

Addressing Transboundary Climate Risks (TCRs) for the Food Security of Countries

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Background

- National adaptation plans (NAPs) in general and in Asia in particular often **focus primarily on domestic climate risks**, but the increasing significance of transboundary climate impacts calls for a broader, interconnected perspective.
- For example, disruptions in agricultural production in **food-exporting countries**, such as India, caused by climate-induced droughts, floods, or heatwaves, can directly affect food availability and prices in food-importing nations, like Japan, which relies heavily on imports from climate-vulnerable regions.
- Conversely, when **importing countries** face climate shocks, their increased demand or reduced purchasing power can destabilize markets for exporting countries, undermining rural livelihoods and long-term agricultural resilience.
- This **interdependence** highlights how climate risks do not stop at national borders and how food systems are embedded in complex global value chains.
- Without addressing these transboundary linkages, **NAPs underestimate risk** overlooking critical vulnerabilities that threaten both regional food security and global supply chains.
- **Revisiting NAPs** to incorporate such perspectives would help anticipate cascading impacts, foster cooperative risk management, and strengthen resilience in both exporting and importing countries.

Examples of transboundary and multi-hazard events with serious implications for food security

(Localization of global risks!)

Transboundary disaster	Period	Multi-hazard and transboundary nature
World food price crisis	2007-2008	A multi-year and multi-country event where natural hazards such as droughts, cyclones, floods at the time and geographical scales interacted with human interventions leading to the rise of food prices across the world
Southeast Asia drought	2019-2020	A multi-year and multi-country drought that interreacted with COVID-19 and the saline water intrusion as a result of drought
COVID-19 interaction with other climate events	2019-2022	Disruption to global industrial supply chains due to COVID-19, typhoons and related flooding (e.g. Malaysia).

Food prices, food imports and climate signals interact in complex ways across borders

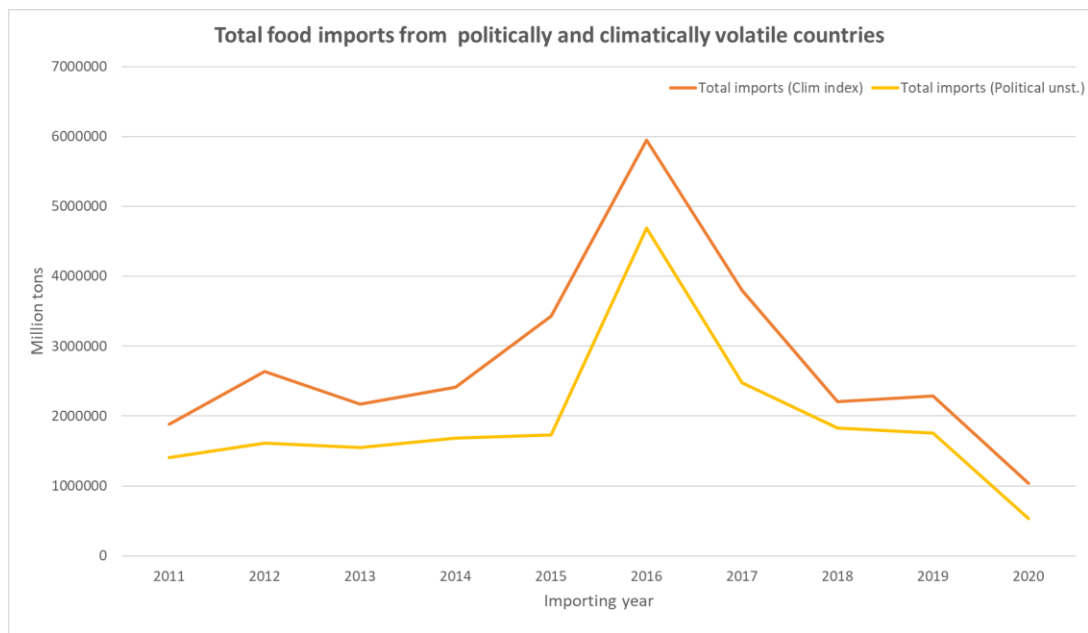
*Spooky Action at a
Distance!*

Albert Einstein, 1947

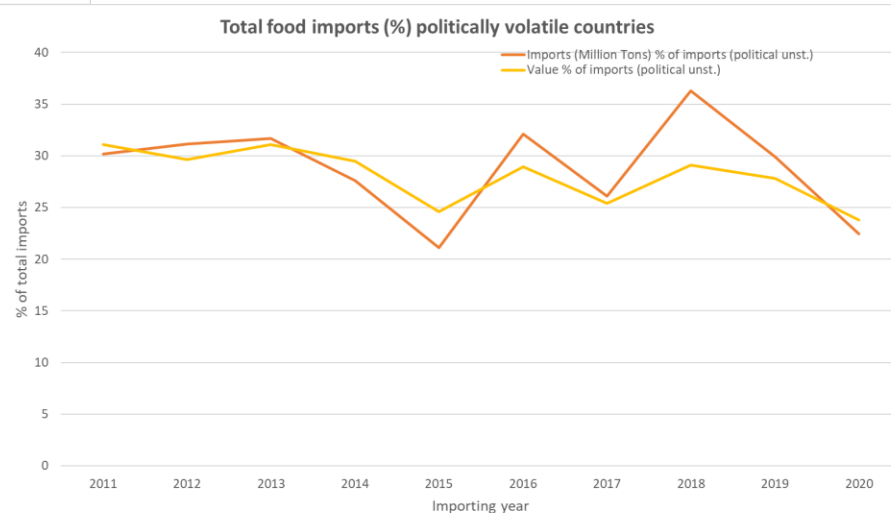
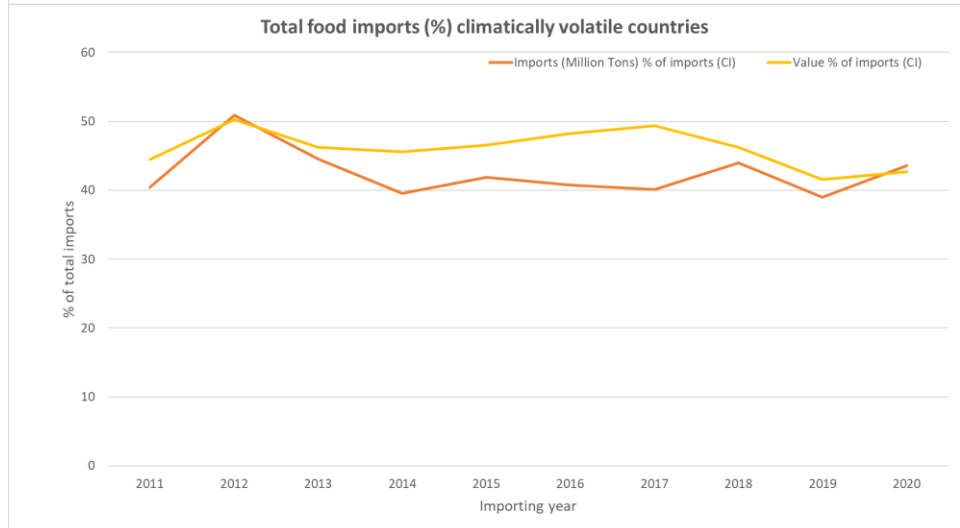
- Multiple factors affect the food prices complicating price forecast
 - **Food production** as a function of production factors
 - **Food demand** as a function of population, income, etc.
 - **Food imports** (import dependency)
 - **Food exports** (affects the net food availability in the country)
 - **Climate signal** (extreme rainfall events, temperature etc.)
- Simple approach to understand food price volatility:
 - If **rainfall variability correlates strongly with price volatility** → domestic production shocks drive price volatility.
 - If **import dependence (or concentration in a few suppliers) correlates** → external exposure drives volatility.
 - If **both interact** → the country may be vulnerable when domestic shortfalls coincide with import market shocks.
- We will look at the cases of **India**, which has very **low concentration ratio** (i.e. *Herfindahl–Hirschman Index*, HHI of 0.04–0.05) for foodgrains and **Japan** (HHI of 0.4-0.6) for bananas.
- India's foodgrain imports are **spread across several countries** (>15) while Japan imports **most of its banana from a few countries** (top 4 account for >95%).

India's Food Import Dependency on Climatically and Politically Fragile Countries

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- ❑ India imported food from **23** of top 30 climatically and **11** politically unstable/vulnerable countries during 2011-2020.
- ❑ In 2020, **43%** of total food imports came from climatically vulnerable countries, and **24%** from politically unstable countries.
- ❑ Nearly **54% of total food imports** came from climatically and politically unstable countries with significant implications for food price volatility in India.



India also exports food to several politically and climatically unstable countries in significant quantities.

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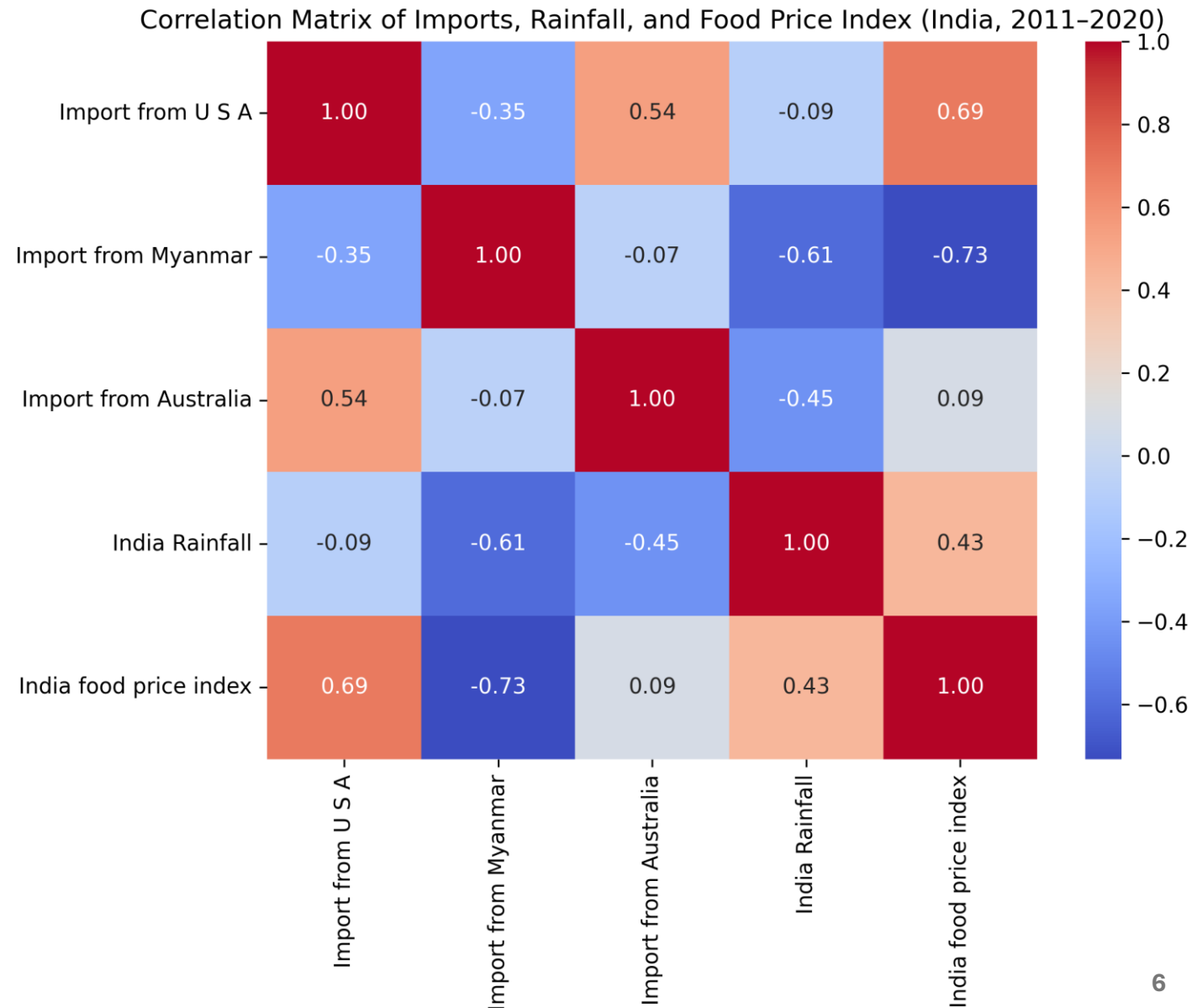
Data source: APEDA and Germanwatch, 2021

How much imports and rainfall characteristics explain the food price volatility of **India**?

- Years with higher imports from the US tend to align with higher food prices.
- Higher imports from Myanmar tend to align with lower food prices.
- Rainfall might matter, but not strongly.
- Australia's imports don't seem to explain much on their own.

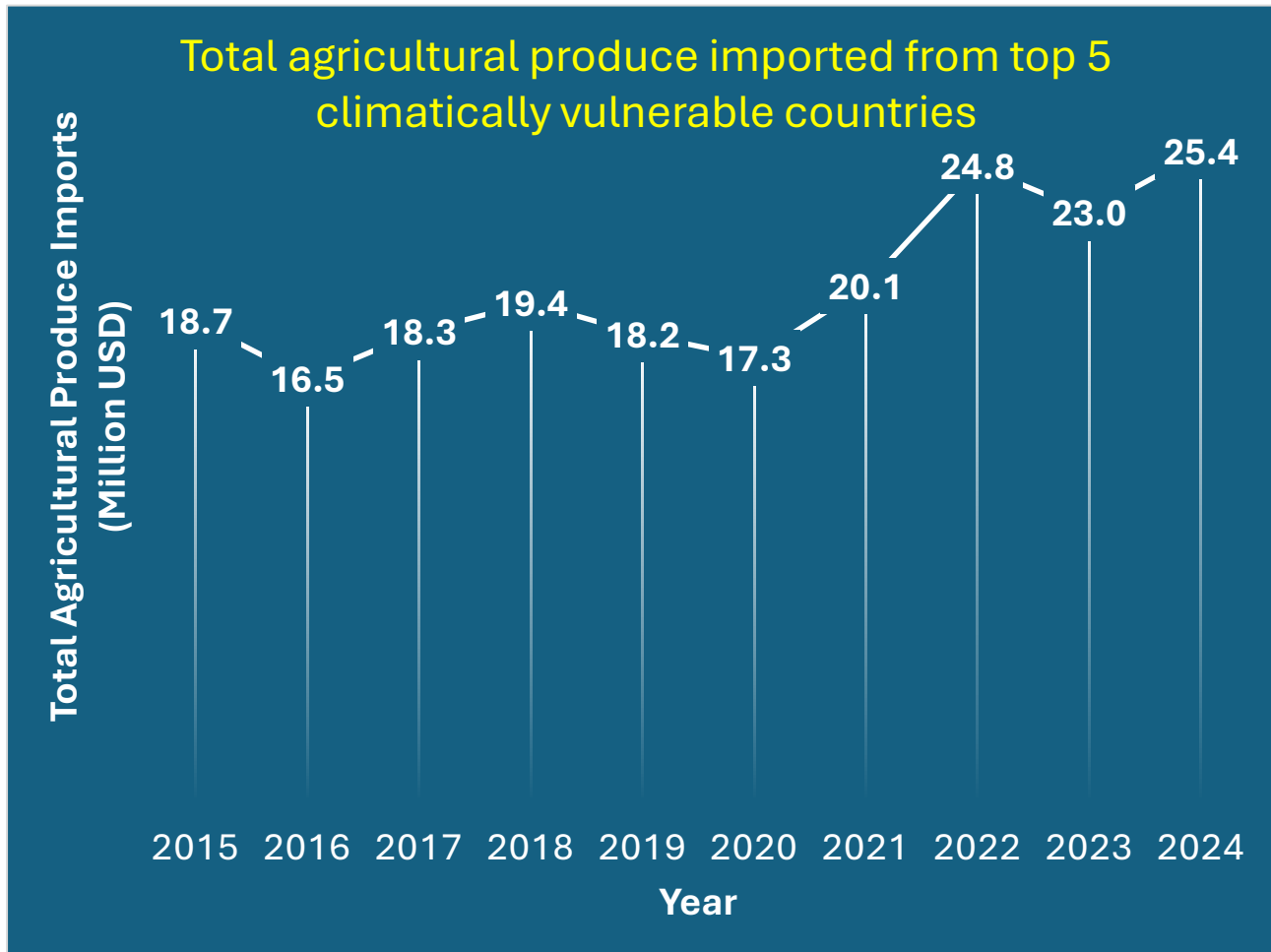
Multiple linear regression:

Rainfall + Imports explain 82.6% of food price volatility in India



$R^2: 0.826$

Japan's Food Import Dependency on Climatically Vulnerable Countries



Data source: www.e-stat.go.jp, 2025

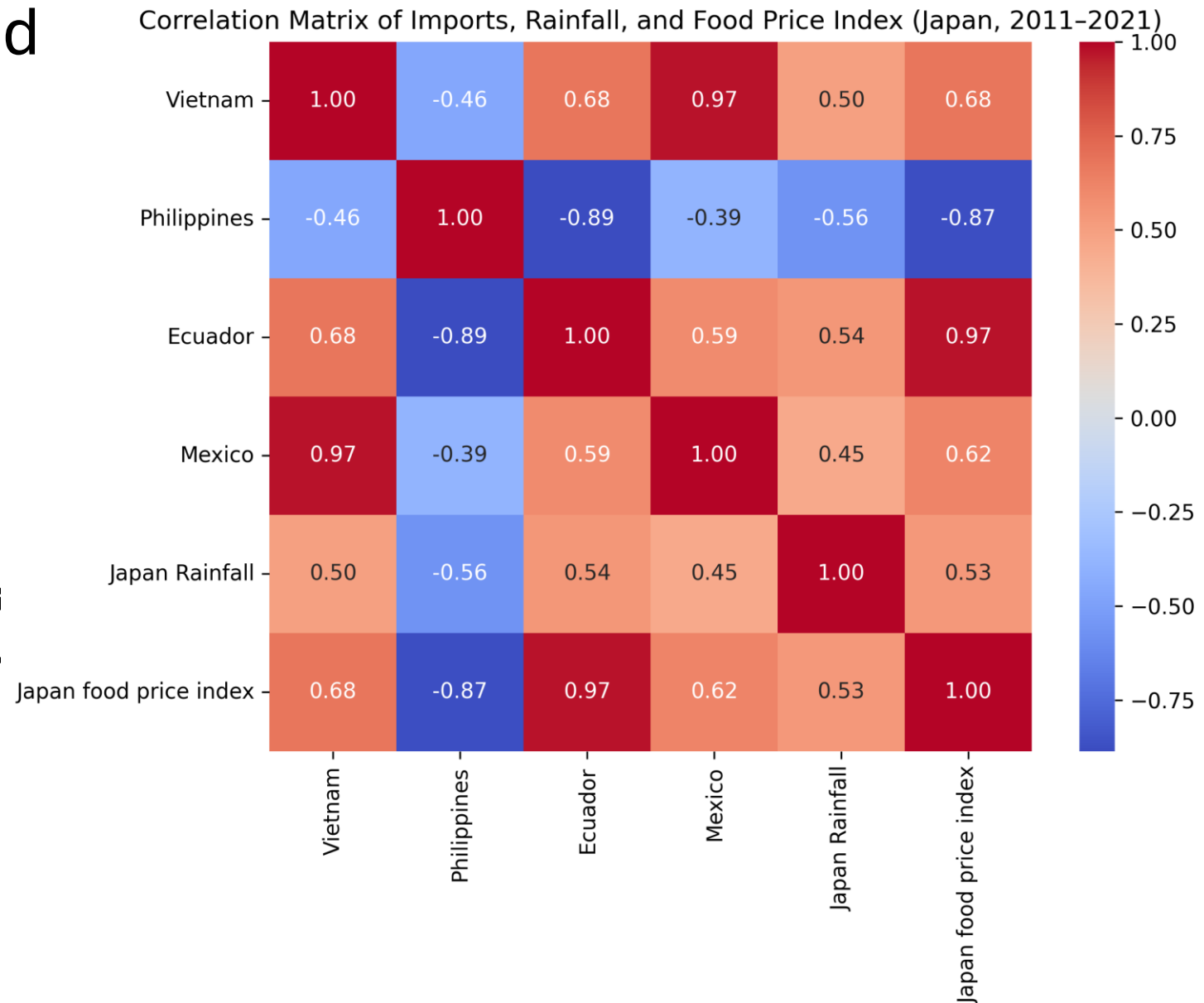
- Japan imports agricultural produce from **5 countries** that are in the top 20 countries with highest climate risk (i.e. CRI, Germanwatch).
- These imports amounted to **22-80%** of the total food produce imported during the charted period (2015-2024)
- Unlike India,
 - Japan doesn't import food from politically unstable countries.
 - It doesn't export to politically unstable countries.
 - Imports are continuously on the rise

How much food imports and rainfall characteristics explain the food price volatility of **Japan**?

- Years with higher imports from the **Ecuador** tend to align with **higher banana prices** in Japan.
- Higher imports from The **Philippines** tend to align with **lower food prices**.
- Imports from other countries seem to explain moderately on their own.
- **Rainfall amount matters** in Japan, but moderately (Japan produces a negligible quantity of bananas).

Multiple linear regression:

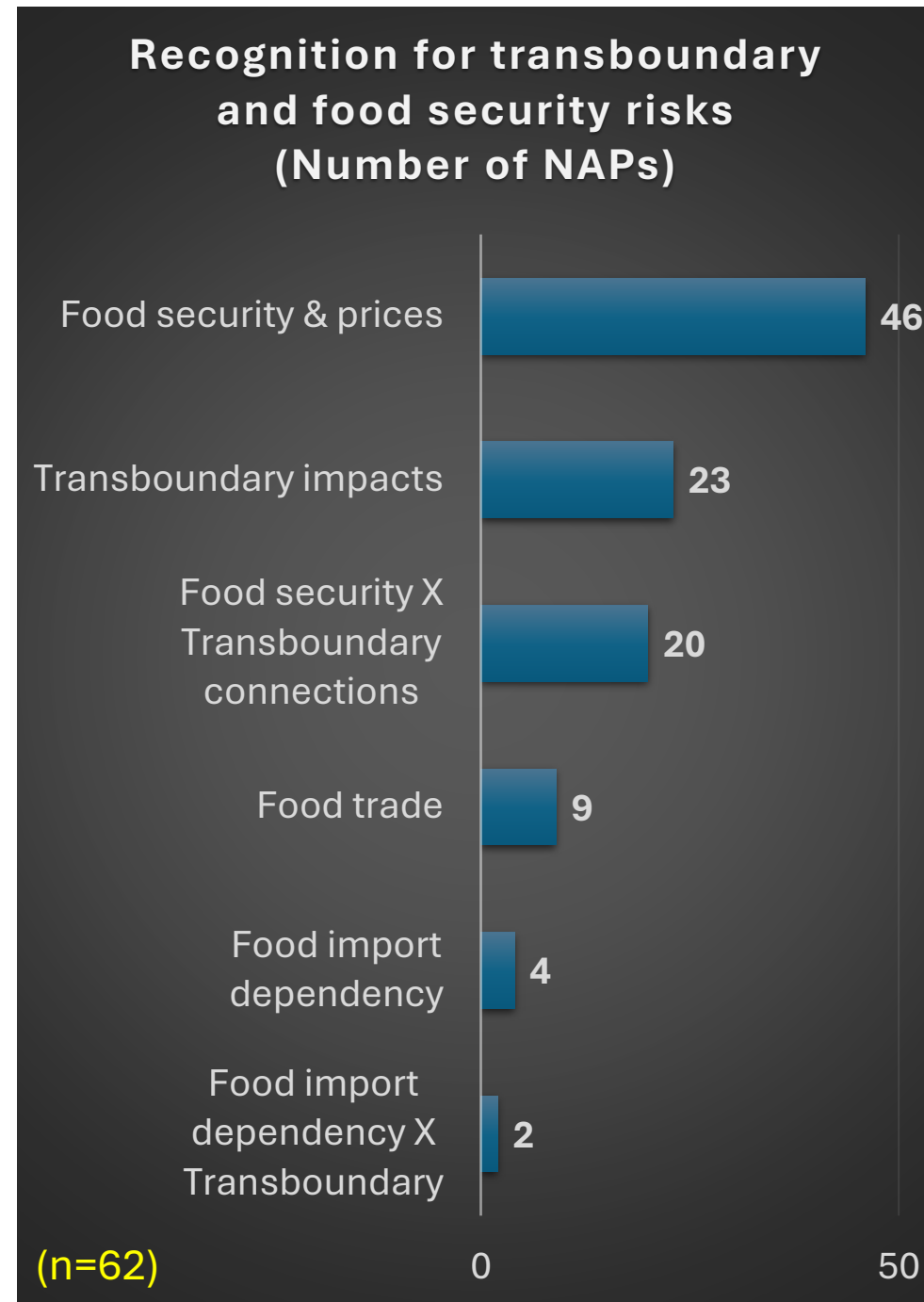
Rainfall + Imports explain 96% of food prices in Japan



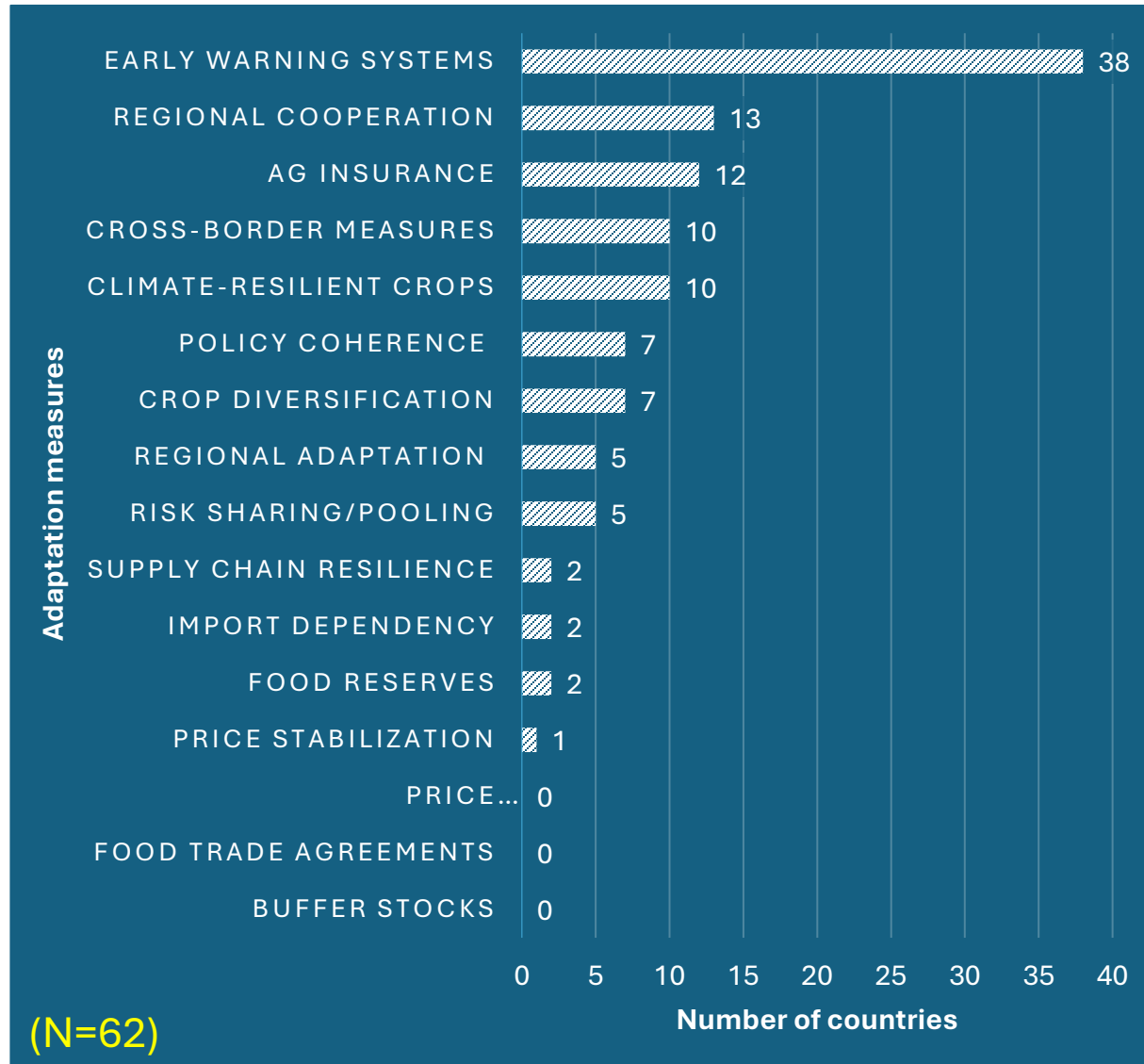
$R^2: 0.960$

Recognition for Transboundary Risks and Food Security Implications among NAPs

- Good news is that **61% of NAPs** recognize the **food security and food prices** in the NAPs.
- Only **32% of NAPs** discussed **transboundary contexts** of countries.
- However, very few NAPs discussed the food import dependency, and transboundary impacts.



Adaptation Strategies Identified by NAPs



- Overall, EWS have received much emphasis in **61% of the NAPs** submitted; however, it's not in the context of food prices and TCRs.
- A **significant deficit** has been limited focus on the TCR impact on food prices and strategies for food price stabilization.
- Further, very few NAPs have discussed food **supply chain resilience, regional adaptation plans** etc.
- Though **regional cooperation** was discussed, the emphasis on food and food price stabilization was not the focus.

Conclusion and Way Forward

- In an increasingly globalized world, **countries are increasingly dependent** on food imports for various reasons with implications on their food security.
- **Food supply chains are relatively rigid** and inability to rapidly change of food supply chains means greater need for supply chain risk evaluation and strategic planning. Diversifying source countries could help in **diversifying the risk exposure** (i.e. by reducing the Herfindahl–Hirschman Index (HHI) value)
- For countries and NAPs, this means **recognizing that adaptation is not just a national and local agenda but also connected to regional and global strategies.**
- It requires alignment strategies that **protect producers, stabilize supply chains, and ensure food access across borders.**
- Analysis of NAPs indicate that **there is a need to strengthen NAPs** with robust analysis of transboundary impacts of climate change on food security of countries.
- While **NAPs have identified various risk management strategies**, they are not necessarily targeting transboundary risks, food import dependency and food price volatility.

For more information on our work:

Thank You!



<https://www.iges.or.jp/en/about/staff/sivapuram-prabhakar>