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ẢNH HƯỞNG CỦA CÁC BIỆN PHÁP PHI THUẾ QUAN ĐỐI VỚI NGÀNH NÔNG SẢN: TỔNG QUAN LÝ THUYẾT

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Tóm tắt

Các biện pháp phi thuế quan (NTM) đã trở thành một vấn đề phức tạp trong thương mại quốc tế trong những năm gần đây do tác động của nó rất rộng và khó định lượng. Sự phức tạp của các NTM đã thúc đẩy nhiều nhà nghiên cứu nhiều hướng tác động của các biện pháp này. Nông sản là một trong những ngành chịu ảnh hưởng của các NTM. Bài báo này xem xét các nghiên cứu từ năm 2001 đến năm 2021 về tác động của các NTM đến ngành nông sản, chủ yếu là SPS, TBT và các biện pháp khác (không tính các biện pháp phòng vệ thương mại). Nghiên cứu cho thấy rằng các NTM có thể vừa tạo thuận lợi cho thương mại vừa có thể cản trở thương mại. Các NTM có tác động không đồng nhất ở cấp độ doanh nghiệp tùy thuộc vào quy mô doanh nghiệp, loại sản phẩm và quốc gia đặt trụ sở. Với sự hội nhập ngày càng sâu rộng của thương mại quốc tế, sự hài hòa và công nhận lẫn nhau về các NTM sẽ trở nên phổ biến với kỳ vọng thúc đẩy thương mại. Tuy nhiên, sự hài hòa và công nhận lẫn nhau không phải lúc nào cũng tạo thuận lợi cho thương mại, đặc biệt là ở các nước đang phát triển. Bên cạnh tác động về giá cả và số lượng, các NTM trong ngành nông sản có ý nghĩa quan trọng đối với phúc lợi và thị trường lao động. Các NTM hướng đến phát triển bền vững mang lại lợi ích phúc lợi cho các nước nhập khẩu bằng cách tăng thặng dư tiêu dùng. Về mặt thị trường lao động, tác động của các NTM là khác nhau tùy thuộc vào bối cảnh của các quốc gia. Cuối cùng, bài viết đề xuất các hướng nghiên cứu khác về đánh giá tác động của các NTM trong thương mại nông sản.

Từ khóa: Biện pháp phi thuế quan, Biện pháp kỹ thuật, SPS, TBT, Nông sản, Ảnh hưởng thương mại, Ảnh hưởng phúc lợi, Lợi ích người tiêu dùng.

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THE EFFECTS OF NON-TARIFF MEASURES ON AGRI-FOOD: A SYSTEMATIC LITERATURE REVIEW

Abstract

Non-tariff measures (NTMs) have become a complicated issue in international trade in recent years as its effects are broad and difficult to quantify. The complexity of NTMs has prompted many researchers to investigate their effects from many aspects. Agri-food sector is one of the most – affected sectors under the implementation of NTMs. This paper examines studies from 2001 to 2021 on the effects of NTMs in agri-food sectors, primarily SPS, TBT, and other measures rather than trade remedies. Our investigation shows that NTMs have mixed effects on trade, depending on product-specific, country-specific, and measure-specific. NTMs can both trade-facilitating and trade-hampering. NTMs have heterogeneous effects at the firm level depending on firm size, type of product, and country located. With the increased integration of international trade, harmonisation and mutual recognition of NTMs become popular with the expectation to boost trade. In the agri-food sector, harmonisation and mutual recognition of NTMs do not always facilitate trade, especially in developing countries. Besides the effect on price and quantity, NTMs in agri-food have important implications for welfare and the labour market. Stringent NTMs bring welfare gain for import countries by increasing consumer surplus. In terms of the labour market, the effects of NTMs are different depending on countries context. Based on the investigation of previous studies, we propose future research direction in assessing the effects of NTMs in the agri-food trade.

Keywords: Non – tariff measures, technical measures, SPS, TBT, agri-food, trade effects, welfare effects, consumer surplus.

1. Introduction

In recent years, with the increase of FTAs between countries, tariffs are declining in their impacts on international trade, which leads to non-tariff measures (NTMs) growing both in quantity and importance in determining global trade. Generally, NTMs aim to reduce the impact of market failures, such as consumer safety hazards, plant and animal health or environmental protection. These standards and measures increase production cost, as manufacturers have to modify their products, which can either bring about trade-enhancing effect by declining information asymmetry or trade-impeding effect through high compliance cost and increased prices. It is noticeable that impacts of NTMs vary among different developing levels and firm levels. Market access barriers applied to lower-income countries are 3-4 times as high as that of middle and high-income ones, who face relatively low trade barriers (Hoekman & Nicita, 2011). On the firm level, trade effects of regulatory standards are found to vary across different-sized firms. NTMs reinforce the market power of surviving exporting firms and are detrimental to smaller ones (Curzi et al., 2020). Larger firms also have a higher chance to join the export market and suffer less significant effects of SPS measures (Fontagné et al., 2015). Besides, NTMs can also lead to an increase in both domestic and international welfare in most cases. Domestic consumers benefit from the decrease in the cost of ignorance that surpasses the negative results from the price increase linked to NTMs. Moreover, as the foreign producers' losses are compensated by domestic welfare, it leads to an increase in international welfare (Disdier & Marette, 2010).

NTMs effect varies among sectors, less applied in some products or greatly found in others with agri-food products represent the latter case. The agri-food sector has shown promising growth in trade value at a global level from 1995 to 2015 (Santeramo et al., 2019c). Especially, developing countries with growing economies often have a comparative advantage over agri-food products. However, this sector is the most affected sector by NTMs, with roughly 60% of products affected by technical measures, while the number for quantity control measures is 45% (Niu et al., 2018). NTMs remain significantly high, with SPS and TBT measures stand out as significant impediments to agri-food trade. As a result, the trade flows of this sector are seriously impeded by increasing barriers, making trade expansion and facilitation for smaller countries even harder. Therefore, to address NTMs and minimise these obstructions on the agri-food sector, it is of utmost importance to have broad coverage research of NTMs effects from different aspects and agents.

In this study, we will give an overview of NTMs' impacts on the agri-food sector in terms of both trade and social aspects by addressing four questions: "(1) How does NTMs quantitively affect the imports and exports of agri-food? (2) Do Harmonisation and Mutual Recognition positively impact agri-food? (3) What are the other non-trade effects of these NTMs levied on agri-food products? (4) Is there any linkage between NTMs and tariffs on agri-food?". To answer these questions, we will review the evidence and gather results from different articles and reports about the impacts of NTMs on the trade of agri-food products and their welfare effects.

This paper contributes to NTM literature by giving a systematic review of pre-existing literature, which comprehensively collects what is known (theoretically and empirically) about the potential impacts of NTMs imposition on agri-food trade. The trend of increasing NTMs imposition prompted researchers to explore their impacts on trade and the direction of these impacts. However, research mainly analyses NTMs impacts under a particular scenario, but there is scanty information about an overview on the current state of NTMs; thus, a systematic literature review is essential to the orientation of future research. Our contribution, therefore, aims at providing a synthesis approach to NTMs effects in the agri-food sector. We strive to compile knowledge and research results about NTMs impacts, especially on the agri-food sector, from various sources to synthesize the most prominent findings on this topic. We extend the understanding of the NTMs impacts to different socio-economic aspects, namely trade, welfare, and employment, using macro and micro-analysis for the broadest coverage. Additionally, we indicate gaps and present potential direction as a blueprint for future research to stimulate more study into this important topic.

Our paper is organized as follows. Section 2 introduces domain-based systematic review as our methodology with a clear review process. Section 3 shows our findings of NTMs impacts on trade and non-trade aspects. Section 4 addresses research questions and gives further directions for future research. Section 5 indicates implications for policymakers and limitations of this paper.

2. Methodology

We use the systematic review to conduct this study. Basic principles of a systematic review include transparency, clarity, focus, unifies research and practitioner communities, equality, accessibility, broad coverage, and synthesis (Palmatier et al., 2018). System review papers can be broadly classified into *domain-based, theory-based,* and *method-based* (Paul & Criado, 2020). Our

paper employs the *domain – based* systematic review in which we review, synthesize, and extend a body of literature in the same domain of NTMs effects.

Domain-based review can be broken down into smaller categories, including structure review focusing primarily on used methods, theories, and constructs; framework-based, bibliometric review, Hybrid – Narrative to search for future research agenda, Review aiming for theory development (Palmatier et al., 2018; Paul & Criado, 2020). We follow the structure-review process in which the procedure is structured scientifically and specifically based on widely used methods on NTMs effects (an overview), theories applied to NTMs research, and current results derived from those articles.

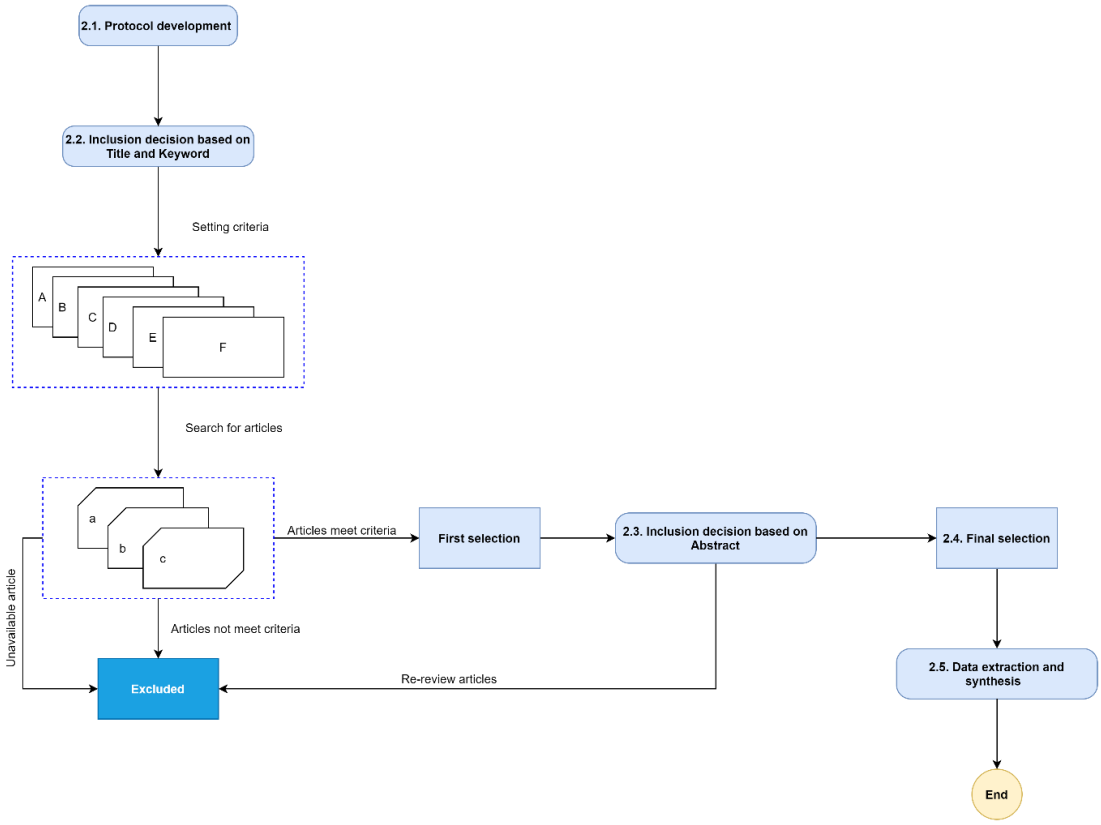

Figure 1. Steps of conducting systematic review

Source: Authors' elaboration

2.1. Protocol development

In the first stage, we develop a set of criteria for searching for articles to review. The following steps illustrate the protocol development:

- Database: ***Science Direct, Sage, Emerald Insight, Proquest, Elsevier, Wiley Online Library, UNCTAD Library*** are online databases that were used for searching articles ranging from 2001 to 2021. A number of search strings and search terms are constructed based on the study purpose. The purpose of the study is to provide a comprehensive view of NTMs research in the agri-food sector; search terms used are "non-tariff measures", "food", "agri-food", "SPS", "TBT", "trade effects", "welfare effects". Articles must be in English only.

- Both empirical and theoretical studies are chosen to be reviewed. We aim to provide a broad view of research on NTMs, so papers that use different methods are chosen.
- Selected papers should focus on the impacts of regular NTMs, such as SPS, TBT, Pre-shipments inspection formalities. We exclude papers investigating the impacts of trade remedies on bilateral trade as the impacts of trade remedies are extremely complicated and go beyond our objectives and research scope.
- *In terms of journal articles*, we strictly choose the peer-revied journal article. Those articles have already undergone a review process of screening for quality. We can ensure the quality of those peer-review articles satisfies a certain level of conceptual and methodological rigour.
- *In terms of working papers*, we choose the credible working papers published by research institutes on NTMs, including OECD Working Paper, ERIA Discussion Paper, World Bank Policy Review. Those sources enable us to filter the quality of papers that meet a certain level of conceptual and methodological rigour.
- *In terms of reports published by UNCTAD, ITC, OECD*, we consider them as reference sources to form the background knowledge and compare findings from articles. We do not deeply review those reports but intend to put more focus on research papers.

2.2. Inclusion Decision based on Title and Keywords

The articles obtained were further screened based on their title and keywords to filter out irrelevant ones. We exclude articles not directly relate to our research field: NTMs effects on agri-food sectors. As we type keywords on the online database platform, there are numerous search results. One author is responsible for excluding those articles that do not appear to be relevant to our studies. One author screens through the abstract of excluded papers to ensure that we do not ignore the relevant papers. After this stage, we obtain 85 papers for review in the next steps.

2.3. Inclusion Decision based on Abstract and Introduction

This stage involves an in-depth reading of abstracts and an introduction to selected articles. Some articles appear to be relevant, but in-depth reading reveals its irrelevance for systematic review. Two authors are in charge of intensive abstract and introduction readings and choose the most relevant papers for detailed text analysis. One author reviews the excluded papers to ensure that we do not miss out on relevant papers. The process ends with 72 papers for further filtration, including 58 journal articles and 14 working papers.

2.4. Final selection

72 papers from stage 2.3 are undergone detailed analysis. The following tables summarize the distribution of NTMs research across years and types

Table 1. Distribution of papers in year

Year	Frequency	Journal articles	Working papers	Percentage (%)
2001	1	1	0	1.39

Year	Frequency	Journal articles	Working papers	Percentage (%)
2004	3	1	2	4.17
2006	1	1	0	1.39
2007	1	1	0	1.39
2008	3	2	1	4.17
2009	1	1	0	1.39
2010	4	3	1	5.56
2011	2	2	0	2.78
2012	4	4	0	5.56
2013	3	2	1	4.17
2014	5	4	1	6.94
2015	5	3	2	6.94
2016	3	2	1	4.17
2017	10	10	0	13.89
2018	8	6	2	11.11
2019	3	3	0	4.17
2020	13	11	2	18.06
2021	2	1	1	2.78
Total	**72**	**58**	**14**	**100**

2.5. Data extraction and synthesis

The detailed analysis of 72 articles is conducted thoroughly reading information and extracting data from articles into a spreadsheet. The spreadsheet includes the following columns: *type of papers (Journal article/Working paper), Authors, Year, Publication, Research questions, Conceptual Framework, Type of research, Model (if have), Variables (if have), Level of research* (Macro – Micro – Meso), *Region, Time frame (for data in research), Data source, Key findings, Contribution of the articles (if have), Directions for future research.* We set up the spreadsheet based on the study purpose of synthesizing the NTMs effects on the agri-food sector.

In reading articles, we focus on the results of NTMs effects on agri-food trade as it is the study focus. We "mine" the data on different aspects of trade and macroeconomic variables potentially affected by NTMs. Relevant data to research questions will be highlighted in the key findings of the spreadsheet.

In terms of methodology, we will brief the major approach to carry out the NTMs research. The methodology is also an essential aspect of conduct research on NTMs, but due to the relevance

and complexity of different methodologies in trade analysis, we will summarize the most frequently used methods according to different approaches.

3. Findings and discussion

3.1. Trade effects of Non-tariff measures

Empirical research quantified the impacts of NTMs on trade flow in two major ways by *ex-post analysis* and *ex-ante analysis.* An ex-post evaluation means backwards-looking, meaning that researchers estimate the observed impacts of NTMs on trade flows. By contrast, ex-ante projection means forward-looking or predicting but *unobserved* potential impacts of NTMs. Ex-post estimation has weaknesses as this method does not capture exports and producers' responses to NTMs changes (Korinek et al., 2008) and full margin effects of NTMs (Beghin, 2009). *Ex – ante projection* simulates the likely scenario *as if* the NTMs changes, predicting economic actors' responses to NTM changes.

Gravity model is the primary instrument for estimating the impacts of NTMs. Researchers construct the gravity model with extra variables to capture certain specificities of bilateral trade. Some forms of proxy for NTM are introduced in the model, such as *Frequency index for NTMs* (Bao & Qiu, 2010), *Dummy variables for NTMs* (de Melo & Solleder, 2020; Shepotylo, 2016), *Ad-valorem equivalent* (Disdier et al., 2008). Some articles employ the CGE model to investigate the effects of NTMs at the firm level. Several papers utilise survey to assess the impacts of trade at the micro – level.

Heckman model or Poisson pseudo maximum likelihood estimator (PPML) has been widely used in NTMs research. PPML estimator enables researchers to correct for heteroskedasticity in error terms and avoid selection bias due to the exclusion of zero trade flow (Santeramo et al., 2019).

a. Macro – analysis of NTMs effects on agri-food trade

The majority of articles investigate the impacts of NTMs on the export or import flow across sectors, such as the quantities exchanged domestically and internationally. Most studies investigated the trade effects of NTMs within the context of developed–developing countries in which developed countries are standard-setters (Disdier et al., 2008; Mendes & Luchine, 2020; Shepherd, 2020). The major themes to assess the macro impacts of NTMs can be classified into two broad categories: *quantity effect* and *price effect.*

- **Quantity effect of NTMs**

Overall, NTMs can be both trade-hindrance and trade-facilitator. In other words, whether NTMs positively or negatively affect trade varies from case to case (Grübler & Reiter, 2021). NTMs can facilitate trade by reducing information asymmetries and negative externalities, ultimately resulting in higher demand for products. The increase in compliance costs can be compensated by increased demand for those products. The study by Cadot et al. (2018) found that the demand-enhancing effect of technical measures is substantial, which means NTMs can be used to correct existing market failures. While de Melo and Solleder (2020) found that the compliance costs are too high in many cases, and increased demand cannot offset those cost rising effects, NTMs are considered "non-tariff barriers". Developing countries are considered vulnerable to the impacts of NTMs due to their comparative advantage in the traditional sectors. To be more

specific, agricultural exports, which serve as their national major exported products, are subject to more extensive effects of SPS and TBT. Santeramo et al. (2019) examined the positive or negative effects of NTMs on trades of the agri-food sector, found that NTMs can be catalysts or trade barriers: in particular, the effects are country-, product-, and measure-specific.

Many researchers found a mixed quantity effect of NTMs. Particularly, Dolabella (2018) found that TBT measures seem to be more trade-restrictive than SPS measures: additional TBT measure is associated with a 1.95% reduction in trade while new SPS can accelerate trade by 1.42%. This result aligned with the finding of Cadot et al. (2018) of higher negative impacts of TBTs on trade than SPS. Bao & Qiu (2010) used the gravity model to assess the impacts of NTMs on China's import of agricultural products at HS2 from other 43 countries, finding that a 1 unit increase in TBT will reduce agriculture imports by about 0.8%. Kareem and Rau (2018) applied the Helpman, Melitz, and Rubinstein model (hereinafter HRM model) to estimate the determinants of bilateral trade of Africa's exports of fruit and vegetable to the EU. The study found that both SPS and TBT requirements are trade-hampering, i.e., discourage fruit and vegetable exports from finding that a 1% rise in food safety regulations results in a 0.6% reduction of vegetable exports (HS2) and 4.34% in fruit exports (HS2). However, when using the same model for banana and tomatoes exports at HS06, the authors found that a 1% increase in technical measures stimulates banana exports by 7% but decreases tomatoes exports by 0.4%. In other words, it is evident that the effects of NTMs are heterogeneous, more likely to be sector-specific and measure–specific. Different types of NTMs, especially SPS and TBT, are more likely to have different effects on exports and imports. The direction of the effect also depends on the specificity of products. Particularly, TBTs can be trade-restrictive at the HS2 level but break down into sub-level, the effects are heterogenous: trade-restrictive for some products but trade-enhancing for other products. Santeramo et al. (2019) used the PPML estimator to assess to what extent the country-specific world-wine trade influences global wine imports using the gravity model. Data from 24 wine importers of the world, primarily developed countries (cover over 90% of total world wine exports), shows that country-specific NTMs, including SPS, PSI, and export-related measures, tend to facilitate trade while TBTs hinder trade in some wine sectors.

Fontagné et al. (2015) collected data on 61 product groups, including agri-food products, in 2001. Their article expanded on Moenius (2004) 's findings, claiming that non-tariff measures, such as standards, have a detrimental impact on agri-food trade but have no effect or even a beneficial impact on the majority of manufactured goods. They concluded that least developed countries (LDCs), developing countries, and OECD countries are all similarly affected throughout the whole product range, based on data from 61 exporting and 114 importing countries. Non-tariff measures, on the other hand, tend to assist OECD agri-food exporters at the expense of exporters from other developing countries and LDCs. Disdier et al. (2008) investigated 690 agri-food items, evaluate the trade effect of standards and other non-tariff measures (HS6-digit level). Their statistics covered bilateral trade between the OECD as importers and 114 additional nations as exporters in 2004. When they looked at different sets of exporting nations, they found that TBT has no effect on OECD exporters' exports to other OECD countries, but it has a negative and considerable impact on developing countries' and LDCs' exports.

- **Price effect of NTMs**

Trade effects of NTMs have been quantified through the application of AVEs. AVEs measure the price effect between with and without NTMs. Using AVEs illustrates better how restrictive in terms of costs that NTMs are and helps to detect which types of NTMs are most trade–restrictive. Overall, most NTMs positively affect prices, and SPS measures are more likely to have the highest price–rising effects. Cadot and Gourdon (2014) used panel regressions on 1,260 country–product pairs, highlight that SPS has the highest AVEs of 14%. It means that SPS triggers a 14% increase in the price of African foodstuff, especially in rice, cereal, meat and edible oils. Effects of TBTs and PSI & formalities are insignificant to the foodstuff price. For ASEAN countries, SPS measures tend to have a substantial price–raising effect on animals and vegetables (21 – 23%), and beverages (59%) (Cadot et al., 2013). Cadot et al. (2018) calculated the bilateral AVE if NTMs, they found that on the same market, the impact of NTMs on bilateral trade unit value (and trade flows) are likely to vary across exporting countries due to compliance costs and other importing, exporting country specificities (including regulatory distance). AVEs of NTMs imposed by OECD countries is higher than that of those they face.

It should be noted that higher AVEs do not always indicate more severe economic welfare impacts — in fact, the opposite interpretation is also plausible: High AVEs means that manufacturers must change the design of their products significantly or improve their quality, implying that the uncontrolled market equilibrium may be far from the societal optimum. This is especially true in the case of agri-food products, especially live animals, where consumer safety risks are arguably considerable. Estimations by Cadot and Gourdon, (2016); Cadot et al. (2018) showed that in terms of the size of the estimated AVEs and their relative importance across products, with agri-food products being the most regulated.

Notably, many NTMs are protectionism–oriented, meaning that they are created to protect the domestic industries, but it's challenging to detect whether NTMs are protectionism or not. Kareem et al. (2017) tried to answer the question of whether NTMs is protecting customer health or protecting imports using evidence from the EU, they found that EU pesticide standards on tomatoes are actually protectionist. However for oranges, and limes and lemons, little evidence shows protectionist tendency. Tomatoes represent a relatively less import-dependent product; meanwhile, oranges, limes, and lemons are heavily import-dependent products. It can be concluded that protectionism depends on the dependence on imports and is very much product specific.

Overall, NTMs have mixed effects on the exports and imports of agri-food. There is no generalisation of whether NTMs positively or negatively impact bilateral trade. Effects of NTMs are more likely to be product-specific and country-specific, meaning that it depends on each type of product and each country. Even for the same NTMs in agri-food, impacts of NTMs on products at the HS6 level are totally different from the NTMs impacts at the HS2 level. In developed countries, NTMs are more likely to boost trade as it helps increase product quality significantly. Meanwhile, NTMs tend to have different effects in each scenario in developing countries, depending largely on how stringent NTMs are.

b. Micro – analysis of NTMs effects on agri-food trade

The precise impact of NTMs requires more disaggregated information, not only at the sectoral level but also at the firm level. The heterogeneous effects of NTMs on firm-level are evident in

many articles, including the extensive margin of trade (the probability of export) and intensive margin of trade (the volume of trade per firm). Studies focus on the most stringent NTMs related to special trade concerns (STCs). At the firm level of agri-food, many articles focus on firms exporting from developing countries as agri-food exports are their comparative advantages. In terms of methodology, the quantitative method with regression model is utilised in most particles.

Most studies examine the impacts of NTMs on a wide range of firms across different sectors rather than focus on a specific sector such as agri-food. There are heterogeneous effects of NTMs associated with firm size and its responses. Firm heterogeneity trade models suggest that the extent to which an SPS measure affects export performance may depend on its size unless size is associated with productivity or the ability to cover additional costs to export (Melitz, 2003). There is no denying that trade barriers and high costs always go hand in hand; hence, only productive firms can survive, and the least productive firms may fail to handle these costs incurred and are forced to leave the export market (Melitz & Ottaviano, 2008), which decreases competition among firms in the export market. Large firms stand a higher chance of joining the export market, and the larger the firm size and their number of destinations or trading partners, the less significant the effect of SPS measures (Fontagné et al., 2015).

- **Impacts of NTMs regarding the firm's size**

Papers focusing on specific impacts of NTMs on exporters on agri-food sectors have similar results. Curzi et al. (2020) used firm-level customs data from 2000 to 2014 to examine the trade and economic effects of NTMs on agri-food exports from Peru. Results show that NTMs affect the agri-food exports heterogeneously depending on the restrictiveness of NTMs and firm size and align firm heterogeneous trade models.

Fernandes et al. (2019) assessed the impacts of pesticide standards for 243 agri-food products from 63 importing countries from 2006 to 2012. The result also confirms the heterogeneous effects of NTMs on agri-food exports, i.e., smaller firms are more vulnerable to strict standards. One interesting finding is that positive network effects of exporters from the same country can reduce the negative impacts of NTMs. The data also shows that more restrictive standards in the importing country decrease the likelihood that a firm from an exporting country with tighter standards enters the market.

Fugazza et al. (2018) investigated the impacts of market-access barriers in Latin America on Peruvian exporters from 2000 to 2014. The results support the heterogeneous effects of NTMs, in which smaller firms are more likely to suffer adverse effects than larger exporters. Additionally, a decline in tariff or tariff liberalisation causes large firms' dwindling market power, but a simultaneous increase in NTMs enables their power to be restored. Notably, the evidence even confirms that very large exporters tend to benefit from impositions of strict NTMs in destination countries (Fugazza et al., 2018). To put it simply, the proliferation of trade protectionism may offer large firms opportunities to gain more market power, which is likely to ultimately bring about a higher concentration level in the export market in the rest of the world.

- **NTMs impact on the trade margins**

Another point to note is that NTMs exert their influence on the trade margins, namely the extensive margin and the intensive margins. Studies into NTMs impacts on the intensive and

extensive margins of seafood exports confirms a difference in impacts of SPS and TBTs. SPS increases exports at the extensive margin and reduces exports at the intensive margin, whereas the opposite is true for TBTs (Fontagné & Orefice, 2018; Fugazza et al., 2018; Shepotylo, 2016). A possible explanation is that SPS measures are positively associated with consumers' demand for seafood and a rise in variable production cost, but TBT measures mainly increase the fixed cost of production.

However, research shows that SPS standards negatively impact both firms' entry to new foreign markets or the extensive margin of firm exports because small firms leave the market with size being a proxy for productivity. SPS also negatively affects the intensive margin of firm exports, evidenced by an 18% reduction in export value (Fernandes et al., 2019). The authors highly recommend that agricultural exporters in developing countries need governmental support such as the provision of testing facilities and essential inputs and streamlined custom clearance procedures to meet foreign standards. Strict standards give rise to the price but sharply reduce the quantity imported, ultimately resulting in negative impacts on export values. Not all NTMs hinder market access for agri-food exports. Only the most stringent NTMs targeted by STCs negatively impact both extensive and intensive margins of trade. Meanwhile, regular SPS and TBT measures increase market access for Peruvian firms (Curzi et al., 2020). Kareem et al. (2017) found that given the extensive margin of export, standards enhance fish trade, while in terms of the intensive margin, food safety regulations act as a barrier to the flow of fish into the market. Interestingly, whether a country supports existing export firms or increases the number of exporters is likely to impact compliance with food regulations at each export margin (Neeliah et al., 2013).

Findings of NTMs effect at the firm level in agri-food sectors support the theory of heterogeneous firms. At the firm level, SPS and TBT are the most affected measures on firms' cost structure. Those types of measures are primarily found to impact both extensive and intensive margin of trade negatively. However, we find little evidence of how firms in agri-food exports are affected by NTMs compared to other sectors.

3.2. Impacts of NTMs harmonisation and mutual recognition

Some trade agreements include the provision of trade harmonisation and mutual recognition on NTMs, meaning that NTMs are not necessarily substituted for tariffs. The effects of NTMs harmonisation are complex: the distribution of benefits from NTMs harmonisation among country members are heterogeneous. NTMs harmonisation is expected to boost trade among RTA members. Few articles investigate the impacts of NTMs harmonisation on agri-food under RTA as the trade agreements provide a guideline for NTMs harmonisation rather than specific sets of NTMs for sectors. The effects are analysed on large scales, i.e., across various sectors rather than on specific sectors like agriculture and food. In terms of standard harmonisation and mutual agreement, the manufacturing sector is investigated much more than the agri-food sector (Chen & Mattoo, 2008; Cheong, 2017).

Chen and Mattoo (2008) found that harmonisation agreements increase trade among agreement members but not with other countries outside the agreement. Harmonisation benefits exports from developed countries but hampers trade from developing countries. The result implies that standard harmonisation does have a heterogenous effect on country members.

Disdier et al. (2015) used data from CEPII and ran econometric models to investigate the quantity effect of TBT provision under North-South RTAs. The study was conducted on overall bilateral trade flow, and the result implies that harmonisation on RTA could lock countries into RTA and reinforces hub-and-spoke trade structure. In other words, harmonisation in RTA can negatively impact country members' integration into world economies. However, the results are not evident for sectoral trade, especially for agri-food trade.

Jensen & Keyser (2012) investigated the East African Dairy Industry case in which the government harmonises the domestic and regional standards with the international equivalent. Harmonisation to international standards attempts to reduce the cross–border costs and procedures for dairy exports. However, in the case of East African countries, harmonisation to international standards significantly hampers trade and becomes "non – tariff barriers" for small farmers in East African countries. The new international standards trigger the higher price for dairy products and severely impacts poor consumers in African countries.

Overall, we found very little evidence of research on NTMs harmonisation and mutual recognition on agri-food sectors in order to generalise the impacts of NTMs harmonisation and mutual recognition on agri-food. Theoretically, NTMs harmonisation and mutual recognition can boost trade among member countries to reduce compliance costs. However, the change in compliance costs to the new NTMs system is heterogeneous among countries. NTMs harmonisation and mutual recognition can benefit countries that already have high-standard NTMs but might hinder trade in countries that have already low-standard NTMs. NTMs harmonisation would be "in between" countries, making the less–developing countries struggle to comply with general standards. However, this hypothesis derived from the theory needs to be tested under empirical data.

3.3. Linkage between NTMs and tariffs

With the increasing number of free trade agreements and regional trade agreements, some studies investigate the effects of NTMs under regional trade agreements. As tariff is no longer a protective measure to shield the domestic industry, NTMs can substitute the tariffs to offset the tariff cuts. Tudela-Marco et al. (2014), when examining the policy substitution in agricultural trade between tariff and non-tariff measures using evidence from 4 southern Mediterranean countries, found that NTMs substitute tariffs in four countries of the sample. Beverelli et al. (2019) studied the extent to which NTMs are substituted for tariff only. The NTMs that constitute actual trade restrictions/standardisation process found empirical evidence to infer that policy substitution holds only for OECD countries policy substitution occurs in developed countries, but not in developing ones.

Some studies even include the comparison between NTMs and tariff impacts on bilateral trade. Devadason et al. (2018) examined the impacts of NTMs for the food sector in Malaysia on imports from ASEAN countries. Authors found that NTMs are more trade-restrictive than tariffs on food imports. Niu2018) found that NTMs are substitutes for tariffs in China, using the database from 1997 to 2015, and that protection from NTMs is shown to be consistently high within the agricultural sector. The AVEs of NTMs were generally increased from 1997 to 2015, especially for sectors with high tariff cuts like animals and vegetables. The levels of the AVEs of NTMs are two to three times higher than tariffs in APEC economies in general (Kawasaki, 2015).

Overall, it does not have a clear cut whether NTMs are substitutes or complementary for tariffs. The relationship between the two types of trade measures depends on the country's objective on trade. Our selected articles do confirm that there is a relationship between NTMs and tariffs.

3.4. Beyond trade effects of Non – tariff measures

Non – tariff measures are associate with more complicated effects than tariffs do. Initially, NTMs were created to support non-trade purposes, such as protecting human health and the environment and ensuring national security. Hence, the effects of NTMs go beyond the impacts on quantity exports or imports. For example, NTMs can increase the national welfare of importing countries by improving the product quality, reducing asymmetric information, reducing the mortality rate (Disdier & Fugazza, 2020). Especially for agri-food products that directly impact consumers' health, NTMs effects on welfare are worth considering. However, welfare is an abstract term, consequently measuring or choosing a proxy for welfare is extremely difficult.

Besides the welfare effects, some articles investigate the impacts of NTMs on employment in exporting countries and living standards changes regarding the imposition of NTMs. Overall, the number of articles that examine the non-trade effects of NTMs are still very limited.

a. Welfare analysis of NTMs

Conceptually, the welfare effects of NTMs are assessed through the supply and demand schedule. Articles examine the effects of the most stringent NTMs on agri-food products, especially the maximum residual limit (MRL). The welfare analysis of NTMs imposition can be both ex-ante and ex-post. *Ex-ante projection* simulates the scenario after and before the imposition of the regulation. Some articles use *ex-post analysis* to assess the effectiveness of measures.

- **Supply and demand approach**

Fugazza (2013) proposed the supply-demand schedule to assess the welfare impacts of NTMs. Harm linked to foreign products is not internalised in supply-demand schedule but considered in welfare calculation. The graph below explains the change in welfare due to the imposition of stringent NTMs. New regulations reduce the foreign supply from S_F to S'_F. Notably, regulation of unhealthy products changes the supply elasticity. NTMs cause cost–raising effects from P_A to P'_A, but reduce the damage for society from damA to damA'.

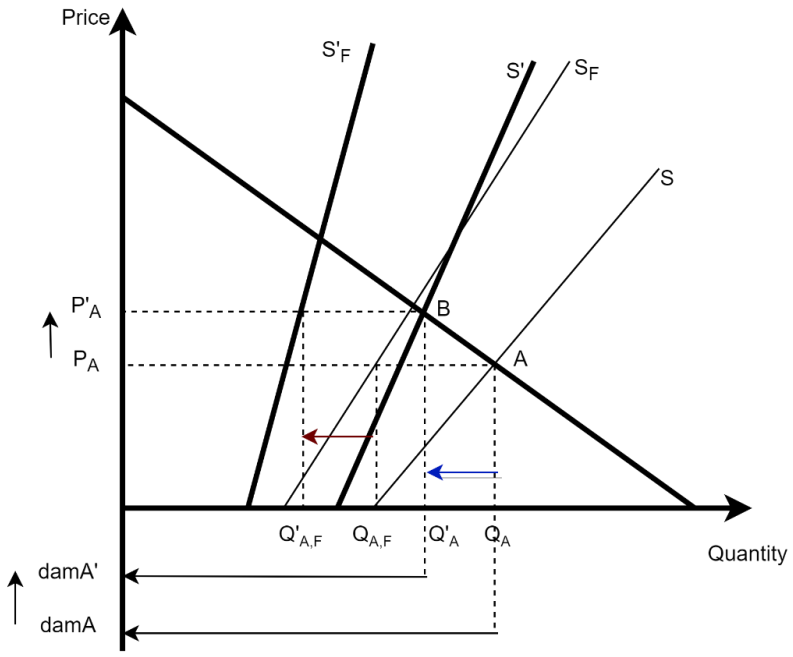

Figure 2. Graphical analysis of welfare impacts of NTMs

Source: Fugazza (2013)

Applying this concept of demand – supply schedule, Lusk Anderson (2004) examined the impact of country–of–origin labelling (COOL) on meat producers and consumers using ex-ante projection. The authors stimulated a partial equilibrium displacement model that links consumption in the meat industry. The result shows that the welfare impacts of COOL will vary significantly regarding how the standards are implemented. In particular, if the implementation costs are significant to marketers, consumers suffer substantial welfare losses due to high prices while meat producer surplus is marginally affected. By contrast, if COOL implementation targets on meet producers, both producer and consumer surplus shrink considerably. The supply and demand approach was also used by Peterson and Orden (2006) to evaluate the impacts of the US standard regime on fresh Mexican Hass avocado imported from Mexico. The authors simulate three scenarios for mitigating pest risk. Eliminating seasonal and geographical restrictions on Mexican avocadoes leads to low pest risks for US producers, resulting in $72 million welfare gains. Welfare gain comes from lower avocado prices and higher consumption. Relaxing pest risk compliance opens markets for Mexican avocado import, reducing the compliance costs for Mexican producers by half but result in smaller welfare gains for the US.

- **Cost – benefit analysis**

The cost – benefit analysis (CBA) approach was applied in very few studies investigating the welfare effect of NTMs. Van Tongeren et al. (2010) used CBA to examine the welfare effect of border measures on importing shrimp by three Asian shrimp exporters: Thai Lan, India, Viet Nam. Authors assess 4 scenarios: (1) no improvement in current production process, (2) import ban by OECD countries if antibiotics are found on shrimp, (3) improved production methods through better management practices, and (4) both better management practices and production of a more

disease-resistant shrimp variety. The result shows that the imposition of strict NTMs directs the major Asian exporters to change the product practices to comply with new NTMs.

Beghin et al. (2012) assessed the impacts of NTMs, i.e., SPS and TBT, on trade and welfare in the context of market imperfections. Authors apply the cost-benefit framework to evaluate the impacts of shrimp regulatory standards, finding that enforcement of a food safety standard can be socially favorable to the status-quo situation, both domestically and internationally.

- **Maximum residual limit (MRL) approach**

Maximum residual limit is included in some articles that evaluate the welfare effects of NTMs on agri-food. This sector closely links to pesticide or fertiliser use, as well as some antibiotic substances that directly threaten consumer health. Many countries implement MRL regulations for agri-food products, especially in developed countries in the EU.

Disdier and Marette (2010) used the gravity model and experimentation results to anticipate the market reactions of NTMs change. The authors assumed the product is homogeneous except for a given characteristic, i.e., the chloramphenicol residues. Results show that NTMs aim to eliminate unsafe products from exporting countries while domestic firms were not affected. Authors calculate domestic consumer surplus, domestic producer profits and foreign profits, and it is evident that consumer surplus increases as the MRL standards are implemented.

Ronen (2017) evaluated the welfare impacts of TBT and SPS measures on virgin olive oil imports. Using an econometric model, the author finds that SPS related to MRL requirement improve welfare in which it reduces the possibility of hazardous products and improves the information quality. As a result, MRL-related measures significantly improve exports by increasing consumer demand for virgin olive oil.

Otsuki et al. (2001) used trade and regulatory data for 15 European countries and 9 African exporters from 1989 to 1998 to evaluate the impacts of new aflatoxin standards. Products examined in the paper include cereals, fruits, nuts, and vegetables. Using the econometric model, the authors found that a 1% decrease in the maximum level of aflatoxin results in a 1.1% reduction in the trade flow of cereals, 0.43% for fruits, nuts, and vegetables. After simulating 3 scenarios – (1) pre harmonisation standard, (2) applying international standard indicated by Codex guideline, (3) new EU standard implementation, the results show that although new NTMs have adverse impacts on African exports, which reduce the export by 64% or equivalent to $670 million, it helps to save 1.4 deaths per billion a year.

The majority of approaches focus more on consumer surplus from implementing strict NTMs regulations. Stringent NTMs do have positive welfare effects on importing countries in which they reduce asymmetric information and improve product quality. Domestic producers also benefit from the imposition of stringent NTMs in which they can increase the domestic market share when only a small volume of like-products are imported. Notably, most articles found that strict NTMs associated with human health result in significant reduction in the trade volume. This result supports the objective of the importing country when imposing strict NTMs, primarily discouraging imports or requiring producers to improve their products. Stringent NTMs have a positive demand effect in which the demand for products increases substantially, showing the confidence of consumers in consuming high-quality products. Still, the benefits of stringent NTMs

are found in developed countries where they are standard setters. One reason underlying this choice of research direction is that consumers in developed countries are more concerned about product standards than those are in developing countries. Product standards are more transparent and accessible in developed countries than in developing countries, making the data collection process more accessible and more sufficient.

b. NTMs effects on the labour market and standards of livings

Some articles assess the impacts of NTMs on employment and household incomes. Articles primarily conduct on developing countries where the agri-food sector comprises a significant share in total labour.

Maertens and Swinnen (2009) investigated one aspect of welfare effects of NTMs, i.e., poverty. The authors assessed the impacts of EU measures (SPS) on fresh fruits and vegetable employment and poverty in Senegal. Agri-food exports from Senegal to the EU have grown substantially since 1991. Using company household surveys and data, the result shows the positive impacts of NTMs in changing the labour structure in Senegal: a significant shift from contract farming with small house farms to large-scale integrated farms. Poorer households are not excluded: they involve in a high-standard export supply chain, ultimately accounting for a higher share of gains from trade. High-standards agricultural trade benefits rural incomes and reduces poverty even if the export industry consolidates and exports are realised on industrial estate farms.

Porto (2018) examined the labor market effects of NTMs in Latin America. Authors simulate two scenarios when the countries lift their NTMs on food and beverage sectors, and the rest of the world lifts NTMs on the country's food and beverage sectors. Overall, when the rest of the world lowers its NTMs, the real income of workers in food and beverage sectors in Latin American countries increases, but this increase is heterogeneous among countries.

Yew et al. (2020) used the CGE model to investigate the effect of NTMs on employment in the food processing sector of Malaysia. Two scenarios are created to assess the impacts of NTMs change: the first scenario is a 10% reduction in AVE of NTM foods (MS), and the second scenario is a 50% reduction in AVE of NTMs foods (AS). Overall, the impacts of NTM reduction are favorable for employment in the short term (1.1% increase in employment under MS and 1.4% increase under AS) and long terms (14% increase in employment for both scenarios). However, the policy changes benefit the skilled and semi-skilled labor while hurt unskilled labor. Moreover, the effect of NTMs reduction depending on whether products are export or import intensive. Export–intensive product manufacturing benefits from these NTM changes while import–intensive product manufacturing is adversely affected.

Kareem and Kareem (2020) assessed the gender implication of EU food safety regulations on the agricultural labor market between 1995 and 2012 in 90 developing countries. Women comprise the majority share of the labor force in the agriculture sector in developing countries. Finding shows that women's employment and the imposition of SPS and TBT measures are negatively correlated: a 10% increase in EU measures results in a 3.7% reduction in female employment in agriculture sectors. This result can be explained as the gender segregation in training with a preference for men. In developing countries, men are more likely to have higher accessibility to education and technical training than women. Complying with those standards is more suitable for men in developing countries, ultimately resulting in the redundancy of women.

The effects of NTMs on the labour market often assess using AVEs. By transforming into AVEs, researchers can evaluate the NTMs impacts relatively similarly to tariff effects. However, the AVEs calculation does not always sufficiently capture the actual impacts of NTMs on household living or employment. In our selected papers, the impacts of NTMs on employment in agri-food sectors are conducted in developing countries where agri-food export constitutes a large share of the total labour force.

4. Future research direction

After synthesising a wide range of papers on NTMs research, some possible directions for future research on the effects of NTMs in the agri-food sectors are proposed.

4.1 Assessing trade effects of NTMs

Numerous papers examine the trade effects of NTMs imposition by developed countries on exports of developing countries. One reason that still few articles study the trade effects of NTMs between developing countries is the difficulty in data collection as those developing countries update their notification infrequently and also shows low transparency in NTMs.

Future research regarding the sectoral effects of NTMs can investigate more closely at the product level in agri-food sectors of trade between developing countries. Recent improvements in the NTMs database of UNCTAD have enabled researchers to collect sufficiently large data for NTMs.

There is still limited research on NTMs effects at the firm level, especially for firms in agri-food sectors. Major exporters of agri-food products are developing countries in which exporting companies are often SMEs (Small and Medium Size Enterprise). Hence, the effects of NTMs on their export decision and cost structure are worth considering. Still, collecting data at firm levels in developing countries faced some difficulties as the customs and firm level information system is not transparent and accurate enough for the data. As agri-food exports play important roles in developing countries, examining the effects of NTMs at the firm level is crucial for policymakers.

4.2 Harmonisation and Mutual Recognition on NTMs

Future research can dig into other aspects of the macro analysis of NTM effects on trade. As we analysed before, very few articles examine the impacts of NTMs harmonisation and mutual agreements on agri-food sectors. One plausible reason is that the data available for NTMs harmonisation and mutual recognition is limited and insufficient.

Future research can use *ex-ante* approaches to evaluate the effect of harmonisation and mutual recognition on NTMs in various regions. By simulating scenarios of changes in the NTMs system, researchers can produce insightful policy implications. In the context of the increased number of RTA and FTA with provision to NTMs, assessing those effects have brings valuable findings for policymakers in setting NTMs standards at home countries, especially those developing countries whose comparative advantage in the agri-food sector.

Under the context of RTAs, Rule of origin (RoO) is an import NTM that exporting firms face. Complying with RoO enables firms to get preferential tariffs in the destination markets. RoO has a close linkage to tariffs and affects the cost structures of exporting firms. Still, fewer articles

mention the effects of RoO on agri-food bilateral trade, even though this NTM significantly causes concerns of exporting firms.

4.3 Linkage between NTMs and tariffs on agri-food

Our selected research has confirmed the linkage between NTMs and tariffs on agri-food. However, those linkages are still subtle and require more research to map out the trend of interchangeably using tariff and NTMs. Future research can compare the use of NTMs and tariffs of one country using panel data to determine whether participating in FTA or RTA changes the trade policy priorities of the countries. Research on trends of using NTMs and tariffs for a group of countries or regions are also favourable.

4.4 Non-trade effects of these NTMs levied on agri-food products

Few papers assess NTMs' effects on the welfare of developing countries. Our selected articles are more concerned with the welfare effect in developed countries that are standard setters and the importers of agri-food products. Assessing other effects of NTMs rather than quantity and price effects is crucial as welfare impacts are the target of designing NTMs. Future research should focus on the specific linkage between strict NTMs and mortality rate or the incidence of some dangerous diseases in importing countries. To conduct that research requires both trade analysis knowledge and immunology knowledge.

Labour impacts of NTMs is also an interesting aspect to investigate, but the number of articles is limited. Our investigation has found new aspects for assessing labour effects, i.e., from a gender perspective. The agri-food sector in developing countries is the biggest employer of female labour, and changes in NTMs significantly have effects on female's employment and other gender-related issues.

5. Implications for policymakers and limitations

This research has important implications for policymakers in developing countries whose agri-food sector is the comparative advantage. NTMs imposed by developed countries have heterogeneous effects on developing countries, and they are often negative. Besides, from different cases of harmonisation and mutual recognition of NTMs, policymakers must take careful steps when implementing or negotiating those provisions on the trade agreement. Harmonisation and mutual recognition of NTMs do not produce favourable results in all cases as it depends on the development status of countries. Moreover, policymakers should consider the welfare impacts of NTMs regarding consumer health. Those aspects are relevant to developing countries whose NTMs system lacks transparency and is less concerned about product quality. This paper aims to provide a comprehensive map for policymakers to understand the various aspects of NTMs effects, not restricted to quantity or price effects.

This research has some limitations in which we do not cover in detail the methodology, including the theory and model used for NTMs analysis. Trade theories and model explanations are extremely complicated, including many mathematical equations. Hence, we would prefer to leave this part in a separate paper to reduce the complexity and ambiguity of our studies.

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