New Estimates of Agricultural Trade Elasticities: Evidence from the 2018/19 Trade Dispute (and 2020 Tariff Removal)

Jason Grant, Charlotte Emlinger, Xin Ning, Shawn Arita, and Sharon Sydow

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COLLEGE OF AGRICULTURE AND LIFE SCIENCES VIRGINIA TECH

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USDA OFFICE OF THE CHIEF ECONOMIST

United States Department of Agriculture

Project Collaborators

- **Collaborators:**
  - Virginia Tech
  - UT Knoxville
  - University of Florida
  - Purdue University
  - GTAP
  - K-State
  - Research Triangle Institute (RTI)

Overall Project Goals:

1) Import demand elasticities
2) Export supply elasticities
3) Methods for identifying elasticities when data are limited

Motivation

- **How responsive are trade volumes to changes in relative price of tradable goods?**

- Trade elasticities – the substitutability of products from different sources - are fundamental parameters influencing policy predictions
  - Essential for projecting the gains from trade; impact of signing new FTAs
  - Key parameter in trade disputes litigated at the World Trade Organization
  - Cited in COOL, India Avian Influenza, Mexico-Dolphin Tuna, trade damage estimates for USDA's trade aid programs (US-China trade dispute)

- Also important for welfare approximations
  - Changes in welfare = *f*(share of domestic exp; elasticity of trade w.r.t. var. trade costs ($\varepsilon = 1 - \sigma$))
  - "Knowledge of the Armington elasticity, along with observed trade shares, are sufficient conditions to quantify the welfare gains for a large class of structural trade models (encompassing gravity-type models) (Arkolakis, Costinot, Rodriguez-Clare 2012)

Objectives of this Study

"… estimates of the trade elasticity based on actual trade policy changes are scarce … it is surprising that trade policy has not been exploited to a larger extent to identify this crucial parameter"

Goldberg & Pavcnik (2016)

- Use trade war period as potentially exogenous shock to tariffs to identify set of product-specific, short run trade elasticities
    - Although one could think of the "politics" of products targeted by retaliatory tariffs
- Compare short run elasticities to studies estimating longer run elasticities
- Uncover potential asymmetries in trade elasticities conditional on the direction of tariff changes

Relevant Literature

Estimates vary widely across study (Head & Mayer (2014); USITC 2020)

Differences driven by empirical design, aggregation and sample periods (Head and Mayer (2014), Ahmad, Montgomery and Schreiber (2020)

Been a while since a global set of agricultural trade elasticities have been estimated

Study	Trade Elasticity	Design	Sample Period
Romalis (2007)	6.3-10.9	US imports from CAN/MEX	1989-1999
Kee, Nicita, Olarreaga (2009)	3.12	Imp. Demand, GDP function approach, 117 countries	1988-2001
Broda & Weinstein (2006)	Mean: 6.6 & 12.6 Median: 2.7 & 3.1	Feenstra (1994)	1990-2001
Soderbery (2018)	3.4	LIML	1991-2007
Simonovska & Waugh (2014)	4.12	Max: Int'l price differences	2004
Giri, Yi & Yilmazkuday (2021)	4.38	Max: Int'l price differences	12 EU countries, 1990
Caliendo & Parro (2015)	0.49 (Autos) to 51 (Petroleum)	Tetrads	1993 (before NAFTA)
Feenstra, Luck, Obstfeld and Russ (2018)	Macro & Micro elasticities	US Imports matched to domestic data	1992-2007
Hertel, Hummels, Ivanic and Keeney (2007)	1.8 (minerals) – 4 (oilseeds) - 34.4 (gas) (GTAP sectors)	Cross-country differences in freight rates and tariffs	1994
Fontagne, Guimbard, Orefice (2021)	107 (Coal) – 0.18 (Knives w/ cutting blades) MEAN: 6	Cross-country tariff differences (panel)	2001,2004,2007,2010
Head & Mayer (2014)	5.03 (stdev: 9.3)	Lit. Rev. of 435 elasticities from 32 papers:	-----

Model

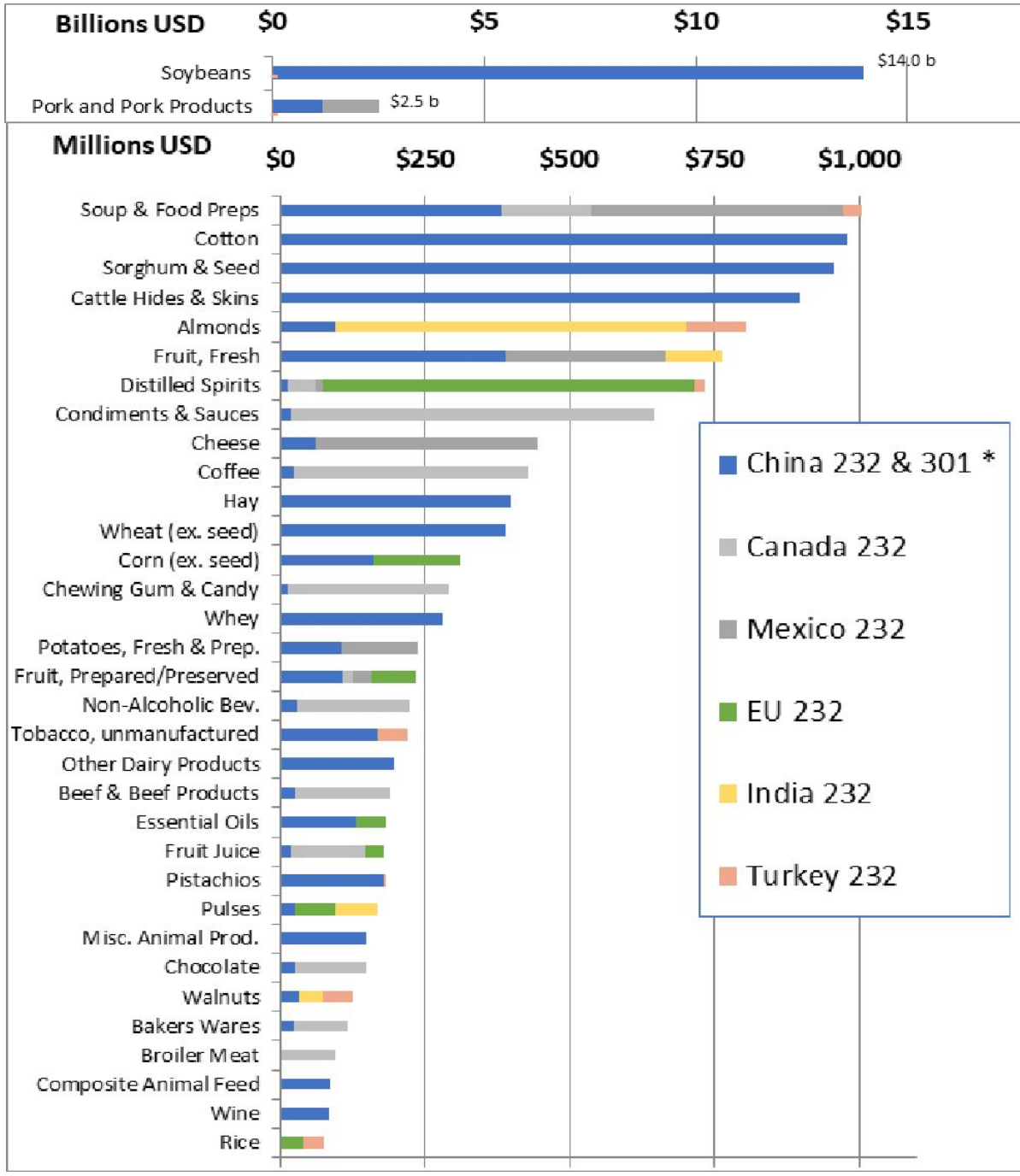
Exploit the within (panel) variation in tariff changes during "trade war" to identify trade elasticities

$$x_{ijkqt} = exp\{\mu_{ijkq} + \pi_{ikt} + \varphi_{jkt} + (1-\sigma)\ln(1 + t^{a}_{ijkt} + t^{ret}_{i=US,j\in R,k,q,t})\} + \varepsilon_{ijkqt}$$

- i, j, k, q, and t denote exporter, importer, commodity, quarter, and year, respectively.
- R is the set of six retaliating countries.
- x_{ijkqt} is the value of trade between i and j in product k, month m and year t.
- t^{a}_{ijkt} & $t^{ret}_{i=US,j\in R,k,q,t}$ is applied tariff and additional retaliatory tariff when i is the U.S. and importer j is one of six retaliating destination countries on product k targeted by retaliatory trade actions in quarter q and year t
- $\mu_{ijkm} + \pi_{ikt} + \varphi_{jkt}$ are country-pair-product-quarter, exporter-product-year, importer-product-year effects, respectively
- **Estimation method: Poisson-Pseudo-Maximum Likelihood** (PPML) with high-dimensional fixed effects (Correia, Guimarães, and Zylkin 2019; Santos Silva and Tenreyro, 2006; 2010; 2011)

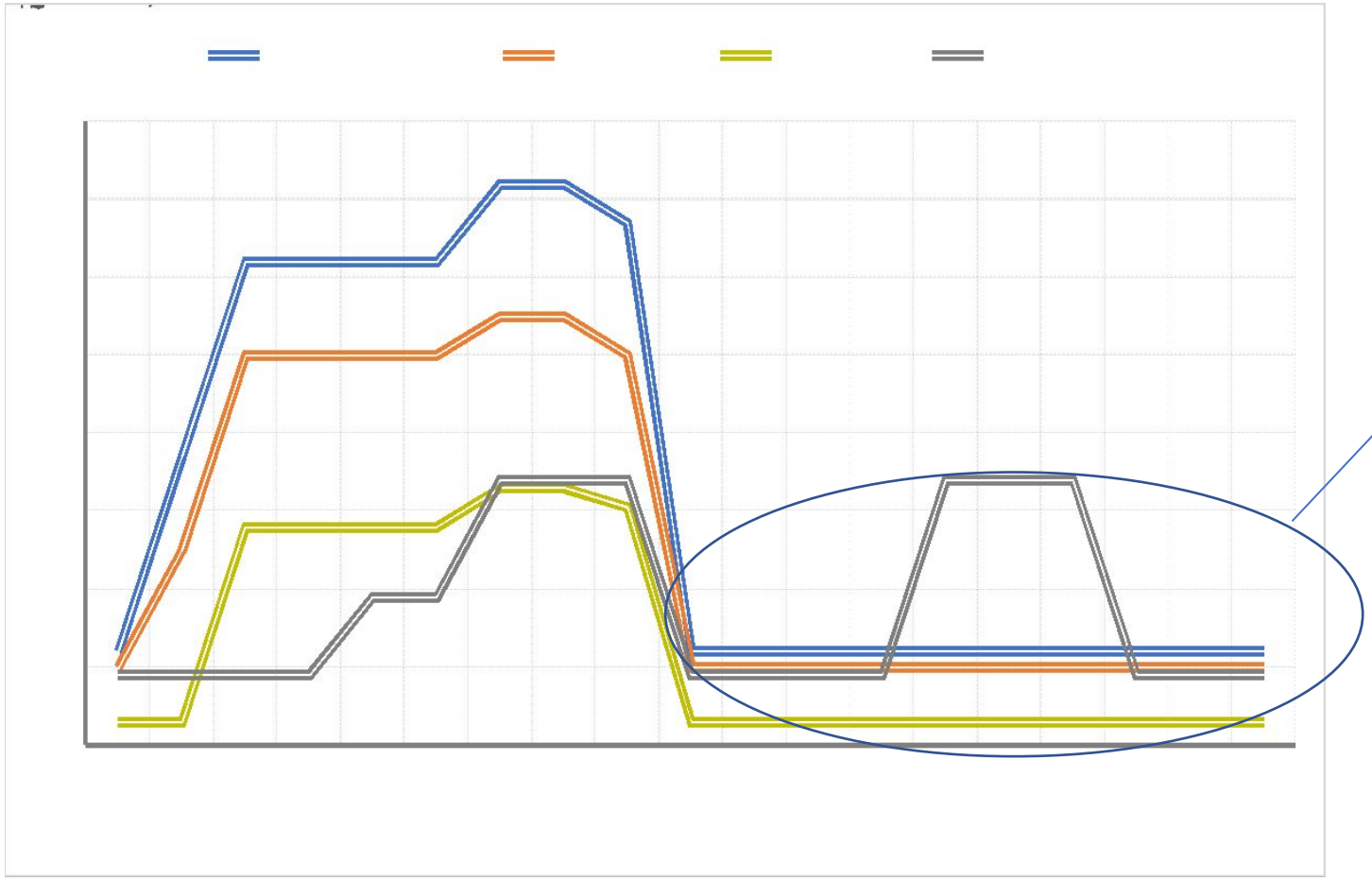
Data

- Quarterly Panel Dataset:
  - 2016Q1-2020Q4
- 63 countries, bilateral trade values
- 1004 HS6-digit products; 223 HS4 categories
  - Includes Ch. 01-24 (incl. fish and seafood)
  - Cotton products (Ch. 51, 52, 53)
  - + essential oils (Ch. 33), albumins/starches (Ch 35), raw hides/skins/leathers (CH 41)
- Dynamically coded all trade war retaliatory tariff changes
  - Section 232 (April 2018)
  - Section 301 (July/Aug/Sep, 2018; 2019)



Within product tariff variation

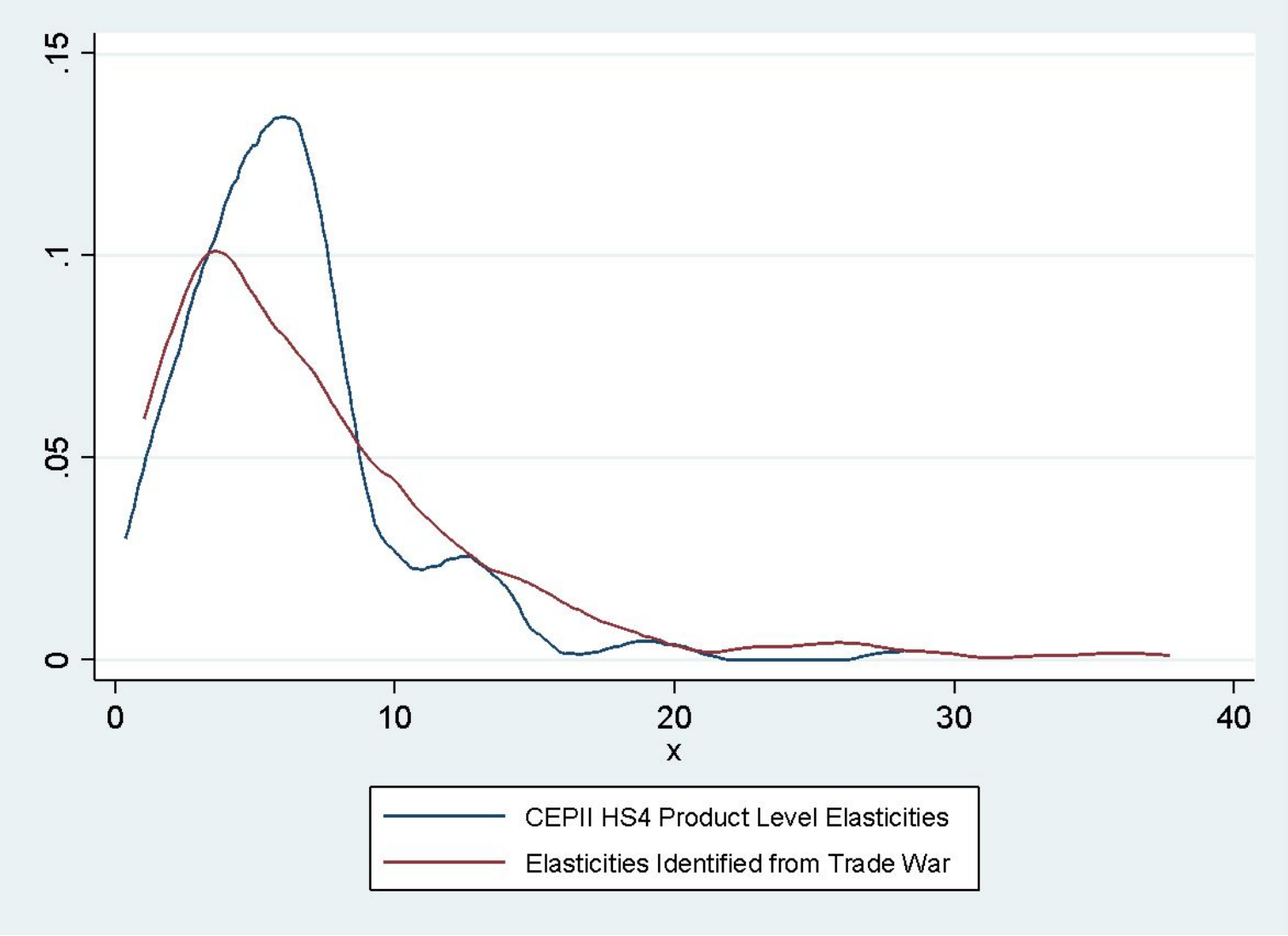
China's Effective Tariff on Imports from U.S., Inclusive of Retaliation & 696 Exclusions



China's 696 system of rolling tariff waivers

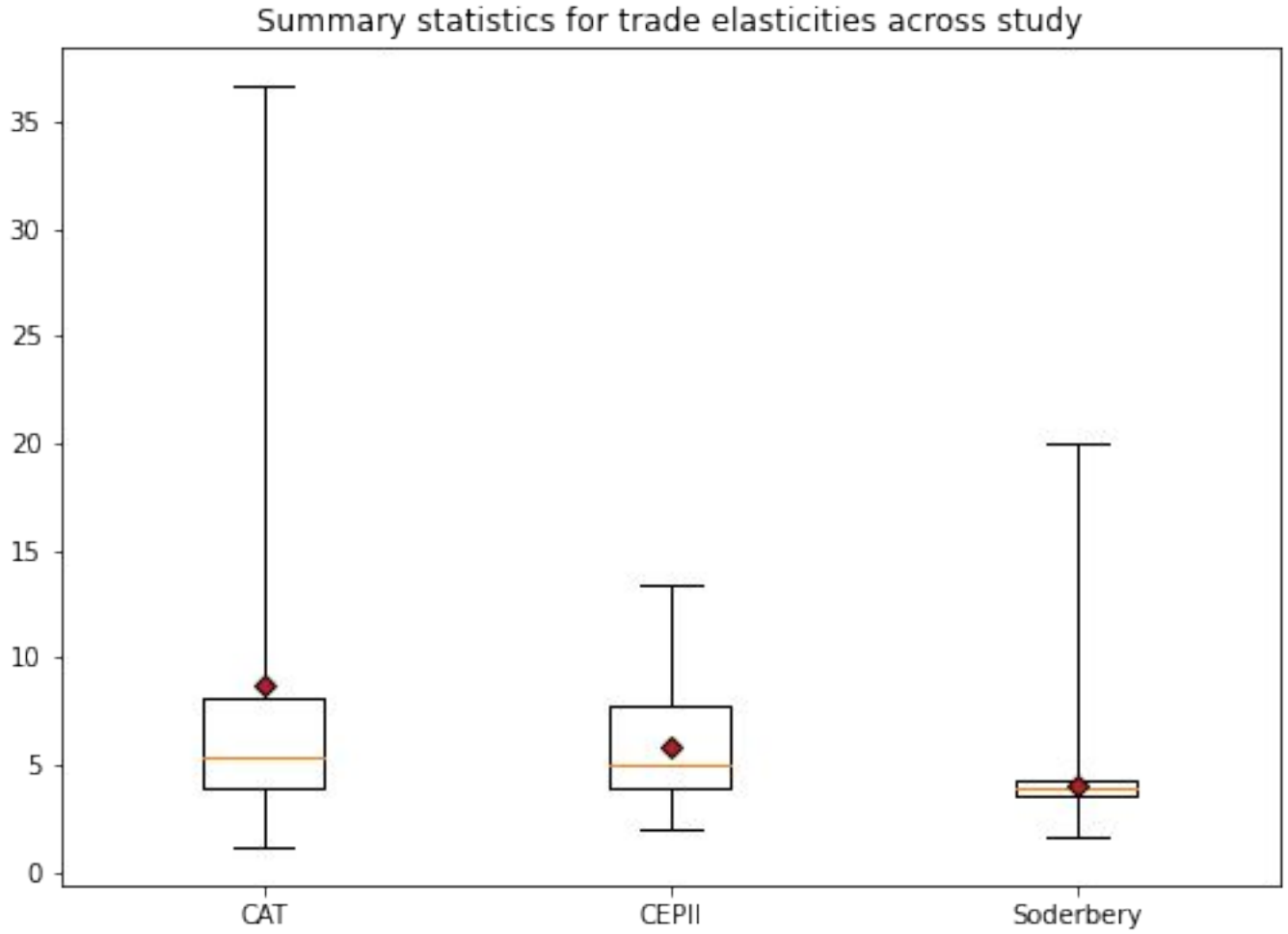
Source: http://gss.mof.gov.cn/?ivk_sa=1024320u

Kernel Density Plots – 194 HS4 digit Agricultural Products

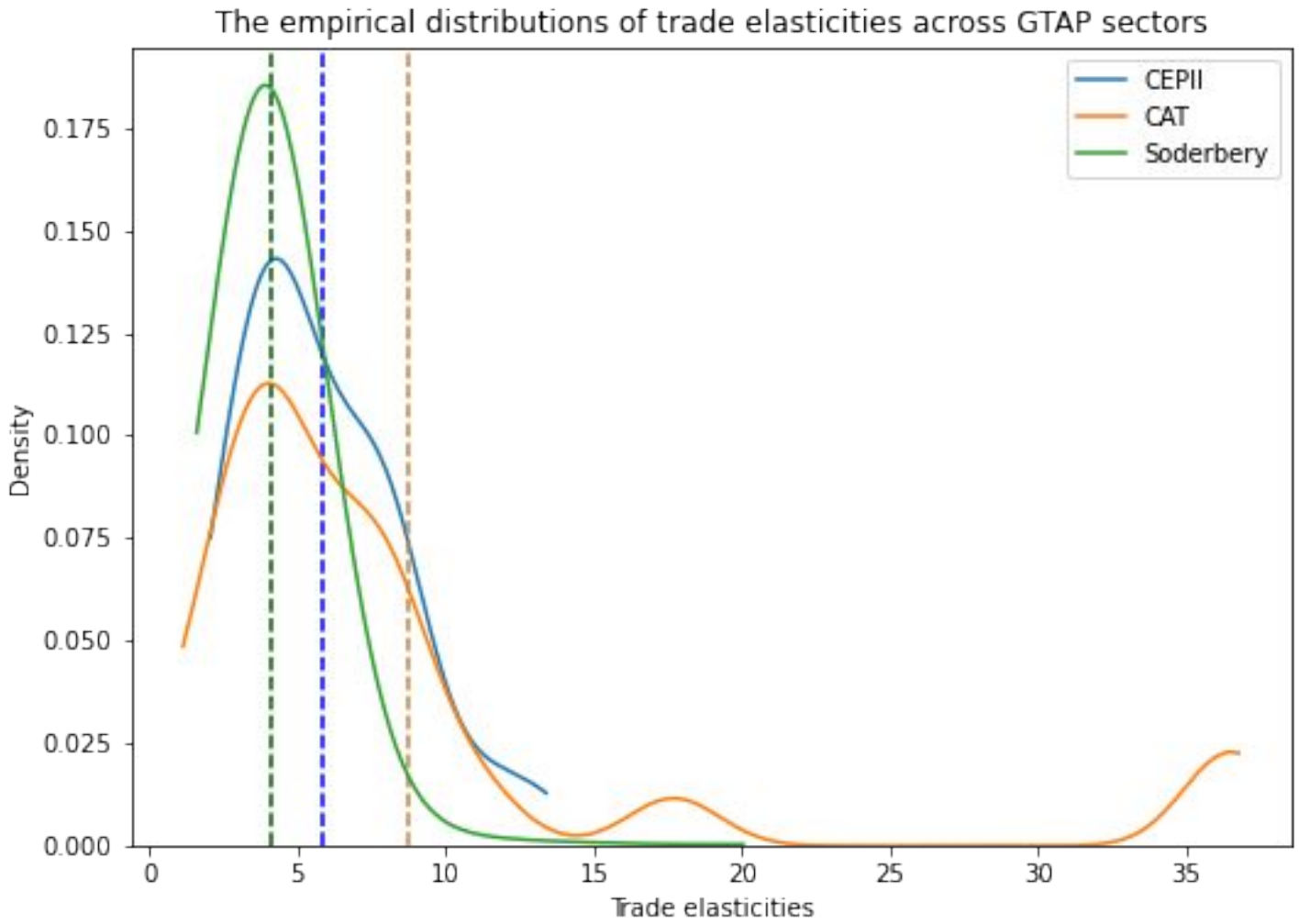


Study	Mean
CEPII	6.12
This Study	7.95

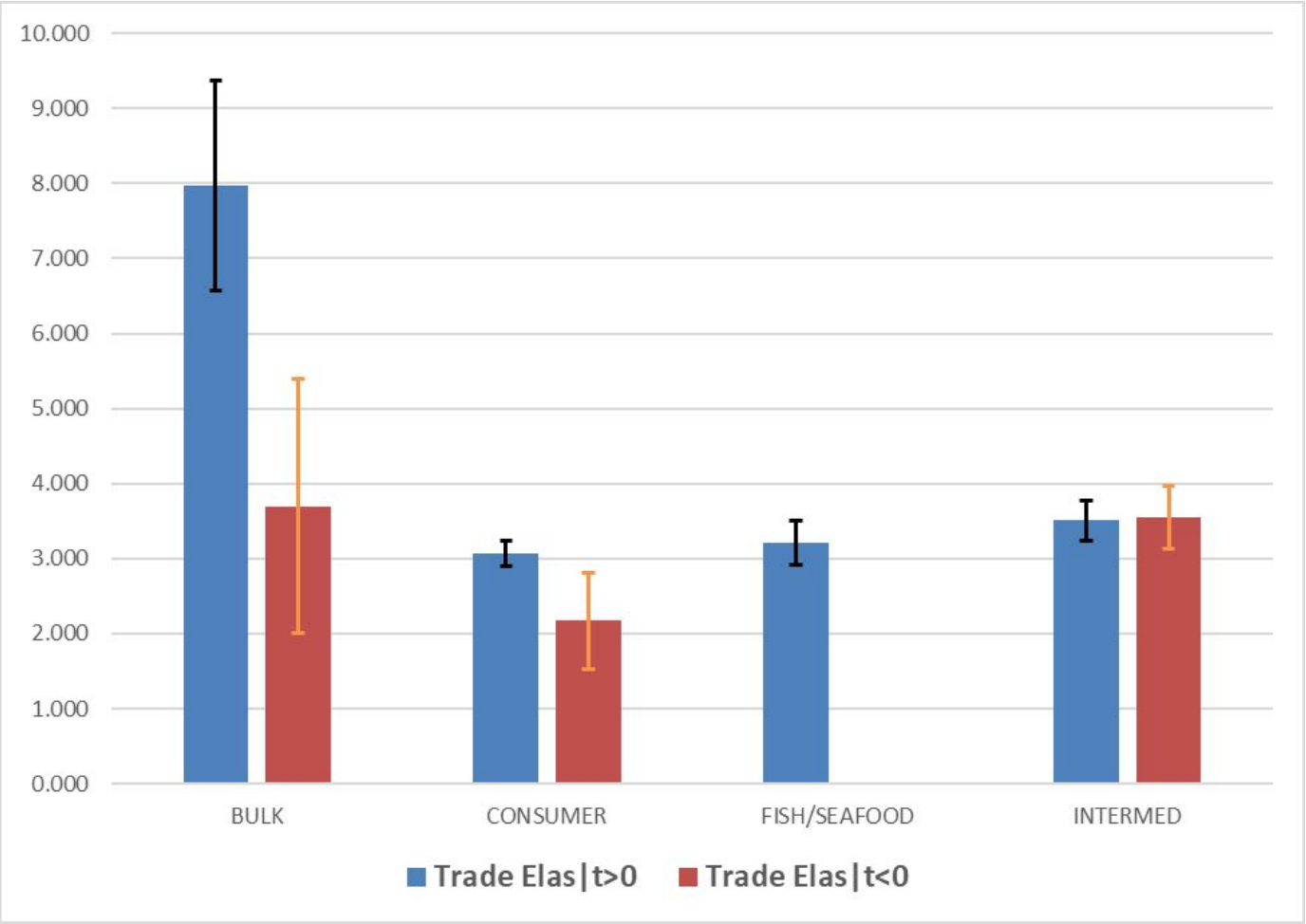
Distributional Range of Elasticities, GTAP Agricultural & Seafood Sectors



Across GTAP Sectors



Trade Elasticities Conditional on Direction of Tariff Changes



Conclusions/Caveats

- Elasticities correspond to infinitesimal shocks
- Are trade elasticities representative of a larger trade dispute situation?
- Our results suggest large mass of within-product elasticities w.r.t tariff changes are generally consistent with longer-run across country estimates
    - Wider dispersion (right tail)
    - Elasticities of more homogeneous bulk products asymmetric with respect to tariff changes ($\Delta t>0$ vs. $\Delta t<0$)
    - Suggest importing firms may be more sensitive to price or tariff increase/protectionism relative to situations in which tariffs are liberalized (loss aversion?)

Thank you

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