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The Effect of Exchange Rate Changes on Trade in East Asia[1]

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Abstract

East Asia is characterized by intricate production and distribution networks. Higher skilled workers in Japan, South Korea, and Taiwan produce sophisticated technology-intensive intermediate goods and capital goods and ship them to China and ASEAN for assembly by lower skilled workers and reshipment throughout the world. These networks have promoted economic efficiency and functioned as an engine of growth. They have also been accompanied by large trade imbalances with the U.S. that could cause Asian currencies to appreciate against the dollar. This in turn would alter relative exchange rates in Asia, given the variety of exchange rate regimes in the region. This paper investigates how such exchange rate changes would affect trade within Asia and between Asia and the U.S. The results indicate that exchange rate changes can cause significant declines in exports of intermediate and capital goods from developed Asia to developing Asia. This evidence implies that exchange rate appreciations in developed Asia relative to developing Asia would disrupt the complimentary relationship that exists between these countries in the trade of sophisticated technology-intensive goods. The results also indicate that exchange rate elasticities for trade between Asia and the U.S. are not large enough to lend confidence that a depreciation of the dollar would improve the U.S. trade balance with Asia. This evidence implies that policymakers in the U.S. should not expect too much from an appreciation of Asian currencies and should focus instead on shortfalls of saving relative to investment if they are concerned about their trade imbalances.

1. Introduction

East Asia is characterized by intricate production and distribution relationships that are part of a global triangular trading network. Higher skilled workers in Japan, Korea, and Taiwan produce sophisticated technology-intensive intermediate goods and capital goods and ship them to China and ASEAN for assembly by lower skilled workers and reshipment to the rest of the world. These production and distribution networks have promoted economic efficiency and helped to make Asia the manufacturing center of the world.

This international slicing up of the value-added chain has been accompanied by large trade imbalances with the U.S. The U.S. trade deficit with East Asia equaled $300 billion in 2004 and $350 billion in 2005. More than half of this deficit was recorded as being with China (see Table 1). If exports were measured on a value-added basis rather than on a gross basis, however, the deficit with China would have been far less and the deficit with the rest of Asia far more.[1]

Many have predicted that these imbalances will put pressure on Asian currencies to appreciate against the dollar (see, e.g., IMF, 2005a). Since East Asia has a variety of exchange rate regimes, pressure on Asian currencies to appreciate against the dollar would affect individual currencies differently. Countries with greater flexibility would experience larger appreciations. This in turn would alter relative exchange rates in the region. How would such exchange rate changes affect triangular trading patterns within East Asia and trade imbalances between Asia and the U.S.?

[1] Chinese value added in processed exports is about 20 percent compared with the cost of intermediate goods imported from the rest of Asia.

Concerning the first question several researchers have noted that import price elasticities in Asia should be different for imported inputs and for final goods. The IMF (2005b) stated that imports for processing will have much lower exchange rate elasticities than imports for domestic consumption. Kamada and Takagawa (2005) argued that, since an exchange rate depreciation increases exports and thus the demand for imported intermediate goods, a depreciation could actually increase imported inputs.

Previous attempts to estimate the effects of exchange rate changes on triangular trading patterns have yielded mixed results. Kamada and Takagawa (2005), controlling for imported inputs by including current and future exports in regressions using quarterly data from 1990 to 2003, found that in most cases the price elasticity of imports for East Asian countries was not statistically significant. Ahearne *et al.* (2003), using a vector autoregression and annual data from 1981 to 2001, found that income growth in importing countries was a much more significant determinant of exports from East Asia than exchange rate changes. Bénassy-Quéré and Lahrèche-Révil (2003), using panel data techniques and annual data from 1984 to 2001, reported that a 10% real appreciation in one East Asian country (other than Japan) reduced total exports to other East Asian countries by 8%.

This paper builds on the model of Bénassy-Quéré and Lahrèche-Révil (2003) by disaggregating exports into intermediate goods, capital goods, and consumption goods. Disaggregating by stages of production should shed light on how exchange rate changes affect trade within Asia, given the importance of fragmented production blocks in the region. The results indicate that changes in bilateral real exchange rates cause significant declines in exports of intermediate and capital goods from developed Asia to developing Asia.[2]

These findings indicate that current exchange rate arrangements would interfere with the complimentary relationship that exists between developed and developing Asia if market forces exerted pressure on Asian currencies to appreciate. There are currently a variety of exchange rate systems in Asia. Japan has essentially a free floating regime; Korea employs a lightly managed system; Indonesia and Thailand use heavily managed floats; and China has a fixed exchange rate regime. Under the current system, if global imbalances triggered appreciations in the region, currencies in developed Asia would appreciate relative to currencies in developing Asia. This would harm firms in Japan, South Korea, and Taiwan by causing large drops in intermediate and capital goods exports to the rest of Asia. In addition, this would harm firms in developing Asia since it is difficult for them to procure vital imported inputs elsewhere. This problem could be mitigated if countries with less flexible exchange rate regimes adopted more flexible regimes.

In addition to investigating the effects of exchange rate changes on trade within Asia, this paper also considers how exchange rate changes affect Asian trade imbalances with the U.S. Chinn (2005a, 2005b), in a series of valuable studies, used cointegration techniques to investigate the relationship between the overall U.S. current account deficit, the multilateral real exchange rate, and real income. He reported that price elasticities for U.S. exports are precisely estimated at between 0.68 and 0.84 and that price elasticities for U.S. imports are not statistically significant unless computers and oil are excluded. If

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[2] Developed Asia is made up of Japan, South Korea, and Taiwan and developing Asia is made up of China, Indonesia, Malaysia, and Thailand.

they are, price elasticities for the remaining 85% of imports are statistically significant and range from 0.29 to 0.49. The sum of the export and import price elasticities just barely exceeds one (1.15 using the midpoints), implying that the Marshall-Lerner conditions for a depreciation to improve the trade balance is just barely met. As Chinn noted, when one takes account of the fact that the trade balance is already in deficit, these results imply that a depreciation may result in a deterioration rather than an improvement of the trade account.

Kenen (2005) stressed the need to estimate disaggregated price elasticities for U.S. trade with Asia. He argued that aggregate price elasticity estimates may be badly biased by changes in the country and commodity composition of U.S. trade. He also said that even though some Asian currencies may be undervalued, it is still necessary to estimate disaggregated price elasticities for Asian countries to determine how an appreciation of Asian currencies against the dollar would affect the U.S. trade imbalance with the region.

This paper takes up Kenen's task. The evidence indicates that a depreciation of the dollar will not improve the U.S. trade balance with Japan, South Korea, and Taiwan and may not improve the U.S. trade balance with China. Results using Johansen maximum likelihood techniques indicate that, although there are cointegrating relationships between the variables of interest, long run price elasticities are too small to satisfy the Marshall-Lerner condition. These findings are reinforced by evidence from dynamic OLS regressions. Results using a gravity model further indicate that price elasticities are too small for a dollar depreciation to reduce U.S. trade imbalances.

These findings indicate that policy makers in the U.S. should not rely on an appreciation of Asian currencies to help correct America's trade imbalances. Rather, they should focus on the shortfall of domestic saving relative to investment.

The next Section presents an analytical description of the global triangular trading patterns. Section 3 tests for the effects of exchange rate changes on triangular trading patterns in Asia. Sections 4 through 6 present evidence concerning how exchange rate changes will affect trade imbalances between the U.S and East Asia. Section 7 draws conclusions.

2. Global Triangular Trading Patterns

Triangular trading patterns, as defined by METI (2005) and Gaulier, Lemoine, and Nal-Kesenci (2005), involve Japan, South Korea, and Taiwan exporting sophisticated intermediate goods and capital goods to China and ASEAN for processing and re-export to the United States and Europe.

Table 2, updated and expanded from Gaulier, Lemoine, and Nal-Kesenci (2005), shows China's role in this triangular trading structure. The data are taken from China's Customs Statistics, which distinguish between imports and exports that are part of processing trade and ordinary imports and exports. Imports for processing are goods that are brought into China for processing and subsequent re-export and processed exports are goods that are produced in this way. Ordinary imports are goods that are intended for the domestic market and ordinary exports are goods that are produced using local inputs.

Table 2 shows that in 2004 40% of China's imports were for processing. Of this 40%, seven-tenths came from other East Asian countries. By contrast, less than onetwentieth came from the U.S. and only one-tenth came from the EU. It is worth noting that China imports almost as many goods for processing from ASEAN countries as from the U.S. and Europe combined. This partly reflects the influence of MNCs located in ASEAN that export sophisticated technology-intensive parts and components to China.

Table 2 also shows that in 2004 55% of China's exports were processed exports. Of this 55% one fifth went to Europe, one-fifth went to Hong Kong (largely as entrepôt trade), one quarter went to the U.S., and another one quarter went to East Asia (excluding Hong Kong).

Table 2 thus suggests that the definition of triangular trade given above should be modified. Triangular trading patterns actually involve Japan, South Korea, Taiwan, *and MNCs located in ASEAN* exporting sophisticated intermediate goods and capital goods to China and ASEAN countries for processing and re-export to the United States, Europe, *and East Asia* (i.e., all over the world).

Because of this triangular trading structure China runs large trade surpluses with the U.S. and Europe. It also runs large trade deficits with East Asia. Its surplus with the U.S. and Europe in 2004 equaled $122 billion and its deficit with East Asia (excluding Hong Kong) equaled $130 billion

The majority of China's processed exports come from FDI enterprises. Such trade-FDI linkages have established production-distribution networks in East Asia that are based on vertical intra-industry trade (VIIT).

This VIIT differs both from the exchange of final goods emphasized by traditional trade theory for vertical inter-industry trade between the North and the South (e.g., between capital goods and apparel) and for horizontal intra-industry trade between the

North and the North (between two differentiated types of automobiles). As Fukao *et al.* (2002) discuss, the production processes of an industry (e.g., the electronics industry) has been split into fragmented production blocks that can be located in different countries and the new VIIT is driven by differences in factor endowments in the fragmented production blocks between developing, emerging, and developed economies in the region. VIIT has led to large efficiency gains and helped make the East Asian region the manufacturing center of the world.

Figures 1 through 5 present Asian exports disaggregated by stages of production. Figures 1 through 3 show exports from Japan, the NIEs (South Korea and Taiwan), and ASEAN (Indonesia, Malaysia, and Thailand) to East Asia. For Japan and the NIEs, 60% of total exports to other East Asian countries are intermediate goods or capital goods. For ASEAN, 40% of total exports to the rest of East Asia are intermediate goods or capital goods. Figure 4 and 5 show exports from China and ASEAN throughout the world. For China, more than 60% of all exports are final goods exports and for ASEAN 40% of all exports are final goods exports.

3. Estimating the Effects of Exchange Rates on Triangular Trading Patterns

3.1 Data and Methodology

To estimate the effect of exchange rate changes on triangular trading patterns in Asia a gravity model is used. Gravity models posit that bilateral trade between two countries is directly proportional to GDP in the two countries and inversely proportional to the distance between them. In addition to GDP and distance these models typically include other factors affecting bilateral trade such as whether trading partners share a common language or a common border. Leamer and Levinsohn (1995, p. 1384) stated that gravity models yield "some of the clearest and most robust findings in economics."[3]

Bénassy-Quéré and Lahrèche-Révil (2003) have estimated an imaginative gravity model using panel data techniques for total exports from East Asian countries to other East Asian countries and to the rest of the world. Their model includes variables measuring how exports are affected by changes in the level and volatility of exchange rates and by changes in the exporting country's competitiveness relative to other East Asian countries.

In this paper Bénassy-Quéré and Lahrèche-Révil's model is modified by disaggregating exports into intermediate goods, capital goods, and final goods. To do this the Chelem data base constructed by the Centre D'Etudes Prospectives et D'Information Internationale (CEPII) is used. Chelem disaggregates international trade into stages of production. These data are harmonized to reconcile discrepancies between exports reported by a country and imports of the same goods reported by its trading partner.

The baseline model estimated here has the form:

$$\ln Ex_{ijt} = \beta_0 + \beta_1 \ln Y_{it} + \beta_2 \ln Y_{jt} + \beta_3 \ln DIST_{ij} + \beta_4 Asia*\ln RER_{ijt} + \beta_5(1 - ASIA)*\ln RER_{ijt} + \beta_6 *VOL_{ijt} + \beta_7(1 - ASIA)*\ln RERC_{ijt} + \beta_8 LANG + \partial_i + \Omega_j + \pi_t + \varepsilon_{ijt} \quad (1)$$

where Ex_{ijt} represents real exports from East Asian country i to country j (either in East Asia or in the rest of the world), t represents time, Y represents real GDP, DIST represents the geodesic distance between the two countries, ASIA is a dummy variable

[3] Quoted in Rose (2000).

equaling 1 if the country is in East Asia and 0 otherwise, RER_{ijt} is the bilateral real exchange rate between country i and country j, VOL represents exchange rate volatility (the annual coefficient of variation calculated using quarterly data), $RERC_{ijt}$ is the bilateral real exchange rate between the Asian exporting country i and the non-Asian importing country j divided by the trade-weighted real exchange between all other East Asian countries and country j, LANG is a dummy variables equaling 1 if the countries share a common language and 0 otherwise, and ∂i , Ωj , and π_t are country i, country j, and time fixed effects.[4] East Asia includes China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. Non-East Asian countries include the OECD countries[5] and Argentina, Brazil, Mexico, and India.

To investigate how exchange rate changes affect global triangular trading patterns two variants of equation (1) are estimated. The first focuses on exports of intermediate goods and capital goods from Japan, South Korea, Taiwan, and ASEAN to the rest of Asia. The second focuses on the exports of final goods (capital and consumption goods) from developing Asia throughout the world.

For exports of intermediate goods and capital goods from Japan the yen/dollar rate is included as an explanatory variable. This is because Japanese firms may respond to an appreciation of the yen relative to the dollar not only by reducing exports to the U.S. but also by shifting the assembly of final goods to developing Asia for subsequent re-export to the U.S. McKinnon and Schnabl (2003) noted that the yen/dollar rate tends to fluctuate exogenously and that Japanese FDI to East Asia increases when the yen

[4] Because of multicollinearity problems the common border dummy variable was dropped.
[5] The OECD countries used are Australia, Austria, Belgium-Luxembourg, Canada, Germany, Denmark, Spain, Finland, France, the United Kingdom, Greece, Ireland, Italy, the Netherlands, New Zealand, Portugal, Sweden, and the United States.

appreciates relative to the dollar and decreases when the yen depreciates relative to the dollar. Matsunaga (2006) showed that increases in Japanese FDI to a country are associated with increases in Japanese intermediate goods exports to that country. Thus an appreciation of the yen relative to the dollar may cause Japanese firms to transfer more of the labor-intensive portion of the production process to developing Asian countries where labor costs are lower.

For similar reasons appreciations of the South Korean won and the Taiwanese dollar against the U.S. dollar may cause South Korean and Taiwanese firms to transfer more of the labor-intensive portion of the production process to developing Asian. Thus the won/dollar and Taiwan dollar/U.S. dollar exchange rates are included as explanatory variables for South Korea's and Taiwan's exports of intermediate goods and capital goods to developing Asia.[6]

When the dependent variable is final goods exports from China and ASEAN, exchange rate elasticities are estimated for non-Asian importing countries and Asian importing countries aggregated together. This is done because Table 2 shows that large quantities of processed exports went to both non-Asian countries and to Asian countries. The results (available on request) are similar if exchange rate elasticities are estimated separately for exports to non-Asian countries and to Asian countries.

Data on exports disaggregated into intermediate goods, capital goods, and finished goods (i.e., consumption plus capital goods), real income, and the real exchange rate are obtained from the CEPII-CHELEM data base. Export and import data are measured in current dollars and deflated by the U.S. CPI. Real GDP is measured in

[6] The variable RERC measuring one Asian country's competitiveness relative to other Asian countries in non-Asian markets is not included in the regressions with intermediate goods and capital goods since the focus here is on trade within Asia rather than on competitiveness relative to the rest of the world.

millions of PPP dollars. The real exchange rate is calculated using PPP standards and represents the bilateral real exchange rate between the exporting and importing countries measured in levels. The relative competitiveness of one East Asian country relative to the others ($RERC_{ijt}$) is calculated as the bilateral real exchange rate of Asian exporting country i with non-Asian importing country j divided by the trade-weighted real exchange rate of all other East Asian countries with country j. The export, import, exchange rate, income, and relative competitiveness variables are measured in natural logs.

Data on distance and common language are obtained from www.cepii.fr. Distance is measured in kilometers and represents the geodesic distance between economic centers. Common language is a dummy variable equaling 1 if two countries share a common language and 0 otherwise.

The gravity model is estimated as a panel using annual data for the 30 countries over the 1982-2003 sample period. Fixed effects are included for the exporting and importing countries and for time. The maximum possible number of observations is 5742.

3.2 Results

Table 3 presents results from estimating equation (1) with total exports as the dependent variable. The model performs well. All of the variables are of the theoretically expected sign and almost all are statistically significant. The results indicate that a 10% appreciation of the bilateral exchange rate on average reduces exports within East Asia by 6.8% and to the rest of the world by 4.5%. In addition, a 10% loss of competitiveness by one East Asian country on average reduces exports from that country to the rest of the world by 7.4%. The elasticities reported by Bénassy-Quéré and Lahrèche-Révil (2003) were similar to those reported here, although their specification differed slightly.[7] Their elasticity for intra-Asian exports was 0.795 compared with a value of 0.68 reported in Table 3, their elasticity for exports to the rest of the world was 0.551 compared with a value of 0.45 reported in Table 3, and their coefficient measuring competitiveness was 0.805 compared with a value of 0.74 reported in Table 2.[8]

Tables 4 and 5 present results for Japanese exports of intermediate and capital goods to the rest of Asia. For intermediate goods a 10% appreciation of the yen relative the currency of the Asian importing country causes exports to that country to decrease by 9%. For capital goods a 10% appreciation of the yen relative the currency of the Asian importing country causes exports to that country to decrease by 16%. In addition, a 10% appreciation of the yen relative to the dollar causes intermediate goods exports to developing Asia (China, Indonesia, Malaysia, and Thailand) to increase by 3.6%

Tables 6 and 7 present results for South Korean and Taiwanese exports of intermediate and capital good to the rest of Asia. For intermediate goods a 10% appreciation of the won or the Taiwanese dollar relative to the currency of the Asian importing country causes exports to that country to decrease by 4.1%. For capital goods a 10% appreciation of the won or the Taiwanese dollar relative the currency of the Asian importing country causes exports to that country to decrease by 13.6%. In addition, a 10% appreciation of the won or the Taiwanese dollar relative to the U.S. dollar causes

[7] For instance, their sample period was from 1984-2001 while the sample period employed here was from 1982-2003. They also excluded Japan from East Asia in their estimation while Japan was included in East Asia in the estimation reported here.

[8] Note that an increase in the exchange rate here corresponds to an appreciation of the currency while an increase in the exchange rate in Bénassy-Quéré and Lahrèche-Révil (2003) corresponds to a depreciation of the currency. Thus a negative exchange rate elasticity in Tables 2-12 corresponds to a positive exchange rate elasticity in Bénassy-Quéré and Lahrèche-Révil's Tables.

intermediate goods exports to developing Asia to increase by 10.2% and capital goods exports to developing Asia to increase by 17.9%.

Tables 8 and 9 present results for exports of intermediate and capital goods from ASEAN (Indonesia, Malaysia, and Thailand) to the rest of Asia. For intermediate goods a 10% appreciation of an ASEAN country's currency relative the currency of the Asian importing country causes exports to that country to decrease by 13.8%. For capital goods a 10% appreciation of an ASEAN country's currency relative to the currency of the Asian importing country causes exports to that country to decrease by 25.4%.

The important implication of these results is that capital goods exports and to some extent intermediate goods exports within Asia are very sensitive to bilateral exchange rate changes. Since there is essentially a complimentary relationship between developed East Asian countries (and MNCs located in ASEAN) on the one hand and developing Asia on the other hand in sophisticated intermediate and capital goods trade, these results imply that exchange rate appreciations in developed Asia relative to developing Asia would reduce intra-regional gains from trade.

Tables 10 and 11 present results for exports of final goods from China and ASEAN. For China a 10% appreciation reduces exports by 12.9% and for ASEAN a 10% appreciation reduces exports by 14.2%. In addition, for China an appreciation of the RMB relative to other East Asian currencies will not reduce exports outside of East Asia while for individual ASEAN countries a 10% appreciation of the exchange rate relative to other East Asian countries will reduce exports to non-East Asian countries by 18%.

The important implication of these results is that labor-intensive final goods exports from developing Asia are also sensitive to exchange rate changes. An appreciation in developing Asia would thus result in a large drop in exports. In addition, for ASEAN countries, a loss of competitiveness relative to other Asian countries could trigger a large drop in exports.

These results have different implications for different countries in the region. Both developed and developing countries would benefit if the yen, won, and NT dollar did not appreciate relative to the currencies of developed Asia, since this would maintain the flow of sophisticated inputs in the region. ASEAN countries would benefit if their currencies did not unilaterally appreciate against other Asian currencies, since unilateral appreciations could cause a large drop in exports to non-Asian countries. China may benefit the most if the RMB appreciated unilaterally against other Asian countries, since it would then be able to purchase more imported inputs from developed Asia but unlike ASEAN countries not suffer a large drop in exports due to a loss of competitiveness. The loss in exports that it did experience could perhaps be compensated for by the lower import prices for intermediate and capital goods.

The next Section turns to evidence concerning how exchange rate changes would affect trade imbalances between the U.S. and Asia.

4. Evidence from Johansen Maximum Likelihood Estimation Concerning the Effect of Exchange Rate Changes on Trade between the U.S. and East Asia

4.1 Data and Methodology

To measure exchange rate elasticities between the U.S. and Asian countries, we begin by specifying import and export functions. Import and export functions in the Bickerdike-Robinson-Metzler imperfect substitutes framework can be represented as:

$im_t = \alpha_{10} + \alpha_{11}rer_t + \alpha_{12}y_t + \varepsilon_{1t}$ (2)

$ex_t = \alpha_{20} + \alpha_{21}rer_t + \alpha_{22}y_t^* + \varepsilon_{2t}$ (3)

where im_t represents real imports, rer_t represents the real exchange rate, y_t represents domestic real income, ex_t represents real exports, y_t* represents foreign real income, and all variables are measured in natural logs.

To test for long run cointegrating relations among the variables and to estimate the cointegrating vector, equation (2) can be written in vector error correction form as:

$\Delta im_t = \beta_{10} + \varphi_1(im_{t-1} - \alpha_{10} - \alpha_{11}rer_{t-1} - \alpha_{12}y_{t-1}) + \beta_{11}(L)\Delta im_{t-1} + \beta_{12}(L)\Delta\, rer_{t-1} + \beta_{13}(L)\Delta y_{t-1} + \nu_{1t}$
(4a)

$\Delta rer_t = \beta_{20} + \varphi_2(im_{t-1} - \alpha_{10} - \alpha_{11}rer_{t-1} - \alpha_{12}y_{t-1}) + \beta_{21}(L)\Delta im_{t-1} + \beta_{22}(L)\Delta\, rer_{t-1} + \beta_{23}(L)\Delta y_{t-1} + \nu_{2t}$
(4b)

$\Delta y_t = \beta_{30} + \varphi_3(im_{t-1} - \alpha_{10} - \alpha_{11}rer_{t-1} - \alpha_{12}y_{t-1}) + \beta_{31}(L)\Delta im_{t-1} + \beta_{32}(L)\Delta\, rer_{t-1} + B_{33}(L)\Delta y_{t-1} + \nu_{3t}$
(4c)

where the φ's are the error correction coefficients, the L's represent polynomials in the lag operator, and the other variables are defined above. Similarly equation (3) can be

written as:

$\Delta ex_t = \beta_{40} + \varphi_4(ex_{t-1} - \alpha_{20} - \alpha_{21}rer_{t-1} - \alpha_{22}y_{t-1}^*) + \beta_{41}(L)\Delta ex_{t-1} + \beta_{42}(L)\Delta\, rer_{t-1}$

$+ \beta_{43} (L)\Delta y_{t-1}^* + \nu_{4t}$
(5a)

$\Delta rer_t = \beta_{50} + \varphi_5(ex_{t-1} - \alpha_{20} - \alpha_{21} rer_{t-1} - \alpha_{22} y_{t-1}^*) + \beta_{51}(L)\Delta ex_{t-1} + \beta_{52}(L)\Delta rer_{t-1} + \beta_{53}(L)\Delta y_{t-1}^* + \nu_{5t}$
(5b)

$\Delta y_t^* = \beta_{60} + \varphi_6(ex_{t-1} - \alpha_{20} - \alpha_{21} rer_{t-1} - \alpha_{22} y_{t-1}^*) + \beta_{61}(L)\Delta ex_{t-1} + \beta_{62}(L)\Delta rer_{t-1} + \beta_{63}(L)\Delta y_{t-1}^* + \nu_{6t}$
(5c)

There are several parameters of interest in equations (4) and (5). The coefficients α_{11} and α_{21} measure long run price elasticities of imports and exports. The coefficients φ_1 and φ_4 measure how fast imports and exports respond to disequilibria. Assuming that imports and exports move towards their equilibrium values these coefficients should be negative and statistically significant. The parameters φ_2 and φ_5 can be used to test whether the exchange rate is weakly exogenous.

Exchange rate changes affect exports and imports by changing the relative prices of domestic and foreign tradable goods. For expenditure switching to take place, exchange rate changes must be passed through into import prices and changes in import prices (relative to domestic prices) must affect spending. Chinn (2005b) and others have argued that exchange rates are more volatile than other macroeconomic variables and disconnected from the real economy. Thus, exchange rate changes are likely to be exogenous relative to changes in relative prices and conditioning on the exchange rate in equations (2) and (3) is appropriate.

The hypothesis that the exchange rate is weakly exogenous is equivalent to the hypothesis that the coefficients φ_2 and φ_5 equal zero. Similarly, the hypothesis that income is weakly exogenous is equivalent to the hypothesis that the coefficients φ_3 and

φ_6 equal zero. If the right hand side variables in equations (2) and (3) are exogenous, then it is possible to infer the effects of exogenous changes in there variables on imports and exports.

Before estimating (4) and (5), augmented Dickey-Fuller tests are used to test whether each series is integrated of order one. The Akaike information criterion is then employed to determine how many lags to use in the vector autoregressions and whether to include time trends in the cointegrating equations. The trace statistic and the maximum eigenvalue statistic are employed to test the null of no cointegrating relations against the alternative of one cointegrating relation.

Data on real income, the consumer price index, and the nominal exchange rate are obtained from *International Financial Statistics* (IFS) and (for Taiwan) from the National Statistics and Central Bank of China websites. Bilateral real exchange rates are calculated as the product of the nominal foreign currency price of dollars and the ratio of the U.S. to the foreign price levels. An increase in rer thus represents an appreciation of the dollar. Data on bilateral imports and exports are obtained from the Japanese Customs Bureau and the U.S. Census Bureau websites.[9] Import and export data are deflated by the consumer price index.[10]

The focus here is on U.S. trade with Japan, Taiwan, South Korea, and China. In 2004 and 2005, 90% of the U.S. trade deficit with East Asia was with these four countries. These countries are also the four largest holders of foreign exchange reserves in the world.

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[9] There was a large drop in Chinese exports in 1987:2 followed by a large rebound in 1987:3 that was not associated with changes in income or the rer. It is not clear whether this large swing was due to measurement error or some exogenous factor. A dummy variable was used to control for it.

[10] The websites for these data are: www.imf.org, http://eng.stat.gov.tw, www.cbc.gov.tw, www.census.gov, and www.customs.go.jp. In every case the sample period for the estimation was the longest possible given the data sets used.

Much interest centers on how an appreciation of these countries' currencies relative to the dollar would affect the U.S. trade balance.

In the estimation Taiwan and Korea are aggregated together since in the case of Taiwan alone the null of a unit root in the autoregressive lag operator polynomial is rejected and in the case of Korea alone the null of no cointegration is not rejected. Given that Taiwan and Korea are both Northeast Asian newly industrialized economies (NIEs) at similar levels of development, their responses to exchange rate changes should be similar and thus aggregating them together should be appropriate.

4.2 Results

Table 12 presents the exchange rate, income, and error correction coefficients from equations (4) and (5). Turning first to U.S. imports from Japan the results are favorable. Both the trace and the maximum eigenvalue tests indicate at the five percent level that there is a long run cointegrating relation between the variables. The error correction coefficients for the real exchange rate and real income are not statistically significant, implying that these variables are weakly exogenous. The error correction coefficient for imports is negative and statistically significant, implying that imports move towards their equilibrium value. The elasticity estimates are of the expected sign and statistically significant. The parameter values indicate that a 1 percent appreciation of the yen relative to the dollar would decrease U.S. imports from Japan by 0.38 percent and that a 1 percent increase in income would increase U.S. imports from Japan by 2.94 percent.

Turning next to U.S. imports from the NIEs the results are also favorable. Both the trace and the maximum eigenvalue tests indicate at the five percent level that there is a long run cointegrating relation between the variables. Again the error correction coefficients for the real exchange rate and real income are not statistically significant while the error correction coefficient for imports is negative and statistically significant. The elasticity estimates are of the expected sign and statistically significant. The parameter values imply that a 1 percent appreciation of the won and NT dollar relative to the U.S. dollar would decrease U.S. imports from the NIEs by 0.56 percent and that a 1 increase in income would increase U.S. imports from the NIEs by 0.60 percent.

For U.S. imports from China there is an ambiguity in the estimates. The Akaike Information Criterion selects a specification with a linear time trend, but it hardly changes when a trend is excluded. In addition the Schwarz Criterion selects a specification without a trend. Table 12 reports results for both specifications. In both cases the trace and the maximum eigenvalue tests indicate at the five percent level that there are long run cointegrating relations between the variables. The elasticity coefficients are of the expected sign and statistically significant except for the coefficient on U.S. income when a trend term is included. U.S. income is highly collinear with the trend term, since U.S. income has increased steadily over the sample period. If a time trend is excluded, the coefficient on income becomes 3.86 with a t-statistic exceeding 18. When the trend term is included the parameter values imply that a 1 percent appreciation of the RMB relative to the dollar would decrease U.S. imports from China by 0.84 percent. When the trend is excluded the parameter values indicate that a 1 percent appreciation of the RMB relative to the dollar would decrease U.S. imports from China by 1.51 percent.

The bottom panel of Table 12 reports results for U.S. exports to Asia. Turning first to U.S. exports to Japan, the null of no cointegration is rejected at the 6 percent level according to the trace statistic and at the 8 percent level according to the maximum eigenvalue statistic. Thus U.S. exports to Japan are borderline cointegrated with these variables. The error correction coefficients for the real exchange rate and real income are not statistically significant while the error correction coefficient for exports is negative and statistically significant. The coefficient on the real exchange rate is of the expected sign and statistically significant. The parameter value implies that a 1 percent appreciation of the yen relative to the dollar would increase U.S. exports to Japan by 0.74 percent.

In the case of U.S. exports to the NIEs there is no evidence of a long run cointegrating relation between the variables. Thus we cannot rely on the estimated price and income elasticities. Inference may be clouded by the impact of the Asian Crisis on imports into the NIEs. Attempts to incorporate a structural break for the Crisis period, however, failed to yield evidence of cointegration.

For U.S. exports to China, both the trace and the maximum eigenvalue tests indicate the presence of one cointegrating vector. However, the coefficient on the real exchange rate is not only statistically insignificant but also of the wrong sign.

The next Section employs dynamic ordinary least squares to test for the robustness of the results reported here.

5. Evidence from Dynamic Ordinary Least Squares Regressions Concerning the Effect of Exchange Rate Changes on Trade between the U.S. and East Asia

5.1 Data and Methodology

An alternative way of estimating the long run parameters in equations (2) and (3) is to use dynamic ordinary least squares (DOLS) estimation. Stock and Watson (1993) show that, provided there is a single cointegrating vector, one can regress the left hand side variable on a constant, the right hand side variables, and leads and lags of their first differences. The resulting estimator is asymptotically equivalent to the Johansen estimator. Its small sample performance, however, compares favorably with that of the Johansen estimator. In addition, the presence of lags and leads of the right hand side variables corrects for endogeneity problems. DOLS thus provides a useful means of checking the robustness of the results obtained using the Johansen procedure.

The estimated equations have the form:

$$im_t = \alpha_{10} + \alpha_{11} rer_t + \alpha_{12} y_t + \sum_{k=-K}^{K} \beta_k \Delta rer_{t+k} + \sum_{k=-K}^{K} \phi_k \Delta y_{t+k} + \varepsilon_{1t} \tag{6}$$

$$ex_t = \alpha_{20} + \alpha_{21} rer_t + \alpha_{12} y_t * + \sum_{k=-K}^{K} \delta_k \Delta rer_{t+k} + \sum_{k=-K}^{K} \varphi_k \Delta y_{t+k} * + \varepsilon_{2t} \tag{7}$$

where K represents the number of leads and lags and the other variables are defined above.

5.2 Results

Table 13 presents the exchange rate and income coefficients from equations (6) and (7). The DOLS results for imports into the U.S. from East Asia corroborate the findings from the Johansen approach reported in Table 12. For imports from Japan the exchange rate and income coefficients are always statistically significant regardless of the number of leads and lags of the first differenced variables. The exchange rate coefficient varies from 0.30 to 0.35 and the income coefficient varies from 2.73 to 3.14. For imports from the NIEs the exchange rate coefficients becomes statistically significant as the number of lags and leads increases and then varies between 0.34 and 0.64. The income coefficients are always statistically significant and vary between 0.46 and 0.78. For imports from China when a trend term is included the exchange rate elasticity is statistically significant and converges to values between 0.86 and 0.95 as the lag length increases. The income elasticity is of the wrong sign. As discussed above, U.S. income is highly collinear with the trend term and when the trend is excluded the income coefficient takes on the predicted sign and becomes highly significant. The exchange rate coefficient in this case varies between 1.36 and 2.03 and the income coefficient between 3.86 and 4.12.

For exports from the U.S. to East Asia, exchange rate changes do not have much explanatory power. For exports to Japan and China, the exchange rate coefficient is of the wrong sign (though not statistically significant) in nine of the ten cases. For exports to the NIEs, although the coefficients are of the right sign we cannot rely on these estimates since there is no evidence of a long run cointegrating relationship among the variables.

The next Section uses the gravity model to obtain one final measure of exchange rate elasticities for trade between the U.S. and Asia.

6. Evidence from Gravity Models Concerning the Effect of Exchange Rate Changes on Trade between the U.S. and East Asia

6.1 Data and Methodology

The gravity model presented in Section 3 can also be used to measure exchange rate elasticities for trade between the U.S. and East Asia. In this case, rather than estimating exchange rate elasticities separately for trade within East Asia and for trade between East Asia and the rest of the world, elasticities can be estimated separately for trade between East Asia and the U.S. and for trade between East Asia and all other countries. The estimated equations then take the form:

$$\ln Ex_{ijt} = \beta_{10} + \beta_{11}\ln Y_{it} + \beta_{12}\ln Y_{jt} + \beta_{13}\ln DIST_{ij} + \beta_{14}USASIA*\ln RER_{ijt} + \beta_{15}(1 - USASIA)*\ln RER_{ijt} + \beta_{16}*VOL_{ijt} + \beta_{17}LANG + \partial_i + \Omega_j + \pi_t + \varepsilon_{ijt} \qquad (8)$$

$$\ln Im_{ijt} = \beta_{20} + \beta_{21}\ln Y_{it} + \beta_{22}\ln Y_{jt} + \beta_{23}\ln DIST_{ij} + \beta_{24}USASIA*\ln RER_{ijt} + \beta_{25}(1 - USASIA)*\ln RER_{ijt} + \beta_{26}*VOL_{ijt} + \beta_{27}LANG + \partial_i + \Omega_j + \pi_t + \varepsilon_{ijt} \qquad (9)$$

where USASIA is a dummy variable equaling 1 for trade between the U.S. and ASIA and 0 otherwise, Im represents imports, and the other variables are defined above. In the results reported below, USASIA is taken to represent trade between the U.S. and China, Japan, and the NIEs.[11] The results are similar though if the estimation is done for trade between the U.S. and all 9 East Asian countries together or if it is done separately for trade between the U.S. and Japan, China, and South Korea and Taiwan.

[11] Since the focus in this Section is on the effect of exchange rate changes on Asian countries together the variable rerc measuring the relative competitiveness of one East Asian country relative to the others is not included.

6.2 Results

Tables 14 and 15 report the results from estimating equations (8) and (9). The focus in these Tables is on U.S. trade with China, Japan, and the NIEs. Table 14 shows that the exchange rate elasticity for exports from the four countries to the U.S. equals -0.84. Thus a 10% depreciation of the dollar would decrease exports from China, Japan, South Korea, and Taiwan to the U.S. by 8.4%.

Table 15 shows that the exchange rate elasticity for imports into the four countries from the U.S. is basically 0 (i.e., -0.06 with a t-statistic of -0.31). This confirms the results reported in Tables 12 and 13 indicating that imports into East Asia from the U.S. are not sensitive to the exchange rate.

To put these numbers and the numbers reported in the previous Sections into perspective it is helpful to employ the Marshall-Lerner Condition. The Marshall-Lerner condition states that a depreciation of the dollar will improve the U.S. trade balance if the sum of (the absolute values of) the demand elasticities for exports and imports exceeds one.

Given the finding that U.S. exports to Asia are not sensitive to the exchange rate, the key parameter is the price elasticity of imports into the U.S. The results indicate that for Japan and the NIEs these elasticities are small and will not meet the Marshall-Lerner condition.[12]

In addition, the evidence in Tables 4-8 indicate that Japan and the NIEs respond to a depreciation of the dollar not only by decreasing exports directly to the U.S. but also by exporting more intermediate and capital goods to developing Asia. Some of these inputs are then used to produce labor-intensive final goods for re-export to the U.S. These findings imply that, if exports were measured correctly on a value-added basis rather than incorrectly on a gross basis, the exchange rate elasticities for exports from Japan, South Korea, and Taiwan to the U.S. would be even smaller than those reported in the Tables.

For China, the results are less clear cut. Using the preferred specification (with a trend), the parameter values in Tables 12 and 13 are too small to meet the Marshall-Lerner condition. This is also true for the coefficients reported in Tables 14 and 15. However, if a trend is included in the cointegrating vector, then the exchange rate elasticities in Tables 12 and 13 are large enough to imply that a depreciation of the dollar will improve the U.S. trade balance with China. Thus in the case of China the data do not provide a conclusive answer to the question of how a depreciation of the dollar would affect the trade balance.

[12] For U.S. imports from Japan in Table 12 the elasticity equals 0.38 and for U.S. exports to Japan the elasticity equals -0.74. Although the sum of these exceeds one, in the case imports exceed exports it is necessary to use the General Marshall-Lerner condition (see Appleyard and Field, 2003). This states that a depreciation of the dollar will improve the trade balance if:

$$Z < \alpha_{21} + Z\,\alpha_{11}$$

where Z is the ratio of imports to exports, α_{21} is the price elasticity of exports, and α_{11} is the price elasticity of imports. According to the Japanese Customs Bureau, imports to the U.S. from Japan over the last two years have exceeded exports from the U.S. to Japan by a ratio of 2.03 to 1. Thus Z equals 2.03. The right hand side of the equation then equals 1.51, far below the left hand side value of 2.03. Thus the General Marshall-Lerner condition is not met.

7. Conclusion

East Asia is characterized by intricate production and distribution networks that allow fragmented production blocks to be allocated across countries based on comparative advantage. These networks have promoted economic efficiency and acted as an engine of growth. They have also been accompanied by large trade imbalances with the U.S.

These trade imbalances could cause Asian currencies to appreciate against the dollar. Since East Asia has a variety of exchange rate regimes, pressure on East Asian currencies to appreciate would affect individual currencies differently. Countries with greater flexibility would experience larger appreciations. This, in turn, would alter relative exchange rates in the region.

This paper has investigated how such exchange rate changes would affect exports of intermediate, capital, and final goods in East Asia. The results indicate that changes in bilateral real exchange rates cause significant declines in exports of intermediate and capital goods from developed Asia to developing Asia and in exports of final goods from developing Asia to the rest of the world. Further, appreciations in Indonesia, Malaysia, and Thailand relative to the rest of the region would cause large additional declines in exports (although appreciations in China relative to the rest of Asia would not affect exports).

These findings indicate that current exchange rate arrangements would interfere with the complimentary relationship that exists between developed and developing Asia if market forces exerted pressure on Asian currencies to appreciate. Under the current system, if global imbalances triggered appreciations in the region, currencies in developed Asia (which tend to have flexible regimes) would appreciate relative to currencies in developing Asia (which tend to have less flexible regimes). This would harm firms in Japan, South Korea, and Taiwan by causing large drops in intermediate and capital goods exports to the rest of Asia. This would also harm firms in developing Asia since it is difficult for them to procure these vital inputs elsewhere.

This problem would be mitigated countries in the region with heavily managed or fixed exchange rate regimes adopted more flexible regimes. Such regimes could be characterized by a multiple currency basket-based reference rate instead of a dollar-based central rate and a wider band around the reference rate. If individual countries adopted greater flexibility in this way, a dollar depreciation due to the large U.S. trade imbalances would tend to produce appreciations throughout the region and thus help keep exchange rates between developed and developing Asia relatively stable.

This paper has also investigated how exchange rate changes affect trade between Asian countries and the U.S. The results indicate that an appreciation of Asian currencies relative to the dollar will not reduce the U.S. trade deficit with Japan, South Korea, and Taiwan.

For China, the results are less clear cut. Using the preferred specification the parameter values are too small to meet the Marshall-Lerner condition. However, using other specifications the estimated coefficients are large enough to meet the Marshall-Lerner condition. Thus the data do not provide a clear answer concerning whether a depreciation of the dollar would improve the U.S. trade balance with China.

Overall the results in this paper indicate that policymakers in the United States should not to expect too much from an appreciation in Asia. Most of the estimated exchange rate elasticities for trade between the U.S. and Asia are small.

Chinn's (2005a, 2005b) estimated exchange rate elasticities for trade between the U.S. and the rest of the world, though larger than those reported here for U.S./Asia trade, are also small Thus if U.S. policymakers want to reduce global trade imbalances, expenditure-reducing policies will probably be necessary.

There is a risk that trade imbalances between the U.S. and Asia could cause a large depreciation of the dollar. East Asian policymakers could prepare for this by adopting more flexible exchange rate regimes. This would help maintain stable exchange rates in the region, providing a steady backdrop for the regional production and distribution networks. U.S. policymakers for their part should not expect a dollar depreciation to correct America's current account deficit. Rather, if they believe that the trade imbalances are unsustainable, they should focus on reducing the shortfall of U.S. saving relative to investment.

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Table 1.
U.S. Global Trade Balance and Bilateral Trade Balance with East Asia in 2005

Country/Region	Exports from the US	Imports to the US	Trade balance
Japan	55	138	-83
China	42	244	-202
Crisis-hit Economies			
Indonesia	3	12	-9
Malaysia	11	34	-23
Philippines	7	9	-2
South Korea	28	44	-16
Thailand	7	20	-13
Non-crisis Economies			
Hong Kong	16	9	7
Singapore	21	15	6
Taiwan	22	35	-13
Total of East Asia Including Japan	**212**	**560**	**-348**
U.S. Total with the Rest of the World	**904**	**1671**	**-767**

Source: US Census Bureau(2005)

Note: For comparison, exports from the U.S. to Europe equaled $186 billion, imports to the U.S. from Europe equaled $309 billion, and the trade balance equaled $-122 billion.

Table 2.

China's Processing Trade – 1993 and 2004

Imports (%)								
	World	S. Korea & Taiwan	Japan	ASEAN 5	Hong Kong	United States	EU15	Rest of World
1993								
Total Imports	100	18	22	6	10	10	15	19
Normal Imports	37	2	8	3	1	5	8	9
Imports for Processing	35	11	8	2	7	2	2	3
Others	28	5	7	1	2	3	6	5
2004								
Total Imports	100	23	17	11	2	8	12	28
Normal Imports	44	6	6	4	1	4	8	15
Imports for Processing	40	14	7	5	1	2	4	7
Others	16	3	4	2	0	2	1	5

Exports (%)								
	World	S. Korea & Taiwan	Japan	ASEAN 5	Hong Kong	United States	EU15	Rest of World
1993								
Total Exports	100	5	17	5	24	18	13	18
Normal Exports	47	2	10	4	10	6	7	9
Processed Exports	48	2	7	1	14	13	7	4
Others	5	0	0	0	0	0	0	5
2004								
Total Exports	100	7	12	6	17	21	17	19
Normal Exports	41	3	5	3	4	6	7	13
Processed Exports	55	4	7	3	12	14	10	5
Others	4	0	0	0	1	1	0	2

Table 2 (continued).

China's Processing Trade – 1993 and 2004

Balance of Trade (billions of US Dollars)								
1993	World	S. Korea &Taiwan	Japan	ASEAN 5	Hong Kong	United States	EU15	Rest of World
Balance of trade	-12.2	-14.0	-7.5	-1.3	11.60	6.3	-3.5	-3.8
Normal trade	5.2	0.3	0.7	-0.1	7.7	0	-2	-1.5
Processing trade	7.9	-9.5	-1.3	-0.6	5.7	9.7	4.2	-0.3
Others	-25.2	-4.9	-6.9	-0.6	-1.7	-3.4	-5.8	-1.9
2004								
Balance of trade	32	-85.6	-20.8	-22.9	89.1	80.3	31.8	-39.9
Normal trade	45.9	-14.7	-5.7	-2.9	19.9	13.7	-2	37.6
Processing trade	106.3	-54.9	3.3	-11.7	64.3	72.7	37.5	-5.0
Others	-69.7	-16.0	-18.4	-8.3	4.9	-6.2	-3.7	-21.9

Notes: Source: Gaulier, Lemoine, and Nal-Kesenci (2005), China's Customs Statistics, and calculations by the author.

Table 3.
Determinants of Total Exports from East Asian Countries

Explanatory Variables								
Bilateral RER (for exports to other East Asian countries	Bilateral RER (for exports to countries in the ROW)	Competitiveness[1] relative to the rest of Asia	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-0.68*** (-5.37)	-0.45*** (-4.25)	-0.74*** (-4.79)	0.33*** (3.58)	0.03 (1.65)	-0.55*** (-5.79)	-0.73*** (-3.81)	0.37*** (2.88)	1.58 (1.04)

Number of Observations	5721
Adjusted R-squared	0.864
S.E of regression	0.702
Hausman Test	284.7
Prob(Hausman Test)	0.000000
F-statistics	551.6
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.
[1] Competitiveness relative to the rest of East Asia is measured as the bilateral real exchange rate between the Asian exporting country i and the non-Asian importing country j divided by the trade-weighted real exchange between all other East Asian countries and country j.

Table 4.
Determinants of Intermediate Goods Exports from Japan

Explanatory Variables

For Japanese Exports			For Exports from all East Asian Countries[1]					
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Yen/Dollar RER (for exports to Developing Asian countries)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-0.90***	-0.31	0.36**	0.29**	-0.04**	-0.55***	-0.38	0.44***	0.60
(-4.09)	(-1.14)	(2.08)	(2.31)	(-2.09)	(-5.67)	(-1.91)	(3.35)	(0.33)

Number of Observations	5587
Adjusted R-squared	0.858
S.E of regression	0.829
Hausman Test	471.3
Prob(Hausman Test)	0.000000
F-statistics	511.4
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. Developing Asia is defined as China, Indonesia, Malaysia, and Thailand. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, Japan's RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other 8 East Asian countries. Similarly, Japan's RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.
[1]The exchange rate coefficient for exports from East Asian countries other than Japan was -0.96 with a t-statistic of -8.41.

Table 5.
Determinants of Capital Goods Exports from Japan

Explanatory Variables								
For Japanese Exports			For Exports from all East Asian Countries[1]					
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Yen/Dollar RER (for exports to Developing Asian countries)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-1.60***	-1.53***	0.04	0.45**	0.01	-0.64***	0.13	0.38***	-1.12
(-6.33)	(-6.27)	(0.19)	(2.82)	(0.37)	(-7.49)	(0.83)	(2.80)	(-0.54)

Number of Observations	5587
Adjusted R-squared	0.827
S.E of regression	1.04
Hausman Test	929.7
Prob(Hausman Test)	0.000000
F-statistics	392.4
Prob(F-statistic)	0.000000

Notes: Developing Asia is defined as China, Indonesia, Malaysia, and Thailand. East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, Japan's RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other 8 East Asian countries. Similarly, Japan's RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.
[1]The exchange rate coefficient for exports from East Asian countries other than Japan was -1.93 with a t-statistic of 13.38.

Table 6.
Determinants of Intermediate Goods Exports from the NIEs (South Korea and Taiwan)

Explanatory Variables								
For NIE Exports			For Exports from all East Asian Countries[1]					
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Won/U.S.$ and NT$/US$ RER (for exports to Developing Asian countries)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-0.41**	-0.45***	1.02***	0.29**	-0.04**	-0.53***	-0.38	0.45***	0.40
(-2.10)	(-2.48)	(3.02)	(2.41)	(-2.05)	(-5.30)	(-1.84)	(3.36)	(0.22)

Number of Observations	5677
Adjusted R-squared	0.859
S.E of regression	0.826
Hausman Test	511.8
Prob(Hausman Test)	0.000000
F-statistics	515.25
Prob(F-statistic)	0.000000

Notes: Developing Asia is defined as China, Indonesia, Malaysia, and Thailand. East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, the NIE's RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other East Asian countries. Similarly, the NIE's RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.
[1]The exchange rate coefficient for exports from East Asian countries other than the NIEs was 1.00 with a t-statistic of -8.89.

Table 7.
Determinants of Capital Goods Exports from the NIEs (South Korea and Taiwan)

Explanatory Variables									
For NIE Exports			For Exports from all East Asian Countries[1]						
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Won/U.S.$ and NT$/US$ RER (for exports to Developing Asian countries)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-1.36***	-1.44***	1.79***	0.44***	0.00	-0.60***	0.148	0.39***	-1.28
(5.60)	(-6.57)	(3.31)	(2.95)	(0.25)	(-7.04)	(0.90)	(2.77)	(-0.66)

Number of Observations	5587
Adjusted R-squared	0.829
S.E of regression	1.033
Hausman Test	1001.6
Prob(Hausman Test)	0.000000
F-statistics	399.02
Prob(F-statistic)	0.000000

Notes: Developing Asia is defined as China, Indonesia, Malaysia, and Thailand. East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, the NIE's RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other East Asian countries. Similarly, the NIE's RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses.

*** (**) denotes significance at the 1% (5%) level.

[1]The exchange rate coefficient for exports from East Asian countries other than the NIEs was -2.01 with a t-statistic of -14.35.

Table 8.
Determinants of Intermediate Goods Exports from ASEAN (Indonesia, Malaysia, and Thailand)

Explanatory Variables								
For ASEAN Exports		For Exports from all East Asian Countries[1]						
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-1.38***	-1.23**	0.29**	-0.04**	-0.54***	-0.45**	0.42***	0.29
(-7.06)	(-7.31)	(2.39)	(-2.05)	(-5.97)	(-2.24)	(3.24)	(0.17)

Number of Observations	5677
Adjusted R-squared	0.859
S.E of regression	0.823
Hausman Test	470.2
Prob(Hausman Test)	0.000000
F-statistics	526.7
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, ASEAN countries' RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other East Asian countries. Similarly, ASEAN countries' RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses. *** (**) denotes significance at the 1% (5%) level.

[1]The exchange rate coefficient for exports from East Asian countries other than the ASEAN countries was -0.72 with a t-statistic of -6.53.

Table 9.
Determinants of Capital Goods Exports from ASEAN (Indonesia, Malaysia, and Thailand)

Explanatory Variables							
For ASEAN Exports		For Exports from all East Asian Countries[1]					
Bilateral RER (for exports to other East Asian countries)	Bilateral RER (for exports to countries in the ROW)	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-2.54***	-1.86**	0.42**	0.01	-0.63***	0.12	0.42***	-0.88
(-11.85)	(-10.81)	(2.76)	(0.32)	(-8.43)	(0.75)	(3.33)	(-0.44)

Number of Observations	5587
Adjusted R-squared	0.826
S.E of regression	1.023
Hausman Test	1022.3
Prob(Hausman Test)	0.000000
F-statistics	403.49
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, ASEAN countries' RER elasticity for exports to East Asia represents the average of the RER elasticities for exports to each of the other East Asian countries. Similarly, ASEAN countries' RER elasticity for exports to the ROW represents the average of the RER elasticities for exports to each of the 21 non-East Asian countries. White (1980) standard errors are employed. T-statistics are in parentheses. *** (**) denotes significance at the 1% (5%) level.

[1]The exchange rate coefficient for exports from East Asian countries other than the ASEAN countries was -1.83 with a t-statistic of -12.23.

Table 10.
Determinants of Final Goods Exports from China

Explanatory Variables							
For China's Exports		For Exports from all East Asian Countries[1]					
Bilateral RER for exports to countries in East Asia and the ROW	China's[2] competitiveness relative to the rest of Asia	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-1.29***	-0.45	0.47**	0.01	-0.66***	-0.26	0.36***	0.68
(-6.20)	(-0.83)	(3.55)	(0.02)	(-7.23)	(-1.40)	(2.61)	(0.38)

Number of Observations	5695
Adjusted R-squared	0.859
S.E of regression	0.800
Hausman Test	511.7
Prob(Hausman Test)	0.000000
F-statistics	520.32
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, China's RER elasticity for exports to East Asia and the rest of the world represents the average of the RER elasticities for exports to each of the other 29 countries. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.

[1]The exchange rate coefficient for exports from East Asian countries other than the China was -1.21 with a t-statistic of -9.42. The coefficient for relative competitiveness for East Asian countries other than China was -0.85 with a t-statistic of -5.61.

[2] Competitiveness relative to the rest of East Asia is measured as the bilateral real exchange rate between China and the non-Asian importing country j divided by the trade-weighted real exchange between all other East Asian countries and country j.

Table 11.
Determinants of Final Goods Exports from ASEAN

Explanatory Variables							
For ASEAN's Exports		For Exports from all East Asian Countries[1]					
Bilateral RER For exports to countries in East Asia and the ROW	ASEAN's[2] competitiveness relative to the rest of Asia	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-1.42***	-1.80**	0.47**	0.00	-0.67***	-0.37**	0.34***	1.04
(-8.79)	(-5.22)	(3.57)	(0.00)	(-8.86)	(-2.10)	(2.56)	(0.60)

Number of Observations	5695
Adjusted R-squared	0.863
S.E of regression	0.785
Hausman Test	572.7
Prob(Hausman Test)	0.000000
F-statistics	537.56
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. Because the data are pooled, ASEAN countries' RER elasticity for exports to East Asia and the rest of the world represents the average of the RER elasticities for exports to each of the other countries. White (1980) standard errors are employed. T-statistics are in parentheses.

*** (**) denotes significance at the 1% (5%) level.

[1]The exchange rate coefficient for exports from East Asian countries other than the ASEAN was -0.96 with a t-statistic of -7.76. The coefficient for relative competitiveness for East Asian countries other than China was -0.95 with a t-statistic of -6.75.

[2]Competitiveness relative to the rest of East Asia is measured as the bilateral real exchange rate between the ASEAN exporting country and the non-Asian importing country j divided by the trade-weighted real exchange between all other East Asian countries and country j.

Table 12.
Johansen MLE estimates for U.S. trade with East Asia[1]

	RER Elasticity	Income Elasticity	Error Correction Coefficients: Export or Import	RER	Income
U.S. Imports					
From Japan	0.38***	2.94***	-1.11***	-0.08	-0.001
	(9.85)	(12.02)	(-7.61)	(-0.42)	(-0.06)
	Lags: 1, Sample: 88:1-05:3, No dummies, Trend included				
From the NIEs	0.56***	0.60***	-0.34***	0.03	-0.007
	(3.65)	(4.66)	(-6.11)	(0.73)	(-1.23)
	Lags: 4, Sample: 85:1-04:4, No dummies or trend				
From China	0.84***	0.01	-0.27***	0.12**	0.007**
	(3.24)	(0.01)	(-5.83)	(2.45)	(1.49)
	Lags: 1, Sample: 87:1-04:4, Centered seasonal dummies for first, second, and third quarters included, Trend Included				
From China	1.51***	3.86***	-0.19***	0.10**	0.008**
	(6.04)	(18.78)	(-4.72)	(2.81)	(2.30)
	Lags: 1, Sample: 87:1-04:4, Centered seasonal dummies for first, second, and third quarters included, No trend				
U.S. Exports					
To Japan	-0.74***	0.19	-0.17***	-0.03	-0.004
	(-2.40)	(0.40)	(-4.10)	(-0.70)	(-0.65)
	Lags: 1, Sample: 88:1-05:3, No dummies or trend				
To the NIEs	-0.50**	0.63***	-0.23***	0.12***	-0.006
	(-2.08)	(5.70)	(-2.77)	(2.79)	(-0.28)
	Lags: 4, Sample: 85:1-04:4, No dummies or trend				
To China	0.57	0.22	0.00	0.00	-0.07***
	(0.47)	(0.66)	(0.00)	(0.05)	(-11.25)
	Lags: 3, Sample: 91:1-04:4, No dummies, Trend included				

[1]The NIEs are defined as South Korea and Taiwan.
T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.

Table 13.
Dynamic OLS estimates for U.S. trade with East Asia[1]

	Number of Lags and Leads	RER Elasticity	Income Elasticity
U.S. Imports			
From Japan (Sample: 88:1-2005:3, Trend Included)	1	0.35***	2.98***
		(6.46)	(8.93)
	2	0.34***	2.87***
		(4.79)	(7.28)
	3	0.32***	3.03***
		(3.69)	(5.95)
	4	0.30***	3.14***
		(2.75)	(4.66)
	5	0.35**	2.73**
		(2.30)	(2.46)
From the NIEs (Sample: 88:1-2004:4, Trend Included)	1	0.15	0.78***
		(1.31)	(7.25)
	2	0.23	0.73***
		(1.71)	(5.74)
	3	0.34**	0.66***
		(2.29)	(5.11)
	4	0.49***	0.57***
		(3.39)	(4.23)
	5	0.64***	0.46***
		(3.78)	(3.03)
From China (Sample: 87:1-2004:4, Trend and centered seasonal dummies included	1	0.17	-3.59**
		(0.63)	(-2.41)
	2	0.48**	-3.41***
		(2.01)	(-2.25)
	3	0.86***	-2.62***
		(4.84)	(-2.90)
	4	0.95***	-2.51**
		(4.09)	(-2.36)
	5	0.92***	-1.87
		(3.06)	(-1.13)

Table 13 (continued)
Dynamic OLS estimates for U.S. trade with East Asia[1]

	Number of Lags and Leads	RER Elasticity	Income Elasticity
U.S. Imports			
From China (Sample: 87:1-2004:4, Centered seasonal dummies included, No trend)	1	1.36***	4.39***
		(9.69)	(28.01)
	2	1.73***	4.12***
		(11.00)	(36.34)
	3	1.98***	3.92***
		(10.66)	(43.34)
	4	2.03***	3.86***
		(8.86)	(38.84)
	5	1.81***	3.88***
		(7.26)	(42.01)
U.S. Exports			
To Japan (Sample: 88:1-2005:3, No trend)	1	0.18	0.16
		(1.64)	(0.89)
	2	0.10	0.21
		(0.85)	(1.15)
	3	0.06	0.19
		(0.53)	(1.04)
	4	0.03	0.18
		(0.22)	(0.81)
	5	-0.06	0.27
		(-0.40)	(1.06)
To the NIEs (Sample: 88:1-2004:4, No trend)	1	-1.03***	0.80***
		(-9.37)	(14.24)
	2	-0.95***	0.80***
		(-7.17)	(11.83)
	3	-0.84***	0.77***
		(-5.27)	(9.88)
	4	-0.73***	0.75***
		(3.99)	(8.00)
	5	-0.47***	0.69***
		(-2.74)	(7.58)

Table 13 (continued)
Dynamic OLS estimates for U.S. trade with East Asia[1]

	Number of Lags and Leads	RER Elasticity	Income Elasticity
U.S. Exports			
To China (Sample: 91:1-2004:4, Trend and centered seasonal dummies included	1	0.24	-0.37
		(0.54)	(-1.61)
	2	0.47	-0.33
		(0.88)	(-1.25)
	3	0.72	-0.48
		(1.21)	(-1.59)
	4	0.11	-0.77**
		(0.13)	(-2.01)
	5	1.18	0.08
		(0.97)	(0.54)

[1]The NIEs are defined as South Korea and Taiwan. Number of leads and lags refers to the number of leads and lags of first-differenced right hand side variables included in the regression. Newey-West (1987) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.

Table 14.
Determinants of Total Exports from CJST (China, Japan, South Korea, and Taiwan)

Explanatory Variables							
.For Exports from CJST.	. For Exports from all East Asian Countries .						
Bilateral RER (for exports to the U.S.)	Bilateral RER	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-0.84*** (-7.52)	-1.23*** (-7.31)	0.29** (2.39)	-0.04** (-2.05)	-0.54*** (-5.97)	-0.45** (-2.24)	0.42*** (3.24)	0.29 (0.17)

Number of Observations	5721
Adjusted R-squared	0.863
S.E of regression	0.710
Hausman Test	14.9
Prob(Hausman Test)	0.01
F-statistics	546.3
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.

Table 15.
Determinants of Total Imports from CJST (China, Japan, South Korea, and Taiwan)

Explanatory Variables							
For Imports from the U.S. to CJST.	For Imports into all East Asian Countries						
Bilateral RER (for exports to the U.S.)	Bilateral RER	Income (Importer)	Income (Exporter)	Distance	Quarterly Volatility	Common Language	Constant Term
-0.06 (-0.31)	0.11 (1.37)	0.25** (2.42)	0.01 (0.66)	-0.54*** (-5.88)	-0.02** (-0.23)	0.18*** (1.34)	0.41 (0.25)

Number of Observations	5724
Adjusted R-squared	0.863
S.E of regression	0.64
Hausman Test	1233.9
Prob(Hausman Test)	0.00
F-statistics	690.9
Prob(F-statistic)	0.000000

Notes: East Asia is defined as China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. ROW is defined as the OECD countries plus Argentina, Brazil, Mexico, and India. The model was estimated as a panel with 9 East Asian countries exporting to each other and to 21 non-East Asian countries over the 1982-2003 period. White (1980) standard errors are employed. T-statistics are in parentheses.
*** (**) denotes significance at the 1% (5%) level.

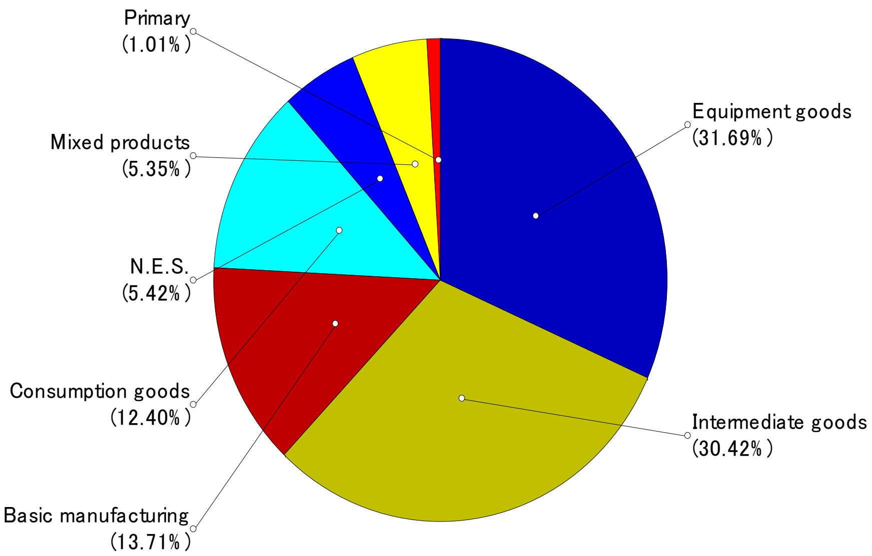

Figure 1. Japan's Exports to East Asia in 2003 Disaggregated by Stages of Production

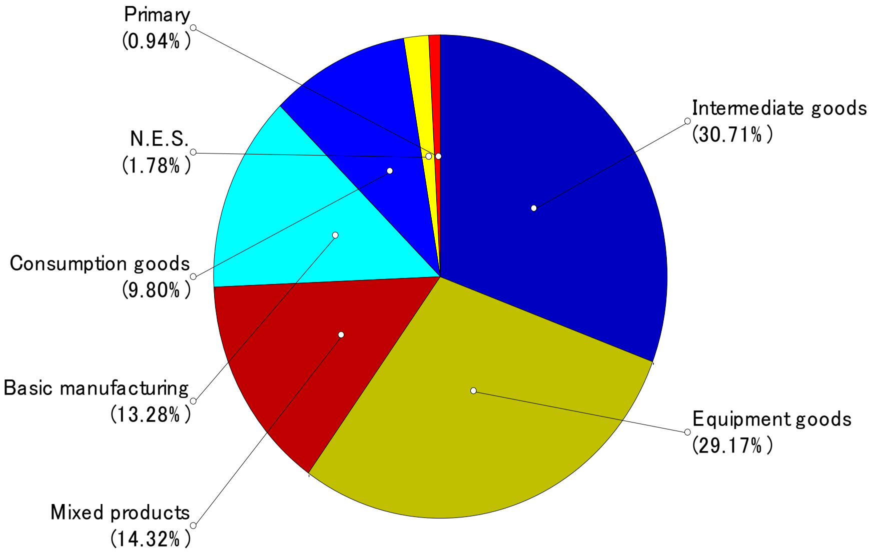

Figure 2. NIEs Exports to East Asia in 2003 Disaggregated by Stages of Production

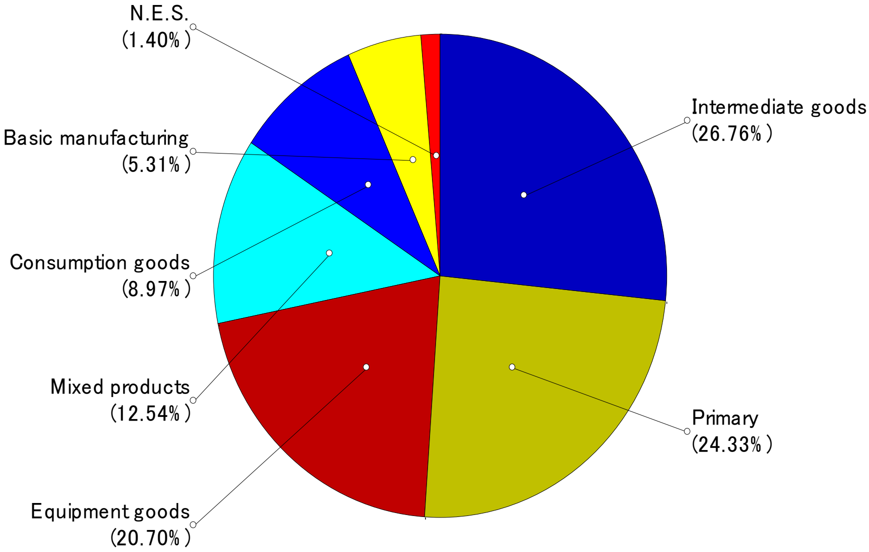

Figure 3. ASEAN’s Exports to East Asia in 2003 Disaggregated by Stages of Production

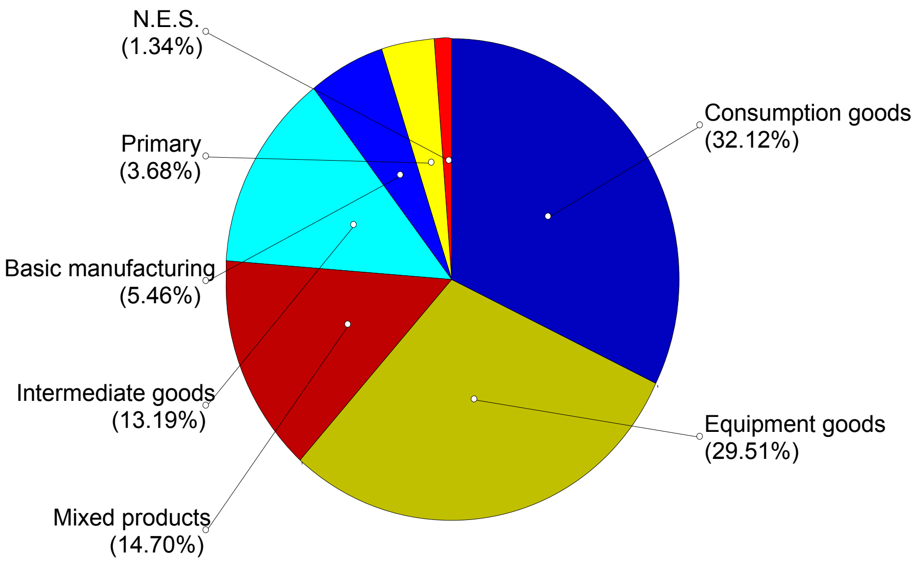

Figure 4. China's Exports to the Rest of the World in 2003 Disaggregated by Stages of Production

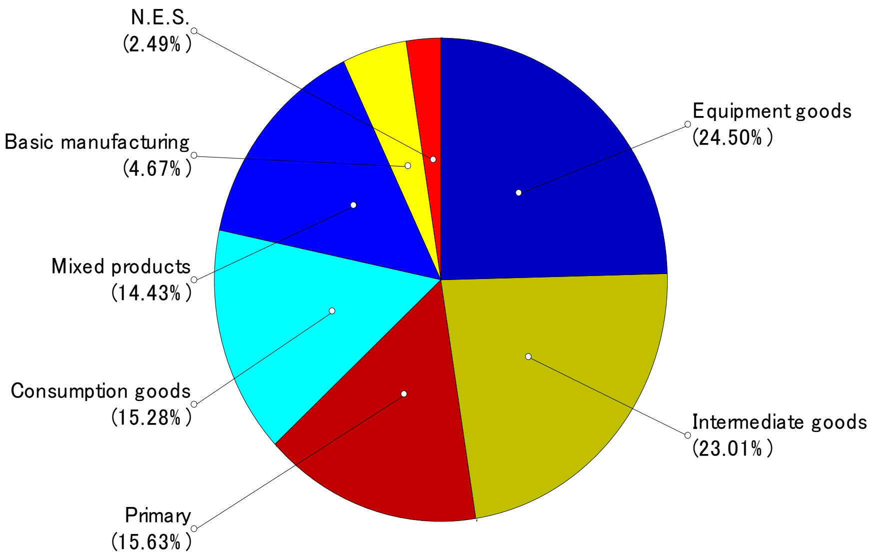

Figure 5. ASEAN's Exports to the Rest of the World in 2003 Disaggregated by Stages of Production