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, expecilly in developing countries, via volatility of price in global food market.

"Haiji-no-shiropan"

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.

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?
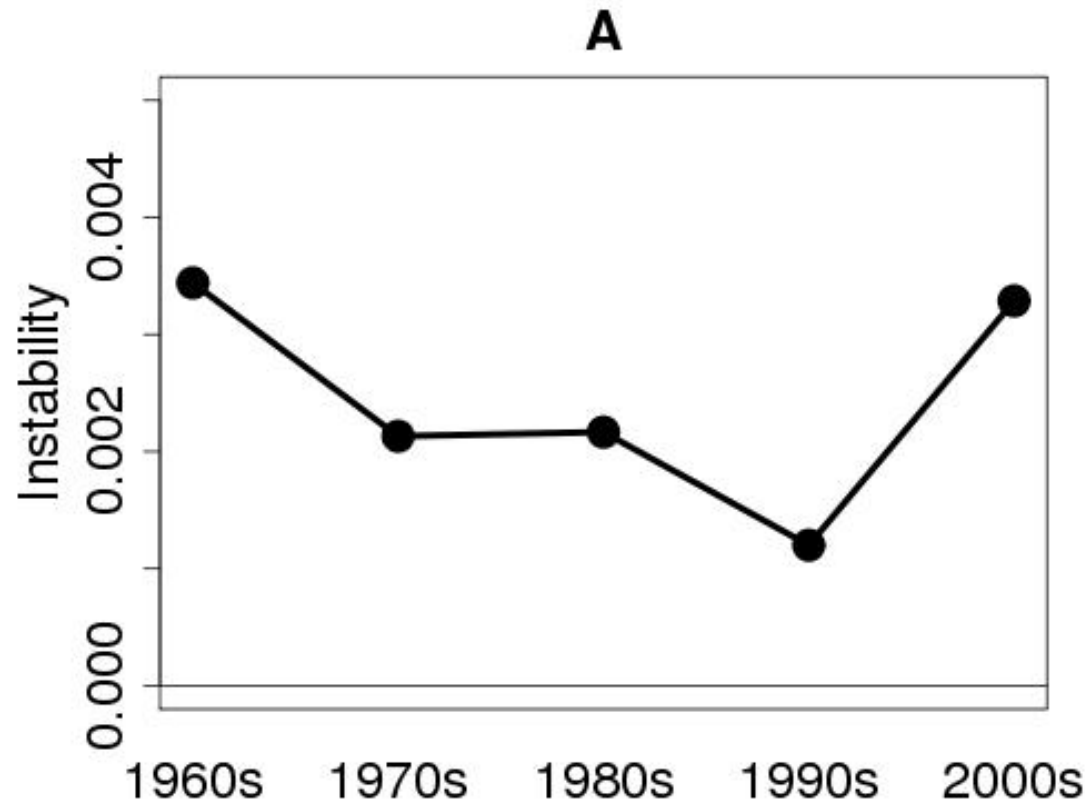
Method

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

$$I(Ys, Ye) \equiv CV(Ys, Ye)^2 = \frac{1}{Ye - Ys + 1} \sum_{yr = Ys}^{Ye} \left(\frac{Ya(yr) - Yt(yr)}{Yt(yr)} \right)^2$$

Y_a: actual yield
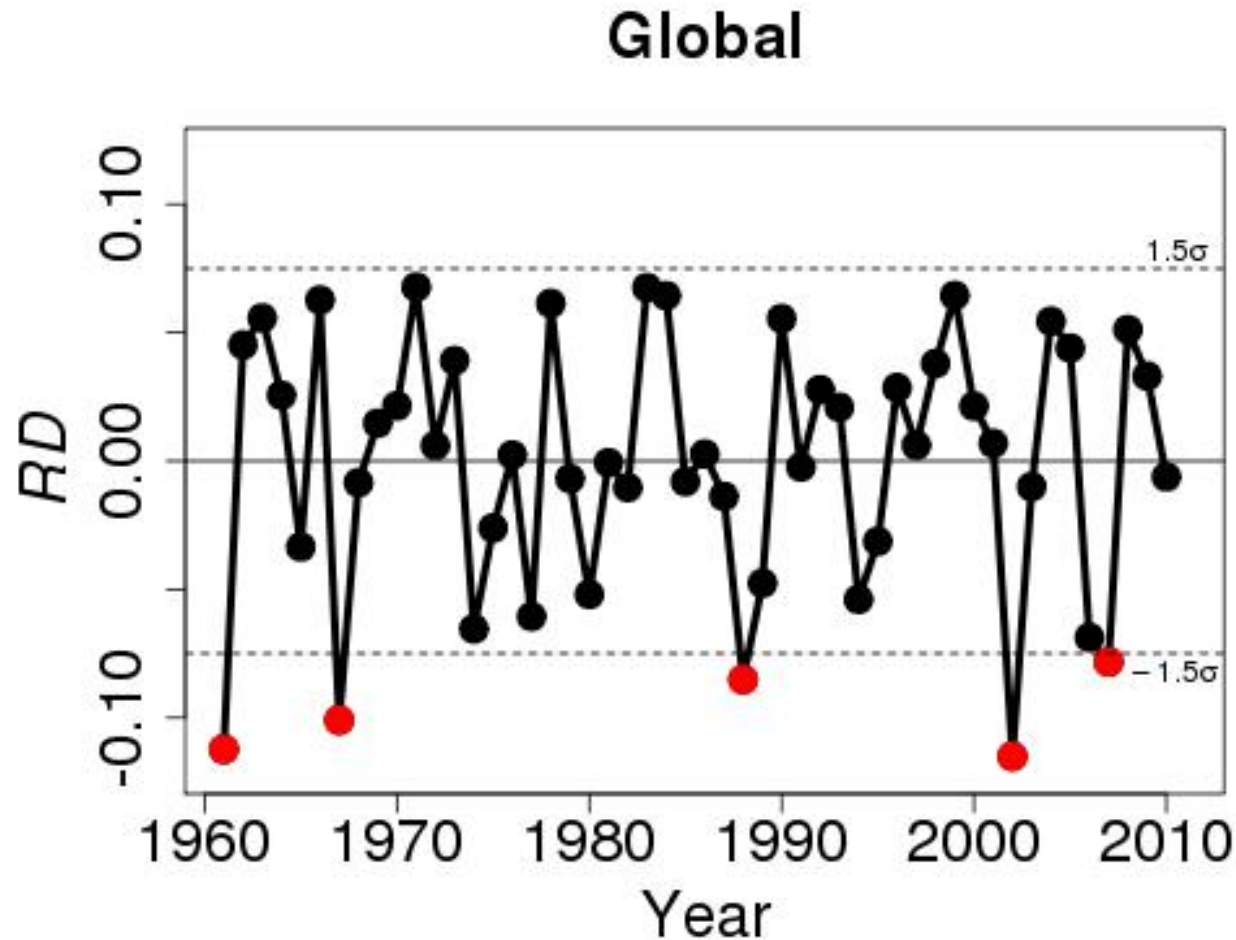Y_t: trend yield

Result

- 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?
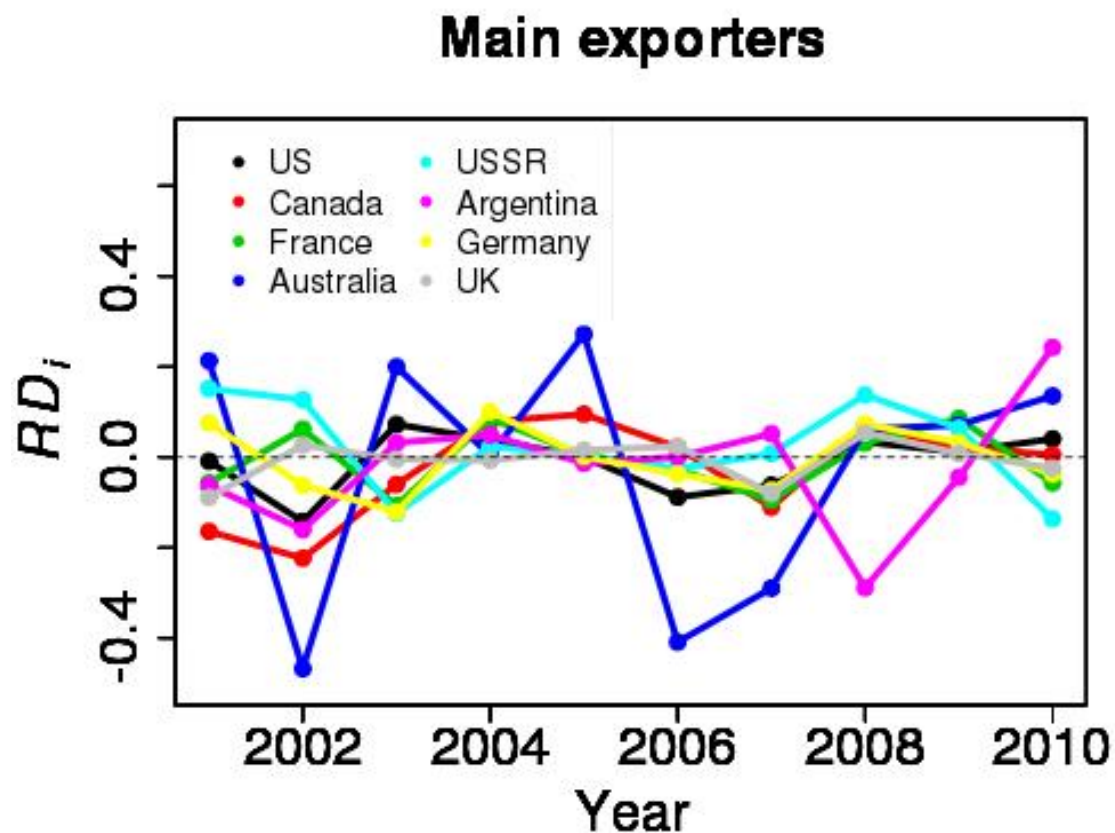
A1: Yes.

Q2: How did it happen?

Instability of each year

Global

- Extreme declines occurred more frequently in the 1960s and the 2000s

Which countries had poor production in the 2000s?

- Australia had poor productivity in 2002, 2006, and 2007.

Q2: How did it happen?

A2 : Poor production in Australia in 2002, 2006, and 2007

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 correaltion instability, we decompose overall production instability into two parts:
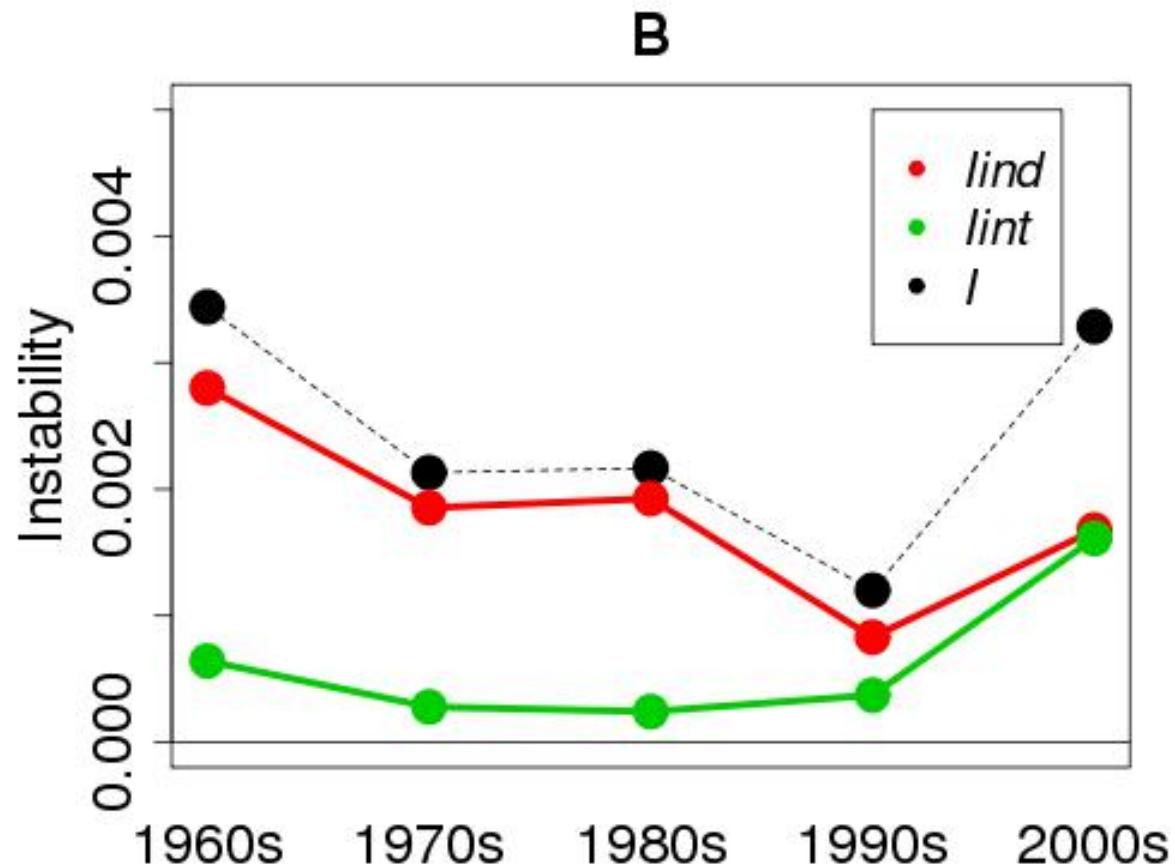 - Individual Instability
  - Correlation Instability

individual   Correlation

$$I(Ys, Ye) \; = \; Iind(Ys, Ye) \; + \; Iint(Ys, Ye). \ldots (6)$$

$$Iind(Ys, Ye) \equiv \frac{1}{Ye - Ys + 1} \sum_{yr=Ys}^{Ye} \left(\sum_{i=1}^{N} \left\{ (RD_i(yr))^2 * (S_i(yr))^2 \right\} \right), \ldots (7)$$

$$Iint(Ys, Ye) \equiv \frac{2}{Ye - Ys + 1} \sum_{yr=Ys}^{Ye} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left\{ RD_i(yr) * RD_j(yr) * S_i(yr) * S_j(yr) \right\} \right). \ldots (8)$$

RD: (relative)deviation; S: market share

Iind and *Iint*

- 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 instaibility in the 2000s?

A2': NO!!!

Correlation instabilty contributed to half of the overall instabiity 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 instaibilty 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!