**A Demand System Estimation of Field Corn on China's Export Restriction: Using LA/AIDS Approach**

Mira Choi, Korea Rural Economic Institute, mchoi@krei.re.kr

Kyeong-ho Kim, Korea Rural Economic Institute, guard@krei.re.kr

Kyungsoo Nam, Korea Rural Economic Institute, ksnam@krei.re.kr

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**KREI**

Korea Rural Economic Institute

## Introduction

Over the last two decades, several countries have imposed export restrictions to protect domestic food supply system (The food crisis of 2007-08, covid-19, the Russian-Ukraine war)

In 2022, 57 nations restricted export of crops and fertilizers (IFPRI, 2022)

Such restrictions raise price volatility, change demand, and further deteriorate farm management

Therefore, it is important to measure how the constraints affect in import market to prepare such changes

We took China's case that levied tariffs and applied export quotas on staple crops in 2007 when the Agflation occurred

We analyse changes in import demand in South Korea's field corn after China's restriction in 2007 to prepare sudden price fluctuations for following reasons

▷ Korea constructed favorable trading backgrounds through numerous FTAs

▷ Field corn is indispensable to animal feed, relaying 100% on import

➡ It is considered as appropriate situation to observe response to export restriction without trading difficulties and focus on demand import regardless domestic production

## Objectives

We examined how export regulation causes changes in importing countries, focusing on the following research questions

➡ Under the restrictions, agencies will respond to reduce price volatility by switching importing countries

These research can help predict how import demand will respond toward another restrictions in the future and provide implications on how to prevent such changes from damaging farm management
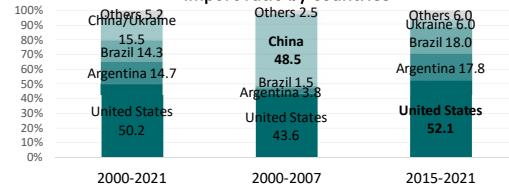
## Data

Field corn's import data of South Korea, 2000-2021

▷ We assumed that import volume is a proxy variable of farmer' field corn demand because agencies would decide the volume representing farmers' demand

<Statistics before and after the restriction>

| | | US | Brazil | Argentina | China/Ukraine | Others |
|---|---|---|---|---|---|---|
| Import Value(1m$) | Before | 220.2 | 40.8 | 73.7 | 316.5 | 31.9 |
| | After | 349.2 | 175.1 | 167.2 | 62.7 | 41.1 |
| Price ($/ton) | Before | 143.3 | 141.4 | 141.6 | 135.4 | 158.5 |
| | After | 242.3 | 228.7 | 232.7 | 278.3 | 266.8 |

<Import ratio by countries>

Others 5.2
China/Ukraine 15.5
Brazil 14.3
Argentina 14.7
United States 50.2
2000-2021

Others 2.5
China 48.5
Brazil 1.5
Argentina 3.8
United States 43.6
2000-2007

Others 6.0
Ukraine 6.0
Brazil 18.0
Argentina 17.8
United States 52.1
2015-2021

Before: China and the US were two main importing countries
After: US became the major exporting country despite the price

➡ augmented dependency on US import and diversified trading nations to South America and Ukraine

## Methodology

AIDS(Almost Ideal Demand System): Deaton and Meulauer (1980) to measure import demand led by price fluctuations

▷ Used the Stone price index of the previous period to avoid collinearity and to solve the simultaneity (Eales et al,1988)

$$\omega_i = \alpha_i + \sum_{j=1}^{n} b_{ij} ln p_j + c_i \ln\left(\frac{E}{P^*}\right) + \left[\sum_{j=1}^{n} d_{ij} ln p_j + e_i \ln\left(\frac{E}{P^*}\right)\right] D_{ex} + \theta_1 \omega_{i,t-1}$$

, where $\omega_i$: expenditure share of item i , $p_i$: price of item i, E: total expenditure
P: stone price index, $D_{ex}$: 1 after 2008, or 0

Calculated Marshallian and Hicksian price elasticities and expenditure elasticities using Clafant(1987)

<Elasticity estimation before and after the export restriction>

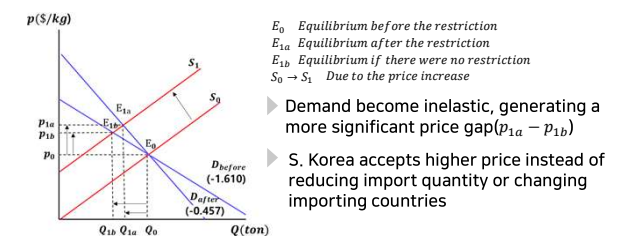| Period | 2000 ~2007 | 2008~2021 |
|---|---|---|
| Marshallian Elasticity | $e_{ij}^{before} = -\delta_{ij} + \frac{a_{ij} - b_i \omega_j}{\omega_i}$ | $e_{ij}^{after} = -\delta_{ij} + \frac{(a_{ij} - c_{ij}) - (b_i - d_i)\omega_j}{\omega_i}$ |
| Hicksian Price Elasticity | $e_{ij}^{before*} = e_{ij}^{before} + \eta_i \omega_j$ | $e_{ij}^{after*} = e_{ij}^{after} + \eta_i \omega_j$ |
| Expenditure Elasticity | $\eta_i = 1 + \frac{b_i}{\omega_i}$ | $\eta_i = 1 + \frac{(b_i + d_i)}{\omega_i}$ |

## Results

Key findings

US and Argentina's own-price elasticities become less elastic

▷ S. Korea tends to secure import volume rather than minimizing the cost by switching importing countries

US demand by Argentina's price change also become inelastic

▶ The dependency on US corn increases regardless the price change

<Elasticity estimation before and after the export restriction>

| | | | US | Brazil | Argentina | China/Ukraine | Others |
|---|---|---|---|---|---|---|---|
| Expenditure | | Before | 0.927*** | -0.946 | 1.335* | 1.068*** | 1.795 |
| | | After | 0.953*** | 0.818*** | 1.105*** | 1.526*** | 1.224*** |
| Price | US | Before | -1.610*** | 4.862 | 3.791*** | 0.489** | 4.211 |
| | | After | -0.457*** | 0.049 | 0.642*** | 1.430*** | 1.291** |
| | Brazil | Before | 0.252 | -0.363 | -0.063 | -0.135 | -0.512 |
| | | After | 0.019 | -0.240 | 0.075 | -0.322 | 0.733 |
| | Argentina | Before | 0.454** | -0.145 | -1.424 | -0.218** | 1.615 |
| | | After | 0.161*** | 0.056 | -0.781*** | -0.021 | -0.150 |
| | China | Before | 0.750*** | -3.991 | -2.799*** | -0.029 | -4.467 |
| | Ukraine | After | 0.146*** | -0.116 | -0.015 | -1.245*** | 0.281* |
| | Others | Before | 0.155 | -0.363 | 0.495 | -0.107 | -0.846 |
| | | After | 0.129*** | 0.228 | 0.078 | 0.269* | -2.532*** |

<Import supply and demand of US in S.Korea before/after the restriction>



$E_0$ Equilibrium before the restriction
$E_{1a}$ Equilibrium after the restriction
$E_{1b}$ Equilibrium if there were no restriction
$S_0 \to S_1$ Due to the price increase

▷ Demand become inelastic, generating a more significant price gap($p_{1a} - p_{1b}$)

▷ S. Korea accepts higher price instead of reducing import quantity or changing importing countries

➡ Farm income stability depends more on major importing country, compared to the past

## Conclusion

The study shows that South Korea accepts more price volatility from the major exporting countries even when trading is relatively open

Given that, importing countries take into account securing quantity than minimizing cost in case of sudden price increases. In reverse, the major exporting countries can seek profit-maximizing. Thus, it is appropriate to build different strategy for exporting and importing countries.

For importing countries, It is essential to monitor production status in exporting countries, promote middle- and long-term contracts, and diversify multiple potential importing countries