High instability of Wheat Production on Global food Markets in the 2000s

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Introduction

• **Food production instability** in exporting countries can affect food security in importing countries, especially in developing countries, via volatility of price in global food market.

In 2007, the price rose from 100 yen to 150 yen due to the poor harvest of wheat in Australia.

Production instability in Australia attacked my food security.

“Haiji-no-shiropan”
Key questions

• **Q1**: Was the wheat productivity in exporting countries in the 2000s particularly unstable from a long term perspective?

• **Q2**: If so, how did it happen?
Q1: Was the wheat productivity in exporting countries in the 2000s particularly unstable from a long term perspective?
Method

• Definition: Instability
  – Square of the coefficient of variance (C.V.)

\[
I(Y_s,Y_e) \equiv CV(Y_s,Y_e)^2 = \frac{1}{Y_e - Y_s + 1} \sum_{yr = Y_s}^{Ye} \left( \frac{Y_a(yr) - Y_t(yr)}{Y_t(yr)} \right)^2
\]

\[Y_a: \text{ actual yield}\]
\[Y_t: \text{ trend yield}\]
• The production instability had decreased from the 1960s to the 1990s
• However, it suddenly increased in the 2000s and went up to the levels in the 1960s
Q1: Was the wheat productivity in exporting countries in the 2000s particularly unstable from a long term perspective?

A1: Yes.
Q2: How did it happen?
Instability of each year

- Extreme declines occurred more frequently in the 1960s and the 2000s
Which countries had poor production in the 2000s?

Q2: How did it happen?


Q2': Is the poor productivity in Australia only reason for the high instability in the 2000s?
Why do I have such a question...

• Production instability in individual countries is not necessary condition for overall production instability
  – e.g. two countries with high instability and negative correlation cause stability in overall production.
  – e.g. small instability of two countries with high correlation cause large instability in overall production

• Don’t we have to pay attention to correlation between exporting counties?
  – We want to know the contribution of correlation instability to overall instability.
Method

• To quantify correlation instability, we decompose overall production instability into two parts:
  – Individual Instability
  – Correlation Instability

\[ I(Y_s, Y_e) = I_{\text{ind}}(Y_s, Y_e) + I_{\text{int}}(Y_s, Y_e). \ldots (6) \]

\[ I_{\text{ind}}(Y_s, Y_e) \equiv \frac{1}{Y_e - Y_s + 1} \sum_{yr = Y_s}^{Y_e} \left( \sum_{i=1}^{N} \left\{ (RD_i(\text{yr}))^2 \cdot (S_i(\text{yr}))^2 \right\} \right), \ldots (7) \]

\[ I_{\text{int}}(Y_s, Y_e) \equiv \frac{2}{Y_e - Y_s + 1} \sum_{yr = Y_s}^{Y_e} \left( \sum_{i=1}^{N-1} \left( \sum_{j=i+1}^{N} \{ RD_i(\text{yr}) \cdot RD_j(\text{yr}) \cdot S_i(\text{yr}) \cdot S_j(\text{yr}) \} \right) \right), \ldots (8) \]

RD: (relative)deviation; S: market share
Correlation was the largest in the 2000s.
The correlation in the 2000s contributed to half of the production instability in the 2000s.
Q2': Is the poor productivity in Australia only reason for the production instability in the 2000s?

A2': NO!!!
Correlation instability contributed to half of the overall instability in the 2000s.
Conclusions

• Wheat production in exporting countries in the 2000s was particularly unstable.

• The instability in the 2000s was caused
  – not only by increase in the instability in individual countries
  – but also by increase in the correlation instability among countries.

• In other words, if the correlation instability had been low in the 2000s, the instability would not have happened.

• We should pay more attention to correlation instability among exporting countries
Thank you for your attention!