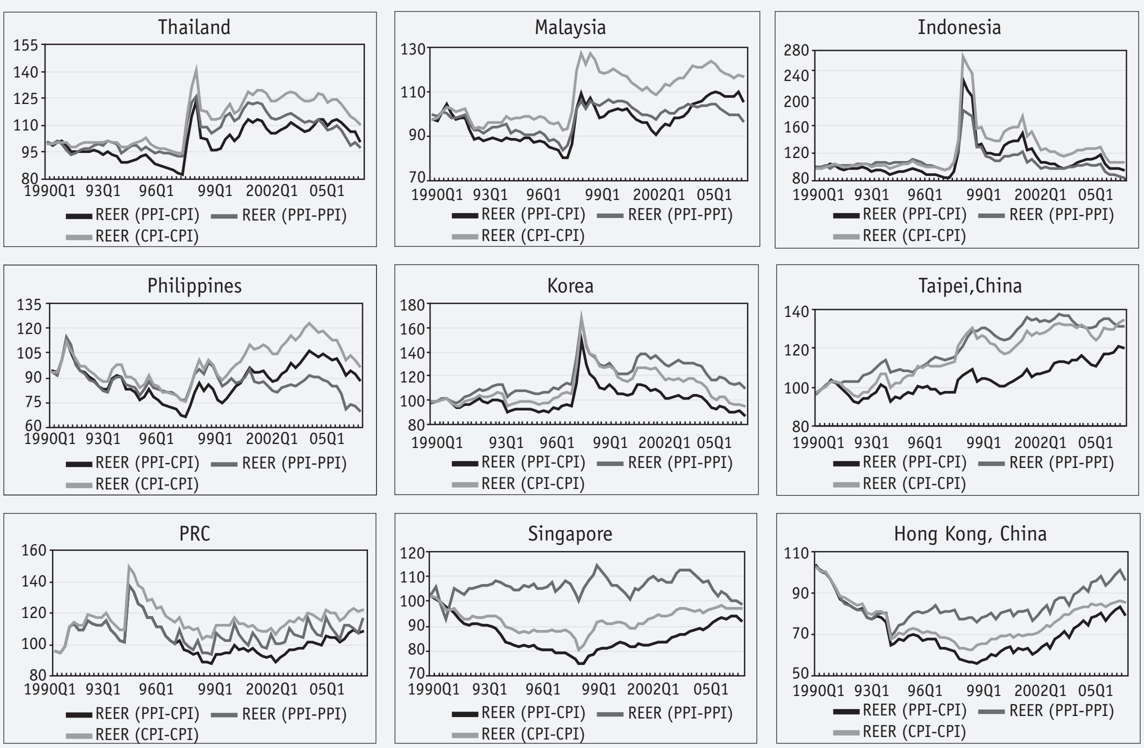
Therefore, a measure based on costs of production would be more appropriate in assessing international price competitiveness. In this regard, the producer price index (PPI), which contains a high proportion of tradable goods and is tightly linked with the costs of production, would conceptually be superior to a CPI-based *RER*.

The *internal* real exchange rate, measured using the PPI-CPI relative price measure, is sometimes used to proxy international price competitiveness. Keeping in mind the basket of goods used in composing price indexes, the PPI adjusted by the nominal exchange rate is used to represent prices of tradable goods, while the CPI is used to reflect nontradable prices. However, as already noted, the internal real exchange rate reflects international price competitiveness only when the law of one price holds. This law is unlikely to hold in reality (Kasa 1992, Faruqee 1995, Corsetti and Dedola 2002).

The divergence in the prices of tradable goods (in terms of a common currency) among countries can emanate from several sources. For example, the increasing importance of differentiated characteristics, especially in manufactured goods, causes finite elasticities of demand under an environment of imperfect competition. Transportation costs, trade restrictions, and taxes may cause the prices of tradable goods to vary across countries. The presence of medium-term labor contracts could be another source of distortion in this *RER* measure, because such contracts keep wages and unit production costs sticky so that producers are often inclined not to adjust prices in response to exchange rate changes.

Although there are at least three price alternatives—CPI-CPI, PPI-PPI, and PPI-CPI—to measure the *RER*, Box Figure 1 shows that these three alternatives tend to move closely to each other so that pattern of *RER* of the nine East and Southeast Asian economies does not seem to be very sensitive to different price measures. The correlation coefficients among these three alternatives during the period 1990–2006 were also very high, i.e., more than 0.8 (Box Table 1). As a consequence, alternative price-based *RER* measures yield virtually identical results in econometric analysis. The exception is Singapore, where the correlation coefficients tend to be high only between the PPI-CPI and CPI-CPI based *RER* measures, while they were lower than 0.4 between the PPI-PPI based *RER* measure and the other two measures.

BOX FIGURE 1
ALTERNATIVE PRICE-BASED RER MEASURES (1990=100)



Box Table 1
Correlation Coefficients

	PPI - PPI PPI - CPI	PPI - PPI CPI - CPI	PPI - CPI CPI - CPI
PRC	0.9	0.92	0.84
Hong Kong, China	0.93	0.95	0.99
Indonesia	0.92	0.9	0.99
Korea, Rep. of	0.84	0.94	0.96
Malaysia	0.87	0.88	0.86
Philippines	0.87	0.83	0.9
Singapore	0.35	0.23	0.89
Taipei,China	0.82	0.96	0.89
Thailand	0.85	0.94	0.93

Economy Weights

The choice of a weighting scheme depends crucially on the purpose for which the *RER* is being constructed. For economies where most trade is covered by official data, actual trade (exports plus imports) weights can be used for assessing changes in competitiveness. However, when the intereconomy pattern of trade is significantly different for imports and exports, it may be preferable for some analytical purposes to use either export or import weights rather than average these together. When assessing an economy's ability to penetrate world markets, the export weight should be used. As weights should reflect reasonably well the structure of exports in the period being analyzed, the use of current weights is generally preferred (Hinkle and Nsengiyumva 1999).

dependent and explanatory variables remain in the rearranged functional form on the right-hand-side and capture the long-run (cointegrating) relationship in the system (7).

$$\Delta Y_t = \alpha + \sum_{i=1}^{m-1} A_i^* \Delta Y_{t-i} + \sum_{j=1}^{k} \sum_{i=0}^{m-1} B_{ij}^* \Delta X_{j,t-i} + C_0 Y_{t-m} + \sum_{j=1}^{k} C_1 X_{j,t-m} + \mu_t \qquad (7)$$

where $A_i^* = -\left[I - \sum_{i=1}^{m-1} A_i \right]$, $B_{ij}^* = \left[\sum_{i=0}^{m-1} B_{ij} \right]$, $C_0 = -\left[I - \sum_{i=1}^{m} A_i \right]$, $C_1 = \left[\sum_{i=0}^{m} B_{ij} \right]$, the long-run multiplier of the system, is given by $C_0^{-1} C_1$.

Equation (7) is known as the error correction mechanism representation of the model and can be rewritten as equation (8) to capture well the error correction mechanism of the model (C_0).

$$\Delta Y_t = \alpha + \sum_{i=1}^{m-1} A_i^* \Delta Y_{t-i} + \sum_{j=1}^{k}\sum_{i=0}^{m-1} B_{ij}^* \Delta X_{j,t-i} + C_0 \left[Y_{t-m} + \left(\sum_{j=1}^{k} C_1 \Big/ C_0 \right) X_{j,t-m} \right] + \mu_t \qquad (8)$$

Equation (7) is the particular formulation generally used as the "maintained hypothesis" of the specification search. The estimation procedure involves first estimating the unrestricted equation (7), and then progressively simplifying it by restricting statistically insignificant coefficients to zero and reformulating the lag patterns where appropriate in terms of levels and differences to achieve orthogonality. As part of the specification search, it is necessary to check rigorously at every stage even the more general of models for possible misspecification. Such checks will involve both a visual examination of the residual from the fitted version of the model and the use of tests for serial correlation, heteroskedasticity, and normality in the residual, including appropriateness of the particular functional form used. In particular, any suggestion of autocorrelation in the residual should lead to a rethinking about the form of the general model. Above all, theoretical consistency must be borne in mind throughout the testing down procedure.

To closely look at how the estimated coefficients of real exchange rate change through time, recursive estimates are performed after equation (7) is appropriately estimated. In recursive estimates, the equation is estimated repeatedly, using ever larger subsets of the sample data. The first observations are used to form the first estimated coefficients and then the next observations are added to the dataset and are used to compute the second estimated coefficients. This process is repeated until all the sample points have been used.

TABLE 5
AUGMENTED DICKEY-FULLER TEST FOR UNIT ROOTS

VARIABLES	*T*-STATISTICS FOR LEVEL WITHOUT TIME TREND[a]	*T*-STATISTICS FOR LEVEL WITH TIME TREND[b]	*T*-STATISTICS FOR FIRST DIFFERENCE[a]
PRC			
TE	3.83(6)	2.83(6)	−3.20(5)**
ME	3.78(6)	3.14(6)	−3.53(4)**
SITC7	1.91(6)	1.55(6)	−4.05(4)*
RER	−4.04(4)*	−2.52(4)	−6.45(3)*
WD	1.67(7)	−0.69(8)	−3.67(6)*
Z(Total)	7.63(5)	−5.28(5)*	−3.38(3)*
Hong Kong, China			
TE	2.55(6)	1.19(6)	−4.06(5)*
ME	3.07(6)	1.64(6)	−2.92(3)*
SITC7	4.06(6)	2.67(6)	−2.71(2)**
RER	−1.42(4)	−1.58(3)	−2.70(3)**
WD	3.76(4)	1.14(5)	−2.96(4)*
Z(Total)	1.39(6)	−3.54(6)*	−5.93(6)*
Indonesia			
TE	−1.14(0)	−2.39(0)	−8.28(0)*
ME	−1.41(0)	−2.32(0)	−9.18(0)*
SITC7	−1.17(0)	−2.40(0)	−10.54(0)*
RER	−2.45(3)	−2.44(3)	−6.40(2)*
WD	0.29(6)	−1.68(8)	−2.96(5)*
Z(Total)	1.67(5)	−3.11(4)	−2.95(4)*
Z(Manufact)	2.05(3)	-4.88(3)*	−3.12(3)*
Korea			
TE	2.59(5)	−0.89(4)	−3.27(3)*
ME	1.88(4)	−1.00(4)	−3.21(3)*
SITC7	3.42(5)	0.32(6)	−2.82(3)**
RER	-2.41(0)	−2.34(0)	−7.04(1)*
WD	1.62(5)	0.13(5)	−2.94(4)*
Z(Total)	2.43(6)	−4.72(6)*	−2.63(6)**
Z(Manufact)	0.77(5)	−1.15(5)	−2.95(5)*
Z(SITC7)	−0.27(5)	−2.09(5)	−2.98(4)**
Malaysia			
TE	−0.67(2)	−3.49(0)*	−9.05(1)*
ME	−0.40(2)	−3.38(0)*	−8.45(1)*
SITC7	−0.84(2)	−3.05(0)	−7.95(1)*
RER	−2.17(1)	−2.91(1)	−5.73(0)*
WD	0.49(5)	−0.94(5)	−2.98(4)*
Z(Total)	1.14(4)	−4.19(5)*	−2.60(5)*
Z(Manufact)	1.35(4)	−3.00(4)	−3.62(6)*
Philippines			
TE	−1.22(2)	−2.60(7)	−11.89(1)*
ME	−1.09(2)	−2.81(0)	−7.88(1)*
SITC7	−1.99(0)	−1.69(0)	−8.49(0)*
RER	−1.98(0)	−2.56(1)	−6.14(0)*
WD	0.23(6)	−1.32(5)	−2.99(4)*
Z(Total)	2.24(6)	−2.41(4)	−2.93(6)**

continued next page.

Table 5. continued.

Z(Manufact)	2.09(5)	–2.31(4)	–2.93(4)*
Singapore			
TE	1.04(0)	–1.49(0)	–9.04(0)*
ME	0.65(0)	–2.07(0)	–9.02(0)*
SITC7	0.10(0)	–2.73(0)	–7.62(1)*
RER	–0.37(1)	1.15(0)	–4.52(0)*
WD	–0.43(5)	–1.02(5)	–3.99(4)*
Z(Total)	0.04(5)	–5.14(6)*	–4.07(5)*
Z(Manufact)	2.64(3)	–0.25(4)	–2.60(3)**
Taipei,China			
TE	2.15(3)	–0.09(4)	–2.79(5)**
ME	1.64(5)	–2.78(4)	–4.19(4)*
SITC7	1.83(4)	–1.15(5)	–3.97(4)*
RER	–0.83(0)	–2.75(0)	–6.91(0)*
WD	1.90(5)	–0.36(5)	–2.62(4)**
Z(Total)	2.46(5)	–4.21(5)*	–2.72(5)**
Z(Manufact)	2.29(5)	–1.15(5)	–3.30(4)*
Z(SITC7)	2.35(5)	–0.97(5)	–2.814)**
Thailand			
TE	0.76(2)	–3.65(0)*	–7.75(1)*
ME	1.16(6)	–2.91(0)	–5.41(5)*
SITC7	0.51(2)	–3.41(1)**	–6.98(1)*
RER	–2.61(1)**	–3.19(2)**	–5.38(2)*
WD	0.66(5)	–0.91(5)	–2.60(4)**
Z(Total)	0.94(6)	–3.22(6)**	–5.37(6)*
Z(Manufact)	0.15(4)	–5.59(3)*	–5.51(6)*

TE means total merchandise exports, ME means manufacturing exports, SITC7 means exports of parts and components, RER means real exchange rate, WD means real income in importing countries, Z means domestic production capacity.

Note: The t-statistic reported is the *t*-ratio on γ_1 in the auxiliary regression below, in which * and ** denote the rejection of the null hypothesis at 5% and 10% level, respectively.

A: $$\Delta X_t = \gamma_0 + \gamma_1 X_{t-1} + \sum_{i=1}^{p} \beta \Delta X_{t-i} + \mu_t$$ (Without time trend)

B: $$\Delta X_t = \gamma_0 + \gamma_1 X_{t-1} + \sum_{i=1}^{p} \beta \Delta X_{t-i} + \gamma_3 T + \mu_t$$ (With time trend)

where *X* is the variable under consideration, *T* is a time trend, and μ is the disturbance term. The lag length (*p*) are determined by the Akaike information criterion to ensure the residual whiteness. Figures in parentheses indicate the order of augmentation selected on the basis of the Akaike information criterion. All variables are in logarithm formula.

VII. RESULTS

The final parsimonious estimates of the export model, together with a set of commonly used diagnostic statistics, and long-run elasticities computed from the steady-state solutions to the estimated equation are reported in the Appendix. Tables 6, 7, and 8 summarize the estimated long- and short-run coefficients associated with real exchange rate, production capacity, and world demand, respectively. The estimated export equations are statistically significant at the 1% level in terms of the standard *F*-test and performs well in terms of standard diagnostic tests for serial correlation (LM), functional form specification (RESET), normality (JBN), heteroskedasticity (ARCH), and whiteness of the regression residuals. The Wu-Hausman test suggests no evidence of simultaneity for any of these variables. While all variables are measured in natural logarithms, the regression coefficients can be interpreted as elasticities.

Looking first at the estimates of the long-run real exchange rate (Table 6), differences are present in the elasticities of real exchange rates across the three export categories in all economies. The long-run real exchange rate coefficients of machinery and transport equipment (SITC7) exports are the lowest in all economies while the coefficients of total merchandise exports are the highest, with those of manufacturing exports coming in between. These results would seem to suggest that exports of manufactured final products, especially labor-intensive products, are more responsive to changes in the real exchange rate than are exports of SITC 7 products, which have to rely to a greater extent on imported parts and components. In the case of total exports, primary products have a significant weight, and primary products by nature rely heavily on local raw materials compared with manufacturing products. Hence, the impact of real exchange rate changes is most prominent in total export categories. Taken together, these results are consistent with the hypothesis that expanding product fragmentation and intermediate goods trade weakens the influence of the real exchange rate on export performance.

The real exchange rate coefficients also vary considerably across the nine economies. In general, the real exchange rate has the least impact on the Philippines's exports while the impact is the greatest in Indonesia. The long-run coefficients of the real exchange rate in the Philippines in all three categories are less than 0.2, while they all are greater than one in the case of Indonesia. This is consistent with the fact that exports and imports in the Philippines have been dominated by parts and components over the past decade. The Philippines's exports are heavily concentrated in electrical machinery with a high reliance on imported components. In contrast, Indonesia has a much greater product diversification in its export basket. In addition, Indonesia to date has been slow in joining international production networks of MNEs in the SITC 7 category. The reliance on primary and traditional manufactured exports possibly makes Indonesian exports more sensitive to the real exchange rate.

The long-run coefficient on export volume with respect to changes in the real exchange rate in Hong Kong, China; Korea; Singapore; and Taipei,China are all relatively low. For SITC 7 exports, the real exchange rate coefficient in these economies is around 0.3 and is insignificantly different from zero in Taipei,China. In addition to the degree to which parts and components are represented in the export basket, real exchange rate coefficients will also be influenced by the technological sophistication and complexity of exports. More advanced and sophisticated products may offer fewer opportunities for substitution, resulting in the lower response of exports to change in real exchange rate.

TABLE 6
REAL EXCHANGE RATE COEFFICIENTS

	TOTAL			TOTAL MANUFACTURING			SITC 7		
	LONG RUN	SHORT RUN		LONG RUN	SHORT RUN		LONG RUN	SHORT RUN	
		NO LAG	1ST LAG		NO LAG	1ST LAG		NO LAG	1ST LAG
China, People's Rep. of	0.60	0.62		0.58	0.58		0.47	0.41	
Hong Kong, China	0.35	0.54	0.39	0.32	0.54	0.30	0.27	0.26	
Indonesia	1.86	1.73	0.35	1.78	1.63	0.39	1.50	1.28	0.41
Korea, Rep. of	0.46	0.28		0.44	0.14		0.28	0.10	
Malaysia	0.78	0.47		0.58	0.31		0.4	0.39	
Philippines	0.11	0.22		0.08	0.35		0.07	0.36	
Singapore	0.41	0.5		0.31	0.41		0.29	0.32	
Taipei,China	0.48	0.27		0.43	0.47			0.35	
Thailand	0.97	0.44		0.69	0.34		0.60	0.33	

Note: Results are based on the long-run restriction of production capacity at unity.

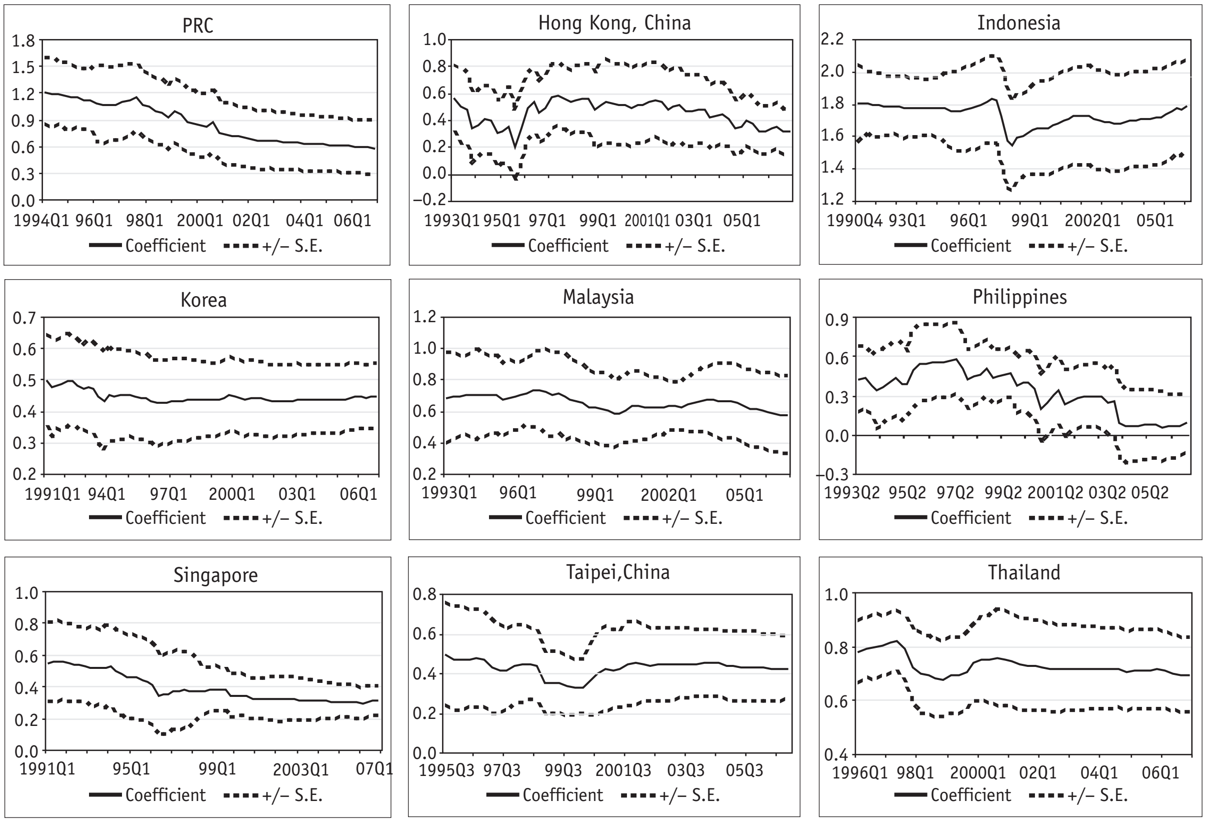
There is only a minor difference in the elasticities of manufacturing exports and total exports to the real exchange rate in Hong Kong, China; Korea; and Taipei,China, reflecting the relative importance of their manufacturing exports in overall exports. As shown in Figure 2, the contribution of manufacturing exports to total exports has exceeded 85% over the past three decades. In Singapore, the relatively lower share of manufacturing exports in total exports results in a wider gap in long-run coefficients between these two categories.

In Malaysia and Thailand, the long-run real exchange rate coefficients of total exports are comparatively high. This may reflect a more diversified export structure. Despite exhibiting a declining trend, the share of nonmanufacturing products in both economies in 2000–2005 still amounts to more than 20% of total exports, compared to less than 10% in the other economies, except Indonesia.

For the short run, the pattern of the coefficients in all product categories provides a striking resemblance to their long-run estimates, but with lower magnitudes. The real exchange rate still has the highest impacts in Indonesia and the lowest in the Philippines, with other economies coming in between. In Taipei,China, the short-run real exchange rate coefficient corresponding to SITC 7 exports becomes statistically significant and tends to be comparable with those in the other NIEs. In Hong Kong, China and Indonesia, the statistical significance of the first lag of the real exchange rate implies that the impact of a current change in the real exchange rate persists on exports over the next quarter.

The rising share of parts and components trade has led to the decline in estimates of real exchange rate elasticities over the past decade. Figure 4 shows how the estimated coefficients of the real exchange rate associated with manufacturing exports have moved through time. As successive data points are added to the sample, the estimated coefficients on the real exchange rate term drifts down. This is a general feature across all nine economies. The decline has been most pronounced in the Philippines and the PRC. By comparison, the estimated coefficient has barely budged in Indonesia, where trade in parts and components has been small.

Figure 4
Recursive Estimates of Long-run Coefficients of Manufacuturing Exports



Source: Author's estimation.

The low value of real exchange rate coefficients for parts and components exports is also revealed in previous empirical studies. For example, Arndt and Huemer (2004) examine the effect of cross-border production sharing between Mexico and the US on the sensitivity of trade to the real exchange rate during 1989–2002. A single-equation approach is employed in this study. Exports are disaggregated into exports of manufactures, nonmanufactures, and motor vehicle parts and components. For motor vehicle parts exports, which largely take place within MNE production networks, export volumes were found to be unresponsive to changes in the real exchange rate.

Athukorala (2004) investigates the role of the real exchange rate in Thailand's export performance over 1995–2003. Export volume is specified as a function of the real exchange rate, world demand, and capacity utilization for total manufactured exports and the four subcategories: chemicals (SITC 5), basic (resource-based) manufacturing (SITC 6), machinery and transport equipment (SITC 7), and miscellaneous exports (SITC 8). Athukorala's results point to significant differences in the degree of real exchange rate elasticities across the four categories, with the coefficient being least for machinery and transport equipment.

Recently, the IMF (2007) estimated the effect of real exchange rate on 16 US goods and services export categories[8] during 1973–2002. The standard empirical trade model relating export volumes to relative export prices and foreign income under the assumption of perfectly elastic supply of domestic goods is applied. The IMF found that the real exchange rate coefficients tends to be low in automotive, consumer durable goods, and capital goods sectors in which international product fragmentation tends to be more pronounced, compared with other goods and service export categories.

The declining response of exports to real exchange rate changes in East and Southeast Asia seems to imply that other variables influencing export supply and demand have increased in importance. In particular, production capacity generally plays an important role in determining export performance (Table 5). Long-run estimates are not only statistically significant but large in absolute value and are close to one. This tends to imply that other supply-side factors, such as infrastructure, logistics capabilities, skills, and the general business climate, are likely to be important in determining export performance. However, in this study, no specific assumptions are made about the source of this supply shift effect (Chinn 2003 and 2005).[9] The production capacity variable may itself be endogenous and subject to real exchange rate influences. Movements of the real exchange rate could influence revenues and profits of parents and affiliates, although this effect would depend on whether most sales are in the domestic market or are exports. In addition, profits after tax will influence reinvested earnings, and this could affect capacity with some lag (IMF 2003).

Nevertheless, theoretically, the real exchange rate is unlikely to be the key factor in influencing production capacity in these economies as MNEs and their involvement play a pivotal role in determining export capacity and success. There is a consensus among economists that MNE involvement is influenced mainly by the general investment climate, which covers a wide range of economic and social factors, such as macroeconomic stability, the general business environment, and institutional context, instead of the movements of real exchange rate (Wells 1986, Hobday 1995, Yusuf et al. 2003, Fukao et al. 2003, Brooks and Hill 2004, Dollar et al. 2004, Hill 2004). Therefore, the possible indirect effect of real exchange rate on production capacity is unlikely to dominate investment decisions enough to alter the results of a declining impact of the real exchange rate on export performance explained above.

[8] The 16 goods and services export categories are: foods, feeds, and beverages; durable industrial supplies; nondurable industrial supplies; transportation capital goods; information techonology capital goods; other capital goods; automotive; consumer durables; consumer nondurables; other goods; travel; passenger fares; other transportation; royalties and license fees; other private services; and other services. The simple average of the real exchange rate coefficient is 0.49 incorrect sign of coefficients associated with royalties and license fees and durable industrial supplies are found.

[9] In terms of statistics, the Wu-Hausman test is conducted to ensure that there is no evidence of simultaneity for any of these variables.

Table 5
Production Capacity Coefficients

	Total			Total Manufacturing			SITC 7		
	Long run	Short Run		Long Run	Short Run		Long Run	Short Run	
		No Lag	1st Lag		No Lag	1st Lag		No Lag	1st Lag
China, People's Rep. of	1.24	0.18		1.16	0.21		1.01	0.30	
Hong Kong, China	1.07	0.38		1.04	0.36		1.02		
Indonesia	1.09		0.88	1.07			1.04		
Korea, Rep. of	1.22	0.14		1.01			1.10		
Malaysia	1.08		0.61	1.04		0.35	1.02		0.36
Philippines	1.10			1.08			1.06		
Singapore	1.09		0.15	1.03		0.23	1.01		0.20
Taipei,China	1.07	0.20		1.04	0.11		0.96	0.10	
Thailand	1.07	0.27		0.99	0.33		1.03	0.18	

Long-run coefficients of world demand vary systematically across export categories (Table 6) and are generally inversely correlated with real exchange rate influences. In all economies, other than the PRC and Indonesia, the responsiveness of exports to external demand is the highest for SITC 7 while it is the lowest for total exports, with manufacturing exports coming in between. These findings add weight to the observation that new emerging patterns of intraregional trade do not necessarily indicate a weakening of integration with external markets outside of developing Asia (ADB 2007).

For the PRC, the responsiveness of SITC 7 exports to changes in world demand is low relative to that for manufacturing and total exports but it is still high compared to most other countries. This is possibly because the PRC's own exports are largely in final assembled goods, especially labor-intensive manufactured products such as clothing and footwear. As shown in Table 1 above, the proportion of parts and components exports in total manufacturing exports in the PRC during 2000–2006 was still less than 15%. In addition, the PRC's labor-intensive manufactured products figure prominently in the world market. Clothing and footwear from the PRC accounted for more than 20% and 25% of global exports during 2000–2005, compared with less than 5% for the other economies in the region. Thus, changes in trading partners' demand tend to affect the PRC's final assembly exports more than its parts and components exports. Note that in contrast to other Asian economies, the PRC's exports tend to rely more on demand from outside the region, particularly from the EU and US markets, over the past decade (Table 2 above). This confirms that even though fragmentation trade has played a pivotal role in deepening intraregional economic interdependence, this has been sustained by continuing strong external reliance on final goods demand.

Indonesia again is an outlier. In all export categories, no statistically significant external demand influence can be detected. Primary exports where prices are set in world markets or by global price setting mechanisms have a high weight in Indonesia's export basket. The insignificance of external demand for SITC 7 could result from the fact that Indonesia has not yet actively participated in international product fragmentation so that SITC 7 exports are not sensitive to changes in trading partners' demand.

Table 6
World Demand Coefficients

	Total			Total Manufacturing			SITC 7			
	Long Run	Short Run		Long Run	Short Run		Long Run	Short Run		
		No Lag	1st Lag		No Lag	1st Lag		No Lag	1st Lag	2nd Lag
China, People's Rep. of	1.34	2.81		1.27	2.88		1.05	3.31		
Hong Kong, China	0.49	0.54		0.56	0.59		0.60	0.57		
Korea, Rep. of	0.66	0.86	0.32	0.70	0.97	0.43	0.71	1.30	0.17	0.69
Malaysia	0.48	0.62		0.59	0.64		0.68	0.57		
Philippines	0.15	0.25		0.54	0.24		0.57	0.26		
Singapore	0.69	0.49		0.73	0.59		0.75	0.66		
Taipei,China	0.88	0.9		1.00	1.04		1.04	1.10		
Thailand	0.46	0.46		0.56	0.68		0.57	0.82		

Note: The results are based on the long-run restriction of production capacity to be unity. For Indonesia, there is no statistical significance of external demand influence for all three export categories.

VIII. CONCLUSIONS AND POLICY INFERENCES

This paper examines patterns and determinants of exports in nine East and Southeast Asian economies, with emphasis on the increasing important role of parts and components exports.

The export equations are estimated for three different export categories—total merchandise exports, manufacturing exports, and exports of machinery and transport equipment (SITC 7)—during the period 1990–2006. The functional form of exports is based on the "imperfect substitution" model in which export volume is determined as a function of real exchange rate, world demand, and production capacity. The time series property of data was tested at the outset to guard against spurious regression. As there is a mix between stationary and nonstationary variables, the "general to specific" modeling procedure is chosen to obtain short-run and long-run determinants of exports.

The key findings suggest that rapid diversification of exports away from traditional products and toward assembly/component specialization within global industries have tended to weaken the link between the real exchange rate and export performance. World demand and production capacity have increased in importance in determining exports. Particularly in the long run, production capacity tends to play an important role in determining performance of exports. Long-run estimates of production capacity variables are not only statistically significant but large in absolute value and are close to one.

The statistical significance of the world demand variable under this form of international specialization adds weight to the observation that external markets outside of developing Asia are still important. While the PRC becomes more important export destinations of Asian economies, the PRC's exports have still relied more on demand from outside the region, particularly from the EU and US markets. This confirms that even though fragmentation trade has played a pivotal role in deepening intraregional economic interdependence, this has been sustained by continuing strong external reliance on final goods demand.

The production capacity variable is important particularly in the long run to maintain a country's competitiveness. Hence, policy emphasis should be shifted toward strengthening supply-side factors. These include improving the business investment climate through increased legal certainty; and strengthened governance to enforce contracts, protect intellectual property, and ensure that product standards are met. In turn these will require institutional advances that reduce trade costs, such as customs reform and improved infrastructure and logistic services, in order to offset costs incurred in improving legal certainty and enforcement of laws and regulations. Labor productivity and unit labor costs are also quite important in this context—particularly in view of emerging shortfalls in the availability of skilled workers in countries with aging populations in the industrial economies.

Multinational enterprises are also averse to ownership restrictions and seek out locations where decisions can be managed effectively between parents and affiliates. Multinationals with large foreign ownership shares tend to have larger export propensities than local firms or affiliates with restricted foreign ownership shares. Multinationals normally accept some exchange rate risk in their multicountry operations and seek to mitigate these through presence in numerous countries. However, MNEs have a tendency to concentrate investment in industrial economies and will come to developing countries only when conditions are conducive. Among the most important of these are macroeconomic stability and potential for growth. East and Southeast Asia have been successful in attracting foreign direct investment precisely for this reason.

The protection of intellectual property rights may also be important in influencing the ability and willingness of MNEs to transfer technology and may influence their decisions on where to conduct assembly operations. Beneficial technology and management spillovers are likely to be seen when the supply-side factors are attended to by governments. Macroeconomic conditions are also clearly important in this context as firms look to potential for domestic markets to expand under stable prices, prudent fiscal policies, and deepening financial markets, particularly for equities and bonds. Clearly more research is needed to determine the relative importance of these diverse variables in export performance. Nor should such analysis ignore the possibility that demand-side factors may take on greater importance in future—particularly in light of the proliferation of discriminatory trade agreements.

APPENDIX

DETERMINANTS OF EXPORTS: FULL REGRESSION RESULTS

1. People's Republic of China

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.01 *(1.02)*	0.02 *(1.51)***	0.04 *(2.47)**
Δ(REER)	0.62 *(3.28)**	0.58 *(2.93)**	0.41 *(2.31)**
Δ(world demand)	2.81 *(7.82)**	2.88 *(7.76)**	3.31 *(6.56)**
Δ(production capacity, PC_i)$_{-1}$	0.18 *(3.75)**	0.21 *(2.24)**	0.30 *(2.33)**
Error correction	–0.56 *(–6.20)**	–0.67 *(–8.09)**	–0.52 *(–4.67)**
Long-run coefficient	***TE/PC*$_i$**	***ME/ PC*$_i$**	***SITC7/ PC*$_i$**
REER	0.60 *(1.92)**	0.58 *(1.96)**	0.47 *(1.52)***
World demand	1.34 *(2.91)**	1.26 *(2.77)**	1.04 *(2.49)**
Trend	0.008 *(2.43)**	0.009 *(2.84)**	0.03 (3.32)*
Adjusted R-square	0.84	0.81	0.76
Standard error of regression	0.07	0.07	0.10
LM test for serial correlation—F test	1.75 (p-value = 0.11)	1.78 (p-value = 0.11)	0.62 (p-value = 0.54)
RESET test for functional form—F-test	0.57 (p-value = 0.45)	3.16 (p-value = 0.08)	1.04 (p-value = 0.31)
J-B test for normality - χ^2	0.76 (p-value = 0.68)	1.74 (p-value = 0.42)	3.03 (p-value = 0.22)
ARCH test for heteroscedasticity—F-test	0.01 (p-value = 0.92)	0.003 (p-value = 0.95)	2.04 (p-value = 0.14)

2. Hong Kong, China

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.04 *(2.64)**	0.02 *(2.11)**	0.03 *(4.94)**
Δ(REER)	0.54 *(2.38)**	0.55 *(2.19)**	0.26 *(1.40)****
Δ(REER)$_{-1}$	0.39 *(1.62)***	0.30 (1.14)***	
Δ(world demand)	0.54 *(9.43)**	0.59 *(8.94)**	0.57 *(10.92)**
Δ(production capacity, *PC*)$_{-1}$	0.38 *(2.12)**	0.36 *(1.80)**	
Error correction	–0.42 *(–3.43)**	–0.47 *(–3.26)**	–0.26 *(–3.18)**
Long-run coefficient	TE/PC$_i$	ME/ PC$_i$	SITC7/ PC$_i$
(REER)	0.35 *(1.61)***	0.32 *(1.52)***	0.27 *(1.51)***
(World demand)	0.49 *(5.07)**	0.56 *(5.67)**	0.60 *(5.92)**
Trend	0.003 *(2.13)**	0.004 *(3.06)**	0.02 *(3.55)**
Adjusted R-square	0.73	0.70	0.67
Standard error of regression	0.05	0.06	0.06
LM test for serial correlation— F test	1.71 (p-value = 0.19)	1.69 (p-value = 0.19)	0.24 (p-value = 0.79)
RESET test for functional form— F-test	0.38 (p-value = 0.54)	0.11 (p-value = 0.75)	0.85 (p-value = 0.36)
J-B test for normality - χ^2	1.55 (p-value = 0.46)	2.22 (p-value = 0.33)	0.67 (p-value = 0.71)
ARCH test for heteroscedasticity— F-test	0.06 (p-value = 0.81)	0.20 (p-value = 0.65)	0.00 (p-value = 0.99)

3. Indonesia

	TOTAL EXPORTS (TE)	MANUFACTURING EXPORTS (ME)	SITC 7 EXPORTS (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.04 *(3.72)* *	0.06 *(3.57)* *	0.15 *(3.04)* *
Δ(REER)	1.73 *(10.50)* *	1.63 *(9.24)* *	1.28 *(5.75)* *
$\Delta(\text{REER})_{-1}$	0.35 *(2.17)* *	0.39 *(1.74)* **	0.41 *(1.81)* *
Δ(production capacity, *PC*) $_{-1}$	0.88 *(2.27)* *		
Error correction	–0.09 *(–1.91)* *	–0.12 *(–2.19)* *	–0.13 *(–2.20)* *
Long-run coefficient	TE/PC_i	ME/ PC_i	$SITC7/ PC_i$
(REER)	1.86 *(9.46)* *	1.78 *(7.98)* *	1.50 *(7.12)* *
Trend	0.04 *(2.94)* *	0.04 *(8.43)* *	0.06 *(2.59)* *
Adjusted R-square	0.70	0.66	0.60
S.E. of regression	0.09	0.12	0.19
LM test for serial correlation—F test	0.19 (p-value = 0.82)	1.68 (p-value = 0.19)	1.79 (p-value = 0.10)
RESET test for functional form—F-test	2.99 (p-value = 0.10)	1.97 (p-value = 0.07)	1.11 (p-value = 0.30)
J-B test for normality - χ^2	0.39 (p-value = 0.82)	0.40 (p-value = 0.80)	2.32 (p-value = 0.31)
ARCH test for heteroscedasticity—F-test	0.44 (p-value = 0.51)	0.19 (p-value = 0.66)	0.19 (p-value = 0.66)

4. Korea

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.02 *(3.39)**	0.02 *(2.76)**	0.02 *(2.08))**
Δ(REER)	0.28 *(2.50)**	0.14 *(1.30)****	0.10 *(1.32)****
Δ(world demand)	0.84 *(9.10)**	0.96 *(12.53)**	1.30 (8.34)*
Δ(world demand)$_{-1}$	0.32 *(3.46)**	0.43 *(5.39)**	0.17 *(1.23)****
Δ(world demand)$_{-2}$			0.69 *(4.67)**
Δ(production capacity, *PC*)$_{-1}$	0.14 *(1.57)***		
Error correction	–0.40 *(–3.47)**	–0.40 *(–3.54)**	–0.40 *(–3.64)**
Long-run coefficient	TE/PC$_i$	ME/ PC$_i$	SITC7/ PC$_i$
(REER)	0.46 *(4.76)**	0.44 *(4.25)**	0.28 *(1.62)***
(World demand)	0.66 *(5.79)**	0.70 *(4.95)**	0.71 (3.32)*
Trend	0.01 *(2.94)**		
Adjusted R-square	0.83	0.81	0.75
Standard error of regression	0.04	0.05	0.08
LM test for serial correlation— F test	1.50 (p-value = 0.17)	1.49 (p-value = 0.18)	1.69 (p-value = 0.12)
RESET test for functional form— F-test	0.13 (p-value = 0.72)	1.10 (p-value = 0.29)	0.46 (p-value = 0.50)
J-B test for normality - χ^2	2.00 (p-value = 0.36)	3.10 (p-value = 0.21)	1.86 (p-value = 0.39)
ARCH test for heteroscedasticity— F-test	0.25 (p-value = 0.61)	1.05 (p-value = 0.31)	0.12 (p-value = 0.72)

5. Malaysia

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.01 *(2.58)* *	0.02 *(2.75)* *	0.02 *(2.49)* *
Δ(REER)	0.47 *(3.96)* *	0.31 *(3.48)* *	0.39 *(2.97)* *
Δ(world demand)	0.62 *(5.11)* *	0.64 *(3.92)* *	0.57 *(3.01)* *
Δ(production capacity, *PC*)$_{-2}$	0.61 *(4.30)* *	0.35 *(2.28)* *	0.36 *(2.02)* *
Error correction	–0.11 *(–2.04)* *	–0.16 *(–1.92)* *	–0.11 *(–1.53)* **
Long-run coefficient	TE/PC_i	ME/ PC_i	$SITC7/ PC_i$
(REER)	0.78 *(5.56)* *	0.57 *(2.35)* *	0.40 *(1.59)* **
(World demand)	0.48 *(3.86)* *	0.59 *(1.52)* **	0.68 *(1.32)* ***
Trend		0.01 *(4.97)* *	0.01 *(4.84)* *
Adjusted R-square	0.60	0.59	0.57
Standard error of regression	0.04	0.05	0.06
LM test for serial correlation— F test	0.31 (p-value = 0.73)	0.68 (p-value = 0.50)	0.31 (p-value = 0.73)
RESET test for functional form— F-test	0.33 (p-value = 0.57)	0.06 (p-value = 0.81)	0.03 (p-value = 0.87)
J-B test for normality - χ^2	2.34 (p-value = 0.31)	1.38 (p-value = 0.50)	1.57 (p-value = 0.46)
ARCH test for heteroscedasticity—F-test	0.61 (p-value = 0.44)	0.003 (p-value = 0.95)	0.33 (p-value = 0.56)

6. Philippines

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.004 *(0.81)*	–0.01 *(–1.14)*	–0.01 *(2.07)**
Δ(REER)	0.22 *(2.12)**	0.35 *(2.01)**	0.36 *(2.07)**
Δ(world demand)	0.25 *(2.21)**	0.25 *(1.35)****	0.26 *(1.36)****
Error correction	–0.49 *(–5.72)**	–0.24 *(–2.97)**	–0.28 (–3.15)*
Long-run coefficient	TE/PC_i	ME/ PC_i	$SITC7/ PC_i$
REER	0.11 *(1.76)**	0.08 *(1.57)***	0.07 *(1.52)***
World demand	0.15 *(1.32)****	0.54 *(2.59)**	0.57 *(2.51)**
Trend	0.008 *(10.35)**	0.02 *(11.83)**	0.02 *(12.73)**
Adjusted R-square	0.68	0.65	0.68
Standard error of regression	0.06	0.05	0.05
LM test for serial correlation— F test	1.51 (p-value = 0.20)	1.54 (p-value = 0.22)	1.26 (p-value = 0.29)
RESET test for functional form— F-test	0.07 (p-value = 0.78)	0.06 (p-value = 0.80)	0.06 (p-value = 0.80)
J-B test for normality - χ^2	2.88 (p-value = 0.24)	0.15 (p-value = 0.93)	0.19 (p-value = 0.91)
ARCH test for heteroscedasticity—F-test	1.22 (p-value = 0.31)	1.25 (p-value = 0.29)	1.54 (p-value = 0.18)

7. Singapore

	TOTAL EXPORTS (TE)	MANUFACTURING EXPORTS (ME)	SITC 7 EXPORTS (SITC7)
Short-run coefficient	**∆TE**	**∆ME**	**∆SITC7**
Constant	0.01 *(2.04)* *	0.01 *(2.25)* *	0.01 *(2.06)* *
∆(REER)	0.50 *(1.52)* **	0.41 *(1.65)* **	0.32 *(1.57)* **
∆(world demand)	0.49 *(4.43)* *	0.59 *(5.35)* *	0.66 *(5.22)* *
∆(production capacity, *PC*)$_{-2}$	0.15 *(1.24)* ***	0.23 *(2.07)* *	0.20 *(1.67)* **
Error correction	–0.29 *(–3.28)* *	–0.30 *(–3.49)* *	–0.18 *(–2.51)* *
Long-run coefficient	TE/PC_i	ME/ PC_i	SITC7/ PC_i
(REER)	0.41 *(6.72)* *	0.31 *(2.31)* *	0.29 *(1.52)* **
(World demand)	0.69 *(3.05)* *	0.73 *(3.17)* **	0.75 *(2.57)* *
Trend	0.006 *(10.13)* *	0.006 *(10.02)* *	0.006 (7.93)*
Adjusted R-square	0.69	0.63	0.68
Standard error of regression	0.05	0.05	0.05
LM test for serial correlation— F test	0.86 (p-value = 0.43)	0.39 (p-value = 0.68)	0.61 (p-value = 0.54)
RESET test for functional form— F-test	0.29 (p-value = 0.59)	0.001 (p-value = 0.97)	0.07 (p-value = 0.80)
J-B test for normality - χ^2	0.36 (p-value = 0.83)	0.90 (p-value = 0.64)	0.75 (p-value = 0.68)
ARCH test for heteroscedasticity—F-test	1.14 (p-value = 0.29)	0.62 (p-value = 0.43)	0.08 (p-value = 0.78)

8. Taipei,China

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**ΔTE**	**ΔME**	**ΔSITC7**
Constant	0.01 *(2.44)**	0.01 *(2.45)**	0.02 *(2.32)**
Δ(REER)	0.27 *(1.42)***	0.47 *(2.17)**	0.35 *(1.32)****
Δ(world demand)	0.90 *(11.88)**	1.04 *(11.95)**	1.10 *(10.18)**
Δ(production capacity, *PC*)$_{-1}$	0.20 *(1.23)****	0.11 *(1.56)***	0.10 *(1.54)***
Error correction	–0.50 *(–4.59)**	–0.49 *(–4.52)**	–0.37 *(–3.30)**
Long-run coefficient	TE/PC$_i$	ME/ PC$_i$	SITC7/ PC$_i$
(REER)	0.48 *(3.84)**	0.43 *(2.63)**	
(World demand)	0.88 *(6.64)**	1.00 *(8.42)**	1.04 *(6.23)**
Adjusted R-square	0.80	0.80	0.77
Standard error of regression	0.03	0.04	0.05
LM test for serial correlation—F test	0.12 (p-value = 0.88)	1.73 (p-value = 0.12)	1.76 (p-value = 0.18)
RESET test for functional form—F-test	0.03 (p-value = 0.86)	0.003 (p-value = 0.95)	0.08 (p-value = 0.78)
J-B test for normality - χ^2	0.14 (p-value = 0.93)	2.68 (p-value = 0.26)	1.84 (p-value = 0.39)
ARCH test for heteroscedasticity—F-test	0.86 (p-value = 0.35)	3.20 (p-value = 0.10)	2.09 (p-value = 0.14)

9. Thailand

	Total Exports (TE)	Manufacturing Exports (ME)	SITC 7 Exports (SITC7)
Short-run coefficient	**∆TE**	**∆ME**	**∆SITC7**
Constant	0.01 *(1.92)* *	0.01 *(0.96)*	0.01 *(1.14)*
∆(REER)	0.44 *(2.99)* *	0.34 *(2.54)* *	0.33 *(2.56)* *
∆(world demand)	0.46 *(2.60)* *	0.68 *(4.39)* *	0.82 *(4.66)* *
∆(production capacity, *PC*)$_{-1}$	0.27 *(1.47)* **	0.33 *(2.06)* *	0.18 *(1.84)* *
Error correction	–0.16 *(–1.66)* **	–0.47 *(–4.52)* *	–0.43 *(–3.99)* *
Long-run coefficient	TE/PC$_i$	ME/ PC$_i$	SITC7/ PC$_i$
(REER)	0.97 *(6.23)* *	0.69 *(5.00)* *	0.60 *(3.28)* *
(World demand)	0.46 *(1.60)* **	0.56 *(2.68)* *	0.57 *(1.83)* *
Adjusted R-square	0.80	0.80	0.75
Standard error of regression	0.03	0.04	0.05
LM test for serial correlation— F test	0.49 (p-value = 0.62)	1.75 (p-value = 0.19)	2.60 (p-value = 0.10)
RESET test for functional form— F-test	1.64 (p-value = 0.21)	0.10 (p-value = 0.75)	0.33 (p-value = 0.56)
J-B test for normality - χ^2	2.65 (p-value = 0.27)	0.75 (p-value = 0.68)	1.45 (p-value = 0.48)
ARCH test for heteroscedasticity— F-test	1.87 (p-value = 0.14)	0.19 (p-value = 0.67)	0.22 (p-value = 0.64)

* significant at the 1% level; ** significant at the 5% level; *** significant at the 10% level.

Note: T-ratios are given in brackets. The long-run coefficients corresponding to production capacity in all economies are not significantly different from 1, so that results are based on the imposition of long-run production capacity coefficient equal to 1. This is also done to ensure the stability of the model in the long run. All variables are measured in natural logarithms so that the regression coefficients can be interpreted as elasticities.

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About the Paper

Juthathip Jongwanich writes that rapid diversification of exports away from traditional products and toward assembly/component specialization within global industries has tended to weaken the link between the real exchange rate and export performance. World demand and production capacity have increased in importance in determining exports. Particularly in the long run, production capacity tends to play an important role in determining performance of exports.

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