# Tariff Evasion in Agriculture: The Role of Non-Tariff Measures

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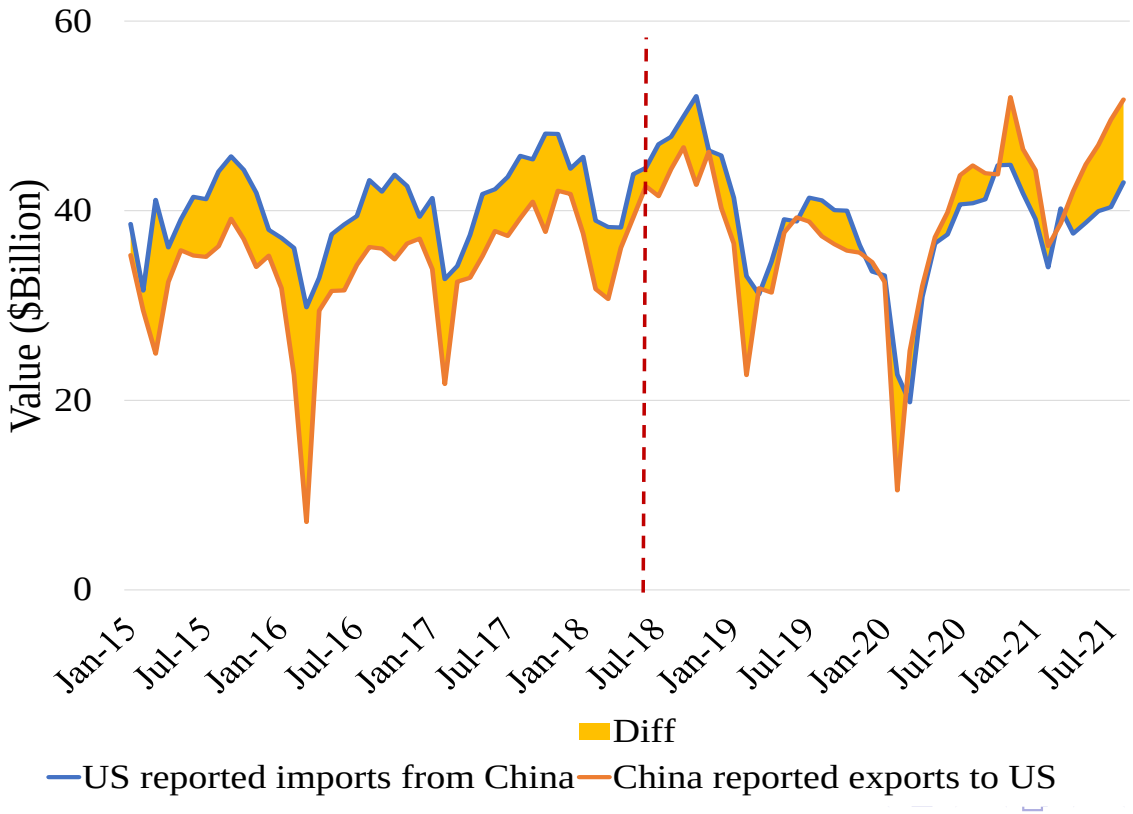
# Motivation: Size and detection of evasion

- **Size**: Illegal trade accounted for **8 to 15%** of global GDP in 2012-2014; Prevalent in both developed and developing countries (Transnational Alliance to Combat Illicit Trade, 2019).
- **Detection**: Gap in **mirror** trade Statistics (China General Administration of Customs, US Census Bureau).



# Motivation: Why evasion in Ag is important?

- Previous studies focus on manufacturing sectors.
- **Trade barriers** are more prevalent in ag than in non-ag sectors, and NTMs are increasingly used as alternative protection (Hoekman and Nicita, 2011).
- **Public health and ecosystem consequences** of evasion in some products, such as alcohol, tobacco, and timber (Yang, 2008; Chimeli and Soares, 2017; Beverelli and Ticku, 2020).

# Research questions

- Is there tariff evasion in Ag?
  - **Tariff evasion**: import evasion (importers evade at the destination via channels such as price/quantity under-reporting, and misclassification) increases with tariff.
- Do NTMs affect tariff evasion in agriculture?
  - Increase evading incentives by higher trade costs (longer delivery time and higher production costs).
  - Reduce evading incentives via higher demand (certifying quality and safety to consumers).

# Outline

- Empirical model
- Data sources and descriptive statistics
- Basic results

# Empirical model: Measurement of import evasion

- Measuring import evasion

$$Gapv_{ijkt} = log(Expv_{jikt}) - log(Impv_{ijkt}) \tag{1}$$

  - $i, j, k, t$: importer, exporter,six-digit HS product, year;
  - $Expv_{jikt}$: country $j's$ reported export value;
  - $Impv_{ijkt}$: country $i's$ reported import value;
  - larger $Gapv_{ijkt}$ means higher import evasion.

- Capture the case of complete smuggling

$$Gapv_{ijkt} = log(1 + Expv_{jikt}) - log(1 + Impv_{ijkt}) \tag{2}$$

# Empirical model: Baseline model

$$Gapv_{ijkt} = \alpha_0 + \beta_0 Tar_{ijkt} + \beta_1 Tar_{ijkt} * NTM_{ijkt} + \beta_2 NTM_{ijkt} + \gamma_1 X_{it} + \gamma_2 X_{jt} + \theta_{ij} + \mu_{ik} + \eta_{kt} + \epsilon_{ijkt} \quad (3)$$

- $Tar_{ijkt}$: tariff country $i$ imposes on country $j$ for product $k$ at year $t$;
- $NTM_{ijkt}$:dummy denotes whether country $i$ has an NTM for product $k$ imported from country $j$ at year $t$;
- $X_{it}$: controls of county $i/j$, (corruption, property rights protection, rainfall and temperature)
- $\theta_{ij}$, $\mu_{ik}$, $\eta_{kt}$ denotes country pair, product by year, and importer by product fixed effects.

# Empirical model: Disaggregating NTMs

$$Gapv_{ijkt} = \alpha_0 + \beta_0 Tar_{ijkt} + \sum_{m=1}^{M} \beta_{1m} Tar_{ijkt} * NTM_{ijkt}^{m} + \sum_{m=1}^{M} \beta_{2m} NTM_{ijkt}^{m} + \gamma_1 X_{it} + \gamma_2 X_{jt} + \theta_{ij} + \mu_{ik} + \eta_{kt} + \epsilon_{ijkt} \quad (4)$$

- $NTM_{ijkt}^{m}$ a dummt measures the number of NTM type m.
- m denotes ten types of NTMs, pre-shipment inspection, quantity control, price control, three SPS subcategories (prohibitions/restrictions of imports for SPS reasons, tolerance limits for residues and restricted use of substances, and labeling/ marketing/packaging requirements), and three TBT subcategories, and other NTMs.

# SPS and TBT classification

**Table A1.** Sub-classification of SPS and TBTs in UNCTD NTM database.

| NTM Code | NTM Level | NTM Code Description |
|---|---|---|
| A000 | 1 | **Sanitary and phytosanitary measures (SPS)** |
| A100 | 2 | Prohibitions/restrictions of imports for SPS reasons |
| A200 | 2 | Tolerance limits for residues and restricted use of substances |
| A300 | 2 | Labeling, Marking, and Packaging requirements |
| A400 | 2 | Hygienic requirements |
| A500 | 2 | Treatment for elimination of plant and animal pests and disease-causing organisms in the final product (e.g., post-harvest treatment) |
| A600 | 2 | Other requirements on production or post-production processes |
| A800 | 2 | Conformity assessment related to SPS |
| A900 | 2 | SPS measures not specified |
| B000 | 1 | **Technical barriers to trade (TBT)** |
| B100 | 2 | Prohibitions/restrictions of imports for objectives set out in the TBT agreement |
| B200 | 2 | Tolerance limits for residues and restricted use of substances |
| B300 | 2 | Labeling, Marking, and Packaging requirements |
| B400 | 2 | Production or Post-Production requirements |
| B600 | 2 | Product identity requirement |
| B700 | 2 | Product quality or performance requirement |
| B800 | 2 | Conformity assessment related to TBT |
| B900 | 2 | TBT Measures not specified |

*Note:* This table shows the sub-classification of TBTs and SPS in the UNCTAD NTM database.

Figure 1: Sub-classification of SPS and TBTs in UNCTAD NTM database

# Endogeneity concerns

- **Reverse causality**: countries use trade policies to address evasion in an HS6 product category?
- **IV**: We use the **average tariffs of the three closest neighboring countries** in the sample as the instrumental variable for a country's tariff (Baldwin and Jaimovich, 2012; Tovar, 2019; Kee and Nicita, 2022; Kee and Nicita, 2022).
- **Assumptions**: neighboring countries' trade policies could correlate with the trade policies of the importing country due to regional trading agreements or common cultural/historical backgrounds. However, neighboring countries' trade policies are not likely to affect import evasion of the country of interest.

# Data sources

Trade and trade policies:

- **Bilateral trade**: UNComtrade
- **Tariffs**: United Nations Conference on Trade and Development's (UNCTAD) Trade Analysis Information System (TRAINS);
- **NTMs**: UNCTAD global database on non-tariff measures;

Controls:

- **Property rights protection and corruption**: V-Dem project by Coppedge et al. (2020)
- **Weather**: NOAA National Centers for Environmental Information (NOAA NCEI, 2021)
- **Geographical and economics variables**: CEPII

# Data cleaning

- Dropping countries without NTM data available;
- Dropping country pairs that never trade with each other during the study period;
- Dropping bilateral observations with less than $5,000 in export value;
- Dropping the top and bottom 1% of observations in terms of import evasion;

**Sample: an unbalanced panel of around 2.1 million observations: 99 importers, 106 exporters, and 327 six-digit HS products from 1990 to 2019.**

# Descriptive statistics: Import evasion over time

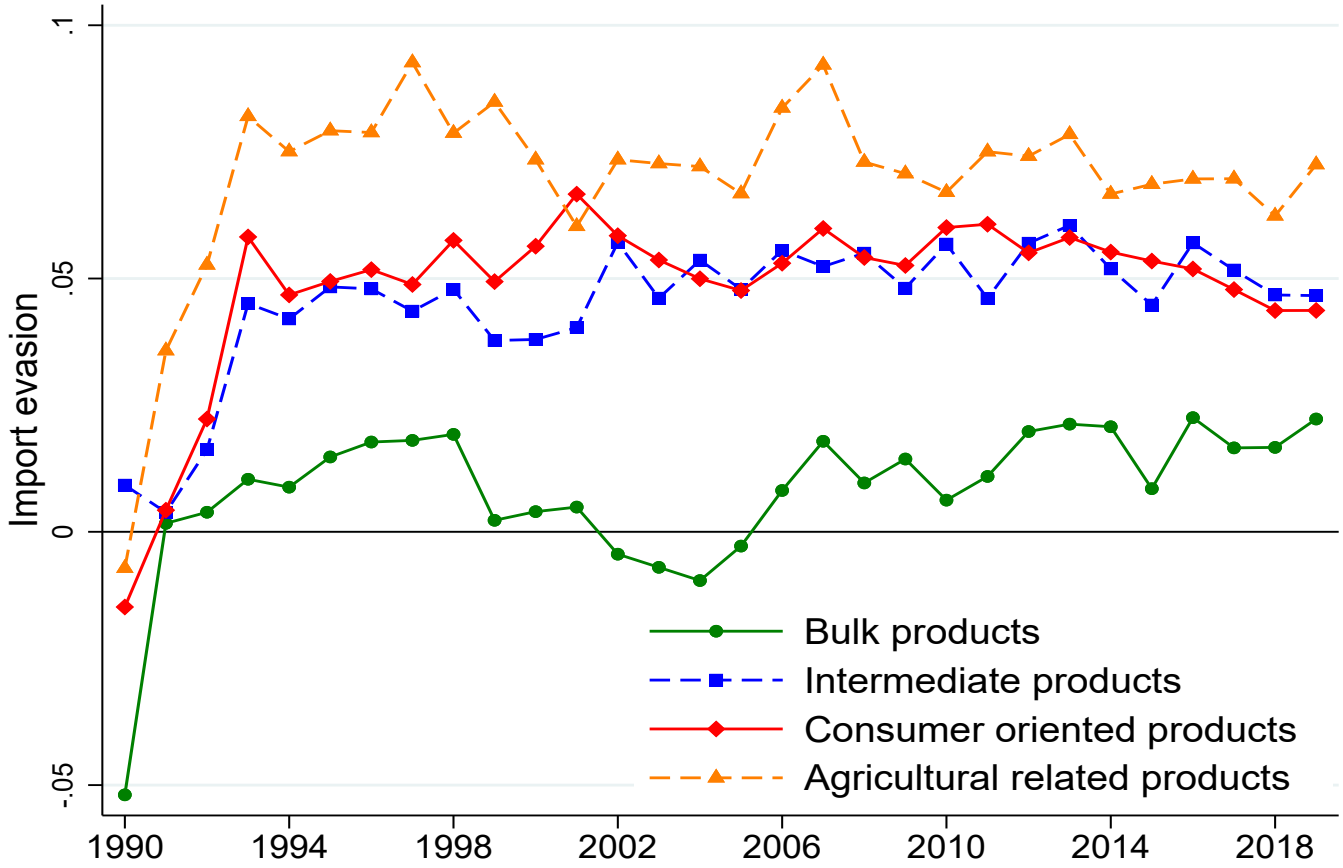



Figure 2: Export value-weighted import evasion in value across four types of agricultural commodities: 1990-2019.

# Descriptive statistics: NTMs over time

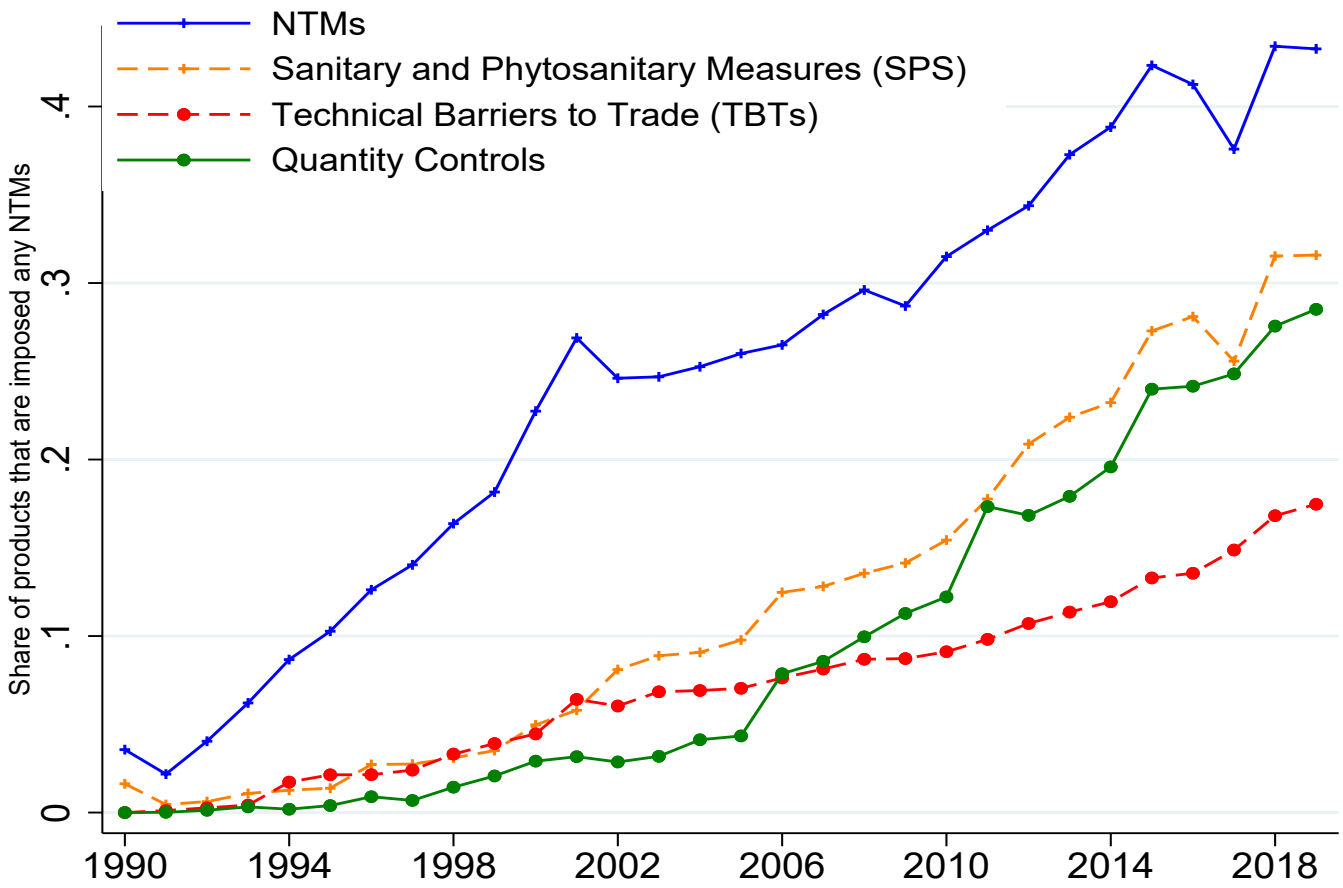



Figure 3: Share of products that were imposed any non-tariff measures (NTMs) in agriculture: 1990 to 2019.

# Impacts of NTMs on tariff evasion

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | OLS | IV | OLS | IV | OLS | IV |
| ***Trade policies*** | | | | | | |
| Tariff | 0.029 | 0.178*** | 0.033* | 0.182*** | 0.032 | 0.272*** |
| | (0.018) | (0.060) | (0.020) | (0.064) | (0.019) | (0.080) |
| Tariff*pre-shipment inspection | | | -0.088** | -0.105** | -0.072* | -0.181* |
| | | | (0.036) | (0.041) | (0.037) | (0.095) |
| Tariff*price control | | | -0.000 | -0.045 | 0.024 | -0.003 |
| | | | (0.018) | (0.027) | (0.017) | (0.060) |
| Tariff*quantity control | | | 0.036 | 0.070** | -0.007 | -0.048 |
| | | | (0.023) | (0.029) | (0.023) | (0.069) |
| Tariff*SPS 1 | | | -0.002 | -0.001 | 0.001 | -0.011 |
| | | | (0.024) | (0.029) | (0.025) | (0.110) |
| Tariff*SPS 2 | | | -0.085*** | -0.009 | -0.121*** | -0.168* |
| | | | (0.024) | (0.029) | (0.027) | (0.090) |
| Tariff*SPS 3 | | | 0.004 | -0.021 | 0.025 | 0.073 |
| | | | (0.022) | (0.025) | (0.024) | (0.085) |
| Tariff*TBT 1 | | | 0.007 | -0.002 | -0.010 | -0.064 |
| | | | (0.048) | (0.061) | (0.063) | (0.213) |
| Tariff*TBT 2 | | | 0.067 | 0.015 | 0.116* | -0.145 |
| | | | (0.046) | (0.042) | (0.062) | (0.149) |
| Tariff*TBT 3 | | | -0.055*** | -0.075*** | -0.029 | -0.115 |
| | | | (0.017) | (0.026) | (0.022) | (0.093) |
| Tariff*Other | | | 0.017** | 0.027*** | 0.008 | 0.044* |
| | | | (0.007) | (0.007) | (0.008) | (0.023) |
| Exporter characteristics | Y | Y | Y | Y | Y | Y |
| Country pair fixed effects | Y | Y | Y | Y | Y | Y |
| HS6 by year fixed effects | Y | Y | Y | Y | Y | Y |
| Importer by HS6 fixed effects | Y | Y | Y | Y | Y | Y |
| NTM as controls | N | N | N | N | Y | Y |
| R-squared | 0.118 | 0.118 | 0.118 | 0.118 | 0.118 | 0.118 |
| Observations | 1,993,507 | 1,993,507 | 1,993,507 | 1,993,507 | 1,993,507 | 1,993,507 |

# Heterogeneity

| | (1) | (2) |
|---|---|---|
| | High-income countries | Non-high-income countries |
| ***Trade policies*** | | |
| Tariff | 0.210** | 0.332* |
| | (0.087) | (0.167) |
| Tariff*pre-shipment inspection | 0.024 | -0.438*** |
| | (0.157) | (0.144) |
| Tariff*price control | -0.132 | 0.080 |
| | (0.089) | (0.089) |
| Tariff*quantity control | -0.125 | -0.053 |
| | (0.110) | (0.155) |
| Tariff*SPS 1 | 0.058 | -0.006 |
| | (0.143) | (0.165) |
| Tariff*SPS 2 | -0.036 | -0.565*** |
| | (0.118) | (0.184) |
| Tariff*SPS 3 | 0.051 | -0.007 |
| | (0.143) | (0.129) |
| Tariff*TBT 1 | -0.681 | 0.043 |
| | (1.163) | (0.209) |
| Tariff*TBT 2 | 0.200 | -0.488* |
| | (0.196) | (0.248) |
| Tariff*TBT 3 | -0.106 | 0.030 |
| | (0.142) | (0.167) |
| Tariff*Other NTMs | 0.040 | 0.036 |
| | (0.033) | (0.033) |
| Importer characteristics | Y | Y |
| Exporter characteristics | Y | Y |
| Country pair fixed effects | Y | Y |
| HS6 by year fixed effects | Y | Y |
| Importer by HS6 fixed effects | Y | Y |
| NTM as controls | Y | Y |
| Observations | 1,372,799 | 620,425 |

# Conclusions

- The first study to document tariff evasion and the role of NTMs in tariff evasion;
- Consistent evidence of tariff evasion;
- Pre-shipment inspections and SPS subcategory of tolerance limits for residues and restricted use of substances significantly reduces tariff evasion;
- Only significant for developing countries;

# Implications, caveats and future work

- **Implications**: Accounting for NTMs' impacts on tariff evasion;
- Future work
  - **Case studies**: specific NTM-, product- or country-specific case studies?
  - **Welfare implications**: is import evasion welfare-enhancing or welfare-decreasing?

# Thanks!
# Q&A

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# Mechanism Test: Price and quantity under-reporting

| | Unit value gap (1) | Import evasion in quantity (2) |
|---|---|---|
| ***Trade policies*** | | |
| Tariff | -0.009 | 0.041 |
| | (0.019) | (0.025) |
| Tariff*pre-shipment inspection | -0.106** | 0.033 |
| | (0.050) | (0.044) |
| Tariff*price control | 0.025 | -0.001 |
| | (0.023) | (0.027) |
| Tariff*quantity control | 0.019 | -0.026 |
| | (0.039) | (0.047) |
| Tariff*SPS 1 | 0.031 | -0.030 |
| | (0.027) | (0.029) |
| Tariff*SPS 2 | -0.096* | -0.025 |
| | (0.050) | (0.050) |
| Tariff*SPS 3 | -0.026 | 0.051 |
| | (0.030) | (0.034) |
| Tariff*TBT 1 | 0.069 | -0.079 |
| | (0.097) | (0.104) |
| Tariff*TBT 2 | 0.119 | -0.004 |
| | (0.103) | (0.135) |
| Tariff*TBT 3 | -0.041 | 0.012 |
| | (0.025) | (0.031) |
| Tariff*Other | 0.025** | -0.017 |
| | (0.012) | (0.013) |
| Exporter characteristics | Y | Y |
| Importer characteristics | Y | Y |
| Country pair fixed effects | Y | Y |
| HS6 by year fixed effects | Y | Y |
| Importer by HS6 fixed effects | Y | Y |
| NTM as controls | Y | Y |
| Observations | 1,993,507 | 1,993,507 |

# Mechanism Tests: Product misclassification

$$Gapv_{ijkt} = \alpha_0 + \beta_0 Tar_{ijkt} + \beta_1 Tar_{ijkt} * Other\_high\_Tar_{ijot}$$
$$+ \sum_{m=1}^{M} \beta_{1m} Tar_{ijkt} * Other\_high\_Tar_{ijot} * NTM_{ijkt}^{m} + \sum_{m=1}^{M} \beta_{2m} NTM_{ijkt}^{m} \quad (5)$$
$$+ \gamma_1 X_{it} + \gamma_2 X_{jt} + \theta_{ij} + \mu_{ik} + \eta_{kt} + \epsilon_{ijkt}$$

| | Import evasion in value (3) |
|---|---|
| ***Trade policies*** | |
| Tariff | 0.006 |
| | -0.024 |
| Tariff*Dummy of higher tariff than similar products | 0.046*** |
| | -0.014 |
| Tariff*pre-shipment inspection* Dummy of higher tariff than similar products | 0.034 |
| | -0.055 |
| Tariff*price control* Dummy of higher tariff than similar products | 0.018 |
| | -0.031 |
| Tariff*quantity control* Dummy of higher tariff than similar products | -0.019 |
| | -0.061 |
| Tariff*SPS 1* Dummy of higher tariff than similar products | -0.054** |
| | -0.025 |
| Tariff*SPS 2* Dummy of higher tariff than similar products | -0.017 |
| | -0.051 |
| Tariff*SPS 3* Dummy of higher tariff than similar products | -0.05 |
| | -0.048 |
| Tariff*TBT 1* Dummy of higher tariff than similar products | 0.12 |
| | -0.088 |
| Tariff*TBT 2* Dummy of higher tariff than similar products | 0.088 |
| | -0.168 |
| Tariff*TBT 3* Dummy of higher tariff than similar products | 0.023 |
| | -0.035 |
| Tariff*Other* Dummy of higher tariff than similar products | 0.008 |
| | -0.012 |
| Exporter characteristics | Y |
| Importer characteristics | Y |
| Country pair fixed effects | Y |
| HS6 by year fixed effects | Y |
| Importer by HS6 fixed effects | Y |
| NTM as controls | Y |
| Observations | 1,993,507 |