

# The Hidden Effects of Non-Tariff Measures on Imported Input Quality and Firm Productivity

*ERIA NTM Conference 2019, Jakarta, Indonesia*

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November 14, 2019

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# Table of contents

1. Introduction
2. Brief Overview of NTMs
3. Literature Review
4. A Simple Model
5. Estimation
6. Conclusion

# Introduction

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# Introduction I

Import tariffs are at an all-time low level (according to a 2017 report by UNCTAD, the weighted mean of import tariffs stood at slightly above 2.5%).

Not much scope to achieve significant increase in trade through reductions in tariff.

Consequently, in recent years, attention has shifted to non tariff measures (NTMs).

In light of this, our paper tries to argue how *implementation* of certain NTMs can result in *per shipment* cost.

## Introduction II

In presence of *per shipment* cost and inventory carrying cost, importers are trying to solve inventory management problem.

*Per shipment* cost  $\implies$  Few, large shipments.

Inventory carrying cost (ICC)  $\implies$  Many, small shipments.

ICC and *per shipment* costs implies that the importers face a trade off between the size and the frequency of the shipment which will further have impact on the quality of the imported good.

## Brief Overview of NTMs

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# Overview of NTMs

According to UNCTAD, *“Non-tariff measures (NTMs) are policy measures other than tariffs that can potentially have an economic effect on international trade in goods.”*

The TRAINS database classifies NTMs into several categories like sanitary and phytosanitary (SPS) measures, technical barriers to trade (TBT), pre-shipment inspections etc., the implementation of which could result in *per shipment* costs.

Two examples on the implementation of NTMs:

- To ensure that TBT requirements have been met, tests and inspections are randomly carried out on shipments in the importing country.
- Pre-shipment inspection to verify the materials used in the goods before exporting.

# Literature Review

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# Qualitative Studies

Literature on NTMs primarily looks at the impact of product standards imposed by the developed countries on exports from developing countries.

Using TBT database, Maskus *et. al.* (2005) found that increase in investment cost to meet the imposed standards, there is increase in variable cost of production.

Chen *et. al.* (2008) found heterogeneous impact of different types of technical measures on the intensive and extensive margins of the firm's exports.

It has also been found that the imposition of compliance cost affects smaller firms more adversely than the larger firms (Fontagne *et. al.*), 2015).

Another strand of literature attempts to quantitatively measure the effect of NTMs.

These papers combine the observed change in import of a given product and a measure of import elasticity to calculate the ad valorem equivalent of a NTM.

It includes papers like Kee *et. al.* (2008), Cadot and Gourdon (2016), Ghodisi *et. al.* (2016)m Kee and Nicita (2016) and Cadot *et. al.* (2018).

# A Simple Model

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## A brief sketch of the model

Total demand for the imported product:  $q$

Cost of inventory borne by the distributor:  $\delta$  (depreciation cost)

*Per shipment cost:  $K$*

Law of motion of inventory:

$$\frac{dl(t)}{dt} = -q - \delta l(t)$$

## Model (Shipment cost)

It can be shown that given demand, shipments of equal sizes are optimal.

Time interval between two successive shipments is given by  $z$ , where,

$$z = \frac{1}{\delta} \ln\left(\frac{\delta}{q}s + 1\right)$$

$s \uparrow$  or  $q \downarrow \Rightarrow$  time interval between two successive shipments  $\uparrow$  (which means frequency of shipment,  $n (= \frac{1}{z}) \downarrow$ )

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$s$ : uniform volume of shipments

## Model (Inventory cost)

Distributor's inventory management cost (IMC) is thus given by,

$$IMC = \frac{1}{z}K + \frac{qr}{z}\left(\frac{1}{\delta}(e^{\delta z} - 1) - z\right)$$

Less frequent shipments  $\Rightarrow$  distributors have to bear the fixed cost amount  $K$  fewer times i.e., total shipment cost is reduced to  $nK$ .

But, the distributor has to hold a bigger inventory  $\Rightarrow$  more wastage due to depreciation and the total wastage is given by  $n(s - qz)r$ .

**Distributor's optimisation problem:** choose a  $z$  that will minimise IMC.

## Model (Optimal $z$ )

**Proposition 1:** Optimal  $z$  solves the following implicit equation:

$$e^{\delta z} \left( \frac{1}{\delta} - z \right) = \frac{1}{\delta} - \frac{K}{qr}$$

As,  $z \rightarrow 0$ ,  $LHS \rightarrow \frac{1}{\delta}$  but RHS remains unchanged and  $LHS = RHS$  only when  $K = 0$ .

When the distributor has infinitely many shipments, then total shipment cost will explode, unless per shipment cost is negligibly small ( $K \rightarrow 0$ ).

$K > 0 \Rightarrow$  finite number of shipments and inventory management to smooth demand

**Proposition 2:** Conditional on the volume of a shipment,  $q$ ,

- *a higher per shipment cost leads to bigger and fewer shipments,*
- *a higher unit value leads to smaller and more shipments.*



## Quality of import II

Importer's profit function:

$$\pi = mc^{\theta+1-\sigma}$$

Higher quality products also have higher price (from the literature) and in our model, generates higher profit (by construction).

In our model, it can be shown that,

$$c = re^{\frac{\delta}{n}}$$

$n$  ( $n = \frac{1}{z}$ ) is increasing in  $r$  and thus there exists an interior  $r$  that maximizes the importer's profit.

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$$\theta + 1 - \sigma > 0$$

**Proposition 3:** When *per shipment* cost rises, the importer buys a product with lower  $r$  and hence lower quality.

Higher *per shipment* cost leads to less frequent imports, which in turn leads to high volume of imports and that in turn leads to bigger fraction of the shipment being lost due to depreciation.

# Estimation

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## Way forward ...

One of the features of the TRAINS database is that it does not give information regarding the implementation of the NTMs.

Implementation information will give us a sense of whether the costs of compliance take the form of an ad valorem, *per shipment* or fixed cost.

We will identify the NTMs imposed by India and then work with officials in the ministry of trade to document exactly how they are implemented.

## Way forward ...

We are planning to use UNCTAD's TRAINS database and Indian trade data to estimate the fraction of NTMs that create trade costs that are *per shipment* in nature.

We also plan to calibrate our model to quantify the effects of changing how these NTMs are enforced so that they do not create *per shipment* cost.

# Conclusion

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# Conclusion

NTMs have slowly taken the limelight from tariffs, when it comes to trade barriers.

Recent trade agreements, such as the Comprehensive and Progressive Agreement for Trans-pacific Partnership focus entirely on NTMs.

But, the enforcement of NTMs have received much less attention.

Our paper argues that the implementation has important consequences for trade, productivity and welfare, more than we have realised.

**Thank you!**