Non-Tariff Measures, Trade Margins and Firm Heterogeneity

Analysis on the UK customs data in 2012-2019

Mustapha Douch
The University of Edinburgh
mdouch@ed.co.uk

Jun Du
Aston University
j.du@aston.co.uk

Oleksandr Shepotylo
Aston University
o.shepotylo@aston.co.uk

Dongzhe Zhang
University of Sussex
dz91@sussex.ac.uk

39^{th} meeting of the European Economic Association and the 76^{th} European meeting of the Econometric Society, 26 August 2024

Aston University BIRMINGHAM UK | Centre for Business Prosperity

HMRC Data Disclaimer

This work contains statistical data from HMRC which is Crown Copyright. The research datasets used may not exactly reproduce HMRC aggregates. The use of HMRC statistical data in this work does not imply the endorsement of HMRC in relation to the interpretation or analysis of the information.

Motivation

- UK has exited the EU on December 31 2020.
- New trade and cooperation agreement (TCA) is zero tariff, but is not frictionless: as it is shallow and does not deal with product harmonization and non-tariff barriers to trade.
- It is important to understand how non-tariff measures impact UK firms' international trade and market access to the EU.

Introduction

- Effect of non-tariff measures (NTMs) are widespread...
- ... but is poorly understood and inconclusive.
- NTMs may affect both the demand and supply sides:
  - demand for quality, health and safety
  - higher trade and production costs
- Some NTMs control quality and safety, while others are "red tape".

NTM and firms

- At the firm level, NTMs drive decisions on the quality and quantity of intermediate goods and technology of production
- This has implications for firm productivity and competitiveness domestically and internationally.
- The effect may be disproportionately more negative on small and medium enterprises (SMEs).

Contribution

- Develop a model with heterogeneous firms to formulate hypotheses on the heterogeneous impact of NTMs.
- Disentangle upstream (NTMs on inputs) and downstream (NTMs on outputs) effects.
- Measure ad valorem equivalents of Sanitary and Phytosanitary Standards (SPS), Technical Barriers to Trade (TBT), Pre-Shipment Inspections, and Licensing in 2012-2019 for 200+ countries (Kee, Nicita and Ollareaga, 2009).
- Use HMRC granular micro-level data on export and import transactions of the UK firms in 2012-2019 linked to the firm census.

Contribution

- Examine effects across different trade margins:
  - Value
  - Quantity
  - Price (unit value)
  - Quality (BLP, 1995; Amiti and Khandelwal, 2013)
- Look at how firms of different sizes are affected
- Investigate how the effects vary by EU vs non-EU destinations

Literature: NTM determinants

- Political economy factors (Maggi et al., 2019).
- Empirical support for tariff liberalization leading to NTM use (Orefice, 2017).
- Economic and political factors influencing NTMs (Hirang, 2019; CHIN et al., 2015).
- NTM measurement (Looi Kee et al., 2009; Kee and Nicita, 2016)

Literature: Effects of NTMs on trade

- Negative impact on trade value (Otsuki et al., 2001; Disdier et al., 2008; Crivelli and Gröschl, 2016; Movchan et al., 2019).
- Varied effects: negative for exports from developing countries, positive for developed countries (Disdier et al., 2008; Anders and Caswell, 2009).
- Positive effect on technologically advanced sectors, negative on agriculture (Hoekman and Nicita, 2011).
- Demand and supply effects disentangled; demand positive, supply negative (Xiong and Beghin, 2014).

Model

Consumer Preferences

- Consumers enjoy consumption of varieties of differentiated goods
- Quality of the final product is a demand shifter
- Consumers are willing to purchase relatively larger quantities despite higher prices due to better quality
- Intangible attributes, such as brand image, influence consumer preferences

Model

Technology and market structure

- Varieties are produced by a mass of single-product firms.
- There is only one production factor: labor.
- Firms choose technology and quality given NTM constraints for their varieties to maximize profits.
- There is a pool of potential entrants. The market is monopolistically competitive.
- Firms draw their unit-input requirement, a, after paying a fixed cost, F_D (in labor units), to produce a variety.
- The unit-input requirement is drawn from a Pareto distribution
- Firms use intermediate inputs which can be sourced domestically or imported.

Model

NTM regulations

- NTMs are modeled as a fixed cost of production f (in labour units)
- The fixed cost represents an investment in production equipment or change procedures caused by NTMs

Implications

- The introduction of upstream NTMs intensifies market competition.
- Less productive firms choose domestic inputs, lower quality and charge higher price
- More productive firms pay fixed costs, import intermediate inputs of better quality and export more conditional on NTM.

Data Sources

1. UK HMRC Overseas Trade Statistics database:
   - Data on the universe of export annual transactions towards the rest of the world.
   - Information on product classification, destination, value and mass.
2. UNCTAD-WTO NTM database:
   - SPS (A), TBT (B), Pre-shipment inspections (C), Licensing (E): MAST classification
   - 100 countries
   - more than 65000 measures
3. Additional Datasets
   - Global trade: COMTRADE database
   - Applied tariffs: UNCTAD TRAINS database

Methodology: NTM measurement

AVE NTM is defined as an equivalent tariff with the same impact on imports as NTM. It is defined as

$$AVE_{nij,t} = \frac{\exp(\beta^{NTM}_{nij,t}) - 1}{\exp(\beta^{\tau}_{nij,t}) - 1} \tag{1}$$

We estimate the following equation for each product n imported by reporter i from partner j in year t:

$$IMP_{nij,t} = \exp(\beta^{NTM}_{nij,t} NTM_{nij,t} + \beta^{\tau}_{nij,t}\tau_{nij,t} + Z_{ij}\beta^{Z} + D_{in} + D_{jn}) + \epsilon_{nij} \tag{2}$$

where

$$\beta^{NTM}_{nij,t} = \beta^{NTM}_{n} + \beta_{EU} \times EU + \beta^{NTM}_{1} share_{ni,t} + \beta^{NTM}_{2} share_{nj,t} \tag{3}$$

and

$$\beta^{\tau}_{nij,t} = \beta^{\tau}_{n} + \beta_{EU} \times EU + \beta^{\tau}_{1} share_{ni,t} + \beta^{\tau}_{2} share_{nj,t} \tag{4}$$

.

Summary statistics

Variables	Mean	S.d.	Obs.
Output NTMs			
AVE SPS	0.0758	0.242	5,477,809
AVE TBT	0.413	0.672	5,477,809
AVE Inspection	0.0106	0.0540	5,477,809
AVE Licensing	0.183	0.372	5,477,809
Input NTMs			
AVE Input SPS	0.0381	0.0723	5,477,809
AVE Input TBT	0.202	0.134	5,477,809
AVE Input Inspection	0.00132	0.00281	5,477,809
AVE Input Licensing	0.0974	0.0864	5,477,809
Dep. Variables			
Log Export	8.120	2.824	5,477,809
Log Export quantity	4.413	3.019	5,477,809
Log Export price	3.707	2.115	5,477,809
Quality	-1.093	3.511	5,477,809

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Main results: Upstream NTMs (on imported inputs)

- Limited impact on export
- TBT reduce quality
- No evidence that inspections and licensing improve quality

Table 1: Input non-tariff measures and export margins

Dependent variable:	(1) Value	(2) Price	(3) Quantity	(4) Quality
Input NTM				
SPS	0.148	-0.231**	0.353	0.0508
	(0.237)	(0.111)	(0.238)	(0.172)
TBT	0.0136	0.0887	-0.0796	-0.104*
	(0.0835)	(0.0638)	(0.0709)	(0.0572)
Observations	4,645,515	4,576,519	4,576,519	4,568,351
R-squared	0.436	0.664	0.465	0.261
Control Variables	Y	Y	Y	Y
Trader FE	Y	Y	Y	Y
Country-Year FE	Y	Y	Y	Y
Product Trend FE	Y	Y	Y	Y

Standard errors clustered at trader level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Heterogeneous effects of upstream NTMs

- All types of upstream NTMs have a strong negative impact on the value and quantity of exports of micro and small exporters.
- Large firms, on the other hand, expand their exports along various margins.

Table 2: Export size and Input NTM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
Dep. var:			Value			Price		
NTM type:	SPS	TBT	Insp	License	SPS	TBT	Insp	L
Micro (1st Q)	-1.926***	-1.184***	-16.82***	-1.975***	-0.259**	0.0214	0.173	-(
x Input NTM	(0.179)	(0.0864)	(2.259)	(0.123)	(0.124)	(0.0529)	(1.087)	(
Small (2nd Q)	-0.362**	-0.204**	2.235	-0.344***	-0.127	0.0459	0.913	(
x Input NTM	(0.158)	(0.0805)	(1.869)	(0.117)	(0.116)	(0.0565)	(1.487)	(
Medium (3rd Q)	0.317	0.375***	9.329***	0.495***	-0.0629	0.0857	1.134	
x Input NTM	(0.203)	(0.103)	(2.139)	(0.132)	(0.113)	(0.0650)	(1.637)	(
Large (4th Q)	1.603***	1.005***	12.99***	1.397***	-0.0207	0.112**	2.980	(
x Input NTM	(0.310)	(0.103)	(4.791)	(0.177)	(0.130)	(0.0558)	(2.941)	(
Obs	4,645,515	4,645,515	4,645,515	4,645,515	4,576,519	4,576,519	4,576,519	4,(
R-sq	0.437	0.437	0.437	0.437	0.664	0.664	0.664	

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
Dep. var.:			Quantity			Quality		
NTM type:	SPS	TBT	Insp	License	SPS	TBT	Insp	L
Micro (1st Q)	-1.692***	-1.204***	-17.54***	-1.891***	-0.268	-0.237***	-4.723***	-0
x Input NTM	(0.217)	(0.0894)	(2.352)	(0.133)	(0.172)	(0.0556)	(1.598)	(
Small (2nd Q)	-0.256	-0.249***	1.199	-0.365***	-0.125	-0.126**	-0.580	-(
x Input NTM	(0.177)	(0.0794)	(2.159)	(0.136)	(0.148)	(0.0526)	(1.748)	(
Medium (3rd Q)	0.352*	0.276***	7.726***	0.380***	-0.144	-0.0335	1.188	-(
x Input NTM	(0.203)	(0.0831)	(2.287)	(0.138)	(0.195)	(0.0600)	(1.845)	(
Large (4th Q)	1.618***	0.889***	9.957**	1.303***	0.222	0.0145	1.361	
x Input NTM	(0.291)	(0.0998)	(4.009)	(0.176)	(0.327)	(0.0741)	(2.509)	(
Obs	4,576,519	4,576,519	4,576,519	4,576,519	4,568,351	4,568,351	4,568,351	4,(
R-sq	0.466	0.466	0.466	0.466	0.261	0.261	0.261	

Standard errors clustered at trader level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Heterogeneous effects of downstream NTMs

- Strong, expected, and robust impact on the margins of exports: price, quantity and value.
- SPS is pervasive across exporter-size bands. For small firms: Negative on export value, negative on price and positive on quality. For large: positive on export value, quantitiy and quality but no effect on price.
- TBT increase quality for large firms.
- Inspection doesn't affect value, but decrease quantity and quality and increase price. Similar for licensing.

Main results: Downstream NTMs

Variables	Value	Price	Quantity	Quality
Output NTMs				
AVE SPS	-0.221***	-0.159***	-0.0599**	0.388***
	(0.0397)	(0.0240)	(0.0277)	(0.0378)
AVE TBT	-0.00860	0.00219	-0.00926	0.0378***
	(0.00934)	(0.00428)	(0.00866)	(0.0109)
AVE Insp.	0.163***	0.330***	-0.168***	-0.872***
	(0.0445)	(0.0300)	(0.0493)	(0.112)
AVE Lic.	0.141***	0.0403***	0.103***	-0.0399**
	(0.0143)	(0.00838)	(0.0145)	(0.0168)
Observations	4,645,515	4,576,519	4,576,519	4,568,351
R-squared	0.436	0.664	0.465	0.261
Firm	Y	Y	Y	Y
Country-Year	Y	Y	Y	Y
Product	Y	Y	Y	Y

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Additional analysis

- Product Heterogeneity
- Exports to the EU vs Extra-EU
- Other export regions

Impact of Output NTM for EU and non-EU destinations of the UK exports

Dependent variable	(1) Value	(2) Price	(3) Quantity	(4) Quality
Output SPS	0.0991***	-0.0484***	0.149***	0.282***
	(0.0275)	(0.0125)	(0.0278)	(0.0405)
Output TBT	0.0102	-0.0208***	0.0320***	-0.155***
	(0.00717)	(0.00396)	(0.00794)	(0.0164)
Output Inspections	0.0950***	0.250***	-0.151***	-0.600***
	(0.0352)	(0.0239)	(0.0396)	(0.122)
Output Licensing	0.0206**	0.0459***	-0.0266**	0.204***
	(0.00853)	(0.00670)	(0.0111)	(0.0247)
EU x Output SPS	-0.424***	-0.143***	-0.278***	0.140***
	(0.0406)	(0.0250)	(0.0341)	(0.0525)
EU x Output TBT	-0.0274***	0.0281***	-0.0548***	0.242***
	(0.00990)	(0.00547)	(0.00994)	(0.0197)
EU x Output Inspections	0.223	0.393***	-0.194	-2.434***
	(0.263)	(0.138)	(0.280)	(0.280)
EU x Output Licensing	0.176***	-0.00580	0.185***	-0.349***
	(0.0192)	(0.0113)	(0.0197)	(0.0301)
Observations	4,645,515	4,576,519	4,576,519	4,568,351
R-squared	0.437	0.664	0.466	0.261
Trader FE	Y	Y	Y	Y
Country-Year FE	Y	Y	Y	Y
Product Trend FE	Y	Y	Y	Y

Standard errors clustered at trader level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Conclusions

- Upstream NTMs do not have robustly significant effects on margins of exporting on average.
- However, there is high heterogeneity of the impact hidden: small exporters are negatively affected on all margins.
- High upstream TBTs have a negative impact on the quality of export.
- Downstream SPS and TBT improve quality.
- Downstream pre-shipments and licensing are red tape, without implications for quality.
- EU countries use SPS and TBT most effectively to control quality.

Thank you!

Twitter: @shepotylo
Email: o.shepotylo@aston.ac.uk

Centre for Business Prosperity, Aston Business School
https://www.lbpresearch.ac.uk/

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Sven M Anders and Julie A Caswell. Standards as barriers versus standards as catalysts: Assessing the impact of HACCP implementation on US seafood imports. *American Journal of Agricultural Economics*, 91(2):310–321, 2009.

LEE CHIN, CHE RUSLI, and AHMAD KHUSYAIRI. The determinants of non-tariff barriers: The role of wto membership. *International Journal of Economics & Management*, 9(1), 2015.

Pramila Crivelli and Jasmin Gröschl. The impact of sanitary and phytosanitary measures on market entry and trade flows. *The World Economy*, 39(3):444–473, 2016.

Anne-Célia Disdier, Lionel Fontagné, and Mondher Mimouni. The impact of regulations on agricultural trade: evidence from the SPS and TBT agreements. *American Journal of Agricultural Economics*, 90(2):336–350, 2008.

Gemelee G Hirang. Determinants of non-tariff measures in asean: A correlation analysis. *APLPJ*, 21:1, 2019.

Bernard Hoekman and Alessandro Nicita. Trade policy, trade costs, and developing country trade. *World Development*, 39(12):2069–2079, 2011.

Hiau Loo Kee and Alessandro Nicita. Trade Frauds, Trade Elasticities and Non-Tariff Measures. 2016. URL `http://pubdocs.worldbank.org/en/315201480958601753/3-KEE-paper.pdf`.

Aston University BIRMINGHAM UK | Centre for Business Prosperity

Hiau Looi Kee, Alessandro Nicita, and Marcelo Olarreaga. Estimating trade restrictiveness indices. *The Economic Journal*, 119(534):172–199, 2009.

Giovanni Maggi, Monika Mrázová, and J Peter Neary. Choked by red tape? the political economy of wasteful trade barriers. 2019.

Veronika Movchan, Oleksandr Shepotylo, and Volodymyr Vakhitov. Non-tariff measures, quality and exporting: evidence from microdata in food processing in ukraine. *European Review of Agricultural Economics*, 2019.

Gianluca Orefice. Non-Tariff Measures, Specific Trade Concerns and Tariff Reduction. *The World Economy*, 40(9):1807–1835, sep 2017.

Tsunehiro Otsuki, John S Wilson, and Mirvat Sewadeh. Saving two in a billion:: quantifying the trade effect of European food safety standards on African exports. *Food Policy*, 26(5):495–514, 2001.

Bo Xiong and John Beghin. Disentangling demand-enhancing and trade-cost effects of maximum residue regulations. *Economic Inquiry*, 52(3):1190–1203, 2014.