ECONOMIC EFFECTS OF TARIFFICATION ON KOREAN RICE MARKET WITH THE WTO NEGOTIATIONS

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ECONOMIC EFFECTS OF TARIFFICATION ON KOREAN RICE MARKET WITH THE WTO NEGOTIATIONS

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ABSTRACT

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The Korean rice import has been increased steadily under an import quota called the Minimum Market Access (MMA) since the implementation of the Uruguay Round Agreement of Agriculture in 1995. Korea had increased rice import to 4% of domestic consumption under the MMA framework for 10 years. As a result of the WTO negotiation on rice imports in 2004, the special treatment of rice imports has been extended to 2014. In exchange for extending the special treatment, however, Korean government had to agree to double the rice MMA and to allow retail sales of imported rice. The import expansion has influenced all areas related to rice, such as production, consumption, prices, income, marketing, producer subsidies, and policies. A lot of debates on rice tariffication have been made mainly due to recent soar of international rice price, rising rice inventory in Korea, and progress in DDA agricultural negotiations.

In this study, random *n*th price auctions are conducted to evaluate foreign rice relative to Korean rice. This study assess consumers' premium for Korean rice and market share under various scenario using auction bids. This study analyzes some economic impacts of an early tariffication in 2011 and tariffication in 2015 after the completion of implementation period for the special treatment. This study proposes a dynamic ex-ante partial equilibrium simulation model and presents deterministic and stochastic simulations to measure the effects of the tariff reduction and the TRQ expansion on the Korean rice sector with scenarios constructed by the revised drafts of

the DDA agricultural negotiations of the WTO. This study also presents policy implications to Korea through the case studies on rice tariffication in Japan and Taiwan.

According to the results of the experimental auction, consumers would be willing to pay 15.4% and 18.4% premium for Korean rice against U.S. rice and Chinese rice, respectively. This study found that consumers sensitively respond to the country of origin and taste of rice. Under the situation of high tariff and international price, the results of market share simulation suggest that substantial impacts of tariffication on the market share of domestic rice are not expected in Korean rice market. Moreover, if rice is designated as a special product, Korean rice is able to keep its shares regardless of international price.

The projections of the Korean rice economy by deterministic and stochastic simulations indicate that the earlier Korean adoption of rice tariffication rather than increases in MMA volume, the better chances to reduce negative effects on Korean rice industry. The results also suggest that Korea should maintain the developing country status and procure rice as a special product in the DDA negotiation to protect its domestic rice sector. Food security cannot be guaranteed without rice being classified as a special product under the developing country status.

Japan and Taiwan have already experienced a similar market opening process from special treatment for rice import (MMA) to tariffication. As for the rice import after tariffication, tariff imports (out-quota import) have been almost completely prevented mainly due to high tariffs in both countries. Simultaneously, TRQ rice has been disturbed in the domestic rice market. This study suggests that Korea should take measures to improve the competitiveness of its rice sector and to prepare for tariffication.

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INTRODUCTION

1.1 Backgrounds

Rice is a main staple food and the most important product in Korean agriculture. Rice farms account for 71 percent of total farms, and income from rice farming was 47 percent of the total farm income in 2008. Paddy fields for rice utilize more than 58 percent of all arable land but represent no more than 1 million ha. One problem is that rice production exceeds demand; therefore, excess stock inevitably accumulates. Even though the number of rice farms has declined steadily, the average rice farm size is very small. About 83% of rice farms are less than 1.5 hectares in size, and 51% of all rice farms are managed by people over 65 years of age. These two factors indicate that Korean rice farming is not competitive in the global market. Nevertheless, Korea has been required to import mandatory MMA quotas until 2014, even though rice consumption has steadily decreased and excess inventory have been burden to rice farmers as well as government.

As a result of Uruguay Round, Korea was subject to special treatment granting a 10-year grace period (1995-2004), during which rice tariffication could be exempted. Instead of adopting the tariff based system for rice import, Korea had increased rice import under the MMA framework from 1% to 4% of domestic consumption for 10 years. Korea extended the special treatment for an additional 10 years until 2014 as a result of the 2004 rice negotiation. The MMA volume in 2014 should be increased to 8.0% of domestic consumption, which estimated to be 12% in considering the recent

decreasing trend of rice consumption. In addition, a certain portion, at least 10 to 30% of rice imports, has to be sold to consumers as table use, not processing.

Agricultural policy reforms have been implemented in accordance with the pressure to open the rice market. Price support through government procurement had been the core of Korea's agricultural policy. As a result of the Uruguay Round Agreement on Agriculture (URAA), agricultural policies have changed to the direction of decoupled payments. The Korean government has substantialized various rice policies to improve the existing policies for rice industry with rice negotiation. Various policy changes such as discontinuing the government rice-procurement program and introducing public stock holding program and rice income direct payment program are under way to accomplish the balance of rice demand and supply by promoting market mechanism. In recent years, consumers have more focused on food safety and high quality when they purchase rice. Therefore, government has changed polices to meet consumers' demands by introducing a quality certification system and promoting rice brands.

Korea has imported rice from U.S., China, Thailand, and other countries through MMA since 1995. The limited opening of rice market gave no impact to the price mechanism of the rice market, since rice imported under the MMA framework was allowed only for the use of food processing and alcohol under government control. Korean government has controlled the price of government-held MMA rice by considering domestic supply and demand situation. The Korean consumers couldn't buy imported rice for table use in the market. As a result of rice negotiations in 2004, a portion of MMA rice imported from U.S. China, and Thailand have been distributed to the Korean market for table use since 2006 (10% of MMA in 2005 to 30% of MMA in

2010). However, the actual quantity of imported rice distributed for table use has been negligible relative to total consumption in Korea. Moreover, most of them have been sold for restaurants and meal service use. Therefore, it was hard to find the marekt value of imported rice at the retail stage and to generalize the substitution effect between domestic rice and imported rice. Making an accurate estimate on price difference between domestic and imported rice is one of principal tasks in deciding on the rice policy. An accurate forecast of price difference can be a basis for deciding the timing of tariffication, optimal tariff level, and target level of improving the competitiveness after rice tariffication. Japan adopted the tariff based system of its rice imports before the expiration of 6-year MMA commitment, not only because they had suffered from an excessive rice inventory but also because they judged that domestic rice was competitive through valuation of imported rice.

Japan and Taiwan have completely opened their rice markets through tariffication. In Uruguay Round (UR) negotiations on agriculture, Japan had increased minimum market access (MMA) as to 4 to 8% of consumption in return for a 6-year-grace period for tariffication with regard to rice import, but it introduced tariffication two years prior to the completion of the grace period in April 1999. As Taiwan joined the WTO in January 2002, it promised import based on MMA as to 8% of consumption in return for a 1-year-grace period for rice, one of important product items. However, it discontinued special treatment in January 2003, the second year of its accession of the WTO and introduced tariffication without going through negotiations with member countries. The two countries have several things in common in that the rice is their staple food and that it accounts for a large portion of producers' income. Both countries are experiencing a similar market opening process in that they changed rice import

regime from MMA to tariff based system. They also have a similar import regime where tariff is not imposed on mandatory TRQ import and high tariffs are imposed on rice import beyond TRQ volume. However, the effect of the market opening has varied. Japan thoroughly managed imported rice in an effort to reduce a shock to the domestic market at a time of opening its rice market. As a result, it achieved a relative stability in the domestic market. On the other hand, Taiwan opened its rice market when it joined the WTO. As domestic rice prices were drastically reduced from 2002, the first year of the grace period, it had an immediate impact. As described earlier, the two countries were similar in terms of a market opening process, but their effects have varied.

Korea decided to extend the special treatment for rice to avoid substantial impacts of tariffication because more drastic tariff reductions than the UR reduction formula were likely to be discussed in the DDA negotiations. In this regard, Korea's decision to extend the special treatment can be viewed as a provisional measure. DDA negotiations, launched in November 2001, are in the finishing stage of the completion, even though there remain some issues to be resolved. The risk factors from DDA modalities are reduced because the revised modalities comprehensively deal with pending issues including market access; the specific disciplines on tariff reduction formula, TRQ expansions, treatment for sensitive and special products are suggested in the DDA modalities text. A lot of arguments have been made that it is better and efficient to adopt the tariff based system rather than to increase the MMA volume as various measures to protect rice are suggested in DDA negotiations.

1.2 Objectives

New challenges for the Korean agricultural market have emerged mainly due to high fluctuations of international grain price. The fluctuations in rice prices brought new debates on opening rice market since Korea extended Minimum Market Access (MMA) framework with more import quota instead of adopting the tariff based system. In addition, rice market opening would have significant effects on the Korean rice industry since substantial changes are expected in agricultural markets as a result of the current WTO/DDA agricultural negotiations. Great attention has been given to the question of the effect of rice import on Korean rice market, as the debates on rice tariffication deepened.

This study is firstly attempted to assess consumers' willingness to pay for foreign produced rice. An experimental auction mechanism, the random nth price auction, is applied to elicit consumers' willingness to pay for foreign produced rice. The experimental auction creates an active market environment to determine participants' true valuations for imported rice. Therefore, experimental auctions can reduce hypothetical bias. In addition, this procedure creates an incentive for participants to reveal their true preferences. This study will focus on analyzing consumers' premium for Korean rice and the change of market shares under various market environments.

This study analyzes the economic impact of not only an early tariffication in 2011 but also tariffication in 2015 after the completion of the special treatment for rice imports. This paper proposes a dynamic ex-ante partial equilibrium simulation model for the rice sector and measures the effects of an unstable global market and exchange

rates through deterministic and stochastic simulations. This study proposes, for the benefit of policy makers, the time and conditions of tariffication for DDA negotiations.

Japan and Taiwan have opened rice market by changing import regime from MMA to tariff based system. In this regard, the study aims to compare the two countries in terms of the rice market opening process where tariffication was introduced earlier than Korea, the market opening effects on the domestic market, the management of imported rice and problems in domestic rice policy. Through this, the study will find several implications to Korea that considers the introduction of tariffication in the rice sector. The main objectives of this study can be described as follows:

(i) To assess consumers' willingness to pay (WTP) for foreign rice and price premium for Korean rice through experimental auctions.

(ii) To estimate the effect of tariff reduction on market shares of foreign rice and domestic rice in Korean rice market, using auction bids under the various scenarios based on the current DDA negotiations.

(iii) To develop a dynamic ex-ante partial equilibrium simulation model for Korean rice sectors.

(iv) To analyze economic effects of tariffication on Korean rice sectors through deterministic and stochastic simulations based on the DDA scenarios.

(v) To find policy implications to Korea through the case studies on rice tariffication in Japan and Taiwan.

1.3 Organization

The next chapter presents a review of a representative studies on measuring the market value of foreign rice and experimental auctions. Some studies on partial and general equilibrium models for Korean rice analyzing the effect of tariffications are also reviewed. Chapter III describes the trade negotiations surrounding rice issue. The results of UR and 2004 rice negotiations are summarized in detail with its implication to rice tariffication. The situation of DDA negotiations and the modalities on market access are also discussed. Chapter IV covers the experimental designs of the random *n*th price auction, data property, the empirical model, and experimental estimation results. Chapter V develops an empirical model for analyzing the effect of tariffication on Korean rice sector. Model specifications and estimation results are presented. The results of deterministic and stochastic simulations under DDA scenarios are tabulated and compared by scenario. Chapter Ⅵ provides backgrounds and mechanisms of rice tariffication in Japan and Taiwan, respectively. The current situations of rice import and TRQ administrations in Japan and Taiwan are also presented. And finally, their implications to Korea are suggested. This study concludes with Chapter Ⅶ, which presents a summary of the study and a statement of the conclusions reached, and suggestions for future research.

CHAPTER II
LITERATURE REVIEW

Numerous studies have attempted to find and explore the price and quality difference between domestic and foreign rice with the rice negotiations in 2004. There have been various opinions on how the price level of imported rice would be determined on the market. However, there was a wide difference between these results and real market value, since most previous studies had estimated the consumers' willingness to pay without considering their hypothetical biases.

The limited amount of imported rice gave no signal to the price mechanism of market, since rice imported in MMA framework was allowed only for processing or alcoholic use under government control. Korean consumers couldn't purchase imported rice for purpose of meal. Therefore, various studies have attempted to find and explore the potential market value of imported rice. However, most of them have relied on the consumers' willingness to pay without considering hypothetical bias.

Lee et al. (2003) identified the patterns of rice consumption and analyzed rice consumption behavior distinguishing home consumption from dining out consumption through consumer survey. According to the results, 44.5% of the consumers surveyed said that they would never buy imported rice and 43.5% of the consumers who had willingness to buy imported rice said that only if imported rice were cheaper and high-quality, they would buy it. For meal service business, they showed intentions to buy imported rice at 80% price level of domestic rice, if the quality of imported rice was similar to domestic rice. This result implies that consumers have significant preference for domestic rice.

Kim (2004) investigated consumers' willingness to pay for domestic and imported rice from U.S. and China through eating quality test of cooked rice. Consumers showed their preferences and buying decisions without information on the rice (blind) or with information on the rice (non-blind) after eating quality test of cooked rice. Consumers' preferences changed dramatically depending on the terms of blind or non-blind. In addition, the willingness to pay for domestic rice increased after ascertaining the country of origin of rice. Under the non-blind condition, domestic rice was most preferred, followed by U.S. rice and Chinese rice and the premium for domestic rice against U.S. rice and Chinese rice were 4,000 won and 8,000 won per 20Kg, respectively.

Lee et al. (2004) also presented more concrete results on the premium for domestic rice. According to the results, consumers differentiated domestic rice from imported rice and placed a significant premium on domestic rice. There was not a noticeable difference in willingness to pay among domestic, U.S. and Chinese rice in a blind test. The willingness to pay for domestic rice was 32% and 43% higher than that of U.S. and Chinese rice, respectively. The premium for domestic rice among meal service business was about 5,000 won per 20kg lower than consumers' premium.

Park et al. (2006) investigated the market value of imported rice using actual market price and analyzed price difference and substitutability between domestic and imported rice. This study shows that the premiums for the lower priced domestic rice against U.S. and Chinese rice are more than 12,000 won and 8,000 won per 20kg, respectively. The average price of U.S. rice was 67% of the lower priced domestic rice's and the Chinese rice was traded around 77% of that. They expected that Chinese short grain rice would have a significant influence on domestic rice industry and the lower

priced domestic rice would be adversely affected if imported rice was distributed in the domestic market.

Kim et al. (2008) assessed the effect of imported rice on the price of domestic rice by analyzing the marketing situation and public auctions for imported rice. According to the results, the public auction for imported rice did not affect domestic rice prices. However, demand for imported rice would increase 50.4% if the price of imported rice fell more than 13.5%. This study suggested that consumers' perception of imported rice has been gradually improved as its quality has improved.

Ito et al. (1993) conducted a blind test to evaluate California and Philippine rice relative to Japanese rice. According to their results, a 30.3%, 14.6%, 52.8%, and 2.3% of the participants most preferred Philippine rice, California rice, and Japanese rice, and California rice, respectively. Their evaluations in terms of prices, where they had willingness to pay relative to the current Japanese rice prices, were 4,717 yen, 4,491 yen, 5,298 yen, and 3,874 yen per 10kg of milled rice. Further, the average prices evaluated by the participants were found to be not statistically different from one another. These results indicate that Japanese consumers would fairly accept foreign produced rice as far as tastes are considered. Given the fact that foreign rice is substantially cheaper than domestic rice, the demand for foreign rice may be considerably large once the market is opened.

Most previous studies show that the price of imported rice would be lower than domestic rice if imported rice is distributed to the market without tariff. They also suggest that the lower priced domestic rice would be substituted with imported rice. However, these studies had been conducted before imported rice was distributed and there are significant differences among their predictive values.

Fewer studies have attempted to investigate the market value of imported rice using actual market price and analyzed price differences and substitutability between imported rice and domestically produced rice. However, these studies were conducted under incomplete market situation: a small quantity of imported rice was distributed in the short term and most was sold to restaurants or meal service businesses. There remains the limitation of finding the price mechanism of imported rice and generalizing the substitution effect between imported rice and domestic one. More research is needed for more accurate results on price difference and substitution effects between imported rice and domestically produced rice.

The most common experimental valuation methods in the agricultural economics literature today are experimental auctions and non-hypothetical choice experiments (Corrigan et al., 2009). Food economists are trying to identify consumers' preferences for new food products. They, therefore, have developed many value elicitation mechanisms. These methods could be broadly categorized as revealed and stated in their preference methods (Hanely et al., 2006).

Umberger et al. (2003) examined consumers' willingness to pay for country of origin labeling (COOL) of beef using the random *n*th price auction. According to the results, the majority of consumers (73%) were willing to pay 11% and 24% premium for COOL of steak and hamburger, respectively. In addition, consumers were willing to pay a 19% premium for steak labeled "Guaranteed USA: Born and Raised in the US." The most common reasons consumers preferred COOL are food safety concerns, a strong desire to support U.S. producers, and beliefs in the high quality of U.S. beef.

Huffman et al. (2003) examined the effect of introducing GM label on consumers' willingness to pay for three food products using the random *n*th price

auction. Consumers decreased WTP for GM-labeled foods by approximately 14% relative to their standard-labeled counterparts. They said that sequencing of food labels affects willingness to pay, and that randomizing treatments was an important methodological feature in experiments of willingness to pay.

Capra et al. (2006) studied the effects of mood on consumers' willingness to pay and the effectiveness of the demand revealing mechanism, using a random *n*th price auction with induced values and homegrown values. They found that mood does affect the effectiveness of the value elicitation mechanism in revealing value, whereas subjects submit significantly higher bids than their induced values under good mood.

There are some studies comparing the random *n*th price auction to other auction mechanisms. Parkhurst et al. (2004) explored bidding behaviors in the second price sealed bid auction and the random *n*th price auction when people have positive and negative induced values for the good. The results suggested that the second price sealed bid auction was precise but biased: highest-value positive bidders tended to overstate benefits, whereas lowest-negative value bidders understated losses. On the contrary, bidding behavior in the random *n*th price auction was demand revealing irrespective of induced value, but it was imprecise.

Lusk et al. (2004) investigated the effect of several procedural issues on valuation estimates from experimental auctions: the second price sealed bid auction, the English auction, the Becker-Degroot-Marschak (BDM) auction, and the random *n*th price auction. According to the results, the second price auction generated higher valuation than any other experimental auctions, especially in latter bidding rounds, and that random *n*th price auction yielded lower valuations than English and BDM auctions.

Dragicevic and Ettinger (2010) evaluated the impact of three auction mechanisms in the measurement of private WTP and WTA for a genuine public good: the BDM, the second price auction, and the random *n*th price auction. The result suggested that the random *n*th price auction unveiled the highest speed of convergence to equality of the welfare measure indices and that the disparity was dropped with repetition under three mechanisms.

A Few studies have investigated how the endowment method generates bias. Knetsch et al. (2001) analyzed the effect of second price and a ninth price auction rule on valuations. According to the results, the exchange of price rule had a significant impact on subjects' biding behaviors. They also suggested that the endowment effect, the disparity between gain and loss values, remained robust over repeated trials and the Vickrey auction may elicit differing demands which are dependent on the context of the valuation.

Lusk et al. (2004) found that endowing subjects with a good prior to eliciting bids can have an impact on valuations, but the effect varies across auction mechanism. They compared differences in bids between the full bidding and the endowment method[1]. According to the result, for the random *n*th price auction, they found results consistent with the loss-aversion hypothesis[2], while for the second price auction an opposite result was obtained.

Corrigan and Rousu (2006) also explored the difference in bids between the full bidding and endowment method by comparing the difference in bids to upgrade from

[1] The endowment approach has people bidding on "upgrading/downgrading" from one endowed good to another good, whereas the full bidding approach has people bidding on both goods simultaneously

[2] People provided an endowment were willing to pay less to upgrade to another good as compared to people without such an endowment(Lusk et al., 2007)

one endowed unit to two units of the same good. They found that bids for the second unit of the good were significantly higher under the endowment method as compared to the full bidding method. It implies that loss-aversion can be ruled out as an explanation for the results.

There are some studies indicating that the demand reduction is often observed in multiple good valuations. List et al. (2000) conducted empirical tests of whether demand reduction is an important factor in uniform price auctions, using both the Vickrey and the uniform price sealed bid auction formats. They suggested that demand reduction obtains more evident in the uniform price auctions relative to the Vickrey auctions and that the amount of demand reduction is frequently large. They also showed that increased numbers of goods might increase demand reduction, as the possibility of more units at a lower price could increase the incentives for demand reduction.

Lusk et al. (2004) evaluated consumer preferences for several types of beef steaks that either could be used to differentiate and brand beef or are already being used to market beef. They conducted a test of whether the number of goods auctioned affected the difference in value between the generic and guaranteed tender steak. According to the result, the differences in subjects' bids for the generic and guaranteed tender steaks were not influenced by whether other steaks were present. They also suggested that randomly drawing a binding good in each treatment made subjects' bids uninfluenced by the number of goods auctioned, assuming subjects' expected utility was linear in probability.

The experimental auctions create an active market environment in order to obtain feedback from subjects. The auction participants use real money to exchange real goods, so they might focus on the valuation task. For these reasons, the experimental

auctions can minimize the hypothetical bias in consumers' willingness to pay for goods auctioned (Fox et al., 1995, Shogren et al., 2001, Lusk et al., 2004). Another advantage of experimental auctions is repeated rounds of bidding for the same goods. After each round, the monitor posts bid prices, and posted bid prices lead subjects to adapt their bid prices to express their true values of goods over repeated rounds of the experimental auction (List and Shogren, 1999).

The random *n*th price auction was designed to reengage off-margin bidders, who have relatively low or moderate preferences for a good can become disengaged from an auction they cannot profitably win. The random *n*th price auction combines elements of two classic demand-revealing mechanisms: the Vickrey second price sealed bid auction and the BDM mechanisms. The key characteristic of the random *n*th price auction is a random but endogenously determined market-clearing price. Randomness is used to engage all bidders and to reduce any incentive to fixate on a stable market-clearing price. The endogenous price guarantees that the market-clearing price retains some relation to bidders' private values. The random *n*th price auction can induce sincere bidding because bidders cannot use a random market-clearing price as a marker, and they all should be engaged in auction because everyone has an equal chance to buy a unit of the good (Shogren et al., 2001).

The endowment approach has some disadvantages relative to the full bidding approach, even though bids from the endowment approach can directly reflect the value difference between two goods. People who provided an endowment are willing to pay less to upgrade to another good as compared to people without such an endowment (loss-aversion effect). Another disadvantage with the endowment approach is that the endowment itself might send an implicit quality signal to participants. If a person is

endowed with a good and is asked to bid to exchange their endowed good for another, it might create the impression that the endowed good is in some way inferior to the auctioned (Lusk et al., 2007).

The multiple good valuation is economical in that more data can be obtained for little additional cost by obtaining valuations for multiple goods from each subjects. However, the multiple good valuation can be affected by demand decrease or diminishing marginal utility. This problem is exacerbated if subjects bid on multiple goods in several bidding rounds and have the possibility of winning goods in each bidding round. This problem can be easily corrected by randomly selecting a binding round or treatment, where subjects are known a priori that only one good will be purchased. (Lusk et al., 2004)

Recent literature on the measurement of the effects of trade liberalization on Korea's domestic rice market include Kako et al. (1997), Lee et al. (1998), Han et al. (1999), Shin (2000), Han et al. (2003), and Kim and Kim (2004).

Han et al. (1999) provides information on dynamic effects of greater rice market access according to scenarios based on the WTO/DDA agricultural negotiations. With the Korean rice model, they analyze changes in various endogenous variables, producer and consumer surpluses and social welfare in order to compare the effects of quotas and tariffs. The results show that self-sufficiency ratio of rice will be 95.3% in case of maintaining the volume of minimum market access (MMA) of rice at 4% in 2010, but in case that MMA is expanded to 8%, the self-sufficiency ratio will be decreased to 90.7% as a result of a shrinking rice production. According to the simulation results on greater rice market access with tariffication, the self-sufficiency ratio will fall down to 78.4% and the acreage to be planted to rice will be diminished by 30% in 2010. In this

case, the instability caused by fluctuations in the international price and the exchange rate will be augmented. In this case, social welfare will be increased. According to the study results, the gap of social welfare between the scenarios of MMA of 8% and tariffication is about 2.6 trillion won. When comparing the changes in surplus per household, however, the decrease in producer surplus per household is 2.5 million won, 7 times more than the increase in consumer surplus. They suggest that the greater rice market access with tariffication, the more serious difficulties Korean farmers will face. They also suggest that to minimize the negative effects of greater market access, domestic prices should decline as much as possible and the Korean government needs to reform rice policy from the current government-controlled mechanism to a market-oriented system immediately.

Shin (2000) analyzed impacts of greater market access on the Korean rice economy, considering world rice market as well as domestic rice market. This study developed a world rice model for projecting world rice supply and demand and simulated effects of the Korean rice market liberalization according to greater market access scenarios of the next WTO agricultural negotiation. Japonica rice market is composed of seven countries: Korea, Japan, Taiwan, Australia, United States, China, and the rest of the world. Indica rice market is composed of ten countries: Thailand, Vietnam, United States, China, India, Indonesia, Pakistan, Philippines, Brazil, and the rest of the world. Equations on rice demand and supply relationship in each country are estimated and are linked to compose world rice market. Two scenarios are chosen for greater market access in the next WTO negotiation in this study. Scenario I based on the Uruguay Round agreement is 6% annual reduction of current tariffs in the next 6 years in general Member countries of WTO and 24% gradual reduction of current tariffs in

the next 10 years for developing countries. Scenario Ⅱ is 50% gradual reduction of current tariffs in all countries by 2010. Main results of this study are summarized as follows: Harvested area in Korea is expected to decrease about 25% in the case that the eight percent of total consumption is imported by MMA, and to decrease 37% if rice is imported under tariffication. Production is expected to decrease about 19 to 32% in accordance with decrease in harvested areas. Self-sufficiency ratio was also expected to drop from 99.7% in 1998 to 90.9% (scenario Ⅰ) or 70.4% (scenario Ⅱ). This indicates that rice import by tariffication may cause much bigger problem on the Korean rice economy than import by MMA.

Han et al. (2003) analyzed and compared the impacts of greater rice market access by tariff and minimum market access. A Korean rice market model was developed, estimated supply-demand equations, and alternative dynamic simulations were conducted to estimate impacts on rice market by four market access scenarios. Four scenarios are basically based on the information of both the Uruguay Round Agreement and the first draft of modalities of DDA. To compare the impacts between tariffication and MMA, tariff equivalent levels that give the same impacts with various MMA levels were estimated. The worst scenario was that Korea were to be classified as one of developed member countries in the first draft of modalities. The worst scenario's major results are: 1) self-sufficiency ratio drops to 69 percent from 100 percents; 2) planting acreage decreases to 691 thousand ha from 1 million ha; 3) production also decreases from 5 million M/T to 3.5 million M/T within next 5 years. The other scenarios' results also show that great structural change will be expected after the DDA of WTO agricultural negotiations since Korean rice market has been over-controlled by government.

Kim and Kim (2004) analyzed on the short-term and long-term impacts of several policies payment system implemented for Korean rice farm. A dynamic ex-anti partial equilibrium model is developed to estimate effects of the direct payment system. The liberalization of rice market is assumed as follows: (a) the case of MMA expansion from 4% in 2005 to 8% in 2010 and (b) the case of reduction of TE rate (a 15% reduction of TE rate with MMA at 4%, a 45% reduction of TE with MMA at 4%). They analyzed the direct payment system for income support and induction of decreasing of aging farms, the direct payment system for maintenance of public function of paddy field and encouragement of environment-friendly farming, and the direct payment for income support and adjustment of production quantity.

The significant differences between this study and previous studies are as follows. First, this study reflects recent situations in the rice sector and changes in the economic environment. Earlier works have not addressed the results of the WTO negotiation on Korean rice imports in 2004 and the recent progress of the DDA agricultural negotiation in the WTO. Second, the proposed rice model of this study determined the domestic rice price not only by international prices but also the domestic demand and supply. Lee et al. (1998) estimated the effects of liberalization with an assumption that the domestic price should be determined only by the international price. Last, this study performed a stochastic simulation as well as a deterministic simulation to consider the instability of international grain and financial markets and climate changes. Previous studies have ignored risks but measured effects on the domestic market under an assumption that exogenous variables such as international prices and exchange rates would be constant at certain levels.

Recently, international grain and financial markets have become increasingly unstable. If the rice market is liberalized by means of tariffication, the instability of international markets would be directly transferred to the domestic market. Therefore, it is necessary to conduct a stochastic simulation to analyze the range of possible effects, as well as risks, to the domestic market. Recent studies applying stochastic simulations for policy analyses include the following: Richardson et al. (2007) analyzed the economic feasibility of ethanol production in Texas with no risk and with historical risk for prices and costs. Seo and Kim (2009) applied a stochastic dominance approach for farmer's sales decision-making for stored apples in Korea.

CHAPTER III
TRADE NEOGTIATIONS ON RICE

3.1 Uruguay Round Agreement on Agriculture

The basic principle of the Uruguay Round Agreement on Agriculture (URAA) which came into effect in 1995 is the market opening with tariffication for all agricultural products protected by the existing non-tariff barriers such as import restrictions and import bans. However, Japan and Korea made a declaration against the comprehensive tariffication, the principle of URAA, that they could not accept the tariffication of rice. As a result of the compromise among these two countries and major member countries such as the US and the EU, special provisions which could suspend tariffication of rice markets were made at the end of the UR agricultural negotiations.

Korea converted import restrictions on all agricultural products to the tariff based system except for rice and on average 24% (at least 10%) tariff reductions were committed for 10 years according to the URAA. Korean rice was subject to special provisions (Annex 5. Section B) granting a 10-year grace period of 1995 to 2004 during which rice tariffication could be delayed. Instead of adopting the tariff based system, rice imports through the minimum market access (MMA) had been scheduled from 1 to 4 percent of the average annual domestic consumption. A relatively low tariff of 5% has been imposed on rice imports within the MMA quota.

Korea had to increase the MMA volume in equal annual installments by 0.25% during the period of 1995-1999 from 51,307 tons, which equal to 1% of the average annual domestic consumption for the base period. During the period of 2000-2004, the

MMA should be increased in equal annual installments by 0.5% of the average annual domestic consumption and the MMA volume should be increased to 205,228 tons in 2004.

Korea could continue to apply the special treatment for rice, if it is agreed as a result of the negotiation with other interested member countries under the URAA. The negotiation on the question of whether Korea could continue the special treatment should be initiated and completed by the end of 2004 in accordance with the URAA. Korea should confer additional and acceptable concessions to other member countries as determined in that negotiation, if it wishes to continue to apply the special treatment. In case the special treatment was not to be continued, rice should be subject to ordinary customs duties, established on the basis of a tariff equivalent (TE) to be calculated in accordance with the attachment to the Annex 5 of the URAA. The initial tariffs on rice imports should be imposed at the level of 90% of its base tariff equivalent, if Korea switches into the tariff based system for rice imports.

Table 1 Minimum Market Access (MMA) for Korean Rice

Year	MMA (M/T)	% of rice consumption	Year	MMA (M/T)	% of rice consumption
1995	51,307	1.00	2000	102,614	2.00
1996	64,133	1.25	2001	128,267	2.50
1997	76,960	1.50	2002	153,920	3.00
1998	89,787	1.75	2003	179,574	3.50
1999	102,614	2.00	2004	205,228	4.00

Source: Republic of Korea “Schedule LX – Republic of Korea: Agricultural Products” 1994

3.2 Rice Negotiations in 2004

The rice negotiation held in 2004 was a subsequent negotiation to determine whether Korea could extend the special treatment for rice, which was provided as an exception for the comprehensive tariffication but due to expire in 2004. In early 2004, Korea notified the WTO members of its intention of entering into negotiation on the question of whether there can be a continuation of the special treatment. Nine countries including the US, China, and Thailand participated in the rice negotiation. Korea notified the results of the negotiation to the WTO at the end of 2004.

Korea succeeded in extending the special treatment for rice for an additional period of 10 years until 2014 as a result of the rice negotiation. In the 5^{th} year, an intermediate multilateral review for the implementation should be conducted without any resulting effect on the special treatment for rice.

In exchange for extending the special treatment, Korea agreed to increase the rice MMA volume. Korea should increase the MMA volume in equal annual installments by 0.4% during the period of 2005-2014 from 225,575 tons, which correspond to 4.4% of the base-period domestic consumption. The MMA volume in 2014 should be increased to 408,700 tons, which equal to 8.0% of the domestic consumption. The MMA volume in 2014 is projected to be 12% of the domestic rice consumption, which is relatively large considering the recent trend of decreasing rice consumption.

Table 2 Minimum Market Access (MMA) Commitments on Rice

Year	MMA (M/T)	% of rice consumption	Table Rice (M/T)	% of total quota
2005	225,575	4.4	22,557	10
2006	245,922	4.8	34,429	14
2007	266,270	5.2	47,928	18
2008	286,617	5.6	63,055	22
2009	306,964	6.0	79,810	26
2010	327,311	6.4	98,193	30
2011	347,685	6.8	104,297	30
2012	368,006	7.2	110,401	30
2013	388,353	7.6	116,505	30
2014	408,700	8.0	122,610	30

Source: Korean Ministry for Food, Agriculture, Forestry and Fisheries

Two methods were employed to allocate the rice MMA volume: the existing MMA volume of 205,228 tons (on a milled basis), should be allocated on a country-specific basis and the future growth in the MMA volume should be administered on a most-favored-nation (MFN) basis. The existing MMA volume of 205,228 tons should be allocated to China (56.6%), U.S. (24.4%), Thailand (14.6%), and Australia (4.4%) based on the historical trade flows from 2001 to 2003. The volume of the country-specific quotas to each of the four countries should be maintained as long as Korea continues the special treatment. Meanwhile, 20,437 tons of rice, which should be additionally imported from 2005 to 2014 as a result of the 2004 rice negotiations and increased by the same amount, should be administered on an MFN basis. If Korea adopts the tariff based system for rice imports during the implementation period or after the completion of the implementation period, the entire volume of the country-specific quotas should be converted into MFN quotas.

Table 3 Country Specific Quotas (CSQs)

Country	Quota (tons)	(%)
China	116,159	56.6
United States	50,076	24.4
Thailand	29,963	14.6
Australia	9,030	4.4

Source: Korean Ministry for Food, Agriculture, Forestry and Fisheries

With regard to the import system and utilization of imported rice, the existing state trading system will be maintained for the whole quotas. However, a certain portion of the MMA volume, which had been utilized only for processing purpose, should have access to domestic marketing channels for table rice. It implies that table rice should have access to normal marketing channels including wholesalers, distributors and end users. The volume of imported rice to be distributed into the Korean market for table use should be increased from 10% of the total MMA volume in 2005 to 30% of that by the sixth year (2010) of implementation period. After the year 2010, 30% of the total MMA volume should be distributed into domestic markets for table use. For example, 22,557 tons of table rice which would be imported in the first year of the implementation period is not so large but 122,610 tons should be imported for table rice in 2014, the last year of the implementation period. Moreover, table rice should be marketed in a timely fashion so that its quality for table use is not adversely affected by the storage time.

The entire volume of the rice MMA has been imported through state trading system under government's control and a 5% in-quota tariff has been imposed. In

addition, mark-ups could be imposed on imported rice including table rice to minimize possible negative effects on the Korean rice market.

Korea is allowed to convert into the tariff based system for rice imports any year during the implementation period of 2005 to 2014. In such a case, rice should be subject to ordinary customs duties in accordance with the UR agreement on Agriculture. In case Korea ceases to apply the special treatment for rice, the MMA volume already concessed should be maintained. After the tariffication, if the MMA volume is not equivalent to the volume determined in accordance with the result of the DDA negotiations, the greater of the two should be applied.

Considering developments in the DDA negotiations and the situations of the international rice markets, Korea may introduce the tariff based system for rice imports before the completion of the implementation period. Rice imports shall be subject to ordinary customs duties in 2015 when the special treatment is discontinued. The rice negotiation in 2004 was based on the provisions of the URAA in which the negotiation on the question of whether could be a continuation of the special treatment was stipulated to be initiated and completed within 2004. Korea will have to introduce the tariff based system for rice imports in 2015 because there are not provisions related to an additional extension of special treatment.

The tariff rates for rice imports to be established on the basis of a tariff equivalent should be calculated according to the guidelines prescribed in the URAA. The applied out-quota tariff after the tariffication should be determined at the level of 90% of a tariff equivalent to be calculated (10% shadow reduction). Moreover, the tariff rate should be modified, reflecting the results of the DDA negotiations.

These results of the rice negotiation in 2004 can be regarded as positive in that Korea gained more time to strengthen the competitiveness of the Korean rice industry by achieving the goal of extending the special treatment for additional 10 years. In exchange for extending the special treatment, however, Korea had to agree to nearly double the rice MMA and to allow retail sales of imported rice, which contributed to declining domestic rice prices.

The time is coming for the Korean government to determine whether it continues with the special treatment until 2014 as the DDA negotiations have been delayed longer than initially expected, or adopts the tariff based system for rice imports before the end of the implementation period. At the very time when the rice negotiation was held in 2004, it was nearly impossible to predict the results of the DDA negotiations. Korea decided to extend the special treatment for rice for additional 10 years considering that there was a need for some kind of stable insurance because more drastic tariff reductions than the UR reduction formula were likely to be discussed in the DDA negotiations. Subsequently, Korea's decision to extend the special treatment in 2004 can be viewed as a provisional measure.

Uncertainty surrounding the rice issue was somewhat reduced because various measures to protect important agricultural products were suggested in the 4th revised modalities text (Dec. 6, 2008) even though there remains some pending issues to resolve in the DDA agricultural negotiations. Additionally, the revised modalities provided detailed outlines of special and differential treatment for sensitive products or special products. According to the modalities text, if Korea maintains a developing country status in the DDA agricultural negotiations, rice can be designated as a special product which is exempted from tariff reductions. Meanwhile, a lot of arguments have been

made that it is better and efficient to adopt the tariff based system for rice imports rather than to increase the rice MMA volume continuously under the special treatment mainly due to the recent spikes in the international grain prices.

3.3 Doha Development Agenda (DDA) in the WTO

International agricultural trade had been placed under the single international rules and regulations through the Uruguay Round Agreement on Agriculture (URAA) negotiations. The objective of substantial and progressive agricultural reform was confirmed in the URAA. Major achievements of the URAA include the abolishment of quantitative barriers to agricultural trade and multilateral disciplines on domestic agricultural policies (Josling 2003). In pursuing the mandate of the negotiations as stipulated in Article 20 of the URAA, the process of agricultural reforms should be continued in terms of gradual and flexible reduction in support and protection.

A new round of negotiations on agriculture and services had been stipulated to start from the year 2000 in the UR Agreement (so-called Built-In Agenda). The DDA, or Doha Round, was launched in November 2001. The Doha Ministerial Declaration (Nov. 14, 2001) reconfirmed their commitment toward comprehensive negotiations aiming at substantial improvements in market access, phase-out of all forms of export subsidies, and substantial reductions in trade-distorting domestic support. In addition, the focus of the Doha Round is on the development of developing countries because developing countries, comprising two-thirds of the WTO membership, are playing an important role in multi-lateral trade negotiations.

The DDA negotiations on the modalities were initially supposed to be completed by April 2003. Country schedules were set to be submitted to the WTO before Cancun Ministerial Conference which was scheduled for 10th-14th September 2003. The whole Round was due to be finalized by the end of 2004. Until the Cancun Ministerial Conference, the WTO members failed to complete the modalities negotiations. The US/EC compromise draft was rejected by developing countries at the Cancun Ministerial Conference. Cotton producing western African countries also strongly objected to the compromise draft. The WTO members finally failed to agree on the modalities mainly due to lack of leadership from Chairs and US/EU, and objections from new influential negotiating groups like G20 and G10.

As a result of renewed efforts by the WTO members, the Framework Agreement was adopted on August 1, 2004. This was the first agreed document since the launch of the Round. However, the Framework Agreement (July package) contained only directions and principles for reducing support and protection. After the Framework Agreement, the negotiations were active but slow-paced due to conflicting interests among various negotiation groups including G5, G10, G20, G33, and G90. After prolonged intensive negotiations during the Hong Kong ministerial Conference in 2005, however, they finally agreed on the elimination of export subsidy by 2013, elimination of cotton subsidy by 2006 and the completion of the modality negotiation by April 2006. They were successful in reviving some momentum to continue the Round, but important issues like MA were not even discussed.

Ambassador Falconer circulated "Draft Modalities on Agriculture" on July 17, 2007. There were too many square brackets in the text and key numbers were provided for in the form of ranges in the areas of market access, export subsidy, and domestic

support. Different members were of different views on the text, but they generally accepted it as "a starting point, the basis for negotiation, basis for future work, or work in progress." After the first revision (Feb. 2008), second and third revisions (May 2008 and July 10 2008, respectively) were issued for the Mini-Ministerial Conference to be held in Geneva (July 2008).

Even though there remain some issues to be resolved in agricultural area, the revised modalities comprehensively deal with pending issues on three pillars, market access, export subsidy, and domestic support. It is possible scenario to conclude negotiating modalities based on the 4th revised modalities text (Dec. 6, 2008) Core issues to be tacked include SSM, tariff simplification, the number of sensitive products, and cotton subsidy reduction issues. Regarding SSM, it would be important to bridge a gap between positions of India and exporting countries, especially US. With regard to tariff simplification, it is noteworthy that EU still insists only 80% of tariff lines could be converted into ad-valorem tariffs. On the number of sensitive products, Japan and Canada insist on 8% and 6% of tariff lines, respectively, which is opposed by exporting countries. And as far as cotton is concerned, reduction rate of US cotton subsidy is a key issue.

3.4 The 4th Revised Modality for Market Access[3]

The 4th revised modalities text provides tariff reduction formulas, which are divided into four bands according to tariff levels, and by which higher current bound

[3] Among many issues in market access, only those rules directly related to tariff reduction and TRQ expansion are addressed in this section.

tariffs are subject to larger reduction rates (tiered formula). This tiered approach is incorporated in part to harmonize tariff levels across products and countries as well.

Table 4 shows reduction rates for each band of bound tariffs. Developed countries reduce 70% of bound tariffs in the top band during the five-year implementation period. The special and differential treatment for developing countries includes 2/3 of the cut for developed countries over the implementation period of 10 years. Furthermore, tariff levels of the tiers for developing countries are higher than developed countries. Developing countries reduce 46.7% of bound tariffs in the top band over the ten-year implementation period.

Table 4 Tariff Reduction Rates

Developed countries		Developing countries	
Band	Cut (%)	Band	Cut (%)
less than 20%	50	less than 30%	33.3%
20%~50%	57	30%~80%	39.0%
50%~75%	64	80%~130%	42.7%
more than 75%	70	more than 130%	46.7%

* Implementation; 5 years for developed and 10 years for developing countries

The DDA modalities text suggests the option to lower the reduction rate by designating important products as sensitive products instead of applying drastic tariff cuts for agricultural products. Table 5 indicates the treatment for sensitive products. Sensitive products, whose tariff cuts are allowed to deviate from the tiered reduction rate by 1/3 to 2/3, are subject to lower reduction rate than general products (1/3 to 2/3 of

tiered reduction rate). However, TRQ expansion in terms of domestic consumption is required as a compensation for less cuts. Developed countries have to increase TRQ by 3~4% of domestic consumption in accordance with deviation levels, and developing countries are required to increase TRQ by 2~2.7%. For example, if rice is designated as sensitive products, the provisional bound rate of 396% would be lowered to 211%, 257%, or 304% respectively given the developed countries' tiered rate of 70%. Simultaneously, 3.0%, 3.5%, or 4.0% of TRQ expansion are also required.

Table 5 Treatment for Sensitive Products

Deviation	Tariff Reduction rate	TRQ Expansion (% of domestic consumption)	
		Developed Countries	Developing Countries
1/3	2/3 level of tiered rate	3.0	2.0
1/2	1/2 level of tiered rate	3.5	2.3
2/3	1/3 level of tiered rate	4.0	2.7

As in the case of tariff reduction, the special and differential treatments for developing countries are also applied to the treatment of sensitive products. Table 6 shows the options for sensitive products of developing countries. The TRQ expansion for developing countries is subject to 2/3 level of that of developed countries. Additionally, a portion of sensitive products have an option to curtail the implementation period instead of TRQ expansion. For example, when sensitive products incorporate 1/3 (or 1/2 or, 2/3) deviation from the normal reduction rate, the implementation period should be shortened to 3 (or 2, or 1, respectively) years.

Otherwise, sensitive products are able to extend the implementation period by 3 years (totally 13 years) by applying the normal reduction rate rather than lower reduction rate.

Developed countries can designate sensitive products up to 4% of tariff lines, whereas developing countries are able to designate sensitive products up to 5.3%. Korea has 1,452 tariff lines for agricultural products at the HS 10 digit level including 16 tariff lines for rice, non-tariffication product. Therefore, Korea can designate 77 tariff lines as sensitive products if Korea maintains the status of developing country in the DDA negotiations, and 58 tariff lines are able to be designated as sensitive products in the case of developed country.

Table 6 Seven Options for Sensitive Products of Developing Countries

Tariff Reduction	TRQ Expansion	Implementation Period	Number of Sensitive Products
① 1/3 Deviation	None	3 years	Up to 1/2 of Sensitive Products
② 1/2 Deviation	None	2 years	Up to 1/3 of Sensitive Products
③ 2/3 Deviation	None	1 year	Up to 1/4 of Sensitive Products
④ Normal cut	None	13 years	Unlimited
⑤ 1/3 Deviation	2.0%	10 years	Unlimited
⑥ 1/2 Deviation	2.3%	10 years	Unlimited
⑦ 2/3 Deviation	2.7%	10 years	Unlimited

Developing countries are able to self-designate special products based on three criteria with 12 indicators: food security, livelihood security and rural development. Special products, if not all, are allowed to be exempted from tariff reductions. Special

products are also exempted from TRQ expansion in exchange for making no tariff reduction unlike sensitive products. Table 7 summarizes the proposed treatment for special products. Developing countries are eligible to designate 12% of tariff lines for agricultural products at the HS 10 digit level as special products. 5% of tariff lines can be exempted from tariff reduction in case the overall average tariff cut is no less than 11%.

Table 7 Treatment for Special Products of Developing Countries

Eligible number	Eligible for no tariff cut	Overall average tariff cut
12% of tariff lines	5% of tariff lines	11%

Exporting countries have strongly argued for introduction of tariff ceilings which set up the least upper bound to ensure that tariffs do not exceed a certain level after reductions are made. The 4th revised modalities text also does not include uniform tariff ceilings. All products except for sensitive products, special products, and a certain portion of general products are subject to tariff ceilings of 100% for developed countries and 150% for developing countries. Sensitive products are eligible to be exempted from tariff ceilings by further expanding TRQ volumes which correspond to 0.5% of domestic consumption for developed countries and 0.3% of that for developing countries. However, special products for developing countries are exempted from tariff ceilings without further expansion of TRQ volumes.

Furthermore, the trade remedy (SSM) is supposed to be introduced as a result of the DDA agricultural negotiations, which allows developing countries to impose additional duties in case imports surged or import prices declined. For example, SSM

enables developing countries to raise import tariffs when import prices fall below 85% of a predetermined trigger level, or when the import volume exceeds 110% of a trigger level. Especially, SSM is considered more useful than SSG. While SSG, the trade remedy for import surges agreed in the UR, has the limitation that it can be applied to specific agricultural products protected by non tariff barriers and tariffied in UR, SSM can be applied to every agricultural product, therefore SSM is considered more useful to developing countries.

Member countries are able to protect their important products by designating them as sensitive or special products even though substantial improvements in market access have been claimed in the DDA negotiations. Moreover, a portion of special products can be fully exempted from tariff reduction. In this regard, there remains little uncertainty arising from the DDA negotiations to introduce the tariff based system for rice imports. In addition, SSM, a more extensive trade remedy than SSG, was newly acknowledged in the DDA negotiations, so more favorable conditions seem to be created to convert into rice tariffication. From this overall perspective, then, a shift into the tariff based system for rice imports needs to be considered.

CHAPTER IV
VALUING FOREIGN RICE AND SUBSTITUTION EFFECT

4.1 Experimental Design for Valuing Foreign Rice

This study is limited to consideration of consumers' willingness to pay for U.S[4]., Chinese[5], and Korean rice[6], even though Korea has imported rice from U.S., China, Thailand, and other countries. However the market demand for imported rice from other countries is negligible in Korea.

The experimental auction, the random *n*th price auction, was conducted in August, 2010. This study employs the full bidding method because the endowment approach is not appropriate for bidding on multiple goods. The full bidding method which has subjects bid full value for several goods is more preferable for this study. A total of 75 subjects participated in the auctions. Auction participants were randomly recruited in a metropolitan area in Korea including Seoul city. Most participants were female and were married because housewives are the primary shoppers for rice. No participant was allowed to participate in more than one experiment.

The experimental auction includes 3 treatments and each treatment includes different information on imported rice: taste only, country of origin label only, and both taste and country of origin label. Since consumers' preferences can change with information on taste and country of origin. The information on country of origin can mainly affect consumers' preferences and the effect of taste would gradually strengthen.

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[4] CALROSE (milled rice, U.S. No.1 grade, medium grain)
[5] Golden Terra (milled rice, U.S. No.1 grade, short grain)
[6] Gyeonggi rice (milled rice, Korean No.1 grade, short grain)

One treatment with 5 repeated rounds is conducted by 2 groups which are composed of 12 and 13 subjects respectively. The structural framework for experimental auction is illustrated in Figure 1.

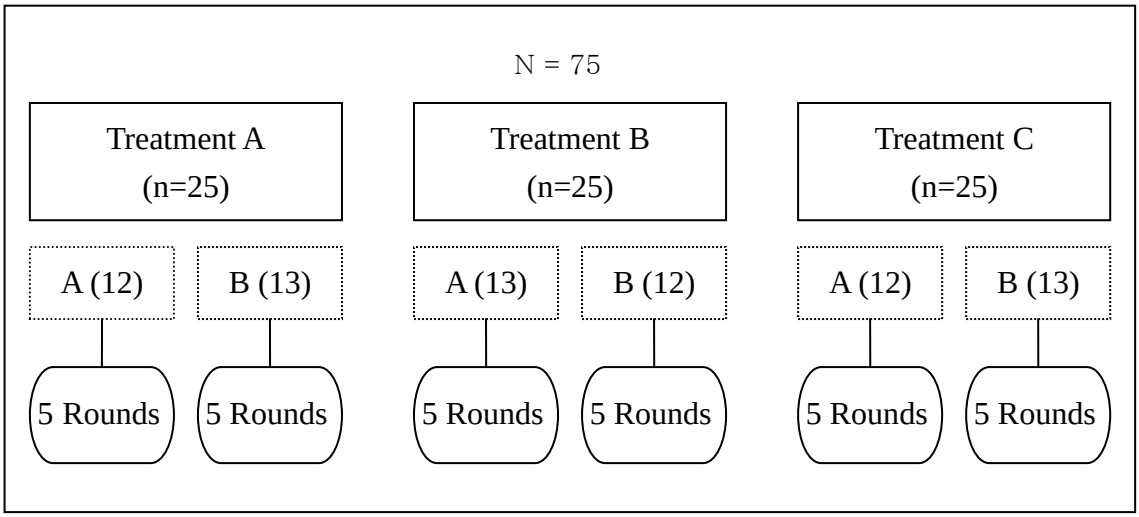


Figure 1 Structural Framework for Experimental Auction

4.2 Design for the Random *n*th Price Auction

In order to elicit consumers' valuations for the imported rice, this study conducted the random *n*th price auction, in which participants submit sealed bids for rice and the winner is determined by randomly selecting a bid price from those submitted (this would then be the *n*th bid) and declaring all who bid above that level as the winner/s. The winning bidder/s would then have to pay the bid price submitted by the *n*th bidder. The procedures of experimental auction, the random nth price auction, are illustrated in Figure 2.

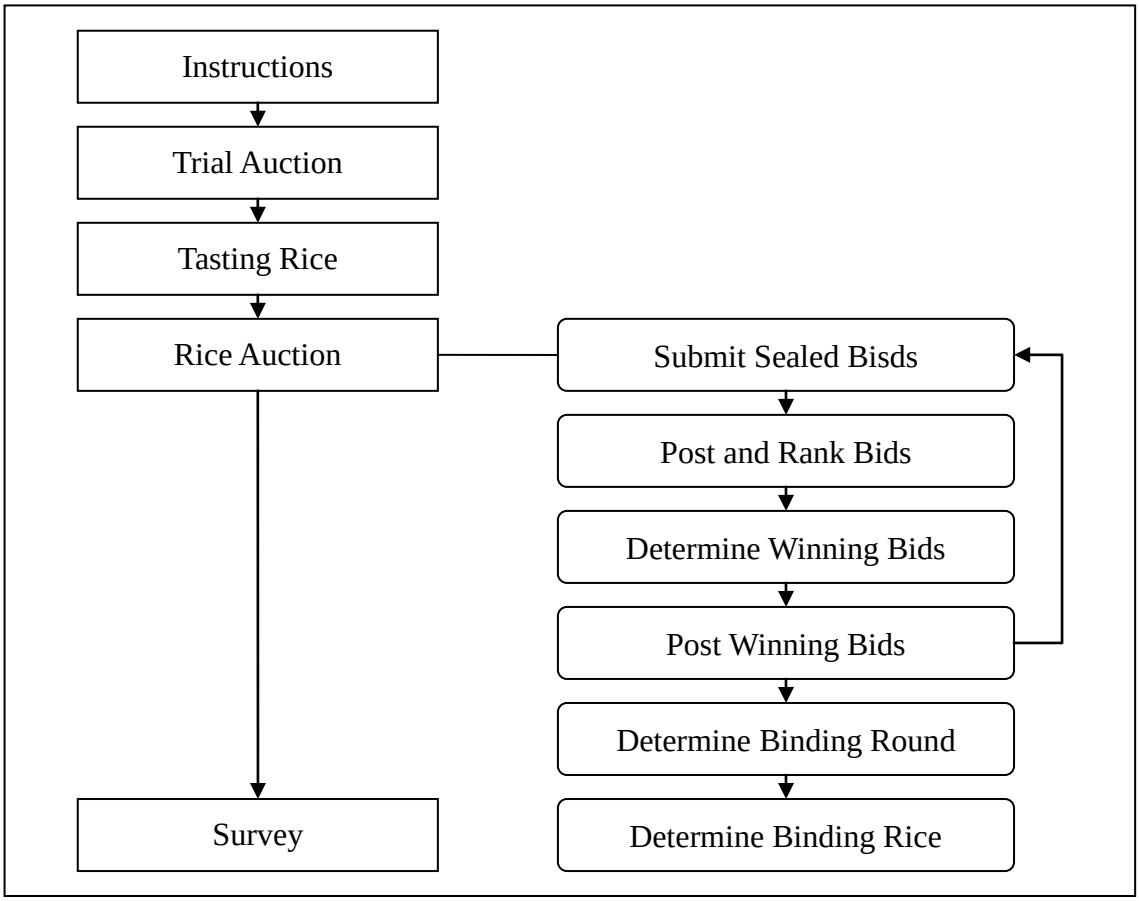


Figure 2 Flow Chart of Experimental Auction for Rice

The random *n*th price auction is conducted as follows:

1) Participants arrive and are assigned to their seats. No one in allowed to communicate with the other participants in the room. Each is given an ID number marked in the folder/packet handed out by the monitors/facilitators. Participants are informed verbally and also provided with written instructions that indicate that they would be allowed to bid for what they would require to pay for rice. Participants are also informed that they would be allowed to place anonymous bids for what they would need to pay to get rice.

2) After all questions have been answered, a trial auction is held using two chocolate bars prior to the rice auction to help subjects learn about the auction mechanism. There are two rounds of bidding for chocolate bars.

3) Next, participants taste freshly cooked rice from different sources without information on their country of origin in treatment A, whereas participants taste cooked rice with information on their country of origin in treatment B. In treatment C, visual displays of fresh rice with information on country of origin of rice are provided without tasting.

4) After tasting, five rounds for rice auction begin. At the start of each round, participants submit a sealed bid price representing how much value each participant puts on the rice.

5) After participants have finished writing their bids, the monitor collects the bid sheets. In the front of the room, each of participants' bids is ranked from highest to lowest for the each kind of rice.

6) Next, a random number is drawn to determine how many participants win the rice. The random number (N) is a number between 1 and the total number of participants. The N-1 highest bidders win the auction and all winning bidders pay the Nth highest bid amount for the exchange. Participants are provided with bidding slips, on which they would write down and record their bids. For

example, supposing there are 10 participants that submitted bids and the number 4 is randomly drawn by the monitor (i.e., N=4), then the 3 (N-1) highest bidders will win the auction and each pays the 4th highest bid amount for the winning rice.

7) For the each rice, the monitor writes the winning participants' numbers, the random number (N), and the winning price on the whiteboard for everyone to see. After posting the prices and winning bidder numbers, the auction is repeated 4 more rounds.

8) On the completion of the 5th round, the monitor randomly draws a number from 1 through 5 to determine the binding round. For example, if the monitor randomly draws the number 3, then the outcomes in other rounds are ignored and the winning bidders and price in round 3 is focused on. Importantly, all rounds have an equally likely chance of being binding.

9) After the binding round has been determined, the monitor randomly draws a number 1 through 3 to determine which rice is on actual auction (either the U.S. rice, the Chinese rice, or the Korean rice). For example, if the monitor draws the number 1, the bids for U.S. are focused on and the bids for Chinese and Korean rice are ignored. Once the binding round and rice have been determined, the winning bidders are announced. Once the binding round and rice have been determined, the winning bidders come forward and pay the Nth highest bid

amount for the winning rice. All other participants pay nothing and will not receive rice.

Participants are informed that the best strategy is to bid exactly what the each rice is worth to them and that it is acceptable to bid 0 won for any rice in any round. Participants are also informed that any communication between bidders result in an automatic penalty of 1,500 won. All participants are paid 10,000 won for taking part in the experiment after 5 rounds of auctions.

4.3 Experimental Data and Results

Experimental Data

The total number of participants in the auction is 75 people from the metropolitan area in Korea including Seoul city. All participants were initially contacted by phone and made an appointment for the experiment. Demographic summary statistics are shown in Table 8. The average age of the subjects is 48.7 years in the experimental auctions. On average, the household size of participants is 3.56 persons. The monthly average household income before tax is from 3 million won to 4 million won. Most participants are married females because the housewives are the primary shoppers for rice. Of the participants in the auction, 43% had graduated from high school, 21% had graduated from junior college (two-year), and 32% had graduated from university. 55% of participants know that imported rice had been distributed and it is available in the market. However, only 7% of the participants in the auction had the

experience of purchasing imported rice and most participants had never bought imported rice. In addition, participants are firstly concerned with taste when they buy imported rice, followed by food safety, price, and others. This result implies that the criterion for selecting rice has changed to taste from price and the importance of food safety has strengthened as per capita income grows.

Table 8 Participants' Socioeconomic Characteristics

Variable	Categories	(N = 75)	
		Mean	Std. Dev.
Age		48.7	9.6
Household size		3.56	1.2
Family income [a]		4.48	2.1
Gender	Male	13%	
	Female	87%	
Education	High school	43%	
	College	21%	
	University	32%	
Awareness about rice import	Informed	55%	
	Uninformed	45%	
Experience of buying imported rice	Experienced	7%	
	Unexperienced	93%	
Concerns on imported rice	Taste	42%	
	Safety	29%	
	Price	15%	

[a] Family income was reported in 9 \1,000,000 intervals: (1: less than 999,999, 2: 1,000,000 to 1,999,999, . . . , 9: 8,000,000 and higher)

Empirical Model

The Ordinary Least Square (OLS) model is used for analyzing consumers' bidding behaviors in experimental auction with individuals' valuation data. The OLS model can describe the relationship between a dependent variable WTP and independent variables X which are expected to influence bids.

(4.1) $WTP = \beta X' + \varepsilon$

This model is also adjusted to incorporate random effects to account for the panel data. Since the result of the Hausman test, which tests the appropriateness of the random-effects specification, shows that the individual-specific error term is uncorrelated with the included regressors.

(4.1) $WTP_{ij} = \alpha_i + \beta X_{ij} + \varepsilon_{ij}$

In the random-effects models α_i are individual-specific errors. This produces an error components model, where the overall error in the model is $\alpha_i + \varepsilon_{ij}$. In a random effects model, the constant is treated as a random variable and is modeled as $\alpha_i = \overline{\alpha} + \sigma u_i$, where $\overline{\alpha}$ is population mean intercept, σ is the population standard deviation of the intercept, and u_i is an unobserved random term that is typically assumed to be distributed normally with zero mean and unit standard deviation.

This study conducts market share simulations using the bids data from experimental auction. Although experimental auctions do not provide a utility level for competing goods, they provide a measure of the monetary value of the good, which can provide a money-metric measure of the utility, when coupled with a price and the assumption of linear marginal utility. Supposing that people submit bids for J goods in

an experimental auction, the money-metric utility individual *i* is derived from good *j*. WTP_{ij} is the bid for good *j* and P_j is the price of good *j*. (Lusk et al., 2007)

(4.3) $$U_{ij} = WTP_{ij} - P_j$$

There are several ways to use the money metric-utility to determine market share: (a) the highest utility rule[7], (b) the Bradley-Terry-Luce (BTL) model, and (c) the logit model[8]. The BTL model is used to simulate market share of imported rice and domestic rice in this study. With the BTL approach, the market share of rice *j* is calculated by dividing the utility of rice j by the sum of utilities for all K rice in the simulated market.

(4.4) $$Market\ share_{ij} = \frac{U_{ij}}{\sum_{k=1}^{K} U_{ik}}$$

The final market share estimate is calculated by averaging these individuals' estimated market share.

(4.5) $$Final\ market\ Share_j = \frac{1}{n}\sum_{i=1}^{n} Market\ share_{ij}$$

Experimental Results

The mean bids of participants are tabulated in Table 9. Consumers' willingness to pay for imported rice from U.S. and China in the auction are 6,878 won/4kg and

[7] The market share of a particular good *j* is calculated by dividing the number of people having the highest utility for good *j* by the total number of people in the simulation.

[8] Market share are calculated by dividing the logit value for one product by the sum for all other products in the simulation. Using the logit formula, the market share of good *j* for individual *i* is given by:

$$Market\ share_{ij} = \frac{e^{\lambda U_{ij}}}{\sum_{k=1}^{K} e^{\lambda U_{ij}}}$$

6,701 won/4kg respectively, whereas consumers' willingness to pay for domestic rice is 7,937 won/4kg. According to the mean bid prices for U.S. rice and domestic rice, consumers would be willing to pay a 15.4% premium for buying domestic rice against the U.S. rice. According to the average bid prices for the Chinese rice and domestic rice, consumers would be willing to pay an 18.4% premium for buying the domestic rice against the Chinese rice. The most common reasons for these results are food safety concerns, a strong desire to support domestic producers, and beliefs that domestic rice is of higher quality.

Consumers are becoming increasingly concerned with food safety and also desire more information to differentiate imported farm products from domestic farm products such as the country of origin. The Genetically Modified Organism (GMO), the Bovine Spongiform Encephalopathy (BSE), and the Avian Influenza (AI) have been very sensitive issues in Korea. In addition, the public auction for imported rice for table use started in 2006, beginning with U.S. rice. The negative social atmosphere toward imported rice has led public auction to fail: Korean farmers desire strongly to protect domestic rice market and public opinion is still hostile to the marketing imported rice. Not only this social atmosphere but also negative palatability results have caused large distributors fail to attend the public auction when imported rice first came into the market.

This study performs five repeated bidding rounds for the same rice in each treatment, with prices posted at the conclusion of each round, and with one of the rounds randomly selected as binding. During multiple bidding rounds with price feedback, market prices are endogenously determined in the auction and participants can incorporate market information into their valuations. As shown in Table 9, bids tend

to increase over the first few bidding rounds and then tend to stabilize after a few rounds of bidding. Participants do not continually increase their bid prices for the U.S. rice across rounds. The mean bid price in round 5 for the U.S. rice is lower than the value in round 4. This result implies that participants display their maximum willingness to pay for U.S. rice in round 4, and that posting the bid price does not bias participants' bidding behaviors.

On the other hand, mean bid prices for the Chinese and Korean rice in the auction continually increase across rounds. Mean WTP increases across rounds can be attributed to the fact that the monitor posts the bidding price after each round. This means that posted prices in the earlier round may affect bid prices in the later round. However, the median bid prices for the Chinese and Korean rice in the auction do not continually increase across rounds. The median bid prices for each kind of rice in the auction increase round 1 through round 4 and they finally stabilized or decrease afterwards. This result indicates that participants display their maximum willingness to pay for Chinese and Korean in round 5; this result support that there is no round affiliation in the auction. The gap between mean and median bids in round 5 is mainly due to the increases in the bid prices of on-margin bidders. The advantage of the random *n*th price auction over the other elicitation mechanisms is the randomness. The randomness may engage all bidders and reduce the likelihood of bias in participants. Even if some bidders who with a lower willingness to pay for each kind of rice than other bidders submitted their true values, they would have an equal chance to purchase rice in the random *n*th price auction.

To identify whether the bidding price stabilizes over the 5 rounds, mean bid prices are divided by each standard deviation in each round. Table 9 indicates the bid

prices stabilized over rounds in the auction. If the mean bid price over standard deviation increases across rounds, the bid price becomes stable due to decreasing standard deviation over rounds. This result is caused by the learning effect. According to auction results, these values increase continually over rounds except round 5. This means that the gap of bid prices between on-margin bidders and off margin bidders decreases and bid prices are not significantly different over rounds.

Table 9 Mean and Median Bids by Country of Origin (Round)

Unit: won/4kg

	Round					
	1	2	3	4	5	Total
WTP(U.S.)						
Mean	6,700	6,755	6,948	7,029	6,957	6,878
Median	7,000	7,000	7,500	7,000	7,000	7,000
Std. dev.	1,601	1,355	1,378	1,331	1,350	1,405
Mean/Std. dev.	4.18	4.99	5.04	5.28	5.16	4.90
WTP(China)						
Mean	6,270	6,424	6,632	7,077	7,100	6,701
Median	6,500	6,500	6,500	7,500	7,100	6,900
Std. dev.	1,886	1,697	1,624	1,628	1,974	1,790
Mean/Std. dev.	3.32	3.79	4.08	4.35	3.60	3.74
WTP(Korea)						
Mean	7,521	7,746	7,909	8,149	8,358	7,937
Median	7,500	8,000	8,000	8,500	8,500	8,000
Std. dev.	1,085	918	959	962	1,021	1,029
Mean/Std. dev.	6.93	8.43	8.25	8.47	8.19	7.72

The information on taste and country of origin would influence Consumers' preferences. The experimental auction in this study is designed to evaluate consumer perceptions and willingness to pay for the rice by providing different information. The

experimental auction is composed of three treatments to account for the potentially important effects of both taste and country of origin on consumers' perceptions and their willingness to pay for the rice. Three treatments formats are defined as follows: (a) Taste = consumers tasting freshly cooked rice without information on the country of origin similar to home consumption of rice, (b) Taste and COOL = consumers tasting freshly cooked rice with information on the country of origin, and (c) COOL = visual display of fresh rice provides consumers information on visual attributes and country of origin under conditions comparable to a supermarket purchase.

Several previous studies have examined information effects. Kim et al. (2004) suggested that consumers' preferences changed dramatically, depending on the terms of blind or non-blind conditions. In addition, the willingness to pay for domestic rice increased after ascertaining the country of origin of rice. Under the non-blind condition, domestic rice was most preferred, followed by the U.S. and Chinese rice. Lee et al. (2004) also showed that consumers differentiated domestic rice from imported rice and placed a significant premium on domestic rice. There was not noticeable difference in willingness to pay among the domestic, U.S. and Chinese rice in a blind test.

Table 10 shows mean and median bid prices by participants with different information from three treatments. Participants' bidding behaviors are affected by different information on rice. This study finds that consumers attach value to the country of origin and taste of rice. Taste information on rice results in favorable assessment for imported rice and resulted in a higher bid price to buy imported rice. WTP difference between treatment B (Taste + COOL) and treatment C (COOL) is much different in the case of imported rice, as shown in Table 10. Participants with information on taste would pay 34.5% higher for the U.S. rice and 45.8 % for the

Chinese rice. However, difference in willingness to pay for domestic rice is not much noticeable. The information on the country of origin led to lower bid prices for imported rice. However, the information on the country of origin induced higher bid prices for domestic rice. The result shows that there are significant differences in willingness to pay for domestic and imported rice between treatment B (Taste + COOL) and treatment A (Taste). Participants decreased their bid prices by 7.8% for the U.S. rice and 1.7% for the Chinese rice. On the other hand, participants increased their bid prices by 8.3% for domestic rice. Participants significantly respond to information on the country of origin. Additionally, the effect of taste dominates that of country of origin on consumers' perceptions and their willingness to pay for imported rice.

Table 10 Mean and Median Bids by Country of Origin (Information)

Unit: won/4kg

	Information (Treatments)			
	Treatment A (Taste)	Treatment B (Taste + COOL)	Treatment C (COOL)	Total
WTP(USA)				
Mean	7,912	7,296	5,426	6,878
Median	7,900	7,000	5,000	7,000
Std. dev.	823	879	1,060	1,405
WTP(China)				
Mean	7,563	7,438	5,101	6,701
Median	8,000	7,600	5,000	6,900
Std. dev.	1,598	1,175	1,362	1,790
WTP(Korea)				
Mean	7,607	8,235	7,967	7,937
Median	7,600	8,500	8,000	8,000
Std. dev.	984	844	1,145	1,029

This study performed a simple mean equality t-test on WTPs by treatment with different information. The results of the t-test are tabulated in Table 11. The mean equality t-test on WTPs of different sources of rice indicates that estimated mean WTPs are statistically different between imported rice and Korean rice. The results of unconditional tests by treatment show that information on taste and country of origin has a significant effect on participants' bidding behaviors. Under treatment A, where participants tasted each kind of rice without information on their country of origin, the mean WTP difference between U.S. rice and Korean rice is estimated to be 305 won per 4kg at 1% of significance level. This implies that the mean WTP of U.S. rice is 305 won per 4kg greater than that of Korean rice. However, mean WTP difference between Chinese rice and Korean rice is statistically not significant. When participants obtain information both of taste and country of origin (Treatment B), mean WTP difference between U.S. rice and Korean rice is – 939 won per 4kg, whereas mean WTP difference between Chinese rice and Korean rice is – 797 won per 4kg. Under treatment C, in which participants receive information on country of origin without tasting rice, mean WTP differences between imported rice and Korean rice become wider. The mean WTP of Korean rice is 2,541 won and 2,867 won per 4kg greater than U.S. Rice and Chinese rice, respectively.

In these contexts, participants' premium for country of origin for domestic rice is very high. However, participants more significantly respond to taste than country of origin. Information on taste has a positive effect on participants' bidding behaviors for imported rice. Once consumers experience imported rice, their negative image on imported rice would improve. This implies that policymakers should try to improve the quality and taste of domestic rice to offset the taste effect.

Table 11 t-test for Equality of Mean WTP

	Mean Difference	Std. Error of Difference	t-value
Treatment A (Taste)			
$H_0 : \mu_{US} - \mu_{KR} = 0$	304.80***	114.69	2.66
$H_0 : \mu_{CN} - \mu_{KR} = 0$	-44.40	167.82	-0.27
Treatment B (Taste and COOL)			
$H_0 : \mu_{US} - \mu_{KR} = 0$	-939.44***	108.95	-8.62
$H_0 : \mu_{CN} - \mu_{KR} = 0$	-797.04***	129.40	-6.16
Treatment C (COOL)			
$H_0 : \mu_{US} - \mu_{KR} = 0$	-2,540.88***	139.59	-18.20
$H_0 : \mu_{CN} - \mu_{KR} = 0$	-2,866.56***	159.18	-18.01

*** denotes significance at 1% level

A regression model is constructed to analyze participants' bidding behaviors. The dependent variables are participants' bid prices for each kind of rice. Independent variables are participants' demographic characteristics, information treatments and round effects. A preliminary data analysis identified relatively low correlations (ranging from 0.01 to 0.20) among the explanatory variables, implying that it would isolate the impact of each attribute on consumers' WTPs. Table 12 indicates parameter estimates of the regression for willingness to pay for imported rice in the auction. According to the results, taste and experience in purchasing imported rice significantly influence the participants' WTPs, whereas age, education, and family income do not. The positive estimate of taste for U.S rice shows that the participants who choose taste as a priority when purchasing rice tend to pay more for U.S rice rather than who choose the others as a priority. Moreover, its coefficient is larger than those of Chinese and Korean rice. This implies that U.S. rice has competitiveness of taste in Korean rice market. The sign for experience variable is positive for Chinese rice and negative for Korean rice.

Participants who have purchased imported rice pay more for Chinese rice and pay less for Korean rice. It implies that consumers who purchased imported rice tend to pay more for imported rice than those who have no experience. Consumers who have bought imported rice tend to realize that the quality of imported rice is better than they expected. Useful information can be obtained through the signs of age, education, and family income variables, even though they are not statistically significant. The negative sign of age variable indicates that older consumers tend to pay relatively less for imported rice comparing with domestic rice. The negative sign of education variable in the case of U.S rice means that consumers with a higher level of education would pay less for U.S. rice. The positive sign of family income variable implies that consumers who have more income tend to pay relatively more for domestic rice compared with imported rice.

According to conditional tests of information effects, the information on taste positively influences participants' bidding behaviors for imported rice. However, the information on country of origin positively influences participants' bidding behaviors for domestic rice. The ordering of information effect is consistent with the previous result in Table 10. Round effects are the same as previous results in Table 9. Participants increase bid pries for Chinese and Korean rice over rounds, while maximum bid prices for U.S. rice are displayed in round 4. As for the result of conditional test itself, it seems reasonable to conclude that there is round affiliation in the auction. As mentioned earlier, however, participants would have an equal chance to buy rice in the random *n*th price auction, even though they have lower willingness to pay than other participants'. In addition, the median bid prices didn't increase

continuously over the rounds. Accordingly, the result can be interpreted as consumers displayed their maximum willingness to pay for Chinese and Korean rice in round 5.

Table 12 Results from Random Effect OLS Regression

	Coefficient Estimates		
	WTP(U.S.)	WTP(China)	WTP(Korea)
Constant	8,479.3***	6,703.9***	6,669.6***
	(13.62)	(7.05)	(9.88)
Age	-11.6	-13.1	-4.2
	(-1.27)	(-0.94)	(-0.43)
Education	-96.6	178.1	71.4
	(-1.02)	(1.23)	(0.69)
Family Income	6.82	36.1	69.8
	(0.17)	(0.57)	(1.56)
Taste (Priority When Purchasing Rice)	480.7***	111.5	185.8
	(2.67)	(0.40)	(0.95)
Experience (Purchasing Imported Rice	459.3	1,637.2***	-356.6
	(1.33)	(3.11)	(-0.95)
Treatment B (Taste and COOL)	-601.5***	52.1	748.6***
	(-2.78)	(0.16)	(3.19)
Treatment C (COOL)	-2,557.4***	-2,484.6***	518.2**
	(-11.51)	(-7.32)	(2.15)
Round2	55.3	154.1	224.8**
	(0.54)	(1.15)	(2.09)
Round3	248.3**	362.3***	388.5***
	(2.42)	(2.70)	(3.61)
Round4	328.9***	807.3***	627.7***
	(3.21)	(6.01)	(5.83)
Round5	257.1**	830.4***	837.1***
	(2.51)	(6.18)	(7.78)
Adj-R^2	0.616	0.507	0.178

z-values in parentheses.

, * denote significance at 5%, 1% levels, respectively.

4.4 Market Share Simulations

This study conducts market share simulations for rice tariffication. Bids from experimental auctions are used to forecast the market share of imported rice and to determine how market share changes after price change of imported rice. Four scenarios are composed by the price level of imported rice. The exchange rate and tariff rate are assumed to be 1,100 won per dollar and 396% of ad valorem, respectively. The retail margin of imported rice including freight, handling charge, and profit is assumed to be 732 won per 4kg (Kim et al., 2008). The consumer price of Korean domestic rice is assumed to be 7,962 won per 4kg which is the average consumer price in 2009.

Table 13 shows the results of the market share simulations. After rice tariffication, if the import price (c.i.f.) of U.S. rice and Chinese rice is higher than $450/MT, the whole share would go to domestic rice in Korean rice market. This result implies that there would be no negative effect of tariffication on the market share of Korean rice under these situations: high tariff and high import price. As expected, demand for imported rice increases when the import price falls. At the import price level of $300/MT, 30.0% and 26.9% of consumers are predicted to choose the imported rice from U.S. and China. The U.S. rice shows a large increase in market share than Chinese rice when the import price changes from $350/MT to $300/MT. This result is due to high standard deviation of bids for imported rice from China. Market share simulations by treatment are also shown in Table 13. When consumers are provided with the country of origin label (treatment b and c), the market share of Korean rice was much higher than imported rice. When consumers taste freshly cooked rice and compare

each other as treatment A and B, the market share of imported rice increases than if they do not have the taste testing as treatment C.

Table 13 Market Share Simulation by Treatment

	Import Price			
	$300/MT[a]	$350/MT	$400/MT	$450/MT
All Treatment				
U.S.	30.0%	9.0%	0.0%	0.0%
China	26.9%	11.5%	4.8%	0.0%
Korea	43.1%	79.5%	95.2%	100.0%
Treatment A (Taste)				
U.S.	56.1%	32.1%	0.2%	0.0%
China	35.2%	32.9%	12.0%	0.0%
Korea	8.6%	35.0%	87.8%	100.0%
Treatment B (Taste and COOL)				
U.S.	21.8%	0.0%	0.0%	0.0%
China	31.9%	0.6%	0.0%	0.0%
Korea	46.3%	99.4%	100.0%	100.0%
Treatment C (COOL)				
U.S.	1.1%	0.0%	0.0%	0.0%
China	5.6%	6.7%	6.7%	0.0%
Korea	93.3%	93.3%	93.3%	100%

Note: Consumer price of Korean rice: 7,962 won/4kg, Exchange rate: 1,100 won/$, Bound Tariff for imported rice: 440%, Retail margin of imported rice: 732 won/ 4kg

[a] c.i.f. price of imported rice from U.S. and China

This study also conducted market share simulations to estimate the effect of tariff reduction on the Korean rice market under 7 scenarios considering the current DDA negotiations: designating rice as a sensitive or special product and deviations from the tiered reduction formula, and combinations thereof. This study excludes the scenario in which rice is designated as a general product, because Korea can self-designate rice

as a sensitive or special product. Tariff cuts for sensitive products are allowed to deviate from the tiered reduction formula by 1/3, 1/2, or 2/3 of the reduction. When rice is designated as a sensitive product of developed country, the bound rate of 396% for rice would be lowered to 304%, 257%, or 211%, respectively given the developed countries' tiered rate of 70%. In exchange for the allowed deviation from normal cuts, Tariff quota expansion is required. If rice is designated as a special product of a developing country, tariff reduction is not required. The special treatment, 2/3 of the cut for developed countries, will be applied for developing countries. When rice is designated as a sensitive product of developing country, the bound rate of 396% for rice would be lowered to 334%, 304%, or 273%, respectively.

Table 14 shows the results of the market share simulations by scenarios. If the import price was higher than $600/MT, more than 90% of market share would go to Korean rice. If rice is designated as a special product in DDA negotiation, most shares would go to Korean rice regardless of import price. This result suggests that there would be no negative effect of tariffication on the market share if Korean retains the developing country status and rice is designated as a special product.

As the result of drop in import price, demand for imported rice increases when the tariff is reduced. If rice is designated as a sensitive product, the greater deviation from the tiered reduction formula, less tariff cut, would give a greater share to Korean rice. However, more expansion of Tariff quota is required.

Table 14 Market Share Simulation by DDA Scenario

		Import Price			
		$450/MT[a]	$500/MT	$550/MT	$600/MT
Developed Country	*Sensitive Product (2/3 deviation)*				
	U.S.	0.5%	0.0%	0.0%	0.0%
	China	9.6%	2.4%	0.0%	0.0%
	Korea	89.8%	97.6%	100.0%	100.0%
	Sensitive Product (1/2 deviation)				
	U.S.	20.0%	4.8%	0.1%	0.0%
	China	22.0%	9.7%	4.8%	0.8%
	Korea	58.0%	85.5%	95.0%	99.2%
	Sensitive Product (1/3 deviation)				
	U.S.	34.1%	25.7%	13.4%	0.4%
	China	31.5%	23.8%	12.8%	7.4%
	Korea	34.4%	50.5%	73.9%	92.2%
Developing Country	*Special Product (no cut)*				
	U.S.	0.0%	0.0%	0.0%	0.0%
	China	0.0%	0.0%	0.0%	0.0%
	Korea	100.0%	100.0%	100.0%	100.0%
	Sensitive Product (2/3 deviation)				
	U.S.	0.2%	0.0%	0.0%	0.0%
	China	4.9%	0.6%	0.0%	0.0%
	Korea	94.9%	99.4%	100.0%	100.0%
	Sensitive Product (1/2 deviation)				
	U.S.	0.5%	0.0%	0.0%	0.0%
	China	9.6%	2.4%	0.0%	0.0%
	Korea	89.8%	97.6%	100.0%	100.0%
	Sensitive Product (1/3 deviation)				
	U.S.	14.9%	0.4%	0.0%	0.0%
	China	15.8%	7.4%	2.0%	0.0%
	Korea	69.4%	92.2%	98.0%	100.0%

Note: Consumer price of Korean rice: 7,962 won / 4kg, Exchange rate: 1,100 won/$, Bound Tariff for imported rice: 440%, Retail margin of imported rice: 732 won/ 4kg

[a] c.i.f. price of imported rice from U.S. and China

CHAPTER V

ECONOMIC EFFECTS OF TARIFFICATION

5.1 Current Rice Market and Policy in Korea

Rice Market

Rice production in Korea decreased to 4,916 thousand M/T in 2009 from 5,626 thousand M/T in 1985. Such a decline, despite increases in production per unit area, can be attributed to the significant decrease in its acreage. As a result of the development and diffusion of newly modified products, rice production per 10a increased by 9.2% from an average of 459 kg during 1985-1989 to 501 kg in 2005-2009. Recently, good weather conditions have also allowed for good harvest seasons to continue even though rice yields are stagnant at 490kg per 10a. In 2008 and 2009, production per 10a recorded 517kg and 532kg, respectively, reaching all time high levels in 2009.

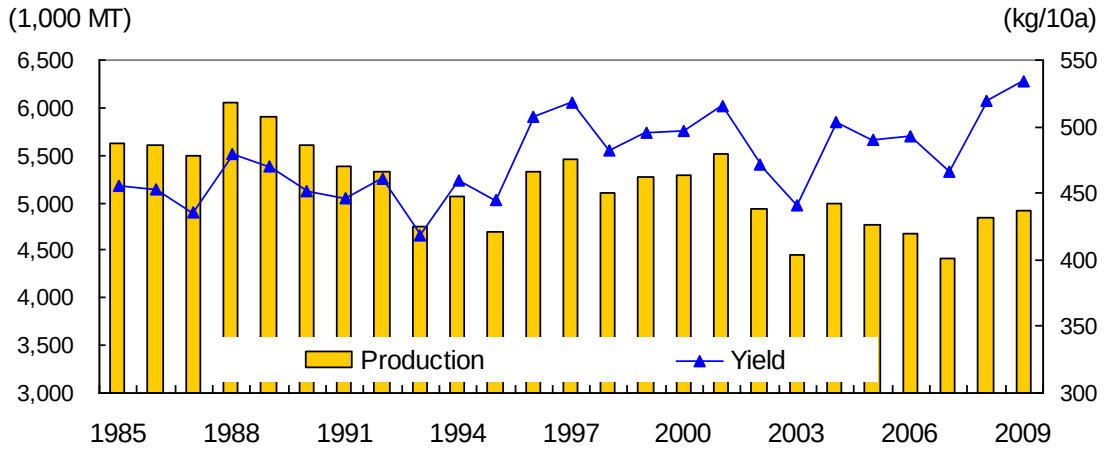


Figure 3 Changes in Rice Production and Yield in Korea

The rice acreage fell by 25% from 1,237 thousand hectares in 1985 to 924 thousand hectares in 2009. The rice acreage fell by an annual average of 1.6% every year in the late 2000s. Such a decrease is a combined result of the diversion of rice paddies to non-agriculture land for such usage as public infrastructure and housing, increase in the cultivated area of farming crops other than rice on paddy fields, and increase in idle farmland. During 1990-1995, annual average rice cultivation area decreased sharply by 38 thousand hectares every year to reach 1,050 hectares in 1996. Due to the relatively larger falls in rice prices compared to vegetables, vegetable cultivation on paddy fields has increased, while rice cultivation area has significantly decreased as converting paddy fields into non-agricultural land became easy on the back of excess rice supply.

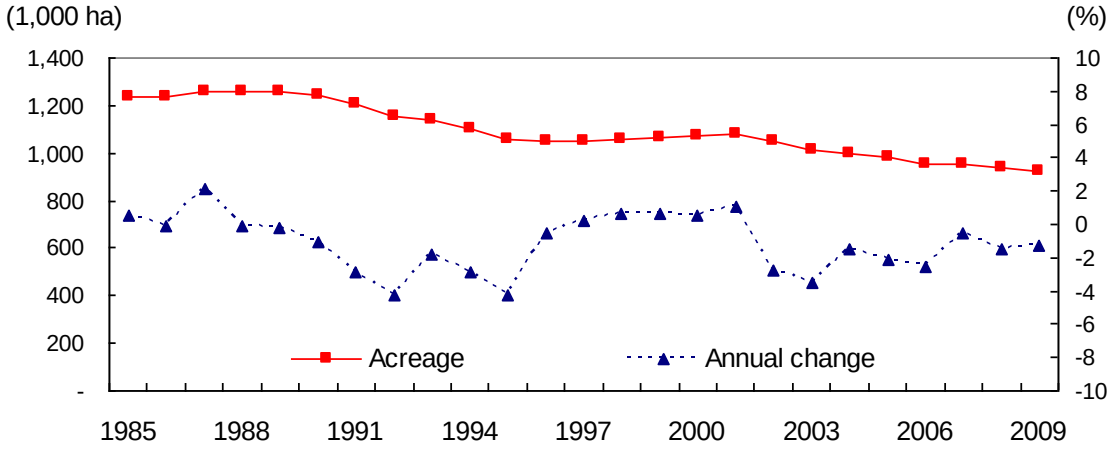


Figure 4 Changes in Rice Acreage in Korea

Annual rice consumption per capita has decreased from 128.1kg in 1985 to 74.0kg in 2009 due to the diversification of diet as the GDP grows in Korea. While rice consumption fell by an annual average of 2.4% every year in the 1990s, the magnitude

or the decline has expanded to 2.6% in the 2000s. Accordingly, food use consumption also steadily decreased from 5,259 thousand M/T in 1985 to 3,704 thousand M/T in 2009. Considering the declining trend in per capita consumption of rice, rice consumption for food use is expected to fall even further in the future. For more details of rice consumption in Korea, refer to Shin et al. (2010).

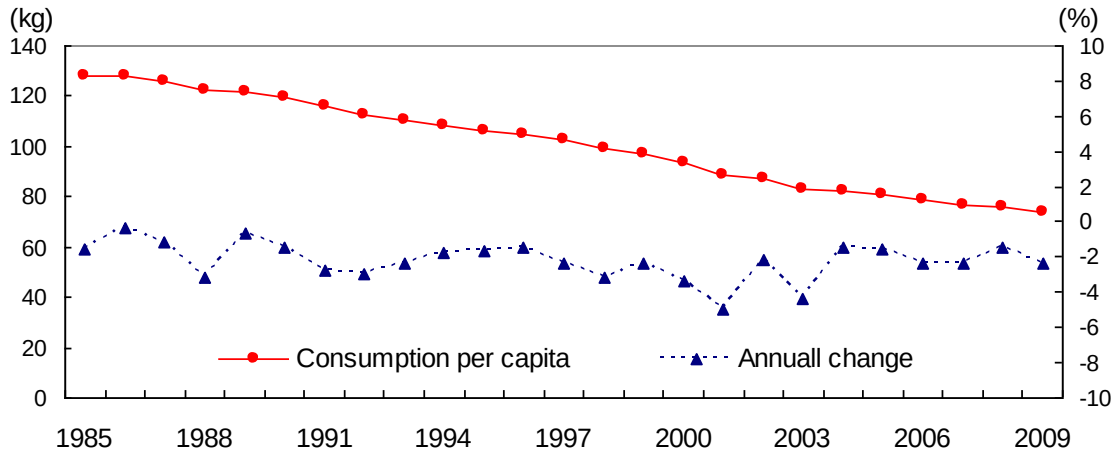


Figure 5 Changes in Rice Consumption per Capita in Korea

Total annual rice demand remained at 4,671~5,210 thousand M/T levels, including rice for processing and industrial use, brewing, and food aid to North Korea. In cases where ending stocks exceeded adequate levels, the government supplied a portion of its rice stocks for processing and industrial and brewing uses. In addition, it has also aided North Korea with rice since 2002. The annual volume of food aid to North Korea was 150~400 thousand M/T during the period of 2002 to 2007.

The prices of rice released by the government in the market for processing and brewing uses are 30~35% and 10% of food market prices, respectively. Government

prices are determined in comparison to the prices of flour and tapioca, which are substitutes for rice used for processing and brewing.

Table 15 Rice Supply and Demand in Korea

Unit: 1,000 M/T

	1990[a]	1995	2000	2005	2006	2007	2008	2009[d]
Total Supply	7,470	6,216	6,092	6,042	5,838	5,756	5,346	5,790
Beginning Stocks	1,572	1,156	722	850	832	830	695	690
Production	5,898	5,060	5,263	5,000	4,768	4,680	4,408	4,843
Imports	-	-	107	192	238	246	243	257
Total Demand	5,445	5,557	5,114	5,210	5,008	5,061	4,671	4,944
Food	5,127	4,777	4,425	3,815	3,860	3,789	3,755	3,704
Processing	80	228	175	324	373	425	655	541
Seed	45	38	46	42	41	41	40	40
Loss [b]	193	514	468	1,029	734	806	221	657
Residual c	1	-	-	-	-	1	1	3
Ending Stocks	2,025	659	978	832	830	695	675	846
Self-sufficiency(%)	108.3	93.6	102.9	102.0	98.5	95.8	94.4	98.0
Per capita Consumption (kg)	119.6	106.5	93.6	80.7	78.8	76.9	75.8	74.0

[a] November-October market year
[b] Loss includes food aids of 150 thousand m/t in 1995, 309 thousand m/t in 2005, 168 thousand m/t in 2006, and 173 thousand m/t in 2007.
[c] Residual includes exports
[d] Projected
Source: Korean Ministry for Food, Agriculture, Forestry and Fisheries.

Ending stocks of rice have fluctuated significantly in each year as shown in Figure 6. In addition to the decline in rice acreage, the year of 1993 was a bad harvest year with 418kg of rice production per 10a. Rice production was not much better and remained at 445kg level per 10a in 1995. As a result, rice inventory at the end of the 1996 rice year was at a record low level of 244 thousand tons (stock-to-use ratio of

4.7%). However, consecutive good harvests and steady decline in consumption once again increased ending stocks. As rice demand expanded after 2002 due to aid provided to North Korea, the ending stock-to-use ratio fell to 17% in 2009, which is higher than the adequate level of 16% recommended by the FAO.

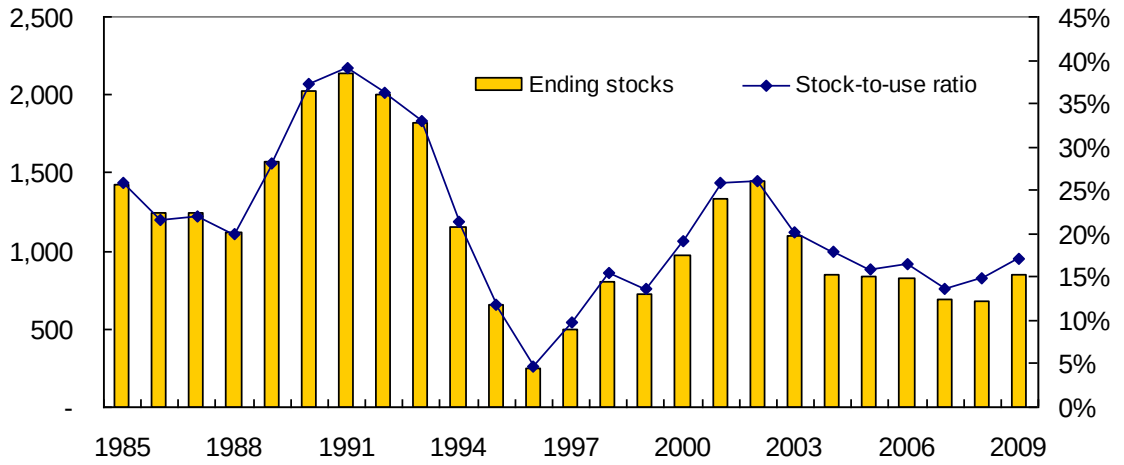


Figure 6 Changes in Ending Stocks and Stock-to-use Ratio of Rice in Korea

Figure 7 displays the annual price movements in the farm gate and retail levels. The market prices have fluctuated according to changes in supply and demand. Rice prices have risen since 1996 as a result of the continued bad harvest and low stock-to-use ratio, while the prices of substitute crops have declined. After government's introducing market-based policies, farm gate price dropped 6.8% and 4.2% in 2005 and 2006, respectively mainly due to instabilities in rice market. The significant decrease in rice price in 2009 was attributed to its bumper crop. The unit import price went up continuously in accordance with the global market trend. As a result, the unit import price reached as high as 80% of farm gate price in 2009 from 24% in 1996.

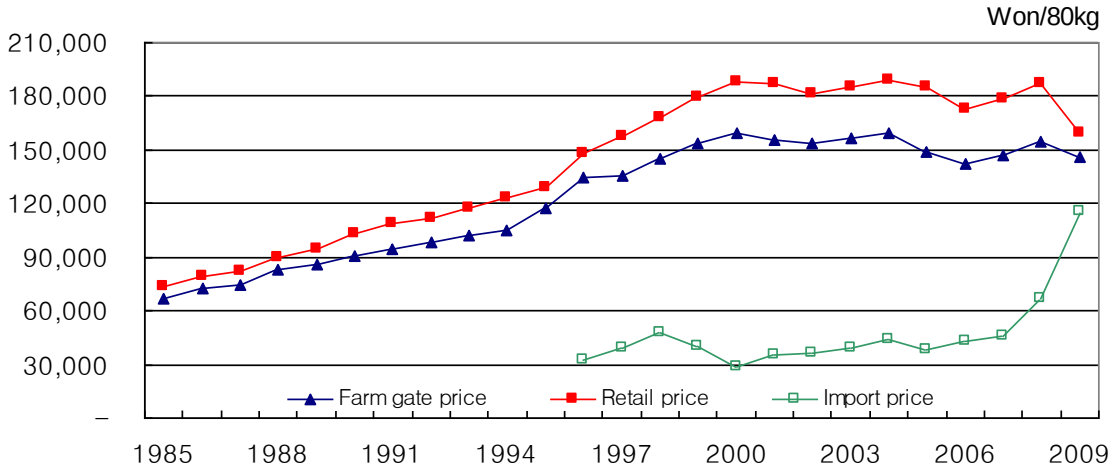


Figure 7 Changes in Farm Gate and Retail Prices of Rice in Korea

Figure 8 describes the trends of rice trade in Korea. The import volumes have gradually increased from 115 thousand M/T in 1996 to 257 thousand M/T in 2009 in accordance with MMA commitment. The fill ratios (actual imports/import quota) have been near 100% though the annual total import volumes fluctuated substantially due to the time lag in shipping. As regards rice exports, the whole exports were for food aid to North Korea. In cases where ending stocks exceeded adequate levels, the Korean government supplied a portion of its rice stocks for food aid to North Korea since 2002. The volumes of food aid were 150 thousand M/T to 400 thousand during the period of 2002 to 2007.

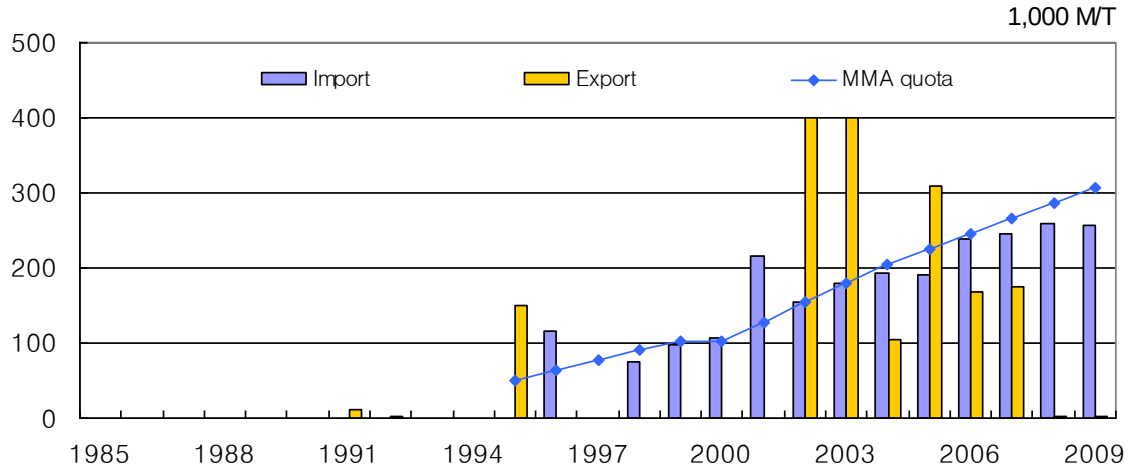


Figure 8 Changes in Trade Volumes of Rice in Korea

Rice Policies

There were fundamental changes in Korean rice policy after rice negotiations in 2004. With the introduction of the direct payment program to facilitate the income stability of farm households, the Korean government discontinued the rice procurement program in 2005. In order to alleviate instabilities in farm household income, the government introduced the income compensation program for rice farmers since 2005. The program set a target price of 178,300 won per 80kg to compensate 85% of its difference with the market price from the government's fiscal budget. This enabled farm household income to stabilize despite the fall in market prices as farm prices which included direct payments did not deviate significantly from target prices. The direct payment program paid out fixed and variable payments to farmers. Fixed payments were classified as a green box since a constant amount (700 thousand won per ha) was paid regardless of market prices, However, variable payments were considered to be

amber box subsidies subject to reduction as they were paid out in connection with market prices.

Korean government has operated a public stock holding program in which the government stocks a certain amount of a commodity in its reserves in preparation for disasters or emergencies. Over the years, the government procurement system was used as a means to achieve food security, along with the enhancement of rice farmers' income through price supports. In times when the market supply of rice decreases due to bad crop harvest, the government would release its stocks to facilitate market stability. Korean public stock holding program was not only being implemented without detailed standards and clear objectives, but also could not effectively respond to unstable supply and demand during bad harvest seasons due to its small stocks. As for years after 2005, the Korean government has decided on an implementation principle of setting the basis amount of rice for year-end public stockholding at 864 thousand tons, purchasing and releasing 432 thousand tons of rice every year. It also decided to review the size of its public stockholdings after 3 years, taking into account such factors as rice consumption. The price at which the government purchases rice from farm households for its public stockholding is the market price during the harvest season. As harvest season price and settles the remainder after the harvest season price is set. Selling prices of public stock holding rice are determined in relation to market prices.

With the introduction of the income compensation and public stock-holding programs, rice prices were able to be determined according to supply and demand without the need for the government's artificial manipulation of stocks. With the implementation of the tow programs, the rice market was allowed to be operated according to market functions.

5.2 Estimation and Model Validation

Model Specification

A rice model is developed to analyze the effects of tariff reductions and TRQ expansions on the Korean rice sector in current WTO agricultural negotiations. The rice model is composed of five behavioral equations with seven identity conditions for deterministic and stochastic simulations to analyze the effects of tariffication on Korean rice sectors.

The model as shown in Table 16 contains demand and supply determinants. The components of supply include acreage, yield, import, and inventory. Since it is difficult to transfer paddy lands to uplands or to other purposes in the short-run, planted acreage, as shown in equation (5.1), is specified as a function of the previous real farm price (i.e., a proxy of the expected price) and the trend (year). The real farm gate price of rice is calculated by dividing the nominal farm gate price by the GDP deflator.

(5.1) $$ACR_t = \alpha_0 + \alpha_1 FP_t + \alpha_2 TREND_t + \varepsilon_t$$

where ACR: Acreage of rice planted

FP: Real Farm gate price of rice

TREND: Year

There are various factors that affect rice yields, such as technology and weather. Yield, as shown in equation (5.2), is specified as a function of the moving average of yield and dummy variables. This study uses the 5-year moving average of yield as the variable for the technology effect and the dummy variable for the weather effect. The dummy variable DM1 is 1 for the years 1993 and 2003 when there were cold-weather

damages and 0 otherwise. The dummy variable DM2 is 1 for the years 2008 and 2009 when there were unprecedented bumper crops and 0 otherwise.

(5.2) $YD_t = \alpha_0 + \alpha_1 MYD_t + \alpha_2 DM1_t + \alpha_3 DM2_t + \varepsilon_t$

where YD: Yield of rice

MYD: 5-year moving average of yield

DM1: 1 for 1993 and 2003, 0 otherwise

DM2: 1 for 2008 and 2009, 0 otherwise

Production is defined as acreage times yield as shown in identity (5.3). To analyze the factors of production changes, acreage and yield are estimated separately because acreage is in a decreasing trend while yield has recently been at a standstill.

(5.3) $PROD_t = ACR_t * YD_t$

where PROD: Rice production

Supply, defined as identity (5.4), is the sum of the previous production, the previous ending stock, and imports. Inventory (ending stock) is made up of the private and government inventories. It is assumed that the government inventory should be maintained at a certain level (17% of the total food consumption of rice) to insure food security over the period 2008-2021. However, the private inventory is endogenously determined by the excess supply of the rice market after satisfying the government inventory.

(5.4) $TSP_t = PROD_{t-1} + STK_{t-1} + IM_t$

where TSP: Total supply of rice

STK: Ending stock of rice

IM: Rice import

To estimate rice demand, the per capita food consumption in equation (5.5) is specified as a function of the real retail price, real income, and the previous per capita consumption. The substitutes - wheat and meat in the modeling process - were not included, because these variables did not show statistical significance. No substitute for rice is assumed, because rice has been a unique staple food in Korea. Real income is the nominal per capita GDP divided by the GDP deflator.

(5.5) $PCON_t = \alpha_0 + \alpha_1 RP_t + \alpha_2 PGDP_t + \alpha_3 PCON_{t-1} + \varepsilon_t$

where PCON: Per capita food consumption of rice

RP: Retail price of rice

PGDP: Rear per capita GDP

Total food consumption of rice is defined as per capita food consumption times population (5.6).

(5.6) $TCON_t = PCON_t * POP_t$

where TCON: Total food consumption of rice

POP: Population

The total demand consists of food consumption, processing, seed, loss, and food aid to North Korea (5.7). The quantity shipped to North Korea during the period of 2002 to 2007 had been 0.1~0.4 million M/T each year. However, this study assumes that Korea would not provide food aid from 2010 to 2021 considering the current state of the relationship between North and South Korea.

(5.7) $TDM_t = TCON_t + PRC_t + SEED_t + LOSS_t + EX_t$

where PRC: Rice processing

SEED: Rice seed

LOSS: Rice loss

EX: Rice export

The private stock is the total supply minus the total domestic demand and the government-held stock in identity (5.8).

(5.8) $PSTK_t = TSP_t - TDM_t - GSTK_t$

where PSTK: Private stock

GSTK: Government-held stock

The total ending stock consists of government-held stock and private stock.

(5.9) $STK_t = GSTK_t + PSTK_t$

Rice import is the minimum market access (MMA) quantity specified by WTO agricultural negotiation scenarios. If the private stock is less than zero, additional imports occur to offset the negative quantity of the private stock in identity (5.10).

(5.10) $IM_t = MMA_t \; or \; MMA_t - PSTK_t \quad (if \;\; PSTK_t < 0)$

The real retail price of rice is specified as a function of the stock-to-use ratio (stock over the total food consumption) and the previous real retail price as shown in equation (5.11). If tariffication is introduced in the domestic rice market, the higher domestic price of rice would decrease toward the lower price level of imported rice; however, the domestic price would not decrease if the domestic price is less than the imported price.

(5.11) $RP_t = \min[\; \alpha_0 + \alpha_1 (STK_t / TCON_t) + \alpha_2 RP_{t-1} + \alpha_3 DM3_t + \varepsilon_t$

or $IMP_t * (TARIFF + 1) * ER_t * QC * MR \;]$

where RP: Real retail price of rice

DM3: 1 for 2005 and 2009, 0 otherwise

ER: Exchange rate of Korean won against US dollar

QC: Quality coefficient (the premium for domestic rice)

MR: Marketing margin

The farm gate price of rice is specified as a function of the retail price in equation.

(5.12) $FP_t = \alpha_0 + \alpha_1 RP_t + \varepsilon_t$

Table 16 A Structural Model for the Korean Rice Sector

(1) Acreage $_t$ = f (Farm Price $_{t-1}$, Trend $_t$)
(2) Yield $_t$ = f (Average of Yield $_{t-1 \text{ to } t-5}$, Dummy)
(3) Production $_t$ = Acreage $_t$ * Yield $_t$
(4) Supply $_t$ = Production $_{t-1}$ + Stock $_{t-1}$ + Import $_t$
(5) Per capita consumption $_t$ = f (Retail price $_t$, Per capita GDP $_t$, Per capita consumption $_{t-1}$)
(6) Total consumption $_t$ = Per capita consumption $_t$ * Population $_t$
(7) Demand $_t$ = Food consumption $_t$ + Processing $_t$ + Seed $_t$+ Loss $_t$+ Export $_t$
(8) Private stock $_t$ = Supply $_t$ – Demand $_t$ – Government stock $_t$
(9) Stock $_t$ = Government stock $_t$ + Private stock $_t$
(10) Import $_t$ = MMA $_t$ or MMA $_t$ - Private stock $_t$ (if, Private stock $_t$ < 0)
(11) Retail price $_t$ = f (Stock $_t$ / Food consumption $_t$, Retail price $_{t-1}$) or = Import price $_t$ *(Tariff $_t$ +1)*Exchange rate $_t$ *Quality coefficient*Margin
(12) Farm gate price $_t$ = f (Retail price $_t$)

Specifically, the consumer price of rice is directly linked to the farm price in the model since the farm gate price of rice is determined by consumers' willingness to pay in the retail market. The gap between supply and demand determines inventory, which affects retail and farm gate prices. As such, the two prices affect and determine supply,

demand, and inventory until the iteration process produces a convergence in the model (Figure 9).

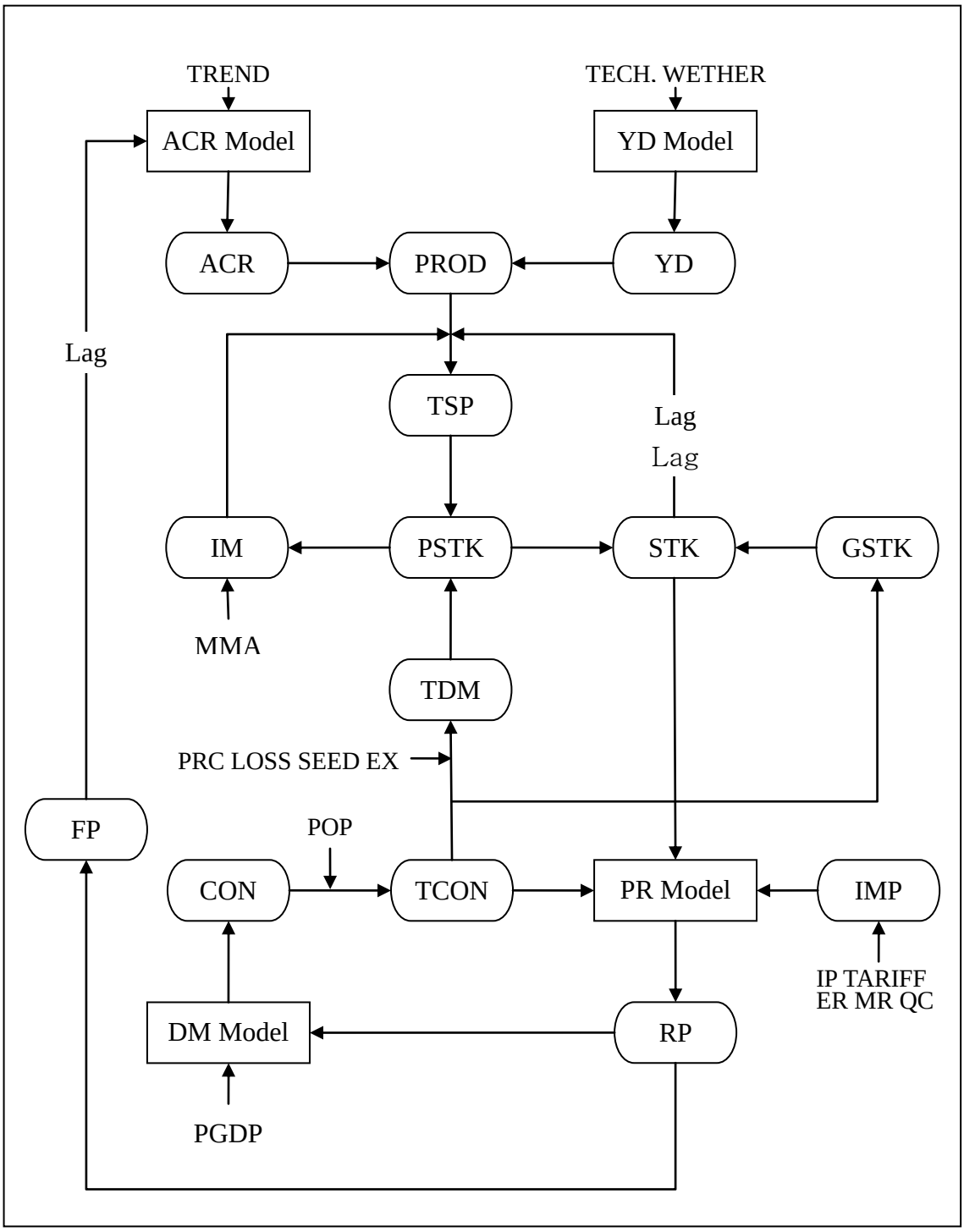


Figure 9 Flow Chart of Simulation Model for Korean Rice

To analyze the effects of tariffication and DDA negotiations on rice supply and demand, additional assumptions on exogenous variables are required for the 2008~2021 period. The exogenous variables refer to macroeconomic variables and other control variables related to imports. Based on the macroeconomic projections of the Bank of Korea (2010), the real GDP growth rate and the inflation rate are projected to be, per annum, 5.2% and 2.6% (2010); and 4.8% and 3.3% (2011 and onwards), respectively.

Imported MMA rice is supplied mainly for process purposes, such as rice cakes, noodles, and liquor. The demand for processing rice, however, has amounted to about 0.1 million tons, which represents less than half of all imported rice. The Korean government has supplied rice for alcoholic products at cheaper prices in an attempt to reduce the excess inventory of imported rice. As a result, rice supply for alcoholic products increased to 0.25 million tons in 2007. It is assumed that the demand for processing uses is constant over time at current levels. Based on an empirical proportion to production, losses and seed volumes are assumed to be 7% and 0.075% of production, respectively.

Estimation Results

Four behavioral equations for planted acreage, yield, per capita consumption, retail price, and farm price were estimated by OLS estimation (Table 17). For the model specification, this study tested statistical significance on autocorrelation and multicollinearity to time-series data. The model was estimated using annual data from 1980 to 2009. OLS estimation, rather than simultaneous equation models, was chosen because simultaneous equation models are significant in large samples. In particular,

OLS estimation tends to minimize bias in simulations, thus showing better performance in analyzing policy effects.[9] The results of Durbin-Watson and Breusch-Godfrey LM tests on the error terms of the estimated equations (to evaluate statistical adequacy of the equations) indicate no evidence of a serial correlation.

The results of the t-statistics for each parameter show that the explanatory variables were statistically significant at the 5% significance level. The estimated models exhibited a high adjusted R^2. Therefore, the empirical results support the assumptions and justify the theoretical model specification.

Table 17 Estimation Results of Behavioral Equations

(1) ln(ACR) = 167.14 + 0.26*ln(FP(-1)) - 21.33*ln(TREND) + 0.72*AR(1)
(30.86) (3.61) (-5.28) (4.13)
Adj-R2 : 0.98, D-W stat : 1.45, LM(2) : 1.54, Sample : 1990-2009

(2) ln(YD)= 2.99 + 0.52*ln(MYD) – 0.12*(DM1) + 0.08(DM2)
(2.50) (2.65) (-3.60) (2.41)
Adj-R2 : 0.53, D-W stat : 1.59, LM(2) : 3.18, Sample : 1985-2009

(3) ln(PR) = 6.24 - 0.07*ln(STK/TCON) + 0.0006*RP(-1) - 0.10*DM3
(34.85) (-3.47) (7.58) (-3.32)
Adj-R2 : 0.78, D-W stat : 2.18, LM(2) : 2.93, Sample : 1987-2009

(4) ln(PCON) = 0.59 – 0.05*ln(RP) - 0.03*ln(PGDP) + 0.96*ln(PCON(-1))
(2.60) (-1.77) (-3.05) (33.87)
Adj-R2 : 0.99, D-W stat : 2.45, LM(2) : 2.48, Sample : 1981-2009

(5) FP = 6,548.98 + 0.81*RP
(3.10) (53.16)
Adj-R2 : 0.99, D-W stat : 1.05, LM(2) : 5.15, Sample : 1980-2009

[9] See Kennedy(1992) for more explanation.

Model Validation

The statistical significance of the individual equations may not guarantee the overall stability and performance of the model. Ex-post dynamic and static simulations[10] were performed to evaluate the overall model stability for ten years from 2000 to 2009. Ex post and ex ante simulations are also used to evaluate the forecasting accuracy of the rice model. Ex post simulation generates forecasted values within the sample period, and the actual values and forecasted values are then compared. RMSPE[11] (Root Mean Square Percentage Error) was calculated as shown in Table 18. Most endogenous variables except for price values were below 0.05 of RMSPE in both static and dynamic ex-post simulations. These results suggest that the model is reasonably stable and accurate.

Table 18 RMSPE of Major Endogenous Variables during the 2000-2009 Period

Variables	Dynamic Ex-Post Simulation	Static Ex-Post Simulation
Acreage	0.023	0.011
Yield	0.026	0.026
Production	0.031	0.025
Per capita consumption	0.013	0.010
Retail price	0.113	0.049
Farm price	0.116	0.040
Self-sufficiency	0.059	0.062
Production value	0.131	0.036

[10] The Gauss-Seidel method was used to perform static and dynamic simulations using E-Views 5.0.

[11] $RMSPE = \frac{1}{n}\sum_{t=1}^{n}\sqrt{(\frac{Y_t^s - Y_t}{Y_t})^2}$

(Y_t^s: forecasted value, Y_t: actual value)

This study also performed stochastic simulations to analyze the uncertain impacts of the rice market opening. The probabilities of endogenous variables in the model were measured using simulated stochastic variables that were obtained for the 2010~2021 period with 5,000 iterations. This model employs yields, import prices, and exchange rates as stochastic variables. The distribution of the stochastic variables was tested and the outputs of the normality test are tabulated in the Table 19. The Shapiro-Wilks, Anderson-Darling, Cramer-von Mises tests, and Chi-Squared tests are used to test for normality. For each test, if the p-value is less than 0.05, which means the null hypothesis, which is a test the data are normally distributed, is rejected at 5% significance level.

Table 19 Test for Normality of Distribution for Stochastic Variables

		Yield	Import Price	Exchange rate
Shapiro-Wilks	Test Value	0.98	0.78	0.98
	P-Value	0.86	0.00	0.94
Anderson-Darling	Test Value	0.22	1.05	0.20
	P-Value	0.80	0.01	0.84
Cramer-von Mises	Test Value	0.04	0.17	0.03
	P-Value	0.70	0.01	0.79
Chi-Squared	Test Value	9.50	5.86	5.86
	P-Value	0.39	0.75	0.75

The results are as follows: yield and exchange rates were normally distributed, and imported prices did not follow a normal distribution (import prices showed an empirical distribution). For exchange rates, this study assumed a truncated normal distribution using the min-max threshold (a minimum of 800 won/USD and a maximum of 1,400 won/USD), taking into consideration recent economic conditions in Korea.

Model validation for the stochastic simulation model is examined for the stochastic component of the model. The stochastic exogenous variables were simulated with 5,000 iterations to determine whether the simulated series are statistically equal to historical series or whether the distributions from the two series are the same. Two statistics are used in the validation process: (1) t-test for mean and (2) F-test for standard deviation. These tests determine whether (1) the means from simulated variables are equal to the forecasted means, which are given by regression models and (2) the simulated variances are equal to the historical variance. The t and F statistics and their p-values are summarized in the Table 20 to test the means and standard deviations of stochastic variables. All the p-values in the table are greater than 0.05, which means the null hypothesis, which is a test parameters of simulated values and historical (or forecasted) values are the same, can not be rejected at 5% significance level. For example, the p-value in the t-test for yield is 1.0, and that in the F-test for the yield is 0.54.

Table 20 Model Validation Statistics for Stochastic Variables

		Yield	Import Price	Exchange rate
t-test for	Test Value	0.00	-0.02	0.04
Mean	P-Value	1.00	0.99	1.23
F-test for	Test Value	1.00	1.23	0.97
S.D.	P-Value	0.54	0.26	0.25

5.3 Tariff Equivalent and Scenarios

Calculation of Tariff Equivalent

In case Korea ceases to apply the special treatment during the implementation period or when the special treatment is discontinued in 2015, rice imports shall be subject to ordinary customs duties in accordance with the UR agreement on agriculture. The tariff rates for rice imports to be established on the basis of a tariff equivalent should be calculated according to the guidelines prescribed in the URAA.

According to guidelines for the calculation of Tariff Equivalents, TE should be calculated using the actual difference between internal and external prices for the years 1986 to 1988. External prices shall be actual average c.i.f. unit values for the importing country. If average c.i.f. unit values are not available or appropriate, external prices shall be either: (a) appropriate average c.i.f. unit values of a near country, or (b) estimate from average f.o.b. unit values of appropriate major exporter adjusted by adding an estimate of insurance, freight and other relevant costs to the importing country. The external price shall be converted to domestic currencies using the annual average market exchange rate for the same period as the price data. The internal price shall generally be a representative wholesale price ruling in the domestic market or an estimate of that price where adequate data is not available.

Tariff Equivalent for Korean rice was estimated according to the attachment to annex 5 in the Uruguay Round Agreement on Agriculture; the estimated TEs for ad-valorem duty are from 412% to 496% as shown in Table 21. They are 762 to 894 won per kg as specific rates. The average c.i.f. unit values of Japan or adjusted average f.o.b. unit values of China can be used for external prices because the average c.i.f. unit values

for the years 1986 to 1988 are not available in Korea. There are three sources of representative wholesale price and adjusted farm gate price for internal prices in Korea: Bank of Korea, Korea Agro-Fisheries Trade Corporation (KAFTC), and National Agricultural Cooperative Federation (NACF).

Table 21 Estimated Tariff Equivalents for Korean Rice

	External Prices	
	f.o.b. Prices in China*1.12	c.i.f. Prices in Japan
Internal Prices		
Wholesales Prices (Bank of Korea)	412% (762 won/kg)	426% (767 won/kg)
Wholesales Prices (KAFTC)	426% (788 won/kg)	440% (793 won/kg)
Farm gate Prices*1.12 (NACF)	481% (889 won/kg)	496% (894 won/kg)

* Specific rates in parenthesis

To simulate the effect of tariffication on Korean rice industry, this study employs 440%[12] as initial TE for Korean rice. The base for calculation of TE is shown in Table 22. The Japanese import price, which is applied to the Japanese rice's TE, was used for the external price. Wholesales prices of medium grade were used for the domestic prices. The applied out-quota tariff after the tariffication should be determined at the level of 90% of a tariff equivalent to be calculated (10% shadow reduction).

[12] Wholesale prices surveyed by the Korea Agro-Fisheries Trade Corporation were used for the domestic price, and the Japanese imported price (which is applied to the Japanese TE) was used for the external price.

During rice tariffication negotiations with exporting countries, TE may change if different data for domestic and external prices are used. The tariff applied to simulations was 396%, which represents a 10% deduction from TE according to the WTO Agreement. Moreover, the tariff rate should be modified, reflecting the results of the DDA negotiations.

Table 22 Base for Calculation of Tariff Equivalent

Base Years	External Prices (a)		won/kg	Internal Prices (b) (won/kg)	b – a (won/kg)
	Import Pr. (Yen/kg)	Exchange rate			
1986	29	526.1	153	920	767
1987	31	569.5	177	951	774
1988	37	571.2	211	1,049	838
Average	32	555.6	180	973	TE: 793 (440%)

* Import prices are C.I.F prices in Japan

Scenarios

This study establishes 4 scenarios based on the time to adopt tariffication and DDA negotiations: adopting tariff based system for rice import in 2011 or continuing special treatment for rice until 2014, designating rice as a sensitive or a special product (retaining the developing country status), and combinations thereof. This study excludes the scenario in which rice is designated as a general product, because Korea can procure rice as a sensitive or special product through WTO negotiations. This study assumes that the early tariffication and the implementation of the DDA agreement begin in 2011

and 2012, respectively. The implementation period for the DDA agreement is assumed to be 5 years for developed countries and 10 years for developing countries.

Table 23 Scenarios for the Simulations

	Tariffication	Status of Korean rice in DDA Negotiations
Scenario 1	2011	Sensitive Product for Developed Country
Scenario 2	2011	Special Product for Developing Country
Scenario 3	2015	Sensitive Product for Developed Country
Scenario 4	2015	Special Product for Developing Country

Scenario 1 assumes an early tariffication in 2011 and the designation of rice as a developed country's sensitive product. Under the scenario, rice's tariff (396%) is assumed to be reduced to 304.9%, and the TRQ volume is increased to 555 thousand tons (2/3 deviation from the normal reduction for the sensitive product). Scenario 2 assumes an early tariffication in 2011 and the designation of rice as a special product. Rice's tariff (396%) and TRQ volume for 2010 (327 thousand M/T) are assumed to be maintained until 2021. Scenario 3 the current special treatment of rice until 2014 and the designation of rice as a developed country's sensitive product. Under scenario 3, rice's tariff (396%) is assumed to be reduced to 304.9%, and the TRQ volume is increased to 636 thousand M/T (2/3 deviation from the normal reduction for the sensitive product). Scenario 4 assumes the current special treatment of rice until 2014 and the designation of rice as a special product. It is assumed that the tariff of 396% and the TRQ volume of 409 thousand M/T for 2014 will continue until 2021.

The level of tariff reductions for sensitive products is assumed to be one-third of the reduction that would otherwise have been required by the tariff reduction formula. It is also assumed that TRQs for sensitive products are increased by 4.5% of the average annual domestic consumption during the period between 2003 and 2005. Developed countries shall reduce 70% (46.7% for developing countries) of bound tariff in the top band during the 5-year (10-year for developing countries) implementation period. However, in case rice is designated as sensitive products for developed countries, the provisional bound rate of 396% would be lowered to 304%. At the same time, 4.0% of TRQ expansion is also required as a compensation for less cut. In addition, sensitive products are eligible to be exempted from tariff ceilings of 100% by further expanding TRQ volumes which correspond to 0.5% of domestic consumption for developed countries (Scenario 1 and 3). Special products are allowed to be exempted from tariff reductions. Special products are also exempted from TRQ expansion in exchange for making no tariff reduction unlike sensitive products. Special products for developing countries are exempted from tariff ceilings without further expansion of TRQ volumes (Scenario 2 and 4).

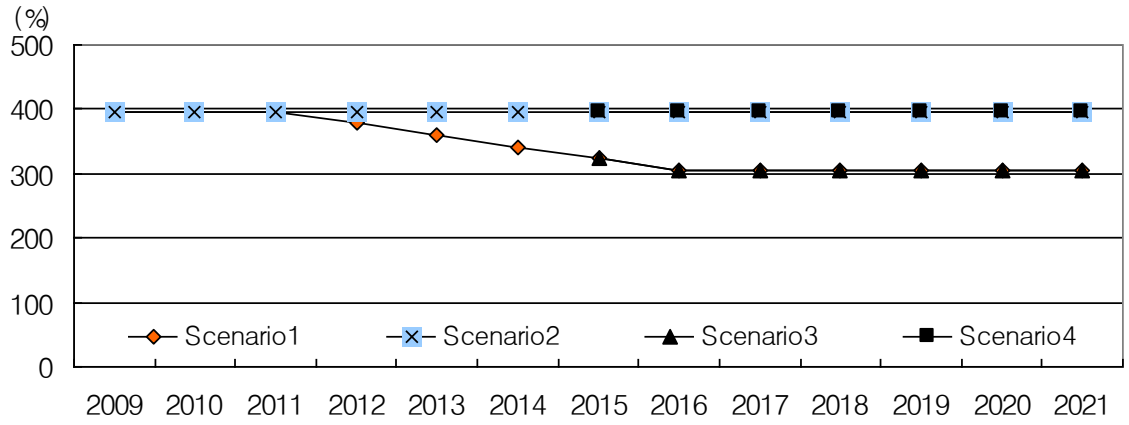


Figure 10 Tariff Changes by Scenarios

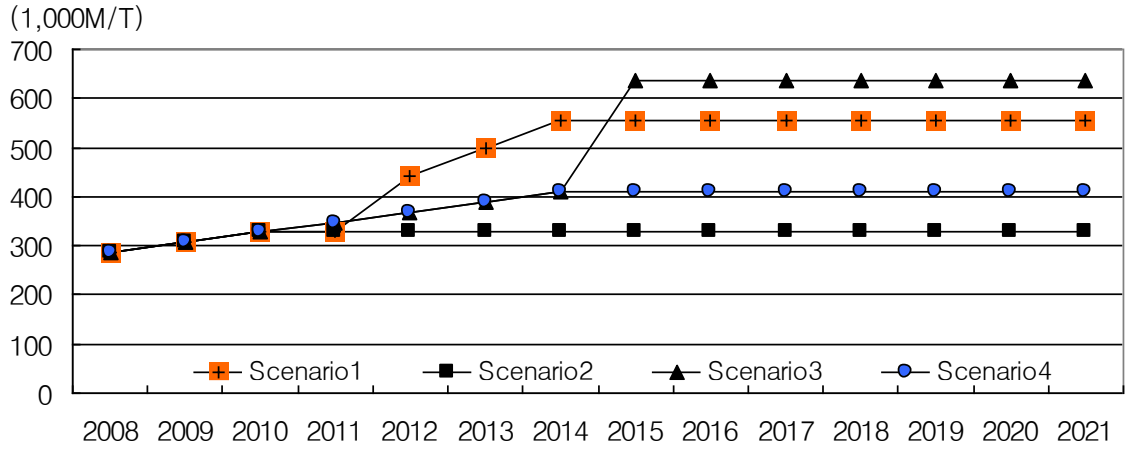


Figure 11 TRQ Changes by Scenarios

The rice import price is assumed to be 475 USD (CIF) per ton (the average rice import price between 1995 and 2009). The exchange rate of Korean won against US dollar is assumed to be constant from 2010 to 2021 (1,137 won/US$). The quality coefficient is assumed to be 20% in consideration of the differing consumer preference for domestic and imported rice (i.e., the wholesale price of domestic rice is 20% higher than that of imported rice - US. No.1 - in 2008). According to the average bid prices for imported rice and domestic rice in previous chapter, consumers would be willing to pay 15.4% and 18.4% premium for buying domestic rice against U.S. rice and Chinese rice, respectively.

5.4 Simulation Results

Deterministic Simulation

This study performed deterministic and stochastic simulations to analyze the impact of the rice market opening. Table 24 shows the projection results by the deterministic simulations. The results show that planted acreage for rice would decrease by 21~24% in the next 12 years from 924 thousand ha in 2009 to 702~729 thousand ha by 2021. Rice production would drop from 4,916 thousand M/T in 2009 to 3,421~3,551 thousand M/T by 2021 (a 28~30% reduction). As the TRQ volume expands, rice imports would increase from 257 thousand M/T in 2009 to 327~636 thousand M/T by 2021. All of the scenarios indicate no additional import beyond the TRQ volume. Stock would increase from 846 thousand M/T in 2009 to 712~2,508 thousand M/T by 2021. The nominal farm gate price is estimated to be 129,116~154,460 won per 80kg in 2021 from 146,445 won per 80kg in 2009. However, the real farm price would decrease from 135,097 won per 80kg in 2009 to 81,205~97,145 won per 80kg by 2021 in consideration of inflation. Per capita consumption would decrease from 74.0 kg in 2009 to 66.5~68.4 kg by 2021. The self sufficiency ratio would fall to 82.9~87.1% by 2021 from 98.0% in 2009. The production value of rice would also decrease from 8,999 billion won in 2009 to 5,521~6,855 billion won by 2021.

Table 24 Deterministic Projections of the Korean Rice Economy

		Scenario 1	Scenario 2	Scenario 3	Scenario 4
2009	Acreage (1,000 ha)	924	924	924	924
	Production (1,000 ton)	4,916	4,916	4,916	4,916
	Import (1,000 ton)	257	257	257	257
	Consumption (1,000 ton)	3,704	3,704	3,704	3,704
	Stock (1,000 ton)	846	846	846	846
	Farm gate Price (Won/80kg)*	146,445	146,445	146,445	146,445
	Per capita Consumption (kg)	74	74	74	74
	Self-sufficiency (%)	98	98	98	98
	Production Value* (Bill.Won)	8,999	8,999	8,999	8,999
2014	Acreage (1,000 ha)	785	787	786	786
	Production (1,000 ton)	3,876	3,887	3,881	3,881
	Import (1,000 ton)	555	327	409	409
	Consumption (1,000 ton)	3,508	3,502	3,505	3,505
	Stock (1,000 ton)	2,685	2,186	2,381	2,381
	Farm gate Price (Won/80kg)	113,033	115,548	114,419	114,419
	Per capita Consumption (kg)	71	71	71	71
	Self-sufficiency (%)	92.0	92.2	92.0	92.0
	Production Value (Bill.Won)	5,476	5,614	5,551	5,551
2021	Acreage (1,000 ha)	704	729	702	717
	Production (1,000 ton)	3,430	3,551	3,421	3,495
	Import (1,000 ton)	555	327	636	409
	Consumption (1,000 ton)	3,372	3,276	3,370	3,319
	Stock (1,000 ton)	2,159	712	2,508	1,194
	Farm gate Price (Won/80kg)	131,311	154,460	129,116	143,073
	Per capita Consumption (kg)	68	67	68	67
	Self-sufficiency (%)	82.9	87.1	82.9	85.2
	Production Value (Bill.Won)	5,630	6,855	5,521	6,250

* Farm prices and production values are nominal prices

Among the scenarios, this study expected that scenario 2, where an early tariffication in 2011 is assumed and rice is designated as a special product in DDA agricultural negotiations, would minimize adverse effects on the domestic rice industry. The results show that the self sufficiency ratio of rice would fall to 87.1% by 2021 from 98.0% in 2009. The production value of rice would also decrease from 8,999 billion won in 2009 to 6,855 billion won by 2021. On the contrary, scenario 3 assumes that the shift into tariffication occurs in 2015 and that rice is designated as a sensitive product in DDA agricultural negotiations. This study expected that the domestic rice industry would be significantly and adversely affected under this scenario. The results show that the self sufficiency ratio of rice would fall to 82.9% by 2021. The production value of rice would also decrease to 5,521 billion won by 2021.

The results of the remaining scenarios do not reveal any meaningful differences in the extent of adverse effects on the domestic rice market. The results imply that adverse impacts on the domestic rice sector can be reduced if the shift into tariffication occurs in 2011 (as compared to 2015). If an early tariffication of rice is applied in 2011, the self sufficiency ratio of rice would fall to 82.9~87.1% by 2021, and the production value of rice would decrease to 5,630~6,855 billion won by 2021. On the contrary, if the shift to tariffication occurs in 2015, the self sufficiency ratio would fall to 82.9~85.2% by 2021, and the production value would decrease to 5,521~6,250 billion won by 2021.

The key factor that determines the future of the domestic rice sector is the maintenance of the developing country status in the DDA negotiations of the WTO, rather than the timing of tariffication. If rice is designated as a special product in the DDA agricultural negotiations, the self sufficiency ratio would fall to 85.2~87.1% by

2021, and the production value of rice would decrease to 6,250~6,855 billion won by 2021. However, if rice is designated as a sensitive product, the self sufficiency ratio would fall to 82.9% by 2021, and the production value of rice would decrease to 5,521~6,855 billion won by 2021.

Inventory controls are the core of the rice policy in future because the stock to use ratio would go up rapidly due to decreases in rice consumption and increases in rice imports, as shown in Figure 12. Without special inventory controls, it is expected that the stock to use ratio would soar to 60% by 2021 under scenario 3 (where the shift into tariffication occurs in 2015 and rice is designated as a sensitive product in DDA agricultural negotiations).

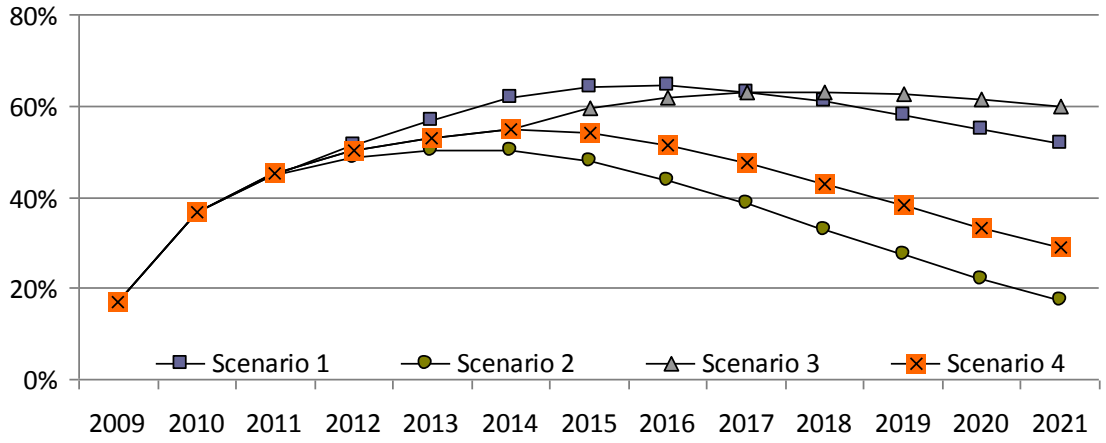


Figure 12 Stock-to-use Ratio Projections

Using the projection results of deterministic simulations, the welfare changes caused by the time to adopt rice tariffication are computed and the results are reported in Table 25 and Table 26. The following table shows welfare differences between scenario 1 (tariffication in 2011 and designation of rice as a sensitive product for

developed countries), and scenario 3 (tariffication in 2015 and designation of rice as a sensitive product for developed countries). If tariff based system for rice import adopted in 2011 rather than in 2015, producers would lose 7 to 72 billion won of producer surplus temporarily due to increase of MMA volume in short term. However, producers would gain 94 billion won in 2021 and their benefits would increase afterwards. Korea has to increase TRQ by 4.5% of domestic consumption in 3 years from 2012 (the beginning year of implementation of DDA agreement) under scenario 1. On the other hand, Korea can increase TRQ by only 0.4% of domestic consumption every year, if Korea continues to apply special treatment until 2014 (Scenario 3). However, Korea has to expand TRQ volume by 4.5% of domestic consumption at a time in 2015 under scenario 3.

Table 25 Welfare Differences between Scenario 1 and 3

Unit: bill. Won

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Producer surplus (a)											
Total	5	-7	-32	-67	-72	-60	-37	-10	22	56	94
Household [a]	6	-8	-39	-81	-87	-72	-45	-11	26	68	114
Consumer surplus (b)											
Total	-5	7	35	75	82	69	44	12	-26	-68	-114
Household [b]	0	0	2	4	5	4	3	1	-2	-4	-7
Customs Revenue (c)											
	-1	2	3	4	-2	-2	-2	-2	-2	-2	-2
Net Social Welfare (a + b + c)											
	-1	2	6	12	8	8	5	0	-7	-14	-22

[a] 827 thousand farms in 2009 (unit: 1,000 won)

[b] 16.9 million households in 2009 (unit: 1,000 won)

We can distinguish welfare differences clearly in the case of developing country compared to the case of developed country. Table 26 shows welfare differences between scenario 2 (tariffication in 2011 and designation of rice as a special product for developing countries), and scenario 4 (tariffication in 2015 and designation of rice as a special product for developing countries). The introduction of tariffication in 2011 rather than in 2015 can minimize the adverse impacts on rice farmers. Producers are expected to gain 5 to 501 billion won of producer surplus as TRQ volumes could be reduced by adopting tariff based system for rice import earlier.

Meanwhile, consumers would lose 5 to 579 billion won of consumer surplus and net social welfare also decrease. The loss of consumer surplus is negligible compared to producer surplus in terms of household. While consumer welfare per household would decrease 34 thousand won, whereas producer welfare per household would increase 420 thousand won in 2021.

Table 26 Welfare Differences between Scenario 2 and 4

Unit: bill. Won

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Producer surplus (a)											
Total	5	15	32	55	81	114	155	208	279	375	501
Household [a]	6	19	39	66	98	138	187	252	337	453	606
Consumer surplus (b)											
Total	-5	-16	-35	-61	-93	-132	-181	-244	-327	-437	-579
Household [b]	-0.3	-1	-2	-4	-5	-8	-11	-14	-19	-26	-34
Customs Revenue (c)											
	-0.5	-1	-2	-2	-2	-2	-2	-2	-2	-2	-2
Net Social Welfare (a + b + c)											
	-1	-2	-4	-8	-14	-20	-28	-38	-50	-64	-80

[a] 827 thousand farms in 2009 (unit: 1,000 won)
[b] 16.9 million households in 2009 (unit: 1,000 won)

Stochastic Simulation

The projections of the rice sector by the stochastic simulations are shown in Table 27. The means of planted acreage would decrease from 924 thousand ha in 2009 to 707~740 thousand ha by 2021. Rice production would also decrease from 4,916 thousand M/T in 2009 to 3,394~3,553 thousand M/T by 2021. The means of import would increase from 257 thousand M/T to 422~650 thousand M/T by 2021. While all of the scenarios indicate no additional import beyond TRQ volume under deterministic simulations, out-quota imports beyond TRQ volume are expected to be 23~140 thousand M/T in 2021 under stochastic simulations. Even though the nominal farm gate price is estimated to be 131,613~158,782 won per 80kg in 2021 from 146,445 won per 80kg in 2009, the real farm price would fall from 135,097 won per 80kg in 2009 to 82,775~99,863 won per 80kg by 2021 due to inflation. The mean of self sufficiency ratio would decrease from 98.0% in 2009 to 84.3~89.6% by 2021.

The projections of rice sector by the stochastic simulations also show that adverse impacts on the domestic rice industry can be minimized under scenario 2 and that significant impacts are expected under scenario 3 in the long term. These results imply that adopting tariff based system for rice imports before the completion of special treatment is favorable to Korean rice industry. As the results of deterministic simulations, the projections of stochastic simulation suggest that key point to influence on Korean rice industry is whether there can be a designation of rice as a special product for developing countries. If rice is designated as a special product, self sufficiency ratio would fall to 87.6~89.6% by 2021, and the production value of rice would decrease to 6,709~7,060 billion won by 2021. However, if rice is designated as a sensitive product

for developed countries, the self sufficiency ratio would fall to 84.3~84.4% by 2021, and the production value of rice would decrease to 5,589~5,721 billion won by 2021.

Table 27 Stochastic Projections of the Korean Rice Economy

		Acreage (1,000ha)	Production (1,000mt)	Import (1,000mt)	Farm gate price (won/80kg)	Self – Sufficiency (%)	Production Value (bill. won)
2009		924	4,916	257	146,445	98.0	8,999
2014	Scenario 1						
	Mean	788	3,786	555	115,543	89.4	5,469
	St. Dev.	6	246	4	4,004	5.8	423
	Min	759	2,823	555	95,708	68.4	4,041
	Max	814	4,748	641	134,956	110.9	7,413
	Scenario 2						
	Mean	791	3,800	329	119,037	89.6	5,656
	St. Dev.	6	247	16	4,693	5.8	457
	Min	769	2,833	327	106,749	68.5	4,128
	Max	821	4,767	912	142,415	111.2	7,789
	Scenario 3						
	Mean	790	3,793	409	117,583	89.5	5,577
	St. Dev.	6	247	8	4,260	5.8	439
	Min	768	2,828	409	106,749	68.4	4,088
	Max	818	4,757	798	140,056	111.0	7,680
	Scenario 4						
	Mean	790	3,793	409	117,583	89.5	5,577
	St. Dev.	6	247	8	4,260	5.8	439
	Min	768	2,828	409	106,749	68.4	4,088
	Max	818	4,757	798	140,056	111.0	7,680
2021	Scenario 1						
	Mean	709	3,406	574	134,282	84.4	5,723
	St. Dev.	15	232	43	11,462	5.7	685
	Min	640	2,605	555	88,498	65.8	3,201
	Max	759	4,196	1,099	170,121	104.3	8,790
	Scenario 2						
	Mean	740	3,553	422	158,782	89.6	7,060
	St. Dev.	15	240	140	12,507	6.0	805
	Min	673	2,735	327	106,931	69.4	4,034
	Max	771	4,359	1,162	184,001	111.2	9,564
	Scenario 3						
	Mean	707	3,394	650	131,613	84.3	5,589
	St. Dev.	14	229	23	10,074	5.6	624
	Min	640	2,596	636	88,498	65.8	3,196
	Max	755	4,169	1,098	170,186	104.2	8,649
	Scenario 4						
	Mean	731	3,512	461	152,636	87.6	6,709
	St. Dev.	15	237	108	12,210	5.9	785
	Min	673	2,679	409	106,931	68.1	3,985
	Max	769	4,348	1,230	181,055	108.6	9,431

The deterministic forecast for the effect of tariffication not only ignores the risk of stochastic variables such as yield, international price, and exchange rate but also produces biased estimates. The deterministic economic analysis for the production value forecasted 6,855 billion won in 2021 under scenario 2 (Table 24), whereas the stochastic analysis forecasted an average of 7,060 billion won with a minimum of 4,043 and a maximum of 9,564 billion won in 2021 (Table 27). The standard deviation and coefficient of variation (CV) are 805 billion won and 11.41%, respectively. Figure 13 presents the production value probability density function (PDF) chart for rice in 2021. The deterministic production value is 2,812 billion won greater than the minimum and 2,709 billion won less than the maximum due to the skewed nature of the distribution for production value.

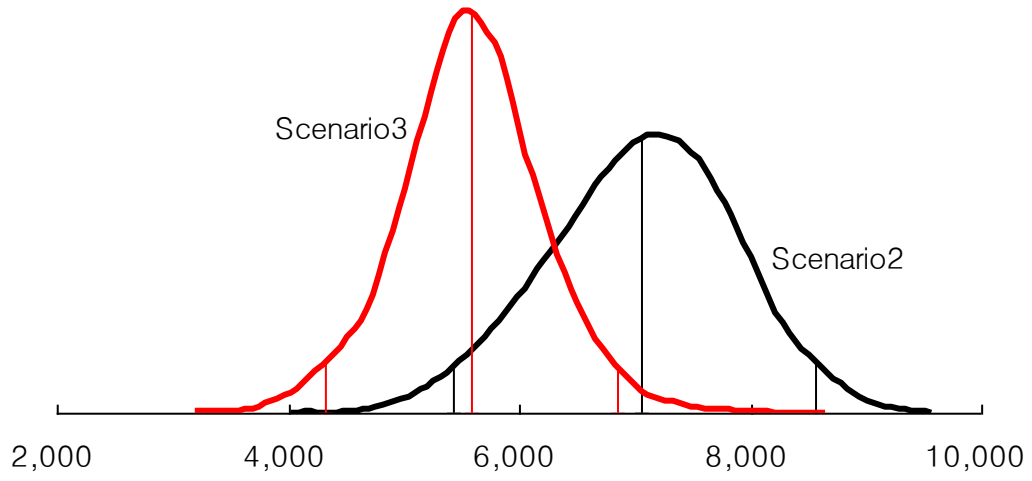


Figure 13 Probability Density Function Forecast of the 2021 PV (bill. Won)

The deterministic forecast of the production value was 5,521 billion won in 2021 under scenario 3. The stochastic forecast of production value has an average of 5,589

billion won, with a standard deviation of 624 billion won and a coefficient variation of 11.16%. The minimum and maximum production values are 3,196 billion won and 8,649 billion won, respectively. The deterministic production value is 2,341 billion won greater than the minimum and 3,128 billion won less than the maximum.

Under scenario 2, the deterministic forecast of self sufficiency ratio of rice was 87.1% in 2021. The stochastic forecast of self sufficiency has an average of 89.6% with a standard deviation of 6.0% and a coefficient of variation of 6.75%. Figure 14 presents the self-sufficiency PDF chart for rice in 2021. The minimum and maximum self-sufficiencies are 69.4% and 111.2%, respectively. The deterministic self sufficiency ratio is 24.1% P less than the maximum and 17.7% P greater than the minimum. The deterministic economic analysis for the self-sufficiency forecasted 82.9% in 2021 under scenario 3. The stochastic forecast of self sufficiency has an average of 84.3% with a standard deviation of 5.6% and a CV of 6.68%. The minimum and maximum self-sufficiencies are 65.8% and 104.2%, respectively. The deterministic self sufficiency ratio is 21.3% P less than the maximum and 17.1% P greater than the minimum.

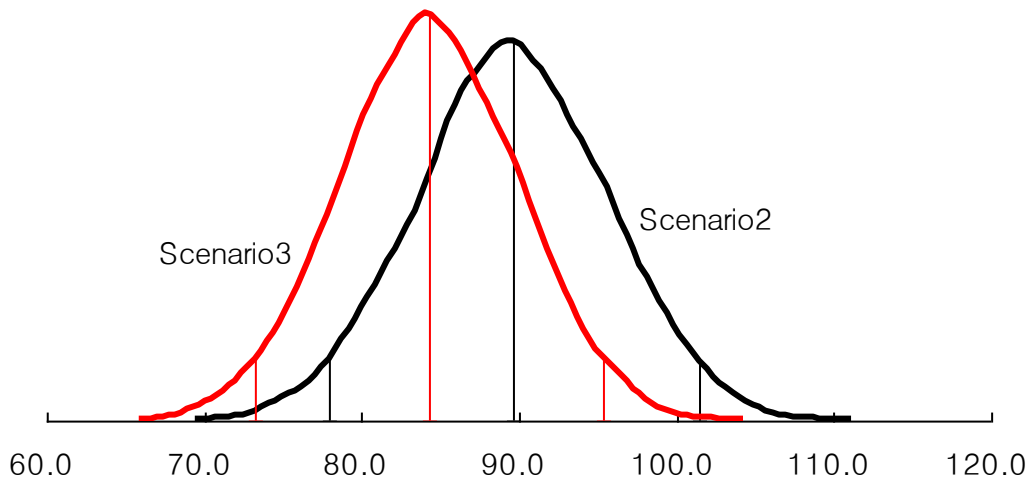


Figure 14 Probability Density Function Forecast of the 2021 Self-sufficiency (%)

The mean of rice imports in 2021 is expected to be 422 thousand M/T for scenario 2, whereas 650 thousand M/T for scenario 3 as shown in Table 28. However, in terms of variability of rice import, an opposite results are found. The out-quota import for scenario 2 would be 140 thousand M/T, which is much larger than scenario 3 (23 thousand M/T). The mean import over standard deviation, which represents the degree of stability, is estimated to be 3.0 for scenario 2 and 28.3 for scenario 3. This result implies that the importing country with higher domestic price can be more easily exposed to the risk and instability caused by the fluctuations of international price and the exchange rate after tariffication.

Table 28 Stochastic Projections of Rice Imports in 2021

Unit: 1,000M/T

	Mean (a)	St. Dev. (b)	TRQ (c)	Out-quota (a-c)	Mean/St. Dev. (a/b)
Scenario1	574	43	555	43	13.4
Scenario 2	422	140	327	140	3.0
Scenario 3	650	23	636	23	28.3
Scenario 4	461	108	409	108	4.3

The cumulative distribution function (CDF) shows the probability of production values and self-sufficiency ratios. Figure 15 illustrates the CDF for stochastic production value projections, and Figure 16 shows the CDF for stochastic self-sufficiency projections. The results suggest that scenario 2 lies more to the right than the other three scenarios. This suggests that scenario 2 should be preferred over the others. Scenario 3 is the furthest to the left than the others, so it is the least preferred. However, the fluctuation of

expected production values is larger than the other three scenarios because the flat slope of the CDF graphs means high fluctuations.

For food security, this study assumed that farm households' gross revenues should be maintained at 90% of their current levels (70% at minimum). In addition, this study assumed 90% for the self-sufficiency ratio target (a minimum of 70%). Figure 17 illustrates the probabilities of 2014 and 2021 production values being less than 70% and greater than 90% of the current levels. Under scenario 2, there was an 18% probability that the 2021 production values would be less than 70% of the current levels and a 9% probability that the values would be greater than 90%. Under scenario 3, there was a 89% probability that the 2021 production values would be less than 70% of the current levels and a 0% probability that the values would be greater than 90%. Figure 18 illustrates the probabilities of 2014 and 2021 self-sufficiency ratios being less than 70% and greater than 90%. Under scenario 2, there was a 0% probability that the 2021 self-sufficiency ratios would be less than 70% and a 47% probability that the ratios would be greater than 90%. Under scenario 3, there was a 1% probability that the 2021 self-sufficiency ratios would be less than 70% and a 16% of probability that the ratios would be greater than 90%.

The results of stochastic simulations suggest that adverse effects on the domestic rice sector can be minimized in the long term if an early tariffication is chosen in 2011. The results also indicate that, for food security, Korea should maintain the developing country status and procure rice as a special product in the WTO negotiations.

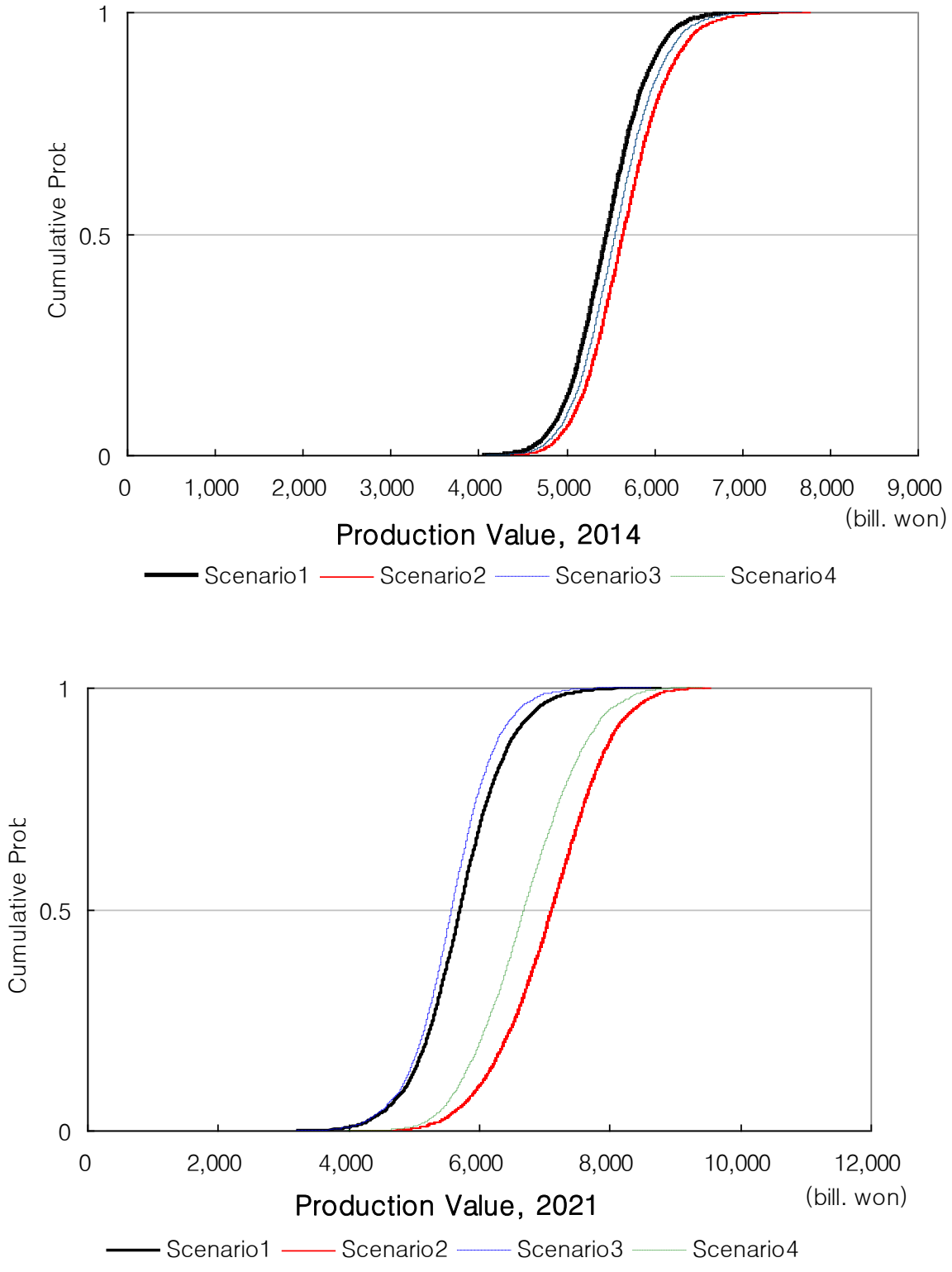


Figure 15 CDF for Stochastic Production Value Projections

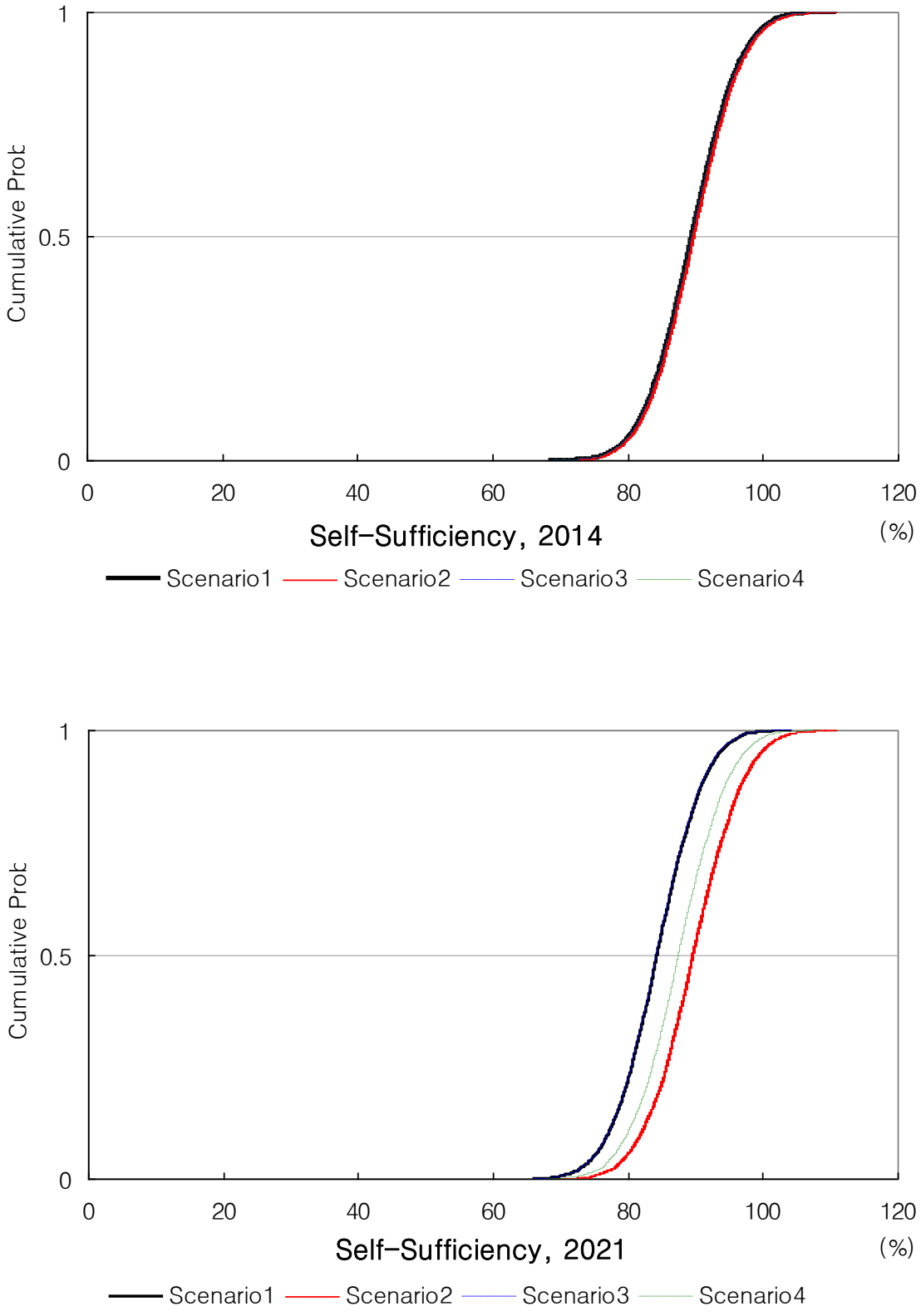
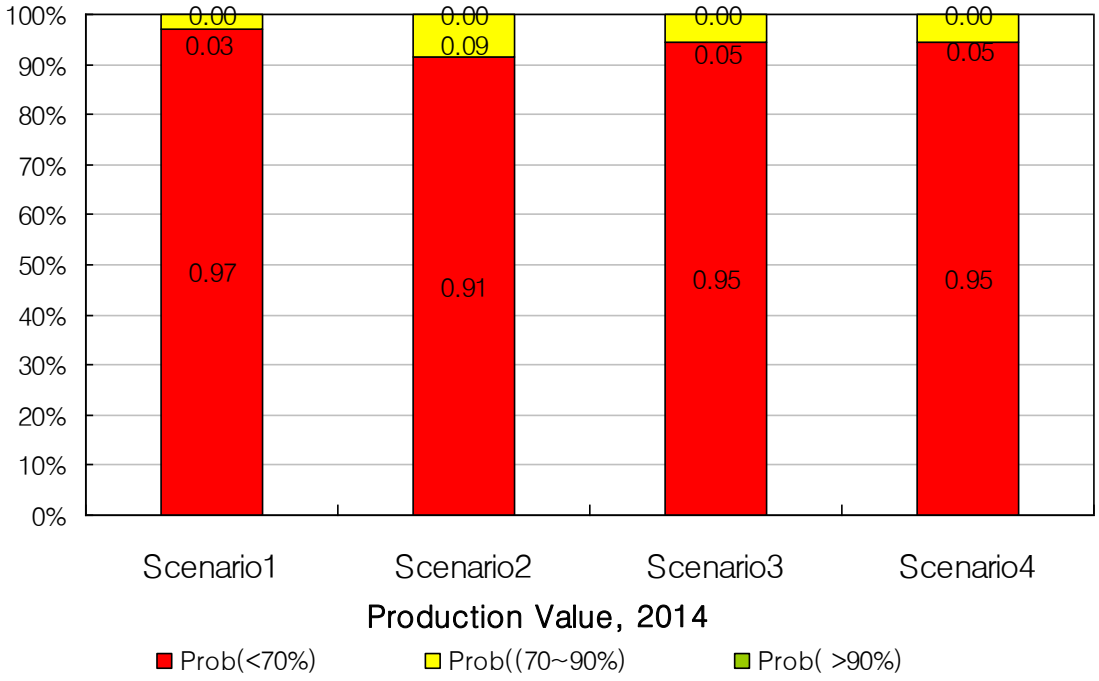


Figure 16 CDF for Stochastic Self-sufficiency Projections



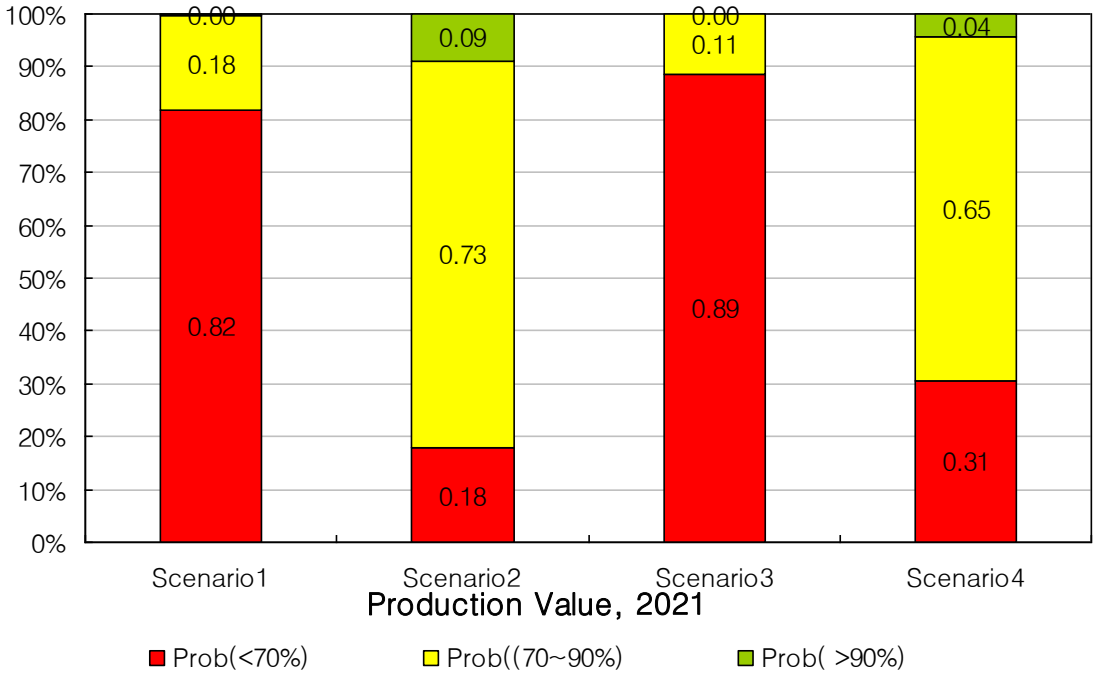
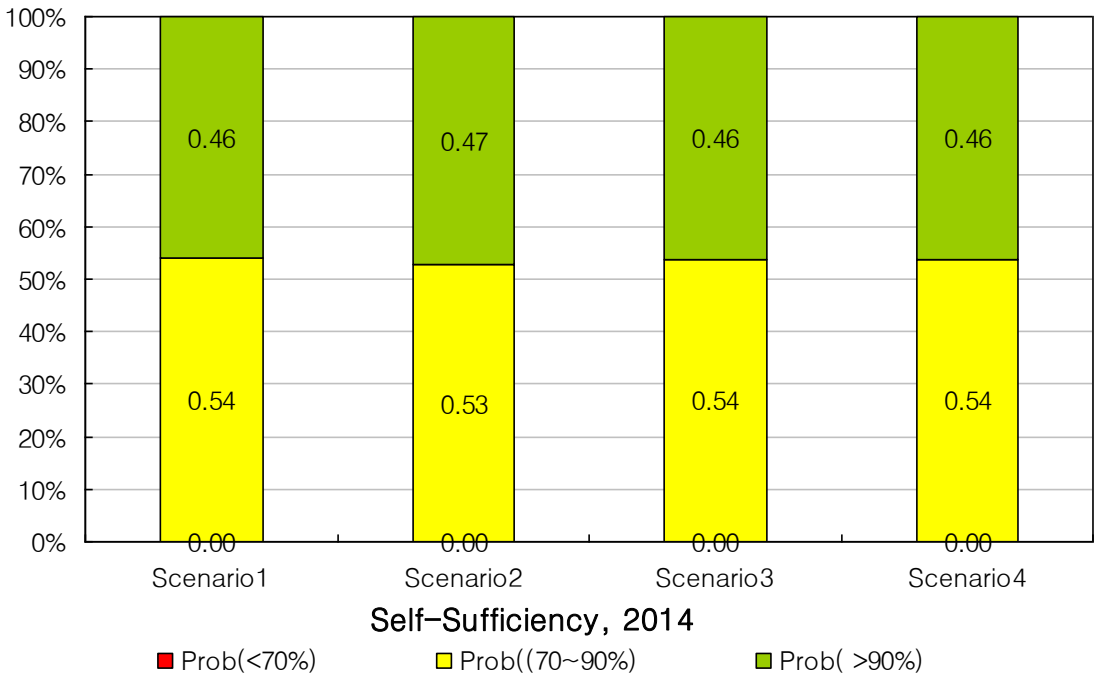


Figure 17 Stoplight Chart for the Probabilities of 2021 Production Values



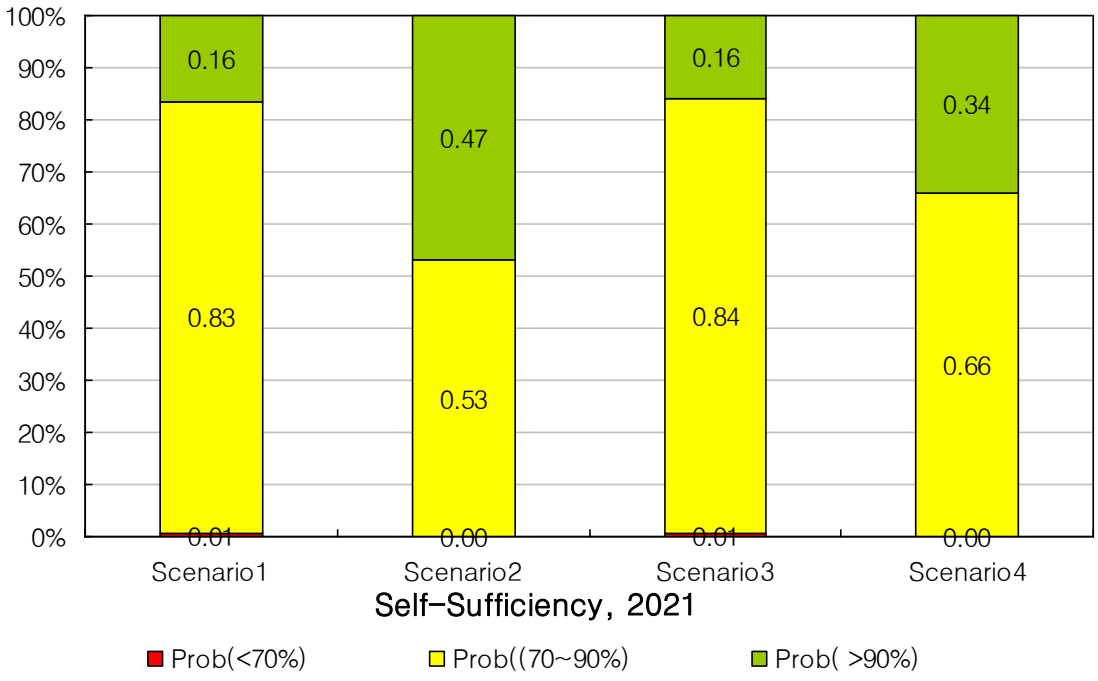


Figure 18 Stoplight Chart for the Probabilities that 2021 Self-Sufficiency

CHAPTER VI

RICE TARIFFICATION IN JAPAN AND TAIWAN

6.1 Rice Tariffication in Japan

Results of UR negotiations

Japan introduced the minimum market access (MMA) instead of adopting the tariff based system for rice imports from 1995 to 2000 as its special measure on rice was recognized by Uruguay Round Agreements on Agriculture (URAA). However, in 1995, it promised to increase the volume by 0.8% every year from 4% of domestic consumption to 8% in the period of 1986 to 1988 based on MMA. MMA rice was managed through state trading, and the private sector was allowed to import rice through Simultaneous Buy and Sell (SBS) system on a partial basis.

It was agreed that MMA volume would be maintained at 8% at a time of introducing tariffication after the conclusion of the implementation period and that Tariff Equivalent (TE) based on differences between domestic and external (import) would be applied. It was agreed to increase the MMA volume by 0.4% from the time of introduction of tariffication if the tariffication is introduced in the middle of the implementation period.

Table 29 Minimum Market Access for Japanese Rice

Unit: 1,000 M/T, Brown rice

	1995	1996	1997	1998	1999	2000
Continuation of Special Treatment	426 (4.0%)	511 (4.8%)	596 (5.6%)	681 (6.4%)	767 (7.2%)	852 (8.0%)
Tariffication in 1999	426 (4.0%)	511 (4.8%)	596 (5.6%)	681 (6.4%)	724 (6.8%)	767 (7.2%)

Source: Japanese Ministry for Agriculture, Forestry, and Fisheries

Background

Securing a 6-year-grace period for tariffication, Japan decided to introduce tariffication from April 1999 against the following backdrop. First, as a good harvest had continued and rice stock had increased since 1994, finding a resolution to rising rice inventory emerged as the most important issue in agricultural policy in the wake of soaring rice stock caused by increase in imported rice based on 8% of MMA volume per annum. Second, agricultural policy reform was pursued to counter tariffication for rice under the WTO system, and attention was drawn to the advantage of reduced annual increase in rice importation to 0.4% from 0.8% at a time of earlier introduction of tariffication. Third, it was judged that reduced burden of negotiations in the New Round at a time of earlier introduction of tariffication for rice would contribute to better responding to subsequent negotiations on agriculture.

As Japan unprecedentedly recorded 75 in harvest index in the wake of a poor rice crop in 1993 when the UR agreement was established, it urgently imported almost 2 million tons of rice. However, it was followed by an abundant harvest for four years in a row from 1994 to 1997. The stock of domestically produced rice continued to increase,

and it recorded 3.8 million tons (about 40% of domestic consumption) in rice stock at the end of 1997 (October 1998). In an effort to adjust the rice stock, set-aside acreage was expanded to 960,000 ha in 1998 and 1999.

Against this backdrop, the Japanese government imported rice based on MMA from 1995. As for 1.54 million tons of rice imported for three years (from 1995 to 1997) based on MMA, 590,000 tons of rice were used for processing, 80,000 tons as staple food and 460,000 tons for food aid to North Korea and Indonesia. As of October 1998, 420,000 tons remained as stocks. There were limitations in dealing with rice imported based on MMA, and its growing volume became a great burden.

Japan reduced government's purchasing prices of rice from 1986 while narrowing a gap between domestic prices and foreign ones. In addition, a stabilization measure for rice farm management was taken to respond to the strengthening of international disciplines and market opening from 1998, and it led to the introduction of tariffication for rice in Japan. The stabilization measure for rice farm management aimed at followings. First, governmental intervention in rice policy is confined to the maintenance of government-held rice (1.5 to 2 million tons) under public stock holding program, and it is not involved in supporting prices while inducing rice prices to be determined by domestic supply-demand relations. Second, a target price is the average of market prices by species for three years, and if market price is lower than target in pertinent year, the difference is compensated by 80%. Third, producers are partially (one fourth) responsible for the compensation every year. It is a drastic innovation from existing policies focused on supporting rice prices with governmental rice purchasing prices and guaranteeing income for farmers. It also corresponds with the direction of UR Agreement on Agriculture focused on excluding price-based support and

guaranteeing income independently of production. In addition, the stabilization measure for rice farm management carry significance in that they make it possible to respond to generalized rice importation in the future with regard to tariffication. It seems that the tariffication for rice was considered at a time of planning to introduce the stabilization measure for rice farm management.

Mechanism of rice tariffication

In consideration of domestic conditions, Japan notified a revision to Country Schedule (C/S) that included the introduction of tariffication to the WTO Market Access Committee three months prior to the implementation on December 21, 1998. The notification announced suspension of special treatment on rice from April 1, 1999 in accordance with 5-2 of Annex of Agreement on Agriculture based on GATT procedures on modification of Country Schedule on March 26, 2980.

Japan calculated initial TE by designating the price of import rice for alcohol from Thailand (32 yen/kg) as the external (import) price and considering the wholesale price (434 yen/kg) of domestically produced quality rice that accounted for 64% of domestic consumption as the domestic price to apply the gap between the two prices that was 402 yen per kg.

The TE of 402 yen per kg is 1,256% at a time of conversion based on ad valorem. As for imposed tariffs, 15% of minimum reduction rate was applied for 6 years to come up with 351 yen per kg in 1999 and 341 yen per kg (1,060% at a time of conversion based on ad valorem) in 2000. Specific duty was allowed to counter possible reduction in international rice prices caused by increased Japonica rice production and burdensome negotiations on high ad valorem.

Table 30 Base for Calculation of Tariff Equivalent for Japanese Rice

Unit: Yen/kg

Base Years	Domestic Prices (A)	External Prices (B)	A-B
1986	438	29	409
1987	435	31	404
1988	429	37	392
Average	**434**	**32**	**402**

Source: Japanese Ministry for Agriculture, Forestry, and Fisheries

Negotiations on rice need to be initiated with interested member countries based on WTO Agreement on Agriculture (Annex 5), and the procedures are followed in accordance with GATT Rules (Article 28). The results of the negotiations are included in a revision to CS, and they take into effect only when the revision to CS is confirmed.

Regarding this, the extension of special treatment was subject to bilateral negotiations, but if it pertained to the earlier introduction of tariffication, Japan notified an amendment to CS that included ① the time of tariffication, ② TE and the basis for the calculation of TE and ③ TRQ administration in accordance with Agreement on Agriculture without going through negotiations. The WTO disclosed them to all member countries for 90 days, and if there is no objection from member countries during the disclosure period, it was taken as meaning that the revision to CS was confirmed.

As for the CS revision notified by Japan, some member countries raised an objection. Regarding too high TE on the part of Japan, four countries including Australia, Argentina, the EU and Uruguay raised an objection. At that time, Japan sought understanding from member countries by explaining that their TE calculation

complied with the WTO Agreement on Agriculture, and the amendment to CS was confirmed in December 2001 after the completion of the implementation period.

In the meantime, the U.S. that accounted for almost 50% of Japanese MMA import criticized Japan arguing that reduction in the growth of MMA volume runs counter to liberalization and that it is problematic to come up with too higher TE by comparing imported rice including broken rice with domestic quality rice, but it did not raise an issue.

Rice import and TRQ administration

As for TRQ excess, Japan has imposed 341 yen/kg of specific duty on imported rice since 2000. It posts 1,060 % at a time of conversion based on ad valorem. As high tariffs are imposed on rice import beyond TRQ volume, tariff import has been completely controlled until now. However, it needs to be noteworthy that mandatory TRQ import volume plays a major role in disrupting the domestic rice market. As for the TRQ import, 9,373,000 tons were imported from 1995 to 2009, and of them, SBS import accounted for 12.7% by posting 1,193,000 tons.

Regarding TRQ administration, Japan is obligated to import a designated quantity of rice as a MMA commitment, it imports rice by applying two methods including Ordinary Minimum Access (OMA) where rice is sold at the risk of losses on the part of the Ministry of Agriculture, Forestry and Fisheries to guarantee stable supply of products and SBS import where the private sector is allowed to get involved. As for the OMA, such two methods as Country Specific Quota (CSQ) system where domestic demand is examined based on sales achievement and survey on intention of wholesalers or real consumers to designate import countries and standards and ‘global tender’ where

import countries are not designated and only the standards are allowed to take part in a bidding are being applied.

As for the SBS import, import countries or standards are not designated, but importers and wholesalers jointly take part to make a successful bid until planned volume in the order of mark-up. SBS rice drastically grew to record 120,000 tons in 1998 from 10,000 tons in 1995 as shown Table 31. However, with the import of quality rice, the SBS rice competed against Japanese rice to be reduced to 100,000 tons in 2001. The entire expected volume was imported in 2007 as well when the international prices soared. On the other hand, as the OMA rice frequently exceeded expected government's purchasing prices due to rising international prices since 2007, bids tended to be ineffective.

As for the MMA rice import from 1995 to 2009, the U.S. recorded 48.5% accounting for the highest portion, and it was followed by Thailand (24.0%), China (11.8%) and Australia 9.8%. The U.S. has recorded about 50% in annual market share since 1995. Thai rice is mostly indica rice, but a lot of glutinous rice and broken rice have been imported. As for the Chinese rice, the rice cultivated in the northeast of Heilongjiang province is very similar to the Japanese rice, so import has been expanded. As the prices are relatively low, market share has been expanded as the SBS rice. The Australian rice is mostly medium grain as seen in the U.S. rice, and as local production has recently reduced to a great extent, import has been suspended.

Table 31 Results of Japan's Minimum Access Rice Tenders

Unit: 1,000MT, Milled rice

		U.S.	China	Thailand	Australia	Others	Total
1995	SBS	6	2	0	2	0	11
	OMA	188	30	95	85	-	398
	Total	194	32	95	87	0	409
2000	SBS	46	53	5	14	1	120
	OMA	284	35	144	94	16	573
	Total	330	88	149	108	17	693
2001	SBS	25	66	0	9	0	100
	OMA	299	56	129	92	5	580
	Total	324	121	130	100	5	680
2002	SBS	20	24	1	4	0	50
	OMA	302	76	135	83	35	629
	Total	322	100	0	87	35	680
2003	SBS	18	79	1	2	0	10
	OMA	298	20	135	78	41	571
	Total	316	98	136	80	41	671
2004	SBS	23	64	1	5	1	94
	OMA	299	24	163	13	86	585
	Total	322	88	165	18	87	679
2005	SBS	18	76	2	4	1	100
	OMA	304	-	164	13	98	579
	Total	322	76	165	17	99	679
2006	SBS	23	68	1	8	1	100
	OMA	296	-	158	39	85	578
	Total	319	68	159	47	86	678
2007	SBS	25	73	2	-	0	100
	OMA	295	-	215	-	7	517
	Total	319	73	217	-	7	617
2008	SBS	19	65	16	-	1	100
	OMA	364	-	217	-	-	581
	Total	383	65	233	-	1	681
2009	SBS	18	62	11	-	0	91
	OMA	273	-	247	-	-	520
	Total	291	62	258	-	0	611
1995 to 2009	SBS	363 (30.4%)	776 (65.1%)	50 (4.2%)	80 (6.7%)	14 (1.1%)	1,193 (100%)
	OMA	4,181 (51.7%)	329 (4.1%)	2,332 (28.8%)	836 (10.3%)	412 (5.1%)	8,089 (100%)
	Total	4,544 (48.5%)	1,105 (11.8%)	2,246 (24.0%)	916 (9.8%)	425 (4.5%)	9,373 (100%)

Source: USDA (2010)

In the meantime, at a time of selling the TRQ rice, a certain operational policy is introduced for managerial purposes to prevent it from affecting the domestic rice market. The government purchases the MMA rice through state trading to sell them for the purpose of processing so that it does not have to affect the domestic market. MMA rice stocks are being used for food aid to foreign countries along with domestic rice, and remaining unsold rice is managed by the government independently of domestic rice stocks.

Table 32 Use of MMA Rice in Japan

Unit: Mill. M/T

Import 10.12	1.08 for staple food	▪ More domestically produced rice than MMA rice that has been supplied as staple food is used in food aid to other countries (1.19 million tons of domestically produced rice were used in food aid to foreign countries from November 1996 to March 2009) ▪ Part of domestically produced rice that was cultivated from 1996 to 1999 was not supplied for the purpose of staple food, but it was sold for the purpose of feed stuff (720,000 tons in sales from February 2004 to June 2006)
	3.52 for processing	▪ Annually 200,000 to 300,000 tons of low priced rice for the purpose of processing (soybean paste, Soju, rice cake and etc.) in fixed demand
	0.18 of glutinous rice	▪ SBS import
	2.53 for food aid	▪ Committed volume (mostly rice) by Japan according to Food aid Agreement is not less than 300,000 tons in flour (about 190,000 tons of rice)
	1.8 for feed	▪ Consecutive sale in the order of import year of MMA rice since July 2006
	0.97 of stocks	

Note: 1. Import volume is referred to as governmental purchases from July 1995 to March 2010.

2. In addition, there are 30,000 tons of non-compliant products and 10,000 tons of products for bio-ethanol, 3. 97 tons of stocks include 350,000 tons of rice for feedstuff

Source: Japanese Ministry of Agriculture, Forestry and Fisheries

As the demand for the MMA rice for processing is not that high, import rice stocks have increased every year, but since 2003, imported rice has been sold as feedstuff to reduce the import rice stocks. In order to reduce surplus rice supply, MAFF has been pushing rice into the feed sector where the utilization ratio of rice in compound and mixed feed increased from 0.1 percent (or 13,464 MT) in 2003 to 2.3 percent (or 557,571 MT) in 2007. However, in 2008, the feed use of rice declined to 468,000 MT. It appears that the maximum amount of rice that can be absorbed by the feed sector is around 500,000 MT. (USDA 2010) However, as the MMA rice is sold as feedstuff, financial burden has been increased. If imported rice (70,000 yen/ton) is sold as feedstuff (30,000 yen/ton), it results in losses (40,000 yen/ton) (As of 2007)

Table 33 Japan's Rice Reserve

Unit: 1,000M/T, Brown rice

	Commercial	Government		Total
		Domestic	MA rice	
1995	370	1,180	0	1,550
1996	390	2,240	310	2,940
1997	850	2,670	390	3,910
1998	470	2,970	420	3,860
1999	220	2,330	440	2,990
2000	110	1,620	560	2,290
2001	370	1,760	750	2,880
2002	460	1,550	950	2,960
2003	130	1,310	1,270	2,710
2004	20	570	1,480	2,070
2005	0	710	1,700	2,410
2006	0	680	1,890	2,570
2007	0	770	1,520	2,290
2008	0	990	970	1,960
2009	0	860	950	1,810

Source: USDA (2010)

Impact on rice market

Since the imposition of high tariffs (341 yen/kg), the prices of imported rice have been increased by 1.5 to 1.6 times those of domestic rice, and it has resulted in suspended commercial import of rice. Since tariffication, the quantity of rice import except for TRQ volume is 100 to 200 tons per annum in the wake of a high tariff barrier, and the quantity of import per case is about 0.5 to 1 ton. Basmati rice, quality rice from India and Pakistan, or rice that failed in bids for SBS is sometimes imported after the payment of duties. High tariff import rice is used in experiments, healthy food use, food industries, retail sale and etc.

Table 34 Rice Imports beyond TRQ (Out-quota Import with High Tariff)

	1999	2000	2001	2002	2003	2004	2005	2006
Volume (M/T)	225	98	69	202	217	112	112	120
Cases	128	159	155	185	216	204	222	229

Source: Japanese Ministry for Agriculture, Forestry, and Fisheries

The import prices of rice have recently been on the rise, but they are still very low compared to those of domestically produced rice in Japan. As of 2007, the price of the Japanese rice was 261 yen per kg, and that of short grains from the U.S. was 139 yen per kg. The price of short grains from China was 157 yens per kg, and that of medium grains from the U.S. was 86 yen/kg. In early 1990s, the price of Gosihikari (unpolished rice) was hovering over 20,000 yen/60kg, but it has been lower than that

since 1995. Except for temporary price hikes, it has failed to recover the previous level of price.

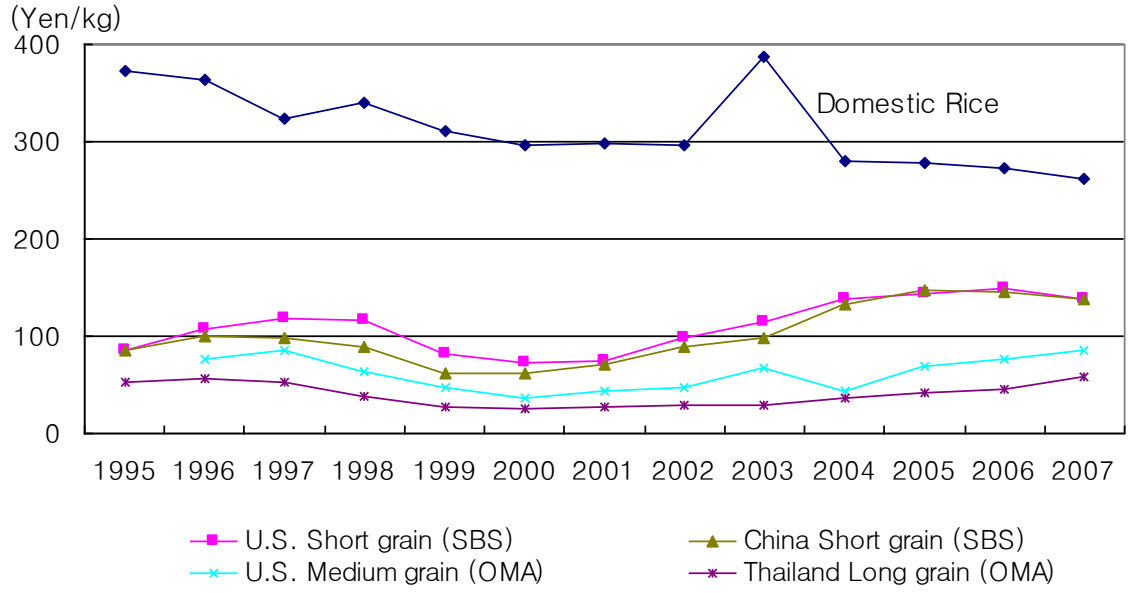


Figure 19 Price Changes in Domestic and MMA Rice in Japan

Source: Japanese Ministry for Agriculture, Forestry, and Fisheries

As a result of DDA negotiations on agriculture, at a time of implementation, Japanese duty on rice would be 102 yen/kg if it is applied to general product. And it will be reduced to 182 to 261 yen/kg if the duty is applied to sensitive product. Developed countries need to reduce duty on rice by 70% for 5 years, but if rice is designated as sensitive product, TRQ volume should be increased by 3.0 to 4.0% of domestic consumption instead of the application of low reduction rates. Japan's rice as a sensitive product is eligible to be exempted from tariff ceilings by further expanding TRQ volumes which correspond to 0.5% of domestic consumption for developed countries.

Table 35 Tariff and TRQ Changes for Japanese Rice under DDA Modalities

	Tariff	TRQ
Current	341 Yen/kg (Ad valorem: 778%)	767 thousand M/T
General Product	102 Yen/kg (70% Cut)	767 thousand M/T
Special Product	1/3 Deviation : 182 Yen/kg 1/2 Deviation : 222 Yen/kg 2/3 Deviation : 261 Yen/kg	3.5% of Domestic Consumption 4.0% of Domestic Consumption 4.5% of Domestic Consumption

Source: Japanese Ministry for Agriculture, Forestry, and Fisheries

Implications

Japan has completely opened its rice market through tariffication for the past 11 years. When it opened the rice market, Japan thoroughly managed imported rice in order to reduce a shock to the domestic rice market. As a result, it has been able to maintain a relatively stable domestic market.

Japan is mandatorily importing 767,000 tons of rice every year regardless of domestic supply and demand, and they need to be imported on a continual basis. However, as both per capita rice consumption and the total rice consumption have decreased in Japan, the relative importance of TRQ volume has been increased. The present TRQ in Japan is 7.2% of consumption recorded in base period of 1986 to 1988, and the percentage was already increased to 9.4% based on the year of 2009. This trend is expected to continue in the future seriously influencing the management of domestic supply and demand of rice in the long run.

The effects of imported rice are relatively insignificant in Japan where 9.4% of domestic consumption rice is imported. About 100,000 tons of SBS rice imported by the private sector are being supplied for the purpose of stable foods, and they tend to compete against low priced rice in Japan. In the long run, the prices of domestic rice tend to be decreased, but it seems to be stabilized.

As Japan imposes very high tariffs on rice import beyond TRQ volume, import has been completely prevented until now. In addition, TRQ rice has been imported through state trading, and the government conducts management in consideration of the domestic market. In particular, as rice is sold for the purpose of processing, feed stuff and food aid in an effort to prevent imported rice from influencing staple foods, some rice is preserved for a long time if necessary.

Japan already reduced government purchasing prices from 1986 to narrow a price gap between domestic products and foreign ones. In addition, Japan introduced a stabilization measure for rice farm management aimed to compensate for reduced prices to some extent so that it could counter decreasing prices caused by increased import with the opening of the market in 1998.

6.2 Rice Tariffication in Taiwan

Background

When Taiwan joined the WTO in 2002, it began to open up its rice market through MMA instead of adopting tariff based system for rice import. In return, it was committed to importing 144,720 tons of MMA rice that accounts for 8% of average

consumption from 1990 to 1992. The private sector imported 35% of rice, and it was distributed on a first-come, first-served basis. Taiwan also promised that it would import 65% of the rice through state trading and not use it in re-export and food aid to foreign countries. If the volume of the private sector and governmental quota is sold in the domestic market, NT$23.26/kg of mark-up ceiling can be imposed. Committed to a one-year-grace period for tariffication in 2002, Taiwan agreed to make a decision on measures to be taken after 2003 through negotiations in 2002. However, referring to precedence on tariffication in Japan, Taiwan also decided to introduce tariffication and notified its intention to the WTO without negotiations with member countries three months prior to the implementation in September 2002.

Taiwan decided to introduce tariffication for similar reasons to Japan. At that time, Taiwan imported 8% of MMA rice in the first year of market opening greatly disturbing the domestic market. If the special treatment is extended, MMA volume had to be drastically increased through bilateral negotiations with related member countries, and it was expected to result in increased demand for expanded market opening and unbearable pressure on negotiations. As seen in Japan, A 0.8% of annual increase or more of MMA rice was expected to be requested, and it was likely to cause a problem in a long-term supply and demand management.

Mechanism of rice tariffication

Based on a revision to Country Schedule specified in Article 28 of GATT, Taiwan notified to the WTO on September 30, 2002 that it would not extend the special treatment for rice import from January 1, 2003 and that it would open the market based on tariffs. Following the Japanese case, Taiwan judged that the introduction of

tariffication was not subject to negotiations and submitted a revision to CS including the time of implementation of tariffication measures, TE, a basis for calculation of TE and TRQ administration in accordance with WTO Agreement on Agriculture.

The contents of TRQ administration section (SectionI-B) of an amendment to C/S submitted in accordance with the introduction of tariffication are as follows. First, governmental reserved rice is allowed to be distributed to the domestic market for industrial purposes and as food products. Second, imported rice cannot be re-exported, and existing MMA system is turned into Tariff-Rate-Quota (TRQ) system for rice import. Third, governmental rice import should comply with a bidding process based on internationally recognized rice trading standards, and the portion of governmental import rice should be maintained at 65%. Fourth, the portion of import by the private sector should be maintained at 35%, and all traders registered as a food distributor are allowed to take part in quota assignment. Fifth, if the volume of is drastically increased or if domestic prices significantly fall, special safeguard (SSG) can be additionally imposed according to URAA.

As Taiwan joined the WTO as a developed country instead of a developing country, if it wants to keep the special treatment, it needs to make a great deal of concession through bilateral negotiations with member countries with regard to TRQ volume, so it was forced to adopt tariffication on more unfavorable conditions than Japan.

According to TE calculation data submitted by Taiwan to the WTO along with a revision to CS, the prices of import price for processing from Thailand were used as international prices. The wholesale prices of domestic ‘brand rice’ that accounts for 45% of consumption were used as domestic prices. However, there is no data on the

wholesale prices for the base years from 1990 to 1992, Taiwan uses wholesale price indices and the actual monthly average of highest and lowest prices published in 1999-2001 to estimate the 1990-1992 prices. 52.61 NT$ of difference between domestic prices and import (external) prices was calculated as the initial TE, and 15% of tariff reduction according to UR negotiations on agriculture was reduced from the initial TE. 45 NT$/kg (52.61 NT$/kg × 0.85) was suggested as a tariff.

Table 36 Base for Calculation of Tariff Equivalent for Taiwanese Rice

Unit: NT$/kg

Base Years	Domestic Prices (A)	External Prices (B)	A-B
1986	62	8	54
1987	62	8	54
1988	60	9	51
Average	**61**	**8**	**53**

Source: Council of Agriculture in Taiwan

Regarding to a revision to C/S including the introduction of tariffication, a few member countries raised an objection. Three countries including the U.S., Australia and Thailand raised an issue against the introduction of tariffication by arguing that it needs to go through negotiations with interested member countries and that there is a problem in methods of calculating TE. Taiwan is presently consulting with interested member countries, and domestic laws were revised to introduce tariffication while the amendment to C/S did not yet come into effect before invoking SSG in May 2003 and imposing additional tariff by the end of December.

It was agreed to provide Country Specific Quota (CSQ) to the U.S., Australia, Thailand and Egypt in March 2007. The CSQs include 64,634 tons for the U.S., 18,634 tons for Australia, 8,300 tons for Thailand and 2,500 tons for Egypt. If the CSQs are not fulfilled in three public sales in a row, they are turned into global quotas. Although the final revision was submitted to the WTO, it was invoked after June 22, 2007. As a result, the governmental purchase of imported rice has been operated within CSQ system.

Rice import and TRQ regime

Taiwan has imposed 45 NT$/kg of specific duty on imported rice. The tariff applied in 2003 is 45NT$/kg, and it is 563% at a time of conversion to ad valorem. As for rice import beyond TRQ volume, such a high tariff has been imposed, rice has not been imported beyond TRQ volume. However, TRQ volume is mandatorily imported, and unlike Japan, it disturbs the Taiwanese rice market.

Governmental reserved rice is allowed to be distributed to the domestic market for industrial purposes and as food products, and the import of rice for re-export is not considered as TRQ import. Governmental rice import is conducted based on a bidding process to fulfill internationally recognized standards of rice trading.

Taiwan imported 3,000 to 5,000 tons of rice every year from Thailand right before the opening of the market. With the opening of the market in 2002, import drastically increased, so it posted 144,732 tons in MMA import in 2002 and recorded 144,649 tons in TRQ import with the introduction of tariffication in 2003. Mandatory import volume is 144,720 tons based on unpolished rice, but as polished rice and unpolished rice are mixed in imports in reality, there are differences in quantity. Unlike Japan, Taiwanese rice import is characterized by a divide into quality rice as staple food

from Japan, Australia and the U.S. and low-grade rice for processing from Thailand and Egypt. In the meantime, some quality scented rice has been imported from Thailand.

Table 37 tabulated import volumes and values from major source countries after the WTO accession. Due to the time lag in shipping or occasional disruptions (e.g., the harbor strike in the West coast of the US, draught in Australia), the annual total import volumes and values fluctuated substantially. However, the unit import prices went up continuously in accordance with the global market trend. The US's import share was around 50% until 2007 but it decreased to 18.4% in 2009. The Thailand's has grown up from 21% in 2002 to 48% in 2009. The unit prices of the two countries were quite similar and competitive. Japan occupies a small market share of 1~2% in volume, but the very high unit values contributes to a 10~20% share in value terms.

Table 37 Rice Import Volumes and Values in Taiwan by Major Source Countries

		Volume (M/T)	Share (%)	Value (1000 US)	Share (%)	Unit value (US/kg)
USA	2002	57,636	53.4	16,296	46.9	0.28
	2003	103,693	67.8	35,454	65.0	0.34
	2004	93,957	52.9	31,430	47.3	0.33
	2005	24,018	32.5	9,022	27.8	0.38
	2006	58,255	49.6	27,806	48.5	0.48
	2007	74,701	52.5	36,497	50.4	0.49
	2008	30,634	28.5	17,749	27.2	0.58
	2009	16,680	18.4	13,350	23.0	0.80
Thailand	2002	22,918	21.3	7,388	21.2	0.32
	2003	31,994	20.9	10,885	20.0	0.34
	2004	38,863	21.9	14,781	22.2	0.38
	2005	46,709	63.2	17,578	54.1	0.38
	2006	49,842	42.4	20,636	36.0	0.41
	2007	48,469	34.1	22,351	30.9	0.46
	2008	43,014	40.1	25,347	38.8	0.59
	2009	43,397	47.8	25,070	43.1	0.58
Japan	2002	660	0.6	2,634	7.6	3.99
	2003	693	0.5	2,638	4.8	3.80
	2004	553	0.3	2,642	4.0	4.78
	2005	939	1.3	4,584	14.1	4.88
	2006	1,122	1.0	4,890	8.5	4.36
	2007	1,179	0.8	5,139	7.1	4.36
	2008	1,191	1.1	5,972	9.1	5.02
	2009	819	0.9	4,696	8.1	5.74
Others	2002	26,645	24.7	8,466	24.3	0.32
	2003	16,645	10.9	5,580	10.2	0.34
	2004	44,328	25.0	17,611	26.5	0.40
	2005	2,214	3.0	1,304	4.0	0.59
	2006	8,214	7.0	4,005	7.0	0.49
	2007	17,887	12.6	8,366	11.6	0.47
	2008	32,492	30.3	16,247	24.9	0.50
	2009	29,986	33.0	15,064	25.9	0.50
Total	2002	107,859	100.0	34,784	100.0	0.32
	2003	153,026	100.0	54,557	100.0	0.36
	2004	177,702	100.0	66,463	100.0	0.37
	2005	73,880	100.0	32,488	100.0	0.44
	2006	117,433	100.0	57,338	100.0	0.49
	2007	142,235	100.0	72,352	100.0	0.51
	2008	107,330	100.0	65,315	100.0	0.61
	2009	90,882	100.0	58,180	100.0	0.64

Source: Council of Agriculture, Executive Yuan.

Impact on rice market

In 2003 right after the introduction of tariffication, the sale of rice stocks increased amid uncertainties about tariffication, and the prices of rice were reduced by 16% in the wake of temporary opening of import volume. However, the situation was stabilized on the back of additional purchase by the government. Since the introduction of tariffication in 2003, rice import beyond TRQ volume has not been conducted due to high tariffs except for TRQ.

The government's response to the new competitive environment is to cut Taiwan's rice production to bring supply more in line with demand and soften the impact of lower demand with subsidies for farmers that switch to cultivating other crops. The other government policy response is a plan to provide incentive payment for Taiwan's rice growers to set aside their paddy by 50,000 hectares over several years to cut down Taiwan's annual rice production.

The steady increase in import volumes has brought downward pressures on both the price and income levels for the rice farmers. The present rice marketing system has failed to provide a conducive environment to assist their transformation from subsidized farming to market-driven production due to the insufficient forward and backward linkages after a long history of government protections. On the export side, Taiwan can no longer sell surplus rice into the world market at discounted prices after the WTO entry. Therefore, the exports decline significantly after 2001 as shown in Figure 20. However, it has been gradually recovered to a small extent in 2005 after the exports to the Japan’s rice market. The rice sold to Japan’s market are produced in the eastern coastal region and marketed by the local township farmers’ organizations.

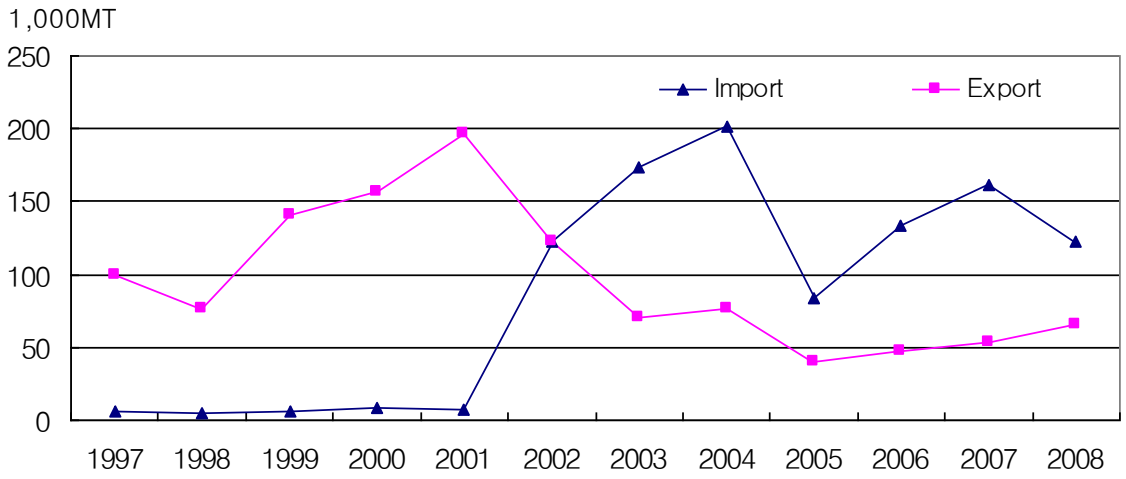


Figure 20 Changes in Trade Volumes of Rice in Taiwan

Figure 21 displays the annual price movements in the farm gate and retail levels. After the rice imports in 2002, rice price dropped 20% during 2nd cropping season in 2002 and 10% during the 1st cropping season in 2003. However, the low stock-to-use ratio and crop losses from several typhoon/flood events stimulated a rebound in 2004. The price level remained stable as shown in Figure 21.

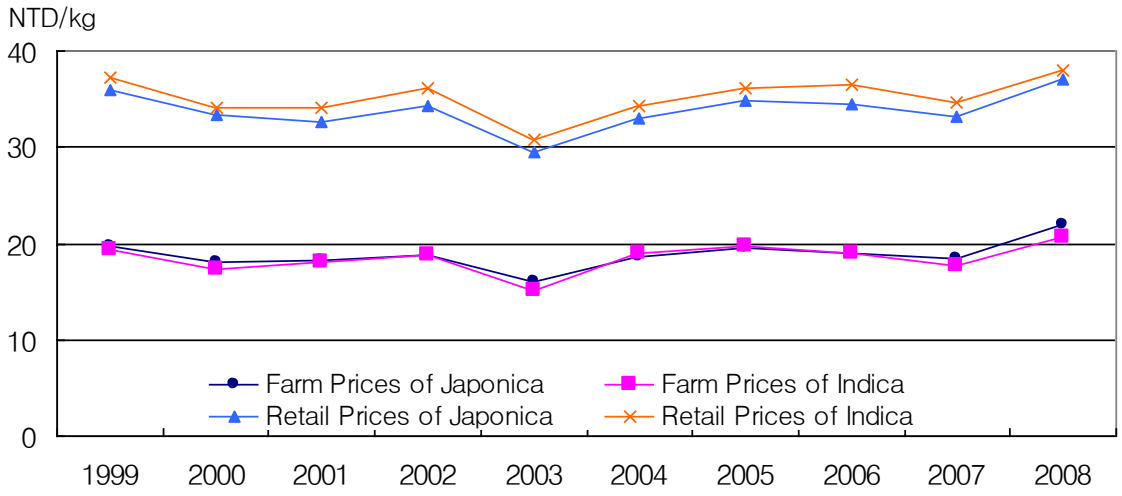


Figure 21 Changes in Farm Gate and Retail Prices of Rice in Taiwan

Figure 22 illustrates that the annual rice production has declined in a continuously fashion partly due to reductions in consumption and partly due to the imports. The government also adopt the rice paddy and upland field utilization adjustment program (which is similar to the land set-aside program) to cope with the rising import situation. The program encourage rice farmers not to produce rice and compensate them with a payment equivalent to the profits from producing rice. As a result, rice production declines rapidly during 2003-2004.

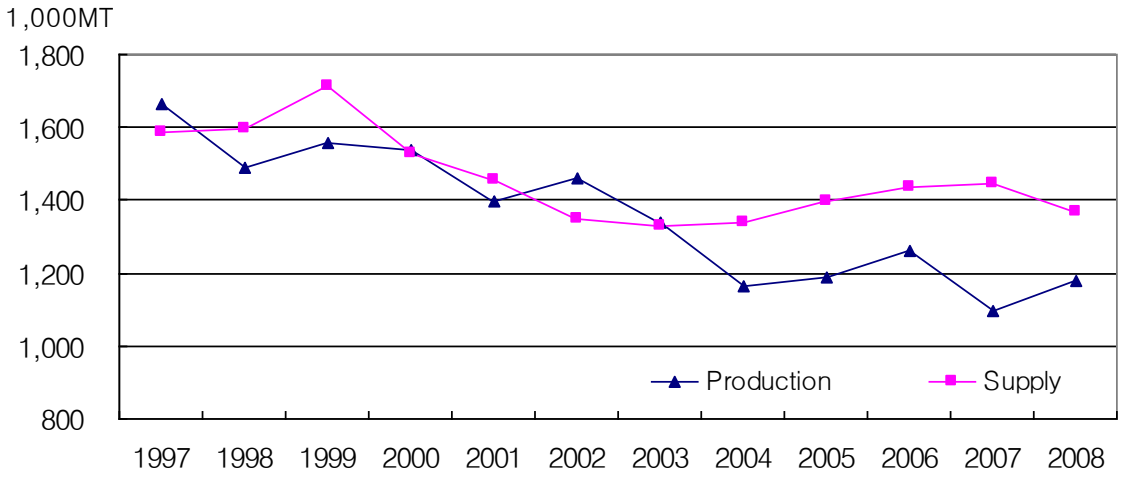


Figure 22 Changes in Domestic Production and Supply in Taiwan

Table 38 indicates that the net farm income per hectare has fluctuated over the past decade, largely due to climate related natural disasters like typhoon or flood. The average net income before and after the WTO accession were almost the same. Although rice import did not bring detrimental effect on farm income, the government price support is also ineffective to support farm income.

Table 38 Net Farm Income per Hectare before and after Tariffication

Unit: NT$/ha

Before	1997	1998	1999	2000	2001	2002	1997-2002 Average
1st crop	51,906	50,806	58,289	52,934	49,536	56,285	53,293
2nd crop	45,383	42,540	39,744	39,111	38,947	37,046	40,462
Total	97,289	93,346	98,033	92,045	88,483	93,331	93755
After	2003	2004	2005	2006	2007	2008	2003-2008 Average
1st crop	54,206	64,643	54,213	50,743	51,436	69,092	57,389
2nd crop	46,064	51,291	33,485	47,476	17,492	26,382	37,032
Total	100,270	115,934	87,698	98,219	68,928	95,474	94,421

Source: Council of Agriculture, Agricultural Yearbook, various issues.

Note: Net farm income is the total receipt minus the expenditure including the imputed own farm labor cost.

Implications

It has been 7 years since Taiwan completely opened its rice market through tariffication. In 2003 right after the introduction of tariffication, the sale of rice stocks increased amid uncertainties about tariffication, and the domestic rice prices were drastically reduced in the wake of temporary releasing of imports by the private sector, but the situation was stabilized through the additional purchase by the government.

Taiwan is mandatorily importing 144,720 tons of rice every year regardless of domestic supply and demand. They need to be imported on a continual basis. However, like in Japan, Taiwan has also witnessed rice consumption decrease, so the relative importance of TRQ is consistently growing. With drastic decrease in consumption in Taiwan, 8% of the consumption from 1990 to 1992 was increased to 8%. This trend will continue in the future, and it is expected to have a serious effect on the domestic supply and demand of rice in the long run.

Taiwan is importing 12.6% of its consumption of rice, and they are being released to the market. Of the imported rice, high priced rice from Japan, the U.S. and Australia and low priced rice from Thailand and Egypt have been released to the market at the same time creating unstable situations where the Taiwanese consumption market is disturbed and producer prices are decreased.

Like Japan, Taiwan also imposes high tariffs on rice in excess of TRQ, so import has been completely prevented until now. However, Taiwan is regulated at a time of managing imported rice at the request of the U.S. with regard to negotiations on Taiwanese accession into the WTO. Imported rice is prohibited from being used for food aid to other countries or feedstuff. Accordingly, it has a problem caused by the fact that TRQ rice is directly affecting the domestic market.

The two countries are very different in terms of rice import and resultant domestic policies on rice. In Taiwan, production is adjusted to manage domestic supply and demand of rice, and the set-aside acreage accounts for 50%. In order to ease tumbling prices, Taiwan not only conducts massive paddy field diversion program but it also implements full-fledged governmental purchases, which tends to run counter to international regulations.

CHAPTER VII
SUMMARY AND CONCLUSION

7.1 Summary

Korea converted import restrictions on all agricultural products to the tariff based system except for rice according to the URAA. Korean rice was subject to special provisions granting a 10-year grace period of 1995 to 2004 during which rice tariffication could be delayed. Instead of adopting the tariff based system, rice imports through MMA had been scheduled from 1 to 4 percent of the domestic consumption. A relatively low tariff of 5% has been imposed on rice imports within the MMA quota.

Korea succeeded in extending the special treatment for rice for an additional period of 10 years until 2014 as a result of the rice negotiation which held in 2004. In exchange for extending the special treatment, the MMA volume in 2014 should be increased to 8.0% of the domestic consumption, which projected to be 12% considering the recent trend of decreasing rice consumption. These results of the rice negotiation in 2004 can be regarded as positive in that Korea gained more time to strengthen the competitiveness of the Korean rice industry. In exchange for extending the special treatment, however, Korea had to agree to nearly double the rice MMA and to allow retail sales of imported rice, which contributed to declining domestic rice prices. Korea decided to extend the special treatment for rice considering that there was a need for some kind of stable insurance because more drastic tariff reductions than the UR reduction formula were likely to be discussed in the DDA negotiations. Subsequently,

Korea's decision to extend the special treatment in 2004 can be viewed as a provisional measure.

The DDA negotiations, launched in November 2001, were initially supposed to be completed by 2003. Until now, the WTO members have failed to complete the modalities negotiations. Even though there remain some issues to be resolved in agricultural area, the revised modalities comprehensively deal with pending issues on three pillars, market access, export subsidy, and domestic support. It is possible scenario to conclude negotiating modalities based on the 4th revised modalities text (Dec. 6, 2008). According to the modalities text, Korea is able to protect rice products by designating them as sensitive or special products even though substantial improvements in market access have been claimed in the DDA negotiations. Moreover, a portion of special products can be fully exempted from tariff reduction. In this regard, there remains little uncertainty arising from the DDA negotiations to introduce the tariff based system for rice imports. In addition, SSM, a more extensive trade remedy than SSG, was newly acknowledged in the DDA negotiations, so more favorable conditions seem to be created to convert into rice tariffication. From this overall perspective, then, a shift into the tariff based system for rice imports needs to be considered.

This study has attempted to elicit consumers' willingness to pay for imported rice. To identify consumers' valuations, an experimental auction, the random *n*th price auction, is applied. This experimental auction creates an active market environment to determine participants' true valuations for imported rice. Therefore, experimental auctions may minimize hypothetical bias. In addition, real money is used to exchange for real goods, and this procedure creates an incentive for participants to reveal their true preferences.

It is also essential to identify consumers' recognition of taste preference and country of origin of rice before introducing rice tariffication to the Korean rice market. This study provides different information on rice to participants. The information on country of origin of rice without taste is provided to some participants to investigate the change of their bidding behaviors in considering their premium for domestic rice. To assess the effect of taste preference on participants' bidding behaviors, the information on taste without country of origin of rice is given to other participants by providing them with tasting freshly cooked rice. Both information on taste and country of origin are also simultaneously provided to participants without the ordering effect to analyze their net effect on participants bidding behaviors.

According to the average bid prices, consumers would be willing to pay a 15.4 % premium for buying domestic rice against U.S. rice and a 18.4% premium for buying domestic rice against Chinese rice. The most common reasons for these results are food safety concerns, a strong desire to support domestic producers, and beliefs that domestic rice was of higher quality

Mean bid prices except for U.S. rice in the auction continually increases across rounds. However, the median bid prices for each kind of rice in the auction do not continually increase across rounds. The median bid prices for each kind of rice in the auction increase round 1 through round 3 or round 4 and decrease or stablilize. This result supports that there is no round affiliation in the auction.

Participants' bidding behaviors are affected by different information on rice. This study found that consumers attached value to the country of origin and taste of rice. Taste information on rice results in favorable assessment for imported rice and results in higher bids to buy imported rice. Participants with information on taste would pay

34.5% higher for U.S. rice and 45.8% for Chinese rice. The information on country of origin causes lower bid prices for imported rice and higher bid prices for domestic rice. Participants decreased their bid prices by 7.8% for U.S. rice and 1.7% for Chinese rice. On the other hand, participants increased their bid prices 8.3% for domestic rice. Participants significantly responded to information on country of origin. Additionally, the effect of taste dominates the effect of country of origin on consumers' perceptions and their willingness to pay for imported rice.

When it comes to regression results, the positive sign of taste variable for U.S rice shows that the participants concerned about taste tended to pay more for U.S rice if they buy imported rice. The sign of experience variable is positive for Chinese rice. Participants who have bought imported rice pay more for it. It implies that those who have bought imported rice tended to pay more for imported rice than those who did not purchase. Consumers who have bought imported rice tend to realize that the quality of imported rice is better than they expected.

According to the results of market share simulations, if the import price (c.i.f.) of U.S. rice and Chinese rice is higher than $450/MT after rice tariffication, the whole share would go to domestic rice in Korean rice market. This result implies that there would be no negative effect of tariffication on the market share of Korean rice under these situations. As expected, demand for imported rice increase when the import price falls. At the import price level of $300/MT, 30.0% and 26.9% of consumers are predicted to choose the imported rice from U.S. and China. When consumers are provided with the country of origin label, the market share of Korean rice is much higher than imported rice. When consumers tasted freshly cooked rice the market share of imported rice would increase than they did not.

This study also conducted market share simulations to estimate the effect of tariff reduction on Korean rice market under the various scenarios considering the current DDA negotiations. If the import price was higher than $600/MT, more than 90% of market share would go to Korean rice. If rice is designated as a special product in DDA negotiation, most shares would go to Korean rice regardless of import price. This result suggests that there would be no negative effect of tariffication on the market share if Korean retains the developing country status and rice is designated as a special product.

Korea's rice imports have increased steadily under an import quota called the Minimum Market Access (MMA) quota since the implementation of the Uruguay Round Agreement of Agriculture in 1995. As a result of the WTO negotiation on rice imports in 2004, the special treatment of rice imports was extended to 2014. However, the import expansion has influenced all areas related to rice, such as production, consumption, prices, incomes, marketing, producer subsidies, and policies.

This study focuses on measuring the effects of both the shift into tariffication in 2011 and tariffication after the special treatment of rice imports, the MMA quota, in 2015. This paper proposes a dynamic ex-ante partial equilibrium simulation model for the rice sector and performs deterministic and stochastic simulations to measure the effects of unstable global markets and exchange rates.

The projections of deterministic and stochastic simulations suggest that adverse impacts on the domestic rice sector can be reduced if the shift into tariffication occurs in 2011 rather than in 2015. According to the projections of deterministic simulations for an early tariffication in 2011, the self sufficiency ratio would fall to 82.9~87.1% by 2021, and the production value of rice would decrease to 5,630~6,855 billion won by

2021. On the contrary, if the shift occurs in 2015, the self sufficiency ratio would fall to 82.9~85.2% by 2021, and the production value of rice would decrease to 5,521~6,250 billion won by 2021.

However, the key factor that determines the future of the domestic rice sector is whether Korea would maintain the developing country status in WTO negotiations, rather than the timing of tariffication. The results imply that Korea should maintain the status and procure rice as a special product in the DDA negotiations to protect its domestic rice sector. If these two conditions hold, Korea may change the special treatment of rice, the MMA quota, to tariffication before 2015. If rice is designated as a special product in the DDA agricultural negotiations, the self sufficiency ratio would fall to 87.1~85.2% by 2021, and the production value of rice would decrease to 6,250~6,855 billion won by 2021. On the contrary, if rice is designated as a sensitive product, the self sufficiency ratio would fall to 82.9% by 2021, and the production value of rice would decrease to 5,521~5,630 billion won by 2021.

The introduction of tariffication in 2011 rather than in 2015 can minimize the adverse impacts on rice farmers. Producers are expected to gain 5 to 501 billion won of producer surplus as TRQ volumes could be reduced by adopting tariff based system for rice import earlier. Meanwhile, consumers would lose 5 to 579 billion won of consumer surplus and net social welfare also decrease. The loss of consumer surplus is negligible compared to producer surplus in terms of household. While consumer welfare per household would decrease 34 thousand won, whereas producer welfare per household would increase 420 thousand won in 2021.

The greater rice market access with TRQ expansion, the more serious difficulties Korean rice sector will face. Without special inventory controls, it is expected that the

stock to use ratio would soar to 60% by 2021 mainly due to decreases in rice consumption and increases in TRQ under scenario 3 (where the tariffication in 2015 and designation of rice as a sensitive product are assumed).

This study also performed stochastic simulations to analyze the uncertain impacts of the rice market opening. The probabilities of endogenous variables in the model were measured using simulated stochastic variables such as employs yields, import prices, and exchange rates. As the results of deterministic simulations, the stochastic projections also indicate that adopting tariff based system for rice imports before the completion of special treatment is favorable to Korean rice industry. Simultaneously, the projections of stochastic simulation suggest that key point to influence on Korean rice industry is whether there can be a designation of rice as a special product for developing countries.

However, the deterministic forecast for the effect of tariffication not only ignores the risk of stochastic variables but also produces biased estimates. For example, the deterministic economic analysis for the production value forecasted 6,855 billion won in 2021 under scenario 2, whereas the stochastic analysis forecasted an average of 7,060 billion won with a minimum of 4,043 and a maximum of 9,564 billion won in 2021. The deterministic production value is 2,812 billion won greater than the minimum and 2,709 billion won less than the maximum mainly due to the skewed nature of the distribution for production value.

Stochastic forecast also indicate that the importing country with higher domestic price can be more easily exposed to the risk and instability caused by the fluctuations of international price and the exchange rate after tariffication. The mean of rice imports in 2021 is expected to be 422 thousand M/T for scenario 2, whereas 650 thousand M/T for

scenario 3. However, the estimated out-quota import for scenario 2 is 140 thousand M/T, which is 117 thousand M/T greater than scenario 3. The mean import over standard deviation, which represents the degree of stability, is estimated to be 3.0 for scenario 2 and 28.3 for scenario 3.

Japan and Taiwan are going through a similar market opening process from partial opening characterized by a grace period for rice tariffication to complete opening characterized by tariffication. Both countries implement mandatory TRQ import and high tariff import beyond TRQ volume.

The two countries took the position that the introduction of tariffication is not subject to negotiations, so they determined TE based on WTO Agreement on Agriculture and notified it to the WTO. However, as for the Taiwanese notification to the WTO, three countries including the U.S., Australia and Thailand raised an objection arguing that the introduction of tariffication is subject to interest of trading partners and that it needs to go through negotiations. Regarding the objection, Taiwan is consulting with interested states. However, both countries revised related domestic laws and introduced tariffication when an amendment to CS was not yet confirmed. In particular, Taiwan invoked SSG on rice amid these circumstances.

As for the background of the introduction of tariffication by the two countries, if the grace period for tariffication is extended, MMA volume had to be increased by at least 0.8% or more per annum, and it was judged that the existing 8% was a big shock to the Taiwanese domestic market.

As for the rice import after tariffication, the quantity of mandatory import has been fully observed, but tariff import has been completely prevented due to high tariffs in the early stage of tariffication. The problem is that TRQ rice is disturbing the rice

market. Japan is reducing the effect by effectively managing TRQ. On the other hand, 8% of TRQ in a basis year went up to 12.6% in 2002 in Taiwan. Furthermore, as quality rice from Japan, Australia and the U.S. has been released to the market, it has had a great impact on the entire markets ranging from places of production to consumer markets.

As for the TRQ management, Japan designated volume by country of origin and usage through the use of the designated import country system in the import stage, and Taiwan uses a similar method at a time of importation. However, in Japan, the rice is sold for the purpose of processing, feed stuff and food aid in an effort to prevent imported rice from heavily influencing the domestic market, and some rice is preserved for a long time if necessary. In the meantime, as Taiwan is restricted in TRQ management, it has a problem that imported rice appears in the market. It prevents imported rice from being used in food aid or feedstuff to help the effect of the market opening materialize immediately. It also specifies release of the rice within a certain period of time. This restriction has resulted in a contradicting situation where imported rice being sold in the domestic market and domestically produced rice being used for food aid to developing countries.

The two countries have differences in domestic policies to respond to the effects of imported rice. Japan innovated policies on rice by introducing autonomy in set-aside program that accounts for 35% of total acreage and the stabilization measure for rice farm management for the purpose of adjusting supply and demand. However, Taiwan is expanding governmental intervention with regard to surplus production or reduced prices through the use of expanded productive adjustment and full-fledged governmental purchase. It has led to a temporary reversal of plummeting prices, but it

causes problems in adjustment of supply and demand, production of quality rice and reduction in domestic support in accordance with WTO rules.

7.2 Conclusion

Uncertainty surrounding the rice issue was somewhat reduced because various measures to protect rice were suggested in the 4th revised modalities text (Dec. 6, 2008). Korea is able to protect rice by designating it as sensitive or special product, even though major exporting countries call for substantial improvements in market access in the DDA agricultural negotiations. In case Korean rice is designated as special product for developing countries, it can be exempted from not only tariff reduction but also TRQ expansion. Meanwhile, a lot of arguments have been made that it is better and efficient to adopt the tariff based system for rice imports rather than to increase the rice MMA volume continuously under the special treatment mainly due to the recent soars in the international rice prices.

This study is motivated by the need to identify consumers' willingness to pay for foreign rice. An Experimental auction mechanism, random nth price auction, is employed to elicit consumers' valuations for imported rice. This study also finds that different information effects on consumers' bidding behaviors. Participants significantly respond to the country of origin and taste. The results imply that consumers are increasingly concerned with taste and food safety.

The market demand for U.S. rice in Korea has been increased continuously with the uniform quality and taste of the rice. Also Chinese rice shows a high market preference as it is similar to Korean rice. To minimize the negative effects on Korean

rice sector after rice tariffication, policymakers should advertise the excellences and differences in Korean rice, and also enhance the quality of the rice. In addition, the country of origin indication system should be more strengthened at the consumption stage.

This study develops a rice model to measure the effects of tariffication and TRQ expansion on Korean rice sectors. The projected results of deterministic and stochastic simulations suggest that the sooner Korea adopt rice tariffication rather than increase MMA volume, the better chances to reduce negative effect on Korean rice industry. The results also indicate that the main point that determines the future of the Korean rice sector is whether it can maintain a developing country status in DDA negotiations. It is uncertain as to how soon the DDA negotiations will be concluded. Although recent changes in the external environment such as rising international rice prices and depreciation in exchange rates represent favorite conditions for tariffication, the domestic rice production has decreased over time. In particular, both the profitability and the competitiveness of the domestic rice market have deteriorated due to consistent increases in production costs. This study suggests that Korea should take measures to improve the competitiveness of its rice sector and that it should adequately prepare for tariffication.

Japan and Taiwan have already experienced a similar market opening process from special treatment for rice import (MMA) to tariffication. As for the rice import after tariffication, tariff import (out-quota import) has been completely prevented mainly due to high tariffs in both countries. On the other hand, TRQ rice is disturbing the rice market. Korea needs to be very prudent at a time of making a choice between reduction in effects of increased MMA import on the domestic market and alleviation of

uncertainties in the wake of tariffication. If the former is more important, Korea needs to introduce tariffication in the stage where MMA volume is relatively low and when imported rice can be managed in an appropriate way. If the latter is more important, MMA increase needs to be fulfilled instead of continuing special treatment for rice imports. However, in consideration of tariffication in Japan and Taiwan, as seen in the previous analysis, it is judged that the earlier introduction of tariffication is expected to reduce its negative effects on the domestic rice industry in Korea.

7.3 Suggestions for Future Research

Suggestions for the future studies on experiment auctions are closely associated with further data availability and model specification. Not only more samples and rounds but also more experimental mechanisms are recommended to identify more accurate values. In addition, more research is required to find appropriate economic model and variables to determine effects of tariffication. Some models give more testable hypothesizes and applications. Implications for future studies can be disaggregated as follows:

(i) It remains to be seen which rice would be affected by rice imports through market segmentation. The effect of rice imports may work differently in the domestic market according to quality. Some previous studies suggest imported rice would affect the lower priced domestic rice. However, high quality rice is also expected to be influenced by imported rice, as in the case of Taiwan after tariffication. More auctions with various kinds of rice are

useful to investigate more accurate values and prevent a bias.

(ii) In addition, an investigation is also recommended of how the price of domestic rice would fall once the imported rice is introduced, although this study presents how shares of domestic rice decrease after tariffication. Domestic prices would fall sharply, if rice imports exceed a certain extent. Own and cross price elasticity of demand can be calculated by investigating how market shares change when prices are altered.

(iii) This study analyzed effects on domestic market under partial equilibrium framework without considering the linkage between domestic and international rice market. More rice imports by Japan, Taiwan, and Korea will definitely affect international rice market. More extended rice model with several country modules can provide more implications on the effect of tariffication for Korean rice.

(iv) As for the rice import, the out-quota imports are expected to be completely prevented due to high tariff and high international prices after tariffication. TRQ rice will disturb domestic rice market as 30% of the total MMA volume should be distributed into domestic markets for table use. Therefore, the model to capture the effect of imported rice for table use is required to be developed.

(v) A change in farm price due to greater market access will affect not only

producers' net returns but also their supply responses. Simulation model can be supplemented by adding some modules to evaluate supply response under farm program instruments such as direct payment program for rice.

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APPENDIX

Appendix 1 Auction Bids (WTPs)

Treatment A

ID	U.S. Rice					Chinese Rice					Korean Rice				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	9,400	8,500	8,500	8,200	8,000	10,000	8,900	8,700	8,800	10,200	8,500	8,000	7,800	7,900	8,900
2	4,500	7,700	7,700	7,800	7,800	8,000	8,500	8,400	8,200	9,000	6,500	8,000	8,000	8,000	8,200
3	8,000	8,000	7,850	7,850	7,900	7,500	8,100	8,100	8,100	8,100	8,500	8,500	8,200	8,200	8,500
4	7,500	7,500	7,500	7,500	7,500	5,500	6,500	7,500	8,000	9,500	6,500	7,000	7,000	8,500	8,700
5	6,500	7,500	7,500	7,500	7,500	7,500	8,000	8,000	8,500	9,500	5,500	7,500	7,500	7,500	8,500
6	7,500	7,500	7,500	7,400	7,500	9,500	10,000	10,000	10,300	10,000	8,500	8,500	7,500	8,500	8,500
7	8,500	8,500	8,500	8,500	9,000	9,000	9,000	9,000	9,000	10,300	7,500	8,500	8,500	8,500	8,500
8	7,500	7,700	8,000	8,200	8,000	8,000	8,200	8,400	8,450	11,300	7,000	7,600	7,700	7,500	10,200
9	7,500	7,700	7,500	7,400	7,600	8,000	7,800	7,700	7,600	9,000	6,500	6,500	6,300	6,300	7,500
10	7,500	8,500	9,000	9,000	9,000	6,000	7,500	8,000	8,200	8,500	6,500	8,000	8,500	9,000	9,500
11	9,500	9,500	9,500	9,500	9,500	10,500	10,500	10,500	10,500	10,500	8,500	8,500	8,500	8,500	9,000
12	8,500	9,000	8,700	8,500	8,300	7,500	8,500	8,300	8,300	8,500	6,500	7,500	7,700	8,500	8,300
13	9,500	8,500	8,500	8,300	7,000	3,500	5,500	4,500	4,500	3,500	7,500	7,500	7,500	8,000	7,700
14	8,000	8,000	8,300	7,500	6,500	8,000	8,000	8,000	7,500	6,500	8,500	8,500	8,000	8,000	7,600
15	8,500	7,500	8,100	8,100	7,500	6,500	5,500	6,000	6,500	5,500	7,500	6,500	6,500	6,500	6,500
16	7,500	7,500	6,700	6,500	6,700	8,500	7,000	6,500	7,000	6,000	10,500	7,500	7,000	7,500	7,800
17	9,000	8,500	8,000	8,500	8,500	8,500	8,500	6,000	8,000	5,500	8,800	8,500	7,000	8,100	8,000
18	7,500	8,000	7,500	7,500	7,000	9,000	9,000	8,000	7,500	7,500	6,500	6,000	5,500	5,500	5,500
19	8,000	7,700	7,800	7,500	5,500	8,500	5,600	5,500	8,000	6,000	9,200	6,000	7,000	8,500	8,000
20	7,500	7,600	8,000	8,500	7,000	5,500	5,600	5,700	6,500	7,000	6,500	6,600	6,600	7,500	7,500
21	7,400	7,900	7,900	6,400	8,300	6,200	5,500	7,500	5,500	5,500	6,300	6,400	7,800	6,000	7,400
22	6,500	7,500	7,500	6,400	6,400	6,300	5,400	5,500	6,200	6,200	6,400	6,400	6,500	6,300	6,300
23	7,500	7,500	7,500	8,500	7,500	5,500	5,500	6,000	6,000	6,500	6,500	6,500	6,600	8,500	8,500
24	9,000	8,000	8,500	8,500	8,300	7,500	6,500	6,500	8,300	7,500	8,500	7,500	7,500	8,100	8,000
25	10,000	8,000	8,500	8,500	8,500	8,000	6,000	6,000	7,900	6,500	9,000	7,000	7,000	8,000	7,500

Appendix 1 Continued

Treatment B

ID	U.S. Rice					Chinese Rice					Korean Rice				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
26	6,000	6,500	6,500	7,000	6,500	5,000	5,000	6,000	6,200	5,000	8,000	8,000	8,200	8,500	8,000
27	7,000	7,000	7,600	7,600	7,600	7,500	7,500	8,100	8,600	8,800	8,000	8,500	9,200	9,600	9,600
28	6,000	7,000	7,000	7,700	7,700	7,500	7,500	7,500	8,600	8,800	8,500	9,000	9,300	9,300	9,300
29	6,000	7,000	7,500	7,000	8,000	6,500	7,000	8,000	8,500	8,500	7,000	8,500	9,000	9,000	9,500
30	7,000	6,300	6,800	6,700	6,800	7,500	6,800	7,600	8,800	8,800	7,200	8,200	8,100	8,400	8,500
31	6,000	7,000	6,500	7,500	7,000	7,000	7,000	7,500	7,000	7,000	8,000	8,000	8,500	8,500	8,000
32	5,600	6,300	6,700	7,000	7,800	6,800	6,800	7,700	8,800	9,200	6,500	8,400	8,800	9,000	9,900
33	6,000	6,200	6,700	6,900	7,100	6,500	6,900	7,600	7,800	8,200	6,300	6,700	8,100	8,300	8,500
34	6,000	6,500	6,500	6,700	7,000	5,000	6,700	7,000	8,200	8,600	7,000	8,500	8,500	8,500	9,000
35	5,000	6,000	6,500	7,000	7,000	6,000	7,000	7,500	7,500	7,500	7,000	8,000	8,500	8,500	8,500
36	7,500	6,500	7,000	7,000	7,000	6,500	6,600	7,200	8,100	8,600	7,000	8,500	8,200	8,300	9,000
37	6,500	6,500	6,600	6,800	7,000	5,000	7,000	7,600	8,300	9,000	8,000	8,500	8,100	8,500	9,200
38	7,000	6,600	7,000	6,700	7,000	3,500	6,700	7,500	8,200	8,600	5,000	8,200	9,500	8,500	9,000
39	8,500	8,000	8,100	8,100	8,100	7,000	7,600	7,600	7,500	7,100	9,000	8,500	8,500	8,500	9,100
40	8,000	8,000	8,300	8,300	8,300	7,800	8,000	8,000	8,000	8,000	7,500	8,000	8,500	8,500	8,500
41	6,000	6,500	7,000	8,400	8,400	6,000	8,000	8,000	9,000	9,000	9,000	8,000	8,500	8,500	8,200
42	5,000	7,300	9,000	6,800	6,800	8,000	4,500	6,000	8,000	8,000	6,000	8,500	7,800	6,300	6,300
43	6,000	6,500	8,010	8,200	8,200	4,500	4,510	4,520	8,010	8,010	6,900	7,200	7,500	8,600	8,600
44	7,000	7,500	8,100	8,100	8,100	7,500	8,100	8,200	8,200	8,200	8,000	8,100	8,200	8,600	8,600
45	8,000	8,500	8,100	8,200	8,200	7,000	8,100	7,000	8,000	8,000	7,500	7,600	8,000	8,500	8,500
46	8,000	8,000	8,500	8,500	8,500	6,000	8,500	9,000	8,500	9,000	7,000	8,000	8,500	9,000	8,000
47	9,500	8,000	8,000	8,020	8,030	8,000	8,000	8,000	8,500	8,500	7,500	7,500	7,500	7,000	7,000
48	8,000	7,600	7,600	8,500	8,600	8,000	7,600	7,600	8,100	8,100	8,000	7,600	7,600	8,300	8,400
49	8,000	8,500	8,200	8,200	8,000	5,000	6,000	6,000	6,000	7,000	9,000	9,000	8,500	8,500	8,500
50	6,000	6,010	8,020	8,500	8,600	7,500	8,010	9,010	9,020	9,100	8,000	7,510	10,010	10,000	10,000

Appendix 1 Continued

Treatment B

ID	U.S. Rice					Chinese Rice					Korean Rice				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
51	7,000	7,000	8,000	8,000	8,500	9,000	9,000	9,500	10,000	10,000	5,000	5,000	5,000	6,000	7,000
52	7,000	5,000	5,300	5,700	6,000	4,000	6,000	5,500	6,000	7,100	7,000	9,000	9,000	9,200	9,200
53	4,000	7,000	6,000	6,500	6,500	5,000	5,000	6,000	7,000	7,000	7,000	7,000	9,000	9,500	11,000
54	4,000	5,000	5,500	5,500	5,000	3,000	3,500	4,000	5,000	5,500	7,000	8,000	8,300	8,500	9,000
55	3,500	5,500	5,700	6,000	5,800	3,000	5,100	5,200	5,300	5,500	9,000	9,500	9,500	9,700	9,900
56	4,000	4,500	5,100	5,700	6,000	3,000	5,000	5,400	6,000	6,200	9,000	9,500	9,500	9,500	9,500
57	5,000	4,500	5,500	6,000	5,000	4,000	4,000	4,500	6,500	4,000	6,000	6,500	7,500	7,000	7,000
58	6,000	5,000	5,000	5,000	5,000	4,000	3,500	4,000	4,000	4,000	8,500	9,000	9,000	9,100	9,100
59	4,000	4,500	6,000	6,500	4,500	2,500	5,200	5,500	5,500	3,000	8,500	8,700	9,000	10,000	10,000
60	5,000	4,500	5,500	5,800	6,000	5,000	5,300	5,500	5,800	7,500	8,000	8,700	9,200	9,200	9,500
61	4,000	4,500	4,500	5,500	6,000	3,000	5,500	5,500	6,000	6,000	8,000	9,000	8,800	9,100	9,500
62	8,000	6,000	5,500	7,000	7,010	6,000	4,500	6,000	6,000	6,050	7,000	9,000	9,000	9,000	9,900
63	6,000	5,550	6,000	6,500	6,500	4,000	4,100	4,500	5,000	6,000	9,000	7,010	7,500	9,000	7,600
64	5,500	5,000	4,900	4,800	4,700	5,000	3,900	5,200	5,000	5,000	8,500	8,000	8,000	8,000	8,000
65	4,000	4,500	4,200	4,100	4,200	6,500	5,000	4,500	5,000	5,500	7,500	6,500	7,000	7,500	7,800
66	6,000	5,800	5,000	5,000	5,500	5,000	4,900	4,000	5,000	5,000	7,000	7,000	7,100	7,100	7,200
67	6,000	6,000	7,000	7,000	7,000	5,500	5,500	5,500	5,600	5,700	7,000	7,000	7,100	7,100	7,200
68	6,000	5,000	4,500	4,500	4,550	7,000	5,500	5,000	5,300	5,350	8,000	8,000	7,900	7,900	7,950
69	5,210	5,000	4,950	4,610	4,500	5,130	3,670	3,770	3,550	3,000	6,970	7,010	7,000	7,050	7,900
70	4,500	5,000	4,500	4,500	4,800	3,000	4,000	4,200	4,500	4,000	6,000	7,000	7,100	7,100	7,200
71	3,500	3,700	4,000	4,000	4,000	3,000	3,200	4,100	4,050	4,000	7,000	7,500	7,500	8,000	9,000
72	6,900	5,000	5,100	5,000	4,900	6,000	4,900	5,000	4,900	4,900	9,000	8,000	7,900	7,500	7,500
73	5,000	5,500	5,000	5,000	5,000	4,000	4,500	5,000	5,000	4,000	7,000	7,500	7,500	7,500	7,500
74	8,000	7,000	7,500	7,000	6,500	7,500	6,000	5,500	5,500	5,000	9,000	8,000	8,000	8,000	8,000
75	6,500	5,000	4,500	4,500	4,700	6,000	4,500	4,500	4,500	4,500	7,000	6,000	6,000	7,000	7,100

Appendix 2 Survey Results

ID	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4a	C4b	C5	C6
1	2	51	2	5	7	5	9	12	2	5	6	1	1	0	3	1	3	3	4
2	2	53	2	5	7	3	5	4	4	3	6	6	1	0	1	3	5	3	2
3	2	50	2	5	7	4	9	7	1	3	5	2	0	0	1	3	2	3	2
4	2	49	2	3	7	3	4	2	1	5	7	4	1	0	1	3	2	2	4
5	1	52	2	5	4	5	3	5	4	3	3	2	0	0	3	3	1	3	2
6	2	41	2	5	7	4	3	12	4	5	6	1	0	0	1	3	2	1	2
7	2	49	2	5	7	4	5	12	5	3	5	1	1	0	4	2	3	2	3
8	2	55	2	6	8	1	4	3	1	3	5	1	0	0	3	2	2	2	2
9	1	54	2	5	8	2	3	4	1	3	5	2	1	0	4	3	2	2	2
10	2	54	2	3	7	6	7	8	2	5	6	2	1	0	1	2	5	2	4
11	2	52	2	5	6	4	5	5	3	3	5	1	0	1	3	2	2	2	3
12	2	53	2	4	2	4	3	4	2	3	5	1	1	0	1	2	3	3	2
13	2	52	2	5	7	4	4	3	2	3	5	2	1	0	3	2	1	2	1
14	2	52	2	6	7	3	9	9	2	4	5	1	0	0	3	2	1	3	1
15	2	45	2	3	7	4	7	5	3	3	5	2	1	0	1	3	2	2	2
16	2	47	2	4	7	4	5	5	1	3	5	2	0	0	3	2	1	3	3
17	2	51	2	5	7	4	7	4	5	1	5	3	0	0	4	2	1	2	5
18	2	36	2	3	7	4	6	3	1	5	3	2	0	0	4	3	2	3	4
19	2	46	1	5	7	4	4	8	2	5	5	3	0	0	4	3	2	2	2
20	2	46	2	5	8	3	4	3	5	2	3	3	1	0	4	3	2	3	4
21	2	55	1	4	1	4	6	3	2	3	4	2	1	0	3	2	5	3	5
22	2	41	2	5	7	4	3	12	4	5	6	1	0	0	1	3	2	1	2
23	1	57	2	3	8	1	4	10	4	3	3	1	0	0	4	3	2	2	2
24	2	56	2	4	7	2	2	10	2	5	6	1	1	0	4	2	4	3	2
25	1	57	2	3	8	1	4	10	4	3	3	1	0	0	4	3	2	2	2

Appendix 2 Continued

ID	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4a	C4b	C5	C6
26	2	42	2	4	7	4	9	4	3	5	7	2	0	0	3	3	4	3	2
27	2	20	2	3	1	4	7	8	1	1	3	1	0	0	1	3	4	4	2
28	2	20	2	3	1	4	8	10	4	3	3	2	1	0	3	3	2	2	2
29	2	49	2	3	4	4	3	7	1	1	4	2	1	0	4	3	2	3	4
30	2	59	2	5	7	2	3	3	1	3	3	1	0	0	4	2	3	2	4
31	2	52	1	5		1	2	10	2	2	3	2	1	0	3	4	3	3	1
32	2	38	2	3	7	4	4	10	2	6	1	3	1	0	4	3	2	3	2
33	1	74	2	6	8	1	3	3	2	3	4	1	0	0	1	3	2	2	2
34	2	65	2	5	7	3	3	10	3	3	5	2	1	0	4	3	5	3	2
35	2	46	1	5	7	4	4	8	2	5	5	3	0	0	4	3	2	2	2
36	2	47	2	5	7	4	4	10	4	5	5	4	0	0	4	3	5	3	2
37	2	50	2	3	7	4	5	0	7	5	1		0	0	4	3	2	3	1
38	2	54	2	3	7	2	3	5	1	3	5	2	1	0	4	1	3	3	4
39	2	20	1	4	1	4	1	10	2	3	3	2	0	0	4	2	1	3	2
40	2	54	2	3	7	6	7	8	2	5	6	2	1	0	1	2	5	2	4
41	2	47	1	3	2	4	2	8	1	3	6	1	0	0	4	3	2	2	2
42	2	46	1	3	5	2	2	5	1	2	3	2	0	0	4	2	1	2	3
43	1	40	1	4	6	3	6	1	1	3	3	2	1	0	4	3	2	3	4
44	2	52	1	4	5	4	4	5	3	1	5	1	1	0	3	4	1	3	2
45	2	55	1	4	1	4	6	3	2	3	4	2	1	0	3	2	5	3	5
46	2	52	2	3	6	4	3	6	1	3	3	2	1	0	4	3	1	2	4
47	1	47	1	4	1	1	2	6	2	6	1	1	0	0	3	1	3	2	2
48	1	20	1	3	1	5	3	2	2	3	1	4	1	0	4	1	2	4	4
49	2	58	2	3	2	5	2	6	2	3	4	2	0	0	1	2	4	3	1
50	2	41	2	5	7	4	3	12	4	5	6	1	0	0	1	3	2	1	2

Appendix 2 Continued

ID	A1	A2	A3	A4	A5	A6	A7	B1	B2	B3	B4	B5	C1	C2	C3	C4a	C4b	C5	C6
51	2	44	2	5	7	5	9	8	2	3	4	1	1	1	3	3	2	2	
52	2	53	2	3	7	3	6	2	7	5	5	1	1	0	4	2	4	2	
53	2	52	2	3	7	4	4	2	3	5	3	1	0	0	3	2	5	3	
54	2	56	2	3	7	2	3	5	1	2	5	2	1	0	3	2	2	4	
55	2	50	2	5	7	4	5	12	7	5	5	1	1	0	1	1	2	2	
56	2	54	2	5	8	4	9	5	5	2	1	2	1	0	1	1	2	2	
57	1	57	2	3	8	4	4	10	1	3	1	1	0	0	4	1	2	3	
58	2	53	2	3	7	4	3	4	1	5	5	3	0	0	1	1	2	4	
59	2	55	2	3	7	2	9	12	6	3	6	2	1	0	1	3	1	2	
60	2	49	2	4	7	5	5	3	1	2	4	3	1	0	1	3	2	4	
61	2	40	2	5	4	3	5	6	2	1	3	3	1	1	3	1	2	2	
62	2	54	2	3	6	3	4	6	1	1	3	2	1	0	4	2	2	3	
63	2	35	2	4	7	3	3	2	2	5	5	1	0	0	4	3	2	3	
64	2	42	2	3	8	4	4	8	1	3	5	2	1	0	1	3	5	3	
65	2	54	2	3	7	3	4	12	1	3	5	2	1	1	1	2	3	3	
66	2	48	2	4	7	4	4	5	3	3	6	3	0	0	3	5	2	3	
67	2	38	2	4	7	4	3	7	2	6	3	1	0	0	1	2	1	3	
68	2	62	2	3	6	3	4	18	6	3	7	2	0	0	1	4	2	4	
69	2	46	2	3	7	3	3	9	3	3	5	3	1	0	4	3	4	4	
70	1	60	2	4	8	3	4	2	2	3	6	2	1	0	4	1	2	2	
71	2	44	2	5	7	6	7	2	4	5	6	2	1	0	1	3	4	4	
72	2	50	2	3	7	5	2	5	4	1	4	3	1	1	1	5	2	3	
73	2	62	2	4	4	2	2	10	2	3	5	1	1	0	3	2	3	3	
74	2	45	2	3	2	2	2	5	1	2	5	2	0	0	4	3	2	3	
75	2	50	2	3	7	4	4	4	6	3	3	1	1	0	3	2	1	3	

Appendix 3 Instruction and Questionnaire for Experimental Auction

Consent Form

You are about to participate in an experiment on willingness to pay for imported rice and domestic rice.

We need your signed consent if you are to act as a subject. Your participation in the experiment is completely voluntary and you may withdraw from the experiment at any time without prejudice to you. Results from the experiment will be strictly confidential. Any name associated with the experiment will be deleted upon completion of the experiment.

If you consent to participate in the experiment, please sign the consent form below.

_____

I have read the consent form statement and agree to act as subject in the experiment, with the understanding that I can withdraw from the experiment at any time without prejudice to me.

_____ _____/_____/_____

Signature Date

Instructions

General Instructions

Thank you for choosing to participate in this study about consumer decision making. You will be taking part in an auction for a product. It is important that you follow directions carefully.

We will now conduct an auction for each of the rice, where you will have the opportunity to purchase one rice. In a moment, you will be asked to indicate the most you are willing to pay for each of the rice by writing bids on the enclosed bid sheets.

Specific Instructions

You will be given a total of 10,000 won for participating in this experiment. This participation fee will be paid to you at the end of the auction, though the amount will be adjusted to reflect any purchases that you will choose to make.

Each of you has been assigned a different number as marked in the folder handed to you. This is your ***ID number***. We use ID numbers to maintain anonymity. At the end of today's auction, you will need your ID number to collect your earnings and any items you may have purchased.

The experiment involves an auction in two stages. Stage 1 is a rial round for different chocolate bars. Stage 2 is actual round for rice. We are interested in the value that you personally place on the items for sale. Therefore, it is very important that you not talk to or try to communicate with the other participants in the room. Any communication between bidders will result in an automatic penalty of 1,500 won.

If you have a question during the course of the auction, please raise your hand and a monitor will come to where you are seated.

Please do not turn pages or fill out forms until instructed to do so.

Trial Auction for the random nth price auction

Before proceeding to the rice auction, you will have the chance to take part in a trial auction using two chocolate bars. The chocolate bar auction is a simplified version of the upcoming real auction, and it is intended to familiarize you with the auction framework. No products will be sold in this practice auction.

First, each of you has been given a bid sheet in your packet. On this sheet you will, in a moment, write the most you are willing to pay to for each of the following: a) foreign chocolate bar and b) domestic chocolate bar.

** Note: you will write 2 bids, one for each chocolate bar. Your bids are private information and should not be shared with anyone*.

After you have finished writing their bids, the monitor will collect the bid sheets. In the front of the room, each of your bids will be ranked from highest to lowest for each chocolate bar. Next, a random number N will be drawn to determine how many participants will win chocolate bars. The N-1 highest bidders will win the auction and all winning bidders will pay the Nth highest bid amount for the exchange. For example, suppose there were 10 participants that submitted bids and the number 4 was randomly drawn by the monitor (i.e., N=4). In this case, the 3(N-1) highest bidders will win the auction and each will pay the 4th highest bid amount for the winning chocolate bar. For each chocolate bar the monitor will write the winning participants' bidder numbers, the random number (N), and the winning price on the whiteboard for everyone to see.

After posting the prices and winning bidder numbers, the auction for an additional round will be re-conducted. At the completion of the 2nd round, the monitor will randomly draw a number 1 through 2 to determine the binding round. For example, if the monitor randomly draws the number 2, then the outcomes in first round are ignored and the winning bidders and price in round 2 is focused on. Importantly, all rounds have an equally likely chance of being binding.

After the binding round has been determined, the monitor will randomly draw a number 1 through 2 to determine which chocolate bar to actually auction (either the imported chocolate bar or the domestic chocolate bar). For example, if the monitor draws the number 1, the bids for the foreign chocolate bar are focused on and the bids for domestic chocolate bar will be ignored.

Rice Auction

If there are information sheets enclosed in your packet, you will have to read them before we proceed to the real auction. Please read silently, return the information sheets inside the envelope, and wait for the signal from the monitor to begin.

The auction you are about to participate in is real. People will be expected to pay money for the items they purchase. You will only have the opportunity to win an auction for one rice. Because we randomly draw a binding round and binding rice, you cannot win more than one auction. That is, under no bidding scenario will you take home more than one rice from this experiment. The winning bidders will actually pay money for the winning rice. This procedure is not hypothetical.

In this auction, the best strategy is to bid exactly what each kind of rice is worth to you. Consider the following: if you bid more than you really want to pay. Conversely, if you bid less than the rice is really worth to you, you may end up not winning the auction even though you could have bought rice at a price you were actually willing to pay. Thus, your best strategy is to bid exactly what the rice is worth to you. It is acceptable to bid 0 won for any rice in any round.

Please taste three samples of cooked rice which monitor provide in advance under the monitor's instructions. The average retail price of domestic rice in 2009 is 7,962 won per 4kg (159,241 won per 80kg). How much do you pay to buy rice respectively? Please use the bid sheets marked "Rice."

No.1	ID number	
	Bid price	

No.2	ID number	
	Bid price	

No.3	ID number	
	Bid price	

Questionnaire

All of your responses will be kept confidential. Please circle the number to the left of the answer, if one is provided.

A. Demographic Questions

A1. What is your gender?

1. Male 2. Female

A2. How old are you? ____ years old

A3. Where are you living?

1. Seoul (_____)
2. Metropolitan Area outside Seoul (_____)

A4. What category below best reflects the level of your formal education?

1. No formal schooling
2. Elementary graduate
3. Middle school graduate
4. High school graduate
5. College graduate
6. Post-graduate

MS____ PhD____ Other (please specify):_____

A5. What is your current employment status?

1. Student
2. Related to office work
3. Related to Production
4. Specialized job
5. Service and sale
6. Self-employed
7. Housewives
8. Other (please specify): _____

A6. How many people in your household are in the following age categories?

Age 9 and younger: ____
Age 10 to 19: ____
Age 20 to 29: ____
Age 30 to 39: ____
Age 40 to 49: ____
Age 50 to 59: ____
Age 60 to 69: ____
Age 60 and above: ____

A7. We recognize that income is private information for some people. We ask this because income is often a very important determinant of people's decisions to purchase and eat certain types of foods. Again, this information will never be linked to your name, nor made available to anyone outside the research team.
What is your **family monthly income before taxes** from all sources, including household family members or other sources of economic support, rather than individual income)?

1. Less than 1,000,000
2. 1,000,000 – 1,990,000
3. 2,000,000 – 2,990,000
4. 3,000,000 – 3,990,000
5. 4,000,000 – 4,990,000
6. 5,000,000 – 5,990,000
7. 6,000,000 – 6,990,000
8. 7,000,000 – 7,990,000
9. More than 8,000,000

B. Consumption Questions

B1. How often do you <u>buy</u> uncooked rice? (Per year)
(____) times

B2. What factors do you concern about when you buy rice?

1. Price
2. Taste
3. Milling date
4. Safety
5. Convenience of buying
6. Nutriment
7. Other (please specify): _____

B3. Where do you usually buy uncooked rice?

1. Internet shopping mall
2. Supermarket
3. Large discount store
4. Rice store
6. Friends or relatives
7. Other (please specify): _____

B4. What price range do you usually pay for rice? (per 20kg)

1. Less than 32,000
2. 32,000 – 35,000
3. 35,000 – 38,000
4. 38,000 – 41,000
5. 41,000 – 51,000
6. 51,000 – 61,000
7. More than 61,000

B5. Do you stick to a certain brand when you purchase rice?

1. Mostly
2. Sometimes
3. Hardly
4. Other (please specify): _____

C. Level of Awareness

C1. Do you know that you can buy the foreign produced rice in the market?

1. Yes 2. No

C2. Do you have any experience to buy the imported rice?

1. Yes 2. No

C3. A small quantity of rice has been imported according to the result of WTO negotiations. Are you willing to buy foreign rice if the rice market is completely open through tarrification?

1. Never buy
2. If the price is cheaper, I'll buy it even if quality is inferior
2. As long as the quality is good, I'll buy it regardless the price of rice
3. If it is cheaper and high-quality, I'll buy it
4. Definitely buy

C4. What factors do you concern about if you buy the imported rice (choose two)?

First: (_____) Second: (_____)

1. Price
2. Taste
3. Safety
4. Nutriment
5. Milling date
6. Other (please specify): _____

C5. What do you think about the quality of imported rice?

1. Very good
2. Good
3. Normal
4. Bad
5. Very bad

C6. What do you think about foreign rice after sampling through the experimental auction today?

1. The quality is worse than I expected
2. It tasted good even though I was biased against imported rice
3. Better than domestically produced rice in terms of quality
4. Not much different from the domestic rice
5. Other (please specify): _____

Appendix 4 Variables for Rice Model

YEAR	ACR 1,000 ha	PROD 1,000m/t	YD kg/10a	IM 1,000m/t	TSP 1,000m/t	TDM 1,000m/t	TCON 1,000m/t	PCON kg
1980	1,233	3,550	288	580	6,468	5,402	5,057	132.4
1981	1,224	5,063	414	2,245	6,861	5,366	5,091	131.5
1982	1,188	5,175	436	269	6,827	5,404	5,123	130.2
1983	1,228	5,404	440	216	6,814	5,293	5,172	129.5
1984	1,231	5,682	462	-	6,915	5,675	5,279	130.1
1985	1,237	5,626	455	-	6,929	5,501	5,259	128.1
1986	1,236	5,607	454	-	7,054	5,805	5,308	127.7
1987	1,262	5,493	435	-	6,856	5,617	5,247	126.2
1988	1,260	6,053	480	-	6,732	5,611	5,129	122.2
1989	1,257	5,898	469	-	7,174	5,602	5,145	121.4
1990	1,244	5,606	451	-	7,470	5,445	5,127	119.6
1991	1,208	5,384	446	-	7,631	5,490	5,032	116.3
1992	1,157	5,331	461	-	7,525	5,526	4,930	112.9
1993	1,136	4,750	418	-	7,330	5,510	4,855	110.2
1994	1,103	5,060	459	-	6,570	5,414	4,814	108.3
1995	1,056	4,695	445	-	6,216	5,557	4,777	106.5
1996	1,050	5,323	507	115	5,469	5,225	4,778	104.9
1997	1,052	5,450	518	-	5,567	5,070	4,710	102.4
1998	1,059	5,097	481	75	6,022	5,216	4,606	99.2
1999	1,066	5,263	494	97	6,000	5,278	4,541	96.9
2000	1,072	5,291	494	107	6,092	5,114	4,425	93.6
2001	1,083	5,515	509	217	6,486	5,151	4,209	88.9
2002	1,053	4,927	468	154	7,004	5,557	4,145	87.0
2003	1,016	4,451	438	180	6,554	5,455	3,987	83.2
2004	1,001	5,000	500	193	5,568	4,718	3,952	82.0
2005	980	4,768	487	192	6,042	5,210	3,815	80.7
2006	955	4,680	490	238	5,838	5,008	3,806	78.8
2007	950	4,408	464	246	5,756	5,061	3,789	76.9
2008	936	4843	517	258	5361	4671	3755	75.8
2009	924	4916	532	257	5790	4944	3704	74.0

Appendix 4 Continued

YEAR	PRC 1,000m/t	LOSS 1,000m/t	SEED 1,000m/t	EX 1,000m/t	STK 1,000m/t	SSR %	TPV 100 mill. won
1980	36	265	44	-	1,066	95.1	
1981	36	195	44	-	1,495	66.2	
1982	67	170	44	-	1,423	93.7	
1983	43	33	45	-	1,511	97.6	
1984	43	174	44	135	1,247	97.6	
1985	43	154	45	-	1,428	103.3	
1986	44	408	45	-	1,249	96.9	
1987	56	268	46	-	1,239	99.8	
1988	70	367	45	-	1,121	97.9	
1989	72	340	45	-	1,572	108.1	
1990	80	192	45	1	2,025	108.3	65,380
1991	148	255	43	12	2,141	102.3	63,983
1992	285	267	42	2	1,999	97.5	67,232
1993	347	266	41	1	1,820	96.8	62,810
1994	315	208	40	1	1,156	87.8	68,133
1995	228	364	38	150	659	93.6	67,598
1996	200	209	38	-	244	89.9	86,132
1997	141	181	38	-	497	105.0	91,928
1998	171	401	38	-	806	104.5	91,826
1999	174	525	38	-	722	96.6	100,451
2000	175	468	46	-	978	102.9	105,046
2001	183	712	47	-	1,335	102.7	107,217
2002	337	1,030	45	-	1,447	107.0	95,564
2003	313	1,111	44	-	1,099	97.4	88,359
2004	335	388	43	-	850	96.5	99,631
2005	324	1,029	42	-	832	102.0	85,368
2006	373	788	41	-	830	98.5	84,057
2007	424	633	41	174	695	95.8	78,575
2008	583	293	40	2	690	94.4	93,796
2009	541	657	40	3	846	98	89,992

Appendix 4 Continued

YEAR	FP won/80kg	RP won/80kg	IP $/mt	PGDP 1000won	GDPDF 2005=100	CPI 2005=100	ER won/$	POP 1,000
1980	48,893	53,230	-	1,026	26.8	28.2	607.4	38,124
1981	55,564	66,740	-	1,273	31.5	34.2	681.3	38,723
1982	57,462	68,250	-	1,441	33.4	36.6	731.5	39,326
1983	58,827	68,040	-	1,671	35.0	37.9	776.2	39,910
1984	60,340	68,845	-	1,894	36.6	38.8	806.0	40,406
1985	66,971	73,562	-	2,100	38.1	39.7	870.5	40,806
1986	72,315	79,300	-	2,433	39.7	40.8	881.3	41,214
1987	74,666	82,240	-	2,834	41.6	42.1	822.4	41,622
1988	83,200	90,130	-	3,343	44.4	45.1	730.5	42,031
1989	85,446	94,780	-	3,737	47.0	47.6	671.4	42,449
1990	90,806	103,440	-	4,464	51.9	51.7	708.0	42,869
1991	94,332	108,890	-	5,345	57.2	56.5	733.6	43,296
1992	97,908	111,980	-	6,034	61.7	60.1	780.8	43,748
1993	101,954	117,360	-	6,760	65.6	62.9	802.7	44,195
1994	104,856	122,820	-	7,840	70.7	66.9	803.6	44,642
1995	117,468	128,470	-	9,085	75.9	69.9	771.0	45,093
1996	134,158	148,380	462.2	10,125	79.7	73.3	804.8	45,525
1997	135,728	157,838	469.4	11,018	82.8	76.6	951.1	45,954
1998	145,388	167,990	389.2	10,824	86.9	82.3	1,398.9	46,287
1999	153,874	179,670	382.8	11,777	86.0	83.0	1,189.5	46,617
2000	159,816	188,220	291.4	12,833	86.8	84.9	1,130.6	47,008
2001	155,344	186,815	313.6	13,755	90.2	88.3	1,290.8	47,357
2002	153,652	181,686	327.2	15,130	93.1	90.8	1,251.2	47,622
2003	156,550	185,433	374.1	16,029	96.4	93.9	1,191.9	47,859
2004	159,880	189,103	435.1	17,213	99.4	97.3	1,144.7	48,039
2005	148,978	185,426	425.0	17,974	100.0	100.0	1,024.3	48,138
2006	142,690	173,010	508.4	18,816	99.9	102.2	955.5	48,297
2007	146,984	178,955	554.8	20,122	101.9	104.8	929.2	48,456
2008	154,937	187,443	690.2	21,117	104.9	109.7	1,102.6	48,607
2009	146,445	159,241	1,028.0	21,808	108.4	112.8	1,276.4	48,747

Appendix 5 Projection Results by Deterministic Simulations

Scenario 1

YEAR	ACR 1,000ha	YD Kg/10a	PROD 1,000mt	SQ 1,000mt	SEED 1,000mt	LOSS 1,000mt	RP won/80kg	PCON kg
2010	901	492	4,434	6,089	33	310	151,717	73.1
2011	858	493	4,225	6,393	32	296	144,653	72.4
2012	831	493	4,098	6,642	31	287	138,470	71.9
2013	807	496	4,000	6,849	30	280	133,978	71.6
2014	785	494	3,876	7,035	29	271	131,293	71.3
2015	766	490	3,754	7,115	28	263	130,616	71.0
2016	751	490	3,676	7,092	28	257	131,690	70.8
2017	738	489	3,612	7,008	27	253	134,259	70.4
2018	728	489	3,557	6,878	27	249	137,918	70.1
2019	719	488	3,508	6,717	26	246	142,530	69.6
2020	711	488	3,466	6,533	26	243	147,843	69.0
2021	704	487	3,430	6,338	26	240	153,829	68.4

YEAR	FP won/80kg	TCON 1,000mt	IM 1,000mt	STK 1,000mt	GSTK 1,000mt	SSR %	TPV 100mill.won	ESTR %
2010	129,597	3,573	327.3	1,632	607	110.3	71,821	36.6
2011	123,868	3,548	327.3	1,976	603	100.4	65,413	44.8
2012	118,853	3,530	440.9	2,253	600	96.3	60,877	51.3
2013	115,210	3,518	497.7	2,480	598	93.8	57,608	56.8
2014	113,033	3,508	554.5	2,685	596	92.0	54,761	61.7
2015	112,484	3,499	554.5	2,784	595	89.5	52,780	64.3
2016	113,355	3,489	554.5	2,778	593	87.0	52,088	64.4
2017	115,438	3,475	554.5	2,712	591	85.6	52,115	63.1
2018	118,406	3,457	554.5	2,605	588	84.5	52,649	61.0
2019	122,147	3,434	554.5	2,470	584	83.8	53,564	58.2
2020	126,456	3,406	554.5	2,317	579	83.2	54,782	55.0
2021	131,311	3,372	554.5	2,159	573	82.9	56,296	51.7

Appendix 5 Continued

Scenario 2

YEAR	ACR 1,000ha	YD Kg/10a	PROD 1,000mt	SQ 1,000mt	SEED 1,000mt	LOSS 1,000mt	RP won/80kg	PCON kg
2010	901	492	4,434	6,089	33	310	151,717	73.1
2011	858	493	4,225	6,393	32	296	144,653	72.4
2012	831	493	4,098	6,528	31	287	139,001	71.9
2013	807	496	4,004	6,565	30	280	135,561	71.5
2014	787	494	3,887	6,530	29	272	134,394	71.1
2015	771	490	3,776	6,400	28	264	135,531	70.8
2016	758	490	3,710	6,181	28	260	138,742	70.4
2017	748	489	3,659	5,920	27	256	143,881	69.9
2018	740	489	3,619	5,636	27	253	150,717	69.2
2019	735	488	3,586	5,345	27	251	159,357	68.5
2020	731	488	3,563	5,062	27	249	169,828	67.5
2021	729	487	3,551	4,804	27	249	182,373	66.5

YEAR	FP won/80kg	TCON 1,000mt	IM 1,000mt	STK 1,000mt	GSTK 1,000mt	SSR %	TPV 100mill.won	ESTR %
2010	129,597	3,573	327.3	1,632	607	110.3	71,821	36.6
2011	123,868	3,548	327.3	1,976	603	100.4	65,413	44.8
2012	119,284	3,529	327.3	2,140	600	96.3	61,098	48.8
2013	116,494	3,515	327.3	2,199	598	93.8	58,306	50.4
2014	115,548	3,502	327.3	2,186	595	92.2	56,143	50.3
2015	116,470	3,488	327.3	2,079	593	89.9	54,967	48.1
2016	119,074	3,470	327.3	1,883	590	87.8	55,219	43.8
2017	123,242	3,446	327.3	1,650	586	86.9	56,361	38.6
2018	128,786	3,415	327.3	1,399	581	86.3	58,257	33.0
2019	135,793	3,378	327.3	1,148	574	86.2	60,877	27.4
2020	144,286	3,331	327.3	914	566	86.5	64,270	22.0
2021	154,460	3,276	327.3	712	557	87.1	68,554	17.4

Appendix 5 Continued

Scenario 3

YEAR	ACR 1,000ha	YD Kg/10a	PROD 1,000mt	SQ 1,000mt	SEED 1,000mt	LOSS 1,000mt	RP won/80kg	PCON kg
2010	901	492	4,434	6,089	33	310	151,717	73.1
2011	858	493	4,225	6,413	32	296	144,543	72.4
2012	831	493	4,097	6,589	31	287	138,631	71.9
2013	807	496	4,001	6,686	30	280	134,765	71.5
2014	786	494	3,881	6,728	29	272	133,002	71.2
2015	769	490	3,766	6,899	28	264	132,495	70.9
2016	754	490	3,689	6,973	28	258	133,276	70.6
2017	740	489	3,622	6,989	27	254	135,273	70.3
2018	729	489	3,564	6,958	27	249	138,185	69.9
2019	719	488	3,510	6,892	26	246	141,922	69.5
2020	710	488	3,462	6,797	26	242	146,245	69.0
2021	702	487	3,421	6,685	26	239	151,123	68.4

YEAR	FP won/80kg	TCON 1,000mt	IM 1,000mt	STK 1,000mt	GSTK 1,000mt	SSR %	TPV 100mill.won	ESTR %
2010	129,597	3,573	327.3	1,632	607	110.3	71821	36.6
2011	123,779	3,548	347.7	1,997	603	100.4	65366	45.2
2012	118,984	3,530	368.0	2,201	600	96.3	60932	50.2
2013	115,849	3,517	388.4	2,318	598	93.8	57944	53.1
2014	114,419	3,505	408.7	2,381	596	92.0	55514	54.8
2015	114,008	3,494	635.9	2,572	594	89.7	53667	59.4
2016	114,641	3,482	635.9	2,664	592	87.4	52865	61.8
2017	116,261	3,467	635.9	2,700	589	86.0	52642	63.0
2018	118,622	3,449	635.9	2,692	586	84.9	52844	63.1
2019	121,653	3,427	635.9	2,651	583	84.0	53373	62.5
2020	125,159	3,401	635.9	2,587	578	83.4	54163	61.4
2021	129,116	3,370	635.9	2,508	573	82.9	55205	60.1

Appendix 5 Continued

Scenario 4

YEAR	ACR 1,000ha	YD Kg/10a	PROD 1,000mt	SQ 1,000mt	SEED 1,000mt	LOSS 1,000mt	RP won/80kg	PCON kg
2010	901	492	4,434	6,089	33	310	151,717	73.1
2011	858	493	4,225	6,413	32	296	144,543	72.4
2012	831	493	4,097	6,589	31	287	138,631	71.9
2013	807	496	4,001	6,686	30	280	134,765	71.5
2014	786	494	3,881	6,728	29	272	133,002	71.2
2015	769	490	3,766	6,672	28	264	133,406	70.9
2016	755	490	3,695	6,520	28	259	135,711	70.5
2017	744	489	3,639	6,318	27	255	139,696	70.1
2018	735	489	3,592	6,084	27	251	145,023	69.6
2019	728	488	3,552	5,832	27	249	151,644	69.0
2020	722	488	3,520	5,575	26	246	159,396	68.2
2021	717	487	3,495	5,325	26	245	168,332	67.3

YEAR	FP won/80kg	TCON 1,000mt	IM 1,000mt	STK 1,000mt	GSTK 1,000mt	SSR %	TPV 100mill.won	ESTR %
2010	129,597	3,573	327.3	1,632	607	110.3	71,821	36.6
2011	123,779	3,548	347.7	1,997	603	100.4	65,366	45.2
2012	118,984	3,530	368.0	2,201	600	96.3	60,932	50.2
2013	115,849	3,517	388.4	2,318	598	93.8	57,944	53.1
2014	114,419	3,505	408.7	2,381	596	92.0	55,514	54.8
2015	114,747	3,493	408.7	2,345	594	89.7	54,014	54.2
2016	116,616	3,478	408.7	2,214	591	87.5	53,867	51.4
2017	119,848	3,459	408.7	2,037	588	86.3	54,510	47.6
2018	124,168	3,434	408.7	1,831	584	85.6	55,758	43.1
2019	129,538	3,402	408.7	1,614	578	85.2	57,518	38.3
2020	135,825	3,364	408.7	1,397	572	85.0	59,756	33.4
2021	143,073	3,319	408.7	1,194	564	85.2	62,501	28.9