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

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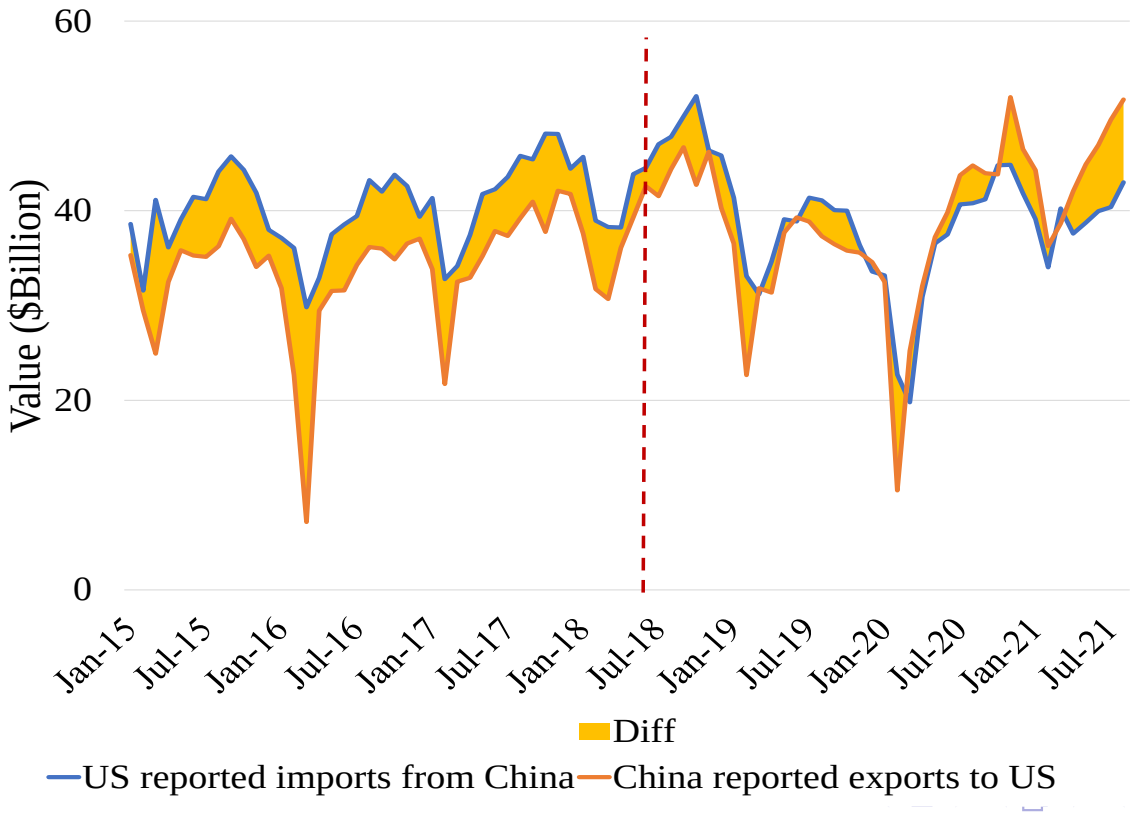
Motivation: Size and detection of evasion

- **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

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

  - 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

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

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)
- θ_{ij}, μ_{ik}, η_{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

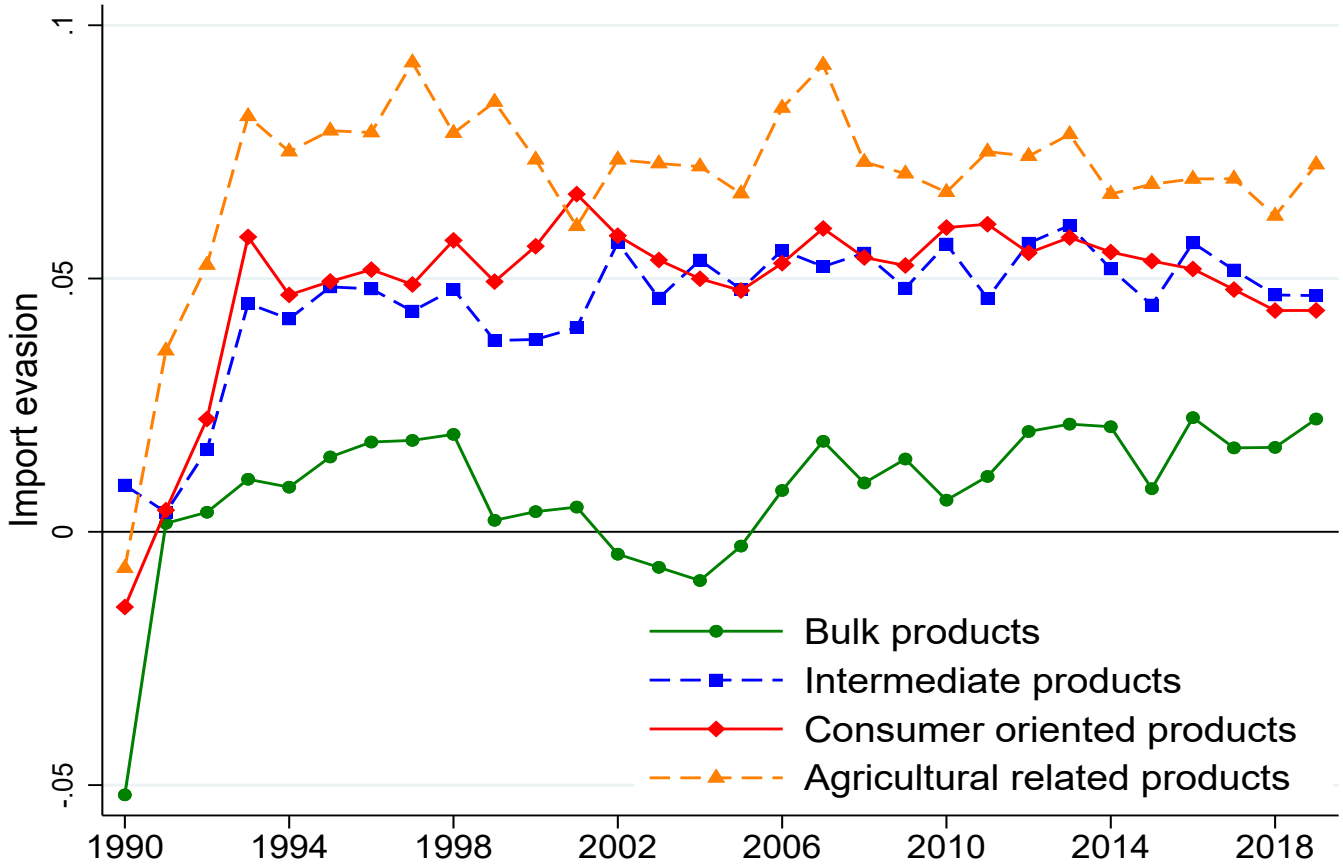


Figure 2: Export value-weighted import evasion in value across four types of agricultural commodities: 1990-2019.

Descriptive statistics: NTMs over time

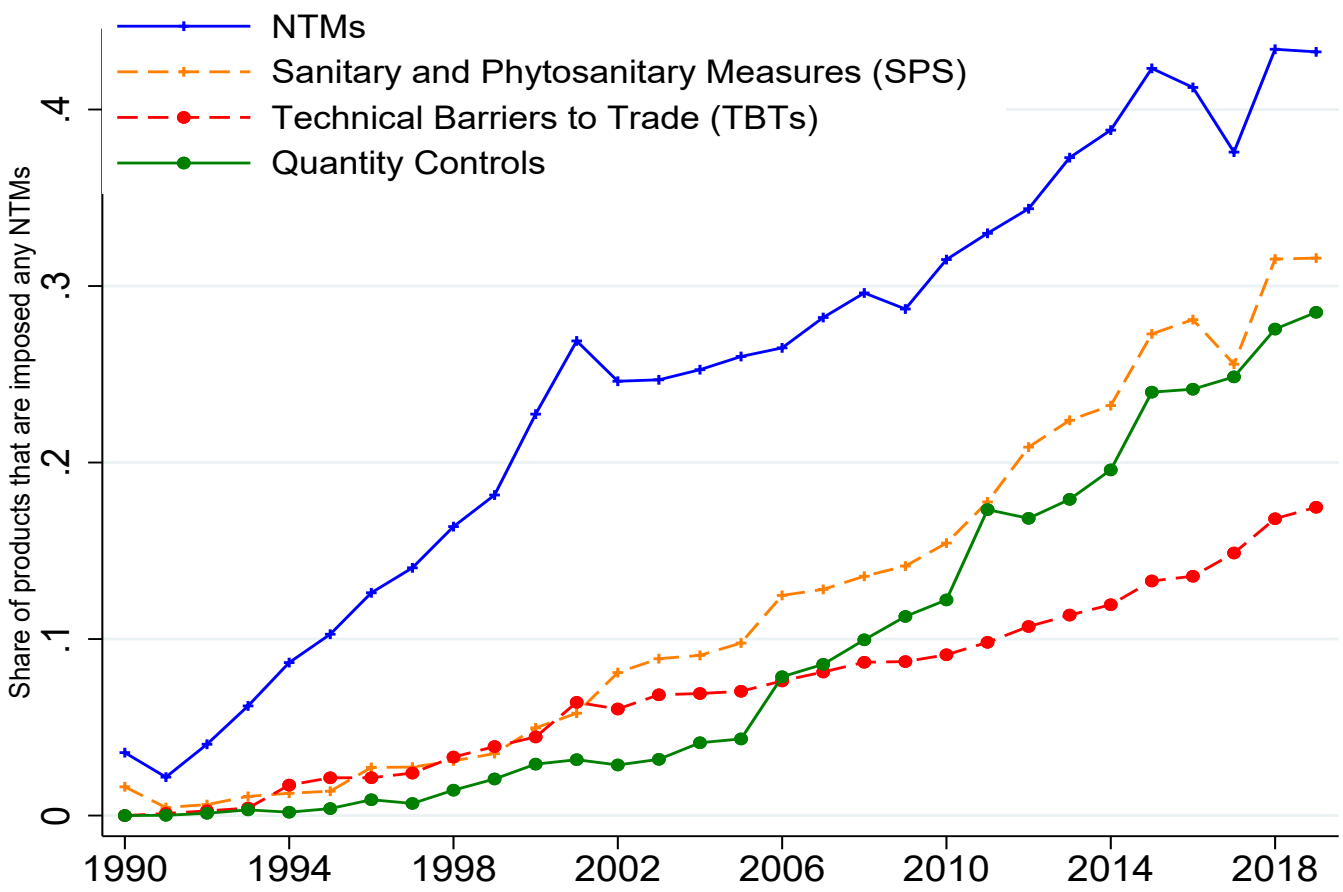


Figure 3: Share of products that were imposed any non-tariff measures (NTMs) in agriculture: 1990 to 2019.

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