Singapore and ASEAN in the New Regional Division of Labour

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Abstract: This paper examines the implications of international fragmentation of production for trade patterns of Singapore and the other ASEAN economies, with emphasis on their regional and global economic integration. The analysis reveals that the degree of dependence of these countries on this new global division labour is much larger compared to the other countries East Asia, Europe and North America. Network-related trade in parts and components has certainly strengthened economic interdependence among ASEAN countries and between ASEAN and other major economies in East Asia, but this has not lessoned the dependence of growth dynamism of these countries on the global economy. The operation of cross-border production networks depends inexorably on trade in final goods with North America and the European Union.

JEL classification: F15, F23, O53
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1. Introduction

International fragmentation of production, the splitting of production process into discrete activities which are carried out in different countries, and the resultant cross-border exchange of parts and components ('fragmentation trade') have been an increasingly important facet of economic globalization over the past three decades. It is clearly evident that while growth in fragmentation-based trade is now a global phenomenon, it is far more important for economic growth and structural transformation in countries in Southeast and East Asia than elsewhere in the world. However, the implications of this form of international specialisation for economic transformation in these countries and for their integration into the global economy have not yet been adequately explored. The existing literature on trade patterns in the region is largely based on the traditional notion of horizontal specialisation scenario in which countries trade goods that are produced from start to finish in just one country.

The purpose of this paper is to examine the size and dynamics of fragmentation trade and its implications for regional and global integration of ASEAN member countries. Two key themes figure prominently in the empirical analysis; the implications of emerging trade patterns of this trade for the debate on regional versus global integration of the countries in the region, and China's evolving role in the process of international fragmentation of production and regional production networks. Our focus on the first theme is based on the premise that, in a context where fragmentation trade is growing rapidly, the conventional approach to trade flow analysis can lead to misleading inferences as to the nature and extent of trade integration among countries and prospect for maintaining growth dynamism through global economic integration. Intra/extra regional patterns of fragmentation trade and trade in related final goods ('final trade') are unlikely to

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follow the same geographic patterns, and hence trade shares calculated using reported trade data can lead to wrong inferences as to the relative importance of the 'region' and the rest of the world for growth dynamism of a given country/region. Relating to the second theme, we aim to probe the debate on whether the emergence of China as the world's most rapidly growing industrial economy would crowd out other countries' opportunities for integrating into the regional and global economy through fragmentation-based specialization.

In order to assess the magnitude and nature of fragmentation-based trade it is necessary to differentiate between parts and components, and final (assembled) products. We do this through a careful disaggregation of 5-digit level data from the UN *Comtrade* database based on the Revision 3 of the Standard International Trade Classification (SITC, Rev 3). The data are for the period from 1993, when almost all countries reporting to the UN trade system had adopted the revised reporting system, to 2004, which is the most recent year for which data are available for all reporting countries. For the purpose of inter-temporal comparison calculations are made for the two-year averages relating to the end points (1993-4 and 2003-4) so as to reduce the impact of ear to year fluctuations of trade flows. Given the nature of available data, the prime focus of analysis is on trade in machinery and transport equipment (products belonging to SITC Section 7). So the tabulations presented here of the magnitude of fragmentation-based trade are downward biased. However, the magnitude of the bias is unlikely to be substantial because fragmentation-based international specialisation is predominantly concentrated in this product category. Among the ASEAN member countries, only the six largest economies— Indonesia, Malaysia, the Philippines, Thailand, Singapore and Vietnam— are covered; Brunei, Cambodia, Laos and Myanmar are ignored because of lack of data. East Asia is defined to include Japan, and developing East Asia which covers the newly industrialised economies (NIEs) in North Asia (South Korea, Taiwan and Hong Kong), China and members of the Association of Southeast Asian Nations (ASEAN).

The paper is organised as follows. Section 2 provides a brief overview of the evolution of fragmentation-based production networks in ASEAN in order to set the stage for the ensuing analysis. Section 3 examines the nature and extent of fragmentation trade and the role of Pacific Rim countries in this new global division of labour followed by an analysis of the implications of fragmentation-based specialization for the debates on

regional versus global integration and the emerging role of China in regional production networks. Section 4 reports the preliminary results of an econometric analysis of the determinant of trade flows of parts and components and the related final goods. The final Section presents the key policy inferences. The procedure followed in extracting data from the UN trade data tapes, data quality, and methodological issues related to estimating the impact of production fragmentation on trade patterns are discussed in Appendix 1.

2. A Brief History

The location in developing countries of relatively labour intensive component production and assembly within vertically integrated international industries ('international production fragmentation' or 'outsourcing') has been an important feature of the international division of labour since about the mid-1960s. The process was started by electronics MNEs based in the USA in response to increasing pressures of domestic real-wage increases and rising import competition from low cost sources. The US government facilitated the process an outward processing tariff (OPT) scheme under which companies were allowed to export material for processing overseas and to re-import the finished products, paying tariff only on the value added abroad (not the exported intermediates). Geography, costs and history all combined to persuade US MNEs to first explore opportunities for outsourcing in neighbouring countries in Latin America. However, unfavourable investment climate in these countries - macroeconomic instability, political tensions, trade union upheavals and uncertainty led American producers to switch to sub-suppliers located in East Asia (Helleiner 1973, Grunwald and Flamm 1985, Feenstra 1998).

This strategic move by US MNEs coincided with the embrace by the newly-independent Singapore of export-oriented industrialization as a deliberate policy to grow away from the traditional staple port economy. This happy coincidence of a significant shift in global production and palpable domestic policy shift, combined with the country's strong locational advantages, a virtually unbroken history as a free port, and other favourable initial conditions, set the stage for a 'electronic revolution' which transformed Singapore from a labour-surplus to a labour-scarce economy within period of less than a decade (Lee 2000, Chapter 4; Goh 1993; Huff 1994, Chapter 11). Perhaps, political instability and policy uncertainty in other potential investment locations in East Asia was also instrumental in tilting MNEs' location decision decisively in favour of Singapore. On

this points, Goh Ken Swee (1993,, one of the key architect of Singapore's export-led development strategy, observes: 1993).

> 'It is a matter for speculation whether in the absence of the upheaval caused by the Cultural Revolution in the mid- and late 1960s, the large American multinationals – among them National Semiconductors and Texas Instruments – would have sited their offshore factories in countries more familiar to them, such as South Korea, Taiwan and Hong Kong. These had resources and skills superior to Singapore. My own judgment remains that these three areas were too close to the scene of trouble, the nature of which could not but cause alarm to multinational investors' (Goh, 1993, p. 253).

The electronics industry began in Singapore in 1968 with the arrival of two US companies, National Semiconductor and Texas Instruments to assembly semiconductor devices. By the begining of 1970s Singapore had the lion's share of offshore assembly activities of the US and European semiconductor industries. By the mid-1980s virtually every international electronics producer was present in Singapore, when the hard disk drive assemblers entered the country further boosting its role as a global assembly centre. During the next five years semiconductor production declined in relative importance, and computer peripherals, especially hard disk drives and computers because the more important part of the islands electronic industry. By the late 1980s Singapore was the world's largest exporter of hard disk drive, accounting for at least half of world production of disk drives (McKendrick *et al*. 2000).

As early as 1972 the MNEs with production facilities in Singapore began to relocate some low-end assembly activities in other countries in the region (particularly in Malaysia, Thailand and the Philippines) in response to rapid growth of wages and land prices.. Many newcomer MNEs to the region set up production bases in these countries bypassing Singapore. By the late 1980s this process had created a new regional division of labour, based on skill differences, differences in factor prices, especially labour, and superior communication facilities. At the time there was a widespread concern in policy circles in Singapore that the regional spread MNE operations in electronics industry could be at the expense of Singapore. However, the subsequent developments have vividly demonstrated that 'the larger the scale and scope of electronic industry [which produces a wide range of heterogenous end-products, each of which needs a large number of equally heterogenous components in its manufacture] in Southeast Asia, the greater the economies of scale and

more the opportunities for specialisation for all participating countries' (Goh 1990). More recently, regional production networks have begun to expand to Vietnam (Athukorala 2006a).[1] Despite obvious advantageous in terms of location and relative wages, Indonesia has so far failed to benefit from this new form of international specialisation because of the unfavourable domestic investment climate (Athukorala 2006b).

Singapore has continued to remain the regional centre of cross-border production networks as the attraction of the country for international production was continuously enhanced by the policy emphasis of the government on infrastructure development, expanding the human capital base and skill upgrading, maintaining labour relations in a manner highly conducive for international production and sound macroeconomic management. Over the years Singapore's role in regional production networks have gradually shifted from low-skill component assembly and test to component design and fabrication and playing a services role in regional production (McKendrick *et al* 2000, Brown and Linden 2005)

The continued attraction of the region as a location of assembly activities seems to have been underpinned by a number of factors. First, despite rapid growth, manufacturing wages in all ASEAN countries except Singapore still remain lower than or comparable to those in countries in the European periphery and Mexico.[2] Moreover, significant differences in wages among the countries within the East Asia region have provided the basis for rapid expansion of intra-regional product sharing systems, giving rise to increased cross-border trade in parts and components. Second, the relative factor cost advantage has been supplemented by a relatively more favourable trade and investment policy regimes,

[1] Until recently, the fledgling electronics industry was largely dominated by small companies from newly industrialized countries in East Asia, with the sole exception of Fujitsu which operated a medium-size assembly plat in Ho Chi Ming City. On 28 February 2006, Intel Corporation, the world's largest semiconductor producer, announced that it will invest $300 million to build a semiconductor testing and assembly plant (with an initial workforce of 1200) in Ho Chi Ming City as part of its worldwide expansion of production capacity.

[2] Average annual compensation (Salary/wage plus other remuneration) per worker (US$) in selected countries: China 1835 (2001), Indonesia 880 (2000), Philippines 2965 (2000), Thailand 3345 (1994), Malaysia 4380 (2000), Vietnam 650 (2000), Taiwan 14420 (1997), Korea 15780 (2000), Singapore 20440 (2000), Poland 2502 (2000), Hungary 2898 (2000), Czech Republic 4150 (1998), Mexico 8050 (2000) (Source: China: China Statistical Press (2003) (average wage for Beijing, Tianjin, Shanhai, Zhejiang, Liaoning and Guangdon); Vietnam, General Statistical Office 2000; other countries: Nicita and Olarreage 2006, Statistical Appendix).

and better ports and communication systems that facilitate trade by reducing the cost of maintaining 'services links'.

Third, as firstcomers in this area of international specialisation, countries ASEAN (in particular (Singapore, Malaysia and Thailand) offer considerable agglomeration advantages for companies that are already located there. Site selection decisions of MNEs operating in assembly activities are strongly influenced by the presence of other key market players in a given country or neighbouring countries. Against the backdrop of a long period of successful operation in the region, many MNEs (particularly US-based MNEs) have significantly upgraded technical activities of their regional production networks in ASEAN and assigned global production responsibilities to affiliates located in Singapore and more recent also to those located in Malaysia, Thailand (Borrus *et al.* 2000; McKendrick, Doner & Haggard 2000). All in all, the ASEAN experience seems to support the view that MNE affiliates have a tendency 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 (Rangan and Lawrence 1999).

The date reported in Table 1 provides a preview of the important role played by this new international division labour in export-led industrialization in Singapore and other countries in the region. Export structures of all countries have shown a palpable shift towards manufactures over time, with Vietnam catching up with the regional patterns from the past decade. Within manufacturing, machinery and transport equipment (SITC 7), in particular the three sub-categories of office machine (SITC 75), telecommunication and sound recording equipment, and electric machinery in which fragmentation is concentrated, have played the pivotal role in this structural shift. It is also evident that relative export performance of individual countries has been exorable linked with their relative success in integrating into global production networks in these product lines.

3. Trends and Patterns of Product fragmentation

Table 2 summarises data on the growing importance of trade in parts and components[3] in world trade machinery and transport equipment. Value of parts and components in total trade increased from about $567 billion in 1993-4 to over 1378 billion in 2003-4, at a compound annual rate of over 13% compared to 11% growth in total manufacturing exports. The share of components in total trade increased from 41% to over 44% between these two time points. Components accounted for over a half of the total increment in world manufacturing exports between these two years.

Countries in East Asia account for the bulk of world trade in component trade. Their share in total components increased from 34% in 1993-4 to 40% in 2003-4. This was in spite of a sharp decline in the share of the regional giant, Japan, from 17.8% to 11.3%. The share of developing East Asia (East Asia excluding Japan) increased from 16.5% to 28.1%. Within that group, all reported countries have recorded increases in world market shares. The faster increase in share of ASEAN compared to the regional average is particularly noteworthy. Interestingly, the significant increase in the relative importance of East Asia in fragmentation trade has taken placed against the backdrop of a notable decline in the shares of NAFTA and EU.

The degree of dependence of East Asian countries as a group on component trade is much higher compared to all other regions in the world. In 2003-4, components accounted for 347%of total exports of machinery and transport equipment of these countries. Within East Asia, countries belonging to AFTA, in particular Malaysia, Philippine, Singapore and Thailand, stand out for their heavy dependence on product fragmentation for export dynamism. In 2003-4, components accounted for 58.4% of total exports in AFTA, up from 46.7% in 1993-4. The growing importance of China in component trade is particularly noteworthy. China's share in total world exports increased from around one per cent in 1993-4 to over 7% in 2003-4. The share of components in total exports of china increased from 24.5% to 34.8 between these two years. The share of Hong Kong in world component trade has eroded persistently as a result of the dramatic relocation of manufacturing ventures to the mainland China during this period.

[3] Henceforth we used the term 'components' in place of 'parts and components' for brevity.

A comparison of export and import data reported in Panel A and B counts to an interesting development ASIAN participation in world machinery trade. The increase in relative position of ASEAN on the export side has been accompanies by a mild decline in the regions share on the import side (See also Figure 1). It seems that the region has become increasingly specialised in the production of components. As will see below this development has mirrored in a sharp increase in the regions component exports to China. It seems that rapid expansion of China's role in world trade has brought about a notable shift in the patterns of regional division of labour, with ASEAN countries playing an increasing role in producing parts and components for rapidly growing final assembly activities in China.

Table 3 provides data on composition of parts and components trade of ASEAN countries. One stinking feature is the heavy concentration of pasts and components trade in electrical machinery, semiconductor devices in particular. Parts and components of electrical machinery accounted for 70% of total parts and component export from the six ASEAN countries, compared to a world trade share of this product category of 38%. For semiconductor devices, the comparable figures were 59% and 32% respectively. At the individual country level the degree of concentration in electrical machinery was particularly higher for Malaysia and the Philippine. ASEAN economies accounted for nearly a fifth of world trade in electrical machinery (18% in semiconductors). Overall, these differences are consistent with ASEAN economies competitive edge in component specialisation in electrical and electronic industries.

(a) *Regional versus Global Economic Integration*

In the previous section we observed that component trade has played a much more important role in trade expansion in East Asia relative to the overall global experience and experiences of countries in other major regions. Given this peculiarity of trade expansion, conventional trade flow analysis based on reported trade data is susceptible to yielding misleading inferences as to the relative importance of intra-regional trade relations (as against global trade) in the growth dynamism of East Asia (and AFTA and other subregional groupings therein). This is because intra/extra regional patterns of trade in parts and components and trade in related final goods (final trade) are unlikely to follow the same patterns. Mixing the two types of trade together is fundamentally flawed because the

growth dynamism based on assembly activities eventually depend on demand for final goods.

Data on the geographic profile of machinery trade of ASEAN economies are provided in Tables 4 through 6. The data vividly shows that intra-East Asian trade accounts for a much larger share in component exports and imports of ASEAN countries compared to the comparable share in total exports and imports. This in turns points to the continued reliance of the region on the rest of the world which absorbs a disproportionately share of final goods.

There is no notable difference between the intra-regional trade shares for EU, NAFTA. However, the alternative estimates are vastly different for East Asia, particularly for developing Asia and ASEAN: Both the level in the two given years and the change over time of intra-regional trade shares are significantly lower in terms of estimates based on final trade. For instance, intra-East Asia share of total machinery trade in ASEAN increased from 51% in 1993-4 to 64% in 2003-4 (Table 4). However, in terms of estimates based on final trade, the share remained virtually unchanged at 51%. While the difference between intra-regional shares of final and total trade is observable for both exports and imports, the magnitude of the difference is much larger on the export side. In 2003-4 only 41% of final goods exported from ASEAN found markets within the East Asian region, compared to 64% of total exports. For ASEAN the relevant figures were 20% and 16% respectively. Moreover, for all East Asian countries Japan is a much smaller market for final goods exports, accounting for less than 10% in all cases in 2003-4, compared to the USA and the EU. It is also interesting to note that, unlike in the case of East Asia (or developing East Asia and AFTA), the estimated intra-regional trade share for NAFTA, the EU and the other regional groupings are remarkably resilient to the inclusion or exclusion of component trade.

In sum, the estimates presented in this section support our hypothesis that, in a context where fragmentation based trade in expanding rapidly, the standard trade flows analysis can lead to misleading inferences regarding the on-going process of economic integration through trade. When parts and components are excluded from trade flows, our estimates suggest that extra-regional trade is much more important than intra-regional trade for growth dynamism of ASEAN economies. Thus, the ongoing process of product

fragmentation seems to have strengthened the case for a global, rather than a regional, approach to trade and investment policymaking.

(b) *Production Fragmentation and China's Integration into the Regional Global Economy*

The dramatic growth of FDI inflows to China over the past one-and-a-half decades has been accompanied by a sharp decline in the share of almost every other country in the total regional (as well as global) inflows. These contrasting patterns, couple with some anecdotal evidence of foreign firms either relocating to China have led to serious concern in policy circles in countries in the region (particularly in ASEAN countries) that 'competition' from China has begun to erode their prospect for attracting FDI as a pivotal element of their outer-oriented growth strategy.[4] The data presented in Table 7 run counter to this pessimistic view.

The shares of Chinese imports of machinery and transport equipment coming from East Asia increased from 53.6% in 1993-4 to 61% in 2003-4 (Table 7). This increase was dominated by components. The East Asia share of total Chinese imports of components increased from 67.7% to 68.5% between these two years. Component accounted for over 70% of the total increment in Chinese imports from the region over this period. Japan has continued to remain the major regional source country of parts and components for China, but there has been a notable diversification of source country composition.

The most notably development is the rapid growth of the combined share of ASEAN economies in components imports from a mere 2.8% in 1993-4 to 16.7% 2003-4. Within ASEAN, import shares of Malaysia and the Philippines have increased at a faster rate compared to that of Singapore. By 2003-4, Malaysia's share in total Chinese imports of components stood at 6.9% compared to Singapore's share of 3.0%. Overall, the data clearly suggest that China's trade integration through fragmentation trade is not predominantly a phenomenon limited to Greater China (or the 'China Circle', *a la* Haughton 1997). The procurement network has rapidly expanded to cover other countries in the region.

[4] See for instance Freeman and Bratels (2004), Chapter 1 and the work cited therein.

On the exports side, China's aggregate intra-regional share has declined persistently in both total manufacturing as well as component exports. Overall, China's evolving export patterns exhibit a clear extra-regional bias (the degree of which has increased over the year), in contrast to greater regional integration on the import side. This difference reflects the increasingly important role of China as a final product assembler for advanced-country markets using middle-products procured from the region. For about the mid 1990s, China has maintained a widening net importing position (trade deficit) with the region (Figure 2). The prime source of the widening deficit has been increasing reliance on countries in the region for sourcing parts and component for fuelling booming domestic final good assembly activities. Net part and component trade with the region increased persistently from about US$ 2 billion in 1997 to over U$50 billion in 2004.

4. Determinants of fragmentation trade[5]

We observed in the previous section the growing importance of fragmentation trade for trade expansion in ASEAN relative to the overall global experience and experiences of countries in other major regions. We now turn to a more formal examination of what forces shape inter-country/inter-regional differences in growth of fragmentation trade. The analytical tool used for this purpose is the gravity model which has been widely used as the 'workhorse' for empirical analysis of international trade flows. The standard gravity model postulates that trade between two countries, like the gravitational force between two masses, is a function of their economic size and the geographic distance between them. We augment this basic by adding a number of explanatory variables informed by the theory of international production fragmentation. Our specification of the gravity model is:

$$\begin{aligned} lnM_{i,j} = {} & \alpha + \beta_1 lnGDP_i + \beta_{2\ ln} GDP_j + \beta_3\, lnPGDP_i + \beta_3\, lnPGDP_j + \beta_5 \\ & ln\,/\Delta PGDP_{i,j}\,/ + \beta_6 lnDST_{i,j} + \beta_7 LNG_{i,j} + \beta_8\, BRD_{i,j} + \beta_9\, RWG_{i,j} + \\ & \beta_{10}\, TELE_{i,j} + \beta_{11} RTA_{i,J} + \beta_{12} AFTA_{i,j} + \gamma T + \varepsilon_{ij} \qquad (1) \end{aligned}$$

[5] This section draws on my ongoing joint research with Nobuaki Yamashita.

Where subscripts *i* and *j* refer to the importing and exporting country in bilateral trade relation and the variables are listed and defined below, with the postulated sign of the regression coefficient for the explanatory variables in brackets.

M	Bilateral trade between *i* and *j*, based on a reporting country's import
GDP	Real gross domestic product (GDP), a measure of the economic size (+)
PGDP	Real GDP per capita (+)
|ΔPGDP|	Absolute difference in GDP per capita (+)
DST	The distance between *i* and *j* (-)
LNG	A dummy variable which is unity if *i* and *j* have a common language and zero otherwise (+),
BRD	A dummy variable which is unity if *i* and *j* share the same border (+)
RWG	An index of relative manufacturing wage of *i* (manufacturing wage in *i* relative to that of *j*, adjusted for the bilateral exchange rate) **(+)**
TELE	telephone mainlines per 1,000 people (+)
ELET	electricity production in kilo-watts (kwh) (+)
RTAINT	A dummy which is unity if both *i* and *j* belong to the same *k*th Regional Trade Agreements (*RTA*) (+)
RTAEXT	A dummy taking unity when only *i* belong to *k*th *RTA* (- or +)
T	A set of time dummy variables to capture year-specific 'fixed' effects
α	A constant term
ε	An stochastic error term, representing the omitted other influences on bilateral trade

The use of GDP as an explanatory variable of bilateral trade flows is normally justified by the modern theory of trade under imperfect competition (monopolistic competition model of trade); one will choose to trade more with a large country than with a small country because it has more variety to offer and customers like variety. The use of this variable is also consistent with the theory of international production fragmentation, which predicts that the optimal degree of fragmentation depends on the size of the market because the scale of production would determine the length to which such division of labour can proceed (Jones *et al*. 2004). The size of GDP can also be treated as a proxy for the market thickness (the economic depth of trading nations) which positively impact on

the location of outsourcing activity (Grossman and Helpman 2005). There are also reasons to believe that GDP per capita has a positive effect over an above the effect of GDP, as countries grow richer, the scale of output of industries become conducive to fragmentation. In addition, more developed countries have better ports and communication systems that facilitate trade by reducing the cost of maintaining 'services links' involved in vertical specialisation.[6]

The choice of absolute difference in per capita GDP and relative manufacturing wage (*RWG*) as explanatory variables is based on the standard comparative advantage explanation of trade flows. The former variable aims to capture differences in resource endowment between countries in explaining trade patterns. The basic premise here is that a pair of countries with dissimilar level of per capita GDP is likely to trade more each other than a pair with similar (hence, the expected sign is positive). Relative labour cost (adjusted for exchange rate differential) is presumably a major factor impacting on the global spread of fragmentation-based (vertical) specialisation (Jones 2000).

Distance (*DST*) is included as a proxy for transport (shipping) costs and other costs associated with time lags such as Internet charges, spoilage and costs associated with physical distance such as ignorance of foreign customs and tastes. Technological advances during the post-war era has certainly contributed to a 'death of distance' when it comes to international communication cost (*a la* Cairncross 1997). However, there is evidence that the geographical 'distance' is still a key factor in determining international transport cost, in particular shipping cost (Hummel 1999). Distance can in fact be a more important influence on vertical trade compared to final trade because of multiple boarder-crossing involved in the value added chain.

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[6] In gravity-model analysis of bilateral trade flows, the GDP variables are usually presented in two multiplicative terms, i.e. $GDP_i * GDP_j$ and $PGDP_i * PGDP_j$. This practice has the advantage of avoiding the statistical problems of possible multicollinearity, and heteroscadasticity (resulting from the presence of effects between extremely large countries and extremely small ones) in model estimation. But there is no theoretical justification for constraining change in partner country and reporting country *GDP* and *PGDP* to have the same degree of effect on bilateral trade flows, particularly when it comes to trade in components. In this study we, therefore, include reporting- and partner-country GDP and PGDP as separate variables. In this we closely follow (Soloaga and Winters 2001). This variable specification is, in fact, amply supported my our estimation results (Table 6); the homogeneity restriction does not hold for the coefficients on GDP_i and GDP_j, and $PGDP_i$ and $PGDP_j$ is all four equations.

A common border dummy (*BRD*) is included to capture possible additional advantages of proximity that are not captured by the standard distance measure (the greater cycle distance between capital cities). A common language dummy (*LNG*) in included to capture the possibility that the use of a common language can facilitate trade by reducing transaction cost and better understanding of each others' culture and legal systems.

An important determinant of trade flows suggested by the theory of production fragmentation is the cost of service links (Jones 2000, Jones and Kierzkowski 1990). A country with better infrastructure (such as well established broadband networking) is presumably a preferable location of global sourcing because of lower cost of establishing 'service links'. There is no single measure for such costs. Drawing on Egger and Egger (2005), we incorporate two infrastructure variables; telephone mainlines per 1,000 people (TELE) and electricity production in kilo-watts (kwh) (ELET).[7]

We include regional dummy variable (*RTA)* to capture the possible trade effects of membership in six regional trading agreements (AFTA, EU, NAFTA, MERCOSUR, ANDEAN and CER), with all countries not belonging to any RTAs forming the base group. Under international production fragmentation, parts and components (goods in process) crosses multiple international borders before they finally get embodied in a final good. A positive coefficient on RTA suggests that the RTA tends to generate more trade among its members.

Component trade is postulated to be relatively more sensitive to tariff changes (under an RTA or otherwise) compared to final trade (or total trade as captured in published trade data) (Yi 2003). Normally a tariff is incurred each time a goods in process cross a border. Consequently, when one percentage point reduction in tariff, the cost of production of a vertically-integrated good declines by a multiple of this initial reduction, in contrast to a one percent decline in the cost of a regular traded good. Moreover, because of tariff reduction it may also make more profitable for goods that were previously produced in entirely in one country to now become vertically specialised. Consequently, the trade stimulating effect of FTA would be higher for parts and component trade than for normal trade, other things remaining unchanged. However, in the case of fragmentation trade one

[7] Data on these two variables are from the World Development Indicator database online version (World Bank).

can assumes a positive coefficient because any positive effect of an RTA on the depth of regional outsourcing activity has the potential to promote such activities extra-regionally as well (assuming of course the nature of 'rules or origin' built into the RTA). Finally, the time-specific fixed effects (T) are included to control for general technological change and other time-varying factors.[8]

We estimate the model with annual bilateral trade data for 35 countries (see Appendix Table A2) for the period of 1992 to 2003. The trade data relates to the Machinery and Transport Equipment of the UN Standard International Trade Classification system (SITC Section 7).[9] The prime focus of our analysis is on trade in components. However, we estimate the model for final goods trade (reported trade minus vertical trade) as well for the purpose of comparison. Under each category, the bilateral trade based on given reporting countries' import (rather than using a composite trade variables as the dependent variable, as is commonly done in trade flow analysis based on the gravity model) is estimated in order to allow for the possible difference in the nature/magnitude of the postulate impact of a given explanatory variable on bilateral trade flows. We used random effect estimator as our preferred estimation technique. The alternative fixed effect estimator is not appropriate because our model contains a number of time-invariant variables (distance, language, border and RTAs dummies) which are central to our analysis of fragmentation-based trade. A major limitation of the random effect estimator compared to its fixed effect counterpart is that it can yield inconsistent and biased estimates if the unobserved fixed effects are correlated with the remaining component of the error term. However, this is unlikely to be a serious problem in our case, because N (the number of explanatory variables) is larger than T (the number of 'within' observations) (Wooldrige 2001). The random effect estimator also takes care of care of the serial correlation problem.

The results are reported in Table. Information on variable construction and the data source are summarised in Appendix 2. As in many other applications of the gravity model to bilateral trade flows, in all regressions the coefficients on the two central gravity variables – the level of GDP and the distance – have the expected signs (positive and negative, respectively) and are significant at the 1% level. The coefficient on GDP is

[8] However, time-dummies are not reported to conserve space.
[9] Country/time coverage of the data set is entirely dictated by the nature of data availability.

similar in magnitude in the two equations suggesting that the market size is an equally important determinant of trade in components as well as the final assembled goods. But, the coefficient on the import per capita GDP is notably different between the two equations: in the component trade equation, the coefficient is statistically significant with the positive sign and in the final-good trade equation it is statistically not different from zero. By contrast, the coefficient on the exporter per capital GDP is statistically significant and comparable in magnitude with the positive sign in the two equations. It seems that differences in the stage of economic development among trading partners is important only in explaining inter-country differences in component trade.

The coefficient on the relative manufacturing wages (*RWG)* is statistically significant with the expected sign in both equations. Thus, there is strong empirical support for the hypothesis that relative wage differentials are a significant determinant of cross border trade in components (as well as the related final products). Interestingly the magnitude of the coefficient is very similar across all equations. This may reflect the interconnectedness of components trade and the dependence of final exports on component imports. The coefficient on $|\Delta PGDP|$ is not statistically significant and carries the unexpected (negative) sign in both equations.[10] Interestingly, our results suggest that relative manufacturing wage (*RWG*) plays an important role in fragmentation-based trade regardless of differences/similarities in overall factor endowment. In other words, the Ricardian competitive advantage (as against Hecksher-Ohlin factor endowment differentials) appears to be an important factor underlying trade in component (as well as in the final assembled goods) (Neary 2003).

The results for the distance variable (*DST*) provide strong support for the hypothesis that cost of transportation and other distance-related costs are an important determinant of trade flows. Interestingly, the distance coefficient for components are larger in magnitude compared to those relating to final trade.[11] This difference is consistent with the hypothesis that vertical specialisation, given the multiple border crossing involved in the production process, is much more sensitive to transport cost. The common language dummy (LNG) is not statistically significant.

[10] The overall regression results are not sensitive to the exclusion/inclusion of this variable.
[11] The difference is statistically significant in both cases.

The two infrastructure variables (TELP and ELET) were dropped from the final estimates because they were found to be highly correlated with PGDP.[12] It seems that there is no need for additional variable for capturing infrastructure quality as it is close correlated with the stage of development as measured by PGDP.

The coefficient on RTA dummy achieves statistical significance in both equations with the expected (positive) sign; supporting the hypothesis the RTAs promote vertical specialisation among member countries. The coefficient on the dummy variable for AFTA is highly significant with the positive sign in both equations. The coefficient in the component trade equation suggests that intra-AFTA is about thirty times higher than the level predicted by the other explanatory variables in the model.[13]

The unique results for AFTA clearly point to the need for going beyond intra-regional tariff reductions (and other variables captured in our model) to understand that region's unique dynamic role in fragmentation trade. Perhaps the explanation lies in economic history, the early choice of the region (firstly Singapore and subsequently Malaysia and other countries) by MNEs as a location of outsourcing activities. It is well known that 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. They may respond sluggishly to relative cost changes once they have invested substantial resources in domestic production facilities and in establishing information links. Moreover, site selection decisions of MNEs operating in assembly activities are strongly influenced by the presence of other key market players in the given country (Rangan and Lawrence 1999). Moreover, rapid economic expansion for over three decades in a number of countries in the region has presumably brought about 'market thickness' (the economic depth of trading nations) which positively impact on the location of outsourcing activity.

[12] This variable deletion was amply supported by the standard F-test.

[13] Note that, as the model was estimated in logs, the percentage equivalent for any dummy coefficient is, [exp (dummy coefficient – 1]* 100.

5 Concluding Remarks

There is clear evidence that the fragmentation-based specialisation has become an integral part of the economic landscape of ASEAN and in the wider East Asian region. Trade in components has been expanding more rapidly than conventional final-good trade. The degree of dependence on this new form of international specialisation is proportionately larger in East Asia, in particular in ASEAN, compared to North America and Europe. A notable recent development in international fragmentation of production in the region has been the rapid integration of China into the regional production networks. This development is an important counterpoint to the popular belief that China's global integration would crowd out other countries' opportunities for international specialization. China's imports of components from countries in ASEAN and other East Asia countries have grown rapidly, in line with rapid expansion of manufacturing exports mostly to North America and the European Union.

Production fragmentation has certainly played a pivotal role in continuing dynamism of the East Asian economies and increasing intra-regional economic interdependence. This does not, however, mean that the process has contributed to lessoning the regions dependence on the global economy. The high intra-regional trade shares reported in recent studies largely reflect rapidly expanding intra-regional trade in components. There is no evidence of rapid intra-regional trade integration in terms of final products. In fact, the region's growth dynamism based on vertical specialisation depends inexorably on its extra-regional trade in final good, and this dependence has in fact *increased* over the years. Put simply, growing trade in components has made the East Asia region increasingly dependent on extra-regional trade for its growth dynamism. In this context, these countries would be better off by upholding universal principles of economic openness.

Finally, what are the implications of these findings for the contemporary policy debate on regional economic corporation? In particular, is the new-found fondness in countries in the region for free trade agreements (FTAs) consistent with the objective of maximising gains from the ongoing process of international product fragmentation? Relating to these issues, our findings do not lend support to the case recently put forward by Baldwin (2006) for a 'New East Asia Regional management Effort' with a reinforced

ASEAN+3, with a view to ensuring smooth functioning of the process of fragmentation-based specialisation (which he bubs 'Factory Asia'). Baldwin has correctly identified the importance of fragmentation-based specialisation for economic growth in these countries, but unfortunately he has completely overlooked the important fact that the growth dynamism based on this new form of specialisation depends inexorably on extra-regional trade in final good, and this dependence has in fact *increased* over the years. Thus, in terms of benefiting from the new opportunities for trade expansion through the fragmentation-based division of labour, the ideal (first best) policy choice appears to be multilateral liberalisation through the WTO process; the ongoing process of product fragmentation seems to have strengthened the case for a global, rather than a regional, approach to trade and investment policymaking.

Appendix 2: Data Source and Method of Data Compilation

There are two approaches to quantifying the magnitude and patterns of manufacturing trade that can be directly attributed to production fragmentation. The first approach, which was commonly used by early studies in this area, is to use the records maintained by OECD countries (in particular the US and countries in the European Union) in connection with the use of special tariff provisions that provide for preferential access for the re-entry of domestically produced components assembled abroad ('outward processing trade (OPT) statistics'). While undoubtedly they provide insights into outsourcing, there are of little use for the present study. The OPT schemes have covered only a selected list of products and the coverage varied among countries and within countries over time. Moreover, and perhaps more importantly, the importance of these tariff concessions as a factor in promoting global sourcing (and therefore the actual utilization of these schemes), has significantly been diminished over the years by the process of investment and trade liberalisation in ICs and regional economic integration agreements. The second approach is to delineate trade in parts and component from the related final (assembled) goods using individual-country trade statistics recorded on the basis of the Standard International Trade Classification (SITC) of the United Nations.

In its original form (SITC, Rev 1), the UN trade data reporting system did not provide for separating parts and components from final manufactured goods. The SITC Revision 2 introduced in the late 1970s (and implemented by most countries only in the early 1980s) adopted a more detailed commodity classification, which provided for separation of parts and components within the machinery and transport sector (SITC 7). There were, however, considerable overlap between some advanced-stage assembly activities and related final goods within the sector in the Revision 2, which made it difficult to separate fragmentation trade from total trade (Ng and Yeats 2001). For instance 'television tubes' were not separable from 'TVc' and ' computer processors' were lumped together with 'computers'. Revision 3 introduced in the mid-1980s marked a significant improvement over Revision 2.

It is important to note that, despite its significant improvement over the previous version, SITC Revision 3 does not provide for the construction of data series covering the

entire range of fragmentation-based trade. Data reported under SITC 7 do provides a comprehensive coverage of fragmentation trade. But data for SITC 8 does not seem to fully capture fragmentation trade within that commodity category. For instance, for some products such as clothing, furniture, and leather products in which outsourcing is prevalent (and perhaps has been increasing), some of the related components (e.g., pieces of textile, parts of furniture, parts of leather soles) are presumably recorded under other SITC categories. Moreover, there is evidence that production fragmentation has been spreading beyond SITC 7 and 8 to other product categories such as pharmaceutical and chemical products (falling under SITC 5) and machine tools and various metal products (SITC 6). Assembly activates in software trade, too, have recorded impressive expansion in recent years. These are lumped together with 'special transactions' under SITC 9. So the tabulations presented here of the magnitude of fragmentation-based trade are downward biased. However, the magnitude of the bias is unlikely to be substantial because fragmentation-based international specialisation is predominantly concentrated in machinery and transport equipment category (SITC 7) (Yeats 2001, Feenstra 1998).

The data for this paper are compiled over the period from 1993 to 2004 from the UN *Comtrade* database based on the Revision 3 of the Standard International Trade Classification (SITC, Rev 3). Given the separation of components from final goods is incomplete for other Sections of the SITC system, in this study focus solely on SITC 7 with a view to minimise any bias in analysing trends in fragmentation trade arising from the incomplete commodity coverage of the original data. Data tabulation is based on a comprehensive list of parts and components prepared at the 5-gidit level. The list was prepared by carefully linking the parts and accessaries identified in the United Nations Statistical Division: Classification Registry (http:/unstats.un.org/unsd/cr/registry) with the 5-digit SITC products. (The list is available from the author on request).

The data are tabulated using importer records, which are considered to more appropriate compared to the corresponding exporter records for analysing trade patterns for a number of reasons (Ng and Yeats 2003, Appendix 1, Feenstra *et al.* 2005). Importer records are admittedly less susceptible to double counting and erroneous identification of the source/destination country in the presence of entrepot trade compared to data based on reporting country records (eg. China's trade through Hong Kong and Indonesia's through Singapore). Also, some countries fail to properly report goods shipped from their own

export processing zones. These exports are simply lump these exports into one highly aggregated category of 'special transactions' under SITC 9. While no fully satisfactory solutions exist for these problems, it is generally believed that data compiled from importer records are less susceptible to recording errors and reveal the origins and composition of trade more accurately since there normally are important legal penalties for incorrectly specifying this information on customs declarations. Among the countries covered in this study, Taiwan is not covered in the UN data system and Vietnam has not yet begun to make data available according to the standard UN format. Singapore was not reporting data on its bilateral trade with Indonesia because of political reasons.[14] In these cases, the data gaps were filled using the corresponding trading partner records.

The data are tabulated using importer records, which are considered to more appropriate compared to the corresponding exporter records for analysing trade patterns for a number of reasons (Ng and Yeats 2003, Appendix 1, Feenstra *et al* 1999 and 2005). Importer records are admittedly less susceptible to double counting and erroneous identification of the source/destination country in the presence of entrepot trade compared to data based on reporting country records (eg. China's trade through Hong Kong and Indonesia's through Singapore). Also, some countries fail to properly report goods shipped from their own export processing zones. These exports are simply lump these exports into one highly aggregated category of 'special transactions' under SITC 9. While no fully satisfactory solutions exist for these problems, it is generally believed that data compiled from importer records are less susceptible to recording errors and reveal the origins and composition of trade more accurately since there normally are important legal penalties for incorrectly specifying this information on customs declarations. Among the countries covered in this study, Taiwan is not covered in the UN data system and Vietnam has not yet begun to make data available according to the standard UN format. Singapore was not reporting data on its bilateral trade with Indonesia because of political reasons. [1] In these cases, the data gaps were filled using the corresponding trading partner records.

[14] In 2005 Singapore started releasing data on trade with Indonesia, after being pressured for decades by the Indonesian government.

Appendix 2

Definition of Variables and Data Source Used in Regression Analysis

Label	*Definition*	*Data Source*
M	Bilateral trade flows ('Component' and 'Final Goods' trade) at constant (1995) dollar	Trade flows: UN-COMTRADE, online database Exchange rates: IMF, *International Financial Statistics* (line rf)
GDP	Real GDP (at 1995 price)	World Development Indicator, The World Bank
DIST	the Great Circle distance between capital cities of two countries	Joe Haveman's International Trade Data, at <http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html>
RWG	Relative labour cost in the manufacturing, adjusted for exchange rate changes: $RWG_{ij} = \frac{W_i}{W_j} E_{ij}$ where, W = manufacturing wage index (1992 = 100) *E* = nominal bilateral exchange rate expressed as the value of *i*'s currency in terms of *j*'s currency. By construct, an increase (decrease) in RWG_{ij} indicates a deterioration (improvement) in *i*'s cost competitiveness vis a vis *j*	Annual manufacturing wages data for USA: 'Interactive database of National Income and Product Accounts Tables' at <http://www.bea.gov/bea/dn/nipaweb/SelectTable.asp?Selected=N#S6> under Section 6 - Income and Employment by Industry All other countries: US Bureau of Economic Analysis (BEA) online database, 'Survey of U.S. Direct Investment Abroad' < http://www.bea.doc.gov/bea/uguide.htm#_1_23>. Bilateral exchange rates: derived from bilateral US$ exchange rates obtained from IMF, International Financial Statistic.

[1] In 2005 Singapore started releasing data on trade with Indonesia, after being pressured for decades by the Indonesian government.

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Table 1: Export Performance of ASEAN Economies by Major Commodity category[1]

SITC	Country/commodity category	Composition (%)			Share in world trade (%)			Growth
Code		1976-7	1983-4	2003-4	1976-7	1983-4	2003-4	1983-04
	INDONESIA							
	Primary products	97.7	74.6	32.6	2.7	1.1	1.7	11.3
	Manufactures	2.3	25.4	67.4	0.0	0.1	0.7	20.4
5	Chemicals and related products	0.9	2.4	6.4	0.1	0.1	0.5	21.1
6	Manufactured goods classified by materials	1.1	15.6	16.8	0.1	0.4	1.1	15.1
7	Machinery and transport equipment	…	2.5	25.6	…	…	0.5	37.3
75	Office machines and data processing equipment	…	…	6.5	…	…	1.0	98.0
76	Telecom, sound recording equipment	…	…	7.2	…	…	1.3	61.9
77	Electric machinery, apparatus and appliances	…	2.1	7.9	…	0.1	0.7	31.3
78/9	Transport equipment and parts	…	0.1	1.3	…	0.0	0.2	122.0
8	Miscellaneous manufactured articles	0.2	4.8	18.6	…	0.2	1.2	22.5
	Total non-oil exports	100	100	100	…	0.4	0.9	15.2
	MALAYSIA							
	Primary products	91.0	63.4	11.6	2.5	2.3	1.2	4.1
	Manufactures 5+6+7+8-68	9.0	36.6	88.4	0.1	0.5	1.9	19.1
5	Chemicals and related products	0.6	1.4	4.8	0.1	0.1	0.7	21.4
6	Manufactured goods classified by materials	3.3	5.4	5.6	0.2	0.3	0.7	15.2
7	Machinery and transport equipment	2.7	25.6	69.7	0.1	0.7	2.8	19.9
75	Office machines and data processing equipment	0.0	0.7	22.2	0.0	0.2	6.6	40.6
76	Telecom, sound recording equipment	0.1	2.9	13.7	0.1	0.9	4.8	23.4
77	Electric machinery, apparatus and appliances	1.9	20.2	30.8	0.4	3.5	5.3	16.7
78/9	Transport equipment and parts	0.0	0.4	0.6	0.0	0.1	0.2	18.0
8	Miscellaneous manufactured articles	2.4	4.2	8.2	0.2	0.3	1.0	17.2
	Total non-oil exports	100	100	100	0.9	1.0	1.7	13.8
	PHILIPPINES							
	Primary products	89.7	51.1	10.4	1.5	0.9	0.4	4.7
	Manufactures	10.3	48.9	89.6	0.1	0.3	0.8	17.7
5	Chemicals and related products	3.4	7.0	3.5	0.2	0.3	0.2	9.4
6	Manufactured goods classified by materials	1.3	1.8	1.0	…	0.1	0.1	12.6
7	Machinery and transport equipment	1.1	0.1	0.8	…	0.0	0.0	38.7
75	Office machines and data processing equipment	0.1	0.7	4.9	…	0.1	0.6	34.1
76	Telecom, sound recording equipment	0.8	22.3	49.0	0.2	3.4	7.0	20.5
77	Electric machinery, apparatus and appliances	1.1	0.4	1.4	0.1	0.0	0.1	34.9
78/9	Transport equipment and parts	0.2	0.2	0.2	0.0	0.0	0.0	
8	Miscellaneous manufactured articles	2.9	17.3	10.7	0.2	0.7	0.5	9.2
	Total non-oil exports	100	100	100	0.6	0.5	0.7	13.8
	SINGAPORE							
	Primary products	26.7	17.8	6.1	0.2	0.5	0.5	7.5
	Manufactures	73.3	82.2	93.9	0.3	0.9	1.5	13.7
5	Chemicals and related products	11.2	6.9	17.0	0.4	0.6	1.8	17.3
6	Manufactured goods classified by materials	13.7	7.5	3.1	0.2	0.4	0.3	8.2
7	Machinery and transport equipment	36.4	54.4	66.5	0.3	1.3	2.0	14.4
75	Office machines and data processing equipment	2.0	11.4	26.4	0.4	2.8	6.0	17.7
76	Telecom, sound recording equipment	4.5	11.1	5.2	0.7	2.9	1.4	9.8
77	Electric machinery, apparatus and appliances	7.5	19.7	27.5	0.5	2.9	3.6	15.7
78/9	Transport equipment and parts	15.1	5.3	2.0	1.1	1.8	1.1	11.6
8	Miscellaneous manufactured articles	12.0	13.4	7.2	0.4	0.9	0.7	8.5
	Total non-oil exports	100	100	100	0.3	0.8	1.3	13.0

	THAILAND							
	Primary products	85.0	66.0	19.9	1.4	1.3	1.5	8.8
	Manufactures	15.0	34.0	80.1	0.1	0.2	1.2	20.3
5	Chemicals and related products	2.4	1.7	6.5	0.1	0.1	0.7	24.5
6	Manufactured goods classified by materials	7.7	13.1	10.9	0.3	0.4	1.0	14.1
7	Machinery and transport equipment	0.9	7.8	47.4	0.0	0.1	1.3	26.3
75	Office machines and data processing equipment	0.0	0.5	13.6	0.0	0.1	2.9	36.2
76	Telecom, sound recording equipment	0.0	0.2	8.5	0.0	0.0	2.1	66.7
77	Electric machinery, apparatus and appliances	0.7	6.0	14.0	0.1	0.5	1.7	20.2
78/9	Transport equipment and parts	0.0	0.2	5.0	0.0	0.0	0.6	40.7
8	Miscellaneous manufactured articles	3.9	11.3	15.3	0.2	0.5	1.3	16.5
	Total non-oil exports	100	100	100	0.6	0.5	1.2	15.5
	VIETNAM							
	Primary products	75.4	86.9	24.7	…	0.1	0.4	15.4
Mfg	Manufactures	24.6	13.1	75.3	…	…	0.2	47.6
5	Chemicals and related products	0.5	0.7	1.5	…	…	0.0	51.5
6	Manufactured goods classified by materials	7.3	2.8	7.6	…	…	0.2	32.1
7	Machinery and transport equipment	4.7	0.5	11.3	…	…	0.1	95.7
75	Office machines and data processing equipment	0.0	0.0	1.2	…	…	0.1	104.7
76	Telecom, sound recording equipment	0.1	0.1	1.0	…	…	0.1	217.8
77	Electric machinery, apparatus and appliances	0.1	0.3	5.4	…	…	0.1	211.7
78/9	Transport equipment and parts	1.3	0.0	1.4	…	…	---	116.5
8	Miscellaneous manufactured articles	12.1	9.1	55.0	…	…	1.1	53.8
	Total non-oil exports	100	100	100	…	…	0.3	27.6
	ASEAN 6							
	Primary products	85.7	51.9	15.6	8.3	6.2	5.8	7.5
	Manufactures	14.3	48.1	84.4	0.7	2.1	6.3	17.4
5	Chemicals and related products	2.4	3.8	7.7	0.9	1.2	3.9	18.0
6	Manufactured goods classified by materials	4.1	7.9	7.3	0.8	1.5	3.3	13.6
7	Machinery and transport equipment	4.4	23.4	47.7	0.5	2.1	6.8	18.5
75	Office machines and data processing equipment	0.2	3.3	16.2	0.4	3.1	17.1	23.7
76	Telecom, sound recording equipment	0.6	7.0	13.4	1.0	7.2	16.5	18.2
77	Electric machinery, apparatus and appliances	1.5	12.5	18.9	1.2	7.1	11.5	17.0
78/9	Transport equipment and parts	1.4	1.6	1.9	1.1	2.0	2.2	18.2
8	Miscellaneous manufactured articles	3.0	9.8	13.3	1.1	2.6	5.8	15.3
	Total non-oil exports	100	100	100	3.3	3.2	6.2	14.2

Notes: The data relate to non-oil merchandise exports (total merchandise exports menus all products belonging the SITC 3). Manufactures cover all products belonging to SITC 5 -8 less SITC 68 (non-ferrous metals). Primary products derived as total non-oil merchandise export minus are manufacture.

… Zero or negligible.

Source: Compiled from Comtrade database.

Table 2: World Trade in Machinery and Transport Equipment, 1993-2004(%)

	Regional/country composition (%)						Share of parts and components in total trade	
	Total trade		parts and components		Final goods			
	1993/4	2003/4	1993/4	2003/4	1993/4	2003/4	1993/4	2003/4
(A) EXPORTS								
East Asia	34.5	37.5	34.3	39.7	34.6	35.8	40.9	46.9
Developing East Asia	15.4	26.1	16.5	28.4	14.7	24.2	43.9	48.2
Japan	19.1	11.4	17.8	11.3	19.9	11.5	38.5	43.9
Rep. of Korea	2.4	4.3	2.9	4.1	2.1	4.4	49.0	42.8
Taiwan	3.3	3.8	3.6	5.4	3.1	2.5	45.0	63.8
China	2.3	9.3	1.4	7.3	3.0	10.9	24.5	34.8
Hong Kong, SAR	1.0	0.7	1.4	1.0	0.8	0.5	55.6	60.4
AFTA	6.3	8.0	7.2	10.5	5.7	6.0	46.7	58.4
Indonesia	0.1	0.5	0.1	0.6	0.2	0.5	31.1	48.4
Malaysia	2.1	2.8	2.4	3.8	1.9	2.0	46.8	59.5
Philippines	0.4	1.2	0.7	2.0	0.2	0.6	73.7	73.5
Singapore	2.8	2.0	3.0	2.7	2.6	1.5	44.9	58.6
Thailand	0.9	1.3	1.0	1.4	0.9	1.3	43.0	45.7
Viet Nam	0.0	0.1	0.0	0.1	0.0	0.1	25.8	55.9
South Asia	0.1	0.2	0.1	0.3	0.1	0.2	49.5	53.0
Oceania	0.3	0.3	0.3	0.3	0.3	0.3	39.6	43.8
NAFTA	22.4	18.1	24.5	19.7	21.0	16.7	44.9	48.4
EU 15	35.3	35.4	32.5	31.1	37.3	38.9	37.9	38.9
World	100	100	100	100	100	100	41.1	44.3
US$ billion	1379	3110	567	1378	812	1732		
(B) IMPORTS								
SITC7,US$ millions	1993/4		2003/4	1993/4	2003/4	1993/4	2003/4	1993/4	2003/4
East Asia	24.7		26.3	27.5	36.6	22.7	18.2	45.8	61.6
Developing East Asia	21.3		22.6	24.0	32.4	19.3	14.8	46.5	63.5
Japan	3.4		3.7	3.5	4.2	3.3	3.3	42.0	49.9
Rep. of Korea	2.4		2.2	2.9	3.0	2.0	1.6	49.5	59.7
Taiwan	2.4		2.0	3.2	2.8	1.8	1.4	55.3	62.1
China	3.5		7.2	2.5	9.8	4.2	5.1	29.0	60.4
China, Hong Kong SAR	3.9		4.0	3.8	5.7	3.9	2.7	40.3	62.5
AFTA	9.2		7.2	11.7	11.2	7.4	4.0	52.6	68.8
Indonesia	0.9		0.3	1.0	0.3	0.9	0.3	43.5	44.7
Malaysia	2.2		1.8	3.1	3.0	1.5	0.8	58.7	75.0
Philippines	0.5		0.8	0.6	1.5	0.4	0.2	48.5	86.1
Singapore	3.7		2.9	5.0	4.6	2.8	1.6	55.1	69.4
Thailand	1.7		1.1	2.0	1.5	1.5	0.8	48.2	58.8
Viet Nam	0.1		0.2	0.1	0.2	0.2	0.3	20.8	38.3

South Asia	0.5	0.8	0.6	0.6	0.4	0.9	47.2	36.0
India	0.4	0.6	0.5	0.5	0.3	0.7	49.4	39.2
Pakistan	0.1	0.1	0.1	0.1	0.1	0.2	39.1	22.5
CEP	1.8	1.6	1.4	0.9	2.2	2.2	30.6	25.0
Australia	1.5	1.4	1.2	0.8	1.7	1.8	32.4	26.0
New Zealand	0.3	0.3	0.2	0.1	0.4	0.4	22.5	20.1
NAFTA	27.2	25.2	28.2	22.3	26.5	27.5	42.6	39.2
USA	20.4	18.4	19.8	14.3	20.8	21.6	40.0	34.6
Canada	4.9	3.9	6.1	4.1	4.0	3.7	51.3	46.8
Mexico	1.9	2.9	2.3	3.8	1.6	2.2	49.1	57.8
EU 15	33.7	35.4	33.1	32.0	34.2	38.2	40.4	40.0
World	100.0	100.0	100.0	100.0	100.0	100.0	41.1	44.3
US$ billion	1379	3110	567	1378	812	1732		

Source: Compiled from UN Comtrade database.

Table 3: ASEAN Parts and Components Trade: Composition and World Market Share by Major Category, 2003-4 (%)

		Indonesia	Malaysia	Pipelines	Singapore	Thailand	Vietnam	ASEAN	World
	EXPORT: composition (%)								
71	Power generating machines	4.6	0.4	0.4	1.9	2.7	3.1	1.3	10.6
72	Special industrial machinery	2.7	0.5	0.1	1.4	0.6	3.7	0.8	3.8
73	Metalworking machinery	0.1	0.1	0.0	0.3	0.2	0.5	0.1	1.0
74	General industrial machines	5.0	1.1	0.6	2.6	5.7	9.2	2.2	9.7
75	Office machines	9.9	21.2	10.5	23.3	21.0	3.1	19.1	11.8
76	Telecomm. And sound equipments	21.3	7.6	3.9	3.5	15.4	6.1	7.3	7.3
77	Electrical machines	46.7	68.0	82.5	65.4	48.5	69.4	66.9	38.3
	Semiconductor devices (SITC 776)	21.9	63.2	75.9	58.7	36.9	5.4	59.2	32.3
78	Road vehicles	9.5	1.0	1.8	0.8	5.8	4.9	2.1	14.7
79	Other transport equipment	0.2	0.1	0.2	0.7	0.1	0.1	0.3	2.8
	P&C export	100	100	100	100	100	100	100	100
	E**XPORT: World market share**								
71	Power generating machines	0.1	0.1	0.1	0.5	0.3	0.0	1.2	100
72	Special industrial machinery	0.2	0.5	0.1	0.9	0.2	0.1	2.1	100
73	Metalworking machinery	0.0	0.2	0.1	0.9	0.3	0.0	1.6	100
74	General industrial machines	0.2	0.4	0.1	0.7	0.8	0.1	2.3	100
75	Office machines	0.3	6.7	1.8	5.3	2.5	0.0	16.6	100
76	Telecomm. And sound equipments	1.0	3.9	1.1	1.3	2.9	0.1	10.3	100
77	Electrical machines	0.4	6.7	4.4	4.6	1.8	0.2	17.9	100
	Semiconductor devices (SITC 776)	0.2	7.3	4.8	4.8	1.6	0.0	18.8	100
78	Road vehicles	0.2	0.3	0.2	0.1	0.5	0.0	1.4	100
79	Other transport equipment	0.0	0.1	0.1	0.7	0.1	0.0	1.0	100
	P&C export	0.3	3.8	2.0	2.7	1.4	0.1	10.3	100
	IMPORTS: Composition								
	Imports								
71	Power generating machines	17.0	2.5	1.0	3.8	5.8	15.6	3.9	10.6
72	Special industrial machinery	11.0	1.5	1.5	4.3	1.5	9.6	3.0	3.8
73	Metalworking machinery	1.2	0.4	0.3	0.6	0.5	2.9	0.5	1.0
74	General industrial machines	20.5	2.8	1.1	4.3	7.2	12.2	4.5	9.7
75	Office machines	1.1	13.3	16.9	16.4	13.6	7.9	14.6	11.8
76	Telecomm. And sound equipments	2.8	4.5	3.9	4.0	3.9	9.4	4.2	7.3
77	Electrical machines	16.4	72.7	72.6	61.8	54.0	28.0	63.2	38.3
	Semiconductor devices (SITC 776)	3.1	61.9	67.5	54.0	39.6	8.0	53.6	32.3
78	Road vehicles	28.3	1.5	2.1	2.1	11.5	13.0	4.2	14.7
79	Other transport equipment	1.8	0.8	0.6	2.8	1.9	1.5	1.7	2.8
	P&C export	100	100	100	100	100	100	100	100
	IMPORTS: World market share								
71	Power generating machines	0.5	0.7	0.1	1.5	0.8	0.3	4.1	100
72	Special industrial machinery	1.0	1.2	0.6	4.8	0.6	0.5	8.7	100
73	Metalworking machinery	0.4	1.3	0.5	2.5	0.8	0.6	6.1	100
74	General industrial machines	0.7	0.9	0.2	1.9	1.1	0.3	5.1	100
75	Office machines	0.0	3.4	2.2	6.0	1.8	0.1	13.5	100
76	Telecomm. And sound equipments	0.1	1.9	0.8	2.4	0.8	0.3	6.3	100
77	Electrical machines	0.1	5.7	2.9	6.9	2.1	0.2	18.0	100
	Semiconductor devices (SITC 776)	0.0	5.8	3.2	7.2	1.9	0.1	18.1	100
78	Road vehicles	0.6	0.3	0.2	0.6	1.2	0.2	3.1	100
79	Other transport equipment	0.2	0.9	0.3	4.3	1.0	0.1	6.9	100
	P&C export	0.3	3.0	1.5	4.3	1.5	0.2	10.9	100

Source: Compiled from UN Comtrade database.

Table 4: Direction of Machinery and Transport Equipment Trade : Total Trade

Reporter		East Asia	Dev. East Asia	ASEAN6	IND	PHL	MAL	SIN	THA	VIE	NAFTA	EU15	World
EXPORTS													
ASEAN 6	1993-4	45.0	34.8	23.0	1.3	1.0	6.0	12.0	2.9	1.0	29.2	18.9	100
	2003-4	52.7	43.0	20.2	1.3	1.7	4.9	8.6	3.2	1.4	20.4	17.9	100
Indonesia (IND)	1993-4	39.3	20.0	5.4	0.0	0.9	2.8	0.0	1.7	1.4	26.1	25.1	100
	2003-4	41.2	25.6	11.0	0.0	1.4	5.7	0.0	3.3	1.3	23.4	22.4	100
Philippines (PHL)	1993-4	28.8	17.7	11.3	0.3	0.0	2.4	6.0	2.6	0.6	52.1	16.3	100
	2003-4	61.4	48.3	18.7	0.2	0.0	7.4	8.0	2.9	1.0	20.4	14.2	100
Malaysia (MAL)	1993-4	50.2	42.8	34.8	0.9	0.4	0.0	30.7	2.8	0.3	30.2	15.2	100
	2003-4	56.1	48.7	27.0	0.8	1.4	0.0	20.5	4.0	0.8	22.1	13.8	100
Singapore (SIN)	1993-4	48.7	43.7	26.3	2.7	2.2	16.1	0.0	5.3	1.9	24.0	17.6	100
	2003-4	55.7	51.3	21.0	2.6	3.2	9.8	0.0	4.4	2.0	15.3	19.6	100
Thailand (THA)	1993-4	41.9	26.3	17.2	0.9	0.6	3.7	12.0	0.0	0.7	29.7	21.2	100
	2003-4	49.1	35.8	17.3	1.9	1.9	5.6	6.7	0.5	2.0	22.2	17.3	100
Vietnam (VIE)	1993-4	32.6	11.2	3.0	0.1	0.0	0.4	2.1	0.3	0.0	1.1	61.0	100
Vietnam	2003-4	26.6	12.0	5.1	0.3	0.7	0.9	1.2	2.0	0.0	22.5	43.5	100
IMPORTS													
ASEAN 6	1993-4	61.7	31.4	15.8	0.5	0.6	7.2	5.3	2.1	0.0	15.1	16.1	100
	2003-4	65.0	45.0	20.9	1.2	2.5	8.6	5.1	3.4	0.2	15.3	13.0	100
Indonesia (IND)	1993-4	54.5	24.6	6.8	0.0	0.1	1.5	4.3	0.8	0.0	11.9	25.8	100
	2003-4	62.4	41.1	18.9	0.0	0.4	3.7	9.2	5.5	0.2	8.7	17.0	100
Philippines (PHL)	1993-4	59.8	31.9	10.4	1.3	0.0	1.1	6.9	1.1	0.0	17.4	13.9	100
	2003-4	62.7	39.6	15.7	1.3	0.0	3.9	7.0	3.2	0.2	23.3	9.4	100
Malaysia (MAL)	1993-4	63.5	31.9	17.8	1.1	0.5	0.0	14.1	2.0	0.0	16.3	15.2	100
	2003-4	64.2	45.7	21.1	2.5	4.0	0.0	9.9	4.5	0.2	18.4	13.4	100
Singapore (SIN)	1993-4	64.4	37.4	21.9	0.0	0.8	17.1	0.0	4.0	0.0	16.2	13.5	100
	2003-4	63.8	49.6	25.3	0.0	3.0	18.4	0.0	3.7	0.1	16.1	13.7	100
Thailand (THA)	1993-4	59.9	24.0	9.5	0.8	0.7	2.9	5.2	0.0	0.0	13.1	16.4	100
	2003-4	68.5	38.2	16.7	1.8	2.0	6.5	5.5	0.5	0.4	9.8	11.9	100
Vietnam (VIE)	1993-4	62.9		28.7	5.4	1.2	2.8	15.8	3.6	0.0	2.1	16.1	100
Vietnam	2003-4	58.3		22.6	2.3	2.0	4.3	7.9	6.1	0.0	6.4	12.5	100
TOTAL TRADAE													
ASEAN 6	1993-4	54.9	32.8	18.7	0.8	0.8	6.7	8.0	2.4	0.4	20.8	17.2	100
	2003-4	58.7	44.0	20.5	1.2	2.1	6.7	6.9	3.3	0.8	17.9	15.5	100
Indonesia (IND)	1993-4	48.1	22.7	6.2	0.0	0.4	2.0	2.5	1.2	0.6	17.9	25.5	100
	2003-4	49.6	31.7	14.1	0.0	1.0	4.9	3.6	4.2	0.9	17.6	20.3	100
Philippines (PHL)	1993-4	45.9	25.5	10.8	0.8	0.0	1.7	6.5	1.8	0.3	33.0	15.0	100
	2003-4	62.0	44.3	17.3	0.7	0.0	5.8	7.6	3.1	0.6	21.7	12.0	100
Malaysia (MAL)	1993-4	57.2	37.1	25.9	1.0	0.5	0.0	22.0	2.4	0.2	22.9	15.2	100
	2003-4	59.6	47.4	24.4	1.5	2.5	0.0	15.9	4.2	0.5	20.5	13.6	100
Singapore (SIN)	1993-4	58.9	39.6	23.5	1.0	1.3	16.7	0.0	4.5	0.7	18.9	15.0	100
	2003-4	60.5	50.3	23.5	1.1	3.1	14.9	0.0	4.0	0.9	15.7	16.1	100
Thailand (THA)	1993-4	53.1	24.9	12.4	0.8	0.6	3.2	7.8	0.0	0.3	19.4	18.2	100
	2003-4	58.8	37.0	17.0	1.9	1.9	6.1	6.1	0.5	1.2	16.0	14.6	100
Vietnam (VIE)	1993-4	56.5		23.3	4.3	1.0	2.3	12.9	2.9	0.0	1.9	25.5	100
Vietnam	2003-4	45.7		15.6	1.5	1.5	2.9	5.2	4.5	0.0	12.8	24.8	100

Table 5: Direction of Machinery and Transport Equipment Trade : Parts and Components

Reporter		East Asia	Dev. East Asia	ASEAN6	IND	PHL	MAL	SIN	THA	VIE	NAFTA	EU15	World
EXPORTS													
ASEAN 6	1993-4	51.1	43.3	32.6	1.0	0.7	10.1	16.6	4.2	0.3	30.0	15.2	100
	2003-4	63.9	55.1	25.2	0.6	2.2	6.4	12.4	3.4	0.5	17.0	13.8	100
Indonesia (IND)	1993-4	39.2	19.6	12.9	0.0	0.8	9.6	0.0	2.5	0.2	27.1	26.2	100
	2003-4	58.5	39.5	22.1	0.0	1.5	13.5	0.0	6.2	1.1	18.3	15.0	100
Philippines (PHL)	1993-4	40.0	27.6	19.5	0.2	0.0	4.6	11.2	3.5	0.0	46.6	11.8	100
	2003-4	67.7	55.9	21.6	0.1	0.0	9.0	9.4	3.0	0.1	15.8	13.2	100
Malaysia (MAL)	1993-4	53.9	48.1	39.6	0.9	0.2	0.0	34.4	4.2	0.0	29.7	14.4	100
	2003-4	61.8	56.2	30.2	0.2	1.6	0.0	24.2	4.1	0.2	20.1	13.2	100
Singapore (SIN)	1993-4	48.2	43.4	28.7	1.3	1.3	20.2	0.0	5.8	0.6	29.4	16.7	100
	2003-4	61.6	56.4	20.0	0.7	4.1	11.6	0.0	3.3	1.0	15.1	16.8	100
Thailand (THA)	1993-4	61.6	44.7	38.2	0.7	0.5	8.2	28.9	0.0	0.5	21.5	13.4	100
	2003-4	68.1	53.3	27.3	2.0	2.8	8.8	12.4	1.0	1.0	14.9	11.0	100
Vietnam (VIE)	1993-4	81.4	74.9	30.4	0.2	0.1	3.1	26.1	0.9	0.0	0.1	16.1	100
	2003-4	87.7	38.5	30.3	0.4	12.5	1.8	2.4	13.1	0.0	4.0	5.3	100
IMPORTS													
ASEAN 6	1993-4	65.9	32.7	20.0	0.1	1.1	8.2	7.3	3.2	0.0	19.1	12.2	100
	2003-4	66.7	46.9	23.7	0.7	4.0	10.4	4.9	3.5	0.3	19.0	10.7	100
Indonesia	1993-4	62.4	16.1	6.9	0.0	0.1	2.1	4.0	0.7	0.0	12.0	21.6	100
	2003-4	73.5	31.5	17.1	0.0	0.8	2.3	5.6	8.3	0.1	8.5	12.3	100
Philippines	1993-4	61.4	21.8	8.3	0.1	0.0	0.7	6.6	0.8	0.0	23.3	13.4	100
	2003-4	60.2	35.4	14.8	0.3	0.0	3.9	7.2	2.6	0.8	29.6	8.2	100
Malaysia	1993-4	64.4	32.7	22.9	0.3	1.0	0.0	19.0	2.6	0.0	22.2	11.5	100
	2003-4	62.4	46.6	21.7	1.5	6.0	0.0	10.1	4.0	0.1	23.5	12.0	100
Singapore	1993-4	67.8	40.3	24.1	0.0	1.5	16.8	0.0	5.8	0.0	19.4	10.9	100
	2003-4	67.8	54.4	29.3	0.0	4.4	20.8	0.0	4.0	0.1	15.9	11.7	100
Thailand	1993-4	66.4	25.0	15.2	0.1	1.2	5.1	8.7	0.0	0.0	15.6	11.3	100
	2003-4	76.7	41.2	22.8	1.4	3.9	10.1	5.7	0.9	0.8	11.3	7.1	100
Vietnam	1993-4	52.4		32.2	0.4	0.3	1.2	22.9	7.4	0.0	1.9	35.1	100
	2003-4	52.1		26.4	1.8	0.8	4.0	12.9	6.9	0.0	4.5	18.9	100
TOTAL TRDAE													
ASEAN 6	1993-4	60.2	36.7	24.8	0.4	1.0	8.9	10.9	3.6	0.1	23.2	13.3	100
	2003-4	65.3	50.9	24.4	0.6	3.1	8.5	8.5	3.5	0.4	18.0	12.2	100
Indonesia	1993-4	60.0	16.4	7.5	0.0	0.2	2.9	3.6	0.8	0.0	13.5	22.1	100
	2003-4	65.9	35.5	19.6	0.0	1.2	8.0	2.8	7.2	0.6	13.4	13.6	100
Philippines	1993-4	50.0	24.9	14.3	0.2	0.0	2.8	9.1	2.2	0.0	35.7	12.6	100
	2003-4	64.5	47.0	18.6	0.2	0.0	6.8	8.5	2.8	0.4	21.8	11.0	100
Malaysia	1993-4	59.9	39.4	30.1	0.6	0.6	0.0	25.6	3.3	0.0	25.5	12.8	100
	2003-4	62.1	51.9	26.4	0.8	3.6	0.0	17.8	4.1	0.1	21.6	12.6	100
Singapore	1993-4	60.4	41.5	25.8	0.5	1.4	18.0	0.0	5.8	0.2	23.1	13.1	100
	2003-4	65.4	55.2	25.8	0.3	4.3	17.3	0.0	3.7	0.4	15.6	13.6	100
Thailand	1993-4	64.8	31.6	22.9	0.3	1.0	6.2	15.5	0.0	0.2	17.6	12.0	100
	2003-4	72.5	47.0	24.9	1.7	3.4	9.5	8.9	0.9	0.9	13.0	9.0	100
Vietnam	1993-4	53.7		32.1	0.4	0.3	1.3	23.0	7.1	0.0	1.8	34.3	100
	2003-4	63.1		27.6	1.4	4.4	3.3	9.7	8.8	0.0	4.3	14.7	100

Table 6: Direction of Machinery and Transport Equipment Trade : Final Goods

Reporter		East Asia	Dev. East Asia	ASEAN6	IND	PHL	MAL	SIN	THA	VIE	NAFTA	EU15	World
EXPORTS													
ASEAN 6	1993-4	41.4	29.8	17.5	1.4	1.2	3.5	9.3	2.1	1.4	28.7	21.0	100
	2003-4	41.5	30.9	15.2	2.0	1.2	3.4	4.8	2.9	2.2	23.9	22.1	100
Indonesia (IND)	1993-4	39.3	20.0	5.0	0.0	0.9	2.5	0.0	1.7	1.4	26.1	25.1	100
	2003-4	37.8	22.8	8.8	0.0	1.4	4.1	0.0	2.7	1.4	24.4	23.9	100
Philippines (PHL)	1993-4	19.5	9.6	4.5	0.4	0.0	0.5	1.7	1.8	1.0	56.6	20.0	100
	2003-4	39.7	21.9	8.7	0.4	0.0	1.6	3.3	2.9	4.0	36.3	17.6	100
Malaysia (MAL)	1993-4	47.7	39.2	31.4	0.9	0.5	0.0	28.2	1.8	0.5	30.6	15.8	100
	2003-4	47.8	37.5	22.3	1.7	1.1	0.0	15.0	3.9	1.7	25.2	14.8	100
Singapore (SIN)	1993-4	49.2	44.0	23.8	4.2	3.2	11.5	0.0	4.8	3.4	18.2	18.6	100
	2003-4	48.6	45.1	22.1	4.9	2.1	7.7	0.0	5.9	3.2	15.4	22.9	100
Thailand (THA)	1993-4	34.2	19.1	9.0	1.0	0.6	2.0	5.4	0.0	0.8	33.0	24.3	100
	2003-4	38.3	25.7	11.6	1.9	1.3	3.7	3.4	0.2	2.5	26.4	20.9	100
Vietnam (VIE)	1993-4	31.7	10.0	2.4	0.1	0.0	0.3	1.7	0.3	0.0	1.1	61.8	100
	2003-4	18.7	8.6	1.9	0.3	-0.9	0.8	1.1	0.6	0.0	24.8	48.4	100
IMPORTS													
ASEAN 6	1993-4	58.8	30.6	12.8	0.8	0.2	6.6	3.9	1.4	0.0	12.3	18.8	100
	2003-4	62.9	42.8	17.4	1.7	0.6	6.3	5.4	3.2	0.1	10.8	15.8	100
Indonesia (IND)	1993-4	51.6	27.8	6.7	0.0	0.1	1.2	4.4	0.9	0.0	11.9	27.4	100
	2003-4	58.8	44.2	19.5	0.0	0.2	4.1	10.4	4.5	0.2	8.7	18.6	100
Philippines (PHL)	1993-4	59.1	36.6	11.5	1.8	0.0	1.3	7.1	1.3	0.0	14.6	14.1	100
	2003-4	68.2	49.1	17.8	3.4	0.0	3.9	6.5	4.8	-0.9	9.1	12.1	100
Malaysia (MAL)	1993-4	62.6	31.1	12.9	1.9	0.1	0.0	9.4	1.5	0.0	10.7	18.7	100
	2003-4	67.5	44.0	20.1	4.1	0.5	0.0	9.7	5.3	0.3	9.6	15.9	100
Singapore (SIN)	1993-4	61.4	34.9	20.0	0.0	0.2	17.3	0.0	2.4	0.1	13.3	15.8	100
	2003-4	57.3	41.7	18.7	0.0	0.7	14.5	0.0	3.2	0.3	16.3	17.1	100
Thailand (THA)	1993-4	56.5	23.5	6.6	1.1	0.4	1.7	3.4	0.0	0.0	11.8	19.0	100
	2003-4	63.1	36.3	12.8	2.0	0.7	4.2	5.4	0.2	0.2	8.7	15.0	100
Vietnam (VIE)	1993-4	64.1		28.3	6.0	1.3	2.9	14.9	3.2	0.0	2.2	13.8	100
	2003-4	59.5		21.8	2.4	2.3	4.3	6.8	6.0	0.0	6.8	11.1	100
TOTAL TRADE													
ASEAN 6	1993-4	51.4	30.2	14.8	1.0	0.6	5.3	6.2	1.7	0.6	19.2	19.7	100
	2003-4	51.4	36.4	16.2	1.9	0.9	4.8	5.1	3.1	1.2	17.8	19.1	100
Indonesia (IND)	1993-4	45.6	24.0	5.9	0.0	0.5	1.8	2.2	1.3	0.7	18.8	26.2	100
	2003-4	45.6	30.8	12.8	0.0	0.9	4.1	3.9	3.4	0.9	18.6	21.9	100
Philippines (PHL)	1993-4	43.4	25.9	8.7	1.3	0.0	1.0	4.9	1.5	0.4	31.2	16.5	100
	2003-4	55.1	36.6	13.6	2.0	0.0	2.9	5.1	3.9	1.3	21.6	14.6	100
Malaysia (MAL)	1993-4	55.0	35.2	22.4	1.4	0.3	0.0	19.0	1.7	0.3	20.9	17.2	100
	2003-4	55.8	40.2	21.4	2.7	0.8	0.0	12.9	4.5	1.2	18.9	15.2	100
Singapore (SIN)	1993-4	57.4	37.9	21.2	1.4	1.2	15.4	0.0	3.2	1.1	14.9	16.7	100
	2003-4	53.4	43.2	20.2	2.2	1.3	11.4	0.0	4.4	1.6	15.9	19.7	100
Thailand (THA)	1993-4	47.7	21.8	7.6	1.0	0.5	1.8	4.2	0.0	0.3	20.2	21.1	100
	2003-4	50.4	30.9	12.2	2.0	1.0	4.0	4.4	0.2	1.4	17.7	18.0	100
Vietnam (VIE)	1993-4	56.8		22.5	4.6	1.0	2.3	12.0	2.5	0.0	1.9	24.7	100
	2003-4	42.7		13.6	1.5	1.0	2.9	4.5	3.7	0.0	14.2	26.5	100

Note: --- Not applicable.

Source**:** Complied from *UN Comtrade* Database.

Table 7: Direction of China's Manufacturing Trade (%)

	Exports		Imports	
	1993-94	2003-4	1993-94	2003-4
(A) TOTAL TRADE				
East Asia	48.8	45.5	53.6	61.0
Japan	11.3	11.5	30.0	23.1
Developing East Asia	37.5	34.0	23.6	38.0
HK	26.8	20.6	7.5	3.1
Korea	1.5	3.3	3.0	9.6
Taiwan	2.6	2.5	11.5	12.7
ASEAN	6.6	7.6	1.6	12.6
Indonesia	1.3	0.9	0.0	0.5
Malaysia	1.0	2.1	0.3	4.5
Philippines	0.4	0.7	0.0	2.7
Singapore	2.6	2.9	1.1	2.8
Thailand	1.2	1.1	0.2	2.1
Vietnam	0.4	0.4	0.0	0.0
Rest of the world	51.2	54.5	46.4	39.0
World	100.0	100.0	100.0	100.0
(B) PARTS AND COMPONENTS				
East Asia	60.8	62.7	67.7	68.5
Japan	17.1	12.4	34.4	22.5
Developing East Asia	43.7	50.3	33.3	46.0
HK	29.3	29.5	14.0	4.0
Korea	3.0	4.6	5.0	10.3
Taiwan	3.9	3.8	11.5	15.0
ASEAN	7.5	12.4	2.8	16.7
Indonesia	1.5	0.9	0.0	0.5
Malaysia	1.6	4.4	0.5	6.9
Philippines	0.4	1.0	0.1	3.9
Singapore	3.1	4.4	2.1	3.0
Thailand	0.8	1.7	0.2	2.4
Vietnam	0.3	0.4	0.0	0.0
Rest of the world	39.2	37.3	32.3	31.5
World	100.0	100.0	100.0	100.0
(C) FINAL GOODS				
East Asia	43.6	36.1	47.8	49.6
Japan	8.8	11.1	28.1	23.9
Developing East Asia	34.8	25.0	19.7	25.7
HK	25.7	15.6	4.9	1.6
Korea	0.9	2.6	2.2	8.6
Taiwan	2.1	1.8	11.6	9.3
ASEAN	6.2	4.9	1.0	6.2
Indonesia	1.3	0.9	0.1	0.7
Malaysia	0.8	0.8	0.2	0.7
Philippines	0.4	0.4	0.0	0.8
Singapore	2.4	2.0	0.6	2.5
Thailand	1.3	0.8	0.1	1.6
Vietnam	0.5	0.4	0.0	0.1
Rest of the world	56.4	63.9	52.2	50.4
World	100.0	100.0	100.0	100.0

Notes: …. Zero or negligible. Source**:** Complied from *UN Comtrade* Database.

Table 8: Regression Results of the Determinants of Bilateral Trade Flows in Machinery and Transport Equipment Sector (SITC 7)

	Parts and Components		**Final goods**	
Model	[1]		[2]	
Estimation Method	**Random Effect**		**Random Effect**	
Explanatory variables	Coefficient	S.E.	Coefficient	S.E.
Log GDP, importer	0.98	[0.02]***	0.81	[0.03]***
Log GDP, exporter	1.56	[0.04]***	1.48	[0.03]***
Log per capita GDP, importer	0.07	[0.02]**	-0.05	[0.04]
Log per capita GDP, exporter	0.34	[0.05]***	0.32	[0.04]***
Log absolute per capita GDP differences	-0.02	[0.03]	-0.04	[0.03]
Log relative labour cost	0.25	[0.03]***	0.30	[0.04]***
Log distance	-0.77	[0.07]***	-0.73	[0.03]***
Common language dummy	0.47	[0.06]**	0.39	[0.15]**
Common land border dummy	0.26	[0.17]*	0.08	[0.15]
Regional dummies				
RTA	0.64	[0.07]***	0.57	[0.08]***
AFTA	4.05	[0.13]***	2.37	[0.23]***
Constant	-41.90	[1.84]***	-39.69	[1.59]***
Number of Observations	10422		10422	
R^2 Overall	0.69		0.69	
Within	0.38		0.39	
Between	0.77		0.69	
Wald Test Statistics Chi2 (20)	7159		7071	

Note:
The standard errors (SEs) of the regression coefficients have been derived using the Huber-While consistent variance-covariance ('sandwich') estimator. Statistical significant (based on the standard t-test) is denoted as ***1%, **5%, and *10%.

Country groups/Regional Trading Arrangements (RTAs) Covered in the Gravity Model :

ASEAN Free Trade Agreement (AFTA): Indonesia, Philippines, Malaysia, Singapore, Thailand

Closer Economic Relation Agreement (CER): Australia, New Zealand

European Union (EU): Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Italy, Netherlands, Luxemburg, Greece Portugal,, Spain, Sweden, UK

North American Free Trade Agreement (NAFTA): USA, Canada, Mexico

The Common market of the South (MERCOSUR): Argentina, Brazil, Paraguay, Uruguay

ANDEAN Pact: Bolivia, Colombia, Ecuador, Venezuela

Figure1: ASEAN Share in World Component Trade

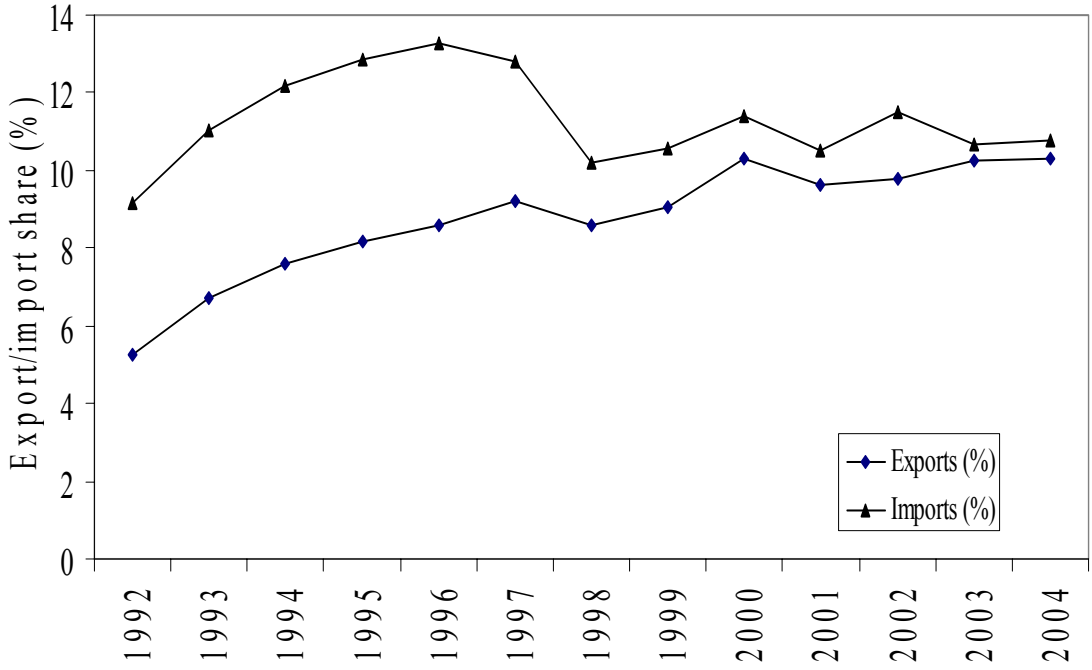
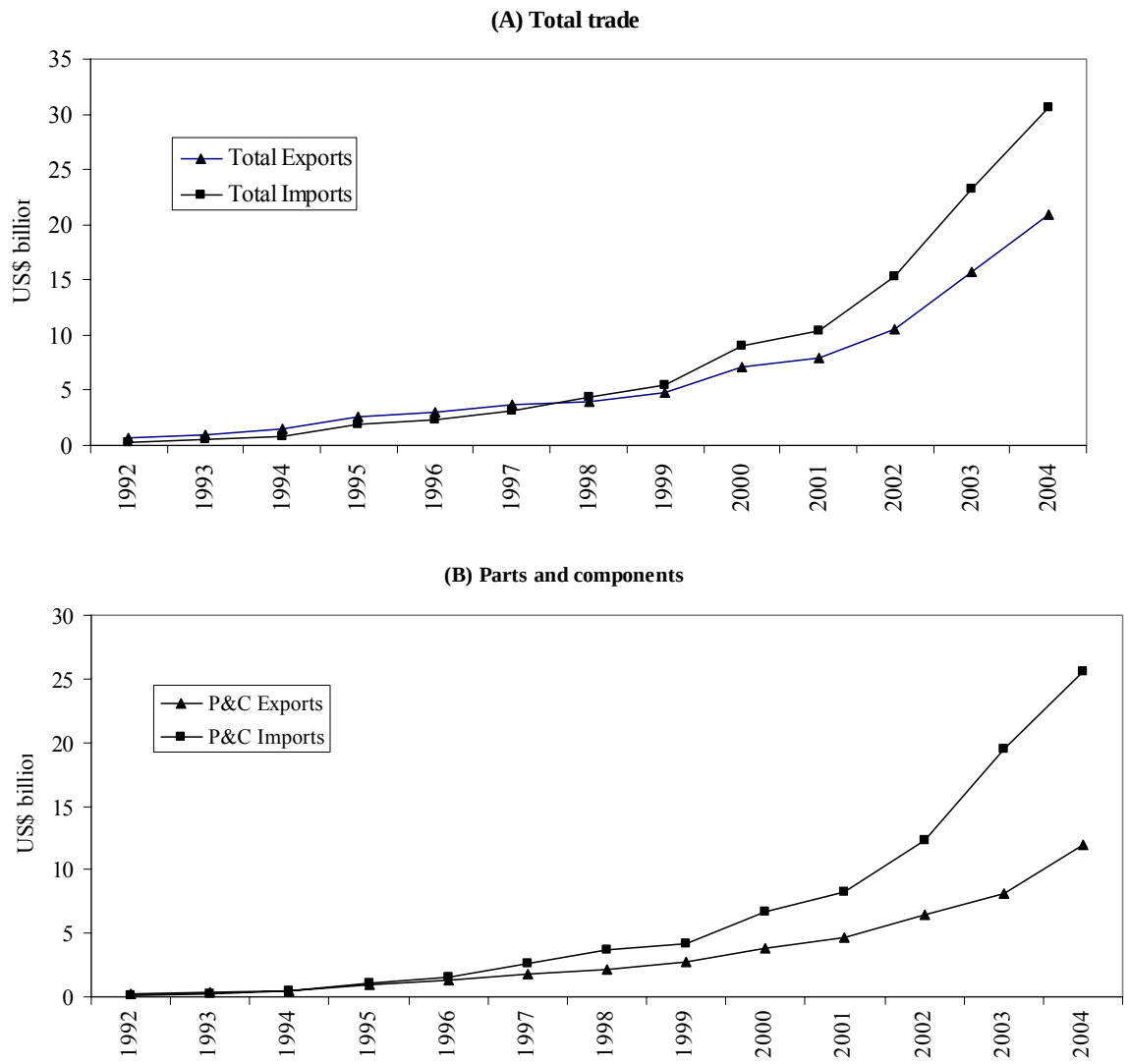


Figure 2: China's Trade in machinery and Transport Equipment with ASEAN Countries (US$ billion)



(c) Final goods