# The power law of agricultural trade:

# Measurement and decomposition of agricultural import diversification across trading partners

**Bo Xiong, bonapartexiongbo@gmail.com**

**Assistant Professor in Agricultural Economics and Management, Zhejiang University**

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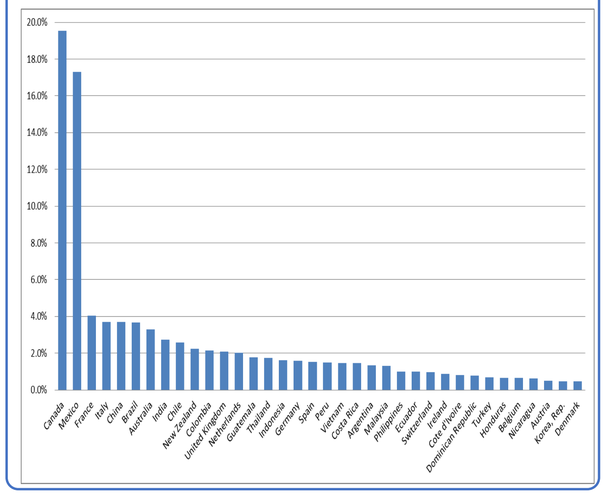
## Abstract

Addressing food security in a globalized world requires a diversified profile of agricultural imports, especially when climate change has made adverse weather conditions occurring more frequently.

We provide the first estimates of the degree of agricultural import diversification for 123 nations in 2014. We find that agricultural import diversification is uncorrelated with a nation's per-capita GDP.

Through further decomposition, we find that the degree of agricultural import diversification in a nation primarily hinges on the spread of agricultural imports across trading partners of similar development stages.


## Example: U.S. agricultural import distribution




## Measurement: Normalized Theil index

The Theil index has been widely deployed to measure inequality, segregation, or the lack of diversity in ecological or social communities. In the context of agricultural imports, the normalized Theil index takes the form of:

$$T = \sum_{i=1}^{I} \left( \frac{v_i}{\bar{v}} \cdot \ln \frac{v_i}{\bar{v}} \right) \Big/ (I \cdot \ln I)$$

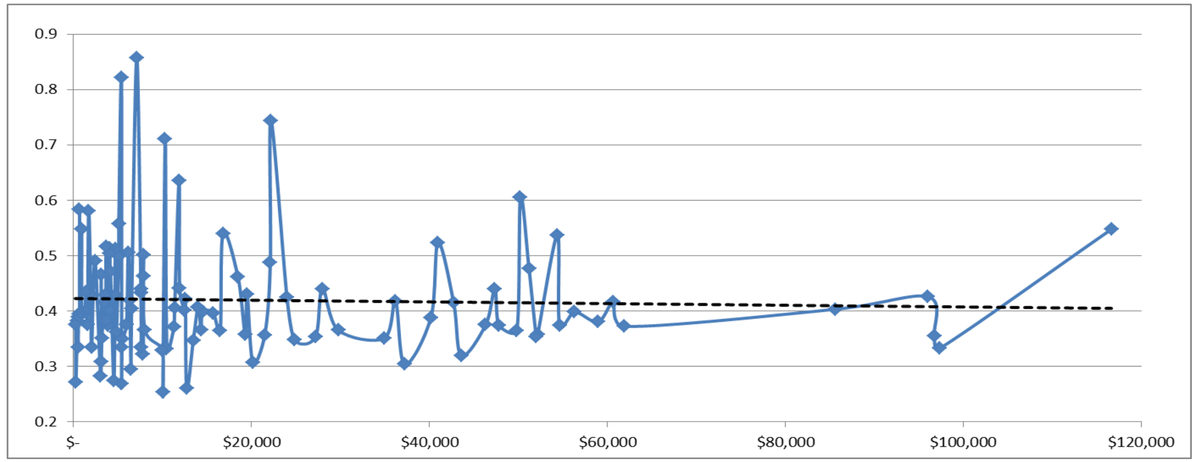
where $I$ is the number of active trading partners that export agricultural products to a nation; Vi is the value of import from trading partner $i$; and V with bar is the average import value in that nation. A higher value of the normalized Theil index corresponds to a less diversified, or more concentrated, profile of agricultural imports.

One major advantage of the Theil index is that the overall measurement can be decomposed into lower-level indices that describe the degree of diversification within subgroups. If we can classify exporting nations by the stages of development, the normalized Theil index can be re-written as:

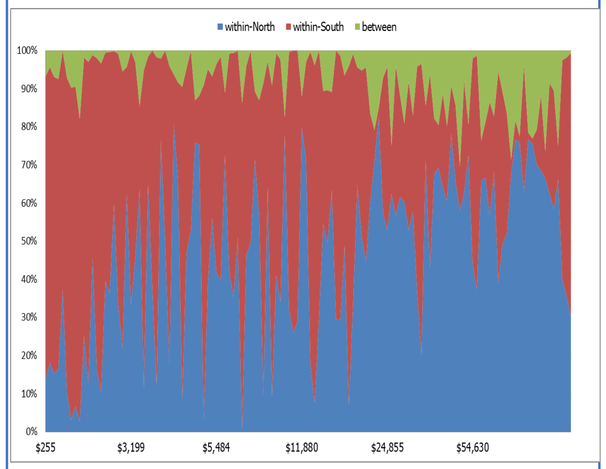
$$T = \underbrace{\frac{s_n T_n \ln I_n}{\ln I}}_{within-North} + \underbrace{\frac{s_s T_s \ln I_s}{\ln I}}_{within-South} + \underbrace{\frac{s_n \ln(\bar{v}_n / \bar{v}) + s_s \ln(\bar{v}_s / \bar{v})}{\ln I}}_{between}$$

where $n$ and $s$ designate the group of North and South respectively; Sn is the import from North over the total imports; Vn with bar is the average import from partners in North. Ss and Vs with bar are defined similarly.

## Agricultural import diversification, against per-capita GDP




## Decomposition




## Conclusions

- We propose the normalized Theil index as the measurement of agricultural import diversification across trading partners.
- We find that the stage of economic development is not a determinant of agricultural import diversification.
- In addition, we find suggestive evidence that a nation's agricultural import diversification is primarily driven by the distribution of imports across trading partners of similar development status.