

# Trade Effects of Asymmetric Genome Editing Regulation

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27 August, 2025

# Introduction & Motivation

- ▶ Genome editing enables precise, rapid crop improvements.
- ▶ Regulatory divergence:
  - ▶ **EU**: stringent, process-based (treated as GMO)
  - ▶ **US**: permissive, product-based
- ▶ Implications: asymmetric regulation will likely induce strong trade disruptions (Fiankor, Curzi & Olper, 2021)

# Trade Scenario: Genome Editing vs GMO

- ▶ **Historical context (GMO):**
  - ▶ Regulatory fragmentation → asynchronous approvals
  - ▶ Trade conflicts (e.g., EU–US soybean disputes)
- ▶ **Current risk (Genome Editing):**
  - ▶ Even deeper regulatory asymmetry (EU vs US, Brazil, Japan) (Molitorisova et al., 2025)
- ▶ **Worse Outlook:**
  - ▶ Genome-edited traits may be *undetectable but still illegal*
  - ▶ Fragmentation of global markets is likely to intensify
- ▶ **Lesson:** Without convergence, genome editing could repeat, and amplify, the trade disruptions seen with GMOs (e.g., Nes et al., 2022).

# Border Detection Challenges

- ▶ **Problem:** Many gene-edited mutations (e.g., single-nucleotide deletions) are *indistinguishable* from natural mutations (Zimny & Sowa, 2022)
- ▶ **Technical Barrier:**
  - ▶ No reliable method exists to identify genome editing origin (Sowa et al., 2021).
  - ▶ Import controls cannot confirm regulatory status of products.
- ▶ **Trade Impact:**
  - ▶ Creates legal and compliance uncertainty for exporters.
  - ▶ Raises risk of de facto trade barriers.

# Regulatory Landscape Snapshot

► Four global regulatory models (Tachikawa & Matsuo, 2023):

Approach 1 Strict GMO (EU, NZ)

Approach 2 Simplified GMO (UK, China)

Approach 3 Case-by-case with confirmation (Argentina, Japan)

Approach 4 Full exemption (US, Australia)

# Potential trade scenario

**Figure:** Expected Response of the Importing Country in Different Situations

|                   |            | Importing Country                       |                                         |                                         |                             |
|-------------------|------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------|
|                   |            | Approach 1                              | Approach 2                              | Approach 3                              | Approach 4                  |
| Exporting Country | Approach 1 | Under GMO regulations                   | Under GMO regulations                   | Consumer Negative Responses             | Consumer Negative Responses |
|                   | Approach 2 | Under GMO regulations                   | Under GMO regulations                   | Consumer Negative Responses             | Consumer Negative Responses |
|                   | Approach 3 | Advance Notice/Pre-market Authorization | Advance Notice/Pre-market Authorization | Advance Notice/Pre-market Authorization | Conventional Trade          |
|                   | Approach 4 | "Hidden GMO"                            | "Hidden GMO"                            | Advance Notice/Pre-market Authorization | Conventional Trade          |

*Source: Tachikawa and Matsuo (2023)*

- ▶ When genome food is exported by countries with Approaches 3 and 4 to countries with Approaches 1 or 2 → Hidden GMO
- ▶ The lack of harmonization disrupts the market (Bertheau, 2021)

# EU agri-food trade

- ▶ USA, Brazil, and Argentina are relevant GMO producers and have less stringent approach to genome editing than the EU
  - ▶ They account for more than 25% of EU agri-food imports, with the USA having a share of about 10%
- ▶ Potential trade disruption due to asymmetric genome editing regulation is likely to mostly affect soybean and soy oilcakes
  - ▶ Soybean and soy oilcakes account for about 30% of EU agri-food trade from the US, while about 50% is imported by Brazil and Argentina

# Trade simulation

- ▶ Gocht et al. (2021) simulate the impact of the EU treating genome-edited crops as GMOs and ceasing agri-food imports
  - ▶ Strong reduction in imports exports, feed use and processing; slight reduction in human consumption
  - ▶ More intensive production of cereals, especially soybean and soy cake (+265%) and increase in domestic prices
  - ▶ Reduction of EU meat production (−10%) and export (−42%) and increase in meat imports
- ▶ Increase in global CO2 emissions as the relocation of production is disadvantageous in terms of carbon efficiency
- ▶ **Conclusion:** Regulatory asymmetry leads to efficiency loss, sustainability drawbacks, and trade distortions.

# Conclusions and Policy Options

- ▶ Regulatory divergence is costly
  - ▶ Trade disruption and loss of efficiency
  - ▶ **Global misalignment** of risk perception
- ▶ Risk-based, transparent frameworks are needed
- ▶ Coordinate globally (e.g. Codex, WTO)
- ▶ **Final message:** “Aligning science and policy is vital to unlock innovation and protect trade.”

# References

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THANKS!