

Free Trade Agreements and Sectoral Adjustments in East Asia*

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Abstract

Although East Asian countries were relatively inactive in signing free trade agreements (FTAs) until the end of 1990s, a number of FTAs involving East Asian countries have been signed since the turn of the century. Because sectoral interests can exert significant influence on policy negotiations, the sectoral results would be most important for political economy considerations. The objective of this study is to evaluate the sectoral adjustments resulting from various FTA scenarios in East Asia using a dynamic global CGE model. Among other issues, the indices of revealed comparative advantage (RCA) are computed and RCA rankings of commodities with various FTA scenarios and those with the global trade liberalization scenario are correlated to examine how “natural” the groupings would be.

JEL classification codes: F13, F15

Keywords: FTA, RCA, East Asia, CGE model

1. Introduction

In the past decade the number of free trade agreements (FTAs) has proliferated rapidly. Other than ASEAN Free Trade Agreement (AFTA), East Asian countries were relatively inactive in signing FTAs until the end of 1990s. Since 2001, however, a number of FTAs involving East Asian countries have been signed or ratified: Singapore-New Zealand (2001), Japan-Singapore (2002), ASEAN-China (2002), U.S.-Singapore (2003), Singapore-Australia (2003), Korea-Chile (2004), Thailand-Australia (2004), Japan-

* Since this is a very preliminary and incomplete version, please do not quote.

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Mexico (2004), and Korea-Singapore (2004). Japan and the Philippines have reached basic agreement to conclude an FTA in 2005, and a large number of FTAs are currently being negotiated in East Asia, including ASEAN-Japan, ASEAN-Korea, Japan-Korea, and Japan-Thailand. The ASEAN+3 group, consisting of the ASEAN countries, China, Japan, and Korea, has provided an effective mechanism for greater cooperation and gradual regional economic integration in East Asia. The trends in negotiating for new FTAs are likely to continue in East Asia.

Whether regional integration agreements (RIAs) are a facilitating intermediate step towards global free trade or a hindrance to greater global trade liberalization is a hotly debated issue (e.g., Krueger, 1999a; Laird, 1999; Panagariya, 2000). Proponents for regional integration argue that RIAs encourage member countries to liberalize beyond the level committed by multilateral negotiations and that they make tough negotiating issues easier to handle (e.g., Kahler, 1995). In addition, RIAs are likely to induce dynamic effects that might contribute to member countries' growth through the accumulation of physical and human capital, productivity growth, and accelerated domestic reforms (e.g., Ethier, 1998; Fukase and Winters, 2003).¹ Opponents worry that the proliferation of RIAs is likely to undermine the multilateral trading system and that beneficiaries of RIAs might form a political lobby to deter further multilateral liberalization (e.g., Bhagwati, 1995; Levy, 1997; Srinivasan, 1998ab; Panagariya, 1999).

Empirical evidence on benefits and costs of RIAs suggests that trade creation exceeds trade diversion in almost all RIAs (Robinson and Thierfelder, 1999). The positive effect on economic welfare resulting from the European Union (EU) and North American Free Trade Agreement (NAFTA) is supported by Brown, Deardorff, and Stern (1992), Harrison, Rutherford, and Tarr (1996), Lee and van der Mensbrugghe (2004), and Roland-Holst, Reinert, and Shiels (1992). However, Yeats (1998) finds that during 1988-94 Mercosur countries experienced significant trade diversion when their intra-Mercosur trade increased sharply.

While the aggregate welfare effect of FTAs is certainly important, the sectoral impact could be of an even greater concern to policy makers. This is because regional

¹ Ethier (1998) suggests that small-country members are induced to lock in their liberalized trade regimes and that RIAs are congruent with further multilateral liberalization.

integration might lead to a sharp contraction of output and employment in highly protected sectors. For example, the agricultural sectors in Japan and Korea are highly subsidized and shielded against foreign imports by significant tariffs and nontariff barriers (NTBs). In a number of developing members, tariffs, industrial policy, and other government policies protect certain manufacturing industries from foreign competition. Since trade policy is often formulated from the bottom up, a modern view of national interest, such as that based on trade reciprocity, might encounter conflicts with established domestic interests.

Using a dynamic global computable general equilibrium (CGE) model, we evaluate the effects of prospective free trade agreements involving East Asian countries, emphasizing sectoral adjustments and changes in the pattern of trade resulting from the formation of FTAs. The next section gives an overview of the model. Section 3 provides a brief description of scenarios and assessments of computational results. The final section summarizes the main policy conclusions.

2. Overview of the Model

The model used in this study, known as the LINKAGE model, is a dynamic global CGE model developed by van der Mensbrugghe (2004).² It spans the period 1997-2015 in the present version and is a relatively standard neoclassical CGE, with constant returns to scale in all sectors, perfect competition and price-clearing behavior in all markets. The model incorporates three types of production structure—crops, livestock, and manufacturing and services. The first distinguishes intensive (chemical- and labor-based) farming versus extensive (land-based) farming. Livestock production is characterized by ranch- versus range-fed cattle. All other sectors conform to the more standard labor-capital substitution effects, albeit with sufficient structure to capture the complex interactions across various inputs and factors of production (see Figure 1).³

² See van der Mensbrugghe (2005) for the model equations. This section largely replicates Lee, Roland-Holst, and van der Mensbrugghe (2004, section 2), but will be updated in a revised version.

³ At the top nest, production is formed by the combination of aggregate intermediate demand other than energy (*ND*) and value added plus energy (*VA*). The second nest consists of two nodes. The first node decomposes aggregate intermediate demand into sectoral demand for goods and services. The second node decomposes *VA* between demand for aggregate labor (*L*) and demand for human capital, physical capital, energy, and sector-specific factor bundle (*HKTE*). The third and subsequent nodes are decomposed by a similar fashion, as illustrated in Figure 1.

Figure 1
Production nesting in the manufacturing and services sectors

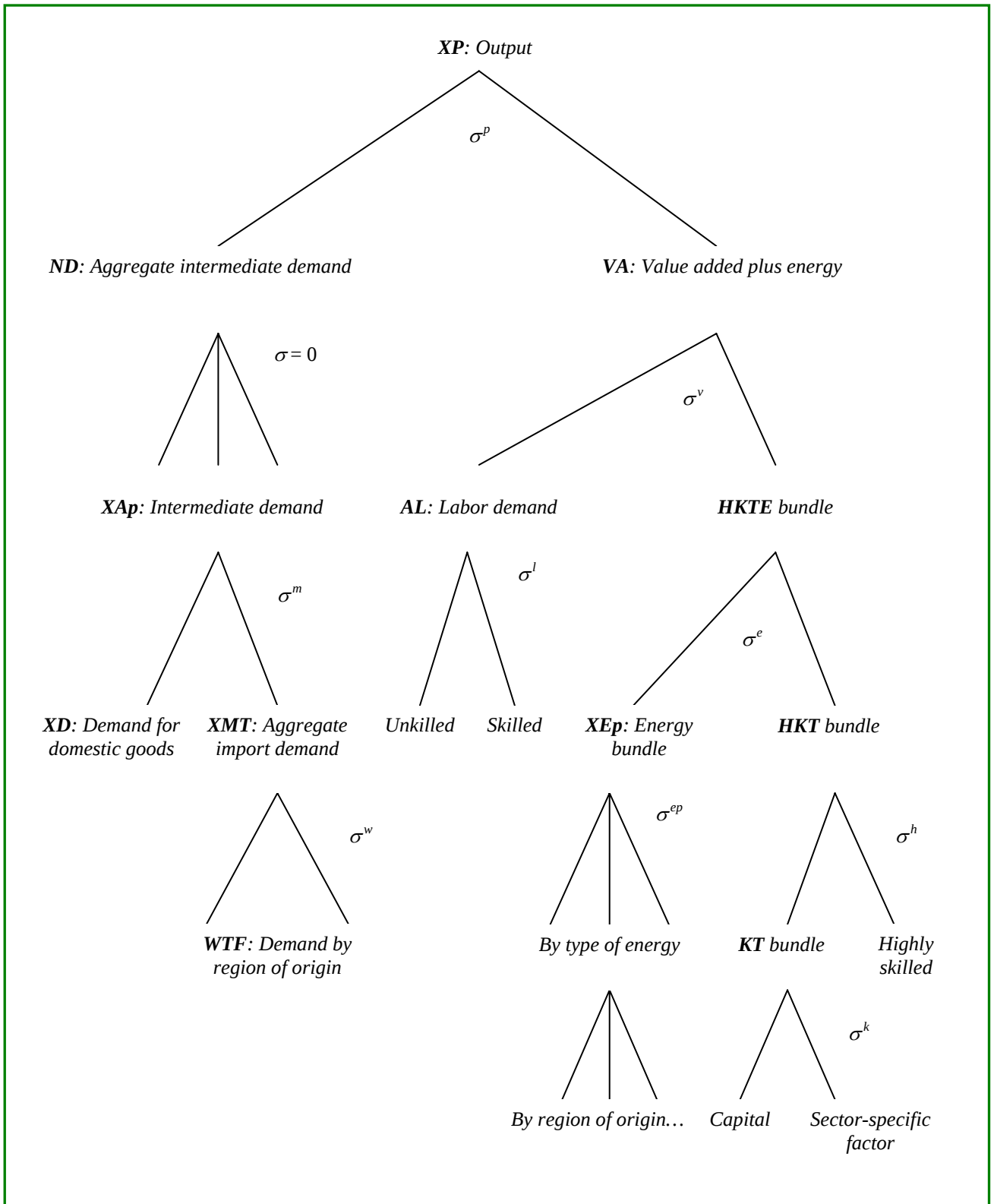


Figure 1 (continued)

Definition of variables and parameters:

XP :	Output (by vintage)
ND :	Demand for aggregate non-energy intermediate demand
VA :	Demand for labor, capital, energy, and sector-specific factor bundle
XAp :	Demand for (Armington) intermediate goods (excluding energy)
XD :	Demand for domestically produced intermediate goods
XMT :	Aggregate import demand for intermediate goods
WTF :	Demand for imported intermediate goods by region of origin
AL :	Demand for aggregate labor (excluding ‘highly’ skilled)
$HKTE$:	Demand for human and physical capital, energy, and sector-specific factor bundle
XEp :	Demand for aggregate energy bundle
HKT :	Demand for human capital, physical capital, and sector-specific factor bundle
KT :	Demand for physical capital and sector-specific factor bundle
σ^p :	Elasticity of substitution between ND and VA
σ^v :	Elasticity of substitution between AL and $HKTE$
σ^l :	Elasticity of substitution between unskilled and skilled labor
σ^e :	Elasticity of substitution between XEp and HKT
σ^{ep} :	Elasticity of substitution between different type of energy
σ^h :	Elasticity of substitution between KT and highly skilled labor
σ^k :	Elasticity of substitution between physical capital and sector-specific factor

Note: The sector-specific factor includes land in agricultural sectors and the resource base in the coal, crude oil, natural gas, and mining sectors.

Factor income accrues to a single representative household, which finances government expenditures (through direct and indirect taxes) and investment (through domestic savings). Domestic savings may be augmented or diminished by a net capital flow. In the current version of the model, the latter is exogenous in any given time period for each region, thereby generating a fixed current account balance. Ex ante shocks to the current account—e.g., a reduction in trade barriers—induces a change in the real exchange rate. Government fiscal balances are also fixed in each time period, and the equilibrating mechanism is lump-sum taxes on the representative household. For example, a reduction in tariff revenue is compensated by an increase in household direct taxation.

Trade is modeled using the ubiquitous Armington assumption of imperfect substitution, i.e., goods are differentiated by region of origin. The model uses a nested demand structure. Aggregate domestic absorption by sector is allocated between domestic goods and a single composite import good. The latter is then allocated across region of origin to determine the bilateral trade flows on a sectoral basis. An analogous dual-nested structure is used to allocate domestic production between domestic and export markets (using constant elasticity of transformation functions).

The model has four trade prices incorporating four separate instruments. First, producers receive price PE for exported goods. Second, the FOB price, WPE , includes domestic export taxes or subsidies. Third, the CIF price, WPM , includes the direct costs of port-to-port shipping, represented by the ad valorem wedge ζ , as well as a non-monetary or frictional cost,⁴ represented by the iceberg parameter λ .⁵ Thus the relationship between the FOB price and the CIF price is given by

$$WPM_{r,r',i} = (1 + \zeta_{r,r',i}) WPE_{r,r',i} / \lambda_{r,r',i} \quad (1)$$

where subscripts r , r' , and i denote exporting region/country, importing region/country, and commodity, respectively. Finally, the domestic price of imports, PM , is equal to the CIF price, WPM , plus the ad valorem tariff (or tariff-equivalent) rate.

Dynamics in this model is recursive. Population and labor supply growth are exogenous. Land and (sector-specific) natural resources supply curves are price-sensitive within period, but land is only partially mobile across agricultural sectors. Capital accumulation is based on past savings and investment. The model incorporates a vintage structure for capital that allows for adjustment costs. New capital is assumed to be perfectly mobile across sectors, whereas installed capital is only partially mobile. All else equal, countries with higher savings rates will have more ‘flexible’ capital since it is assumed that substitution elasticities are higher with new capital than with installed capital.

The final important ingredient in the dynamic behavior of the model regards the productivity assumptions. Agricultural productivity is given in the baseline. Productivity in manufacturing and services is calibrated in order to achieve some target for real per capita GDP growth.⁶ In these sectors, productivity is the sum of three components. There is a sector-specific component, a component linked to the sectoral export-output ratio (the ‘openness’ component), and an economywide component. The latter is the calibration component (i.e., one target-one instrument). The sector-specific component is based on an

⁴ This type of cost is referred to as ‘iceberg’ transport cost, developed by Samuelson (1952) based on a concept developed earlier by von Thünen. More recently, these have been used in work by Helpman and Krugman (1985) and Fujita, Krugman, and Venables (1999).

⁵ A rise in λ represents an improvement in trade ‘efficiency’ and thus a reduction in trade cost. This could correspond to a reduction in administrative barriers to trade (e.g., customs procedures) and/or a lower technical barrier (e.g., mutual recognition of technical standards in production, packaging and marketing).

aggregate assumption, typically that productivity is some percentage point higher in manufacturing than in services (e.g., 2 percentage points). The openness component is calibrated in the baseline so that it explains a specified share of total sectoral productivity. In policy reforms scenario, this component ($\chi_{i,t}$) is assumed to be endogenous, i.e., it changes with the ratio of exports to output:

$$\chi_{i,t} = \phi_{i,t} \left(\frac{E_{i,t}}{X_{i,t}} \right)^{\eta_i} \quad (2)$$

where $E_{i,t}$ is exports of commodity i , $X_{i,t}$ is output of commodity i , $\phi_{i,t}$ is a shift parameter, and η_i is the elasticity of productivity with respect to openness. For example, if manufacturing productivity in the baseline is 4 percent in some year, the openness component explains 50 percent of total sectoral productivity, and the export-output ratio increases by 10 percent, then productivity would increase by 5 percent (to 4.2 percent) assuming the openness elasticity is one.⁷

Previous studies have shown that two additional factors that are not incorporated in the present model would significantly boost the gains from trade. First, Harris (1984), Brown and Stern (1989), and Francois and Roland-Holst (1997), among others, have demonstrated that incorporation of increasing returns to scale and imperfect competition could lead to multiple changes in the aggregate results. Second, foreign capital flows (e.g., foreign direct investment and portfolio investment) are exogenous in the current version of the model, but it has been shown that allowing for capital to flow to countries with relatively high rates of return could significantly raise the gains from trade reform.⁸

⁶ Productivity is assumed to be labor-augmenting.

⁷ Note that if the export-output ratio increases by 10 percent, then assuming $\eta_i = 1$ the openness component of productivity, $\chi_{i,t}$, increases by 10 percent. Since the other two components of productivity are exogenous, an increase in sectoral productivity is calculated as

$$[\theta_\chi (1 + g_\chi) + (1 - \theta_\chi)] - 1 = [0.5*(1 + 0.10) + (1 - 0.5)] - 1 = 0.05$$

where θ_χ is the share of sectoral productivity explained by the openness component and g_χ is the rate at which $\chi_{i,t}$ increases.

⁸ See, for example, Petri (1997) and Lee and van der Mensbrugghe (2001).

Table 1. Regional and Sectoral Aggregation

A. Regional Aggregation

Countries/Regions	Corresponding economies/regions in the GTAP database
China	China and Hong Kong
Japan	Japan
Korea	Korea
Taiwan	Taiwan
ASEAN	Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, rest of Southeast Asia
Australasia	Australia and New Zealand
North America	United States, Canada, Mexico
Latin America	Central America and the Caribbean, South America
EU-25	Austria, Belgium, Denmark, Finland, France, Germany, Great Britain, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, plus the ten new member countries
Rest of world	All the other economies/regions

B. Sectoral Aggregation

Sectors	Corresponding commodities/sectors in the GTAP database
Rice	Paddy rice, processed rice
Other grains	Wheat, cereal grains n.e.s.
Vegetables and fruits	Vegetables and fruits
Other crops	Oil seeds, sugar cane and sugar beet, plant-based fibers, crops n.e.s.
Livestock	Bovine cattle, sheep and goats, animal products n.e.s.
Natural resources	forestry, minerals
Fossil fuel	Coal, oil, gas
Food	Fishing, food products, beverages and tobacco products
Textiles	Textiles
Apparel	Wearing apparel
Leather	Leather products
Wood products	Wood products
Paper products	Paper products publishing
Petroleum products	Petroleum and coal products
Chemicals	Chemical, rubber, plastic products
Mineral products	Non-metallic mineral products
Iron and steel	Iron and steel
Nonferrous metal	Nonferrous metal
Metal products	Fabricated metal products
Machinery	Machinery and equipment
Electronic equip.	Electronic equipment
Motor vehicles	Motor vehicles and parts
Other transport equip.	Other transport equipment
Other manufactures	Manufactures n.e.s.
Trade and transport	Trade, sea transport, air transport, transport n.e.s.
Services	Construction, public utilities, communication, financial services, other services

Source: GTAP database, Version 6 (Beta Release).

Most of the data used in the model come from the Beta Release of the GTAP database, version 6, which provides 2001 data on input-output, value added, final demand, bilateral trade, tax and subsidy data for 87 regions and 57 sectors.⁹ For the purpose of the present study, the database is aggregated into 10 regions and 26 sectors as shown in Table 1.

3. Scenarios and Results

3.1 Policy Scenarios

To evaluate sectoral adjustments and changes in the pattern of trade resulting prospective free trade agreements in East Asia, the following six policy scenarios are considered:

- 1) ASEAN-China FTA: Free trade among the ASEAN countries and China/Hong Kong
- 2) ASEAN-Japan FTA: Free trade among the ASEAN countries and Japan
- 3) China-Japan-Korea FTA: Free trade among China/Hong Kong, Japan, and Korea
- 4) ASEAN+3: Free trade among the ASEAN countries, China/Hong Kong, Japan, and Korea
- 5) ASEAN-EU: Free trade among the ASEAN and EU-25 member countries
- 6) Global trade liberalization (GTL): Complete abolition of import tariffs and export subsidies

While the likelihood of actually completing the above trade liberalization or FTAs within a reasonable time horizon differs significantly across scenarios, it is worth examining each of them. Scenario 1 is expected to be realized as ASEAN countries and China signed a framework agreement in 2002 to establish the FTA for trade in goods by 2010 for China and ASEAN-6 and by 2015 for newer ASEAN Member States.¹⁰ Scenario 2 that excludes

⁹ Dimaranan and McDougall (forthcoming) give detailed descriptions of the GTAP database, version 6.

¹⁰ ASEAN-6 refers to the original ASEAN members; i.e., Brunei, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Newer ASEAN Member States are Cambodia, Lao PDR, Myanmar, and Vietnam.

sensitive sectors has also become a real possibility after ASEAN and Japan signed an agreement on the Comprehensive Economic Partnership (CEP) in November 2003.¹¹ The proposal for China-Japan-Korea FTA (scenario 3) has been considered by the governments of the three countries (Wong et al., 2004), and a joint research on economic cooperation among these countries has been undertaken by the Development Research Center of the State Council of China, the National Institute for Research Advancement of Japan, and the Korea Institute for International Economic Policy. Although negotiations for an FTA among the economies of ASEAN+3 have not yet begun, we include scenario 4 because a number of studies have examined the possible effects of such an arrangement (e.g., Brown, Deardorff, and Stern, 2003; Lee and Park, 2005). In addition, since EU has established a cooperative relationship with ASEAN, it would be natural to consider scenario 5 in which ASEAN and the EU form an FTA. Finally, we have the global trade liberalization (GTL) or full WTO scenario so that the effects of the FTA scenarios may be discussed relative to the global scenario.

In all FTA experiments, we gradually remove bilateral tariffs and export subsidies of the relevant sectors among the member countries over the 2007-2012 period. We set the elasticity of productivity with respect to openness, η_i , to 0.5 in agricultural sectors and to 1.0 in all other sectors. We assume that non-monetary trade costs would be reduced by 2 percent in all FTA scenarios, but they remain unchanged in the unilateral and global scenarios (scenarios 1 and 7).¹²

3.2 *Effects on Welfare*

Aggregate income gains and/or losses summarize the extent trade distortions are hindering growth prospects and the ability of economies to use the gains to help those whose income could potentially decline. We compare the six policy scenarios with the

¹¹ Yamazawa and Hiratsuka (2003) provides an overview of ASEAN-Japan Comprehensive Economic Partnership.

¹² Smith and Venables (1988) use a 2.5 percent reduction in intra-EU trade costs in their study of the Single Market program's possible pro-competitive effects, whereas Keuschnigg and Kohler (2000) and Madsen and Sorensen (2002) use a 5 percent reduction in real costs of trade between the EU and Central and East European countries. We use a smaller reduction in these costs among the members of FTAs in scenarios 2-6 because the reductions in technical barriers are expected to be smaller in these cases than in the EU case.

baseline situation in the terminal year, 2015, using a measure of compensated or equivalent variation aggregate national income. Real income is summarized by Hicksian equivalent variation (EV). This represents the income consumers would be willing to forego to achieve post-reform well-being (u^p) compared to baseline well-being (u^b) at baseline prices (p^b):

$$EV = E(p^b, u^p) - E(p^b, u^b) \quad (3)$$

where E represents the expenditure function to achieve utility level u given a vector of prices p (superscript b represents baseline levels, and p the post-reform levels). The model uses the extended linear expenditure system (ELES), which incorporates savings in the consumer's utility function. The ELES expenditure function is easy to evaluate at each point in time.

Table 2 summarizes the welfare results for the seven policy scenarios as deviations in EVs from the baseline in 2015. The GTL or full WTO scenario (scenario 6) is the most attractive for all countries and regions. To be realistic, however, the WTO process is fraught with uncertainty about the scope, depth, and timeliness of multilateral commitments to abolish trade barriers.¹³ This kind of uncertainty has been an important impetus to regional agreements, particularly those between small groups of nations who find consensus, implementation, and monitoring easier.

In the ASEAN-China FTA scenario (scenario 1), in 2015 EV of ASEAN increases by 2.5%, whereas EV of China increases by a smaller percentage (1.0%). This largely results from two factors: (1) the share of ASEAN's exports to China is significantly larger than the share of China's exports to ASEAN; (2) the exports to output ratio is substantially higher for ASEAN countries. The welfare effects on non-member countries are negligible except for Korea and Taiwan, which experience 0.2 and 0.3 percent declines in their EVs. When ASEAN and Japan form an FTA (scenario 2), ASEAN's EV increases by 1.5 percent while Japan's EV increases by 0.5 percent. Welfare of other East Asian countries (China, Korea, and Taiwan) declines slightly.

¹³ See, for example, Langhammer (2004) for causes and triggers of the setback at the WTO Ministerial Conference in Cancún in September 2003.

Table 2

Effects on welfare (deviations in equivalent variations from the baseline in 2015)

Region	FTA and GTL Scenarios					
	(1) ASEAN- China	(2) ASEAN- Japan	(3) China- Japan-Korea	(4) ASEAN plus 3	(5) ASEAN- EU	(6) GTL
A. Absolute deviations (US\$ billion in 2001 prices)						
China and Hong Kong	23.6	-2.8	61.8	56.6	-2.1	88.8
Japan	-1.7	18.8	32.4	27.1	-0.4	53.7
Korea	-1.0	-0.8	33.9	31.3	-0.7	45.5
Taiwan	-1.1	-0.7	-1.3	-2.1	-0.5	10.2
ASEAN	24.3	14.5	-4.5	12.9	14.2	25.2
Australia/New Zealand	-0.2	-0.2	-0.6	-0.8	-0.2	9.9
North America	-0.3	-0.9	-0.3	-1.0	0.2	111.9
Latin America	-0.1	-0.3	-1.7	-1.9	-0.7	31.6
EU-25	-1.8	-0.8	2.2	1.2	70.6	67.6
Rest of the world	-1.7	-1.5	1.5	-0.4	-6.0	97.5
East Asia total	44.2	29.0	122.3	125.9	10.6	223.3
World total	40.1	25.2	123.4	123.1	74.5	541.8
B. Percent deviations						
China and Hong Kong	1.0	-0.1	2.5	2.3	-0.1	3.6
Japan	0.0	0.5	0.8	0.7	0.0	1.4
Korea	-0.2	-0.1	5.0	4.7	-0.1	6.8
Taiwan	-0.3	-0.2	-0.3	-0.5	-0.1	2.5
ASEAN	2.5	1.5	-0.5	1.4	1.5	2.6
Australia/New Zealand	0.0	0.0	-0.1	-0.2	0.0	2.0
North America	0.0	0.0	0.0	0.0	0.0	0.8
Latin America	0.0	0.0	-0.1	-0.1	0.0	1.9
EU-25	0.0	0.0	0.0	0.0	0.9	0.8
Rest of the world	0.0	0.0	0.0	0.0	-0.2	2.6
East Asia total	0.5	0.3	1.4	1.5	0.1	2.6
World total	0.1	0.1	0.3	0.3	0.2	1.5

When a free trade area is formed among China, Japan, and Korea (scenario 3), Korea is expected to accrue the greatest welfare gain of 5.0 percent, following by China (2.5 percent) and Japan (0.8 percent). This is largely because Korea will have preferential accesses to the large Chinese and Japanese markets and its exports to China and Japan, which already constitute large shares of Korea's total exports, will increase dramatically. Under the trilateral FTA, Korea, China, and Japan respectively obtain about 75, 70, and 60 percent of the GTL's benefits. Thus, the China-Japan-Korea FTA could be a very attractive stepping stone to globalization for the three countries although large political obstacles must be surmounted to achieve such an FTA.

Under the ASEAN+3 FTA scenario (scenario 4), the welfare of all members increases although the welfare gains for China, Japan, and Korea are somewhat smaller than under the trilateral FTA. These losses are more than offset by the ASEAN's gains and East Asia as a whole is expected to gain \$126 billion (1.5%) in 2015, compared with its \$223 billion (2.6%) gain under the GTL. In other words, East Asia will be able to attain 56 percent of GTL's benefits from the ASEAN+3 FTA.

If free trade between ASEAN and the EU is realized (scenario 5), ASEAN is expected to realize a 1.5 percent gain in its welfare, slightly larger than the gain expected under the ASEAN+3 FTA scenario. The EU's welfare will increase by 0.9 percent.

3.3 *Effects on Sectoral Output*

While the aggregate welfare and trade results are of interest in themselves, the most useful results are at the industry level, where structural adjustments and resource reallocations occur in response to policy changes. Because sectoral interests can exert significant influence on policy negotiations, the sectoral results would be most important for political economy considerations. In this section we examine the effects of alternative policy scenarios on sectoral output.

Tables 3-6 summarize output adjustments for the 26 sectors in China and Hong Kong, Japan, Korean, and ASEAN under the six policy scenarios. Sectoral adjustments are expressed in percent deviations from the baseline for the year 2015. They are large in most of the agricultural and food sectors for East Asia in general and Japan and Korea in particular because of high trade barriers in these two countries.

[To be completed]

Table 3

China and Hong Kong's sectoral output adjustments under alternative scenarios (percent deviations from the baseline for the year 2015)

Commodity/sector	Scenarios					
	(1) ASEAN- China	(2) ASEAN- Japan	(3) China- Japan-Korea	(4) ASEAN plus 3	(5) ASEAN- EU	(6) GTL
Rice	0.4	-0.3	25.3	22.6	0.0	21.6
Other grains	0.3	-0.1	34.6	33.7	0.2	-48.7
Vegetables and fruits	0.2	0.0	6.1	5.7	0.2	6.6
Other crops	0.0	-1.3	200.3	197.8	-1.1	1.4
Livestock	0.7	-0.1	3.0	3.0	-0.1	5.7
Natural resources	-0.3	0.0	-0.9	-1.1	0.1	-2.6
Fossil fuel	0.3	0.1	0.0	0.1	0.2	-4.2
Food	1.3	-0.4	5.7	5.9	0.1	4.1
Textiles	0.9	-0.1	0.0	0.5	-0.9	11.2
Apparel	-0.1	-0.1	4.9	3.5	-1.0	20.6
Leather	2.0	-0.2	2.5	2.8	-1.1	19.4
Wood products	-1.4	0.2	0.6	-0.9	0.8	1.2
Paper products	0.1	0.1	0.0	0.2	0.2	0.0
Petroleum products	2.3	0.0	-0.9	1.1	0.0	-2.9
Chemicals	-2.1	0.0	-0.5	-2.0	-0.1	-3.1
Mineral products	0.0	0.0	-0.5	-0.6	0.1	0.2
Iron and steel	0.7	-0.3	-1.9	-1.2	-0.1	-3.6
Nonferrous metal	0.1	-0.1	-2.3	-2.2	0.1	-6.6
Metal products	0.3	-0.2	-0.7	-0.6	-0.1	1.5
Machinery	0.4	-0.1	-1.3	-1.2	-0.1	-2.5
Electronic equip.	1.6	0.2	0.8	0.0	-0.2	2.7
Motor vehicles	2.0	-0.7	-4.2	-4.2	-0.8	-13.3
Other transport equip.	15.8	-0.4	0.1	14.3	-0.2	14.8
Other manufactures	-0.4	0.1	-0.6	-0.8	0.2	-0.5
Trade and transport	0.0	0.1	0.1	0.0	0.3	0.4
Services	0.2	0.0	0.4	0.3	0.0	0.4

- China's agricultural and food sectors expand under the China-Japan-Korea FTA and ASEAN+3 FTA scenarios. In particular, the percentage increases in output of other crops are around 200 percent relative to the baseline in 2015 under these two scenarios.
- Among the manufacturing sectors, output of other transportation equipment increases 14-16 percent when the ASEAN countries are included in the FTA.
- Output of the apparel and leather sectors increases moderately when Japan is an FTA member (scenarios 3 and 4), but the increase is small relative to the GTL scenario because China's exports of these products to Japan are relatively small compared with its exports to North American and the EU.
- The motor vehicle sector contracts when Japan and Korea are FTA members, but the contraction is relatively small compared with the GTL scenario.

Table 4

Japan's sectoral output adjustments under alternative scenarios (percent deviations from the baseline for the year 2015)

Commodity/sector	Scenarios					
	(1) ASEAN- China	(2) ASEAN- Japan	(3) China- Japan-Korea	(4) ASEAN plus 3	(5) ASEAN- EU	(6) GTL
Rice	0.4	-53.1	-74.8	-74.2	0.2	-79.8
Other grains	0.5	4.6	0.1	-1.4	0.4	-97.1
Vegetables and fruits	0.2	0.6	-0.7	-1.1	0.2	-5.8
Other crops	0.4	0.4	-3.3	-3.1	0.3	-7.8
Livestock	0.2	-0.9	0.5	-0.9	0.2	-6.7
Natural resources	1.2	-0.1	-0.6	0.3	0.7	-0.4
Fossil fuel	1.2	-1.9	-3.3	-2.6	0.7	-8.6
Food	0.1	-2.2	-3.2	-4.6	0.1	-15.5
Textiles	-1.7	2.8	21.6	18.5	0.2	14.3
Apparel	0.2	-0.6	-7.0	-5.8	0.2	-7.7
Leather	0.5	-3.6	-11.7	-12.8	0.4	-21.2
Wood products	1.4	-0.9	-2.1	-1.1	1.0	-1.6
Paper products	0.1	0.0	-0.1	0.0	0.1	-0.5
Petroleum products	-0.1	0.1	-0.1	-0.3	0.0	-3.5
Chemicals	-0.6	0.6	2.3	1.6	0.0	1.4
Mineral products	0.0	0.5	2.7	2.7	0.0	2.6
Iron and steel	0.4	3.0	1.7	3.8	-0.4	3.9
Nonferrous metal	0.8	1.2	1.9	2.5	0.3	-0.1
Metal products	0.0	1.1	0.5	1.5	-0.1	1.9
Machinery	0.1	-0.2	3.0	2.4	-0.2	1.5
Electronic equip.	-0.2	-0.8	-0.7	-1.4	0.5	-0.3
Motor vehicles	-0.2	4.4	-0.5	3.0	-1.9	13.2
Other transport equip.	-1.6	0.8	-2.8	-3.9	0.3	6.9
Other manufactures	0.6	0.7	-0.2	1.0	0.2	-0.2
Trade and transport	0.1	0.0	-0.1	-0.1	0.1	0.4
Services	0.0	0.2	0.3	0.2	0.0	0.5

- Japan's rice sector contracts by 53-78 percent under the ASEAN-Japan FTA, China-Japan-Korea FTA, and ASEAN+3 FTA scenarios. Compared with the GTL scenario, the contractions of other agricultural and food products, particularly other grains, are relatively small.
- Under the China-Japan-Korea FTA and ASEAN+3 FTA scenarios, the textile sector expands by 19-22 percent while the apparel and leather sectors contract by 6-7 percent and 12-13 percent, respectively.
- Under the ASEAN+3 FTA scenario, output of steel increases by 3.8, almost the same percentage increase as the GTL scenario largely because about three-quarters of Japan's steel exports are shipped to other East Asian countries.
- Japan's motor vehicle industry expands when ASEAN is included in the FTA, but contracts slightly under the China-Japan-Korea FTA scenario.

Table 5

Korea's sectoral output adjustments under alternative scenarios (percent deviations from the baseline for the year 2015)

Commodity/sector	Scenarios					
	(1) ASEAN- China	(2) ASEAN- Japan	(3) China- Japan-Korea	(4) ASEAN plus 3	(5) ASEAN- EU	(6) GTL
Rice	0.3	-0.1	425.4	392.4	-0.1	559.2
Other grains	0.9	-0.7	-99.8	-99.7	-0.4	-99.9
Vegetables and fruits	0.2	-0.2	-29.3	-27.8	0.1	-39.1
Other crops	0.6	-0.8	-43.9	-40.9	-0.4	-74.2
Livestock	0.0	-0.6	116.7	107.8	-0.1	119.2
Natural resources	2.0	0.3	-12.8	-12.2	0.5	-20.0
Fossil fuel	0.5	0.3	-4.0	-5.6	0.3	-18.1
Food	0.0	-0.8	100.3	90.8	0.0	106.8
Textiles	-1.5	-0.3	8.2	10.5	-0.6	11.8
Apparel	1.2	0.3	-3.2	-2.3	0.1	-6.0
Leather	-2.0	-0.4	79.9	72.0	-0.6	54.6
Wood products	1.8	0.7	-6.1	-9.0	1.1	-9.0
Paper products	0.4	0.3	-1.5	-2.6	0.4	-6.1
Petroleum products	-2.1	-0.1	16.2	12.2	-0.1	21.5
Chemicals	-3.0	-0.1	-1.0	-4.4	-0.2	-8.6
Mineral products	0.3	0.2	-6.4	-6.5	0.0	-13.1
Iron and steel	1.2	-0.9	-11.8	-9.8	-0.6	-15.1
Nonferrous metal	1.1	-0.2	-10.0	-7.6	-0.1	-17.8
Metal products	0.4	-0.4	-5.8	-5.3	-0.2	-7.6
Machinery	0.4	0.1	-12.3	-11.5	-0.1	-16.8
Electronic equip.	0.0	0.6	-8.8	-9.4	0.2	-11.3
Motor vehicles	0.7	-1.0	-9.2	3.7	-1.9	13.8
Other transport equip.	-1.7	0.2	-20.3	-22.3	-0.4	5.8
Other manufactures	1.1	0.0	2.2	4.8	0.0	-5.4
Trade and transport	0.4	0.2	1.6	1.7	0.3	3.2
Services	0.0	0.0	1.1	0.9	0.1	1.5

- Under both FTA scenarios in which Korea is a member (i.e., scenarios 3 and 4), Korea's rice sector is expected to expand by about five-fold. The surge in rice output is driven by an extremely large increase in the exports to Japan.
- Large contractions in output of other grains, vegetables and fruits, and other crops, as well as large expansions in output of livestock and processed food under the two FTA scenarios are consistent with sectoral adjustments of these sectors under the GTL scenario.
- Among the manufacturing sectors, output of textiles, leather, petroleum products, and other manufactures would increase, but the motor vehicle industry is expected to contract under the China-Japan-Korea FTA scenario.

Table 6

ASEAN's sectoral output adjustments under alternative scenarios (percent deviations from the baseline for the year 2015)

Commodity/sector	Scenarios					
	(1) ASEAN- China	(2) ASEAN- Japan	(3) China- Japan-Korea	(4) ASEAN plus 3	(5) ASEAN- EU	(6) GTL
Rice	-1.2	24.7	-6.4	-1.2	7.4	-1.9
Other grains	-10.0	-0.5	-1.5	-0.1	-5.5	-14.9
Vegetables and fruits	6.5	-3.4	-1.5	3.7	-3.2	5.6
Other crops	11.4	9.4	-0.6	11.1	13.4	0.1
Livestock	1.5	4.3	-1.7	1.8	3.3	8.4
Natural resources	-4.7	-3.3	1.2	-2.6	-5.3	-7.0
Fossil fuel	-3.6	-1.6	0.4	-1.8	-3.5	-5.4
Food	3.0	11.5	-3.3	5.4	7.3	17.7
Textiles	-0.5	0.5	-2.9	-2.0	12.2	7.6
Apparel	-0.9	3.2	-1.3	3.6	14.1	25.5
Leather	-8.9	0.9	-2.9	-4.5	26.7	8.3
Wood products	-6.6	-1.8	1.3	-0.5	-5.7	-3.2
Paper products	-1.2	-2.0	1.2	-0.9	-3.3	-2.4
Petroleum products	1.7	0.9	-1.0	-0.6	0.3	-0.4
Chemicals	22.3	-0.6	0.3	19.0	0.7	14.7
Mineral products	0.9	-2.2	0.5	0.7	-2.3	-1.4
Iron and steel	0.8	-7.0	2.2	-5.5	-3.1	-10.6
Nonferrous metal	-3.3	-3.7	1.5	-3.6	-6.0	-12.1
Metal products	0.3	-0.5	1.0	-1.1	-0.6	-3.4
Machinery	10.3	4.5	0.6	9.2	2.5	7.2
Electronic equip.	0.5	-0.7	0.9	-0.1	-2.1	-2.3
Motor vehicles	9.0	-13.3	1.0	-17.3	-4.9	-20.0
Other transport equip.	-8.2	11.4	1.7	-5.3	13.7	-8.4
Other manufactures	-3.6	-1.4	0.6	-2.2	-0.8	-7.3
Trade and transport	-0.5	-0.6	0.3	-0.5	-0.5	-0.3
Services	-0.2	-0.3	0.0	-0.4	-0.3	-0.6

- Under the FTA scenarios in which ASEAN is a member (i.e., scenarios 1-2 and 4-5), the sectoral adjustments differ significantly across the scenarios. For example, whereas the textile, apparel, and leather industries expand by 12-27 percent under the ASEAN-EU scenario, these industries either increase only slightly or contract in the other three scenarios. This is mainly because China has comparative advantage in these products over ASEAN.
- Output of chemicals and machinery expands substantially when China is a member of the FTA.

3.4 Changes in the Pattern of Trade

In this section we examine the effects of alternative FTA scenarios on the pattern of East Asian trade. Specifically, we compute the indices of revealed comparative advantage (RCA), developed by Balassa (1965), and correlate RCA rankings of commodities with various FTA scenarios and those with the global trade liberalization scenario to examine how “natural” the groupings would be.

RCA is defined as

$$RCA = \frac{E_{r,i} / \sum_r E_{r,i}}{\sum_r E_{r,i} / \sum_r \sum_i E_{r,i}} \quad (4)$$

where $E_{r,i}$ is country (region) r 's exports of commodity i . In other words, RCA is defined as the share of commodity i in country r 's total exports relative to the commodity's share in total world exports. When the RCA index is greater than one, commodity i is more important in country r 's exports than it is in total world exports, implying that the country has a comparative advantage in the commodity.

Table 7 provides the RCA indices for the 26 sectors in China and Hong Kong, Japan, Korean, and ASEAN in 2001. In general, the larger the RCA index for a given commodity, the higher is the ranking of the product by comparative advantage (Krein and Plummer, 1994b). However, the RCA index may be distorted by tariffs, nontariff barriers, subsidies, and other policies. For example, RCA in Japan's rice sector is equal to 1.87, but this number is likely to be highly distorted.

In China and Hong Kong the commodities/sectors with the five highest RCA index values in 2001 were leather (5.20), apparel (3.77), other manufactures (3.43), trade and transport (2.17), and textiles (1.94). In Japan they were motor vehicles (2.33), machinery (1.76), electronic equipment (1.76), iron and steel (1.58), and other transport equipment (1.25).¹⁴ In Korea the commodities with high RCA rankings were textiles (2.69), electronic equipment (2.39), other transport equipment (1.83), petroleum products (1.72),

¹⁴ Rice is excluded from the ranking in Japan and ASEAN because the RCA index appears to be highly distorted.

and iron and steel (1.61), whereas in ASEAN they were electronic equipment (3.07), wood products (1.69), other crops (1.53), apparel (1.49), and leather (1.44).

Table 7

Revealed Comparative Advantage Indices for China, Japan, Korea, and ASEAN in 2001

Commodity/sector	China and Hong Kong	Japan	Korea	ASEAN
Rice	1.21	1.87	0.09	4.48
Other grains	0.37	0.00	0.00	0.06
Vegetables and fruits	0.65	0.01	0.23	0.66
Other crops	0.46	0.04	0.17	1.53
Livestock	1.05	0.09	0.08	0.35
Natural resources	0.35	0.05	0.04	1.39
Fossil fuel	0.18	0.00	0.00	0.87
Food	0.44	0.12	0.26	1.18
Textiles	1.94	0.72	2.69	0.97
Apparel	3.77	0.05	0.84	1.49
Leather	5.20	0.05	0.99	1.44
Wood products	1.46	0.06	0.12	1.69
Paper products	0.40	0.27	0.57	0.64
Petroleum products	0.47	0.15	1.72	1.01
Chemicals	0.52	0.91	1.01	0.69
Mineral products	1.12	0.97	0.54	0.69
Iron and steel	0.32	1.58	1.61	0.27
Nonferrous metal	0.39	0.59	0.69	0.55
Metal products	1.37	0.75	0.98	0.45
Machinery	0.86	1.76	0.78	0.58
Electronic equip.	1.26	1.76	2.39	3.07
Motor vehicles	0.07	2.33	1.15	0.11
Other transport equip.	0.42	1.25	1.83	0.24
Other manufactures	3.43	0.71	0.58	0.75
Trade and transport	2.17	0.56	0.55	0.80
Services	0.46	0.43	0.56	0.77

Source: GTAP database, Version 6 (Beta Release).

Outline of what we plan to do:

1. We first compute the RCA indices under the GTL scenario for the year 2015 (already done).
2. Next, we compute the RCA indices for each member country of FTA with respect to the bloc it joins, rather than the world as a whole, for the five FTA scenarios in 2015. For example, for the ASEAN+3 FTA scenario each member's RCA is calculated as the share of commodity i in member r 's exports to the ASEAN+3 bloc relative to the commodity's share in total world exports to the ASEAN+3 countries.

2. We then correlate RCA rankings of commodities with various FTA scenarios and those with the global trade liberalization scenario to examine how “natural” the groupings would be.

[To be completed]

4. Concluding Remarks

In this paper, we have examined the effects of alternative FTA scenarios in East Asia on sectoral adjustments and the pattern of trade. Our general findings indicate that ...

[To be completed]

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