The Impact of the Uruguay Round on World Agriculture

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Abstract

This paper focuses on the impact of the Uruguay Round (UR) implementation on world agriculture using a multi-regional general equilibrium model and the mapping function of the Geographic Information System (GIS). The results of this study show that the Uruguay Round has had a negative impact on world agriculture in the light of total food production and food distribution. For commodities such as grains, while grain production rises in exporting countries, the effect is not sufficient to cover the fall in production in importing countries. In particular, the impact is serious on food security in importing countries of agricultural products. The negative impact is almost concentrated in importing countries, particularly Japan, the European Union (EU) and South Korea. As is clearly visible on the maps produced by the GIS function, the real state of world agriculture as well as the results evaluated by this Computable General Equilibrium (CGE) model has changed

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negatively in major importing countries and particularly the Least Developed Countries (LDCs), Sub-Saharan Africa following the Uruguay Round.

Key words: Uruguay Round; Multi-regional General Equilibrium Model; World Food Production; Food Security; Geographic Information System.

Ⅰ. Introduction

The Uruguay Round Agreement on Agriculture represents a fundamental change in the way agriculture is treated under the rules governing trade among World Trade Organization (WTO) member countries. Prior to the Uruguay Round, General Agreement on Tariffs and Trade (GATT) rules on trade contained various exceptions in many aspects of agricultural products.

The Uruguay Round negotiations produced a final document, including final text, tariff schedules and other details, emphasizing on cuts in import tariffs, export subsidy disciplines and domestic support reductions in agriculture.

CGE models have examined the economic implications of the Uruguay Round Agreement (Francois, McDonald and Nordstrom, 1996; Harrison, Rutherford and Tarr, 1995; Hertel, T., W. Martin, K. Yangishima and B. Dimaran, 1995). These studies focused on aggregate aspects such as welfare and GDP effects of the Uruguay Round. Unlike some previous studies, this study assessed the impact of the Uruguay Round on world agriculture in the regional perspective.

There are more than 1.2 billion people living in poverty in developing countries; in addition, more than 800 million people worldwide do not have access to sufficient food to meet their needs for a healthy and productive life. A key function of agriculture is to ensure stable supplies of food. Yet, food insecurity is still a major problem in food importing countries, particularly in Net Food Importing Developing Countries (NFIDCs) and Least Developed Countries (LDCs). This is because unstable world food price, terms of trade and concentration of agricultural markets by some multinational companies have weakened the world food security.

This study analyzes the global effects by commodity and country/region, such as in exporting and importing countries due to the UR. We used a multi-sector, multi-regional CGE model and the Geographic Information System (GIS). Therefore we can see the quantitative results of this study with (on) the map produced by the GIS function as follows: (1) changes in the level of agricultural production; (2) changes in world agricultural trade and in exporting and importing countries; and (3) changes in food security.

Ⅱ. The Model and Data

Model

There are two types of CGE model: one is a one-region CGE model that represents production, consumption and trade in one country; the other is a multi-regional CGE model including economic links among regions. As the world economy becomes more integrated, there is an increasing demand for quantitative analyses of policy issues on a global basis. In particular, if we assess the impacts of policy issues such as global changes in either tariff rates or exports subsidies on the

economy, we must use the multi-regional CGE model that captures production, consumption and bilateral trade among regions.

To measure the global effects of policy changes resulting from the UR, the multi-regional CGE model has more advantages than the one-region CGE model. This is because the multi-regional CGE model captures the commodity and country/region's effects of policy changes. This model assess not only the impact of the UR on production, consumption, export and import in each country/region, but also on the multi-regional bilateral trade through bilateral tariff rates reduction.

The model used for these analyses is an adaptation of the comparative static CGE model. As with all such trade-focused CGE models, the defining feature of the model is the modeling of trade transactions by way of the Armington assumption of imperfect substitution between domestic and traded goods.

Production necessitates the use of intermediate inputs and primary factors that are mobile across sectors within a region but are internationally immobile. We assume a single representative consumer as well as a single government agent in each region. We incorporate a Constant Elasticity of Substitution (CES) production function for value added and a Leontief production function for intermediates and the value added composite. Output is transformed into exports and domestic goods according to a Constant Elasticity of Transformation (CET) function of exports and domestic goods.

Each agent's utility function is of a nested CES type, which allows multi-stage budgeting. We assume each agent demands composite commodities, which is a Constant Elasticity of Substitution (CES) function of imports and domestic goods.

Data

The trade transactions recorded in the Global Trade Analysis Project (GTAP) database not only distinguish between commodities on the basis of their regions of origin and destination, but also on the basis of the agents including intermediate demand and final demand by household, government and investment.

The remaining data in the GTAP database are region specific and serve primarily to support the trade data and trade focus of their intended applications. Domestic absorption is accounted for by intermediate demand and final demand.

The regional household receives all income from factor sales. This income is then distributed to the single household, savings and government. There are five different tax instruments – import and export duties, sales/commodity taxes and income taxes. The capital account draws together savings by the household, government (internal balance) and rest of the world (external balance) and then disburses those funds to investment via commodity (domestic and imported).

The world economy has been disaggregated into 24 regions, with 22 production sectors in each region. Except for the tariff data, the data employed to calibrate the model came primarily from the 1992 GTAP database (Version 2). The source of the data on import tariffs in our model is the

database assembled by Harrison *et al*. This data set is World Bank (WB) tariff data, which is based on the Integrated Data Base (IDB) of the GATT Secretariat.

This model is based on the computer code provided by Glenn Harrison, Thomas F. Rutherford and David Tarr.[1] This model, however, incorporates the CET function to include imperfect transformation between domestic goods and exports.

With most CGE models, the various elasticities of substitution and transformation affect the policy results. For our model, we needed the elasticities of transformation for the CET function as well as the elasticities of substitution between imports and domestic goods for the trade aggregation function. Relying on our a priori beliefs as to plausible values for these elasticites, we assumed that the elasticities of transformation are 0.9-3.9 and the elasticities of substitution are 1.9-5.2. In addition, the data employed to review the trends in agricultural production and trade during the 1990s came from the Food and Agriculture Organization (FAO) of the United Nations.

We applied our constant returns to scale (CRTS) static model to evaluate the impact of the UR on world agriculture. To measure the effects of the UR, we employed the following scenario: In manufacturing, tariff cuts are based on the submissions of the Contracting Parties to the GATT Secretariat. In the area of tariff reduction in agriculture, the UR calls for a reduction of the budgetary outlay on export subsidies by 36% for developed countries and 14.4% (1995-2000) for developing countries on the basis of the UR implementation. The reduction of import tariffs and domestic support can be determined in the same way as those of the export subsidies. The UR implementation period is different between developed and developing countries. The one of developed countries is 6-year period, 1995-2000, the one of developing countries is 10-year period, 1995-2004. This study used the period, 1995-2000, as a period of the UR implementation.

Ⅲ. Major Results

Production

The impact of the UR on regions' agricultural production is reported to be a billion US dollar in 1992, as shown in Table 1 by major agricultural sector and exporting and importing countries of agricultural products. The simulation results suggest a negative impact of the UR on world agricultural production, at least in the aggregate. The effect, however, differs from commodity to commodity and region to region. For commodities such as grains, while grain production rises in exporting countries, the effect is not sufficient to cover the fall in production in importing countries. This is primarily because the importing countries reduce protections that have relatively higher tariffs and export subsidies in importing countries. The exporters have an opportunity to improve market access through tariff reduction in agriculture; this enables these countries to increase

[1] Their code is available for public access on web site http://theweb.badm.sc.edu/glenn/ur_pub.htm, and was employed in their evaluation of the Uruguay Round in Harrison, Rutherford and Tarr [1995][1996][1997].

production to require supply for exports. While there is a production increase in exporting countries, the decrease in importing countries induces an additive imbalance of world agricultural production. This is one of the primary causes of food insecurity in developing countries and particularly in net importing countries of agricultural products.

For non-grain crops such as vegetables and fruits, the changes are more serious than grains. As the world economy has developed, high-value trade in products has been increasing as a result of rising incomes. The demand for non-grain crops has been increasing due to consumer preferences and growth of income. The demand for imported goods, however, negatively affects domestic production through the substitution effect; this effect results in sharp disturbance of cropping system in importing countries.

<Table 1> Impact of the Uruguay Round on regions' agricultural production

(1992 $billion)

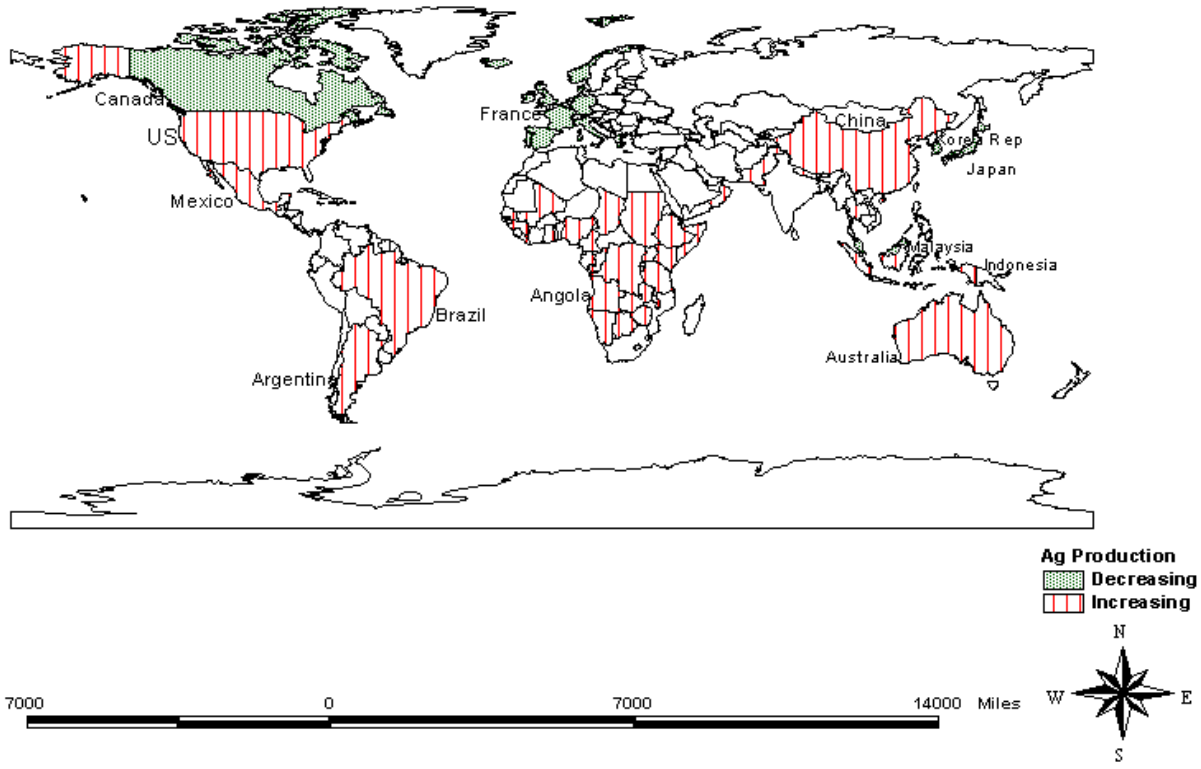
	Grains	Non-grain crops	Milk products	Meat products and livestock
Exporting Countries	0.85	4.31	-0.17	2.26
Importing Countries	-4.96	-21.40	-2.95	-16.66
World	-3.72	-10.19	-2.91	-12.95

Exporting Countries: Australia, New Zealand, Canada, United States, Indonesia, Malaysia, Philippines, Thailand, Argentina and Brazil.

Importing Countries: Japan, South Korea, Switzerland, Singapore and European Union.

We incorporated the simulation results with the function of the GIS to show them graphically. Figure 1 represents the distribution of agricultural products in each country. The GIS tool helps us understand the output more easily using geographic information.

<Figure 1> Impact of the Uruguay Round on regions' total agricultural production using the GIS



Trade

Tables 2-3 represent the impact of the UR on regions' agricultural trade in a billion US dollars in 1992. For commodities such as grains, while exports of grains fall, imports rise in importing countries. This is because the importing countries reduce tariffs and export subsidies in agriculture due to the UR implementation. Additionally, exporting countries such as Australia and the United States gain because of increasing demand in importing countries such as Japan, the EU and South Korea.

For non-grain crops, the impact of the UR on imports is positive in the aggregate. Exports in exporters increase because importers of agricultural products face reduced tariffs. However, Exports in importers decrease because of export subsidies reduction.

Compared with grains and milk products, non-grain crops and meat products are sharply increasing in agricultural trade. This is primarily because the import demand for high-value products rises as a result of increasing factor income.

<Table 2> Impact of the Uruguay Round on regions' agricultural export

(1992 $billion)

	Grains	Non-grain crops	Milk products	Meat products and livestock
Exporting Countries	0.90	4.80	0.60	3.34
Importing Countries	-1.24	-1.61	-1.31	-0.93
World	-0.23	8.43	-0.62	2.88

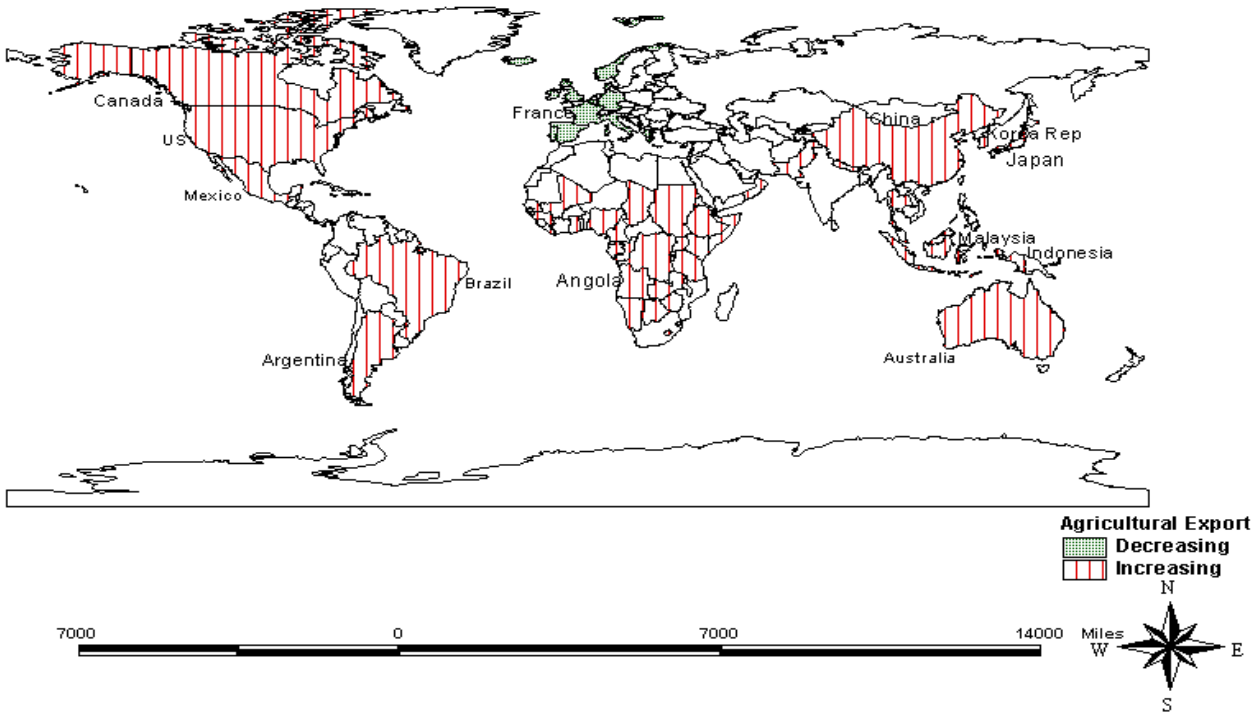
<Table 3> Impact of the Uruguay Round on regions' agricultural import

(1992 $billion)

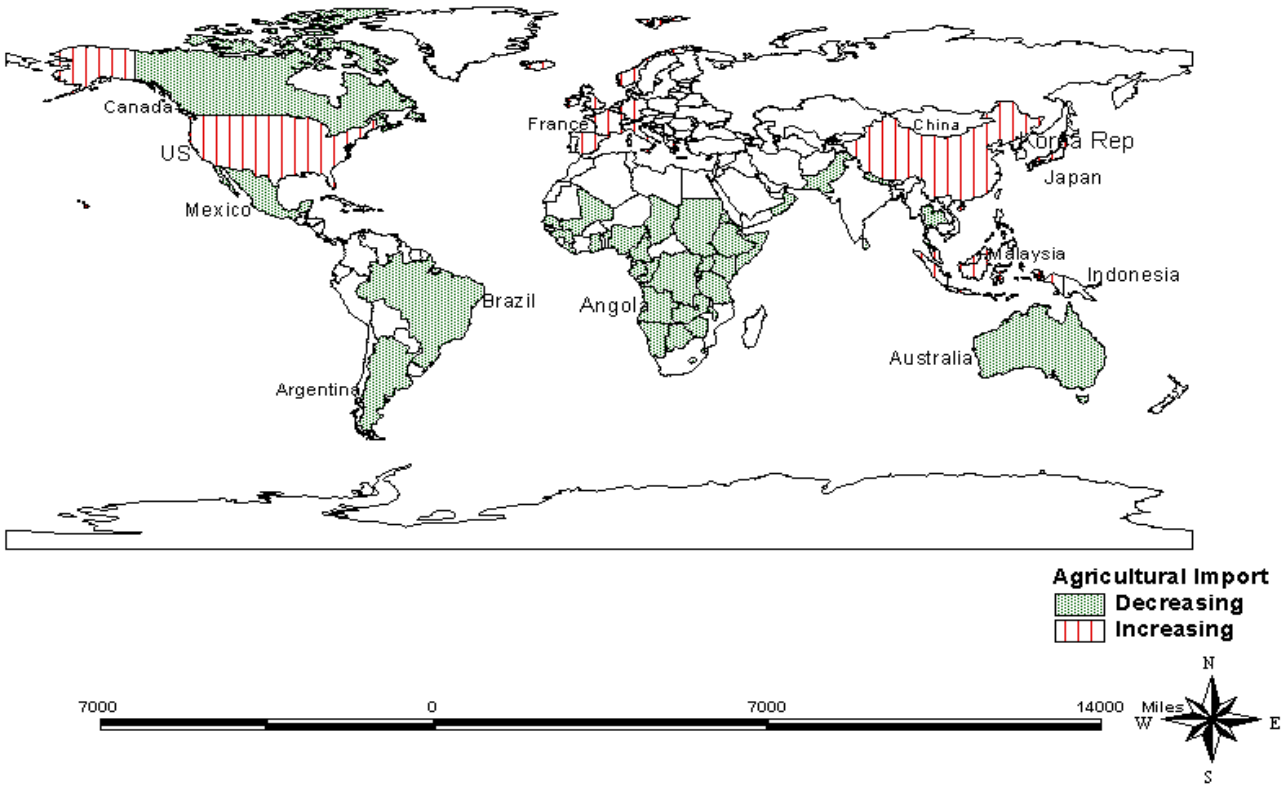
	Grains	Non-grain crops	Milk products	Meat products and livestock
Exporting Countries	-0.01	1.32	0.10	0.17
Importing Countries	3.27	14.17	1.49	11.20
World	2.95	14.52	1.01	10.80

Figures 2-3 show the impact of the UR on regions' agricultural trade using the GIS. This representation helps us to understand the output more easily.

<Figure 2> Impact of the Uruguay Round on regions' total agricultural export using the GIS



<Figure 3> Impact of the Uruguay Round on regions' total agricultural import using the GIS



Food Security

In this paper we consider indicators about food security. The ratio of total exports to food imports is an indicator of the ability of different countries to finance their food imports out of total export revenues (Diaz-Bonilla, E., M. Thomas, and S. Robinson, 2000).

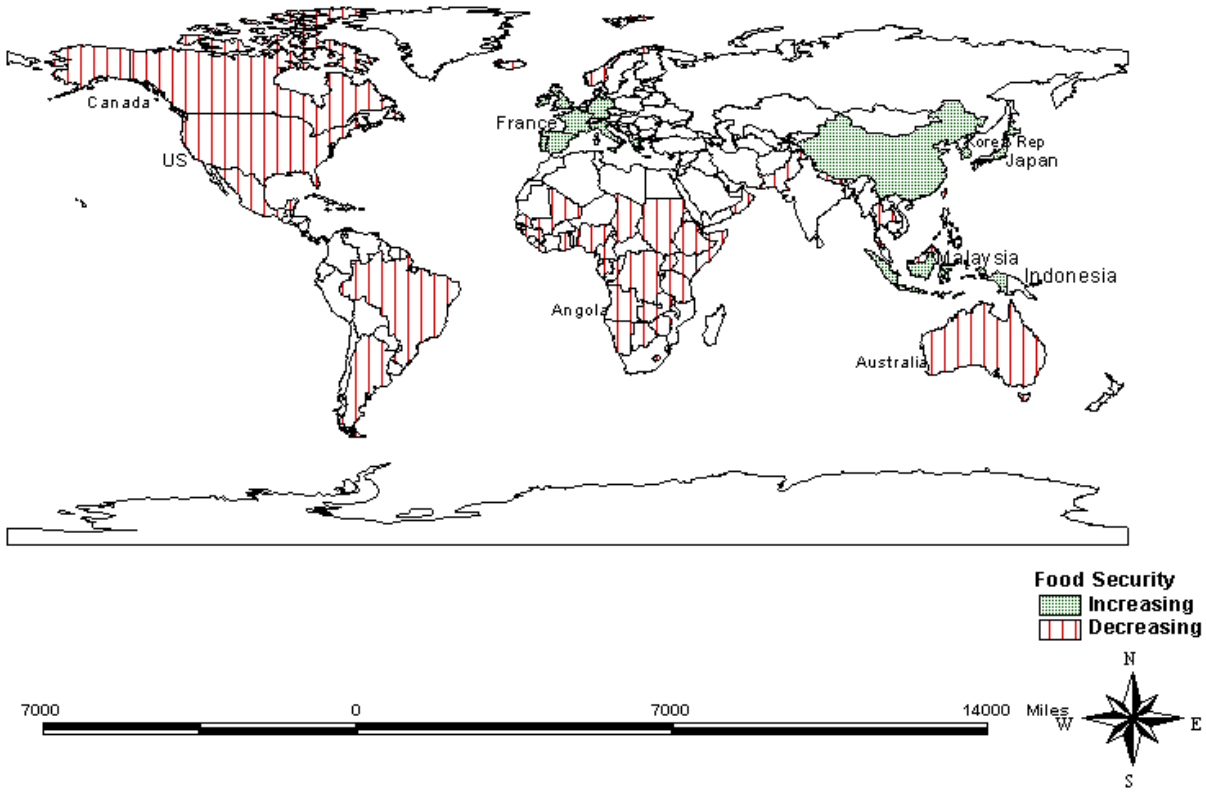
In the case of the ratio of total exports to food imports, changes in food security vary from exporters to importers of agricultural products. As the ratio of total exports to food imports increases, food security in that country becomes unstable. The simulation results show that the ratio of total exports to food imports increased slightly in exporting countries, while it increased sharply in importing countries. Therefore, world food security has become more unstable since the UR implementation.

<Table 4> Impact of the Uruguay Round on regions' food security

(Percent)

	The ratio of total exports to food imports
Exporting Countries	0.5
Importing Countries	6.7
World	4.8

<Figure 4> Impact of the Uruguay Round on regions' food security using the GIS



Ⅳ. Major Changes in Real World Agriculture

Production

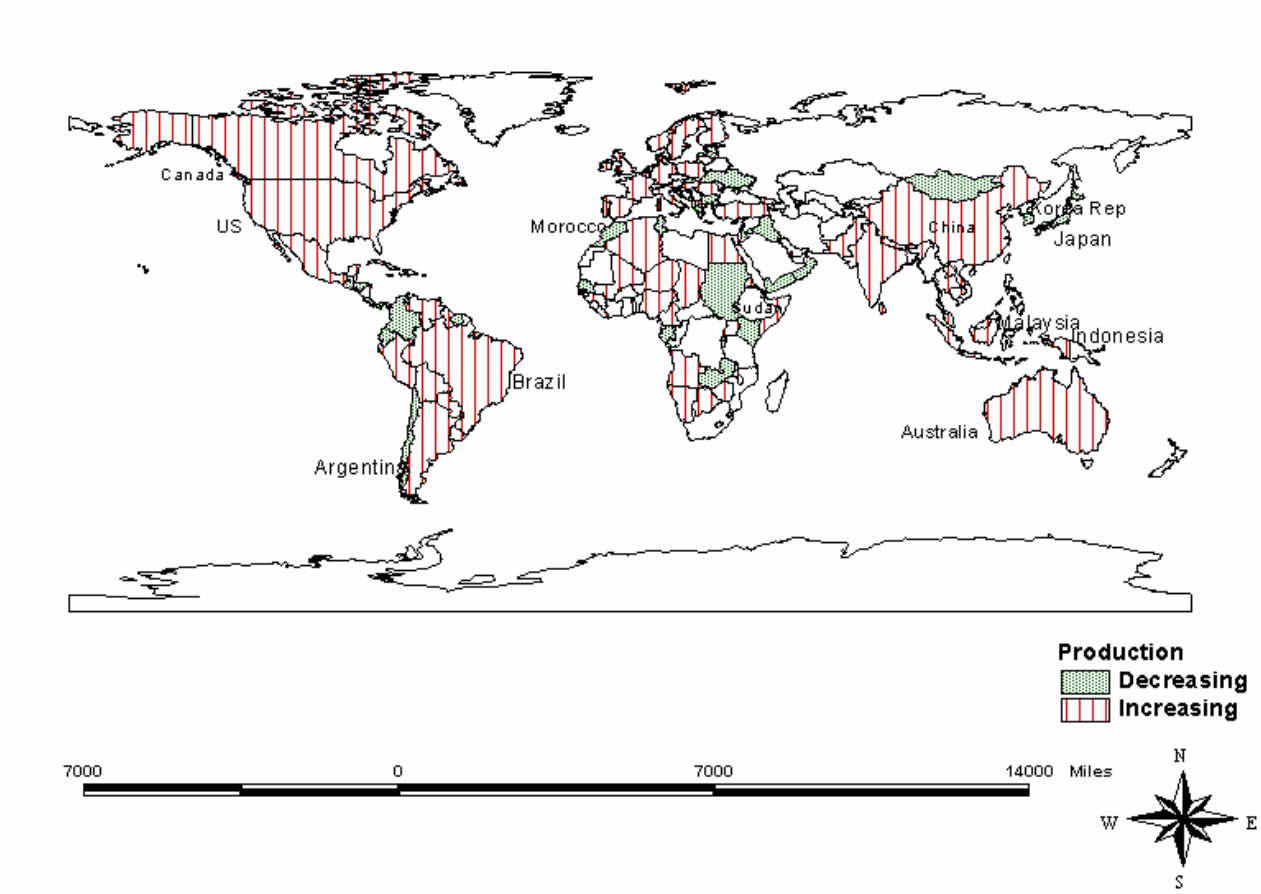
This paper reviews the major trends in the real state of world agricultural production and trade during the 1990s, especially after the UR.

According to data from the FAO of the United Nations, production varies from exporters to importers of agricultural products: production has actually been increasing in exporting countries, while changes in production have been decreasing in importing countries.

Cereal production is increasing in exporting countries and the EU, while production is

decreasing in importing countries such as South Korea and Japan and the Least Developed Countries (LDCs) such as Sub-Saharan Africa. The real state of cereal production and the simulation results evaluated by this CGE model are almost the same in major importing countries such as South Korea and Japan. However, there are considerably differences between the real state and the simulation results in some countries such as the EU and Canada. This is primarily from the differences from country to country in agricultural policies corresponding to the UR.

<Figure 5> Real state of cereal production by country



Trade

The main trends in agricultural trade during the 1990s relate to the changing directions and commodity composition of agricultural trade as well as changes in world markets resulting from policy reforms related to the Uruguay Round Agreement on Agriculture. Agricultural trade is less important for high-income countries but remains a substantial source of export earnings for some of them, including Australia, New Zealand and the United States.

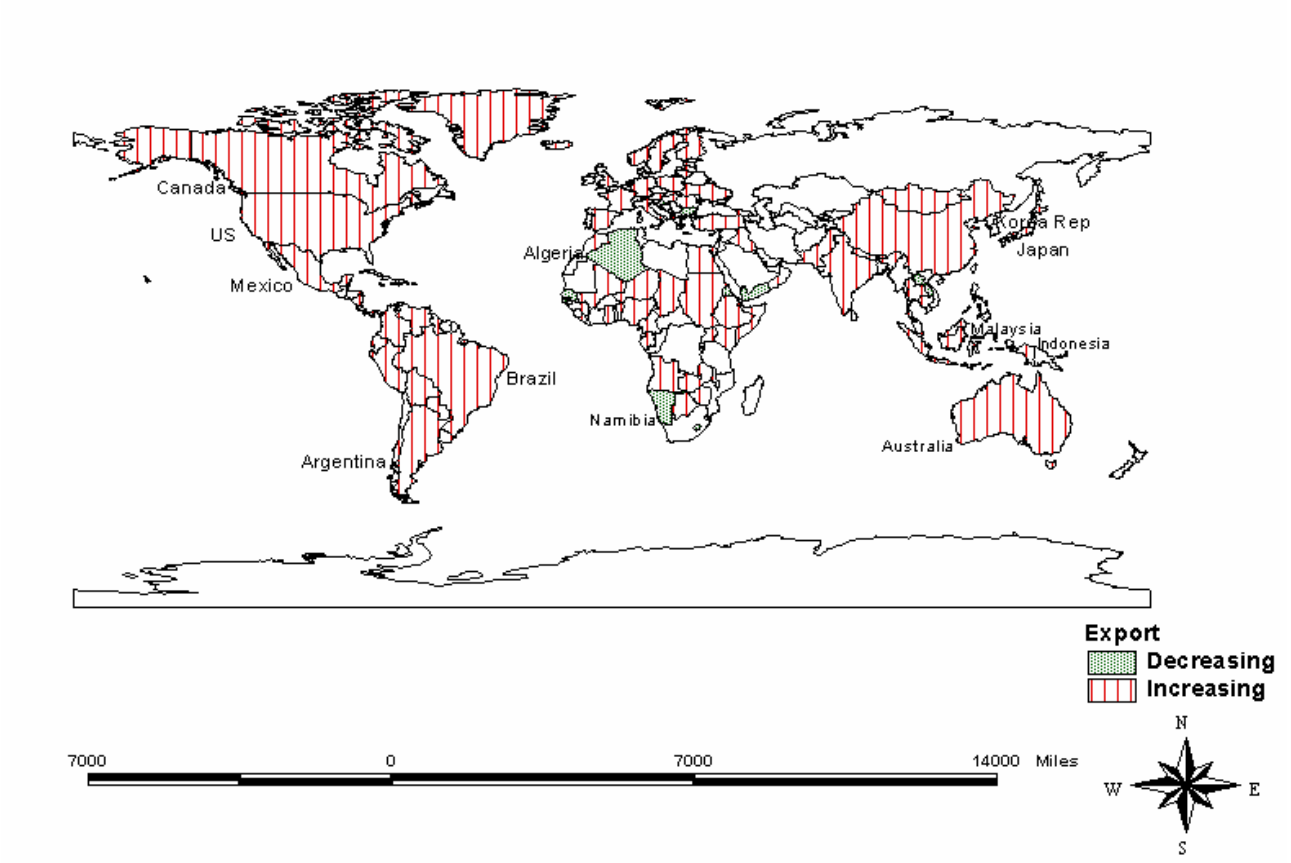
There has also been a structural shift in the commodity composition of this trade from bulk commodities to value-added products, as a result of rising incomes. High-value trade in products has been a source of agricultural export growth for a number of exporting countries.

According to the FAO, trade of agricultural products is increasing. The trade of agricultural

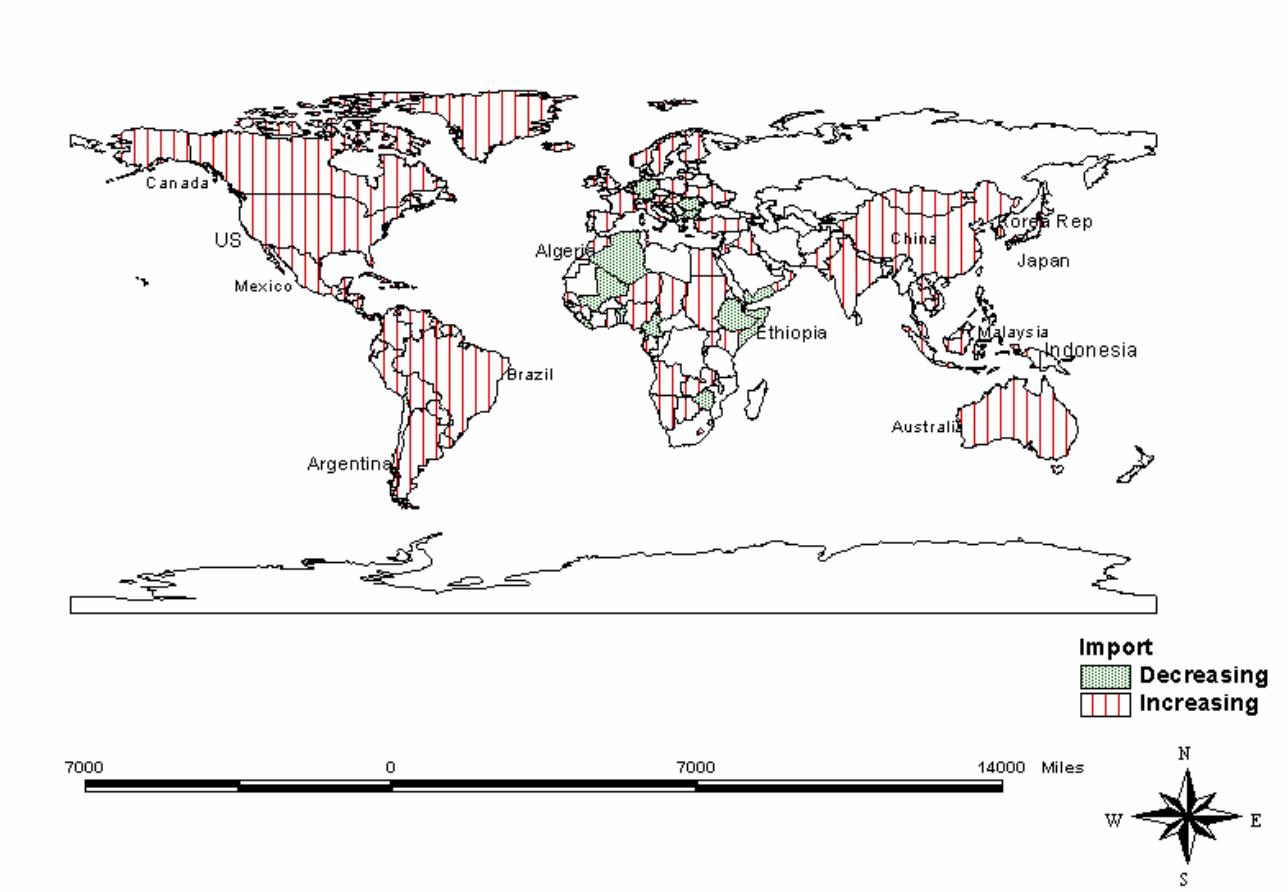
products, however, differed from exporting to importing countries: (1) imports is increasing in the exporters and importers of agricultural products; (2) exports is increasing in the exporters of agricultural products; and (3) exports is decreasing in importing countries such as South Korea and Japan. This is shown in Figures 6-7.

There are many similarities between trade of agricultural products in real state and the results evaluated by this CGE model. However, there are several differences in some countries because of different agricultural policies corresponding to the UR.

<Figure 6> Real state of agricultural export by country



<Figure 7> Real state of agricultural import by country



V. Summary and Conclusions

As the world economy becomes more integrated after the UR, we use the multi-sector, multi-regional CGE model to analyze the impact of the UR on world agriculture. This study focuses on the impact of the UR on exporting and importing countries' agriculture as well as world agriculture.

World agricultural production has decreased by US $29.8 billion in 1992 by this model. The total value of agricultural production in exporting countries has increased by $7.3 billion, while the value of agricultural production in importing countries has decreased by $46 billion.

This study finds that free trade results in more trade. Total exports of agricultural products from exporting countries have increased by $9.6 billion, while the exports of agricultural products from importing countries have decreased by $5.1 billion. In contrast to exports, total imports of agricultural products in exporting countries have increased by $1.6 billion, while those in importing countries have increased by $30.1 billion. As such, the biased agricultural production by region brings the problem of world food security.

As far as food security is concerned, the simulation results by this CGE model show that the ratio of total exports to food imports increase slightly in exporting countries, while the one increases sharply in importing countries. Therefore, world food security becomes unstable since the UR

implementation.

In conclusion, it seems that the liberalization of agricultural trade has aggravated world food. If the WTO is really to be a useful international organization for promoting the welfare of global society, it must make justifiable rules to strengthen world food security.

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