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## **Estimating Costs of Protection for Agricultural Exports to Developing and Emerging Markets**

**Yunus Emre Karagulle, Jason Grant, Xi He, and Charlotte Emlinger**

*Selected presentation for the International Agricultural Trade Research Consortium's (IATRC's) 2023 Annual Meeting: The Future of (Ag-) Trade and Trade Governance in Times of Economic Sanctions and Declining Multilateralism, December 10-12, 2023, Clearwater Beach, FL.*

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# Estimating Costs of Protection for Agricultural Exports to Developing and Emerging Markets

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IATRC Annual Meeting  
December, 2023

## Through 19th-21st century

- New transportation and communication systems
- General Agreement on Tariffs and Trade (GATT) of 1947
- World Trade Organization (WTO) in 1995
- Increasing number of regional trade agreements (RTAs)

⇒ Reduce trade costs and boosted to the integration of world economies ( Jacks, Meissner and Novy, 2011)

⇒ **Connected and interdependent global economy**

Friedman (2005) argues that "the world is flat!"

## Why is the agricultural sector special?

- The URAA (1994) was the first agreement achieved to lower tariffs for agriculture (Bureau et al., 2019).
- 27% of agricultural products are excluded from trade agreements compared to 1% of manufacturing products (Damuri, 2012)
- Average tariff rates are significantly higher than other sectors (Guimbard et al., 2012).
- Subject to more regulations than other sectors (Blank and Egger, 2021; Gaigné and Gouel, 2022)
- Distinct challenges on transportation (Beghin and Schweizer, 2021)

## Question?

How have agricultural trade costs evolved over the last two decades?

## What we do

- Build a trade costs dataset
- Document the trade costs evolution
- Measure the variation in trade costs and explain it.

## 1. Bilateral Trade Costs

$$X_{ij,t}^k = \exp[\alpha_{ij,\tau}^k D_{ij,\tau}^k + \eta_{i,t}^k + \theta_{j,t}^k] \varepsilon_{ij,t}^k$$

- $D_{ij,\tau}^k$  is directional country pair dummy equals 1 for each country pair  $ij$  for the period  $\tau$ , and sector  $k$ , otherwise 0;
- $\alpha_{ij,\tau}^k$  is the country pair coefficient that denotes raw trade cost measure
- $\eta_{i,t}^k$  and  $\theta_{j,t}^k$ , denotes exporter-time; and importer-time fixed effects
- Estimating each sector ( $k$ ) separately

## 1. Bilateral Trade Costs

$$X_{ij,t}^k = \exp[\alpha_{ij,\tau}^k D_{ij,\tau}^k + \eta_{i,t}^k + \theta_{j,t}^k] \varepsilon_{ij,t}^k$$

## 2. Elasticities

$$X_{ij,t}^k = \exp[\beta_1^k \ln \text{Tariff}_{ij,t}^k + \beta \mathbf{Z} + e_{i,t}^k + e_{j,t}^k] \varepsilon_{ij,t}^k$$

- $\mathbf{Z}$  is vector of bilateral determinants of trade.
- $\sigma^k = -\beta_1^k$



## 1. Bilateral Trade Costs

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## 2. Elasticities

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$$\ln(TC_{ij,\tau}^k) = -\frac{1}{1-\sigma^k} (\hat{\alpha}_{ij,\tau}^k)$$

## 3. AVE Trade Costs

## Datasets Used

- UN Comtrade and FAO production data (Syrengeles, Emlinger and Grant, 2021) → Intranational Trade Flows
- MacMaps Database(CEPII)
  - Disaggregated tariff data (2001-2016) Guimbard et al., 2012)
- Gravity Database(CEPII) (Head, Mayer and Ries, 2010.; Head and Mayer, 2014)

## Constructing Trade Costs Dataset

- Exporter, importer, product, and period level.
- Directional/Asymmetric
- 2001-2018
- 37 products/sectors at the 4-digit level of the SITCR1.
- 151 exporters, 161 importers.

Figure 1: Change in trade costs for BICO sectors.

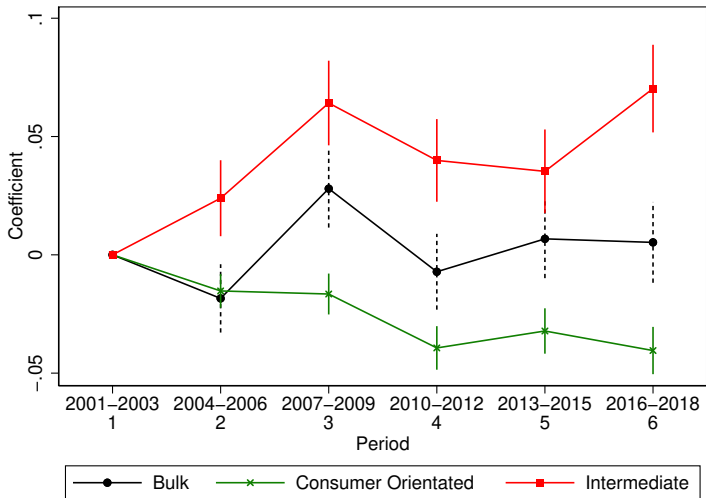
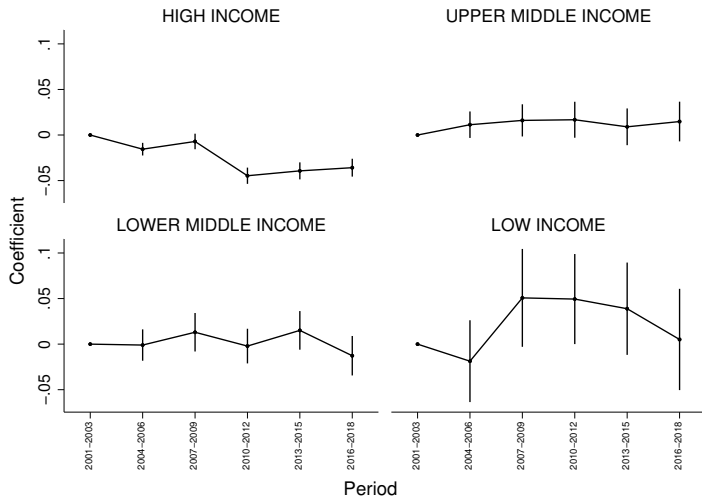
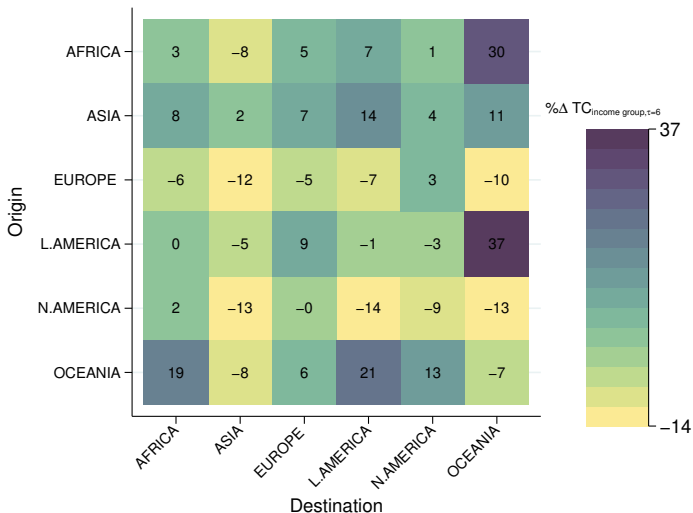


Figure 2: Trade costs evolution over time by exporter's income level.

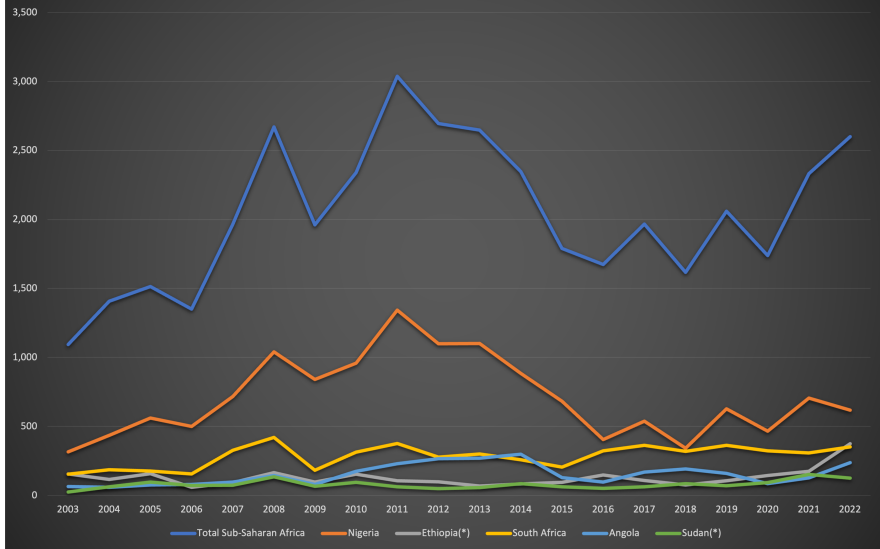


**Figure 3:** Percentage change in trade costs across regions in 2016-2018 compared to 2001-2003.

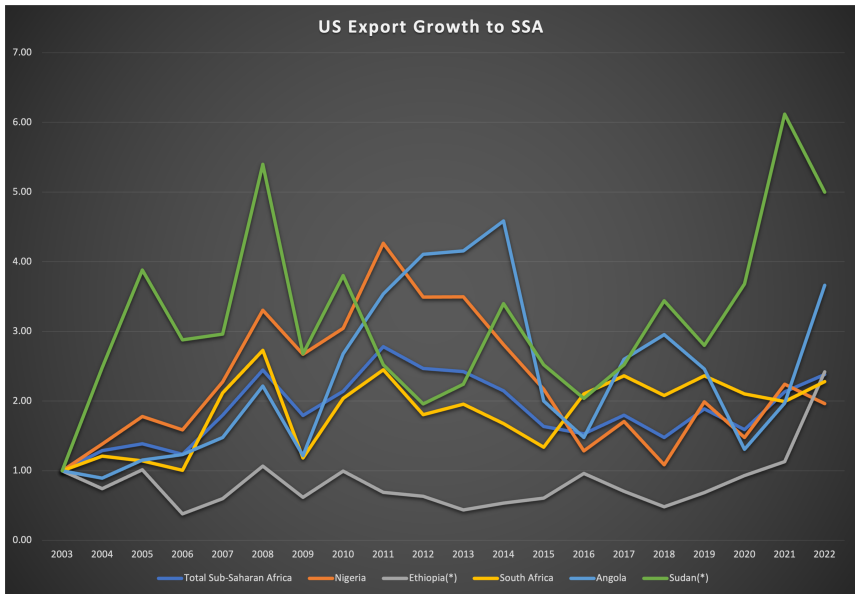


## A Framework to Quantify Trade Costs of U.S. Agricultural Exports to SSA

## US Exports to SSA in Million \$ (Top 5)



Source: <https://apps.fas.usda.gov/gats/>



Source: <https://apps.fas.usda.gov/gats/>



# Structural Gravity Model

$$X_{ijt} = \exp(\pi_{it} + \phi_{jt} + \beta \mathbf{Z}_{ijt}) + \epsilon_{ijt} \quad (1)$$

$X_{ijt}$  represents trade flow from origin  $i$  to destination  $j$  of at time  $t$ .  $\pi_{it}$  and  $\phi_{jt}$  are exporter-time, importer-time fixed effects, respectively.  $\mathbf{Z}_{ijk}$  is a vector of explanatory variables.

$$\begin{aligned} X_{ijt} = & \exp(\beta_1 \text{DIST}_{ij} + \beta_2 \text{CNTG}_{ij} + \beta_3 \text{LANG}_{ij} + \beta_4 \text{CLNY}_{ij} + \beta_5 \text{RTA}_{ij} \\ & + \beta_6 \text{INTBRDR}_{ij} + \sum_{\substack{\{N.America\} \\ \{f=Asia\}}} \beta_f \text{BORDER\_USA\_FTA}_{ij} + \beta_{11} \text{BORDER\_USA\_SSA}_{ij} \\ & + \pi_{it} + \phi_{jt}) + \epsilon_{ijkt} \end{aligned} \quad (2)$$

$$\% \Delta AVE = \exp \left( \left( \frac{\exp(\beta_{USA\_FTA})}{\exp(\beta_{US\_SSA})} \right)^{\frac{1}{1-\sigma}} - 1 \right) \times 100 \quad (3)$$

## Dataset

- New Structural Gravity Database that accounts for stock changes for storable commodities
  - USDA - PSD data → Intranational Trade Flows
  - BACI (CEPII) International Trade Flows
- Annual data from 2013 to 2022
- 36 Sectors
- 70 Exporters and Importers
- Tariff Data, MacMaps Database(CEPII)

	(1)	(2)	(3)	(4)
TARIFF	-3.53*** (0.91)	-3.73*** (0.89)	-3.75*** (0.89)	-3.65*** (0.88)
RTA	0.48** (0.18)	0.40* (0.18)	0.39* (0.18)	0.31 (0.19)
BRDR	-3.97*** (0.24)	-3.97*** (0.24)	-3.96*** (0.24)	-4.00*** (0.25)
BRDR_USA_NAFTA		-2.75*** (0.38)	-2.74*** (0.38)	-2.57*** (0.38)
BRDR_USA_SSA		-5.39*** (0.37)	-5.34*** (0.37)	-5.27*** (0.36)
BRDR_EU_SSA			-3.37*** (0.48)	
BRDR_USA_PPCC				-2.83*** (0.46)
BRDR_USA_CAFTA				-2.66*** (0.36)
BRDR_USA_KOR				-2.99*** (0.37)
BRDR_USA_JPN				-2.60*** (0.34)
CONSTANT	15.30*** (0.51)	15.17*** (0.47)	15.21*** (0.47)	15.17*** (0.48)
<i>N</i>	38088	38088	38088	38088
pseudo <i>R</i> <sup>2</sup>	0.98	0.98	0.98	0.98
<i>p</i>	0.00	0.00	0.00	0.00
FE	it,jt	it,jt	it,jt	it,jt

Distance, Colonial Links, Common Language, Contiguity are not shown here.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Relative Cost of Protection in AVEs (%)

	(1)	(2)	(3)	(4)
SSA vs NAFTA		-35.57	-35.17	-36.21
USA-SSA vs EU-SSA			-28.04	
SSA vs PCCC				-33.39
SSA vs CAFTA_DR				-35.27
SSA vs KOREA				-31.69
SSA vs JPN				-35.96

	(1)	(2)	(3)
	Wheat	Grain	Chicken
TARIFF	-2.97*** (0.75)	-1.72 (0.92)	-1.61** (0.61)
RTA	0.92*** (0.28)	0.80* (0.33)	0.15 (0.37)
BRDR	-4.55*** (0.41)	-4.54*** (0.39)	-6.40*** (0.82)
BRDR_USA_NAFTA	-3.59*** (0.84)	-3.07* (1.35)	-5.31*** (0.92)
BRDR_USA_SSA	-4.68*** (0.61)	-5.86*** (0.98)	-5.95*** (1.18)
Constant	17.59*** (1.29)	16.51*** (0.99)	11.91*** (1.54)
$\Delta$ % AVEs			
SSA vs NAFTA	-16.57	-37.20	-10.14
<i>N</i>	37053	36849	35259
pseudo <i>R</i> <sup>2</sup>	0.97	0.98	0.98
<i>p</i>	0.00	0.00	0.00
FE	it,jt	it,jt	it,jt

Distance, Colonial Links, Common Language, Contiguity are not shown here.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Concluding Remarks

- High trade frictions against the U.S. export to SSA region
- Slow down in trade cost reduction
- Trade costs evolution is;
  - Asymmetric/Directional
  - Heterogeneous among products, countries, regions and income groups
- Unequal integration of economies
- Hard to uphold the argument that agricultural trade becomes more connected and integrated