

# Trade Effects of Veterinary Drug Maximum Residue Limits in Major Meat Markets

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# Vet Drug Regulation in the News

 July 14, 2025

## Domestic Seafood Producers Petition USTR to Address Unfair Trade Practice of Use of Banned Veterinary Drugs in Foreign Aquaculture

Today, the Southern Shrimp Alliance partnered with other domestic seafood producers, including members of the domestic crawfish industry and the Oregon Trawl Commission (OTC), to formally request that the Office of the U.S. Trade Representative (USTR) initiate a Section 301 investigation to address the unfair trade practice of using banned veterinary drugs in aquaculture in China, India, Indonesia, and Vietnam for seafood exported to the United States.

 February 7, 2024

## Food Regulatory Authorities in the EU, Japan, and the United States Once Again Confirm that India and Vietnam Continue to Use Banned Antibiotics in their Shrimp Aquaculture

As part of its "Know Your Supplier" initiative, the Southern Shrimp Alliance annually updates databases providing detailed information regarding shrimp imports rejected from the European Union, Japan, and the United States due to the presence of banned antibiotics. The databases, made available in Excel format, now include information for calendar year 2023 for the actions taken by enforcement agencies in three of the world's major shrimp import markets.



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## Why China has a beef with Canadian meat exports

RCMP, CBSA investigating origins of pork shipment flagged by Chinese inspectors



Mark Gollom · CBC News · Posted: Jun 27, 2019 3:00 AM CDT | Last Updated: June 27, 2019

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### Summary

- EU challenges China's dairy probe at WTO over EV tariffs
- China's commerce ministry expresses regret over EU's WTO challenge
- China initiated anti-subsidy investigation on EU dairy products in August

BRUSSELS, Sept 23 (Reuters) - The European Commission launched a challenge at the World Trade Organisation (WTO) on Monday against China's investigation into EU dairy products, initiated after the European Union placed import tariffs on Chinese electric vehicles.

This is the first time the European Union has taken such action at the start of an investigation, rather than wait for it to result in trade measures against the bloc.

# Vet Drug MRL & Real-World Trade



March 11, 2025

Office of the U.S. Trade Representative  
Jamieson Greer  
U.S. Trade Representative  
600 17th St NW  
Washington, DC 20508

***Docket Number USTR-2025-0001: Request for Comments to Assist in Reviewing and Identifying Unfair Trade Practices and Initiating All Necessary Actions to Investigate Harm from Non-Reciprocal Trade Arrangements***

Dear Ambassador Greer,

The Meat Institute appreciates the opportunity to submit comments to the Office of the U.S. Trade Representative (USTR) in response to Docket Number USTR-2025-0001, "Request for Comments to Assist in Reviewing and Identifying Unfair Trade Practices and Initiating All Necessary Actions to Investigate Harm from Non-Reciprocal Trade Arrangements."

## China Continues to Renege on Commitments Made in the U.S.-China Phase One Agreement

The U.S. meat and poultry industry has benefited from significant market access gains under the U.S.-China Phase One Agreement. The Meat Institute appreciates President Trump's leadership to secure the agreement, which expanded eligibility for nearly all U.S. beef cuts from cattle of all ages, provided for the adoption of Codex maximum residue limits (MRLs) for growth promoting hormones in beef, increased the number of beef and pork plants approved to export, and provided eligibility for further processed products, among other gains. Barriers to trade, however, remain, including China's requirement that U.S. pork imports be accompanied by ractopamine-free certificates of analysis, even though all U.S. pork destined for China is being produced under ractopamine-free verification programs; China's zero-tolerance policy regarding pathogens on the surface of raw pork and beef imports; and China's ban on the use of Codex and Food and Drug Administration-approved beta agonists.

Alarming, the country's General Administration of Customs (GACC) has, in direct violation of the Phase One Agreement, suspended a growing number of U.S. beef export establishments for ractopamine findings. While GACC maintains a zero-tolerance policy for ractopamine in beef, Annex 7, provision 4 of the Phase One Agreement, provides, "if China determines, based on scientific inspection, that a particular shipment of U.S. meat or poultry products is in violation of applicable food safety import requirements, China may refuse importation of that shipment." However, the Agreement explicitly states that "a significant, sustained or recurring pattern of non-conformity with an applicable food safety measure" [i.e. a ractopamine finding] must be established before China may refuse to accept shipments from an establishment – suspend a facility's export eligibility.<sup>6</sup> In recent months, China has moved to suspend multiple additional U.S. export facilities, including a cold storage establishment. In each of these instances, U.S. beef export facilities were suspended upon their first ractopamine finding, not following a period of repeated violations, and each of the establishments subsequently reviewed and revised internal processes and controls to prevent recurrences. Yet, there remains no clear path to reinstating establishments suspended by GACC.

burgeoning consumer markets. For example, Thailand restricts beef offal and maintains zero tolerance on residues of ractopamine. There is no question about the safety of this product – it was approved for use in the United States after an exhaustive risk assessment by the U.S. Food and Drug Administration, it is recognized as safe for use in livestock production by the *Codex Alimentarius*, and many countries around the world, including several in the region, like Japan, have adopted ractopamine maximum residue limits for imported products. In

# Objectives

The objectives of this study are to:

- ▶ separately identify the demand and supply trade effects of vet drug MRLs;
- ▶ estimate the potential demand-increasing and supply-restricting effects in the major meat markets.

The structural gravity model with veterinary drug MRLs as demand and supply shifters:

$$X_{ijkt} = \exp \left[ \mu\rho M_{jkt} + \gamma \ln Q_{ikt} - \mu\omega_1 R_{ijkt} + \mu\omega_2 FTA_{ijkt} + \mu\omega_3 LNG_{ij} \right. \\ \left. + \mu\omega_4 COL_{ij} + \mu\omega_5 BDR_{ij} + \mu\omega_6 RLG_{ij} - \mu\omega_7 \ln DST_{ij} \right. \\ \left. - \mu\omega_8 \ln(1 + TAR_{ijkt}) + \kappa_{ikt} + \kappa_{jt} \right] \cdot \epsilon_{ijkt} \quad (1)$$

where:

- ▶  $X_{ikt}$ : Bilateral trade flow between  $i$  &  $j$  in meat market  $k$
- ▶  $M_{jkt}$ : Vet drug residue regulatory index for importing country  $j$ .
- ▶  $R_{jkt}$ : Bilateral heterogeneity in vet drug residue regulations
- ▶  $Q_{ikt}$ : Production capacity of  $i$  in  $k$
- ▶  $\kappa_{it}, \kappa_{jt}$ : exporter-time & importer-time fixed effects.

Following (Okunola et al., 2025), aggregate bilateral stringency index  $M_{ck}$ :

$$M_{ck} = \frac{1}{N_{ck}} \sum_{d=1}^D \sum_{z=1}^Z \left[ \frac{\left(1 + \text{MRL}_{dz(k)}^s\right) - \left(1 + \text{MRL}_{dz(k)}^c\right)}{\left(1 + \text{MRL}_{dz(k)}^s\right)} \right] \quad (2)$$

where:

- ▶  $N_{k(c)}$ : Number of drug-tissue MRL pairs in meat market  $k$  for  $c = i, j$
- ▶  $D$ : set of antimicrobials regulated by  $c = i, j$  in  $k$
- ▶  $Z$ : set of meat tissues (muscle for beef and pork and muscle + edible offal for poultry markets)
- ▶  $\text{MRL}_{dz(k)}^s$ : Codex MRL when it exists or median MRL, otherwise.
- ▶  $\text{MRL}_{dz(k)}^c$ : country-level MRLs.

Okunola A. Dennis E. & Beghin J. (2025). AEPP. <https://doi.org/10.1002/aepp.13516>

## Vet drug MRLs as Supply shifter - $R_{ijkt}$

Bilateral aggregate regulatory stringency heterogeneity is defined as:

$$R_{ijkt} = M_{jkt} - M_{ikt}. \quad (3)$$

where:

- ▶  $R_{ijkt}$  measures bilateral regulatory heterogeneity in each  $k$ .
- ▶  $M_{ck}$  is the aggregate stringency index for  $c = i, j$  in product  $k$ .

$$\begin{cases} R_{ijkt} > 0, & \text{stringent importer,} \\ R_{ijkt} = 0, & \text{harmonized regulations,} \\ R_{ijkt} < 0, & \text{stringent exporter.} \end{cases}$$

## Data & Data Sources

Data	Source
Bilateral trade flows	CEPII
Standard gravity variables	CEPII
Tariffs	ITC's MacMap
Vet Drug MRLs	Okunola et al. (2025), FoodChain ID. Inc.

- ▶ Meat Markets: beef, poultry, pork
- ▶ No. of HS6 products: 25
- ▶ Countries: 112
- ▶ No. of vet drugs: 410
- ▶ Data period: 2017–2023
- ▶ No of Observations: 1,255,680

# Market Effects of Veterinary Drug Residue Limits

Variable	I	II	III
Demand shifter	-0.070** (0.033)	0.265*** (0.058)	0.180*** (0.063)
Supply shifter	0.095*** (0.022)	0.052 (0.040)	0.034 (0.033)
Tariff	-3.094*** (0.233)	-1.917*** (0.287)	-0.699*** (0.227)
Production capacity	1.098*** (0.030)	0.999*** (0.016)	0.996*** (0.013)
FTA	0.410*** (0.082)	0.496*** (0.112)	-0.090 (0.301)
Distance	-0.085 (0.064)	-0.854*** (0.034)	
Border	1.778*** (0.088)	0.516*** (0.072)	
Common Colony	0.293 (0.200)	1.972*** (0.298)	
Common Language	-0.104* (0.057)	0.465*** (0.079)	
Common Religion	-1.627*** (0.141)	0.475*** (0.116)	
Constant	-4.877*** (0.805)	3.376*** (0.357)	-1.988*** (0.247)
Importer-Time FE	No	Yes	Yes
Exporter-Time FE	No	Yes	Yes
Bilateral FEs	No	No	Yes

Standard errors in parentheses. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Main Findings

- ▶ Vet drug regulations increase demand for meat products
- ▶ Supply effect is smaller & insignificant
- ▶ Meat market is tariff-sensitive
- ▶ FTA effect disappeared with bilateral FEs in Model III

# Key Takeaways

## **Positive & significant demand effect:**

- ▶ Increase consumer confidence
- ▶ Market segmentation where compliant exporters gain market access
- ▶ Reduce information asymmetries in the meat market

## **Positive but insignificant supply effect:**

- ▶ Exporters may already comply with destination standards
- ▶ Compliance cost is already absorbed or sunk
- ▶ Supply effects are dominated by importer-side enforcement rather than exporter regulation.

# Ongoing robustness and heterogeneity checks

## Restricting to positive trade flows (intensive margin):

- ▶ Examine vet drug MRL effects conditional on market entry

## Heterogeneous effects by trade direction:

- ▶ North–North trade
- ▶ North–South trade
- ▶ South–North trade
- ▶ South–South trade

## Job Market (2025)

PhD Candidate, University of Nebraska-Lincoln  
(International Ag Trade, Food Policy & Agricultural Production)

## Contact Information

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**Thank you!**

## References I

- Okunola, A., Dennis, E., and Beghin, J. (2025). Are veterinary drug maximum residue limits protectionist? international evidence. *Applied Economic Perspectives and Policy*, 47(3):1209–1231.
- Xiong, B. and Beghin, J. (2014). Disentangling demand-enhancing and trade-cost effects of maximum residue regulations. *Economic Inquiry*, 52(3):1190–1203.

# Consumer Problem

$$\max_{\{q_{kij}^d\}_{k,i}} \left[ \sum_k \sum_i (\phi_{kj} q_{kij}^d)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Subject to:

$$\sum_k \sum_i p_{kij} q_{kij}^d = Y_j \quad (1)$$

- ▶  $\phi_{kj}$ : consumer's perception of quality of product  $k$ .
- ▶  $\sigma$ : constant elasticity of substitution.
- ▶  $p_{kij}$ : price of product  $k$  imported from country  $i$  to country  $j$ .
- ▶  $q_{kij}^d$ : quantity of product  $k$  imported from country  $i$  to country  $j$ .
- ▶  $Y_j$ : national income of country  $j$ .

# Producer Problem

$$\max_{\{q_{kij}^s\}_{j \in \Theta}} \sum_{j \in \Theta} p_{kij} q_{kij}^s$$

Subject to:

$$\left[ \sum_j \left( \tau_{kij} q_{kij}^s \right)^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} = Q_{ki} \quad (2)$$

- ▶  $\tau_{kij}$ : "iceberg melting" trade cost factor between  $i$  and  $j$ .
- ▶  $Q_{ki}$ : production capacity of country  $i$  in product  $k$ .
- ▶  $\delta$ : non-positive constant elasticity of transformation.
- ▶  $q_{kij}^s$ : quantity of product  $k$  shipped from  $i$  to  $j$ .

# Structural Gravity Model

$$X_{kij} = \left[ \frac{Q_{ki}}{\pi_{ki}} \right]^{\frac{\sigma-1}{\sigma-\delta}} \left[ \frac{Y_j}{\lambda_j} \right]^{\frac{1-\delta}{\sigma-\delta}} \left[ \frac{\phi_{kj}}{\tau_{kij}} \right]^{\frac{(\sigma-1)(1-\delta)}{\sigma-\delta}} \quad (3)$$

$$\ln X_{ijkt} = \mu \ln \phi_{jkt} - \mu \ln \tau_{ijkt} + \gamma \ln Q_{ikt} - \gamma \ln \pi_{ikt} + (1-\gamma) \ln Y_{jt} - (1-\gamma) \ln \lambda_{jt} + \epsilon_{ijt} \quad (4)$$

where:  $\gamma = \frac{\sigma-1}{\sigma-\delta}$  &  $\mu = \frac{(\sigma-1)(1-\delta)}{\sigma-\delta}$

## Demand shifter - consumer meat quality preference

Following (Xiong and Beghin, 2014), the consumer's perception of meat quality  $\phi_{jk}$  is parameterized as:

$$\phi_{jk} = \rho_{0k} \exp(\rho M_{jk}) \quad (5)$$

where:

- ▶  $\rho_{0k}$  consumer's perception of food quality in the absence of veterinary drug regulation.
- ▶  $\rho$  is the estimable consumer's perception of food quality.
- ▶  $M_{jk}$  is the aggregate regulatory stringency for country  $j$ .

## Bilateral trade cost: $\tau_{ijkt}$

$$\tau_{ijkt} = \exp \left[ (\omega_1 R_{jkt}) - (\omega_2 \text{FTA}_{ijt}) - (\omega_3 \text{LNG}_{ij}) - (\omega_4 \text{COL}_{ij}) - (\omega_5 \text{BDR}_{ij}) - (\omega_6 \text{RLG}_{ij}) \right] (\text{DST}_{ij})^{\omega_7} (1 + \text{TRF}_{ijkt})^{\omega_8} \quad (4)$$

where:

- ▶  $R_{jkt}$  measures the bilateral regulatory heterogeneity
- ▶  $Q_{ikt}$ : Production capacity of  $i$  in  $k$
- ▶  $\kappa_{ikt}, \kappa_{jt}$ : exporter-time & importer-time fixed effects.

## Vet drug MRLs as Supply shifter - $R_{ijkt}$

Bilateral aggregate regulatory stringency heterogeneity is defined as:

$$R_{ijkt} = M_{jkt} - M_{ikt}. \quad (5)$$

where:

- ▶  $R_{ijkt}$  measures bilateral regulatory heterogeneity in each  $k$ .
- ▶  $M_{ck}$  is the aggregate stringency index for  $c = i, j$  in product  $k$ .

$$\begin{cases} R_{ijkt} > 0, & \text{stringent importer,} \\ R_{ijkt} = 0, & \text{harmonized regulations,} \\ R_{ijkt} < 0, & \text{stringent exporter.} \end{cases}$$

Following (Okunola et al., 2025), aggregate bilateral stringency index  $M_{ck}$  is defined as:

$$M_{ck} = \frac{1}{N_{ck}} \sum_{d=1}^D \sum_{z=1}^Z \left[ \frac{\left(1 + \text{MRL}_{dz(k)}^s\right) - \left(1 + \text{MRL}_{dz(k)}^c\right)}{\left(1 + \text{MRL}_{dz(k)}^s\right)} \right] \quad (6)$$

where:

- ▶  $N_{k(c)}$ : total number of drug-tissue pairs for  $c$  in  $k$ .
- ▶  $D$ : set of all drugs used in producing  $k$ .
- ▶  $Z$ : set of meat products (muscle for beef and pork and muscle + edible offal for poultry markets)
- ▶  $\text{MRL}_{dz(k)}^s$ : Codex MRL when it exist or median MRL, otherwise.
- ▶  $\text{MRL}_{dz(k)}^c$ : country-level MRLs.

The structural gravity model accounting for demand and supply shifters:

$$\begin{aligned}
 X_{ijkt} = \exp \left[ \mu\rho M_{jkt} + \gamma \ln Q_{ikt} - \mu\omega_1 R_{ijkt} + \mu\omega_2 FTA_{ijkt} + \mu\omega_3 LNG_{ijkt} \right. \\
 \left. + \mu\omega_4 COL_{ijkt} + \mu\omega_5 BDR_{ijkt} + \mu\omega_6 RLG_{ijkt} - \mu\omega_7 \ln DST_{ijkt} \right. \\
 \left. - \mu\omega_8 \ln(1 + TAR_{ijkt}) + \kappa_{ikt} + \kappa_{jt} \right] \cdot \epsilon_{ijkt}
 \end{aligned}
 \tag{7}$$

where:

- ▶  $X_{ikt}$ : Bilateral trade flow of meat products between  $i$  in  $k$
- ▶  $M_{jkt}$  is the regulatory index for importing country  $j$ .
- ▶  $R_{jkt}$  measures the bilateral regulatory heterogeneity
- ▶  $Q_{ikt}$ : Production capacity of  $i$  in  $k$
- ▶  $\kappa_{ikt}$ ,  $\kappa_{jt}$ : exporter-time & importer-time fixed effects.