WTO vs. TRAINS: A quantitative comparison of time-varying Ad-Valorem Equivalents for non-tariff trade measures

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Background

- Decrease in applied tariffs by countries, but an increase in applied non-tariff measures (Ferrantino, 2006; Orefice, 2017)
- Non-tariff measures affect trade (price and quantity) differently than tariffs: Policy concern
- Quantifying the impact of NTMs is complex: NTM heterogeneity, less straightforward effects than tariffs, and data limitations
- NTMs quantified using Ad Valorem Equivalents (AVE) using NTM incidence data
- Two primary NTM data sources:
  - WTO Notifications
  - UNCTAD Trade Analysis Information System (TRAINS) database

  → Data Collection/Benefits and Limitations

Research question

- Do WTO notifications and the UNCTAD database yield different static and time-varying ad valorem equivalent (AVE) estimates?
- If so, is it possible to improve the WTO notifications database using the UNCTAD database to create new data with better country and time coverage?

Objectives:

- Estimate AVE from the two databases and compare estimates
- Investigate how the gap in the estimates changes with the level of HS aggregation, studied countries and years, type of NTM (SPS or TBT), and the measure of NTMs (either count or binary). Find where the measurement stems from.
- Create a new NTM database that combines WTO and UNCTAD information

Motivation and focus

Contribution: While both databases have been used in multiple analyses to estimate AVE in the trade literature:

- For TRAINS: mostly static AVE (Beghin, Maertens, and Swinnen, 2015; Cadot and Gourdon, 2016; Cadot, Gourdon, and Van Tongeren, 2018)
- For WTO: static and time-varying AVE (Ghodsi et al., 2017; Ghodsi and Stehrer, 2022)

→ Only De Melo and Nicita (2018); Rau and Vogt (2017) discuss qualitatively the merits and drawbacks of each

Focus:

- Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary Measures (SPS)
- Countries with frequent data collection by UNCTAD from 2012 to 2016: Brazil

Database comparisons

	UNCTAD-TRAINS	**WTO notifications**
Access	Open source ✓	Open source ✓
Reporting	Snapshot of existing NTMs for a country at collected years ✓	Self-notification to the WTO of implementing NTMs ✗
Availability	Data availability limited to collected years and country ✗	Data availability limited to WTO members ✓
Coverage	Reporting/affected countries, Implemented NTM at the HS6 level, with product details ✓	Reporting/affected countries, Implemented NTM at the HS6 level, with product details ✓
Timeframe	Implementation year ✓	Notification year ✗
NTM repeal	Account for withdrawal ✓	Do not account for withdrawal ✗

Table: Comparison of UNCTAD-TRAINS and WTO Notifications

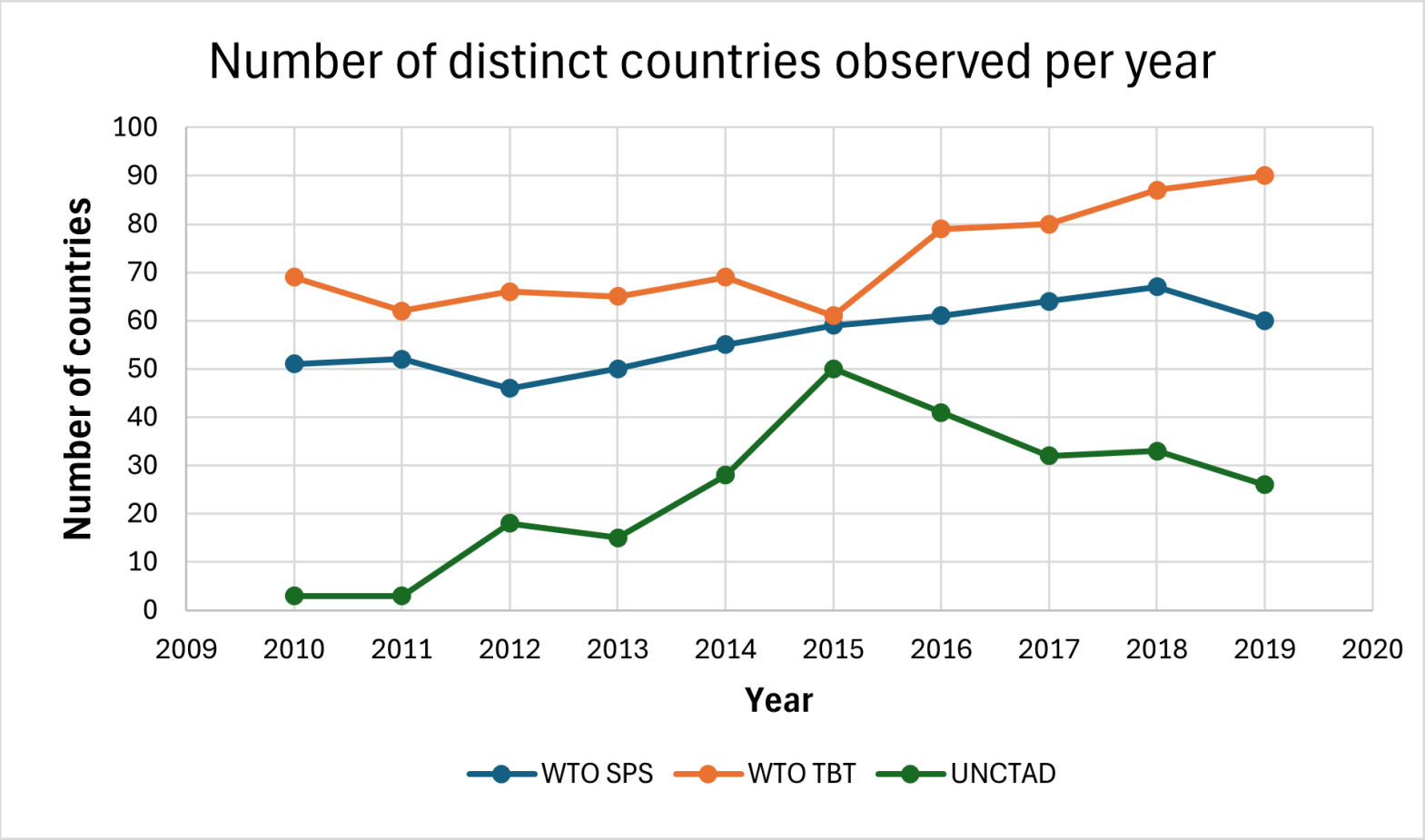
Data usage and Assumptions

WTO notifications data usage requires making assumptions on NTMs.

- No withdrawal: when NTM is notified, indicated as implemented until the last period
- Year of notification is the year of implementation
- Missing HS code retrieved through product descriptions and matched to other data (executed by Ghodsi et al. (2017), we use this data for further analysis)
- All countries correctly notify WTO when implementing an NTM

$\rightarrow$ Assumptions lead to Measurement error and bias AVE estimates

Time and country coverage



NTM database:

- UNCTAD: 92 countries
- WTO notifications (I-TIP): 120 countries for TBT and 103 for SPS in WTO

Empirical Method

Price-based approach by Ing et al. (2016); Kravchenko et al. (2022)

$$\begin{aligned}\ln p_{ijkt} = {} & \beta_1\delta_i + \beta_2\delta_j + \beta_3\rho_k + \beta_{\theta_{ijt}}\theta_{ij} + \beta_{4k}NTM^{SPS}_{ijkt} + \beta_{5k}NTM^{TBT}_{ijkt} \\ & + \beta_{6ik}(NTM^{SPS}_{ijkt} \times \delta_i) + \beta_{7ik}(NTM^{TBT}_{ijkt} \times \delta_i) + \beta_{8k}\ln(1 + \text{tariff}_{ijkt}) \\ & + \beta_7\tau_t + \varepsilon_{ijkt} \end{aligned} \tag{1}$$

p_{ijkt} : price specific to importer i and exporter j for product k at time t

$\delta_i/\delta_j/\tau_t/\rho_k$: importer/exporter/time/product fixed effect

θ_{ij} : gravity characteristics (distance, contiguity, landlocked, common language, and RTA)

$NTM^{SPS}_{ijk}/NTM^{TBT}_{ijk}$: count SPS/TBT imposed by i on imports from j on good k

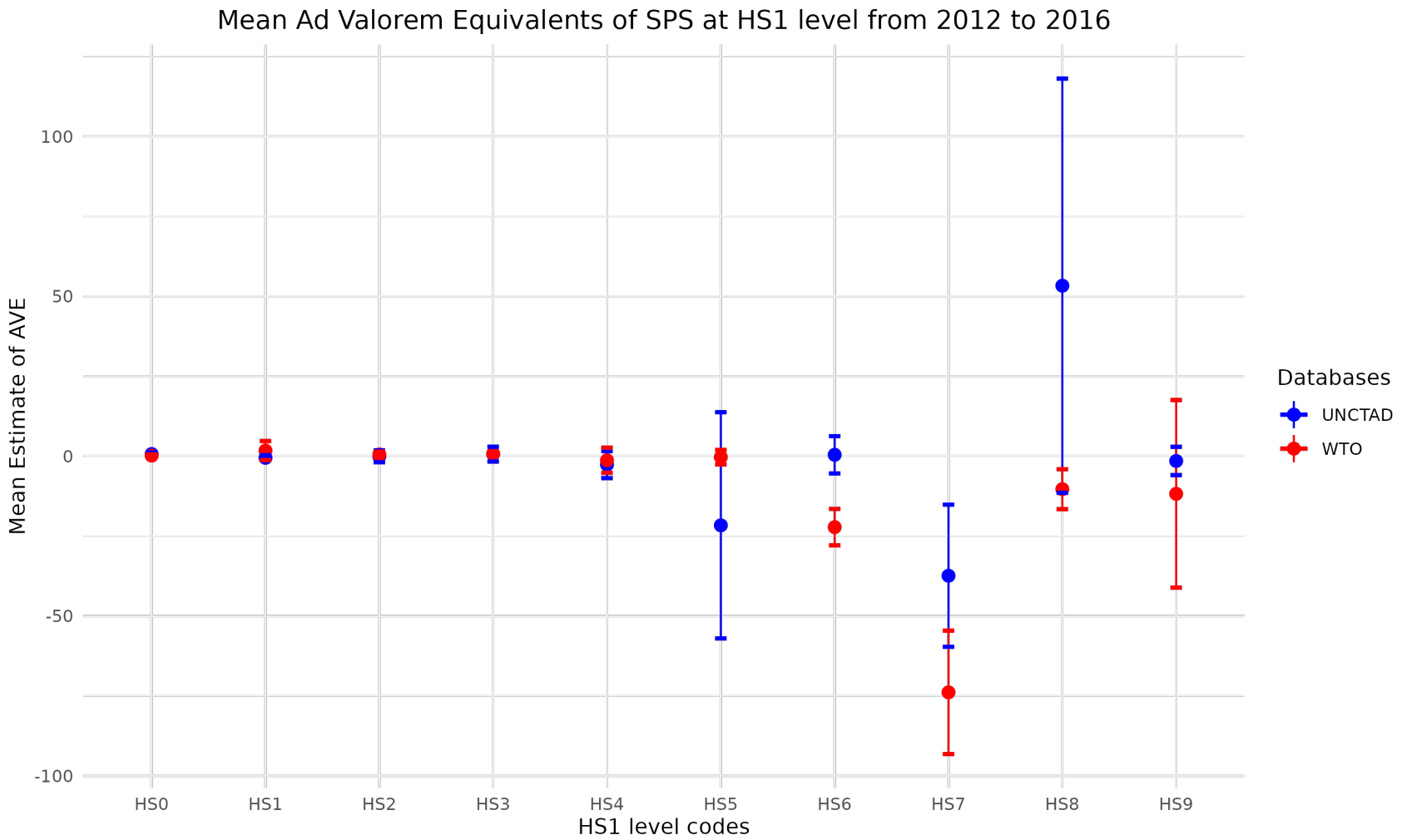
Tariff_{ijk} : applied tariff imposed by country i on imports from j on good k

Derive mean and total Ad Valorem equivalent

$$\text{AVE}^{SPS}_{ik} = \left[\exp\left(\beta_{4k} + \beta_{6ik}\delta_i\right) - 1\right] \times 100 \tag{2}$$

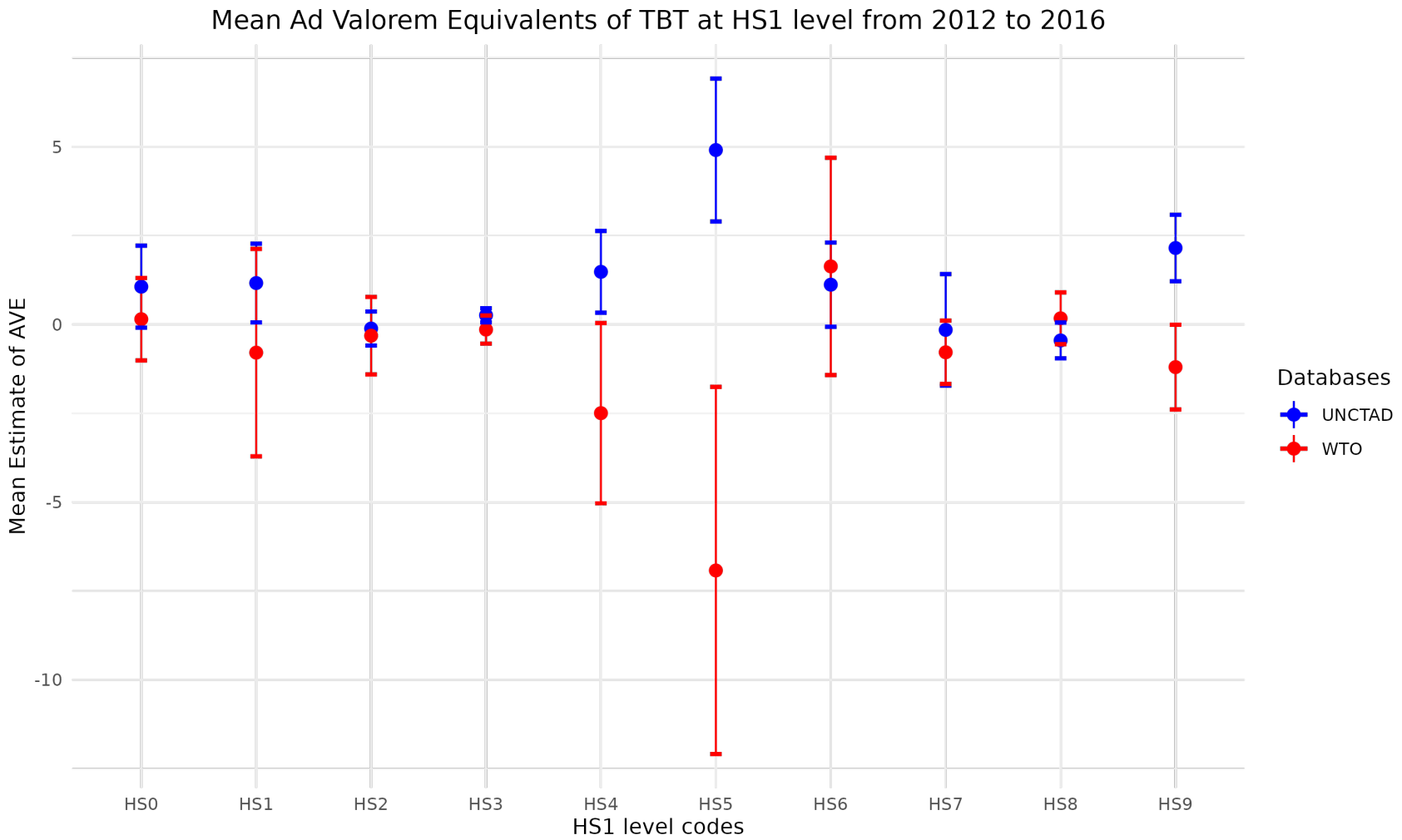
$$\text{AVE}^{SPS}_{ikt} = \left[\exp\left(\beta_{4k} \times NTM^{SPS}_{ijkt} + \beta_{6ik}\delta_i \times NTM^{SPS}_{ijkt}\right) - 1\right] \times 100 \tag{3}$$

Mean AVE for Brazil (SPS)



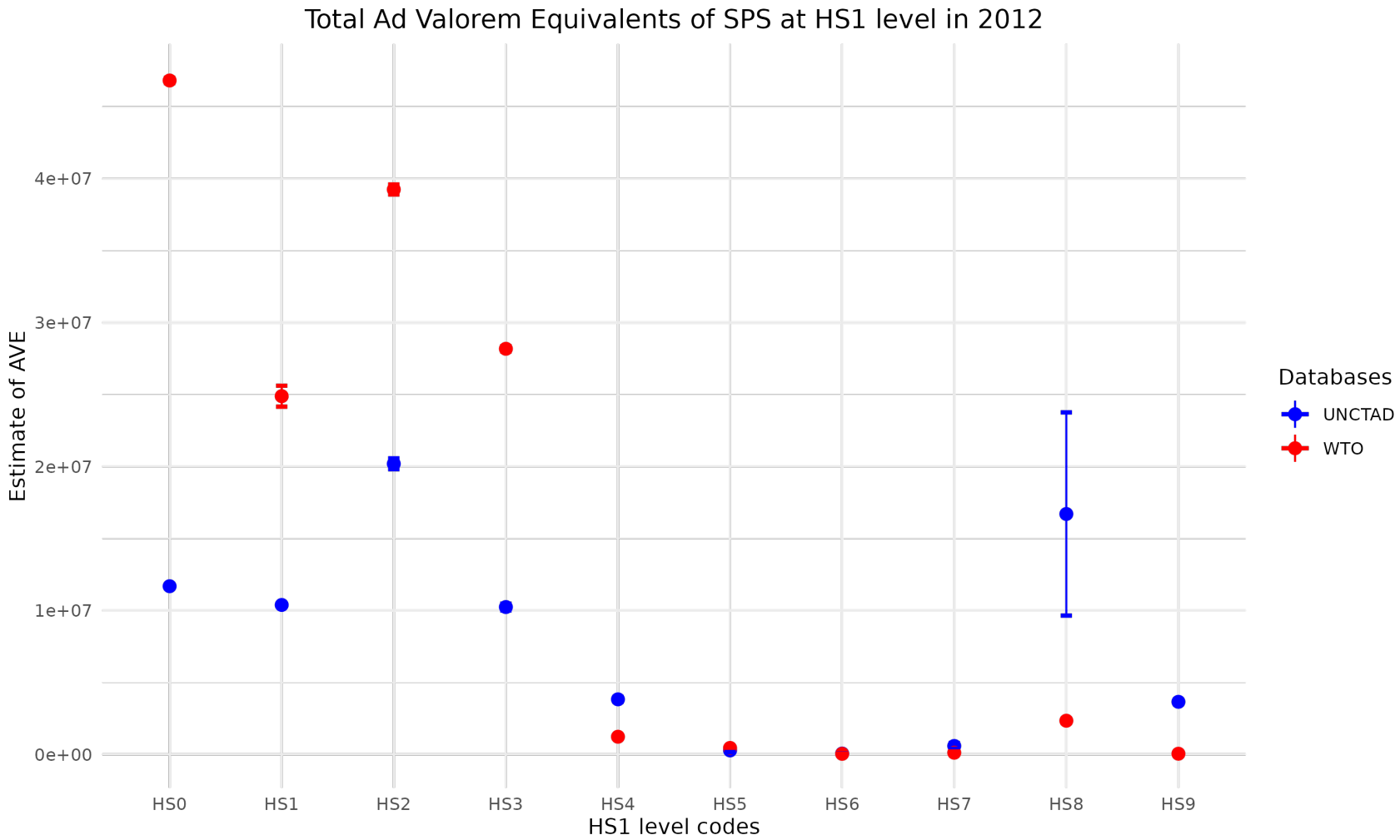
▸ regU ▸ regW

Mean AVE for Brazil (TBT)

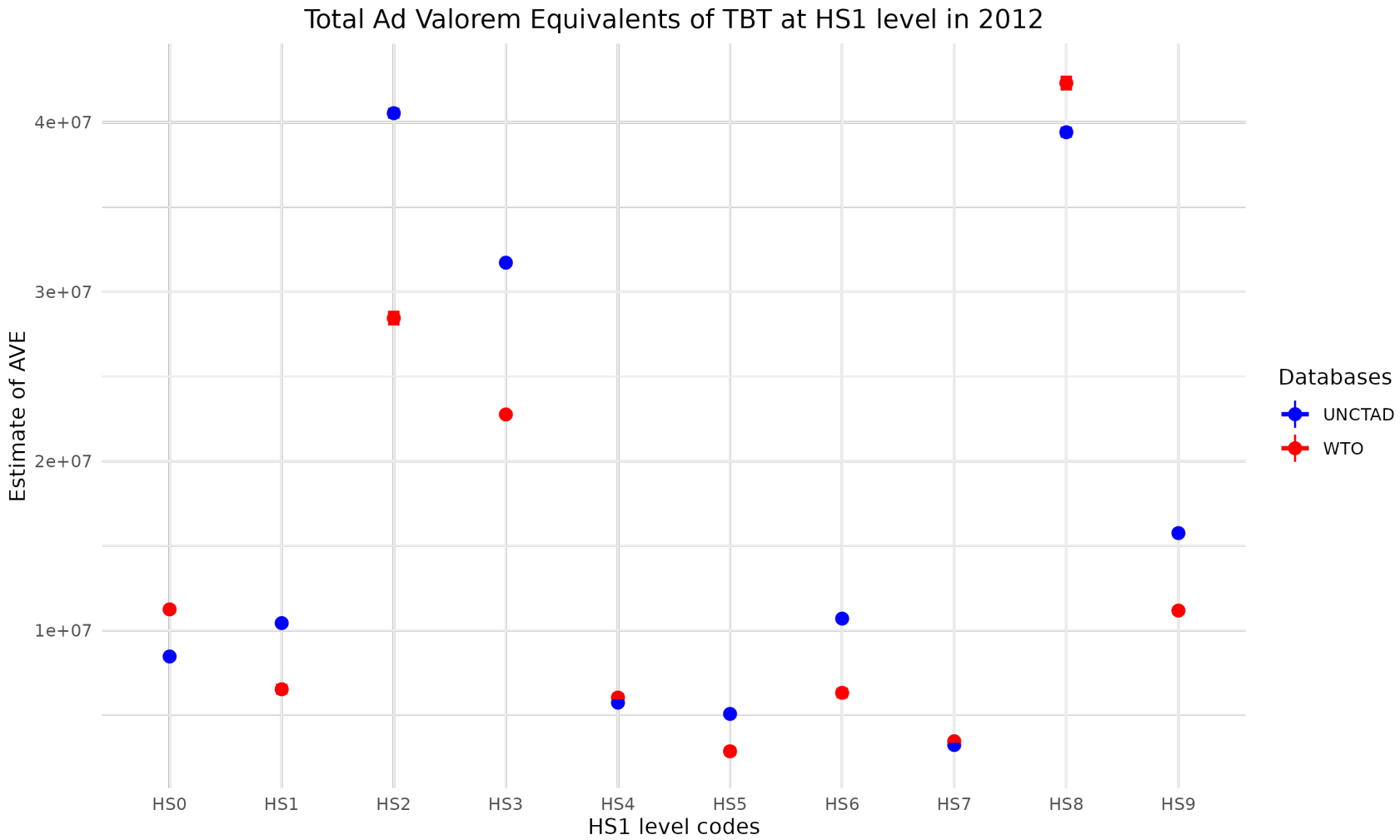


regU regW

Total AVE for Brazil (SPS) in 2012



Total AVE for Brazil (TBT) in 2012



Discussion

- Total AVE using total NTM counts: bigger gap between UNCTAD and WTO
- Some of the discrepancies between AVEs can be explained by comparing the number of NTMs applied at HS6 vs HS1 groups: ▸ SPS ▸ TBT
  - A higher number of NTMs from WTO relative to UNCTAD due to the assumption of no withdrawal widens the gap between total AVE estimates but not the mean AVE estimates.
  - A lower number of NTMS from WTO relative to UNCTAD leads to larger gap between mean AVE estimates due either to Brazil not notifying the WTO or missing the HS6 level code
- Stemming from:
  - difference in the number of NTMs per HS6 digit code (assuming no withdrawal for NTMs)
  - NTMs not notified to WTO

Conclusion

Key Findings:

- Discrepancies in mean AVE vary by groups of HS1, either due to the assumption of no withdrawal or self notifications bias to WTO
- The gap between estimates becomes larger When accounting for the total number of NTMs

Limitations:

- Reverse causality and endogeneity: trade policy measures may be influenced by the importance of the good traded (traded volume) (Trefler, 1993; Lee and Swagel, 1997)

Next steps...

- Use Bootstrapping to determine the statistical difference between AVE estimates
- Account for endogeneity using IV (neighboring countries)
- Generalize the analysis to more countries and time-period
- Change the level of HS aggregation for the estimated AVE

Thank you!

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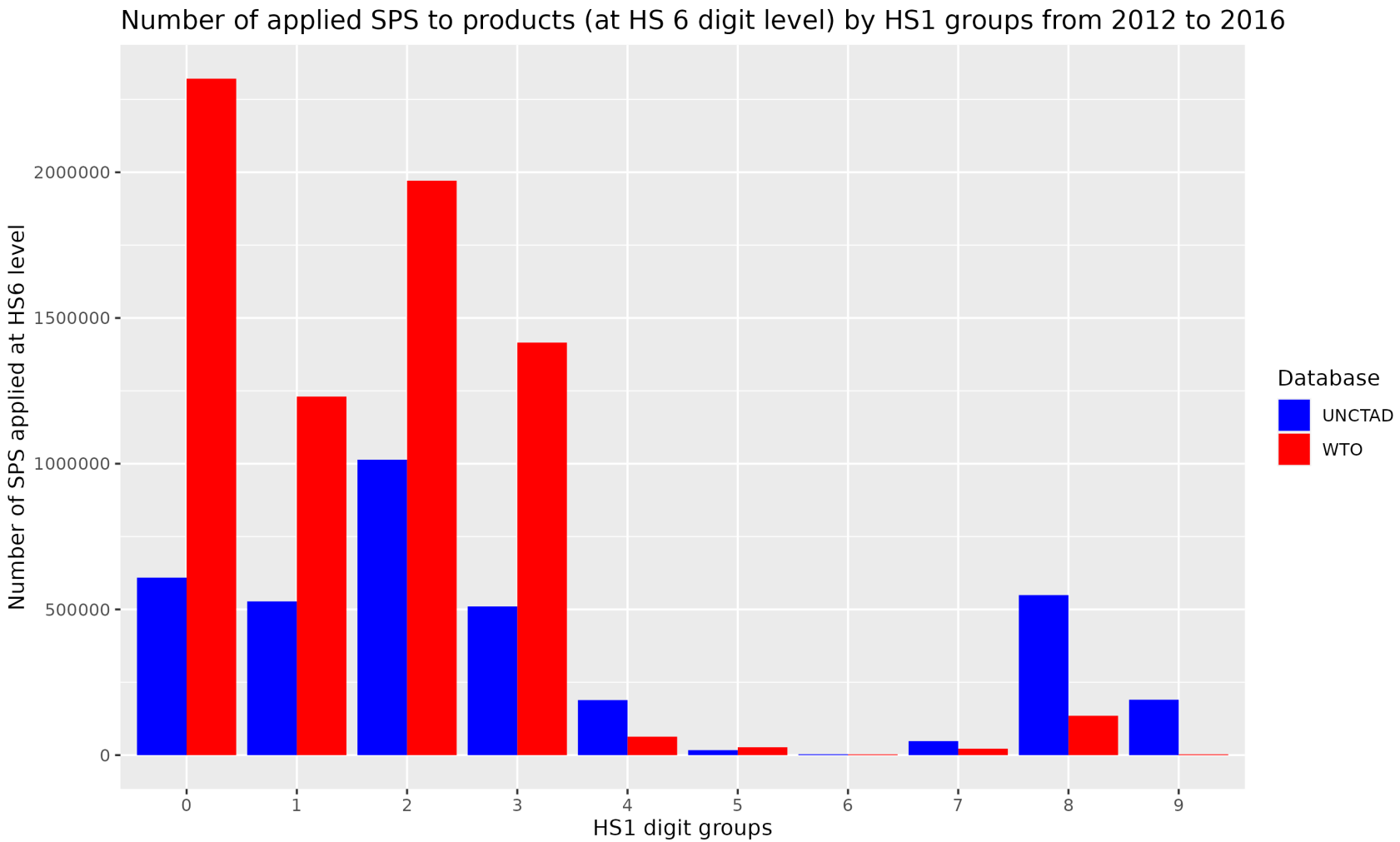
Distinct SPS applied at the HS6 level for HS1 groups



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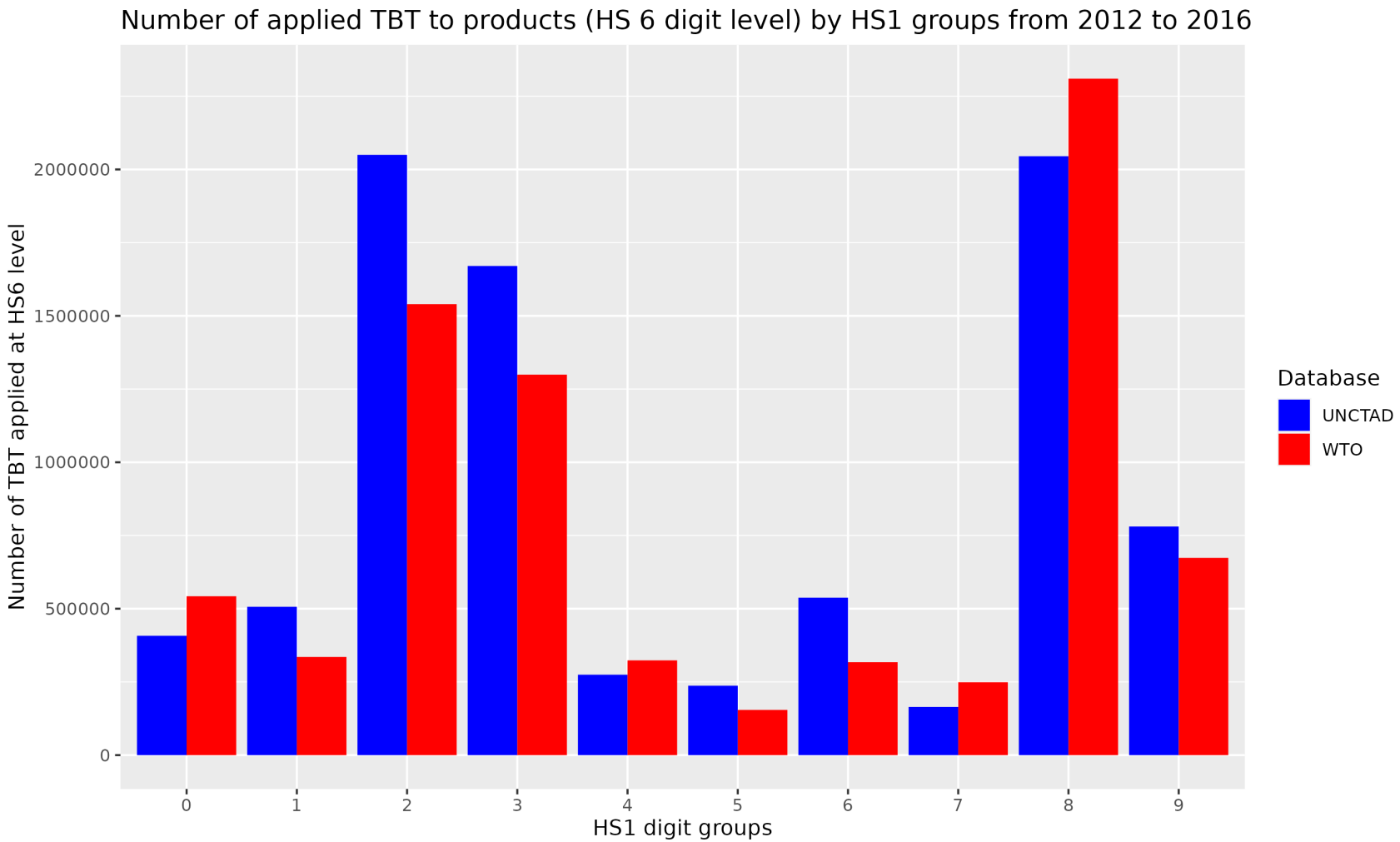
Distinct TBT applied at the HS6 level for HS1 groups



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Regression results UNCTAD

HS 1 level	H0	H1	H2	H3	H4
Constant	70.73 (75.09)	-0.2396 (65.36)	-60.44 (116.6)	44.40 (55.81)	-6.149 (61.80)
log(dist)	-7.538 (8.873)	0.0381 (7.724)	7.172 (13.78)	-4.666 (6.594)	0.8782 (7.302)
contig	3.903 (4.691)	-0.5733 (4.082)	-3.173 (7.278)	2.746 (3.484)	-0.4392 (3.855)
comlang_off	1.925 (2.607)	-0.3320 (2.263)	-1.803 (4.043)	0.2445 (1.949)	0.1522 (2.157)
rta	-0.2075 (0.1348)	0.1274 (0.1361)	-0.1005 (0.1131)	0.0332 (0.0758)	0.0377 (0.0869)
NTM SPS	0.0067* (0.0027)	-0.0051 (0.0040)	-0.0003 (0.0095)	0.0063 (0.0117)	-0.0267 (0.0222)
NTM TBT	0.0106. (0.0058)	0.0116* (0.0056)	-0.0011 (0.0024)	0.0026** (0.0010)	0.0147* (0.0058)
log(1+tariff)	0.0102 (0.0884)	-0.0173 (0.1645)	-0.0078 (0.0913)	0.0599 (0.0790)	0.2006 (0.2466)
Observations	16,951	21,447	63,759	86,346	65,925
R2	0.72989	0.61898	0.55659	0.50297	0.62047
Adj. R2	0.71941	0.6111	0.55009	0.49945	0.61704

HS 1 level	H5	H6	H7	H8	H9
Constant	-154.3 (133.9)	-16.29 (67.01)	-34.35 (57.56)	51.93 (37.98)	62.13 (83.00)
log(dist)	18.91 (15.82)	2.283 (7.918)	4.470 (6.801)	-5.760 (4.488)	-6.775 (9.808)
contig	-9.380 (8.354)	-0.8277 (4.179)	-2.777 (3.591)	3.177 (2.369)	3.687 (5.179)
comlang_off	-9.999 (8.156)	-0.6746 (2.317)	-1.561 (2.013)	0.9357 (1.324)	1.426 (2.886)
rta	-0.0188 (0.1212)	-0.0841 (0.0863)	-0.0624 (0.0784)	-0.00669	0.0407 (0.1234)
NTM SPS	-0.2438 (0.2304)	0.0043 (0.0296)	-0.4684** (0.1813)	0.4274* (0.2156)	-0.0151 (0.0229)
NTM TBT	0.0479*** (0.0098)	0.0112. (0.0060)	-0.0015 (0.0080)	-0.0045. (0.0026)	0.0213*** (0.0047)
log(1+tariff)	0.0812 (0.1116)	-0.1442 (0.1069)	0.2553. (0.1343)	0.1330 (0.1032)	-0.02142
Observations	40,154	84,932	91,114	226,434	68,084
R2	0.444	0.48747	0.47634	0.52367	0.50496
Adj. R2	0.43493	0.48359	0.47213	0.52104	0.50082

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Regression results WTO

HS 1 level	H0	H1	H2	H3	H4
Constant	75.55 (75.10)	-3.056 (65.40)	-60.92 (116.6)	44.47 (55.81)	-7.269 (61.80)
log(dist)	-8.098 (8.874)	0.0638 (7.725)	7.197 (13.78)	-4.661 (6.594)	1.025 (7.303)
contig	4.211 (4.691)	-0.5817 (4.083)	-3.183 (7.279)	2.744 (3.484)	-0.5177 (3.855)
comlang_off	2.090 (2.607)	-0.3381 (2.263)	-1.816 (4.044)	0.2440 (1.949)	0.1060 (2.157)
rta	-0.2099 (0.1348)	0.1214 (0.1361)	-0.1028 (0.1131)	0.0324 (0.0758)	0.0373 (0.0869)
ntm_count_SPS	0.0017 (0.0020)	0.0173 (0.0149)	0.0053 (0.0045)	0.0076* (0.0033)	-0.0128 (0.0203)
ntm_count_TBT	0.0015 (0.0059)	-0.0079 (0.0150)	-0.0032 (0.0056)	-0.0014 (0.0020)	-0.0253. (0.0133)
log(1+MFN_tariff)	0.0131 (0.0884)	-0.0101 (0.1645)	-0.0081 (0.0913)	0.0604 (0.0790)	0.1829 (0.2468)
Observations	16,951	21,447	63,759	86,346	65,925
R2	0.72975	0.6189	0.5566	0.50296	0.62045
Adj. R2	0.71927	0.61101	0.5501	0.49944	0.61702

HS 1 level	H5	H6	H7	H8	H9
Constant	-160.5 (133.9)	-15.92 (67.01)	-35.21 (57.56)	52.74 (37.98)	60.98 (83.01)
log(dist)	19.52 (15.83)	2.245 (7.919)	4.572 (6.801)	-5.855 (4.488)	-6.552 (9.809)
contig	-9.694 (8.356)	-0.8084 (4.179)	-2.831 (3.591)	3.226 (2.369)	3.564 (5.179)
comlang_off	-10.31 (8.158)	-0.6645 (2.318)	-1.592 (2.013)	0.9609 (1.324)	1.354 (2.886)
rta	-0.0178 (0.1212)	-0.0847 (0.0863)	-0.0622 (0.0784)	-0.00663	0.0478 (0.1234)
ntm_count_SPS	-0.0031 (0.0117)	-0.2511*** (0.0374)	-1.343*** (0.3772)	-0.1090** (0.0356)	-0.1253 (0.1697)
ntm_count_TBT	-0.00203	0.0162 (0.0154)	-0.0079. (0.0046)	0.0017 (0.0037)	-0.0121. (0.0062)
log(1+MFN_tariff)	0.0288 (0.1126)	-0.1439 (0.1069)	0.2477. (0.1344)	0.1294 (0.1033)	-0.02146
Observations	40,154	84,932	91,114	226,434	68,084
R2	0.44381	0.48745	0.47636	0.52368	0.50483
Adj. R2	0.43474	0.48357	0.47215	0.52106	0.50069

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