A Computable General Equilibrium Analysis of a Two-Stage Trade Liberalization Game of China, Japan and Korea

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여태까지의 동북아 FTA에 대한 CGE 연구는 자국의 이익을 극대화한다는 관점에서, 또는 전체 권역에 가장 바람직한 형태의 FTA를 찾는다는 관점에서 추진되었고, 이에 따라 한국, 중국, 일본 등 3국의 전략적 행동과 상호의존성의 결과를 고려하지 못하고 있다. 이런 한계성의 뒤에서 본 연구는 3국의 전략적 의사결정 구조를 2단계 게임으로 가정할 때의 동북아 FTA의 하부구조완전 내쉬균형의 해와 정책적 시사점을 찾아보고자 한다. 게임의 이득행렬은 GTAP 동학모형으로 계산하였다.

주요 연구 결과는 다음과 같다. 첫째, 연구의 모의실험 결과는 1단계에서 중국과 일본이 FTA를 우선 체결하고, 2단계에서 한국이 참여하면서 동북아 FTA 또는 동아시아 FTA가 완성되는 것이 하부구조완전 내쉬균형의 순서이다. 둘째, 이 해는 중국과 일본의 입장에서 (자국 이익 극대화만을 고려할 때의) 최적해이기도 하다. 한국 입장에서 (자국 이익...
I. The Liberalization Sequence in Northeast Asia from a Game Theoretical Perspective

While there have been discussions regarding a desirable East Asian free trade agreement (FTA) (focusing on the regional scope), the best strategy for key players such as China, Japan and Korea, differences in political and economic solutions, and the rivalry between China and Japan, there have been few empirical attempts to formally quantify these arguments and proposals under a game-theory framework which is able to analyze strategic interactions of key players. This paper attempts to address this need by constructing a two-stage game in which three players decide upon a strategic FTA sequence to maximize the payoff to each player, and the payoff matrix of each sequence of the game is quantified using a computable general equilibrium (CGE) simulation.

East Asian countries have achieved market-driven integration with
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global and regional economies, resulting in a proliferation of intra-and inter-regional trading agreements (Kawai, 2005; Park, 2009). With respect to intra-regional integration, China, Japan and Korea have signed a liberalization agreement with the Association of South East Asian Nations (ASEAN). However, attaining the ultimate goal in the region, construction of an East Asian Free Trade Area (EAFTA), is likely to be prolonged by slow progress in bilateral and/or trilateral trade negotiations between these three important East Asian players. As noted by Evenett et al. (2004: 11), a FTA involving only two of these nations is almost certain to set off a chain reaction in the rest of East Asia, supporting the implication that a FTA in Northeast Asia ultimately results in the formation of an EAFTA. For that reason, this paper addresses only the Northeast Asian integration process.

Discussions about an EAFTA reveal that China and Japan have different visions regarding the desired solution. In October 2001, the East Asia Vision Group (EAVG) recommended the establishment of an EAFTA in a report to the leaders of ASEAN plus three (ASEAN+3).1) Following China’s initiative, Korea has also been promoting the formation of ASEAN+3 (Joint Expert Group on EAFTA Phase II Study, 2009). However, Japan is attempting to form ASEAN+6 (Comprehensive Economic Partnership in East Asia CEPEA), which includes Australia, New Zealand, and India, as a desirable EAFTA with the motivation to alleviate the Japanese concerns that ASEAN+3 will be dominated by China (Track Two Study Group on Comprehensive Economic Partnership in East Asia, 2009).2)

1) In November 2002, the East Asia Study Group also proposed the formation of an EAFTA. After the termination of China-ASEAN, Japan-ASEAN and Korea-ASEAN FTAs, the natural sequence progression would be the ASEAN+3.
A China-Japan-Korea FTA will be the focus of an industrial-governmental-educational study. The 2007 study of a China-Korea FTA was complete, and negotiations are processing now. In the case of the Korea-Japan FTA, negotiations began in December 2003 but were terminated in November 2004.

There have been empirical and game-theoretic approaches to determine a stable and sustainable regional scope for the EAFTA and to examine its possible impacts. However, two approaches did not converge. The empirical approach, employing a CGE or gravity framework, was successful in quantifying policy options for each country as well as for East Asia as a whole, but it suffered from theoretical rigidity. For example, Park (2009), Kawai (2007), Lee and Shin (2006), and Scollay and Gilbert (2000) all argued that ASEAN+3(6) and APEC would be economically desirable options in an EAFTA, with the smallest diversion of extra-bloc trade and with significant economic impacts on member countries.

On the other hand, the game-theoretic approach, in which a coalition (network) formation game is modeled, successfully identifies a country’s key incentives for signing a FTA in order to explore conditions for establishing a stable FTA configuration (FTA network) and its impact on global free trade. Key variables of an incentive mechanism include symmetry of countries (determined by market size, industry size, technology level and endowment level), substitutability of trade commodities, level of industrialization and political motives (Aghion et al., 2007; Das and Ghoshi, 2006; Furusawa and Konishi, 2007; Grossman and

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2) In addition, Australia has insisted on ASEAN+8 which includes the US and Russia. The Asia-Pacific Economic Cooperation (APEC) also conducted a discussion on the vision of a FTA including countries such as the US, Canada, Mexico, and Chile.
helpman, 1995; kim, 2005; ornelas, 2005; sagii and yildiz, 2010; yi, 1996). this approach increases our understanding of fta formation behavior by developing concepts such as a player’s strategic decision making and interdependence, sequential bargaining and dynamic path, and coalition externalities (related to trade creation and diversion). however, these abstract descriptions of fta events are not sufficiently associated with tangible policy implications.

this paper tries to narrow the distance between cge empirics and game theory research on an eafta by establishing a simplistic two-stage game in which the payoff matrix of a dynamic path of the eafta is quantified using a cge simulation. this is possible because cge analysis can consistently capture the main features of the game-theory approach with a real database.3) strategic decisions on the choice of partner country can be programmed according to the policy scenario of the analysis, and the player payoffs can be calculated under circumstances in which interdependence between players is described using a database (gtap 7 data base) and equations of international trade linkages across players and input-output linkages across industries within a country (gtap model). because of these two set of linkages, coalition externalities (trade creation and diversion) of the game can also be quantified in a cge analysis.

lee and moon (2010), after reviewing a few existing studies on the sequence through which an eafta is formed,4) noted the importance

3) however, the criticisms that cge analyses employ excessively strong assumptions such as perfectly competitive markets and the constant-returns-to-scale production functions and that the database used requires updating and is sometimes inaccurate are still valid.

4) there have been a few studies which address the sequencing issue in fta: baldwin (2005), bond (2005), evenett (2005), moravcsik (2005) and other papers presented
of the sequence with regard to the mutual dependence and strategic behavior between negotiating nations in order to establish a final FTA using a CGE study. This study analyzed the EAFTA sequence scenario under the presumption that Korea has the priority in entering into a negotiation: the main Korean concern is which country, after the United States (US) and the European Union (EU), should the next FTA involve. However, there are limitations of this paper that must be considered.

First, as a result of focusing on an EAFTA initiated by Korea, we were unable to take into account liberalization sequencing when the priorities of the three nations of Northeast Asia are in conflict\(^5\). Second, when considering liberalization sequencing of all three countries, a more theoretically consistent analysis of their strategic behaviors is needed. That is, there is a need for explicit employment of the game theory framework.

The goals of this study are to (1) analyze the dynamic path (sequence) of the EAFTA from the perspectives of the three countries instead of from the perspective of Lee and Moon’s Korea and to (2) formally apply the game theory framework for the first time to perform a serious analysis of the interdependent strategic behaviors of

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5) Lee and Moon (p. 379)'s main concern was FTA sequencing from Korea's perspective: which country should receive the next FTA after the US and the EU. This led to the assumption that Korea will have priority in negotiations. Thus, sequencing scenarios in which China and Japan have priority are excluded.
the three countries. In short, we intend to construct FTA strategies among the three countries into an extensive-form game and to identify the Nash equilibrium of the game after quantifying the payoffs using CGE simulation results.

The questions of this study are as follows:

(1) What is the subgame-perfect equilibrium (optimal FTA sequence) in Northeast Asia when China, Japan and Korea have equal priority to choose a partner country?

(2) To what extent could liberalization gains in the three countries occur in this subgame-perfect equilibrium sequence?

(3) Why is the solution of the economic game no longer optimal when taking into account the politico-economic rivalry between China and Japan? What implications does this have for the FTA strategies of the three nations?

We believe that this paper contributes to the field of economic integration in Northeast Asia in that it combines game theory and CGE empirics to analyze the mutual dependence of FTA strategies among the three large countries.

This paper is organized as follows: Section 2 models the sequential-liberalization, three-player two-stage game in East Asia and then offers an explanation of the quantification of payoff matrix in each game sequence under CGE simulations. In Section 3, empirical results of the Three-Country Economic Model of Sequential FTAs in Northeast Asia are illustrated to determine a Nash equilibrium sequence. In Section 4, we discuss implications of the infeasibility of a subgame-perfect equilibrium path in politico-economic reality. Section 5 summarizes the major findings and implications of the study.
II. Analytical Framework: Game Theory and CGE-Based Payoff Matrices

1. A Game-Theory Model of FTA Sequences in Northeast Asia

As mentioned in the introduction, the following game is designed to analyze the strategic choices of China, Japan and Korea relating to the creation of FTAs in Northeast Asia. The strategic factors each country faces pertain to the choice of with which country to enter into a bilateral FTA. If two nations exclude the third and sign a bilateral FTA, the third nation is left with two choices: join this FTA or remain without participation in the FTA in the second stage. To obtain payoff matrices of the game, this paper uses CGE simulation values for cases in which various forms of strategic FTA options are programmed into a global CGE model. These values are the result of the FTA sequence through changes in trade linkages across countries and changes in input-output linkages in the industries of each country.6)

The rules of the simplistic game proposed by this paper are as follows. First, it is assumed that if two nations actually agree to form a FTA, then the remaining nation cannot participate in the FTA in Stage 1. Second, the country that was excluded from the FTA in Stage 1 can participate in the FTA in Stage 2, although it is not mandatory.

The first rule is a hypothesis that has some practicality. When considering the progress in or discussion of the formation of a China-Japan-Korea FTA, the possibility of three nations reaching a simultaneous agreement is likely to be very low. Ultimately, the general prediction is that a

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6) See the next sub-section titled CGE-Based Payoff Matrix.
Northeast Asian FTA in which all three nations participate will be formed only after two nations initiate the FTA and recruit the third country at a later time.

The assumption of the second rule is that, if a certain period of time passes after the formation of a FTA between any two of the nations, there is no economic reason or justification to exclude the participation of the third nation. Furthermore, if an excluded country desires to participate, it can subsequently establish FTAs with the other two nations already joined through FTA. We believe this assumption of simultaneous establishment of FTAs is valid.7)

This game consists of two stages. In Stage 1, two of the countries form a coalition and sign a FTA. In this case, the remaining nation that does not enter into a FTA but is also not ruled out for later inclusion. It is also possible for three countries not to form a FTA. In Stage 2, a country excluded from the coalition in Stage 1 again decides whether to participate in the FTA established in the earlier stage. If no FTA was formed in Stage 1, no FTA will be established in the second stage.

Likewise, the solution of the two-stage game is obtained via backward induction. In Stage 2, the final stage of the game, each country determines its optimal payoff strategy and then goes back to Stage 1. Each country then decides whether it should form a FTA and, if so, with which country to sign the agreement based on the knowledge of the national best strategies (response) identified in Stage

7) If we use terminology of Yi's (1997) coalition formation game, the second rule of this paper is the "open membership rule," and the formation of a Northeast Asian FTA in the second stage is equivalent to the "grand coalition." Applying Yi's implication, a country not included in the coalition of Stage 1 joins the coalition in Stage 2 for the case of negative externalities (trade diversion overwhelming trade creation) but does not for the case of positive externalities.
2. The combination of the choices obtained in this manner is called the subgame-perfect Nash equilibrium. Each country will make a decision which provides it with the greatest payoff out of a combination of choices given in Stage 1 (FTA sequences over two stages) because each player can reasonably expect the ultimate payoff matrices of the possible scenarios (sequential FTA strategies).

Figure 1 is a representation of the extensive form of the game in which each of the three players, Japan (J), China (C) and Korea (K), simultaneously choose a strategy. Here, SC refers to a strategy in which another nation selects China (C) as its partner, and SJ and SK are for Japan and Korea, respectively.

The decision nodes surrounded with dotted lines in the figure signify members of the same information set. For instance, a situation in which China must make a decision without knowing the decision of Korea is presented. In other words, a situation is presented in which all three nations have to make strategic decisions without knowing what strategies the other countries will choose.

Figure 1. FTA Game including China, Japan and Korea
2. CGE-Based Payoff Matrix

The novelty of this study is in the identification of the Nash equilibrium of the game shown in Figure 1 after quantifying the payoff matrices, crucial components of the game. Here, we quantify the payoff matrix (players’ payoffs) of each sequential game scenario using the GTAP-Dyn simulation results by applying the proper FTA sequence of the FTA for each scenario. Even though there are many sequential FTA scenarios in Figure 1, only seven are significant, six of which are shown in Sequences 1-6 of Table 1. The remaining scenario is that in which there is no FTA between the three nations, resulting in zero payoffs for each country (Figure 1).

To calculate payoffs for the three countries in each sequence of the game, this paper employs a multiregional recursive dynamic Global Trade Analysis Project (GTAP) model (GTAP-Dyn), an extension of the standard GTAP model that includes international capital mobility, capital accumulation and the adaptive expectation theory of investment (Ianchovichina and McDougall, 2001). We believe this is a suitable empirical framework to analyze the interdependence of the strategic decisions presented here. Microeconomic equilibrium equations of inter-regional relations (trade linkages across regions) and inter-industry relations within each region (input-output linkages across industries) of the GTAP model (Lee & van der Mensbrugghe, 2004; Park, 2009)

8) This novelty is a weakness in other aspect at the same time. The payoff matrix of each FTA sequence is only a simulation result from a CGE model, and a variety of payoff matrices are possible from different CGE models. Thus, the payoffs of Figure 1 are not unique and have meanings relative to others of the same figure.

9) This paper uses GTAP 7 database. See Narayanan and Walmsley (2008).
are used to capture the ultimate outcomes of strategic interdependence. They can also capture changes in economic variables, including payoffs, for each sequence of the game, depending on complementary and/or substitutive trade relations between countries/regions in the presence of liberalization events. The CGE-simulation framework of the six significant sequences of the game is as follows. After the formation of the three countries’ FTAs with ASEAN in Period 1 (2005-2009) and Korea’s FTAs with the US and the EU in Period 2 (2010-2013), only six FTA sequences (S1–S6) are possible in Northeast Asia. In Period 3 (2014-2016), represented as Stage 1 in the game in Figure 1, three types of coalitions are possible: a China-Japan FTA, a China-Korea FTA and a Japan-Korea FTA. The excluded country in Stage 1 of each scenario (for example Korea in the case of a China-Japan coalition) decides in Stage 2 whether to participate (Period 4: 2017-2019). Simulation results of each sequence, the changes in economic variables including payoffs (here, growth rate in GDP), are reported in Period 5 (2020-2022).

The payoffs, growth rates in the GDPs of the three countries in each sequence are reported in the last three rows of Table 1.¹⁰ For convenience when estimating the economic impacts of the sequential FTAs in East Asia, the years analyzed, 2004-2022, are divided into five periods: 2005-2009, 2010-2013, 2014-2016 (Stage 1), 2017-2019 (Stage 2), and 2020-2022.

¹⁰ We construct payoff matrix in terms of GDP growth rates. In other words, each country is assumed to maximize GDP growth in the strategic FTA game, Change in welfare (for example, EV, equivalent variation in GTAP) would be a better indicator of payoff than is growth rate; unfortunately, EV calculation in the recursive dynamic GTAP model is problematic, arising from difficulty in the consistent application of price changes, occurring every period, to the calculation of EV (Walmsley, Dimaranan and McDougall, 2000).
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For these simulations, the world economy is grouped into nine regions: Korea, China, Japan, ASEAN, Australia and New Zealand (ANZ), South Asian Preferential Trade Agreement (SAPTA), US, EU-25, and the rest of the world (ROW). GTAP’s 57 industries are also regrouped into seven primary sectors (rice, crops, vegetables and fruits, other agricultural products, meat and dairy products, food, and mining), seven manufacturing sectors (textiles, chemicals, metal, transportation vehicles, electronics, machinery, and other manufactured goods) and one service sector. This paper addresses the liberalization of goods only and does not include services. We also assume that China, the US and ASEAN eliminate tariffs in seven agricultural and seven manufacturing sectors when forming FTAs, whereas Korea, Japan and the EU eliminate all tariffs except in the rice sector.

Table 1. CGE-Based Payoff Matrices for the Game in Figure 1

<table>
<thead>
<tr>
<th>Sequence 1</th>
<th>Sequence 2</th>
<th>Sequence 3</th>
<th>Sequence 4</th>
<th>Sequence 5</th>
<th>Sequence 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-2009</td>
<td>C-ASEAN, J-ASEAN, K-ASEAN</td>
<td>C-ASEAN, J-ASEAN, K-ASEAN</td>
<td>C-ASEAN, J-ASEAN, K-ASEAN</td>
<td>C-ASEAN, J-ASEAN, K-ASEAN</td>
<td>C-ASEAN, J-ASEAN, K-ASEAN</td>
</tr>
<tr>
<td>2014-2016 (Stage 1)</td>
<td>China-Japan, China-Japan, China-Korea, China-Korea, Japan-Korea, Japan-Korea</td>
<td>China-Korea, Japan-Korea, China-Japan, Japan-Korea, China-Japan, Japan-Korea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017-2019 (Stage 2)</td>
<td>-</td>
<td>China-Korea, Japan-Korea, China-Japan, Japan-Korea, China-Japan, Japan-Korea</td>
<td>-</td>
<td>China-Japan, Japan-Korea, China-Japan, Japan-Korea, China-Japan, Japan-Korea</td>
<td></td>
</tr>
<tr>
<td>2020-2022</td>
<td>China</td>
<td>0.602</td>
<td>0.835</td>
<td>0.242</td>
<td>0.724</td>
</tr>
<tr>
<td></td>
<td>Japan</td>
<td>0.192</td>
<td>0.226</td>
<td>-0.030</td>
<td>0.161</td>
</tr>
<tr>
<td></td>
<td>Korea</td>
<td>-0.248</td>
<td>2.202</td>
<td>2.435</td>
<td>2.876</td>
</tr>
</tbody>
</table>

Note: 1) K, Korea; C, China; J, Japan
2) Database: GTAP 7 Data Base; CGE model: recursive dynamic GTAP model (GTAP-Dyn)
III. Empirical Results and Further Discussion

1. Three-Country Game of Northeast Asian FTA

The solution of the game is shown in Figure 1. First, the payoff vector shows the economic growth effect (growth rate in real GDP) in the order of China, Japan and Korea. Only the significant values according to the rules of the game introduced in Section 2 are presented, and the rest of the payoff matrices were excluded. That is to say, if the insignificant payoff vector is excluded according to the first rule of the game, only the six payoff matrices shown in Figure 1 are significant.

First, the best strategy for each country, chosen in Stage 2 of the game, is determined. In this stage (Period 4: 2017-2019), China compares the expected payoffs of sequence 5 and 6 when it does or does not participate in the China-Japan coalition (FTA) concluded in the first stage (0.693% and -0.006%, respectively) and select the situation in which the country will obtain greater growth. Using the same logic, Japan will take a participatory strategy (sequence 4) because the expected payoff when it participates in a China-Korea coalition (0.161%) is greater than the payoff of sequence 5 when it does not participate (-0.030%). Korea also chooses the participatory strategy of sequence 2 (2.202%) that has a greater growth effect than does that in which it does not participate (-0.248%). In conclusion, all three nations, China, Japan and Korea, will choose a participatory strategy in Stage 2.11)

11) In Stage 2, the participatory strategy is better for Korea than is the non-
Returning to Stage 1 of the game, under the premise that all of the countries will pursue a participatory strategy in Stage 2 (sequence 6 for China, sequence 4 for Japan, and sequence 2 for Korea, respectively), the strategies providing the greatest payoff to each nation are determined. China chooses to form a FTA with Japan (sequence 2), Japan selects China (sequence 2), and Korea selects China (sequence 4). Ultimately, the subgame-perfect equilibrium solution of the game is the FTA sequence in which, in the first stage, China and Japan conclude a FTA without Korea, who then joins the FTA in the second stage (sequence 2). The bold lines in Figure 1 depict this subgame-perfect equilibrium sequence.

In sum, the Nash equilibrium sequence of the Northeast Asian FTA with regard to economic benefit is C-J FTA in Stage 1 and C-K and J-K FTA in Stage 2 (Sequence 2 of Table 1). The three countries’ growth gains from this Nash equilibrium sequence are 0.835% in China, 0.226% in Japan and 2.202% in Korea, indicating that China and Korea gain a great deal, while the GDP growth in Japan is relatively small. In addition, if the Northeast Asian FTA is delayed or

participatory strategy; more accurately, the expected benefit of participation is positive, whereas that of no participation is negative. This implies that the China-Japan coalition in Stage 1 produced negative externalities in the non-member country, Korea. This same effect is produced in the other two sequences.

12) Because the CGE simulation result is sensitive to the theoretical model, this paper also calculates the payoff matrices of the six scenarios of the Table 1, employing standard GTAP model with capital accumulation closure instead of GTAP dynamic model. These simulations employ the same regional and industrial grouping and apply the same liberalization shocks to those of recursive dynamic ones of Table 1. However, these simulations are different from dynamic ones in that three countries’ FTAs with ASEAN and Korea’s FTA with the US and the EU are not considered before estimation because of the static feature of the model. Appendix Table 1 shows the estimation results. Even though the payoff values change, the Nash equilibrium solution does not change.
rejected, China and Korea will experience the greatest impacts. These conclusions imply that China and Korea have strong economic incentives to actively pursue Northeast Asian free trade, whereas Japan does not. This analysis illustrates why Japan has been so hesitant to form a China-Japan-Korea FTA.

The payoffs of China and Japan are maximized in the Nash equilibrium sequence (Sequence 2) listed in Table 1, whereas Sequence 4 (China-Korea FTA in the first stage and China-Japan and Japan-Korea FTAs in the second stage) is the most desirable strategy for Korea. This demonstrates that the best strategy for Korea is not the Nash equilibrium, unlike the situations of China and Japan: this implies that Korea will not achieve its optimal strategy when entering into a FTA with China and Japan.

Therefore, the implication of the game to China and Japan is very clear: the most desirable strategy is to sign a FTA between them at the earliest possible moment. However, our model refers to a strategic choice that takes into account only purely economic interests. Therefore, there is a very significant limitation with regard to this

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13) A reviewer indicates a possibility of a different Nash equilibrium sequence when we allow less liberalization in Japan in Stage 1. To check this, we construct alternative liberalization scenario (70% reduction in tariffs in six agricultural and food sectors in Japan and Korea), and calculate corresponding payoff matrices (Appendix Table 2). The results show that the subgame-perfect Nash equilibrium sequence of the alternative is same to that of the original liberalization scenario (elimination of tariffs in the six agricultural and food sector in Japan and Korea).

14) Sequence 4 was the most desirable scenario for Korea (Lee and Moon, 2010): however, this situation is feasible only when Korea has priority in choosing the partner country. For Korea, entering into a FTA with China as soon as possible is the most desirable strategy and supports the recent Korean government’s position of considering a FTA with China. However, this sequential FTA scenario is not feasible in the game of Figure 1.
conclusion in that it does not account for political factors such as the rivalry between China and Japan for dominance in East Asia.

2. Further Discussion: Rivalry between China and Japan

Contrary to the conclusion of the game in Figure 1 (C-J FTA in Stage 1 and C-K and J-K FTA in Stage 2: Sequence 2) the efforts of China and Japan to conclude a FTA in the real world seem to be very weak. The reason for this is the politico-economic rivalry between those two nations or two sides (China on one side and Japan and the US on the other side) (Sohn, 2010; Wan, 2010). More accurately, Japan aims to form a Japan-centered EAFTA emphasizing conventional market-economy principles and order, whereas China wants a China-centered FTA that reflects a strong political motivation to assert political and economic hegemony in East Asia.

Because Japan will not agree to the Nash equilibrium sequence (no consideration of China as a top priority FTA-partner country), it could be assumed that the negative political payoff of Japan’s agreement to a China-centered FTA is greater than the positive economic benefit of

15) Another reason for Japan’s hesitation to accept comprehensive and deeper-level FTAs is sensitiveness to agricultural sectors and domestic politics (Furusawa and Konishi, 2007; Cowhey, 1993). Furusawa and Konishi (p. 330) purport that developed countries are reluctant to form FTAs with less developed countries because the political costs of opening sensitive markets such as agriculture are large, and the total effect including the political costs is negative and large.

16) The recent example of this is Japan’s suggestion to include Australia and New Zealand as well as India into the Northeast Asian FTA. In addition to that, a FTA with APEC, which includes US, Canada, Chile, and Mexico, is deemed to be an attempt by the US and Japan to maintain their dominance in East Asia. Realistically, China considers politics to be the first priority when carrying out a FTA rather than economics (Sheng, 2007).
0.226\% increase in GDP (expected benefit of the Nash equilibrium sequence: Sequence 2). Similarly, the political loss to China from forming a Japan-centered FTA is assumed to be around 0.835\% in terms of GDP growth (expected benefit of Sequence 2). If these two arguments are valid, we can explain both the solution of the economic game and the actual events in Northeast Asia (lagged progress in China-Japan FTA). In the real world characterized by rivalry between two nations or two sides as well as economic payoffs dependent on one other, the plausible equilibrium scenario would be that China and Japan form a FTA with Korea in Stage 1, while continuing to avoid a FTA with each other as they carry out China-centered or Japan-centered economic integration in Stage 2.

Ultimately, the major characteristic of the Northeast Asian integration is the instability in the rational strategic decision making of each country arising from the difference between the Nash equilibrium sequence of the economic game and the solution to the game that includes both politics and economy. In other words, the instability of the relationship between China and Japan interferes with the formation of an EAFTA.

The implications of this conclusion on the FTA strategy of each country are as follows. Because time is on China’s side in the long run,\(^{17}\) China is expected to actively pursue Northeast Asian integration based on political motives. Therefore, the best strategy for China is to proceed and establish a politico-economic FTA centered around itself.

\(^{17}\) As China-centered regional trades increase at relatively higher rates than do Japan-centered trades, the probability of a China-centered EAFTA increases. Eventually, there will be no conflict between the political and economic motivations of China.
while forming a coalition with Korea to stalls Japan’s efforts to construct a Japan-centered architecture.

Although Japan does not want an EAFTA centered around China (this tendency is further intensified due to difficulties in internal adjustments of domestic politics), Japan will eventually agree to a Korea-China-Japan FTA because the opportunity cost of exclusion from FTAs in East Asia (expected payoff from EAFTA) will increase with time, and at a certain critical point, this opportunity cost will offset Japan’s political loss. Consequently, Japan’s strategic position will face a more intense challenge as time passes. In this sense, the best strategy for Japan would be to pursue a more active role in EAFTA negotiations, with the goal of demanding that China adopt market-economy principles and systems, while modifying the conventional Japan-centered EAFTA strategy.18)

A Korean FTA with China will provide many economic benefits, and it is highly likely that Korea will receive side payments from China to compensate for the formation of a China-centered EAFTA. However, there is a possibility that Korea will incur a political loss (in-stabilized market principle and order): therefore, it is risky to only consider the economic payoff. Although it is not as severe as the case of Japan, Korea also faces a conflict between an economy-based, China-friendly short-term strategy and a long-term market-system-focused strategy. Thus, while maintaining a credible commitment to cooperation with Japan (maintaining market economy principles and systems), Korea must carry out an economy-centered China-friendly FTA

18) This implication is in the same line with Sohn’s (2010: 517) argument of a soft balancing strategy in which Japan seeks to bind China within an inclusive multilateral framework which includes universal values.
strategy. Finally, the implication of the Korean policy toward Japan is that there is not much economic benefit from forming a FTA with Japan; however, there is much political benefit in maintaining a market-economy system.

V. Summary and Conclusions

This study establishes a simplistic two-stage game in which China, Japan and Korea determine a strategic FTA sequence to maximize each country's payoff using a recursive dynamic CGE simulation. When the three Northeast Asian countries have equal priority rights to choose coalition partners in Stage 1, and when only the economic payoffs are considered, the Nash equilibrium sequence of the Northeast Asian FTA is the S4 scenario: China-Japan FTA in Stage 1 and China-Korea and Japan-Korea FTAs in Stage 2 (Sequence 2 of Table 1).

The game also involves other implications. First, the countries that benefit the most from the FTA among the three Northeast Asian countries are Korea and China. On the other hand, if the EAFTA is delayed or excluded, the countries that will experience the greatest loss are also Korea and China. Second, for China and Japan, the most desirable strategy is to sign a FTA between these two countries at the earliest possible moment in the economic game in which only the economic benefits are taken into account. From the perspective of Korea, however, entering into a FTA with China as soon as possible is the most desirable strategy.

However, the politico-economic rivalry between two countries (China
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and Japan) or two sides (China against Japan and the US) is more important than economic benefits in the real world, causing the Nash equilibrium sequence of the economic game to lose its feasibility. In this case, the plausible equilibrium scenario would be that China and Japan form a FTA with Korea in Stage 1, while never forming a FTA with each other as they carry out China-centered or Japan-centered economic integration in Stage 2. From this, we can derive one important feature of the Northeast Asian FTA game: the instability of the optimal strategic decision of each country due to different solutions to the economic and political games.

Finally, it should be mentioned that all CGE models have their own deficiencies. A CGE model includes an equation system to explain regional inter-industry relations as well as intra-regional trade relations. Theoretically, a variety of equation systems are possible, and a CGE model is just one of them. Therefore, the limitations and particularities of the payoff matrices in this paper are unavoidable (Lee and Moon, 2010: 379).


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Sequencing of Regional Economic Integration: Issues in the Breadth and Depth of Economic Integration in the Americas, University of Notre Dame, 9-10 September.

19) Narayanan, B. G. and T. L. Walmsley (eds.) (2008). Global Trade, Assistance, and Production: The GTAP 7 Data Base, Center for Global Trade Analysis, Purdue University.


### Appendix Table 1. CGE Based Payoff Matrices

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Sequence 1</th>
<th>Sequence 2</th>
<th>Sequence 3</th>
<th>Sequence 4</th>
<th>Sequence 5</th>
<th>Sequence 6</th>
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<tbody>
<tr>
<td>China-Japan</td>
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<td>China-Korea</td>
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<tr>
<td>Japan-Korea</td>
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<tr>
<td>Stage 2</td>
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<td>China-Japan</td>
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<td>China-Japan</td>
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<tr>
<td>Result</td>
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<tr>
<td>China</td>
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<td>0.260</td>
<td>0.756</td>
<td>-0.020</td>
<td>0.756</td>
</tr>
<tr>
<td>Japan</td>
<td>0.116</td>
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<td>-0.030</td>
<td>0.132</td>
<td>0.048</td>
<td>0.133</td>
</tr>
<tr>
<td>Korea</td>
<td>-0.260</td>
<td>1.480</td>
<td>1.501</td>
<td>1.781</td>
<td>0.587</td>
<td>1.773</td>
</tr>
</tbody>
</table>

Note: 1) K, Korea; C, China; J, Japan
2) Database: GTAP 7 Data Base; CGE model: standard GTAP model with capital accumulation closure

### Appendix Table 2. Alternative CGE-Based Payoff Matrices

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Sequence 1</th>
<th>Sequence 2</th>
<th>Sequence 3</th>
<th>Sequence 4</th>
<th>Sequence 5</th>
<th>Sequence 6</th>
</tr>
</thead>
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<tr>
<td>Stage 2</td>
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<tr>
<td>Result</td>
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<td>1.781</td>
<td>0.587</td>
<td>1.773</td>
</tr>
</tbody>
</table>

Note: 1) 70% tariff-reduction in six sectors (agriculture and food) in Japan and Korea
2) K, Korea; C, China; J, Japan
3) Database: GTAP 7 Data Base; CGE model: recursive dynamic GTAP model (GTAP Dyn).
A Computable General Equilibrium Analysis of a Two-Stage Trade Liberalization Game of China, Japan and Korea

Lee, Chang Soo • Kim, Nam Yll

This paper establishes a simplistic two-stage game in which China, Japan and Korea decide upon a strategic free trade agreement (FTA) sequence to maximize the payoff to each country, and the payoff matrix of each sequence of the game is quantified using a computable general equilibrium (CGE) simulation. In this game, the three Northeast Asian countries have equal priority in negotiations for an East Asian FTA (EAFTA); the S4 scenario (China-Japan FTA in Stage 1 and China-Korea and Japan-Korea FTA in Stage 2) is a subgame-perfect Nash equilibrium sequence for EAFTA. However, the instabilities of the strategic decisions for each country are due to the determination of different solutions in the economic versus political games.

Key Words: FTA sequence, North-East Asia, game theory, CGE
JEL Classification: F15, C72, D58