日本・EU 間自由貿易協定の締結が農業由来の環境負荷に及ぼす潜在的影響

誌名：農林業問題研究
ISSN：03888525
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巻/号：47巻2号
掲載ページ：p. 194-197
発行年月：2011年11月
Potential Environmental Impact from Agriculture Caused by a Free Trade Agreement between Japan and the EU: A Case of Nitrogen Balance

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1. Introduction
More than 150 Free Trade Agreements (FTAs) were made around the world by the year 2008 (Mizuno, 2010). Japan has also been using FTAs to complement multilateral trade liberalization within the WTO framework. For example, Japan and Singapore signed a New-Age Economic Partnership Agreement in January 2002, and Japan and Mexico reached final accord on an FTA in March 2004. Thus, a number of FTAs involving Japan are currently being negotiated, including those between Japan and Korea. In June 2007, the Japan Business Federation (Nippon Keidanren) issued its first proposal entitled "Call for the Start of a Joint Study for a Japan-EU Economic Partnership Agreement" (Nippon Keidanren, 2007). Thereafter, it has continued to work towards the realization of an economic partnership agreement with the EU.

Tsuge and Yamamoto (2011) estimated the potential economic impacts of an FTA between Japan and the EU (JEUFTA) using the standard static Global Trade Analysis Project (GTAP) model (Hertel, 1997). Their results showed that the EU is likely to experience a loss in real GDP but an even larger gain in agricultural and food sectoral outputs than Japan under full trade liberalization. However, several previous empirical studies which analyzed agricultural trade liberalization seek to measure not only the potential economic impact but also the potential environmental impact from agriculture (e.g., Rae and Strutt, 2005 and 2007; Sawauchi, 2009; Yamamoto et al., 2009).

The JEUFTA might cause environmental damage in the EU such as water pollution due to more manure from livestock and more nitrogenous fertilizers used in cropping. However, as far as we know, no attempt has been made to measure the impact caused by agricultural trade liberalization under the JEUFTA on the potential environmental issues from agriculture in both Japan and the EU.

The purpose of this paper is to measure the potential impact on the environment caused by agricultural trade liberalization under the JEUFTA, using the GTAP model (Hertel, 1997) and the OECD Nitrogen Balance Database (OECD, 2001b).

2. Methodology
In this paper, we use the same methodology as Rae and
The nitrogen balance is defined by OECD as the physical difference (surplus/deficit) between nitrogen inputs into, and outputs from, an agricultural system. Nitrogen inputs and outputs are calculated by the relevant quantity of crop outputs or livestock numbers multiplied by nitrogen coefficients in the OECD Nitrogen Balance Database (OECD, 2001b). As shown in Fig. 2, we assume that these coefficients will remain constant when trade is liberalized, and that the level of nitrogen inputs and outputs will change by the same proportion as the levels of crop outputs or livestock numbers (Rae and Strutt, 2005 and 2007).

In order to estimate the impacts of nitrogen balance, we use the data derived from Tsuge and Yamamoto (2011) on the changes of crop outputs or livestock numbers due to the full trade liberalization under the JEUFTA. They estimated the potential economic impact of the JEUFTA using a standard static version of the GTAP model. The model they used measured the static impact of trade policy changes without incorporating dynamic effects. The scenario they modeled assumed the complete removal of all import tariffs between Japan and the EU, not only in the agricultural sector but in non-agricultural sectors.

3. Results

As shown in Table 1, Japan's nitrogen balance is projected to decrease by 2.5% from the initial level of nitrogen surplus. While our results show a decreased level of nitrogen outputs (4.2%), and the decrease in nitrogen inputs (3.3%) is smaller in magnitude. The decreased

### Table 1. Impacts of the JEUFTA on Nitrogen Balance (1,000 tonnes, %)

<table>
<thead>
<tr>
<th></th>
<th>Initial 1997</th>
<th>JEUFTA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Japan EU(14)</td>
<td>Japan+EU (14)</td>
</tr>
<tr>
<td>Harvested crops</td>
<td>368.2 &amp; 5,985.5</td>
<td>362.6 &amp; 6,066.3 (1.4)</td>
</tr>
<tr>
<td>Forage and pasture</td>
<td>226.5 &amp; 6,025.6</td>
<td>207.0 &amp; 6,083.2 (1.0)</td>
</tr>
<tr>
<td>Total outputs</td>
<td>594.7 &amp; 12,011.1</td>
<td>569.6 &amp; 12,149.5 (1.2)</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Livestock manure</td>
<td>487.6 &amp; 6,196.2</td>
<td>470.3 &amp; 6,338.8 (2.2)</td>
</tr>
<tr>
<td>Other nitrogen inputs</td>
<td>179.3 &amp; 3,937.8</td>
<td>179.5 &amp; 3,934.9 (0.1)</td>
</tr>
<tr>
<td>Total inputs</td>
<td>1,235.3 &amp; 19,902.3</td>
<td>1,194.3 &amp; 20,157.8 (1.3)</td>
</tr>
<tr>
<td>Total nitrogen balance</td>
<td>640.7 &amp; 7,891.2</td>
<td>624.7 &amp; 8,008.3 (1.5)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses are percentage deviations from the initial period; fertilizer means inorganic fertilizer; livestock manure means net livestock manure; other nitrogen inputs include biological nitrogen fixation, atmospheric deposition, and seeds and planting materials.
inputs from fertilizer and livestock manure are the main reasons for the predicted improvement in the overall nitrogen balance of Japan. This arises mainly from the large decreases in output from the livestock sector. Tsuge and Yamamoto (2011) showed that, in percentage terms, the decline in output of raw milk would be highest among the agricultural sectoral outputs in Japan under the full trade liberalization of the JEFTA.

On the other hand, the EU's nitrogen balance is projected to increase by 1.5% from the initial level of nitrogen surplus. While our results show an increased level of nitrogen outputs (1.2%), and the increase in nitrogen inputs (1.3%) is slightly larger in magnitude. The increased inputs from fertilizer and livestock manure are the main reasons for the predicted deterioration in the overall nitrogen balance of the EU. This arises mainly from the large increases in output from the livestock sector. Tsuge and Yamamoto (2011) showed that, in percentage terms, the increase in output of raw milk would be the second highest among the agricultural sectoral outputs in the EU under the full trade liberalization of the JEFTA.

The total nitrogen balance of Japan and the EU is projected to increase by 1.2% from the initial level of nitrogen surplus. While our results show an increased level of nitrogen outputs (0.9%) and an increased level of nitrogen inputs (1.0%). The increased inputs from fertilizer and livestock manure in the EU are the main reasons for the deterioration in the overall nitrogen balance. This arises mainly from the large increase in outputs from the livestock sector in the EU.

Yamamoto et al. (2009) and Sawauchi (2009) showed that both the FTAs between Japan and Korea, and among Japan, Australia and New Zealand are likely to lead to an overall increase in the total nitrogen surplus for Japan, Korea, Australia and New Zealand. Our results also show that the JEFTA seems to lead to an overall increase in the total nitrogen surplus for Japan and the EU.

4. Conclusions

The purpose of this paper was to measure the potential impact on the environment from agriculture caused by agricultural trade liberalization under the JEFTA, using the GTAP model and the OECD Nitrogen Balance Database. The nitrogen balance was used to estimate the potential changes in nitrogenous pollution from agriculture caused by the JEFTA. Our scenario assumed the complete removal of all import tariffs between Japan and the EU.

We estimated that the total nitrogen balance for Japan and the EU is an increase of 1.2% under the full trade liberalization of the JEFTA. Our results suggested that the JEFTA is likely to lead to an overall increase in the potential nitrogen pollution from agriculture.

Acknowledgments

The authors wish to thank Professor Takashi Fujimoto, Professor Masaru Kagatsume and Professor Keshav Lal Maharjan for their constructive comments at the 2010 Annual Meeting of the Association for Regional Agricultural and Forestry Economics, Kyoto, 23 October, 2010. This work was supported by a Grant-in-Aid for Scientific Research (C) (20580226).

Notes

1) While the EU is made up of 27 member countries as of 2010, the EU is defined as the EU15 in order to match the definition of the EU with the benchmark of the GTAP database version 5.4. In addition, the OECD database does not cover the nitrogen balance for Luxembourg. Thus, in this paper EU15 is treated as 14 member countries excluding Luxembourg in estimating nitrogen balance.

References

[4] OECD, Environmental Indicators for Agriculture: Volume 3 Methods and Results (Paris: OECD,
2001a).


