# "EFFECT OF NON-TARIFF BARRIERS ON EXPORTS – A THEORETICAL STUDY"

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**“EFFECT OF NON-TARIFF BARRIERS ON EXPORTS – ATHEORETICAL STUDY”**

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1.

CERTIFICATE

CERTIFIED that the work incorporated in this thesis titled “Effect of Non-Tariff Barriers on Exports –a Theoretical Study” submitted by Atreyee Sinha Chakraborty was carried out by candidate underour supervision. It is an original contribution and has not been submitted elsewhere for the award of any other degree. Materials obtained from other sources have been duly acknowledged in thisthesis.

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## DECLARATION BY THE CANDIDATE

I, Atreyee Sinha Chakraborty, hereby declare that this thesis on the topic titled *"Effect of Non-Tariff Barriers on Exports –a Theoretical Study"* is submitted for the awardof Degree of Doctor of Philosophy in Economics to the Gokhale Institute of Politics and Economics, Pune, 411004. It is an original contribution and has been completed during my tenure as a research scholar at Gokhale Institute of Politics and Economics, Pune.

This thesishas not been submitted by me elsewhere for the award of any degree or diploma-part or full. The information gathered by me elsewhere for the thesis is original, true and factual. Materials obtained from other sources have been duly acknowledged in the thesis. I hereby request, to consider the thesis for the award of the degree of 'Doctor of Philosophy'.

**Atreyee Sinha Chakraborty**

August, 2015

***Dedicated to my***
***Parents***

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# Chapter – 1: Introduction

Robert Baldwin points out as early as in 1970, **"The lowering of tariffs has, in effect, been like draining a swamp. The lower water levelhas revealed all the snags and stumps of non-tariff barriers that still have to be clearedaway."** With tariff barriers becoming increasingly less important, differences innational regulatory regimes are becoming ever more visible. These regulatory regimesinclude areas as varied as government procurement rules, inward foreign investment,competition policy, labor standards and environmental norms as well as productstandards and technical regulations .The ability to gain market access depends increasingly on compliance with trade regulatory measures that are beyond the realm of traditional trade policies. Although traditional trade policiessuch as tariffs and quotas no longer have a significant impact on restricting market access as they have been progressively liberalized, first under the auspices of the GeneralAgreement on Tariffs and Trade (GATT)/World Trade Organization (WTO) and subsequently in the context ofregional and bilateral preferential trade agreements but the fact that tariff liberalization alonehas generally proven unsuccessful in providing genuine market access has drawn further attention to non-tariffmeasures (NTMs) as major determinants in restricting market access.Non-tariff measures include a very diverse array of policies that countries apply to imported and exportedgoods. Some NTMs are manifestly employed as instruments of commercial policy (e.g. quotas, subsidies, tradedefense measures and export restrictions), while others stem from non-trade policy objectives (e.g. Sanitary and Phitosanitary (SPS) measures and Technical Barriers to Trade (TBT)measures). The latter often serve a legitimate purpose as they are put in place for valid concerns such asfood safety and environmental protection.A growing number of public

standards are being introduced globally, in a broadrange and rich variety of areas, includingnutrition (e.g. low fat), health (e.g. lowlead or pesticide residue), safety (e.g. no small toy parts, equipment safety measures),environment (e.g. organic, no genetically modified organisms, low carbondioxide emission) and social concerns (e.g. no child labor).[1] The bulk of these regulations are grouped in two major categories, namely SPS measures and TBTs. The former includes regulations and restrictions to protect human, animal or plant life or health, while the latter addresses all other technical regulations, standards and procedures. Independently from their objective and legal framework, SPS measures and TBTs can have important effects on international trade. Richard Baldwin (2000) points out those TBTs have been the main concern of the EU as far as trade barriers are concerned ever since the abolishment of all internal tariffs in 1973. In the context of trade talks betweenthe EU and ASEAN, Pascal Lamy expressed the belief that harmonizing standards and rules in areas such as safety, health or consumer protection rather than abolishing tariffs and quotas, were **"the real 21st century trade issues"**.[2]In terms of incidence, TBTs are by far the most used regulatory measures, with the average country imposing them on about 30 per cent of products and trade. Countries also impose SPS measures on an average of approximately 15 per cent of trade.[3]These measures may however, discriminate against imports and therefore restrict trade and cause market distortions. This situation can occur when technical regulations are not well targeted, not scientifically underpinned, comprise unclear certification and assessment procedures, or is arbitrarily applied. Technical barriers at times entail **high compliance costs**, especially for companies that operate in different markets. Producers in developing countries face considerable challenges in overcoming TBT as they often do not have the capital, technical and institutional capacity to

[1]Swinmen&Vandemoortele(2010)
[2]quoted in Chen and Mattoo (2004), Baller (2007)
[3] UNCTAD(2008)

comply with emerging regulations and conformity assessments. The WTO TBT Agreement aims to ensure that technical regulations, standards and conformity assessment procedures do not constitute unnecessary barriers to trade, by setting disciplines for the elaboration, application, notification and review of such measures by WTO members. Its key principles and provisions are presented in Box 1.

**Box 1. Key principles and provisions of the WTO Agreement on TBT**

***Non discrimination and national treatment***: Article 2.1 of the Agreement states that "in respect of their technical regulations, products imported from the territory of any Member be accorded treatment no less favorable than that accorded to like products of national origin and to like products originating in any other country". The same principle applies to conformity assessment procedures and related fees and information requirements, which must not discriminate against imported products.

***Avoidance of unnecessary obstacles to trade***:When a government is preparing a technical regulation to achieve a certain policy objective, the regulation should not be more trade-restrictive than necessary to fulfill the legitimate objective. According to the Agreement, specifying, whenever appropriate, product regulations in terms of performance rather than design or descriptive characteristics, helps in avoiding unnecessary obstacles to international trade (Art. 2.8). The obligation to avoid unnecessary obstacles to trade applies also to conformity assessment procedures (Art 5.1). Thus such procedures should not be stricter or more time-consuming than what is necessary to assess the compliance of a product with domestic laws and regulations.

***Harmonization of technical regulations, standards and conformity assessment procedures***: The Agreement calls governments to use existing international standards, or the relevant parts of them, as a basis for setting national technical regulations and to follow international recommendations and guides, or relevant parts thereof, when setting conformity assessment procedures. The Agreement however allows for exceptions when international standards, guides and recommendations are ineffective or inappropriate to fulfil a country's "legitimate objectives". In addition, governments should participate, "within the limits of their resources" in the preparation by international standardization bodies, of international standards for products for which they either have adopted, or expect to adopt, technical regulation, and in the elaboration of international guides and recommendations for conformity assessment procedures.

***Acceptance of technical regulations as equivalent***: Alongside harmonization, the Agreement encourages Members to accept "equivalent" technical regulations of other Members if these regulations adequately fulfill the objectives of their own domestic regulations (Art. 2.7).

***Mutual recognition of conformity assessment:*** Furthermore, the Agreement encourages Members to recognize "whenever possible" the results of each other's procedures for assessing whether a product conforms to mandatory technical regulations. Without such recognition, products might have to be tested twice, first by the exporting country and then by the importing country. The agreement also encourages Members to enter into negotiations for the conclusion of agreements for the mutual recognition of conformity assessment results. Yet MRAs requires confidence in the competence of other Member's conformity assessment bodies and procedures. The WTO agreement therefore recognizes that prior consultations may be necessary to arrive at a mutually satisfactory understanding regarding the competences of conformity assessment bodies (Art 6.1).

***Transparency***: To help ensure transparency, all WTO Members are required to establish national enquiry points and to notify to the WTO Secretariat, discuss and publish technical regulations and conformity assessment procedures which do not exist, which differ from existing international standards, recommendations or guides, or which may have a significant effect on trade of other Members, before they are adopted (Art 2.9 and 5.6). Members must publish a notice in a publication at an early stage and notify other Members through the WTO Secretariat, giving a brief indication of the purpose of the new technical regulation or conformity assessment procedures. Finally, they should allow reasonable time for other Members to comment on proposed technical regulations before their entry into force, which the TBT Committee has recommended to be at least 60 days. The Code of Good Practice applicable to (voluntary) standards states explicitly that a standardizing body must give interested Parties at least 60 days for the submission of comments on a draft standard.

***Technical assistance*** The Agreement calls on Members to provide technical assistance to other Members (Art 11). Technical assistance can be targeted to, e.g., the preparation of technical regulations, the establishment of national standardizing bodies, the participation in international standardization bodies and the provision or strengthening of adequate equipment and capacities for testing and certification.

***Special and differential treatment***: Members shall, in the preparation and application of technical regulations, standards and conformity assessment procedures, take account of the special development, financial and trade needs of developing countries. In addition, developing countries are not expected to use international standards which are not appropriate to their development, financial and trade needs. Finally, the Committee on TBT can grant developing countries specified, time-limited exceptions in whole orin part from the obligations of the Agreement (Art 12).

***Enforcement and dispute settlement:*** The WTO Technical Barriers to Trade Committee is the major forum to consult on matters pertaining to the operation of the agreement and discuss concerns about the regulations and their implementation (Art 13). In order to resolve concerns between countries on TBT matters, the TBT Agreement explicitly refers to the WTO Dispute Settlement Body for consultations and solutions of disputes (Art 14).

Source: WTO TBT Agreement

In the past two decades, applied tariffs have been halved on average globally. During the same period, policymakers have started grasping the "front-stage" importance of non-tariff barriers among which **standards and technical regulations are major items**. The SPS and TBT Standards increased from just 576 notifications in 1995 to 1,305 notifications in 2004, and subsequently doubled to 3,257 notifications by 2010.

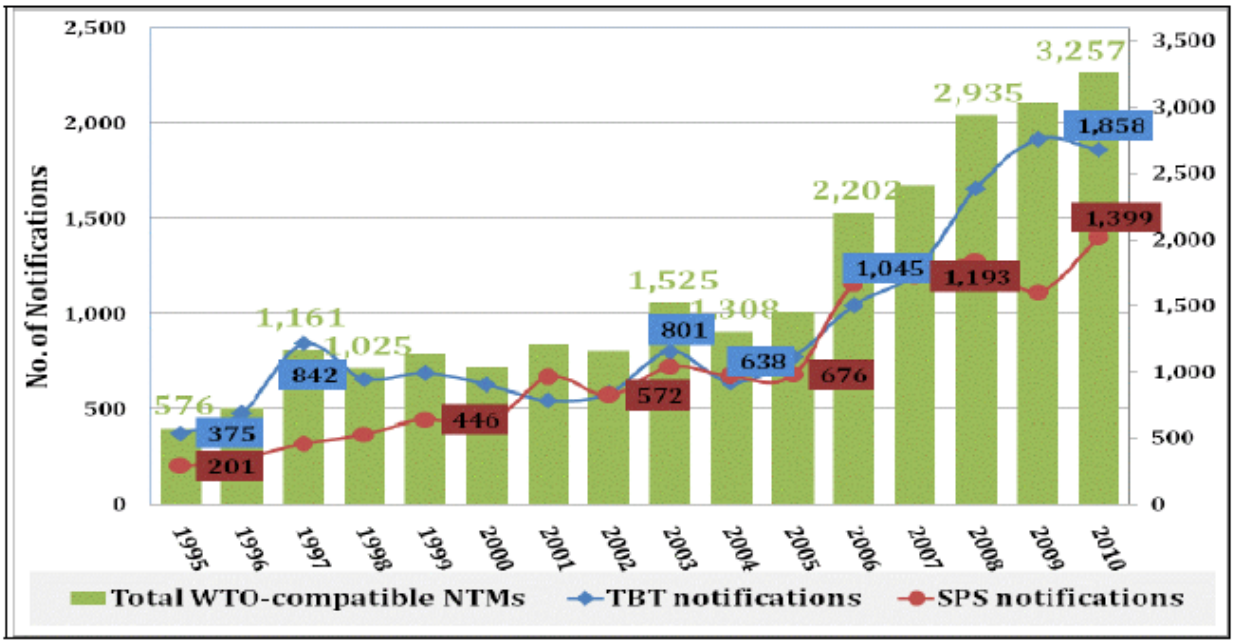



**Figure 4.1: Non tariff measures: Notifications by WTO**

***Source:-Kallummal.M (2012)***

**Exponential growth rates in NTMs**

| NTMs | Pre-Doha deadline | Post-Doha deadline | Exp. growth, 1995-2010 |
|---|---|---|---|
| TBT notifications | 4.6 | 21.6 | 9.2 |
| SPS notifications | 16.7 | 12.5 | 13.2 |
| Yearly NTMs | 9.4 | 17.4 | 10.7 |
| Cumulative NTMs | 37.8 | 16.1 | 23.8 |

***Source:-Kallummal.M (2012)***

Therefore, NTM standard notifications have seen an upward trend since 1995, contrary to the trend of falling average tariffs of WTO Members (see table: Exponential growth rates in NTMs). Total WTO-compatible NTMs have increased at a rate of nearly 11 per cent per year.

Though the SPS and TBT measures ensure consumer safety, increase the transparency of product information and compatibility of products and serve other goals yet, business surveys and discussions in the WTO and other trade policy forums also indicate that, in both developed and developing countries, these requirements often increase transaction costs and are of greater concern to exporters and governments than any other type of non-tariff measure. Technical regulations are on the rise and can be used as instruments of commercial policy in unilateral, regional, and global trade contexts. Their operation as potential non-tariff barriers (NTBs) is of particular concern to developing countries. Barriers to trade are measures in markets which make it difficult, or even impossible, for actual or potential foreign companies to enter or sell. Such measures areconsidered undesirable in the context of world trade, because they restrict the flow of goods and services, drive prices up and are harmful to consumers. Exporters frequently face difficulties in gaining access to markets due to requirements that products be tested and assessed in the importing country to ensure that local regulatory requirements are met. The multilateral agreement on Technical Barriers to Trade (TBT) seeks to ensure that technical regulations,

standards and procedures for assessing conformity do not create unnecessary obstacles to trade. It requires inter aliathat applicable regulations are transparent, justifiable, non-discriminatory and based on international standards whenever possible.

India is actively pursuing bilateral/regional Free Trade Agreements. While Free Trade Agreements would certainly imply a reduction in tariffs, the gains from such trade would be limited in the presence of non-tariff barriers.

**Table 1.1: Coverage Index of NTM in 1997-98 and 2002-03**

| | **Total value of exports subject to NTMs in 1997-98 as a proportion of total value of exports in 1997-98** | **Total value of exports subject to NTMs in 2002-038 as a proportion of total value of exports in 2002-03** |
|---|---|---|
| Singapore | 0 | 8.7 |
| Indonesia | 0 | 28.8 |
| Philippines | 0 | 36.5 |
| Malaysia | 6.6 | 31.9 |
| Thailand | 0 | 24.5 |
| Vietnam | 3* | 3.9 |
| Sri Lanka | 0 | 0.5 |

Source: Saquib and Taneja(2005)

Note: * For Vietnam NTM frequency was available for 1999 hence export data for 1999-2000 was used.

According to the Organization for Economic Co-operation and Development (OECD), there is a growing consensus, supported by a growing body of theoretical, empirical and policy analysis, including by the World Trade Organization (WTO), that technical regulations, standards and procedures for determining conformity can have both positive and detrimental effects on competition and international trade (OECD, 2005). In 2004, UNCTAD's TRAINS database sensed on average 5,620 tariff lines being subject to one type of NTB in each country. Technical measures account for 58.5 per cent of that total.[4]**Though the idea ofphasing out of tariff, quota is to promote free trade as it is welfare improving yet the new form of protectionism like "export standard" called "Non-Tariff measures" are often working as "Non –Tariff barriers" not only distorting the free flow of trade but also making the welfare situation worse.**

Before spelling out the scope of the present dissertation, in the following section we review the particular issues that have been analyzed in the existing literature, and the context in which these have been done. There is substantial literature on individual types of NTMs, and in some instances sophisticated empirical analysis of their effect. However, this information is likely to be instrument, industry or country specific. There are good reasons why this is the case and these reasons are likely to stay. Unlike tariffs, NTMs like export standards are not straightforwardly quantifiable, not necessarily easy to model, and information about them is hard to collect.

[4] UNCTAD(2008)

## 1.1 Standard[5] and Export performance: some issues

### 1.1.1"Protection"(to public health, environment)vs"Protectionism"(for domestic industry)

On the one hand, all World Trade Organization (WTO) members accept the right of national governments to use such measures to protect public health and safety. This right is enshrined in Article 2.1 of the Agreement on Sanitary and Phytosanitary Standards (SPS Agreement), which states that "Members have the right to take SPS measures necessary for the protection of human, animal or plant life or health." On the other hand, many WTO members fear that governments will use such measures for purely protectionist ends. The Agreement thus requires governments to employ SPS measures "only to the extent necessary" and only when they can be scientifically justified (Article 2.2), and prohibits governments from using such measures in an arbitrary or discriminatory fashion (Articles 2.3, 5.5).As such, the Agreement does not prevent countries from taking measures necessary to ensure that these levels of "protection" are met. Least developed and developing countries enjoy special and differential treatment but have to bear in mind that producing to standards lower than those of the rest of the world makes it harder for them to export. Often the SPS standards and TBT laid down by developed countries **are incompatible with the normal methods of production** in developing countries and costs of compliance act as an absolute barrier to trade. The large incidence of TBTs and SPS measures raises concerns for developing countries' exports. These measures impose quality and safety standards which often exceed multilaterally accepted norms. SPS and TBT measures, by their very nature, may result in restrictions on trade. All governments accept the fact that some trade restrictions may be necessary to ensure food safety and animal and plant health protection. However, governments are sometimes pressured to go beyond what is needed for health, plant or

[5] By "standard" we will mean mandatory standards like technical measures.

animal life or environmental protection and to use those restrictions to shield domestic producers from economic competition. Such pressure is likely to increase as other trade barriers are reduced as a result of the Uruguay Round agreements. A SPS or TBT regulation which is not actually required for health/safety or environmental reasons can be a very effective protectionist device, and because of its technical complexity, a particularly deceptive and difficult barrier to challenge. Moreover exporters are normally at a disadvantage vis-à-vis domestic firms, in terms of adjustments costs, if confronted with new regulations.Another area requiring attention relates to the proliferation of NTMs specifically the export standards andthe use of them to regulate trade both in terms of countries adopting these measures and in their variety. A major concern is that the proliferation of increasingly complex trade rules could hide protectionist intents. In this regard, an area of interest is the identification of the possible, even unintentional, discriminatory and trade distorting effects of export standards.

There is both anecdotal and statistical evidence that SPS measures have been abused. For example, the US avocado ban survived for decades after the US Department of Agriculture concluded that Mexican avocados posed no risk of fruit-fly infestation, largely because efforts to relax the ban were strenuously opposed by US avocado growers (Lamb 2006). Likewise, European officials have tended to cite political (in this case, public) pressures rather than scientific evidence to support the EU's ban on hormone-treated beef (Davis 2003, ch.9). More generally, Kono (2006) finds that TBTs are unrelated to proxies for consumer concerns, such as stringent domestic regulations, but are significantly related to traditional interest-group determinants of protection. And while Otsuki, Wilson and Sewadeh's (2001) finding on the impact of the EU's aflatoxin standard does not in itself prove that the measure has protectionist motives, the fact that the standards expected to save only 0.7 lives per year out of a population of

500 million does raise questions about exactly whom EU officials are trying to protect. Kono (2009) in this respect suggested that political economists can ensure the legitimate use of SPS measures by two ways, firstly by institutional reforms which would improve WTO's dispute settlement system and secondly by identifying which SPS measure reflect concern about public welfare and which serve purely protectionist end. Swinmen & Vandemoortele (2011) analyze the relationship between trade and the political equilibria and compare the political outcome with the social optimum to identify under which cases political considerations lead to standards being set 'too low' or 'too high', and which standards could be labeled as protectionist measures.

### 1.1.2Standards and Market Access

The most important aspect of the analysis of NTMs is not related to their use but to their impact. In an analysis of the implications of export standards for international trade, there are several areas that require particular attention. One important area is the quantification of the costs that they impose on international trade. Given their heterogeneity in intent, scope and implementation mechanisms, standards impose diverse costs (and benefits) on different actors. A better understanding of those costs and benefits would greatly contribute to both domestic and international policy making processes. A key area of research is related to the effect of those costs on market access of exporting countries. More specifically, there are two main issues of concern. One is that, although nominally nondiscriminatory, the effect of export standards can be discriminatory against a country's trading partners. This de facto discrimination is generally disadvantageous to developing countries for various reasons. First, developing countries often have a more limited capability (or incur higher costs) for meeting the requirements dictated by the standard. This is due to a less advanced production process technology, weak trade-related

infrastructure and inadequate export services. Discrimination also results from an information problem. Many developing countries do not have the resources to analyze and understand the nature and implications of the standards that their exports face. Discrimination can also result from the more rigorous administrative procedures that are often applied to imports originating from developing countries, especially least developed countries. Another reason why export standards are of particular relevance to developing countries is that they are frequently applied to product groups of particular export interest to these countries. Products that are subject to standards are often those where developing countries have a comparative advantage. All things considered, the overall restrictions on trade imposed by export standards may be systematically biased, although sometimes unintentionally, against developing countries and more so against low-income and least developed countries.

Ultimately, trade analysts and policymakers are mainly interested in better understanding the effects that NTMs have, in particular on international trade and more generally on welfare. The quantification of the effect of NTMs is often complex. There can be various reasons behind the imposition of export standards which can be broadly classified into two categories: a) quality, (covered under TBT) b) negative-externality (Covered under both SPS and TBT).The common factor is that both will increase the cost of compliance. Regardless of whether export standards are imposed (or implemented) with protectionist intent or to address legitimate market failures, standards are thought to have important restrictive and distortionary effects on international trade and this is particularly true for firms in developing countries. Studies conducted by the United Nations Conference on Trade and Development (UNCTAD), for example, have shown that some developing countries have suffered considerable export losses due to their inability to respond to

restrictive and duplicative environmental standards and regulations imposed in developed countries.

The evidence from empirical research also indicates that SPSmeasures can be a potent barrier to trade. For example, in Henson and Loader's (2001: 91) survey, a sample of 65 developing-country governments identified SPS measures as the main obstacle to agricultural and food exports, significantly ahead of "other technical requirements," "transport and other direct export costs," tariffs, and quantitative restrictions. These perceptions are echoed in more objective indicators: for example, Otsuki, Wilson and Sewadeh (2001) find that the European Union (EU)'s proposed aflatoxin standard would, relative to existing international standards, reduce African food exports to the EU by 64 percent. The potential impact of such measures is also illustrated by the longstanding US ban on Mexican avocados: when this ban was finally relaxed in the late1990s, annual US imports of Mexican avocados jumped from less than $1 million to over $50 million in just a few years (Zahniser 2006). Hence, whatever their rationale, SPS measures clearly have the potential to impede trade. Firm level surveys have been conducted, attempting to gauge the direct impact of standards and technical regulations on firms' production costs and hence export performance. The World Bank TBT survey looks at 689 firms in over 20 industries in 17 developing countries (Wilson and Otsuki, 2004). 70% of these firms report that they face technical regulations in their export markets, whereby EU and US regulations are generally considered the most important by the firms surveyed. The study shows that in order to meet standards, firms invest in additional plant or equipment, one-time product redesign, product redesign for each export market, additional labor for production, additional labor for testing and certification, or lay off workers instead of making these types of investment in order to keep the costs from increasing. Chen, Wilson and Otsuki (2004) show that testing procedures and lengthy

inspection reduce exports of developing countries by 9% and 3% respectively and standards reduce the likelihood of exporting to more than three markets by 7%.

Quantitative analysis deriving the trade effect of diverging standards directly from costs of standards has generally proven challenging due to the large number of standards in existence. Additionally, the wealth and idiosyncrasy of legal documents recording them makes it difficult to match standards across countries. Studies conducted in this vein are those by Moenius, 1999; Swann, Temple and Shurmer, 1996; Vancauteren and Weiserbs, 2003; Mantovani&Vancauteren, 2003.Disdier et al (2008) analyses the trade effects of SPS measures on tropical and diversification products and examine the extent at which SPS and TBT work as a barrier for exporters for ACP,Latin America and Asian countries.Crivelli and Groschel(2012)attempts to estimate the impact of SPS measures on trade patterns ,using a Heckman selection model on the HS4 disaggregated level of trade and find that SPS concerns reduce the probability of trade in agriculture and food product consistently. However the amount of trade is positively affected by SPS measures conditional on market entry which suggests that SPS measures constitute an effective market entry barrier. Das (2008) brings to the fore some of the key SPS issues and concerns for developing countries, by taking India as a case in point. A general weakness of these attempts to estimate the impact of standards on trade is that they are generally not based on a sound theoretical framework.

A number of studies have focused on firms in developing Countries, and examine empirically factors affecting decision-making such as entry costs that influence a firm's export behavior. Roberts and Tybout (1997) test for the presence and magnitude of sunk costs using a sample of Colombian plants, while Bernard and Jensen (2004) test for the possible existence of entry costs by looking at the effects of exporting yesterday on exporting today. Both papers find entry cost

significant in explaining firms' export decisions. The attempts of modeling standards barriers and their remedies theoretically are also very limited in number and have been undertaken only very recently. All of them use Krugman's (1980) framework as the basis to model trade between countries, but are very different in the way they are being implemented. A series of articles like Bockstael 1984; Bredhal et al, 1987 have studied product quality standards as a trade barrier. There is a number of research works which deals with the externality linked standards some of which show that standards and regulations can increase the global welfare. Sanitary or technical requirements (barriers) may be socially desirable. Calvin and Krissoff (1998) support this idea by affirming that unlike a tariff, this kind of requirement may increase national social welfare if it corrects a market failure by incorporating important product externalities in the product price. Roberts et al. (1999) propose an analytical framework to analyze NTBs that distinguishes three economic effects: i) the "regulatory protection effect", i.e., the fact that a regulation provides some rents to the domestic sector; ii) the "supply shift" effect, that focuses on the effects of imports on the domestic supply and the costs of enforcing compliance, and iii) the "demand-shift" effect, that takes into account the fact that a regulation may bring information and increase consumer demand for the product. Using comparative-statics in a partial equilibrium framework, they illustrate the different effects of these three components of NTBs, in particular in terms of welfare. Fischer and Serra (2000) examine the behavior of a country that imposes a Minimum standard on a good produced by a domestic firm and shows that when there is consumption externality the Minimum Standard chosen by the domestic social planner is a non –increasing function of size of the foreign market and is always "protectionist". Economists like Barret(1994) and Kennedy (1994) has concentrated on environmental production standards and shown that countries have an incentive to lower their environmental standards so as to reduce

production cost and become more competitive. Brander and Spencer (1985) show the simultaneous use of standards as a strategic trade instrument has negative consequences for both the countries. Boom (1995) develops a duopoly model and shows the quality standard imposed by any one country alters the decisions of both firms and shows the increase in Minimum Quality Standard (MQS) will benefit the consumers by increase in quality and reduction in price provided both firms continue supplying both markets. Though she suggests that MQS can be used as a technical barrier to trade, but does not develop the possibility. Further. Ganslandt&Markusen (2001) shows technical regulations which govern the admissibility of goods into an economy raise costs of exporters erring new markets and may have a particularly high impact on firm from developing countries, though standard may also have a positive side by certifying product quality and safety to the consumer.Roberts and Unnevehr (2005) state that the additional costs of reduced trade caused by sanitary and technical requirements must be balanced against the public health benefits of safer food. The need for balance between costs and benefits among countries is what makes these measures so controversial in international trade.Chen &Novy (2012) review the literature on the measurement of trade costs in international trade with a special emphasis on non-tariff measures and in particular on standards and regulations.

### 1.1.3Harmonization of Standards and Mutual Recognition Agreements (MRAs)

The Agreement on Sanitary and Phytosanitary Measures (SPS) builds on previous GATT rules to restrict the use of unjustified sanitary and phytosanitary measures for the purpose of trade protection. The basic aim of the SPS Agreement is to maintain the sovereign right of any government to provide the level of health protection it deems appropriate, but to ensure that these sovereign rights are not misused for protectionist purposes and do not result in unnecessary

barriers to international trade.[6] **Though the SPS and TBT Agreement encourages governments to establish national measures consistent with** international standards which is often referred to as "harmonization", the WTO itself does not and will not develop such standards. However, most of the WTO's member governments (132 at the date of drafting) participate in the development of these standards in other international bodies. The standards are developed by leading scientists in the field and governmental experts on health protection and are subject to international scrutiny and review. International standards are often higher than the national requirements of many countries, including developed countries, but the SPS Agreement explicitly permits governments to choose not to use the international standards.

Among the various SPS measures prevalent among developed and developing countries, there are also differences in terms of the usage of national, international and regional standards. This suggests that the use of these measures is not actually as visualized under the SPS Agreement. Some studies did find that the effect of national standards on trade exceeded the effects of international standards and specifically by developed countries. For these countries, the SPS Agreement provided leeway in the application of national standards even if they were not found to be scientifically consistent.

[6] SPS and TBT agreement of WTO

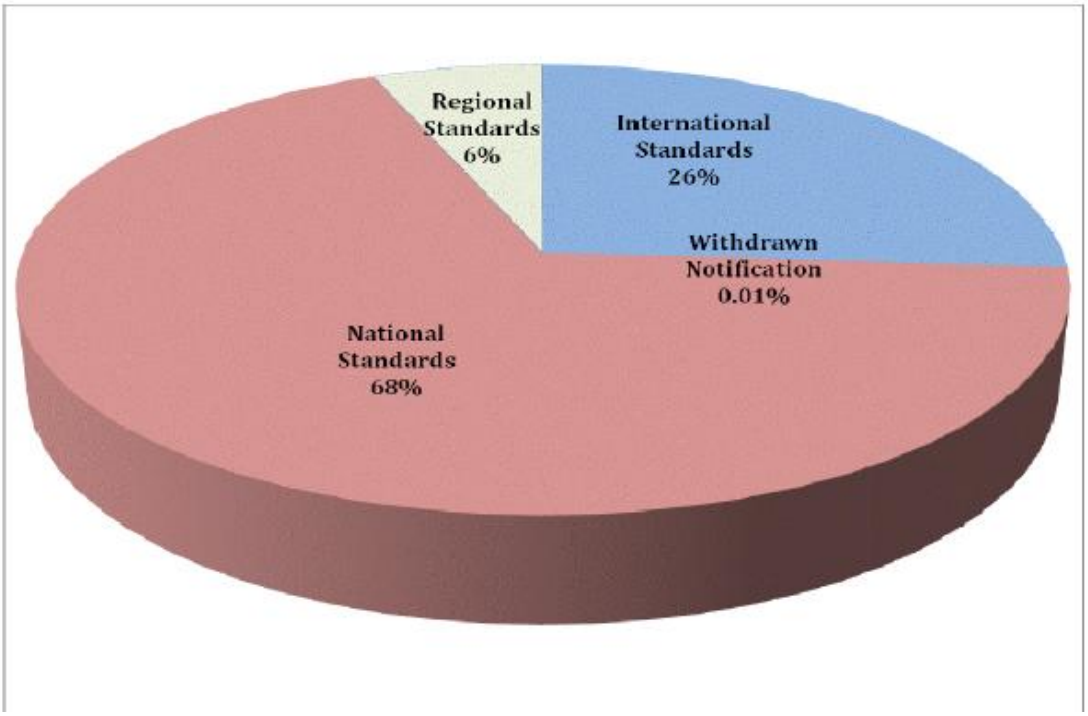



**Figure 1.5: National VS International Standards-developed members**

***Source:-Kallummal.M (2012)***

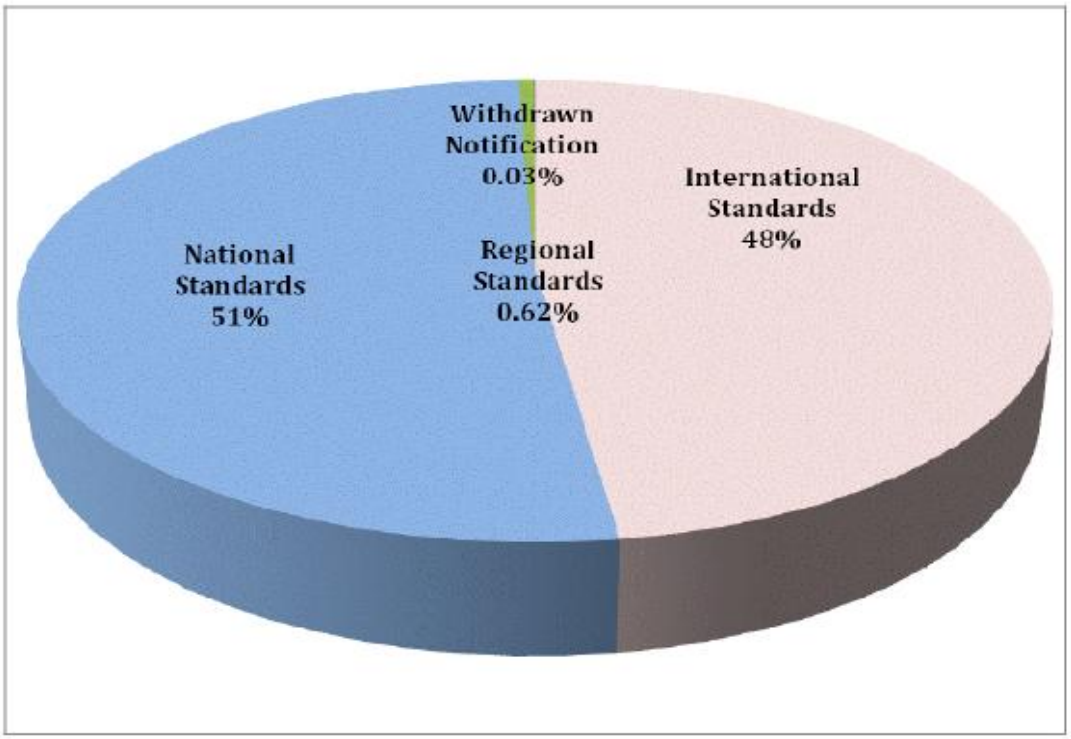



**Figure 1.6: National VS International Standards-developing members**

***Source:-Kallummal.M (2012)***

Though developing Members have also applied their national standards to 51 per cent of their notifications, however the share of notifications following international standards (48 per cent) was not significantly lower. Specifically, in case of SPS Notifications the use of national standards was very low for India with an 18 per cent share of the total. India has thus been a strong proponent of international standards, with 82 per cent share of the country's total SPS notifications being international standards.

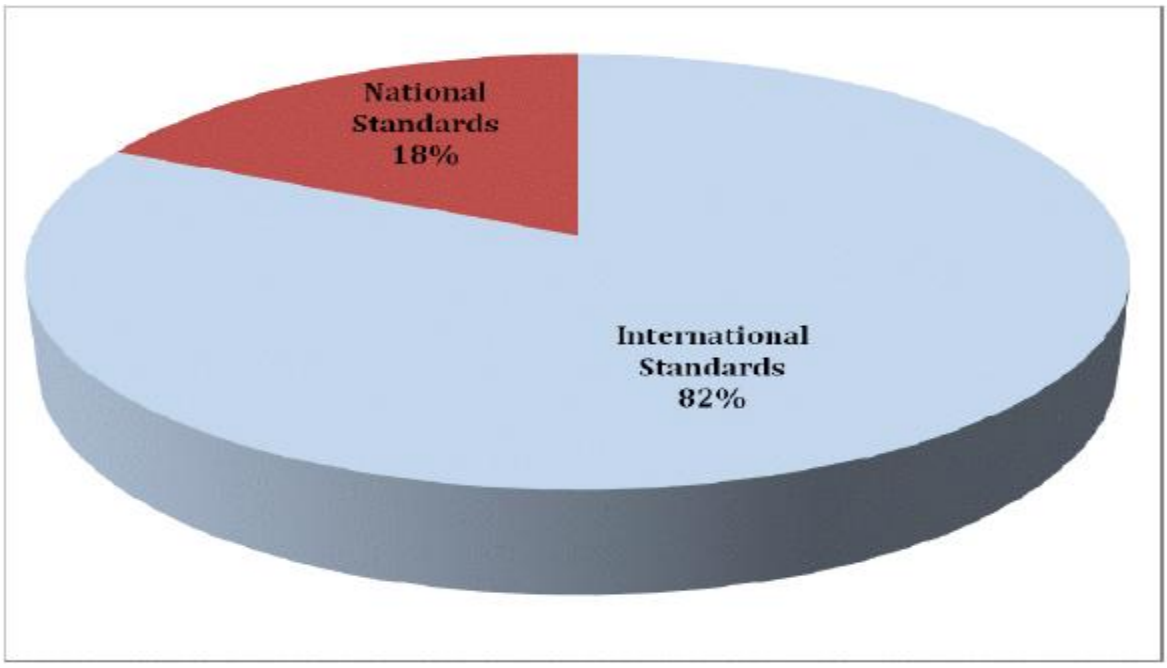



**Figure1.4:-Indian SPS measures and its National VS International Standards**

***Source:-Kallummal.M (2012)***

Divergent regulations cost for exporters by loss of economies of scale. If a firm must adjust its production facilities to comply with diverse technical requirements in individual markets, production costs per unit are likely to increase. This imposes handicap particularly on small and medium enterprises. Compliance with technical regulations generally needs to be confirmed. This may be done through testing, certification or inspection by laboratories or certification bodies, usually at the company's expense. Information costs include the costs of evaluating the technical impact of foreign regulations, translating and disseminating product information, training of experts, etc Agreements on standards raise issues that are both politically and analytically challenging. Unlike tariffs, standards cannot be simply negotiated away because the original reason for their existence is not trade protection but the enhancement of welfare by

remedying market failure - arising, for example, from invisible safety attributes of products, negative environmental externalities, or product incompatibility due to the producers failure to coordinate. Agreements on standards must therefore secure the gains from integrated markets without unduly compromising the role of standards as remedies for market failure. Not only are the motives for standards ostensibly honorable, so in principle is their implementation: unlike tariffs, the same standards may not be applicable for both foreign and domestic firms. However, even after supposed symmetry of treatment, the impact on trade may turn out highly asymmetric because the costs of compliance are likely to differ across countries.Baldwin (2000) shows the TBT liberalization will involve hegemonic harmonization or mutual recognition of rules and test; such liberalization will almost surely entail preferential arrangements among rich nations, creating in essence a two-tier system of market access with developing nations in the second tier.Mattoo and Chen (2004) find that harmonization in the EU raises both intra-regional trade as well as trade with excluded developed countries; at the same time their results indicate that it diverts trade away from developing countries. The paper also shows that MRAs have a more powerful impact on both types of trade, but if they contain rules of origin, then intra-regional trade increases at the expense of imports from the rest of the world, especially developing countries Baller (2007) looks at trade effects from TBT liberalization for members of the liberalizing region as well as two separate groups of excluded countries, industrialized and developing respectively. The study finds compelling evidence that Mutual Recognition Agreements for testing procedures have a strong impact on both export probabilities and bilateral trade volumes. Costinot (2008) compares the performance of the WTO's national treatment principle and the EU's mutual recognition principle with respect to product standards.

### 1.1.4.AScope of Harmonization and MRAs of Standards

There often exists a great difference in standards across markets each of which requires an individual compliance cost such as the redesign cost. Hence, the difference in regulations across markets can severely limit a firm's scale production capacity and affect a firm's decision to export.Regional trade agreements (RTAs) present opportunities for harmonization and mutual recognitions as the same region shares the similar geo-climatic and cultural practices the precondition for harmonization might be already present. But export standards are most often not an important issue in some RTAs including South Asian Free Trade Agreement(SAFTA). Meyer, N.et al (2010) examines whether and how eight major regional integration agreements within African Region address TBT issues and finds that TBTS are not an important issue in Sub –Saharan African RTAs.Existing provisions for eliminating TBT related barriers or harmonizing legitimate technical regulations and formulated mostly in broad and "non-perspective terms".Non-tariff barriers have been a highly contentious issue though most of the quantitative restrictions (of the NTBs) have already been phased out in most of the SAARC countries. The only major form NTBs that need to be tackled now are the ones relating to standards on health and consumer safety grounds. Mutual recognition of standards and/or their harmonization at the regional level could help to reduce the problem. Unfortunately, the treaty SAFTA has hardly any provisions relating to antidumping, subsidies and countervailing measures, technical barrier to trade, and sanitary and phytosanitary measures out of which the last two deals with export standards. These issues are pertinent when a region moves into a free trade arrangement. Of Late (2011) the Governments of SAARC Member Statesappreciating the importance of Standardization with reference to trade within and outside the Member States**;**recognizing the need to improve cooperation and coordination amongst member states in implementation of SAARC Standards in respect of products and/or processes; aspiring to facilitate intra-Regional

trade within member States; anddesiring to enhance their access to the Global markets have agreed **on** the Establishment of **South Asian Regional Standards Organization (SARSO).** The following is the current status of harmonization(as on 22 January 2015) of identified products by the respective Sectoral Technical Committees under SARSO.

**Table 1.2:-Products on which standards are being harmonized**

| **SARSO Sectoral Technical Committees (STCs)** | **Identified Products on which standards are being harmonized** | **Meetings held/to be held** |
|---|---|---|
| STC on Food and Agricultural Products | 1. Refined Sugar<br>2. Biscuits<br>3. Standards of on Microbiological requirements for cream portion of filled biscuits<br>4. Instant Noodles<br>5. Black tea<br>6. Vanaspati/Banaspati (veg. ghee)<br>7. Skimmed Milk Powder<br>8. National/CODEX Standard for Hygienic condition | First Meeting at SAARC Secretariat on 24 August 2011<br>Second Meeting at Dhaka, Bangladesh on 12-13 December 2011.<br>Third Meeting at Karachi, Pakistan on 2-3 April 2012.<br>Fourth Meeting was held in India on 21-22 Sept 2014.<br>Fifth Meeting is to be held in Sri Lanka. |
| STC on Jute, Textile and Leather | 1. Identified Hessian products<br>2. Jute Tarpaulin Fabric<br>2. Jute Bags for packing of various commodities<br>3. Jute twine<br>4. Jute Carpet backing Fabric<br>5. Jute yarn<br>6. Cotton Drill Fabric<br>7. Cotton Twill Fabric<br>8. Towels and Toweling Fabric | First Meeting at the SAARC Secretariat, Kathmandu on 23-24 November 2011<br>Second Meeting in Dhaka on 17-18 April 2013.<br>Third Meeting was held in Colombo on 18-19 Dec 2013.<br>Fourth Meeting is to be held in India. |

| | | |
|---|---|---|
| STC on Building Materials | 1. Steel Tube for Structural purposes<br>2. Ordinary Portland Cement<br>3. Steel Bars for Concrete Reinforcement<br>4. Structural Steel<br>5. High strength deformed steel bars and wires for concrete reinforcement<br>6. Steel wires used in pre-stressed concrete<br>7. Method of testing of steel and steel tubes (such as tensile testing, flattening, bend test etc<br>8. Ceramic Tiles | Three Meetings have been held at the SAARC Secretariat on<br>21-22 November 2011;<br>10-11 July 2012;<br>4-5 June 2013.<br>Fourth Meeting is to be hosted by Nepal. |
| STC on Chemicals and Chemical Products | 1. Toilet soap<br>2. Liquid Toilet Soap<br>3. Baby Toilet Soap<br>4. Soft Soap<br>5. Laundry Soap<br>6. Detergent Powder<br>7. Tooth Paste<br>8. Shampoo (Hair Shampoo)<br>9. Shampoo for Babies | First Meeting was held in India on 23-24 Sept 2014.<br>Second Meeting is to be hosted by Sri Lanka |
| STC on Electrical, Electronics, Telecom and IT | 1. Electric cable (PVC insulated/sheathed)<br>2. Double capped fluorescent Lamp (Safety Requirements and Performance Requirements)<br>3. New Products Identified: Switches, Sockets, MCBs, Solar photovoltaic systems, transformers | First Meeting was held in India on 25-26 Sept 2014<br>Second Meeting is to be hosted by Afghanistan. |
| STC on Conformity Assessment | Established by the First Meeting of the SARSO Technical Management Board (Dhaka, 31 March – 1 April 2014) | First Meeting is to be held in India. |

**Source:** - *www.saarc-sec.org*

Dr. Syed HumayunKabir, Director-General of SARSO made a presentation on the activities of SARSO during the Forty-first Session of Standing Committee held in Kathmandu on 23-24 November 2014. The Standing Committee also took note of the critical importance of SARSO in eliminating all forms of barriers to regional trade and urged for all possible support from all member States for effective functioning of the Organization. This shows the member states have

realized the need for harmonization and mutual recognition of conformity assessment to boost interregional as well as intraregional trade though still there is provision in SARSO agreement (like WTO'S provision in TBT agreement) that to fulfill legitimate objectives which may include *inter alia* national security requirements, prevention of deceptive practices, protection of human health and safety, animal or plant life or health, or the environment, the National Standards can differ from the relevant SAARC Standards, but in such an eventuality, the concerned Member State shall provide to the other Member States the details of such differences along with the reasons thereof.

Mutual recognition of existing standards (whereby a country grants unrestricted access of its markets to products that meet any participating countries standard) is one of the simplest and most powerful agreements to deal with export standards. This was the approach taken in principle by the EU but probably was not a good option as there was significant difference in initial standards of the countries.[7]The central problem in the EU mutual recognition approach is the overarching exemption contained in Article 36 of the EC treaty. This provision preserves the member countries rights to restrict or prohibitimports on grounds of health and safety and other policy objectives, as long as this is not a means of arbitrary discrimination or a disguised restriction on trade. This provision substantially dilutes the effects of implementing mutual recognition because it allows a country with stringent regulations not to recognize orequivalent the regulations of other countries with lower stringency.Crivelli P, Grechi, J (2012) split SPS measures into requirements related to (i) conformity assessment, and (ii) product characteristics. Both types of measures are implemented by policy makers to achieve a desired level of healthsafety, yet, entail diverse trade costs. They find that conformity assessmentmeasures hamper not only the likelihood to trade but also the amount oftrade, while measures related to

[7] Chen &Mattoo (2004)

product characteristics do not affect themarket entry decision, but have a strong positive impact on the trade volume.

### 1.1.4:"Tariff" and "Standards"

The steady decline of tariff rates as the result of eight GATT rounds of multilateral trade negotiations (MTNs) raised the relative importance of NTBs as both protection and regulatory trade instruments. As levels fell in tariffs, non-tariff barriers increasingly took centre-stage in market-access concerns. Available evidence indicates that NTMs are often applied as alternative trade policy instruments, as multilateral trade agreements impose limits on the use of traditional trade policy instruments, such as tariffs. So, the result is that NTMs are rapidly gaining importance in regulating trade, and have almost replaced tariff barriers in manufacturing sector.Inorder to facilitate a comparison between the trade effects of these different NTMs,studies analyse the impact of NTMs on international trade by estimating a "tariff equivalent", i.e. the level of tariff that would have an equally trade-restricting effect as theNTM in question. This enables a comparison to be made with tariffs, and is important for any analysis of the welfare implications of various tradepolicy measures. In the trade literature, "equivalent tariff"of NTMs is computed using one oftwoapproaches–the"price-gap"orthe "econometrics-based approach". The basic principle of "price-gap" method involves a comparison of prices before and after the NTM mark up where this difference is expressed as tariff equivalent.An Econometrics based method is an alternative to "price gap" method to estimate the impact of non –tariff measures on either price or quantity (trading) using econometric model like gravity equations. Estimating the "quantity impact" is particularly useful because data on trade flows are more easily available at disaggregate level. Moreover when the NTM is absolutely prohibitive, no prices are observed, or when the product is highlydifferentiated, prices are not particularly

informative. By gravity model we get "tariff equivalent" is a tariff that has the same effect on the value of trade (imports).In this context. Bora et al (2002) reviews various approaches including the above mentioned methods to measure and quantify NTMs within the context of the existing data collections.Beghin (2006) describes some common measures of NTBs including tariff-equivalents of the NTB policy or policies and count frequency measures of NTBs. But the basic limitation is that all of them have considered NTB as a whole instead of taking separately SPS and TBTs. But the comparison between volume of trade as well as welfare effect of "equivalent tariff" and the corresponding NTB will definitely depend on the nature of NTB. Beghin&Bureau (2001) present promising methodologies including the method to calculate "equivalent –tariff" to model and quantify non-tariff barriers (NTB) to trade in agricultural and food sector.

## 1.2 Motivation and Outline of the Thesis:

Though the existing literature have examined a handful of issues at length, there are quite a few issues that have been either left unexplored or have been examined only in a very narrow context. The present dissertation aims at filling this gap in the theoretic literature especially with reference to effects of product standard and its compliance cost. One of the misconceptions about standards and technical regulation is that it is always linked to some negative externality and another is that standards are always imposed with protectionist intention. Though standards can be intrinsically "protectionist" whenever they do not address market failures such as externalities and information asymmetries between consumers and producers of goods being traded or they don't change the demand for the product,some standards may restrict trade but improve welfare in the presence of negative externalities or informational asymmetries. Moreover standards can expand trade as they enhance demand and trade of a good through better information about the good or by enhancing the good's characteristics. What emerges from the above survey of the

literature is that quite a few relevant issues have been either left unexplored or narrowly defined and analyzed. There are good reasons why global analysis of NTBs across sectors and countries are lacking. Under a common denomination NTBsgroup together a vast array of potentially tradedistortingpolicy instruments. Moreover Unlike tariffs, NTBs are not straightforwardlyquantifiable and not necessarily easy to model,and information about them is hard to collect and there is little understanding of the exact implications of NTMs on trade flows, export led growth and social welfare in general.[8]

The common and standard classification of "Export Standards" is widely discussed SPS and TBT standards. According to Roberts et al. (1999), standards can be classified into two broadcategories: risk-reducing measures (such as food safety standards, plant healthprotection standards); non-risk-reducing measures (e.g. food quality standards,environmental conservation standards). Brom (2000) classifies standards into threecategories: (i) standards that matter to all consumers, e.g. food safety standards;(ii) standards that matter to special groups of consumers because they are linkedto personal life style choices, e.g. quality standards; and (iii) standards that regulatesocial and environmental issues based on the ethical values of a society. Many contributionsin the literature on standards and trade (e.g. Thilmany and Barrett, 1997;Marette and Beghin, 2010) make no distinction between different types of standards(such as safety and quality standards). Some studies in the literature on minimum quality standards (e.g. Leland, 1979; Ronnen, 1991; Boom, 1995) illustratetheir analyses with examples of safety standards.Baldwin (2000) classifies standard on the basis of implementation as: horizontali.e. quality related and vertical i.e. externality related. Swinnen&Vandemortele (2010) introduce consumer preference heterogeneity which leads to classification of "standards" as non-risk

[8]Fugazza&Maur (2008)

reducing standards (quality preferences) and risk reducing standards(preference towards risk aversion).

**The present thesis looks into the rationale behind the imposition of the standard from the importing country's point of view and classifies accordingly. There is hardly any theoretical work which has dealt with different kinds of standards, taking into account the reason(s) behind imposition of standard.**This dissertation intervenes the literature around **three** among those issues.Standard and regulations may take different forms which should be discussed separately.**Firstly** standard can **be purely related to product design or product quality** which is already prevailing in the foreign market and not to prevent any "true" or "imposed" negative externality. In that case it will be absolutely cost rising for the exporters unless it affects the demand for the product.

**Secondly export standard can be related to some "imposed"(by importing country) negative externality** where the actual externality generated by consumption/production is zero. In this case the standard is truly "protectionist" and (under certain conditions) leads to the improvement in the welfare of importing country at the cost of welfare of the exporting country.

**Thirdly"standard" can be linked to "true" (actual) externality but its imposition and implementation drastically differs if it is related consumption[9] or production externality**[10]. The existing literature though talks about "true" externality related standard but almost silent about the difference in the dynamics of consumption and production linked standard.

Though not assumed explicitly, **the thesis resembles trade between developed (importing) and developing (exporting) country** where the former is technically more advanced and plays

[9]Category (i) according to Brom (2000)
[10] Category (iii) according to Brom (2000)

the role of **"standard setter"** (so compliance cost for that country is lower) and the latter is technically less advanced and plays the role of **"standard taker"** resulting in higher cost to comply with the given standard.

**Chapter 2** of the thesis deals with **"quality" related standard** and shows its effect on welfare for both exporting as well as importing country. It develops a simple model where the importing country imposes a "standard" on exporting country (s) which increases the cost of compliance for the latter. The result shows in bilateral trade the importing country will always benefit by the imposition of quality related standard as long as exporting country has positive compliance cost, whereas in the multilateral trade (more than one exporting country ), the importing country may or may not benefit from that situation. Even if quality related standard changes the willingness to pay, in a bilateral trade importing country will surely be more benefitted from that which might not be the true for exporting country. It also shows under this situation **"Harmonization" of standard and "Mutual Recognition Agreements"** can improve the trade volume as it helps the exporting firm to accrue the economies of scale as well as reduced compliance cost (undercertain conditions).

**Chapter3**of the thesis deals with **"purely protectionist standard"** which can be raised by importing country to prevent **"imposed"**(by importing country)negative externality;though applicable for both the trading partners but actually cost rising for the exporting country. These standards can be designed in such a way that the exporting country's compliance cost becomes much higher than its trading partner and works as a tool of protection for the latter. Its comparison with "equivalent tariff" shows tariff could have led to better situation for both the countries and could have been the "first best tool of protection". The difference between the said

standard and quality standard is the latter may change the consumer's willingness to pay but the former will only increase the producers' cost.

**Lastly the standard can be raised to prevent "true" negative externality** like many environmental and safety standard. In that case the consequence on welfare depends on the size of the initial negative externality and the cost of compliance of the two trading partners which generally happens to be lesser for developed countries. **Chapter 4** deals with these type of standards and specifically differentiates between the consequences of **consumption and production externality related standard** which is absent in the exiting literature. It shows the rationale as well as effect of standard differs depending on whether standard is production or consumption linked. Finally, **chapter-5** provides the summary of the results obtained in chapters 2 to 4, policy implications and sets out the agenda for future research. Bibliographical references are presented thereafter.

# Chapter – 2: Quality related standard affecting trade and welfare

## 2.1Introduction

While there has been a significant decline in explicit trade barriers (due to trade reforms) such as tariffs and quotas over the past decades, standards and technical regulations are increasingly mentioned as a factor driving trade costs.These consist of technical regulations and sanitary and phytosanitary measures (SPS), imposed by governments to protect the health and safety of their citizens and the environment, and voluntary standards established by national, regional and international standards bodies, such as ISO 9001 for quality management systems and ISO 22000 for food safety management systems. They also comprise private standards established by consortiums and retailers. Thoughthe World Trade Organization (WTO) has tried to minimize the use of standard as non-tariff barriers by requiring its members to use international standards as a basis for their technical regulations and SPS still the exporting countries (specially developing countries) may find it difficult to deal with quality related standards either due to lack of information or due to lack of technical expertise.Studies conducted by the United Nations Conference on Trade and Development (UNCTAD), for example, have shown that some developing countries have suffered considerable export losses due to their inability to respond to restrictive and duplicative standards and regulations imposed in developed countries. Standards and technical regulations are an increasingly prominent part of the international trade policy debate. In particular, there has beenconsiderable discussion of whether standards and regulations affect tradecosts and export prospects for developing countries.

Standards and technical regulations have assumed increased importance in the trade policy agenda. Possibly, this is because they have become quantitatively more important and burdensome, or possibly they are simply relatively more important as traditional trade barriers such as tariffs and quotas decline in importance. In either event, there seems to be a case for closer examination and more formal modeling of standards as they impact on trade and nationalwelfare.Standards and technical regulations are often portrayed as barriers to trade that restrictcompetition in the local economy by raising costs to foreign suppliers. The idea that standardscan constitute an anti-competitive and protectionist device seems obvious. Yet it is clear that they may also have benefits, not just to domestic consumers but also to foreign suppliers. If a standard certifies a product as safe, healthy or of good quality, such certification can raise consumer demand for the imports, possiblyresulting in increased profits to foreign firms in spite of higher costs. The World Bank Technical Barriers to Trade Survey (2002) enables such analysis by eliciting systematically firm-level information on their production and export activities, cost structures, impediments to domestic sales and exports, and compliance with standards and technical regulations. The surveys wereadministered to 619 firms in 17 developing countries from five regions, including Eastern Europe, Latin America, Middle East, South Asia, and Sub-Saharan Africa. The 619 firms in the survey vary significantly in characteristics such as the value of sales, the size of employment, age and ownership structure. This survey collects firms' responses to a series of questions on topics including mandatory standards, conformity assessment (testing, certification, labeling requirements and inspection) and their effect on cost of production and ability to export.Standards across markets can simply differ in the content of the norm (referred as horizontal standards such as a standard on permissible electric plug) as well as strictness of the norm (referred as vertical standards such as

the nutrition standard). So a Fixed compliance cost$F_j$ is inevitable to enter in the new export market.[11] Standards and technical regulations affect both dimensions of export performance for a number of reasons. First, governments have the ability to set standards based on domestic firms' product characteristics or technology capacity. This can raise foreign exporters' costs to accommodate these requirements. Second, there often exists a great difference in standards across markets each of which requires an individual fixed compliance cost such as the redesign cost. Hence, the difference in regulations across markets can severely limit a firm's scale production capacity and affect a firm's decision to export. As the SPSagreement keeps the provision of use of "national standards"(tighter than international standard) ,developed Members have applied their own national standards (3,452notifications) in 68 per cent of their total notifications. International standards (1,323notifications; 26 per cent) have only been given second preference. Regional standards have been applied in 6 per cent of the notifications by these Members. Thus, a prevalenceof "national standards" was found to be correct in the case of developed countries. Thiscould be detrimental to developing countries' market access prospects in the case of raw agricultural and processed food products. For example, a study by Centre for WTO Studies(CWS) in 2010 observed the prevalence of national standards across the QUAD countries. Developing Members have also applied their national standards to 51 per cent oftheir notifications. However, the share of notifications following international standards(48 per cent) was not significantly lower. Only 1 per cent of these Members' notificationsapplied regional standards.[12]

The standard can be directly related to quality, not to any externality.ASEAN countries specification of percentage of broken rice in case of export of Basmati and Non-Basmati

[11] Baldwin (2001)

[12]"SPS measures and possible market access implications for agricultural trade in the Doha Round: An analysis of systemic issues", By MuraliKallummal,ARTNeT Working Paper Series No. 116/July 201

ricefrom India or Singapore; importers demand for 50s yarn are some of the examplesof such type of quality related standards(Saqib and Taneja, 2005).Ronnen (1991), Boom (1995) and Valletti (2000)all find positive effects of minimum quality standards on consumers' welfare, but findmixed effects on overall welfare. Leland (1979) shows that, in general, the effect of aminimum quality standard on welfare is ambiguous, depending on consumers' sensitivityto quality variations and on producers' marginal cost of providing quality.

Country-specific standards effectively create additional costs for foreign producers by forcing them to adjust their product and production process so as to meet individual national standards. Further costs will arise from the requirement to subsequently prove conformity with these standards (World Bank TBT Survey, 2004; Baldwin,2000; Chen and Mattoo, 2004; Wilson, Chen and Otsuki, 2006). This creates twonegative side effects:firstly the exporting firm losses the benefit of scale economies as it has to design the product for different markets differently and secondly it has incur conformity assessment cost for each market separately. Regional trade agreements (RTAs) present opportunities for harmonization and mutual recognition as same region shares the similar geo-climatic and cultural practices the precondition for harmonization might be already present. But export standards are most often not an important issue in some RTAs including South Asian Free Trade Agreement(SAFTA).

In this chapter we analyze a profit-maximizing firm's export behavior by modelingits decision to export when some specific standard has been imposed by the importing country.This imposed standard is not related to "actual" or "imposed" negative externality; it is purely related to quality.It may or may not change the demand for the commodity. We shall explore boththe possibilities to check its effect on volume of trade and welfare.

## 2.2The model:-

For simplicity, let us suppose the world consists of **2countries, labeled as *j=A, B., where A is the importing country and country and B is the exporting country.*** The importing country imposes variedstandards[13] and technical requirements on the good that is marketed in its market. Firstly we assume complying with standards has no effect on consumers' demandfor the regulated product.Firm 1 is domiciled in country A, in which it sells $Q_{1A}$ units of output, while it imports $Q_{2A}$ from country B. Firm 2, domiciled in B, exports $Q_{2A}$ in A and sells $Q_{2B}$ in B. For supplying in domestic market either no cost of production or cost of production is fixed. The compliance with importing country's technical requirements implies a differentiated unit cost to the firm, in general denoted by***Fij≡Fj+Di.***[14]The first component of this fixed cost, ***Fj***, isthe common cost to comply with the technical regulations imposed in country *j*(here, country A) which is identical across exporters. The second component, *Di,* represents the firm-wisedeviationfrom *Fj*due to the varied impact each firm receives from standards and technicalregulations. *Di varies* across exporters (here, only country B) due to their difference in factors such astechnology endowment and hence the ability to meet standards.Most studies consider that the introduction of standards implies compliance costsfor producers (amongst many others Leland, 1979; Ronnen, 1991; Valletti, 2000),and this holds for both domestic producers and those in countries (interested in)exporting to the host that imposes the standard(Suwa-Eisenmann and Verdier, 2002; Henson and Jaffee, 2007).

Country A's product also has to comply with the specific standard but let us assume no extra cost has to be borne by the producers for complying with that standard. Country B and C produce for

[13] By "standard" here we man mandatory "standard" which is a part of TBT of WTO
[14] Compliance cost

their local market at "null Standard" and there is no fixed set up cost to produce at"null standard" and the standard stipulated by importing country.[15]

Further we assume constant returns to scale to production and we assume away any role of exchange rate. We deal with purely the volume of trade.

The inverse demands in market A and B are, respectively

$$p_A = a - b(Q_{1A} + Q_{2A}) \quad (2.2.1)$$

$$p_B = a - bQ_{2B} \quad (2.2.2)$$

The profit functions of firm 1 and firm 2 are respectively,

$$\pi_1 = [a - b(Q_{1A} + Q_{2A})]Q_{1A} \quad (2.2.3)$$

$$\pi_2 = [a - b(Q_{1A} + Q_{2A})]Q_{2A} + [a - bQ_{2B}]Q_{2B} - (F_A + D_{2A})Q_{2A} \quad (2.2.4)$$

The equilibrium outputs are:-[16]

$$Q_{1A} = (a + F_A + D_{2A})/3b \quad (2.2.5)$$

$$Q_{2A} = (a - 2F_A - 2D_{2A})/3b \quad (2.2.6)$$

$$Q_{2B} = \frac{a}{2b} \quad (2.2.7)$$

### 2.2.1Effect on Trade:-

The imposition of standard by importing country will affect the volume of trade. As in this section we have assumed away any change in demand , we can infer the volume of trade will

[15] Both these assumptions have been relaxed in Chapter 3&4
[16] Appendix 2.1

shrink as the exporting country has to incur the extra cost to comply with the standard specified by the importing country, which will reduce the supply of exports.

***2.2.1.AProhibitive Standard:-***

These solution to equation 2.2.6 is valid for $F_{ij}+D_{ij} \in [-a, 1/2a]$, (*i =2; j=A)*). If $F_{ij}+D_{ij} \geq$ ½ a, there is a domestic monopoly in country *j* with the rival firm excluded by too high export cost (and thus the solution is that of $F_{ij}+D_{ij}$ = ½a).**Here the Standard isProhibitive in nature.**[17]

***2.2.1.BExport Loss:-***

Compared to free trade(i.e. null standard in the importing country) there will be a loss in export (as well the volume of trade shrinks) by

$$(2F_A + 2\ D_{2A}) / 3b \qquad (2.2.8)$$

**Proposition2.2.1:-***Higher the compliance cost (both fixed and variable) for exporting firm, higher will be the output of the importing firm.*

$$\frac{\partial Q_{1A}}{\partial F_A} > 0 \ and \frac{\partial Q_{1A}}{\partial D_{2A}} > 0 \qquad (2.2.9)$$

**Proposition2.2.2:-***Higher the compliance cost to meet the standard in export market s, lower will be the amount of export.*

$$\frac{\partial Q_{2A}}{\partial F_A} < 0 \ and \frac{\partial Q_{2A}}{\partial D_{2A}} < 0 \qquad (2.2.10)$$

**Proposition2.2.3:-***The elasticity of export quantity with respect to fixed and variable compliance cost will be less than 1.*

[17]If $F_{ij}+D_{ij} \leq -a$, the exporting firm is a monopolist in the importing country's market.

$$\left(\frac{\partial Q_{2A}}{\partial F_A}\right)\left(\frac{F_A}{Q_{2A}}\right) < 1 \; and \left(\frac{\partial Q_{2A}}{\partial D_{2A}}\right)\left(\frac{D_{2A}}{Q_{2A}}\right) < 1 \qquad (2.2.11)$$

### 2.2.2 Effect on Welfare:-

As we have assumed away the presence of any externality, the social welfare function will be summation of consumer and producer surplus. For the importing country, i.e. country A there will be a resulting loss in consumer surplus by the following amount

$$(4a - 2F_A - 2D_{2A})(F_A + D_{2A})/18b \qquad (2.2.12)$$

Producer surplus for the importing country will increase as expected due to increase in the local firm's market share. The gain in producer's surplus is $(F_A^2 + D_{2A}^2 + 2aF_A + 2F_AD_{2A} + 2aD_{2A}) / 9b$

Welfaregain:-$(F_A + D_{2A})/3b$(2.2.13)

**Proposition2.2.4:-***Higher the compliance cost of the trading partner, (i.e. the exporting country)higher will be the welfare gain of the importing country.*

For country Bi.e. exporting country as there is no change in $p_B$ and $Q_{2B,}$ there will be no change in consumer surplus. Loss in Producer's Surplus as well as welfare is as follows:

$$(2a - 2F_A - 2D_{2A})(2F_A + 2D_{2A})/9b \qquad (2.2.14)$$

## 2.3 Extension :(Nxn)

Extending this model to Nxn framework (i.e. N country,n firms) we get some interesting results. Let us assume A is the importing country and other (N-1) countries are exporting to country A. The fixed part of the cost of compliance(Fj) remains same across the exporters whereas the variable part (Di)differs depending on the available technology etc in the particular exporting

country;e.g. fixed part can be the expense related to purchase of some quality assurance certificate which the importing country issue and variable part can be the expense incurred in the exporting country to achieve the targeted quality required in the export market.All other basic assumptions remain unchanged.

The inverse demands in market A, B, C,……,N are respectively

$$p_A = a - b(Q_{1A} + Q_{2A} + Q_{3A} + \cdots \ldots \ldots \ldots Q_{nA}) \quad (2.3.1)$$

$$p_B = a - bQ_{2B} \quad (2.3.2)$$

$$p_N = a - bQ_{nN} \quad (2.3.3)$$

Again,

$Q_1 = Q_{1A}$

$Q_2 = Q_{2A} + Q_{2B}$

$Q_3 = Q_{3A} + Q_{3C}$

……

$Q_n = Q_{nA} + Q_{nN}$

The profit function of a representative firm,

$$\pi_i = \sum_{j=A}^{N} p_j Q_{ij} - \sum_{j=A}^{N} (F_j + D_{ij}) Q_{ij} \quad (2.3.4)$$

The equilibrium outputs are as follows:[18]

When j is importing country,

$$Q_{ij}{}_{\forall i \in j} = (a + (n-1)F_j + \sum_{i=1}^{n} D_{ij})/(n+1)b \qquad (2.3.5)$$

$$Q_{ij}{}_{\forall i \in j} = (a - 2\,F_j - nD_{ij} + \sum_{k=1,k\neq i}^{n} D_{kj})/(n+1)b \qquad (2.3.6)$$

When j is exporting country,

$$Q_{ij}{}_{\forall i \in j} = a/2b \qquad (2.3.7)$$

### 2.3.1 The effect on trade:-

Equation 2.3.6 shows the amount of export for the $i^{th}$ exporting country. It can be observed that comparative efficiency of the exporting country matters a lot for export performance which is negatively related to own compliance cost and positively related to competitor's compliance cost.

**Lemma 2.1:-** The elasticity of importing country's (say j) domestic output with respect to fixed part of compliance cost (for Foreign firms) is less than 1, i.e.

$$\frac{\partial Q_{ij}}{\partial F_j}\frac{F_j}{Q_{ij}} < 1 \;\forall i \in j; because D_{ij} > 0, a > 0 \qquad (2.3.8)$$

**Proof:** -From equation 2.3.5,

[18] Appendix 2.3

$$\frac{\partial Q_{ij}}{\partial F_j}\frac{F_j}{Q_{ij}} = (n-1)Fj/(a+(n-1)F_j+\sum_{i=1}^{n} D_{ij}) \text{ , which is a fraction}$$

**Lemma 2.2:-** The elasticity of importing country's (say j) output with respect to the variable part of compliance cost (ofanyexportingfirm) is less than 1, i.e.

$$\frac{\partial Q_{ij}}{\partial D_{ij}}\frac{D_{ij}}{Q_{ij}} < 1 \; \forall i \in j; because F_j > 0, \sum D_{ij} > 0, a > 0 \qquad (2.3.9)$$

**Proof**:-From equation 2.3.5,

$$\frac{\partial Q_{ij}}{\partial D_{ij}}\frac{D_{ij}}{Q_{ij}} = 1/(a+(n-1)F_j+\sum_{i=1}^{n} D_{ij}) \; thisisafraction.$$

**Lemma 2.3:-**The absolute elasticity of exported output (for any firm i) with respect to fixed part of compliance cost is always less than 1.

**Proof:-** From equation 2.3.6

$$\frac{\partial Q_{ij}}{\partial F_j}\frac{F_j}{Q_{ij}} = -2Fj/(a-2F_j-nD_{ij}+\sum_{k=1,k\neq i}^{n} D_{kj})$$

This expression is greater than 1 iffDijexceeds some critical value,

$$\widetilde{D_{ij}} = \left(a+\sum_{k=1,k\neq i}^{n} D_{kj}\right)/n \qquad (2.3.10)$$

From equation 2.3.6 it is clear that the above condition is not possible as long as firm i is exporting some positive quantity to country j.

**Lemma 2.4**:-The elasticity of exported output (for any firm i) with respect tovariablepartofcompliance cost is always less than 1.

**Proof:-** from equation 2.3.6,

$$\frac{\partial Q_{ij}}{\partial D_{ij}}\frac{D_{ij}}{Q_{ij}} = -nD_{ij}/\left(a - 2\,F_j - nD_{ij} + \sum_{k=1,k\neq i}^{n} D_{kj}\right)$$

This expression is greater than 1 iff$D_{kj}$falls below some critical value.

$$\sum_{k=1,k\neq i}^{n} \widetilde{D_{kj}} = \left(2F_j - \quad a\right) \tag{2.3.11}$$

From equation 2.3.6 it is clear that the above condition is not possible as long as firm 'i' is exporting some positive quantity to country j.

### 2.3.2 Effect on welfare:-[19]

The welfare calculation in nxn is little complex as the competitors in export market vary in efficiency. For the importingcountry(j) there will be gain in producers' surplus of the amount:

$$\left\{\left(2a + (n+1)F_j + \sum_{i=1}^{n} D_{ij}\right)\left((n-1)F_j + \sum_{i=1}^{n} D_{ij}\right)\right\}/(n+1)^2 b \tag{2.3.12}$$

Loss in consumer surplus of the amount:

$$\left\{\left(2na - (n-1)F_j - \sum_{i=1}^{n} D_{ij}\right)\left((n-1)F_j + \sum_{i=1}^{n} D_{ij}\right)\right\}/2(n+1)^2 b \tag{2.3.13}$$

[19] see Appendix 2.4

Gain in producer's surplus will outweigh the loss in consumer's surplus if fixed and variable part of exporters' cost of compliance is sufficiently high.

For the exporting country (i.e. country i) there is nochange in consumer surplus but the producer surplus will change by:

$$\left(2a - 2F_j - nD_{ij} + \sum_{k=1,k\neq i}^{n} D_{kj}\right)\left(2F_j + nD_{ij} + \sum_{k=1,k\neq i}^{n} D_{kj}\right) / (n+1)^2 b \qquad (2.3.14)$$

In the nxn structure imposition of standard will be beneficial for the importing country if the exporting partners have the high compliance cost , where as in the 2x2 structure it will be always beneficial to impose the standard for the importing country. Actually the loss in consumer surplus for importing country with the imposition of standard increases with increase in the number of exporters (as more exporters means more quantity)and higher is the initial demand (a) ,higher will be the initial consumer surplus and the subsequent loss in consumer surplus. For the exporting country 2x2 situation will always lead to loss in producer surplus as standard increases the cost of production which leads to fall in the volume of export but in Nxn the producer surplus may improve for some exporting country if it is relatively more efficient than its competitors in export market (equation 2.3.4).

**Lemma 2.5**:-Bilateral trade will result in a zero sum situation where importing country will gain at the cost of exporting country whereas welfare consequence of multilateral trade( (n-1)exporting countries) will depend on absolute and relative magnitude of compliance cost of the export partners.

Proof:- Follows from (2.3.12),(2.3.13) and (2.3.14) ■

## 2.4 Standards which affect willingness to pay:

In many situations**,** it is surely not the case that standards are simply cost raising measure with no offsetting positive value. Standard may increase the willingness to pay of the consumers and in that way it may have a positive impact on welfare.

In a vertically differentiated[20] product space, all consumers agree over the most preferred mix of characteristics and more generally, over preferencesordering.A typical example is quality. Most agree that high quality is preferable but the consumers' income and prices of the product determine the consumers' ultimate choice.

Suppose the utility function of the consumer is like following,

$u = \theta s - p$

$= 0$, if he buys a good with quality s at price p (2.4.1)

If he does not buy "u" can be thought of as a surplus derived from the consumption of the good.'s' is a positive real number that describes the quality of the good. The utility is separable in quality and price.θ, a positive real number is a taste parameter. All consumers prefer high quality for a given price; however a consumer with a high θis more willing to pay to obtain high quality and a high income consumer is having a high θ.

Under the above condition suppose the exporting firm produces 2 qualities, one for own market, ($s_B$) another for export market.($s_A$), are sold at prices ($p_B$) and $p_A$."Quality per unit of money" is higher for quality A,i.e. low quality good is not dominated.(otherwise, the problem will become trivial, all the consumers will go for high quality).The consumers with a taste parameter

[20]Tirole (1988)

exceeding $\theta_c = (p_A - p_B) / (s_A - s_B)$ (2.4.2) will buy high quality good and those with a taste parameter lower than θc but exceeding $p_B/s_B$ will buy low quality good and others do not buy at all.

When the standard has been imposed by importing country it is more likely that consumers of the importing country are having higher θ and if we incorporate thatassumption in the model described in section 2.2 then for country A, $\theta > \theta_c$and country B,$\theta < \theta_c$.So the high quality affects the willingness to pay for the consumers of Country A and the consumers become more willing to pay for higher quality. The new demand curve faced by the exporter in export market is:-

$$p'_A = a' - b(Q_{1A} + Q_{2A}), where a' > a \quad (2.4.3)$$

⇒With the improvement in the quality the willingness to pay at each price has increased. The new profit functions are as follows;

$$\pi_1 = [a' - b(Q_{1A} + Q_{2A})]Q_{1A} \quad (2.4.4)$$

$$\pi_2 = [a' - b(Q_{1A} + Q_{2A})]Q_{2A} + [a - bQ_{2B}]Q_{2B} - (F_A + D_{2A})Q_{2A} \quad (24.5)$$

The equilibrium outputs are:

$$Q_{1A} = (a' + F_A + D_{2A}) / 3b \quad (2.4.6)$$

$$Q_{2A} = (a' - 2F_A - 2D_{2A}) / 3b \quad (2.4.7)$$

$$Q_{2B} = a / 2b \quad (2.4.8)$$

### 2.4.1Effect on Trade:-

The exporting country may benefit from expansion of demand if

$$(a' - a) > 2\,F_{ij} \qquad (2.4.9)$$

If the above condition is fulfilled then the standard will work as trade enhancing tool. It will depend on the magnitude of the shift of demand as well as the supply curve.

### 2.4.2 Effect on welfare:-

The effect on consumer surplus of the importing country will be ambiguous because of demand shift. In particular consumer surplus will increase if

$$2(a' - a) > F_{ij} \qquad (2.4.10)$$

Producer surplus will also increase more due to shift in demand. So there will be larger gain of welfare.

For exporting country the consumer surplus remains unchanged as before and the producer surplus as well as welfare increases if condition 2.4.9 is fulfilled. Even if the imposition of standard changes the willingness to pay; it will be more beneficial for the importing country. Condition 2.4.10 is less stringent the condition 2.4.9.

## 2.5Tariff and Standard:-

If the importing country govt is free to impose tariff then amount of tariff which will lead tosameamount of export or same increase in price will be ($F_A + D_{2A}$) (2.5.1) If the standard does not change the willingness to pay, and the firm in the importing country need not have to bear any extra cost to maintain the standard,theimporting country govt must be indifferent between using tariff or standard as a tool of protection. On the other hand if the standard changes the willingness to pay then it may be beneficial for the importing country to impose standard than tariff.

## 2.6Multiple Export Markets:-

The exporting country may target more than one export market.In that case the standard in different export markets may be different which may lead to difference in both the fixed and variable part of the compliance cost. If production technology shows constant returns to scalethen difference in standard will lead to the same result as the harmonized standards in all the markets. If the production technology shows increasing returns toscale then there will be more output loss due to difference in standard.

Suppose Dij shows the variable compliance cost for the $i^{th}$ firm to export to $j^{th}$ country market. Initially we assume the production technology shows constant returns to scale. We take a 3x3 framework where country A exports to Country B and Country C. The exporting country has to bear a fixed set up cost $F_j$ to enter into any export market j and the variable cost $D_{ij}$ and we assume$F_j$ and Dij varies across markets.Firm 1 is situated in country A, 2 in country B and 3 in country C.Let us take the total cost of compliance with foreign standard as:-$E_{ij} = D_{ij} + F_j$ (2.6.1), $E_{ij}$varies across markets. Initially we assume the production technology shows constant returns to scale.

The Profit of firm1,(Exporting Firm)

$$\pi_1 = (a - bq_{1A})q_{1A} + \{a - b(q_{1B} + q_{2B})\}q_{1B} + \{a - b(q_{1C} + q_{3C})\}q_{1C} - E_{1B}q_{1B} - E_{1C}q_{1C} \quad (2.6.2)$$

The profit of importing country firm:

$$\pi_B = \{a - b(Q_{1B} + Q_{2B})\}Q_{2B} \quad (2.6.3)$$

$$\pi_C = \{a - b(Q_{1C} + Q_{3C})\}Q_{3C} \quad (2.6.4)$$

The equilibrium exports are:

$$q_{1B} = (a - 2E_{1B})/3b \quad (2.6.5)$$

$$q_{1C} = (a - 2E_{1C})\ /3b \quad (2.6.6)$$

Total export:-

$$q_{1B} + q_{1C} = \{2a - (2E_{1B} + 2E_{1c})\}/3b \quad (2.6.7)$$

However assuming production technology shows Increasing Returns to Scale

Let the cost function showing the cost of exporting to country B &C be: $E_{1B}.q_{IB}^{0.5}$ and $E_{1c}.q_{1C}^{0.5}$ respectively. The equilibrium outputs are:

$$q_{1B} = \left(a + \sqrt{a^2 - (12b * E_{1B})}\right)/6b \quad (2.6.8)$$

$$q_{1C} = \left(a + \sqrt{a^2 - (12b * E_{1C})}\right)/6b \quad (2.6.9)$$

Total export:-

$$q_{1B} + q_{1C} = \left\{2a + \sqrt{a^2 - 12b * E_{1B}} + \sqrt{a^2 - 12b * E_{1C}}\right\}/6b \quad (2.6.10)$$

### 2.6.1 Effect of Harmonization of Standard:

In this section, we examine the impact on trade as a result of initiative like harmonization. Instead of straightforward assuming upward or downward harmonization [21] we can assume harmonization at the average level of standard that leads to the compliance cost fixed at the average level and common to both the markets.

Suppose the standard has been harmonized in the world market and the exporting country has to bear the cost of compliance common for all the export markets. Let the common cost be:

[21] Chen and Mattoo(2004)

$E_1=(E_{1B}+E_{1C})/2$ (2.6.11)

Assuming initial standard in one of the countries (say country B) is more stringent than another (country C) it is upward harmonization for the later and downward harmonization for the former.

The equilibrium exports under C.R.S,

$$Q_{1B} + Q_{1C} = \{2a - (2E_{1B} + 2E_{1c})\}/3b \quad (2.6.12)$$

The equilibrium exports under IRS,

$$Q_{1B} + Q_{1C} = \left\{2a + \sqrt{a^2 - 6b * E} + \sqrt{a^2 - 6b * E}\right\} / 6b \quad (2.6.13)$$

**2.6.1.AEffect on Trade:-**

Harmonization of standard will work as a trade booster when the production technology shows I.R.S as the firms can reap the benefits of economies of scale.

**Lemma2.6:-**Harmonization to average standard will lead to increase in the import and so as the volume of trade in the region when the production technology shows IRS whereas it will not affect the volume or trade if the production technology shows CRS.

Proof:-Follows from (2.6.7)&(2.6.12);(2.6.10)&(2.6.13) ■

**Lemma2.7:-**Import in the harmonizing region increases unambiguously for the country with most stringent initial standard (Country B) as the exporting country can reap the benefits of both the integrated market as well as reduction in compliance cost, whereas for country C the effect on import is ambiguous as the exporting country can get the benefit of only the former.

Nevertheless the import in Country C will increase iff,[22]

$E_{1B} < 3E_{1c}$ (2.6.14)

[22]Comparing values of $q_{1c}$ before and after harmonization.

The above result predicts that if the difference between the initial standards is not sufficiently high then the import in the country can increase after harmonization even if it follows upward harmonization.

**2.6.1.BEffect on welfare:-**

The welfare effect of standard harmonization on exporting country depends on the effect on producer's surplus as the consumer surplus of the exporting country remains unchanged with or without harmonization. The revenue from export market which has undergone downward adjustment will surely increase unless the demand is highly inelastic[23].The revenue from the market with upward adjustment will also increase if condition 2.6.14 is fulfilled and demand is not very inelastic.

For the importing country there will be an increase in consumer surplus due to increase in price and larger flow of quantity. But there will be a reduction in profit.[24]

## 2.7Effect of Mutual Recognition Agreements (MRAs):-

Compliance with technical regulations generally needs to be confirmed. This may be done through testing, certification or inspection by laboratories or certification bodies, usually at the company's expense. As we know, on-transparent and discriminatory conformity assessment procedures can become effective protectionist tools. One of the most powerful measures to boost trade is the mutual recognition of existing standards, whereby a country grants unrestricted access of its market to products that meet any participating country's standards. This was the approach taken in principle by the European Union, with the spur of the Cassis de Dijon judgment of the European Court of Justice. Mutual recognition agreements (MRAs) are, however, not likely to be an option if there is a significant divergence in the initial standards of

[23] As there will be fall in price in the importing country due to increase quantity from exporting country
[24] see Appendix 2.5

the countries, as became evident in the context of the European Union. In such cases, a certain degree of harmonization is a precondition for countries to allow products of other countries to access their markets.

Mutual recognition can be equivalent to downward harmonization[25],i.e. products that comply with a standard set by any participating country can be freely sold in the entire region which will lead to choice of least strict standard. In the present model mutual recognition can be adoption of average standard with the cost of compliance consisting $\min(F_A,F_B)$ instead of $(F_A+F_B)$.
The effect is very obvious. It will lead to a further increase in the volume of trade as it leads to further decrease in the cost of compliance and the exporting firm will reap the benefit of integrated market as well as reduction in cost

## 2.8Conclusion:

Barriers related to product standards are the main concern of developing country's export today. Exporters from developing countries are increasingly feeling the pressure to conform to international standards if theywish to enter successfully developed country markets.

Much has been achieved in various developing countries to construct the requisite quality infrastructure, to enable exporters both to understand the nature and detail of the quality standards to be met and to take the steps to comply with them. Butmany developing countries yet to install the necessary infrastructure to help their exporters meet market requirements.The potential to use product standards as hidden trade barriers is immense. Even if a small part of this potential is allowed to be exploited, the implementation of the free trade regime could

[25] Chen and Mattoo(2004)

become dominated by protectionists and those who would welcome trade retaliation and counter retaliation. However, transparency and harmonization of standards couldbecome trade facilitators in addition to providing technical quality and safety parameters. Exporting country has to incur significant cost to meet up the standard specified by their trading partner as the trading partner (importing country) has the advantage to set the "standard" nearer to the domestic standard if its intention is to protect the local producers. As mentioned earlier, this chapter specifically deals with those standards which are purely related to quality and does not deal with externality. The simple model developed in the chapter shows the following important things,

**In a bilateral trade the importing country will always benefit by the imposition of quality related standard as long as exporting country has positive compliance cost, whereas in the multilateral trade (more than one exporting country ), the importing country may or may not benefit from that situation**.

a) **Higher is the cost** to comply with quality related standard , higher will be the loss in the **volume of trade**, provided standard does not change willingness to pay.

b) When there is export competition (nxn) comparative efficiency of exporting country positively relates to share in export market.

c) Imposition of standard bythe importing country is always harmful for the exporting country when importing country has only one trading partner (2x2) whereas it may not be always harmful for any exporting country if it has multiple competitors in export market (nxn) and it is relatively much more efficient than them.

d) Even if quality related standard changes the **willingness to pay**, **importing country will be surely more benefitted from** that and exporting country may or may not be benefitted from shift in demand.

e) When the exporting country targets multiple export markets, difference in standards in export markets can be harmful as it restricts the exporting firm to accrue the benefit of economies of scale.

f) If the production technology is showing IRS ,**standard harmonization** at the average standard surely increases the revenue of exporting firm from the importing country market if the latter has gone through downward adjustment and also from the importing country market which has done upward adjustment unless the initial difference between standards(in two markets) are very high.

g) **Mutual Recognition of standards** can improve volume of trade even under C.R.S and can aggravate the benefit of scale economies under I.R.S

This chapter has dealt with the quality related standards and has not specifically taken into consideration the other possible reasons behind imposition of standards for the importing country. Along with maintaining the quality of exports, the "export standards" also focus on maintenance of plant and animal life as well as the protection of the environment in which case the importing country can impose externalitylinked standards. Externality linked standards affect the welfare function of the trading countries not only through consumer and producers'surplus but also through the change in the initial externality. Externality linked standards can be imposed to abate production or consumption externality. Moreover externality itself can be "imposed externality" by the importing country to protect the local market where the actual externality generated by consumption or production of the product is zero. These externality linked standards are the focus of next two chapters.

## Appendix 2.1

$$\frac{\partial \pi_1}{\partial Q_{1A}} = a - 2bQ_{1A} = 0$$

(A.2.1)

$$\frac{\partial \pi_2}{\partial Q_{2A}} = a - bQ_{1A} - 2bQ_{2A} - F_A - D_{2A} = 0$$

(A.2.2)

$$\frac{\partial \pi_2}{\partial Q_{2B}} = a - 2bQ_{2B} = 0 \qquad \text{(A.2.3)}$$

From above equations:-

$$2bQ_{1A} + bQ_{2A} = a$$

$$bQ_{1A} + 2bQ_{2A} = a - F_A - D_{2A}$$

$$2bQ_{2B} = a$$

Solving by Cramer's rule one can get the quantities.

## Appendix 2.2

Consumer surplus under free trade is:- $4a^2 / 18b$ (A.2.4)

The consumer surplus after it imposes standard on imports is:-

$(2a - F_A - D_{2A})^2 / 18b$ (A.2.5)

Producer Surplus for firm 1 i.e. firm in Country A under free trade is $a^2 / 9b$ .(A.2.6)

Producer surplus after the country imposes the standard on imports is:

$(a + F_A + D_{2A})^2 / 9b$ (A.2.7)

Producer Surplus under free trade is $13a^2 / 36b$(A.2.8)

Producer surplus after complying with international standard:-

$a^2 / 4b + (a - 2F_A - 2D_{2A})^2 / 9b$ (A.2.9)

## Appendix 2.3

The result for nxn has been derived by similarity.

For 2x2:

$$Q_{1A} = (a + F_A + D_{2A})/3b$$

$$Q_{2A} = (a - 2F_A - 2D_{2A})/3b$$

$$Q_{2B} = a/2b$$

For 3x3 i.e. one importing country A (where firm 1 is situated) and 2 exporting countries B and C(where firm 2 and 3are situated).

$$Q_{1A} = (a + 2F_A + D_{2A} + D_{3A})/4b$$

$$Q_{2A} = (a - 2F_A - 3D_{2A} + D_{3A})/4b$$

$$Q_{3A} = (a - 2F_A - 3D_{3A} + D_{2A})/4b$$

$$Q_{2B} = a/2b$$

$$Q_{3C} = a/2b$$

For 4x4 ,i.e. one importing country A (where firm 1 is situated) and 3 exporting countries B ,C and D(where firm 2 , 3 &4 are situated).

$$Q_{1A} = (a + 3F_A + D_{2A} + D_{3A} + D_{4A})/5b$$

$$Q_{2A} = (a - 2F_A - 4D_{2A} + D_{3A} + D_{4A})/5b$$

$$Q_{3A} = (a - 2F_A - 4D_{3A} + D_{2A} + D_{4A})/5b$$

$$Q_{4A} = (a - 2F_A - 4D_{4A} + D_{2A} + D_{3A})/5b$$

$$Q_{2B} = a/2b$$

$$Q_{3C} = a/2b$$

$$Q_{4D} = a/2b$$

Looking at the similarity we derive the result for nxn

**Appendix 2.4:**

All the resultshave been derived in inductive way.

From Appendix 2.2

The gain in producer Surplus for importing country in 3x3:

$$(2a + 2F_A + D_{2A} + D_{3A})(2F_A + D_{2A} + D_{3A})/16b$$

The same in 4x4:

$$(2a + 3F_A + D_{2A} + D_{3A} + D_{4A})(3F_A + D_{2A} + D_{3A} + D_{4A})/25b$$

The loss in consumer surplus for importing country in 3x3

$$(6a - 2F_A - D_{2A} - D_{3A})(2F_A + D_{2A} + D_{3A})/32b$$

The same in 4x4

$$(8a - 3F_A - D_{2A} - D_{3A} - D_{4A})(3F_A + D_{2A} + D_{3A} + D_{4A})/50b$$

So the result follows for nxn

The loss /gainin producer surplus for exporting country in 3x3

$$(2a - 2F_A - 3D_{3A} + D_{2A})(2F_A + 3D_{3A} + D_{2A})/16b$$

The same in 4x4

$$(2a - 2F_A - 4D_{4A} + D_{2A} + D_{3A})(2F_A + 4D_{4A} - D_{2A} - D_{3A})/25b$$

The result follows for nxn.

## Appendix 2.5

Firm i situated in importing country j,

Before Harmonization,

$$Q_{ij} = \left(5a - \sqrt{\quad (12b \quad F_i \quad )}\right)/12b \quad \text{(A.2.10)}$$

$$P_i = \left(5a - \sqrt{\quad (12b \quad F_i \quad )}\right)/12 \quad \text{(A.2.11)}$$

After Harmonization,

$$O_i = \left(5a - \sqrt{a^2 - (6b + E)}\right)/12b \quad \text{(A.2.12)}$$

$$P_i = \left(5a - \sqrt{a^2 - (6b + E)}\right)/12 \quad \text{(A.2.13)}$$

# Chapter – 3: Standards and "imposed" negative externality

## 3.1 Introduction:

Standards and technical regulations are increasingly mentioned as a factor driving trade costs. The 1947 GATT accords allowed the use of minimum standards to protect human, animal and plant health, as well as to bring order in the market. Although the accords stated that standards should not be used as covert forms of protectionism, GATT jurisprudence shows that it is not easy to prove that a minimum standard has a protectionist aim.The Marrekesh accords setting up the World Trade Organization (WTO) established that standards can differ from internationally accepted levels only when there is scientific evidence supporting the decision.Despite the agreement, the US National Research Council correctly predicted that the use of standard as a tool of protection will become more and more important. Standards imposed by importing country which is linked with some "imposed" negative externality. [26]Thereis empirical evidence of imposition of such kind of standards by different importing countries in different times for different imported items.Singapore, one of the major importer of Peanuts for India demands 0% aflatoxin (below the traceable limits) for any exporter of groundnut in the country whereas the aflatoxin limit for ground nut in EU is 2 ppb and in case of Asian countries like Indonesia and Malaysia limit stands at 5ppb.The limit set by Singapore is clear case of setting up a standard without any scientific justification and risk assessment which is advocated in SPS agreement.[27]Another example of such kind of barrier has been identified through a case study.

[26] Purely "protectionist" standards
[27]Saqib and Taneja (2005)

Import of Indian meat is banned in Singapore and Indonesia. Indonesia has banned the Indian meat on the pretext of the foot and mouth disease prevalent in India. Even after numerous certificates and declaration from the Ministry of Health, Indian meat is banned in these countries on a false allegation of foot and mouth disease.[28] Indian exporters of mangoes believe that while setting the standard the acceptable level of risk defined by New Zealand is too stringent and could not be justified scientifically.In the case of rice as well, Indian producers have complained that aflatoxin standards serve protectionist purposes.The problems are larger in the case of basmati or premium grade rice rather than for non-basmati rice. Exporters were of the opinion that USFDA standards and the relative stringency of the basmati rice standards were primarily on account of protection provided to domestic producers in the United States.[29] The EU has always been a major source of SPS-related problems for India. This is not unexpected given that the EU is generally known to have the strictest SPS regulations in theworld. Developing countries at large have been severely affected due to its non-acceptanceof established international standards and the application of its own higher standards ongrounds of observance of higher safety norms. It is widely believed that often there is notenough justification for such higher standards. More so because very often it is found thatlower standards exist in several other developed countries. The EU does not alwaysprovide sufficient evidence to justify those stricter requirements also. In many cases, thescientific justification of the EU requirements has been called into questions too.**All these evidences prove that there exist export standards with purely "protectionist" intentions imposing a real challenge for the exporters specially those who target developed country export markets.**

[28]*ibid*.
[29]Jha (2002)

In this chapter we develop a simple two country two firm model where the foreign country (importing) imposes a minimum “standard” on a good which is exported by domestic firm. Though the importing country may argue for justification of the standard as reducing negative externality but actual externality related to consumption of this product iszero. Costs rise with “standard” for both the countries but the marginal compliance cost is higher and more responsive to changes in “standard” for exporting (Home) country. Moreover there is a high fixed set up cost for producing at two standard levels which compels the exporting country to produce at the “standard” (specified by the importing country) even for its own market. Under such conditions the net gain from trade for the exporting country will be a decreasing function of the standard whereas for importing country it can be an increasing function of standard even if higher standard does not abate any negative externality. While the importing country’s firm will lobby for the lowest minimum standard which will exclude the exporting firm, the standard actually chosen by government (Local Social Planner/ Policy maker) of importing country can be lower than that but “Protectionist” in nature.

As norms and standards usually apply to both national and foreign production, they do not correspond to the classical forms of protectionism, which openly discriminate against imports.However it may cloak protectionist intentions. Moreover it is even possible protection is the only goal of standard In particular, there has beenconsiderable discussion of whether standards and regulations affect tradecosts and export prospects for developing countries. Whether an NTB (“standard” here) is protectionist is sometimes difficult to identify in the presence of market failure.If an NTB is equal to the measure that a social planner would implement for domestic purposes (i.e., all firms are domestic firms or all agents belong to a single economy), the NTB is presumably non- protectionist (Fisher and Serra, 2000).

The rest of the chapter is organized as follows.Section 2 presents the theoretical model to track the role of standards and technical regulations in explaining aFirm's export performance.The structure of the model has been framed following Fischer and Serra (2000) where the importing country imposes a standard and the costs rise with standard. Contraryto Fischer and Serra, we have assumed cost of compliance with standard (and its responsiveness too) differs across countries depending on the efficiency of the firm.Section 3 shows the comparison of welfare effect of NTB (standard here) and "equivalent tariff". Section 4 defines the "protectionist" standard and formally proves "imposed" standard is "protectionist". Section 5 finds out the optimum standard under "imposed" negative externality[30] and section 6 concludes.

## 3.2The Model:-

We analyze a profit-maximizing firm's export behavior by modelingits decision to export to a set of differentiated markets. For simplicity, let us suppose the world consists of 2 countries, labeled as ***j= Home (H), Foreign (F),***where F is the importing country and H is the exporting country.[31]

The importing country imposes variedstandards and technical requirements on the good (described as $\tau$ in this model and taken as continuous)that is marketed in its market such asemission standards and regulations, to reduce the "imposed" negative externality arising fromconsumption, such as pollution. Because of the nature of the standards as the provision of apublic good, a firm's compliance with the standards has no effect on consumers' demandfor the regulated product.Moreover in this model we assume the externality shown by importing country is "imposed" externality i.e. the actual externality generated by consumption or production of the commodity is zero.Firm 1 is domiciled in country H, in which it sells *q*units of output in its own

[30] Which is necessarily zero

[31] Again the reason for trade can be difference in some fixed cost (chapter2) and we can assume $R_H < R_F$

market while it exports $q_h$ tocountry F. Firm 2, domiciled in country F sells $q_f$**in own market**. We further assume that standard has no effect on demand for the good, as probably occurs for many environmental standards. The compliance with foreign country's technical requirements implies a differentiated cost to the domestic as well as foreign firm.

Domestic firm does not specify any technical requirement but has to incur a fixed setup cost to maintain the two different standards in two different markets.If the set up cost (F) exceeds the cost of maintaining different standards then, domestic firm will go for same standard.[32] The demand functions which are assumed to be linear are for both home and foreign country are respectively given by

$$p = a - bqandp* = a - b'(q_f + q_h) \qquad (3.3.1)$$

The profit functionsof domestic and foreign firms are respectively,

$$\pi = max_{\{q,q_h\}}[(a - bq)q - \{a - b(q_h + q_f)\}q_h - c_h(\tau)(q + q_f)] - R_H \qquad (3.2.2)$$

$$\pi^* = max_{\{q_f\}}[\{a - b(q_h + q_f)\}q_f - c_f(\tau)q_f] - R_F \qquad (3.2.3)$$

Where Π and Π*are Home and Foreign firm's profit functions. The parameter τ represents the minimum standard set in Foreign Market (F). We use $c_h(\tau)$ & $c_f(\tau)$ to denote constant unit production cost at standard level τ (compliance cost) for Home and Foreign country respectively. Unit production costs rise with the standard and are convex in standard. The unit compliance cost for Home is greater than that of foreign country and more responsive to changes in τ. These conditions can be expressed as,

[32] Or else we can carry the same analysis by assuming the domestic firm is catering two different export markets one with requirement of "high standard" and another with requirement of "null standard". Further we can assume there is duopoly in the first market ( as the firm in the importing country is also supplying) and monopoly in the second market ( no local firm in the second country).

$$c_i \geq 0, c'_i > 0, i = H, F; c_h > c_f; c'_h > c'_f \quad (3.2.4)$$

We can justify this assumption assuming that foreign country is technically more equipped to adopt the "standard" compared to Domestic country which is very common when the standard imposed by the importing country has some "protectionist" intention and so designs it in its own favour. The importing country can impose those standards which are nearer to its local standards so becomes less expensive to adopt. The unit costs are an increasing function of standard, and as standard does not alter the demand for the good firms will always produce at a minimum permitted standard.

Therefore assuming constant marginal utility of income and that no cost involved in whether the good complies with minimum standard, social welfare in Home can be expressed as consumer surplus plus the producer surplus from local market as well as from foreign market, i.e.,

$$W^H(\tau) = \frac{3(a-c_h)^2}{8b} + \frac{(a-2c_h+c_f)^2}{9b'} + E(q,\tau) \quad (3.2.5)$$

$E(q,\tau) < 0$ is the loss associated with externality. For Foreign country the social welfare undermonopoly (i.e. when high standard keeps the imports out) is:

$$W^m{}_F(\tau) = \frac{(a-c_f)^2}{8b'} + \frac{(a-c_f)^2}{4b'} + E(q_f + q_h, \tau) \quad (3.2.6)$$

The social welfare under duopoly,

$$W^d{}_F(\tau) = \frac{(2a-c_f-c_h)^2}{9b'} + \frac{(a-2c_f+c_h)^2}{9b'} + E(q_f + q_h, \tau) \quad (3.2.7)$$

With no standard i.e. under free trade,

$$q_h = \frac{a}{3b'}, q_f = \frac{a}{3b'}, q = \frac{a}{2b} \quad (3.2.8)$$

With standard i.e. under protected trade,

$$q_h = \frac{\left(a-2c_h(\tau)+c_f(\tau)\right)}{3b'}, q_f = \frac{\left(a-2c_f(\tau)+c_h(\tau)\right)}{3b'}, q = \frac{(a-c_h)}{2b} \quad (3.2.9)$$

The solution shows for Home country the output for local market as well as export market is more under free trade. The output of the foreign firm after the imposition of standard can exceed its free trade output if $c_h(\tau) > 2c_f(\tau)$ (3.2.10)

Comparing 3.2.9 with 3.2.8 we can see the reduction in the "volume" of trade with trade regulations through increase in the cost of compliance.

### 3.2.AEffect of tightening of standard on output:-

**Proposition 3.1**:-*When the importing country (H) tightens the standard (τ),*

i) *The output in the local market of exporting country falls, where as that in the importing country increase.*
ii) *The amount of export falls.*

**Proof:**

$$-\frac{\partial q}{\partial \tau} < 0 \; as, c'_h(\tau) > 0 \quad (3.2.11)$$

$$\frac{\partial q_h}{\partial \tau} < 0 \;\; as, \left|c'_h(\tau)\right| > \left|c'_f(\tau)\right| \quad (3.2.11a)$$

$$\frac{\partial q_f}{\partial \tau} > 0 \;\; if, \left|c'_h(\tau)\right| > \left|2c'_f(\tau)\right| \quad (3.2.12)$$

It shows if the responsiveness of cost of compliance of domestic firm is too high compared to its trading partner then the output of foreign firm can increase with increase in $\tau$, and export from domestic country will always fall with the tightening of standard. We will do our rest of the analysis assuming 3.2.10 and 3.2.12 holds.

## 3.3Tariff vs NTB

Tariffs on manufacturing goods have been reduced to low levels through eightsuccessive rounds of the World Trade Organization (WTO) and its predecessor, theGeneral Agreement on Tariffs and Trade (GATT).**The reason for phasing out of tariff is it crates unnecessary distortions and loss of world welfare as it has a sharp negative effect on consumption.**As tariffs have been lowered, demands for protectionism have induced new NTBs, such as TBT (Technical Barriers to Trade)[33]interventions. The United Nations Conference on Trade and Development (UNCTAD, 2005) estimates that the use of NTBs based on quantity and price controls and finance measures has decreased dramatically, from a little less than 45% of tariff lines faced by NTBs in 1994 to 15% in 2004, reflecting commitments made during the Uruguay Round. However, the use of NTBs other than quantity and price controls and finance measures increased from 55% of all NTB measures in 1994 to 85% in 2004. The use of TBT almost doubled, from 32% to 59% of affected tariff lines during the same period.

This new protectionism also affects welfare, may reduce the consumer surplus and distorts trade. The comparison between tariff and NTB shows sometimes NTB may lead to worse situation than that of tariff. To make the effects comparable first of all we should calculate the "equivalent tariff**"**for a specific NTB (standard in this case).

[33] Minimum Standard falls in this category

### 3.3.ACalculation of equivalent Tariff (for a given τ)

Instead of taking the most often used "Price –wedge method"(price that would prevail without the NTB, to the price that would prevailin the presence of the NTB if the price paid to suppliers were to remain unchanged[34] is the tariff equivalence[35]) "trade equivalence"[36] method has been chosen to calculate the equivalent tariff. The idea is instead of maintaining the sameprice if the importing country maintains the same volume of trade (i.e. the same amount of import) what amount of tariff it should impose on trading partner. The equivalent tariff [37]is of the amount= $(2c_h-c_f)/2$(3.3.1)[38]

### 3.3. BWelfare effect: - NTB vs "equivalent tariff"

**This section does a comparative study between welfare effects of two different forms of protectionism i.e. tariff and non –tariff barrier (minimum standard), when there is no true negative externality(the reason for which standard has been imposed), i.e.a situation in which standards are purely "Protectionist".**

We take the standard case of total surplus (consumer surplus and producer surplus) maximization as welfare maximization. In the given framework if we compare between NTB (here "standard" henceforth mentioned as NTB in this section) and "equivalent tariff" (henceforth mentioned as tariff), there is a **loss of consumer surplus for** exporting country from NTB**of the amount**

$$c_h(2a - c_h) / 8b \qquad (3.3.2)$$

[34]in this model price paid to the suppliers will change as the net price of the product in importing country will fall with the fall in world demand for the good. ( due to tariff or Non-tariff barrier)
[35]Deardorff and Stern, 1998
[36] which is also known as quantity impact calculation
[37] assuming the tariff improves the welfare of the importing country
[38] See Appendix3. 1

This is the loss in consumer surplus from its own local market as it is compelled to produce at a high standard though it does not have any technical requirement for its own market. Similarly there is a loss of producer surplus (due to high cost of production and low demand) from local market of the amount$c_h(2a - c_h)/\ 4b$. (3.3.3)

Though there will not be any change of profit for exporting firm from the foreign market under tariff and NTB but definitely there is loss from home market and consumers are also negatively affected. Therefore under this situation NTB leads to positive welfare loss for exporting country compared to "equivalent tariff". In that context, the exporting country will prefer to be "discriminated" by tariff than that of NTB.

Next we find out what happens to importing country. It also faces a loss of consumer surplus and producer surplus[39]under NTB (compared to tariff) of the following amount respectively,[40]

$$c_f(8a - 4c_h - c_f)/\ 24b' \quad (3.3.4)$$

$$c_f(4a + 4c_h - 5c_f)\ /12b' \quad (3.3.5)$$

In this case the importing country will prefer to "protect" its firm by tariff than by NTB.

**Lemma 3.1**:-Importing country's welfare necessarily improves with "tariff" which is not the case with "standard" (NTB).

**Proof:**-With the tariff the net gain in welfare[41] for importing country is $(2c_h - c_f)^2\ /24b'$which is always positive whereas with "Standard" the net welfare gain is

[39] the potential tariff revenue inflates the amount of loss
[40] See Appendix3.2

$\left[(c_h - c_f)^2 + c_f(2c_f - 4a)\right]/6b$ which is positive if the difference between $c_h$&$c_f$ is sufficiently high.

However if the importing country is not free to impose tariff and its welfare increase with increase in standard importing country will go for imposition of positive standard instead of zero standard (i.e. free trade) though the exporting country's welfare is maximized at zero standard. Here NTB is the second best tool of protection.

## 3.4 .Welfare effectof Free Trade and Protected trade:

This section studies decision taking by the Govt. We begin our analysis by considering the welfare functions of exporting country, importing country under duopoly as well as under monopoly (result of prohibitive standard).

With no externality the social welfare function of exporting country $W^H(\tau)$ is decreasing ,as standard does not have any positive effect on Home country's welfare function as the Home country is losing consumer as well as producer's surplus from local market (due to increase in cost of production) and producer's surplus from Foreign market also. Social welfare of importing country under monopoly (i.e. either under autarky situation or after imposition of prohibitive standard on exporting country) is also decreasing in τ but the social welfare under duopoly can be increasing in τ provided there is largedifference between $c_h(\tau) and c_f(\tau)$[42].Moreover it can be initially decreasing inτ ,can reach a minimum ($\tau_{min}$)and then increasing in τ[43],as the difference between $c_h(\tau) and c_f(\tau)$ increases with increase

[41] Calculated on the basis of gain in producers' surplus-loss in consumer surplus and excluding the tariff revenue.
[42] See Appendix 3.3
[43] See Fig A.1 and A.2 in Appendix

in τ.So the intuition suggests that though the foreign firm may always lobby for the standard$\tau = \tau_e$which excludes the domestic firm from the export market,the actual standard imposed by the gov't will depend on the behavior of welfare function. It will maintain the standard $\tau^*$such that$\tau^* = \tau_e$, in the first situation (when welfare function is increasing)but in the second situation (i.e. the welfare function is "u" shaped) thepolicymakerof importing country will go for null standard or prohibitive standard depending on the behavior of welfare function.

Next we should find out what is the highest minimum standard $\tau_e$at which the exporting firm will quit to export. The net gain from Trade for the exporting country (after the imposition of standard)is as follows,

$$G(\tau) = \left(a - 2c_h + c_f\right)^2/9b' - 3(2ac_h - {c_h}^2)/8b \qquad (3.5.1)$$

The first term shows the gain in producer's surplus (as trade gives access to foreign market) and the second term shows the loss in consumer surplus as well as producer surplus in domestic economy. The latter term also can be interpreted as the welfare lossof the exporting country as the domestic firm fails to maintain two different standards for two markets (due to high set up cost).However $G(\tau)$is decreasing and once it reaches to 0 the Domestic firm will reach to break even between export or not.Moreover this break even will also depend on the elasticity of demand in two markets.Trade will be welfare improving for exporting country (at least up to a certain level ofτ)iff $b > b'$i.e. demand in exporting country should be less elastic than that in importing country. This assumption can be given sound intuitive explanation. If the demand in exporting country is relatively more elastic then demand in local market will fall sharply due to increase in price as a result of additional cost (compliance) incurred in the process of production. On the other hand the revenue from Foreign market will not be substantial (and so the producer

surplus earned by domestic firm from export market) due to fall in foreign price with the entry of domestic firm in the foreign market. In that case the loss in consumer and producer surplus from home will outweigh the gain from export market. As the trade will be gainful for exporting country only if the additional producer's surplus earned from export market exceeds the loss in producer and consumer surplus from home market, in the above case the exporting country will stop export under any positive standard.

Therefore, to get any positive optimum standard the assumption $b \geq b'$ has to be maintained.As long as the additional profit from foreign market outweighs the loss from local market the domestic firm will continue to export. Assuming domestic firm exports at the break even standard[44] and the importing country's welfare is increasing in standard (which we will relax in section 5) thegovt of importing country will set the standard at$\tau = \tau_e$.[45]

**Definition of Protectionist Standard:**

In the literature there is variety of opinion on when government measure or action is protectionist. According to Baldwin (1970), a measure is protectionist if it lowers real global income. Engel (1996) defines a measure to be protectionist if it differs from the choice of a world welfare maximizing social planner. Fisher and Serra (2000), characterize a standard (in an open economy) as non-protectionist if the social planer would use it if all firms were local and in this model additionally we have to assume they produce for the local market only.

[44] Even if it does not export at $\tau_e$welfare of foreign country remains unchanged if domestic firm is able to produce at two different standards. (see appendix3.4)

[45] $\tau_e$ in the present case will be lower compared to when domestic firm can produce at two different standard levels.

**Proposition 3.2:-***The standard followed by importing (standard imposing) country will be "protectionist" by either*

*i) the comparison between Local (importing country)and global (one firm in importing country and another in exporting country) duopoly (Fischer &Serra ,2000)*

*ii) local (importing) and global (importing and exporting country) welfare (Engle 1996)*[46]

**Proof:-**

Following that definition let us compare the standards that result from maximizing social welfare when both firms are in the same country with what pertains when one firm is domestic and another firm is foreign.

The social welfare of foreign country under duopoly when both firms are in foreign country,

$$W^D = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' + (a - 2c_h + c_f)^2/9b' \qquad (3.5.2)$$

The social welfare of foreign country under duopoly when one firm is in foreign country and another in domestic country,

$$W^d = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' \qquad (3.5.3)$$

The difference $W^D - W^d = (a - 2c_h + c_f)^2/9b'$ satisfies,

$$\frac{d(W^D - W^d)}{d\tau} = \{2(a - 2c_h + c_f)/9b'\}(-2c_h' + c_f') \qquad (3.5.4)$$

[46] Mentioned by Fischer and Serra (2000)

This term is negative. This means the marginal benefit of rise in minimum standard is greater under duopoly with imports than under a local duopoly. So the minimum standard used in the former case is always high and protectionist by definition. Note that any positive standard imposed here is "protectionist" as there is no real negative externality.

Following Engle (1996) definition of "protectionist standard" we define world welfare as,

$$W^w = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' + (a - 2c_h + c_f)^2/9b' + 3(a - c_h)^2/8b' \quad (3.5.5)$$

$$\frac{d(W^w - W^d)}{d\tau} = \frac{2(a - 2c_h + c_f)(-2c_h' + c_f')}{9b'} + \frac{3(a - c_h)(-c_h')}{4b'} \quad (3.5.6)$$

This term is again negative (and large in magnitude). This means the marginal benefit of rise in minimum standard is greater under duopoly for importing country than the world as a whole.So the minimum standard used in the former case is always high and protectionist by definition. Note that any positive standard imposed here is "protectionist" as there is no real negative externality.

This result reflects two important facts. Firstly in the given framework if the standard is imposed without any externality it will be always protectionist by definition. More interestingly the Gov't of importing country clearly has an incentive towards the imposition of a positive standard even if that is actually not linked to any negative externality, provided there is large difference between cost of compliance as well as its responsiveness of that to changes in standard between two countries.This standard leads to net welfare loss for the exporting country compared to free trade as it creates distortion in local market by raising the production cost which leads to loss in producer surplus as well as consumer surplus.Higher the Cost of compliance for exporting firm higher is the welfare loss.At a too high standard domestic firm quits exporting.

## 3.5Finding out optimum τ

We have taken compliance cost as explicit function of τ.

$$c_h = \bar{c_h}\tau^2 \tag{3.5.1}$$

$$c_f = \bar{c_f}\tau^2 \tag{3.5.2}$$

$$[\bar{c_h}] > 2[\bar{c_f}] \tag{3.5.3}$$

$$b = \bar{b}\tau^2 \tag{3.5.4}$$

We can reconstruct the welfare function of the importing country under duopoly as follows,

$$W_F{}^d(\tau) = \left(2a - \bar{c_f}\tau^2 - \bar{c_h}\tau^2\right)^2/18b' + \left(a - 2\bar{c_f}\tau^2 + \bar{c_h}\tau^2\right)^2/9b' \tag{3.5.5}$$

If $W^d$is throughout increasing in τ then it will be minimized at$\hat{\tau} = 0$ and Gov't will set τ>0

When $W^d$is first decreasing and then increasing, it will be minimized at ;

$$\hat{\tau} = \sqrt{4a\bar{c_f}/\left(\bar{c_f}^2 - 2\bar{c_h}\bar{c_f} + \bar{c_h}^2\right)} \tag{3.5.6}$$

**Lemma 3.2:**-Higher the difference between$\bar{c_f}$and$\bar{c_h}$ lower will be$\hat{\tau}$.

**Proof:-**$\frac{d\hat{\tau}}{d(\bar{c_h} - \bar{c_f})} < 0$ (3.5.7)

Condition (3.5.7)indicates that higher the difference betweencost of compliance with standard τ, lower will be$\hat{\tau}$ i.e.The welfare of the foreign country under duopoly will start increasing for a smaller value of τ.

Next we should find out what is the highest minimum standard $\tau_e$at which the exporting firm will quit to export. The net gain from Trade for the exporting country (after the imposition of standard) is as follows,

$$G(\tau) = \left(a - 2\bar{c_h}\tau^2 + \bar{c_f}\tau^2\right)^2/9b' - 3[2a\bar{c_h}\tau^2 - (\bar{c_h}\tau)^2]/8b \qquad (3.5.8)$$

$G(\tau)$is decreasing and once it reaches to 0 the Domestic firm will reach to break even between exporting or not. Moreover this break even will also depend on the elasticity of demand in two markets.

$$\tau_e = \sqrt{3^{3/2}a\left(\sqrt{\left(-16bb'\bar{c_h}\bar{c_f} + 24bb'\bar{c_h}^2 + 27b^2\bar{c_h}^2\right)} - 8ab'\bar{c_f} + 16ab'\bar{c_h} + 27ab\bar{c_h}\right)/\left(8b'\bar{c_f}^2 - 32b'\bar{c_h}\bar{c_f} + 32b'\bar{c_h}^2 + 27b\bar{c_h}^2\right)} \qquad (3.5.9)$$

Finally what should be the optimum standard will depend on the nature of welfare function of the foreign country under duopoly with standard and the net gain of exporting country after imposition of standard.

**<u>Proposition 3.3:-</u>*If $W^d{}_F$ is increasing in τ,Foreign country sets***

$$\tau^* = \tau_e \qquad (3.5.9)$$

**<u>Proposition 3.4:-</u>*If $W^d{}_F$ first falls, reaches minimum value at$\hat{\tau}$ and then increases then Foreign Country sets:***

$$\tau^* = \tau_e if \tau_e > \hat{\tau} and W^d{}_F(\tau = \tau_e) > W^d{}_F(\tau = 0) \qquad (3.5.10)$$

$$\tau^* = 0, otherwise \qquad (3.5.11)$$

**Therefore even if the firm in the importing country will lobby for prohibitive standard, the Govt in importing country may prefer Null standard i.e. no NTB. The difference in the cost of compliance leads to difference in the policy adopted by importing country Govt.**

**Table 3.1 Game Theoretic Presentation (No externality)**

| | | Exporting Country | |
|---|---|---|---|
| | | Trade (Export) | Autarky (No Export) |
| Importing Country | $\tau$=0(free Trade) | $a^2/3b', 3a^2/8b + a^2/9b'$ | $3a^2/8b', 3a^2/8$ |
| | $\tau=\tau_{e(NTB)}$ | $(2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b',$ $(a - 2c_h + c_f)^2/9b' + 3(a - c_h)^2/8b,$ | $3(a - c_f)^2/8b',$ $3a^2/8b$ |

The Home country has two available strategies (Export, No Export) and the Foreign country has two available strategies (Free Trade, Protected Trade).Assuming (3.5.10) is fulfilledand domesticfirm exports at breakeven; ($\tau=\tau_e$ , export) is the Nash equilibrium[47] though it is not the Pareto efficient situation.($\tau$=0,export) is the Pareto efficient situation but it is not a Nash equilibrium as the importing country can do better by switching to $\tau=\tau_e$.**If either of two above mentioned conditions arenot fulfilled then the latter will be Nash equilibrium.**

## 3.6: Concluding remarks:

Standards dealing with pseudo negative externality leads to huge welfare and trade loss for the exporting country. If the exporting country has to incur huge cost of compliance then it becomes detrimental for exporting country and on the contrary higher the difference in cost of compliance higher will be the welfare gain for the importing country. So the importing country can extract

[47] Note though $\tau=\tau_e$is not adominant strategy for importing country but "export" is the dominant strategy also for the exporting country if the given conditions are fulfilled.

the possibility of raising the standard upto “prohibitive level”. In the earlier chapter imposition of standard was always beneficial (at least in bilateral trade) for the importing country, but underthese circumstancesthe imposition of standard is beneficial only when the exporting country is relatively less efficient. The simple model developed in this chapter shows the following important results like,

a) The significant difference in cost of compliance leads to adoption of **“prohibitive standard”** by importing country without the **presence of any true negative externality** created by the production/consumption of the commodity.
b) Though the reduction of tariff is expected to enhance the world welfare but the presence of this kind of NTB may lead to worse situation than tariff.(for importing country less welfare gain and for exporting country more welfare loss).
c) **(Prohibitive standard, export)** is a probable Nash equilibrium which is not pareto efficient.
d) The “standard” imposed by the importing country is “protectionist” by definition.
e) “Standard” (NTB) is not a dominant strategy for the importing country implying that the decision to impose standard for the importing country depends on the strategy chosen by the exporting country showing that here standard works as a trade strategy tool with purely protectionist intention.

## Appendix3.1:

Suppose the amount import is kept fixed at $\overline{q_h}$

$$\pi_1 = (a - bq)q + \left(a - b'\left(q_f + \overline{q_h}\right)\right)\overline{q_h} - t\overline{q_h} - R_H$$

$$\pi_2 = \left(a - b'\left(q_f + \overline{q_h}\right)\right)q_f - R_F$$

F.O.C:

$$\frac{\partial \pi_1}{\partial q} = a - 2bq = 0 \qquad (A.3.1)$$

$$\frac{\partial \pi_1}{\partial q_h} = a - b'q_f - 2b'\overline{q_h} - t = 0 \qquad (A.3.2)$$

$$\frac{\partial \pi_2}{\partial q_f} = a - 2b'q_f - b'\overline{q_h} = 0 \qquad (A.3.3)$$

Putting the value of $q_h$ in (3.A.2), $q_f = (a + t)/3b'$ $(A.3.4)$

Substituting 3.A.4 in 3.A.3 the value of equivalent tariff comes.

## Appendix3.2:

From 3.A.2,

$$q_f = \left(2a + 2c_h - c_f\right)/6b' \qquad (A.3.5)$$

The consumer surplus under "equivalent tariff" for importing country,

$$\left(4a - 2c_h + c_f\right)^2/72b' \qquad (A.3.6)$$

Consumer surplus under NTB is: $(2a - c_f - c_h)^2/18b$ (A.3.7)

Loss in consumer surplus (under NTB): $c_f(8a - 4c_h - c_f)/24b$ (A.3.8)

The producer surplus under "equivalent tariff" for importing country,

$(2a + 2c_h - c_f{}^2)/36b$ (A.3.9)

Producer surplus under NTB is $(a - 2c_f + c_h)^2/9b$

Loss in producer surplus under NTB for importing country : $\frac{c_f(4a+4c_h-5c_f)}{12b}$ (A.3.10)

Comparing between Free Trade and Tariff,

The gain in Producer surplus for importing country after tariff,

$$\left[(2a - 2c_h - c_f)^2/36b\right] - a^2/9b = (4a + 2c_h - c_f)(2c_h - c_f)/36b \quad \text{(A.3.11)}$$

The loss in Consumer surplus=$(8a - 2c_h + c_f)(2c_h - c_f)/72b$ (A.3.12)

**Appendix3.3:**

The welfare of the importing country under duopoly and monopoly (with prohibitive standards) are respectively,

$$W_F{}^d(\tau) = (2a - c_h - c_f)^2/18b + (a - 2c_f + c_h)^2/9b \quad (A.3.13)$$

$$W_F{}^m(\tau) = (a - c_f)^2/8b + (a - c_f)^2/4b \quad (A.3.14)$$

$$\frac{dW_F{}^d(\tau)}{d\tau} > 0 \; iff\left(c_h{}' - 2c_f{}'\right) > \left(2a - c_f - c_h\right)\left(c_h{}' + c_f{}'\right)/2\left(a - 2c_h + c_f\right) \qquad (A.3.15)$$

Otherwise it will be initially decreasing will reach a minimum and then increasing.

$$At\hat{\tau}, \quad \frac{dW^d{}_{(F)}}{d\tau} = 0 \; and \frac{d^2W^d{}_{(F)}}{d\tau^2} > 0$$

**Appendix3.4:**

If the exporting country can maintain two different standards, then

At $\tau = \tau_e, a = 2c_h - c_f$

$$W_F{}^d(\tau_e) = W_F{}^m(\tau_e)$$

## Diagrams:-

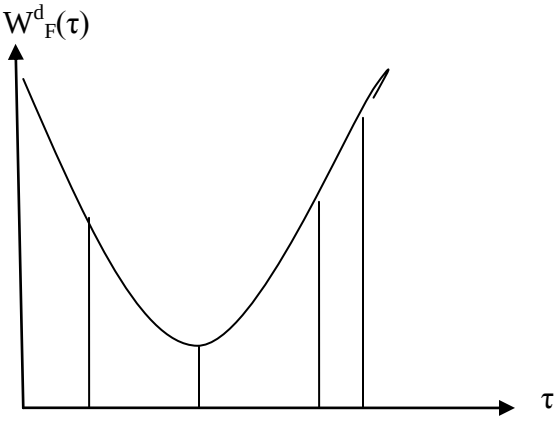



Figure:-3.A.1 Foreign welfare function under duopoly (u-shaped)

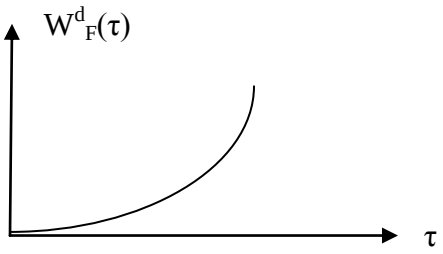



Figure:-3.A.2:- Foreign welfare function under duopoly (increasing)

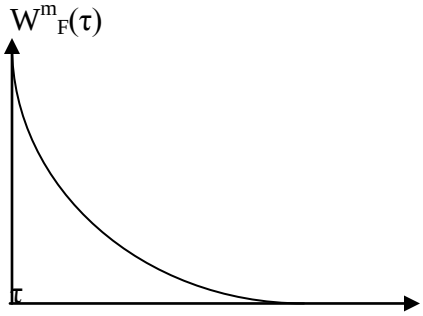



Figure3.A.3:-Foreign welfare function under monopoly

# Chapter – 4: Standards and "True" Negative Externality

## 4.1 Introduction:

In Chapter 3, we dealt with standards which are not related to actual negative externality ("no externality"/ "imposed externality") Protection is the only one goal of such kind of standards. But it is not always the case.**Standard imposed by foreign country can be related to "true" negative consumption or production externality**. The examples of standards that reduce consumption externalities can be that aerosols and refrigeration equipment shouldnot contain Cfcs in order to protect ozone layer, standards on biodegradable detergents and rules relating to recycling of containers.Standards which reduce production externalities can be related to "emission standard" or "labour standard". **Even though these standards are imposed to combat negative externality, they can also be "protectionist" (i.e. above the "optimum" limit) by nature**.In Canada, for example, the cyromazine MRL permissible in potato and potato products, and trimethylsulfonium salt MRL in lentil were both found to be more stringent than international standard. In European Union members, it was glyphosate MRLs in eggs and egg products, and milk and milk products. Another example is Minimum Residue Limits (MRLs) for pesticides in cereals, fruit and vegetables, and products of animal origin. In United States' case it is MRLs in beetsand in spinach, corn, beans, sugar cane, soybeans, sorghum, potatoes, hops, wheat and coffee.In the case of Japan, it was the cadmium presence in brown rice and polished rice as well as the cyazofamid MRL for various agricultural products that were found to be more stringent than international standards. These are just some of the more conspicuous examples of

the violation of the "spirit" of the SPS Agreement, and imposing the standard above the "optimum" standard. Overall, the study by CWS, 2010shows mostly there was a movement towards higher thresholds that were more stringent than internationally accepted norms; and an increase in the product coverage was observed.It should also be noted that the prevalence of national standards based on risk assessments point to the increased use of provisional maximum residue limits (P-MRLs). Higher P-MRLs are proposed when residue trials and toxicological data show an unacceptable risk to consumers. However, any additional residue and toxicology data from WTO Members concerning MRLs to be changed will be judged by local experts of the importing country. This is a lengthy and time-consuming process and can possibly destroy the production capacities in the developing countries. This will also give developed countries additional flexibility to use their discretion. All these effectively block market access by developing countries' exports (Swann, 2010; Disdier, Fontagne and Mimouni, 2007; and Fontagne, Mimouni and Pasteels, 2005).

The purpose of this chapter is to deal with **"true" externality** related to either consumption or production of the commodity. It showseven in the presence of externality, the importing country can use "protectionist" standard i.e. the standard above the optimum level (like following more stringent norms than internationally accepted).Moreover contrary to the earlier chapter in this situation there can be some welfare maximizing standard for exporting country also i.e. "positive standard" can place the country in Pareto superior regime. When the standard targets "true" consumption externality, the exporting country may also improve in welfare by adopting the standard; provided it follows that standard in the local market also. In that case the **exporting country may have some positive "welfare maximizing standard"**, but not surprisingly the importing country will not necessarily follow that standard.Lastly if the standard targets "**true"**

**production externality** there is higher chances for the exporting country to improve upon by adopting “positive standard” but the importing country may or may not be interested to impose and follow “positive standard” and may prefer to follow “null standard”.

Negative externality related to production or consumption distorts the welfare function of the countries when they are engaged in free trade and in such situations “regulated trade” can be better than “free trade”. Trade regulation can take various forms like tariff, quota, VER, specification of externality linked “standard” etc.The externality can be related to production or consumption. Consumption or the production related externalities have different consequences on volume of trade as well as welfare for both exporting and importing country. One major limitation of the present literature is sometimes it fails to discriminate between the nature of externality created by consumption or production of “dirty” goods.Tian (2003) demonstrates that an increase in the minimum required ‘environmental friendliness’ of imported goods is not necessarily protectionist in effect, as it may hurt domestic firms and increase imports.Acharyya(2001)rightly points out that to use production externality argument , that holds the centre stage in the large body of literature on trade and environment to justify imposition of environmental standard by North where the dirty good is imported and consumed , we need a much broader perspective. As he argues, if exports of dirty goods by India increase production and hence environmental degradation there, one might wonder why the importing country say U.S would like to impose environmental standards. Two possible answers can be i) concern for global environment and ii) transboundary pollution. So in the absence of non-physical relations and transnational damages (either due to nature of emission or due to the fact that exporting and importing countries in question are geographically far apart) “concern against dirty goods are hard to justify in terms of production externality”.

## 4.2Defining externality:-

**In this section we consider the existence of a true externality, for which reason, the functional relation between standard and welfare depends on the externality<u>E (τ, q)</u>**. We consider an externality of the type, $E(\tau, q) = (l(\tau) - d)q; d > l(\tau) > 0; l' > 0; l'' < 0$ (4.2.1)

In other words we assume that either consumption or production produces a negative externality, which rises linearly with quantity. The magnitude of externality declines when the standard of the product is raised, but at a marginally diminishing rate. We assume externality (and its reduction) is not observable by individual (so does not affect demand) but has effect on welfare. Further we can assume we are doing the valuation of externality in monetary terms (the cost on health or any other resource) so that the cost and benefit of a marginal increase in standard becomes comparable.

We can further assume, $c_f < l < c_h;\ c_f' < l' < c_h'$ (4.2.2)

### 4.2.1 Consumption Externality:-

First we are dealing with the case of "consumption externality" i.e. the consumption of the product is generating some negative effect. The amounts of externality for importing and exporting country arerespectively:

$$E_H(\tau, q) = (l(\tau) - d)q \text{ and } E_F(\tau, q) = (l(\tau) - d)(q_h + q_f)$$

#### 4.2.1.1 Consumption Externality and Tariff:-

"Standard" imposed by importing country (when compared to "equivalent tariff") leads to loss in consumer surplus and producer surplus for exporting country from its local market (as discussed in the last chapter). But there will be the benefit of reduction in negative externality by, $c_h(l(\tau) - d)/\ 2b$ (4.2.3)

This is the benefit of reduction in consumption of the good which creates negative externality. This benefit will outweigh the loss of consumer and producer surplus only when the initial negative externality is extremely high. But that is very unlikely as in that case probably the country itself could have adopted that minimum standard (as it is improving welfare) instead of requiring null standard.[48]If the latter happens the exporting country will prefer to be discriminated by "NTB" like "minimum standard" than tariff. Otherwise it will continue to prefer "tariff" than "NTB".

"Standard" will lead to an excess loss in consumer surplus and producer surplus for importing country by the same amount mentioned under "no externality" plus a fall in negative externality (due to the difference in consumption under tariff and "Standard"[49]) by the amount,

$$(l(\tau) - d)c_f \ / \ 2b' \qquad (4.2.4)$$

This benefit of fall in externality can overshadow the loss in consumer and producer surplus only when the initial negative externality is very high. If the latter happens the importing country will prefer NTB like minimum standard as a tool of protection even if it is free to impose tariff.

**Proposition 4.1:-*If the initial negative externality is sufficiently high, NTB like "minimum standard" will be the first best tool of protection.***

#### 4.2.1.2 Consumption externality and Welfare:

**In this section we consider the functional relation between standard and welfare depending on theconsumption externality**.

[48] we have assumed exporting country's requirement is null standard but compelled to follow the standard stipulated by importing country due to high set up cost at two different standards

[49]Appendix 3.2( Chapter3)

With negative externality social welfare of exporting country can be an increasing function of τ if the initial negative externality is very high.[50]For importing country the social welfare under duopolyis:

$$W^F{}_{CE}(\tau) = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' + \left[\frac{(2a-c_f-c_h)}{3b'}\right](l(\tau) - d) \quad (4.2.5)$$

The above can be an increasing function of standard under a less stringent condition than no externality.[51] In the later the marginal benefit of increase in standard is $c_h{}'$and cost is$c_f{}'$ . With consumption externality as the marginal benefit$(c_h{}' + l')$ of rise in standard is higher the condition is less stringent.

Similar to no externality situation the foreign firm will lobby for a prohibitive standard at which the domestic firm will quit exporting. Thegovernment (with increasing $W^F{}_d$) in that case can maintain$\tau^*{}_{CE} = \tau_{CEe}$,[52]where$\tau^*{}_{CE}$ is the optimum standard with negative externality and $\tau_{CEe}$ is the prohibitive standard with externality.If$W^F{}_d$ is initially falling (and minimized at$\tau^{min}{}_{CE}$and $\tau^{min}{}_{CE} > \tau_{CEe}$ then government of importing country will set$\tau^*{}_{CE} = 0$.Therefore,

$$\tau^*{}_{CE} = \tau_{CEe} \; if \; \tau_{CEe} > \tau^{min}{}_{CE} \; and \; W^F{}_d(\tau_{CEe}) > W^F{}_d(\tau = 0) \quad (4.2.5a)$$

$$= 0, Otherwise \quad (4.2.5b)$$

If$l'$ is sufficiently high and/or the initial negative externality is very large, then LSP will set the standard$\tau^*{}_{CE} \geq \tau_{CEe}$.[53] (4.2.6)

[50] See Appendix 4.1
[51]See Appendix 4.2
[52]If the government does not want to go for prohibitive standard then it will maintain the standard $0 < \tau^*{}_{CE} \leq \tau_{CEe}$
[53]see Appendix 4.2

The welfare of the exporting country (after the imposition of standard) will include consumer surplus from home, producer surplus from home as well as foreign and the externality associated with consumption.

$$W_{CE}^{H}(\tau) = 3(a - c_h)^2 / 8b + \left(a - 2c_h + c_f\right)^2 / 9b' + (l(\tau) - d)(a - c_h) / 2b \qquad (4.2.7)$$

The relation between $b \; and \; b'$should not be same like "imposed"externalityand to make the matter simpler we can assume $b = b'$ .

The striking point is thatcontrary to "imposedexternality" [54]situation, $W^H(\tau)$can be initially increasing in $\tau$ , can reach a maximum and then decrease, provided the initial negative externality is very large.This possibility arises as we have taken the assumption that the exporting country is following the same standard for local market also, so with the imposition of $\tau$ it is getting the benefit of reduction in domestic consumption externality. Consequently the breakeven standard for exporting country will be higher than the earlier ("imposed" externality)[55] case;

i.e.$\tau_{CEe} > \tau_e$ (4.2.8)

Assuming the domestic firm exports or quits (appendix1) at the break even the foreign govt will set the standard at:-$\tau^*_{CE} \leq \tau_{CEe}$ (4.2.9)

For importing country the social welfare under duopoly$(W^F{}_d(\tau))$ can be an increasing function of standard under a less stringent condition than "imposed"externalitysituation. As the social welfare of exporting country $W^H(\tau)$ can be initially increasing in $\tau$ , can reach a maximum and then decrease, (provided the initial negative externality is very large), there is a possibility that

[54] Chapter3
[55] Ibid

exporting country can improve upon with the imposition of "standard" ( upto a certain τ) but the importing country is following the null standard if condition 4.2.5 is not fulfilled.

**Lemma 4.1:** $\frac{\partial W_{CE}^{H}(\tau)}{\partial \tau} > 0$ is neither necessary nor sufficient for $\frac{\partial W_{CE}^{F}(\tau)}{\partial \tau} > 0$

**Proof:**-Differentiating 4.2.4 and 4.2.7 w.r.t τ

$$\frac{\partial W_{CE}^{F}(\tau)}{\partial \tau} = (2a - c_h - c_f)(-c_h' - c_f')/9b' + 2(a - 2c_f + c_h)(-2c_f' + c_h')/9b' + \left[\frac{(2a - c_h - c_f)}{3b'}\right] l'(\tau) + (l(\tau) - d)(-c_h' - c_f')/3b' \quad (4.2.10)$$

$$\frac{\partial W_{CE}^{H}(\tau)}{\partial \tau} = 3(a - c_h)(-c_h')/4b' + 2(a - 2c_h + c_f)(-2c_h' + c_f')/9b' + (l'(\tau))(a - c_h)/2b' + (l(\tau) - d)(-c_h')/2b' \quad (4.2.11)$$

When there is "real" negative externality, the increase in τ will have two effects on welfare. The direct effect, which will lead to fall in negative externality as a result of increase in *l* through $l'(\tau)$ and the indirect effect which will lead to change in the existing negative externality through increase in compliance cost as the change in compliance cost leads to change in production and/or consumption.

The fall in consumption due to increase in cost of compliance for importing country is $(c_h + c_f)/3b'$ whereas for exporting country it is $c_h/2b'$ which is greater than the former term due to our assumption regarding the compliance cost.The fall in the negative externality with increase in τ, through increase in compliance cost (as it leads to fall in consumption) is captured in the last term of 4.2.10 and 4.2.11.Due to assumption of the model last term of 4.2.11 exceeds

that of 4.2.10. So if the initial negative externality is very large there is a possibility that 4.2.10 is decreasing in τ but 4.2.11 is increasing in τ.

If the initial negative externality is not that large it is likely that $\frac{\partial W_{CE}^{H}(\tau)}{\partial \tau} < 0 \; but \; \frac{\partial W_{CE}^{F}(\tau)}{\partial \tau} > 0$ (like "imposed" externality situation).

The final task is to find out whether this standard is "protectionist" or not. Recall the definition of protectionist strategy mentioned in no-externality (Fischer &Serra2000). We can redefine the welfare of Foreign (F) when both firms are in F(local duopoly)

$$W^{D}{}_{cE} = \frac{(2a-c_f-c_h)^2}{18b'} + \frac{(a-2c_f+c_h)^2}{9b'} + (a-2c_h+c_f)^2/9b' + (l(\tau)-d)(2a-c_f-c_h)/3b'$$

(4.2.12)

Social welfare of F when of firm is in D and another in F (global duopoly),

$$W^{d}{}_{cE} = \frac{(2a-c_f-c_h)^2}{18b'} + \frac{(a-2c_f+c_h)^2}{9b'} + (l(\tau)-d)(2a-c_f-c_h)/3b' \quad (4.2.13)$$

$$\frac{\partial(W^{D}{}_{cE}-W^{d}{}_{cE})}{\partial \tau} = 2(a-2c_h+c_f)\frac{(-2c_h'+c_f')}{9b'} \quad (4.2.14)$$

This term is negative. This means the marginal benefit of rise in minimum standard is greater under duopoly with imports than under a local duopoly. So the minimum standard used in the former case is always high and protectionist by definition. So when there is a true negative externality the LSP of foreign country will always use a standard higher than if both the firms are *domestic.*

Lemma 4.1 and the above results apparently seems contradictory as the former is clamming the exporting country's welfare can be increasing in τ even though that of importing country can be decreasing (with sufficiently large initial negative externality) but 4.2.14shows the standard used by importer will be "Protectionist" (i.e. marginal benefit for increase in standard is higher for importing country under present situation than under local duopoly). Actually there is no contradiction because situation described in lemma 4.1 happens when fall in negative consumption externality (with increase in τ) in exporting country's local market has been taken care of. But the way we have defined "protectionist Standard" exporting country's local consumption is not coming in consideration. Otherwise if we use definition of "protectionist" standard in terms of world welfare Engle (1996)then there will be no contradiction.

The world welfare under consumption externality,

$$W^w{}_{c_E} = \frac{(2a - c_f - c_h)^2}{18b'} + \frac{(a - 2c_f + c_h)^2}{9b'} + \frac{(a - 2c_h + c_f)^2}{9b'} + \left\{\frac{3(a - c_h)^2}{8b'}\right\} + (l(\tau) - d)(3a - c_f - c_h)/3b' \quad (4.2.15)$$

$$\frac{\partial(W^w{}_{c_E} - W^d{}_{cE})}{\partial\tau} = 2(a - 2c_h + c_f)\frac{(-2c_h' + c_f')}{9b'} + \left\{\frac{3(a-c_h)(-c_h')}{4b'}\right\} + (l(\tau) - d)\left(\frac{-c_h'}{2b'}\right) + l'(\tau)\left(\frac{a-c_h}{2b'}\right) \quad (4.2.16)$$

If initial negative externality and/or $l'(\tau)$ is sufficiently high then the above term can be positive implying that the marginal benefit of rise in minimum standard can be greater if we take into account the world welfare (welfare of both the countries) than that of importing (i.e. standard imposing country).So the minimum standard is not "Protectionist".

**Proposition 4.2**:- ***The standard followed by importing (standard imposing) country will be necessarily "protectionist" by the comparison between welfare consequences of Local (both the firms in importing country) and global (one firm in importing country and another in exporting country) duopoly [56] but not necessarily by the comparison between local (importing) and global (importing and exporting country) welfare[57]***

**Proof:**-Follows from (4.2.14) &(4.2.16) ■

**We can give a game theoretic presentation** where the Home country has two available strategies (Export, No Export) and the Foreign country has two available strategies (Free Trade i.e. null standard ,protected Trade i.e. positive standard)

**Table 4.1:- Game Theoretic Presentation (Consumption Externality)**

| | | Trade (Export) | Autarky (no export) |
|---|---|---|---|
| Importing Country | τ=0(free Trade) | $a^2/3b' + (l(\tau) - d)2a/3b'$, $35a^2/72b'$ , $(l(\tau) - d)a/2b'$ | $3a^2/8b' + (l(\tau) - d)a/2b'$, $3a^2/8b' + (l(\tau) - d)a/2b'$ |
| | $\tau=\tau c_{Ee(NTB)}$ | $(2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9 + (l(\tau) - d)(2a - c_f - c_h)/3b'$, $(a - 2c_h + c_f)^2/9b' + 3(a - c_h)^2/8b' + \tau(l(\tau) - d)(a - c_h)/2b'$ | $3(a - c_f)^2/8b' + (l(\tau) - d)(a$ $3a^2/8b' + (l(\tau) - d)(a/2b')$ |

[56] Fischer & Serra(2000)
[57]Engle (1996)

Assuming G (τ)>0 and (4.2.5a) is fulfilled ($\tau=\tau_{cEe}$, export) will be the Nash equilibrium. As G(τ)>0, "Export" is also the "Dominant" strategy for Exporting country. If 4.2.5a is fulfilled then $\tau= \tau_{CEe}$[58] can be a dominant strategy for the importing country(depending on the size of initial negative externality).

In case of "imposed" negative externality τ>0 is never a "dominant" strategy for the importing country because if the exporting country does not export then positive standard will lead to unnecessary loss in consumer and producer surplus for the importing country, where as in thissituation of "true" negative externality (consumption) positive standard can be a "dominant" strategy for the importing country, provided the initial negative externality is very high.

**4.2.1.3 Finding out optimum τ:-**

The welfare function of foreign country under duopoly with consumption externality,

$$W_{CE}^{d} = \left(2a - \bar{c_f}\tau^2 - \bar{c_h}\tau^2\right)^2/18b' + \left(a - 2\bar{c_f}\tau^2 + \bar{c_h}\tau^2\right)^2/9b' + \left(\bar{b}\tau^2 - d\right)\left(2a - \bar{c_f}\tau^2 - \bar{c_h}\tau^2\right)/3b' \; if \; \tau^2 < \frac{d}{\bar{b}} \quad (4.2.17)$$

$$W_{CE}^{d} = \left(2a - \bar{c_f}\tau^2 - \bar{c_h}\tau^2\right)^2/18b' + \left(a - 2\bar{c_f}\tau^2 + \bar{c_h}\tau^2\right)^2/9b' \; if \; \tau^2 \geq d/\bar{b} \quad (4.2.18)$$

If$W^d$initiallyfalls(which is less likely as $W^d$ will be a decreasing function of τ under a more stringent condition than no externality case) it will be minimized at:[59]

[58] Or, $\tau>\tau_{cEe}$ will be the dominant strategy for importing country.
[59] Calculated by "equation solver" software (Annex 4.1) & taking only positive value

$$\hat{\tau}_{CE} = \sqrt{\left[-d\left(\bar{c_h} + 2\bar{b}\right) + 2a\left(\bar{c_f} - \bar{b}\right)\right]/\left[\bar{c_h}^2 + 2\bar{c_h}\bar{c_f} - 2\bar{b}\bar{c_f} - 2\bar{b}\bar{c_h} + 3\bar{c_f}^2\right]} \quad (4.2.19)$$

**Lemma4.2**:-Higher the magnitude of $\bar{b}$ lower will be $\hat{\tau}_{CE}$ .

**Proof:**-Given (4.2.19);

$$\frac{d\hat{\tau}_{CE}}{d\bar{b}} < 0 \quad (4.2.20)$$

Condition 4.2.20indicates that with increase in τ, if the negative externality falls at a higher rate then,$W^d$ will be minimized for a lower value of τ.

**Lemma 4.3:** Higher the magnitude of $d$ lower will be$\hat{\tau}_{CE}$

**Proof:-**Given 4.2.15;$\frac{\partial \hat{\tau}_{CE}}{\partial d} < 0$(4.2.21)

Condition 4.2.17 indicates that if the initial negative externality is very large then,$W^d$ will be minimized for alower value of τ.

Next task is to find out what is the highest minimum standard $\tau_{CEe}$at which the exporting firm will quit to export. The net gain from Trade for the exporting country (after the imposition of standard) is as follows,

$$G_{CE}(\tau) = \left(a - 2\bar{c_h}\tau^2 + \bar{c_f}\tau^2\right)^2/9b' - \bar{c_h}\tau^2\left(\bar{b}\tau^2 - d\right)/2b' - 3[2a\bar{c_h}\tau^2 - (\bar{c_h}\tau)^2]/8b' \;\; if\; \tau^2 < d/\bar{b}$$

(4.2.22)

$$G_{CE}(\tau) = \left(a - 2\bar{c_h}\tau^2 + \bar{c_f}\tau^2\right)^2/9b' - 3[2a\bar{c_h}\tau^2 - (\bar{c_h}\tau)^2]/8b' \quad if\ \tau^2 \geq d/\bar{b} \qquad (4.2.23)$$

This expression shows the net gain of exporting country from trade without any negative externality plus the gain from reduction in negative externality due to the standard which the domestic firm has been compelled to follow for its local market also.

$G_{CE}(\tau)$is decreasing (unless the initial negative externality(d) is very large) and once it reaches to 0 the Domestic firm will reach to break even between exporting or not.However, if the initial negative externality is very large,$G_{CE}(\tau)$will be first increasing, will reach a maximum and then decreasing and finally reaches to zero.If the later happens,$G_{CE}(\tau)$is maximized at, (see appendix4.1)

$$\tau_e(G_{max})_{consumption} = \sqrt{\left(-8ab'^2\bar{c_f} - 18d\bar{c_h} + 43ab'^2\bar{c_h}\right)/\left(8b'^2\bar{c_f}^2 - 32b'^2\bar{c_h}\bar{c_f} + 59b'^2\bar{c_h}^2 - 36\bar{b}\bar{c_h}\right)} \qquad (4.2.24)$$

**<u>Lemma 4.4:--</u>Higher the initial negative externality higher will be** $\tau_e$(max)

**<u>Proof:</u>**[60] Given (4.2.24) ,$\frac{d\tau_e(G_{max})_{consumption}}{d(d)} > 0$ (4.2.25 )

Condition 4.2.21indicates that if d is high gain from trade for exporting country will be maximized for a higher value of τ.

[60] see Appendix 4.3

### 4.2.2Production Externality:-

Suppose, there exists a "true production externality" i.e. the production of the good is creating some negative effect which is not included in private cost of production. The social welfare function of exporting country:

$$W^{H}{}_{PE}(\tau) = 3(a - c_h)^2/8b' + \left(a - 2c_h + c_f\right)^2/9b' + (l(\tau) - d)\left(5a - 7c_h + 2c_f\right)/6b' \quad (4.2.26)$$

The social welfare functions of importing country under duopoly:

$$W_{PE}{}^{F}{}_{d}(\tau) = \left(2a - c_f - c_h\right)^2/9b' + \left(a - 2c_f + c_h\right)^2/9b' + (l(\tau) - d)\left(a - 2c_f + c_h\right) /3b' \quad (4.2.27)$$

The net gain from trade for exporting country,

$$G_{PE}(\tau) = \left(a - 2c_h + c_f\right)^2/9b' + c_h(l(\tau) - d)/2b' - 3(2ac_h - {c_h}^2)/8b' + (l(\tau) - d)\left(a - 2c_h + c_f\right)/3b' \quad (4.2.28)$$

The last term shows the additional negative externality created by the production for export market. Compared to consumption externality situation, there is a higher possibility that net gain will be first increasing in τ, reach a maximum and then decreasing.

Again our task is to find out whether this standard is protectionist or not. Recall the definitions of protectionist strategy mentioned in "no-externality" and consumption externality.First we will use the definition by Fischer &Serra (2000).We can redefine the welfare of F when both firms are in F,

$$W^{D}{}_{PE} = \left(2a - c_f - c_h\right)^2/18b' + \left(a - 2c_f + c_h\right)^2/9b' + \left(a - 2c_h + c_f\right)^2/9b' + (l(\tau) - d)\left(2a - c_f - c_h\right)/3b' \quad (4.2.29)$$

Social welfare of F when of firm is in D and another in F,

$$W^{d}{}_{PE} = \left(2a - c_f - c_h\right)^2/18b' + \left(a - 2c_f + c_h\right)^2/9b' + \left(l(\tau) - d\right)\left(a - 2c_f + c_h\right)/3b' \quad (4.2.30)$$

$$\frac{d(W^{D}{}_{PE} - W^{d}{}_{PE})}{d\tau} = \frac{(a-2c_h+c_f)\left(-4c_h{}' + 2c_f{}' + 3l'\right)}{9b'} + \frac{(l(\tau)-d)\left(-2c_h{}' + c_f{}'\right)}{3b'} \quad (4.2.31)$$

The sign of the above term is ambiguous. Contrary to "imposed"externality(equation 3.5.4.) and consumptionexternality (equation 4.2.16) the term is likely to be positive in the above situationif initial negative externality (and/or $l'$) is sufficiently large. In that case the benefit of increase in standard for Foreign will be higher in case **of local duopoly as local duopoly leads to entire production within the "Foreign" country.**So the Standard may not be "protectionist".

For using Engle (1996) definition of protectionist standard we define world welfare,

$$W^{W}P_E = \frac{\left(2a - c_f - c_h\right)^2}{18b'} + \frac{\left(a - 2c_f + c_h\right)^2}{9b'} + \frac{\left(a - 2c_h + c_f\right)^2}{9b'} + \left\{\frac{3(a - c_h)^2}{8b'}\right\} + \left(l(\tau) - d\right)\left\{\frac{\left(7a - 2c_f - 5c_h\right)}{6b'}\right\} \quad (4.2.32)$$

$$\frac{d(W^{W}{}_{PE} - W^{d}{}_{PE})}{d\tau} = \frac{2\left(a - 2c_h + c_f\right)\left(-2c_h{}' + c_f{}'\right)}{9b'} + \frac{3(a - c_h)\left(-c_h{}'\right)}{4b'} + \frac{\left(l(\tau) - d\right)\left(-7c_h{}' + 2c_f{}'\right)}{6b'} + l'\frac{\left(5a + 2c_f - 7c_h\right)}{6b'} \quad (4.2.33)$$

**The sign of the above term is again ambiguous and can be positive** if initial negative externality (and/or $l'$) is sufficiently large.

**Proposition 4.3:-*In the presence of production externality minimum standard used by importing country is not necessarily "protectionist" when we consider the definition by Fischer and Serra (1999)[61] as well as the definition given by Engle.(1996) [62]***

#### 4.2.2.2 Finding out optimum τ:-

Assuming the gains from trade is inverted u shaped for the exporting country, the standard at which gains from trade will be maximized is:[63]

$$\tau_e(G_{max})_{production} = \sqrt{\frac{\left(-8ab'^2\bar{c_f} + 12b'^2d\bar{c_f} + 18d\bar{c_h} - 24b^2d\bar{c_h} + 43ab'^2\bar{c_h} - 12ab'^2\bar{b}\right)/}{\left(8b'^2\bar{c_f}^2 - 32b'^2\bar{c_h}\bar{c_f} + 24\,b'^2\bar{b}\bar{c_f} + 59b'^2\bar{c_h}^2 - 48b'^2\bar{b}\bar{c_h}\right)}} \quad (4.2.35)$$

#### 4.2.2.3Production Externality and Welfare:-

The welfare function of Foreign country, under production externality,

$$W_{PE}{}^{F}{}_{d}(\tau) = \left(2a - \overline{c_f}\tau^2 - \overline{c_h}\tau^2\right)^2/18b' + \left(a - 2\overline{c_f}\tau^2 + \overline{c_h}\tau^2\right)^2/9b' + \left(\bar{b}\tau^2 - d\right)\left(a - 2\overline{c_f}\tau^2 + \overline{c_h}\tau^2\right)/3b', if\ \tau^2 < d/\bar{b} \quad (4.2.36)$$

$$W_{PE}{}^{F}{}_{d}(\tau) = \left(2a - \overline{c_f}\tau^2 - \overline{c_h}\tau^2\right)^2/18b' + \left(a - 2\overline{c_f}\tau^2 + \overline{c_h}\tau^2\right)^2/9b', \quad if\ \tau^2 \geq d/\bar{b} \quad (4.2.36a)$$

If $W^d$ initially falls (which is less likely compared to no externality case but more likely than consumption externality case) it will be minimized at:[64]

[61] See the definition in chapter 2
[62] See the definition in chapter 2
[63] Calculated by "equation solver" software (Annex 4.3) & taking only positive value. Assuming G(τ) is inverted U shaped.

$$\hat{\tau}_{PE} = \sqrt{\left[d\left(\bar{c_h} - 2\bar{b}\right) + a\left(2\bar{c_f} - \bar{b}\right)\right] / \left[\bar{c_h}^2 - 2\bar{c_h}\bar{c_f} - 2\bar{b}\bar{c_f} - 2\bar{b}\bar{c_h} + 3\bar{c_f}^2\right]} \qquad (4.2.37)$$

**Proposition 4.4:-***The value of τ after which the welfare of importing country starts to increase will be higher in case of production externality as the benefit of increase in standard is less for production externality than for consumption externality for the importing country*.

i.e.$\hat{\tau}_{PE} > \hat{\tau}_{CE}$ (4.2.38)

**Proof: Follows from (4.2.19) &(4.2.37)** ■

Finally the government of the importing country sets,

$$\tau^* = \tau_e(prohibitive)_{production} \; iff \; \tau_e(prohibitive)_{production} \geq \hat{\tau}_{PE} \; and \; W^d(\tau_e) > W^d(\tau = 0) \qquad (4.2.39)$$

*= 0, otherwise* (4.2.40)

**Proposition 4.5:*For importing country, the possibility of following "null standard" is higher under production externality than under consumption externality.***

Proof: - Follows from (4.2.38)&(4.2.39) ■

For importing country the social welfare under duopoly can be an increasing function of standard under a less stringent condition than no externality, but under a more stringent condition than consumption externality. As the social welfare of exporting country $W^H(\tau)$ can be initially increasing in τ , can reach a maximum and then decreasethere is a possibility that exporting

[64] Calculated by "equation solver" software (Annex 4.4) & taking only positive value

country can improve upon with the imposition of "standard" ( upto a certain τ) but the importing country is following the null standard if condition 4.2.39 is not fulfilled.

**Lemma4.26:-** $\frac{\partial W^H{}_{PE}(\tau)}{\partial \tau} > 0$ is neither necessary nor sufficient for $\frac{\partial W^F{}_{PE}(\tau)}{\partial \tau} > 0$

**Proof:-**Differentiating 4.2.22 and 4.2.23 w.r.t τ

$$\frac{\partial W^H{}_{PE}(\tau)}{\partial \tau} = 3(a - c_h)(-c_h{}') /4b' + 2\left(a - 2c_h + c_f\right)\left(c_f{}' - 2c_h{}'\right) / 9b' + \left[\frac{\left(5a - 7c_h + 2c_f\right)}{6b'}\right] l'(\tau) + (l(\tau) - d)\left(-7c_h{}' + 2c_f{}'\right)/6b' \quad (4.2.41)$$

$$\frac{\partial W^F{}_{PE}(\tau)}{\partial \tau} = \left(2a - c_h - c_f\right)\left(-c_h{}' - c_f{}'\right) /9b' + 2\left(a - 2c_f + c_h\right)\left(-2c_f{}' + c_h{}'\right) /9b' + \left[\frac{(a-2c_f+c_h)}{3b'}\right] l'(\tau) + (l(\tau) - d)\left(-c_h{}' - 2c_f{}'\right)/3b' \quad (4.2.42)$$

The peculiarity of production externality is that increase in τ leads to increase in negative externality for the importing country (due to indirect effect )[65]as it leads to net increase in production( as $c_h{}' > 2c_f{}'$); whereas for exporting country both effects (direct and indirect) leads to reduction in negative externality. As the total production is more in exporting country (taking into account production for local market) the effect of increase in standard will be more welfare improving for exporting country due to direct effect also. Therefore if the negative externality is not very small it is likely that 4.2.41 will be increasing in τbut 4.2.42 will be falling in τ.

[65]Though due to "direct effect" it decreases.

Interestingly even if we don't consider the local market of exporting country still direct and indirect effect work in the same direction (and improves welfare).If condition 4.2.39 is fulfilled then the standard set under production externality will be higher than under consumption externality. The importing country under production externality is less likely to set a positive standard than under consumption externality as the marginal gain of rise in standard is more for importing country under consumption externality. But from exporting country's side prohibitive standard is higher under production externality. So when the positive standard is there, it is likely to be higher under production externality than under consumption externality will be welfare improving for exporting country and welfare reducing for importing country.

**Table 4.2:- <u>Game Theoretic Presentation (Production Externality)</u>**

| | | Exporting Country | |
|---|---|---|---|
| | | Trade (Export) | Autarky (No export) |
| Importing Country | τ=0(free Trade) | $a^2/3b' + (l(\tau) - d)a/3b'$, $3a^2/8b' + a^2/9b' + (l(\tau) - d)(5a/6b')$ | $3a^2/8b' + (l(\tau) - d)a/2b'$, $3a^2/8b' + (l(\tau) - d)a/2b'$ |
| | $\tau=\tau_{e(NTB)}$ | $(2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' + (l(\tau) - d)($ $(a - 2c_h + c_f)^2/9b' + 3(a - c_h)^2/8b' + (l(\tau) - d)\{(5a -$ } | $3(a - c_f)^2/8b' + (l(\tau) - d)(a -$ , $3a^2/8b' + (l(\tau) - d)(a/2b')$ |

| | | | |
|---|---|---|---|
| | | | |

As long as $G(\tau)>0$, and condition (4.2.33) is fulfilled ($\tau= \tau_e$,Export) will be the Nash equilibrium. Moreover contrary to the other two situations ("imposed" externality &consumption externality) "Export" may not be a dominant strategy because the country may not choose to export under free trade if the initial negative externality is very high.[66]

**Self Imposition of Standard:**

Why can't the exporting country follow the standard by itself?The exporting country is the "standard taker" not the "standard maker".So even if the exporting country follows the standard for its production, the importing country can be reluctant to follow that standard (as it will increase the cost of production) and as a result exporting country will lose competitiveness.

The problemalso lies in the valuation of externality as we have assumed that the exporting country is the developing country. For the exporting country generally the valuation of the externality will be different and there can be under valuation of externality (though we have assumed away that possibility).In that case actually the prohibitive standard will be lower than what we have derived(both in the case of consumption externality &production externality) and a particular measure may simply be a 'perceived barrier' and may not actually be a barrier.

[66] This is under some restrictive assumption like the "exporting" country's ability to adopt some standard to combat externality is constrained by some factor or it will not be a gainful trade if it adopts the standard alone and the importing country continues to follow null standard.

## 4.3 Concluding remarks:-

Presence of real negative externality makes the situations different for consumption externality and production externality. The analysis in this chapter specifically shows that the adoption and imposition of "standard" by importing country will depend of what kind of externality it targets.

i) **With huge difference in compliance cost** the possibility is always there (whether production or consumption externality) that importing country's welfare will be increasing in $\tau$ and exporting country's welfare will be decreasing in $\tau$ and the importing country will adopt the **"prohibitive standard"**.

ii) But when the initial negative externality is very high there is a possibility that importing country's welfare is initially decreasing in $\tau$ though that of exporting country is increasing in $\tau$.

iii) The above situation is possible with negative consumption externality as we haveassumed that exporting country is also following the same standard for its local market.

iv) Similar kind of situation is possible with production externality even if we don't take the above mentioned assumption.

v) In case of "consumption externality**" ($\tau = \tau_{CEe}$,Export)** is likely to be Nash equilibrium and **"export" is the dominant strategy** for exporting country contrary to which **"export" may not be a "dominant" strategy in case of "production externality"** , as the exporting country may choose "no export" under free trade.

**vi)** The **"optimum standard"** under consumption externality is necessarily **"protectionist"** if we assume a local duopoly instead ofglobal duopoly, (Fisher&Serra,2000),whereas if we follow the global welfare maximization criterion (Engle 1996)**"optimum**

**standard"** might **not be "protectionist"**. Under production externality the **"optimum standard" might not be protectionist by either of the two definitions.**

## Appendix4.1:

$$G_{CE}(\tau) = (a - 2c_h + c_f)^2/9b' - c_h(l(\tau) - d)/2b' - (2ac_h - {c_h}^2)/8b'$$

$$\frac{dG_{CE}(\tau)}{d\tau} = 2(a - 2c_h + c_f)({c_f}' - 2{c_h}')/9b' - (a - c_h)/4b' - {c_h}'(l(\tau) - d)/2b' - c_h(l'(\tau))/2b'$$

If (l(τ)-d ) is sufficiently high then L.H.S can be initially increasing (for small value of τ) , can reach a maximum and then it will fall.

## Appendix 4.2:

The welfare of the importing country under duopoly and monopoly (with prohibitive standards)i.e. in the presence of externality are,

$$W^F{}_d(\tau) = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b' + \left[\frac{(2a - c_f - c_h)}{3b'}\right](l(\tau) - d) \qquad A.4.1$$

$$W^F{}_m(\tau) = (a - c_f)^2/8b' + (a - c_f)^2/4b' + [(a - c_f)/2b'](l(\tau) - d) \qquad A.4.2$$

*A.4.1* is increasing in τ under a less stringent condition than no externality and A.4.2is decreasing in τ unless the initial negative externally is very large and /or $l'$ is sufficiently high.

$$W^F{}_d(\tau) = (2a - c_f - c_h)^2/18b' + (a - 2c_f + c_h)^2/9b'$$

$$\frac{dW^F{}_d(\tau)}{d\tau} > 0 \; iff \; ({c_h}' - 2{c_f}') > (2a - c_f - c_h)({c_h}' + {c_f}')/2(a - 2c_h + c_f) \qquad A.4.3$$

$$W_{CE}^{F} = \left(2a - c_h - c_f\right)^2/18b' + \left(a - 2c_f + c_h\right)^2/9b' + \left[\left(2a - c_f - c_h\right)/3b'\right](l(\tau) - d)$$

$$\frac{dW_{CE}^{F}}{d\tau} > 0 \; iff \; \left(c_h{}' - 2c_f{}'\right)$$
$$> \left(2a - c_f - c_h\right) + 9b'(l(\tau) - d)\left(c_h{}' + c_f{}'\right)$$
$$- 3l'(\tau)\left(2a - c_f - c_h\right)/2\left(a - 2c_h + c_f\right) \qquad A.4.4$$

## Appendix 4.3

$$\frac{d}{d(d)}\{\tau_e(G_{max})_{consumption}\} = 9\bar{c_h}\,/\left(8b'^2\bar{c_f}^2 - 32b'^2\bar{c_f}\bar{c_h} + 59b'^2\bar{c_h}^2 - 36\bar{b}\bar{c_h}\right)\tau_e(max) \text{A.4.5}$$

# Chapter-5: Summary and Conclusion

## 5.1 Summary

Trade is not an end in itself, but a means to economic growth and national development. The primary purpose is not the mere earning of foreign exchange but the stimulation of greater economic activity. It is commonplace to recognize that the use of tariffs has gradually been replace by the use of non-tariff barriers like quotas, export subsidies, local content requirement, anti-dumping, export standards (SPS and TBT).Baldwin (1984) for instance writes: "Not only have these measures become morevisible as tariffs have declined significantly through successive multilateral trade negotiationsbut they have been used more extensively by governments to attain the protectionist goals formerly achieved with tariffs"(p. 600).[67]In terms of incidence, TBTs are by far the most used regulatory measures, with the average country imposing them on about 30 per cent of products and trade. Countries also impose SPS measures on an average of approximately 15 per cent of trade. Trade economists have mostly interpreted the growth in the number and form of export standards as a political economy response to the constraints being imposed by international trade agreements on traditional trade restrictions. As the use of tariffs is progressively more limited, new forms of non-tariff barriers (NTBs) are increasingly used .In this interpretation, export standards are just a new form of NTBs and protection-in-disguise. For example, Bredahl et al. (1987) illustrate this with the USA'simplementation of a larger minimum size requirement on vine-ripened tomatoes mainly imported from Mexico – than on green tomatoes produced in Florida.Anderson et al. (2004)

[67] quoted in Anderson &Schmitt(2000)

argue that governments raise genetically modified (GM) food standards as protection against imports. Thepresent thesis singles out export standards (mandatory) and analyses the reasons behind imposition of standard which varies from purely "protectionist" goal to legitimate concern for health and safety of plant, animal, environment or the society and tries to find out the "optimum" standard under different situations. After elaborating upon the basic issues and the perspective in which the dissertation has been put in chapter1,**chapter 2 discusses the role of quality linked standard on trade and welfare.** Quality standard imposed by importing country imposes additional cost of compliance on exporting country and (in 2x2 structure) the latter losses both in terms of trade and welfare unless the quality standard changes the demand of the consumer substantially. Even in that situation the importing country gains more in terms of welfare. But in Nxn framework, i.e. multilateral trade welfare consequence will depend on absolute and relative magnitude of compliance cost of the exporting partners. Anyway, harmonization and mutual recognition of standard can be beneficial for the exporting country as it can accrue the benefit of scale economies and in general the volume of trade increases in the harmonizing region.

Rest of the two chapters of the thesis deals with externality linked standards.**Chapter3 deals with imposed (by importing country) negative externality**[68]. The purpose of this chapter has been to examine the welfare effects of product standards on an exporting country when the country by its own choice prefers to follow null standard which is not possible due to high set up cost at two different standards. If the standard is not linked with a true negative externality, the exporting country, given the assumptions of the model will always prefer to be discriminated by "tariff" and the importing country will also prefer to protect its market by "tariff" rather going

[68] Where the actual externality associated with production/consumption is zero.

for NTB. **The typical assumptions taken here resemble the trade between developed and developing country when the developed country** imposes some minimum standard on a product but becomes relatively "costly" for the developing country to comply with this requirement. As the importing country is not free to set tariff it will go for NTB like minimum standard (as it is welfare improving than free trade). But the minimum standard affects the exporting country's local producers and consumers also. So NTB leads to worse situation for both the countries and definitely worst for exporting country. Next we examine what should be the "optimum" standard under this situation. From the point of view of foreign firm, the minimum standard that excludes exporting firm from export market has a favorable effect of eliminating competition. Though it increases foreign firm's own cost of production also but according to the assumption of the model the protective effect will outweigh the cost raising effect of increase in standard for foreign firm and the foreign firm will lobby for that minimum standard which excludes domestic firm.**As the optimum standard should be zero under (imposed externality) so any positive standard in this situation is "protectionist".**

**Chapter4**examines the effect of **actual externality** (consumption and production) linked standards. Even if there is consumption linked actual negative externality the standard will not be welfare enhancing unless the initial negative externality is very high. So if we compare between tariff and NTB, NTB is worse for exporting country with no externality and probably with externality also. For importing country tariff as a tool of protection is better without externality and may be worse with externality if the initial negative externality is extremely high. However for importing country it is a comparison between two better states (protection by tariff or NTB) whereas for importing country it is the comparison between to worse states (discrimination by tariff or NTB) where NTB obviously tend to increase the lag between exporting and importing

country. Next we examine what should be the "Optimum" level of NTB and whether it is "protectionist". In a nutshell it concludes,

i) With huge difference in compliance cost the possibility is always there (whether production or consumption externality) that importing country's welfare will be increasing in $\tau$ and exporting country's welfare will be decreasing in $\tau$ and the importing country will adopt the "prohibitive standard" (or even go beyond that, if importing country's welfare is increasing in $\tau$ under monopoly due to reduction in negative externality.)

ii) When the initial negative externality is very high there is a possibility that importing country's welfare initially decreases in $\tau$ though that of exporting country increases in $\tau$ which is possible with negative consumption externality(as we have assumed that exporting country is also following the same standard for its local market).Similar kind of situation is possible with production externality even if we don't take the above mentioned assumption.

iii) The "optimum standard" under consumption externality is necessarily "protectionist" if we assume a local duopoly instead of global duopoly (Fisher&Serra,2000),whereas if we follow the global welfare maximization criterion (Engle 1996) "optimum standard" might not be protectionist.

iv) Under production externality the "optimum standard" might not be protectionist by either of the two definitions.

## 5.2Policy Implications

What policy conclusions can be drawn from this thesis? The analysis clearly shows that the imposition of export standards most of the time may lead to **"over standardization"** or **"under standardization"** instead of "optimum standardization" for exporting country. Barriers related to product standards are the main concern of global trade today.The potential to use product standards as hidden trade barriers is immense. If even a small part of this potential is allowed to be exploited, the implementation of the free trade regime could become dominated by protectionists and those who would welcome trade retaliation and counter retaliation. However, transparency and harmonization of standards couldbecome trade facilitators in addition to providing technical quality and safety parameters.There is an urgent need for discipline in the usage of SPS and TBT measures as a tool for "disguised" protection. This can be possible only if the entire WTO membership workstowards a harmonious blending of three issues, i.e., science, safety and trade. This can bebest achieved by harmonizing the standards/regulations across the various WTO Members.There is also a lackof mutual recognition of inspections and standards, and developing countriesfind that the major importing industrialized countries often demand 'sameness' inthe process rather than 'equivalence' in standards (WTO, 1999; FAO, 2000)

This issue in particular has prompted developing countriesto seek greater transparency in new notifications in the WTO and specialtreatment in recognition of problems facing these countries .[69]In many such circumstances, harmonization with international standards can act to reduce theregulatory trade barriers created by national standards. This would also prevent WTOmembers from arbitrary or unjustifiable discrimination due to different export standards.

So harmonization and mutual recognition of standards will be one of the major footstep towards trade facilitation for which Regional Trading Blocs (RTBs) and Regional Trading Agreements

[69]Sawhney(2005)

(RTAs) can be used as an instrument.Towards harmonization of SPS measures on as wide a basis as possible, SPS encouragesWTO Members to 'base' their measures on international standards, guidelines orrecommendations, where they exist (Article 3.1). Hence, it is important for developing countries to ensure that their views and concerns are taken on board in course of developing international standards. This requires effective participation in the standard setting processes of the key international standard setting bodies, though the track records of developing countries; however, indicate that their participation in the proceedings of the international standard setting bodies is very poor, both in quantitative and qualitative terms. The lack of an effective participation by developing countries implies that international standards generally get set as per the wishes of developed countries, by default or often with a slender majority vote. Consequently, the measures based on these standards are often difficult to be coupled with, particularly since the safety clients in many cases are prescribed without conducting any clinical study in the developing countries with regard to contaminants, pesticides, animal diseases, etc. This approach, coupled with the lack of participation by the developing countries, often results in inappropriate international standards being set. Efforts should also be made to involve relevant industries in the process, as they are the major stakeholders. The governments may develop strategies to work together with business communities towards achieving effective participation in standardization process.

**Export standards** sometimes have a worse effect on developing countries than that of tariff. The difficulty in disentangling the legitimate requirements from those with a protectionist motivation makes the situation more complex. The need is to find out the reason behind imposition of export standard. It may a) truly serve public or **consumer interest**,b) can be **purely "protectionist**"(as discussed in chapter 3 of the present thesis),c) may be a **mixture of above two** ("over

standardization"). The developing nations face difficulties in complying with the new requirements. On the other side, developed countries implement changes faster and obtain faster results in terms of trade performance. Moreover, they usually count on more government support and private organization to update and keep pace with innovations and higher consumption patterns. Thus, lags between the richer countries and the poorer ones are also tending to increase unless there is conceptual studies regarding the legitimacy issue, but certainly it is not a topic to be addressed only by the economists. The negotiations under the WTO and other organizations will have to consider the broader perspective to be relevant in dealing with trade disputes.For this, WTO's dispute settlement body should play active and conducive role. In addition, a gradual shifting of the production activities of the so-called "dirty industries" to developing countries has been observed since the 1980s(Grossman and Krueger, 1995).Often the negative externality associated with production in the exportingcountry is "overlooked" by "standard makers"[70] (very often the developed importing countries) and the former follows the lucid environmental standards, enjoys "pseudo comparative advantage" and specializes in "dirty industries". Thus the issue of **"under standardization"** should also be addressed by WTO as the otherwise "standard setters" by their own interest may be reluctant to do the same.

Anyway, if a measure could be considered to be legitimate, instead of in a narrower and stricter classification as a barrier, the exporting country (specially the developing countries) should set their "own house in order". The necessary technical assistance is also required to comply with the standards more easily.There are several domestic and technological constraints which need to be addressed at their end. Some of the companies do not have basic technology even for standardized products, and they "perceive" (and effectively it ends in) any valid and legitimate

[70]Section 4.2.2 of the thesis proposes the theoretical justification behind such behavior

standard as a non-tariff barrier. There is also lack ofinformation about foreign standards among developing country (specially small and medium scale producers) and particularly on changingstandards. This clearly means that the imperative on the part of **developing country governments to support the technological upgrading of their domestic sectors has become extremely urgent.**

## 5.3Scope of Future Research

**Quite a few extensions of our analyses in this dissertation can be conceived of.**The result depends on specific but realistic conditions of the model. Some of these assumptions can be relaxed in future research.First we have focused on government decision process on standards by explicitly assuming only producers' lobby (subject to the welfare function) in standard setting process. When the "median voter theorem" predicts in a democracy the trade policy should aim to fulfill the need of the consumers (as they are large in number),[71]the collective action problem shows that compared to an individual producer, individual consumer may not have much incentive to lobby for trade policy change.[72]However we show that consumers are also affected by standard .So we can incorporate consumers' lobby also in standard setting process by govt. Regarding the comparison between tariff and "standard" we have calculated "equivalent tariff" by keeping the "volume" of trade unchanged under two situations. In this respect we can re-examine the effect taking the value of trade with respect to the importing country (i.e. the value of import).This extension can be more realistic as the producers in the importing country under any policy changes (whether from tariff to NTB or vice versa) will lobby for keeping their

[71]Krugman&Obsfeld(2000)

[72] Ibid

revenue unchanged. Even we can extend this analysis by calculating "equivalent tariff" on the basis of "equivalent profit to the producers" under two situations (tariff and standards).

In Chapter 3 &4 we have assumed the exporting firm is following the same "standard"(imposed by the importing country) in the local market also as the fixed cost of production under two different situations is high enough to outweigh the benefit from producing at a lower standard for local market. We can relax this assumption though that will change not the direction (apart from consumption externality situation[73]) but the magnitude of the results. Another possible extension would be to incorporate the change in consumers' preferences for the product which creates less negative externality. (Section 4.2)The assumption that valuation of externality remains uniform across countries may not be true especially when it is a trade between developed and developing country.For the exporting country generally the valuation of the externality will be different and there can be under valuation of externality. In that case actually the prohibitive standard will be lower than what we have derived (both in the case of consumption externality & production externality) and a particular measure may simply be a 'perceived barrier' and may not actually be a barrier.**Though the present dissertation could not address these issues, the basic structures andbenchmark results provide the launching pad for such analyses to be carried out in thefuture.**

*** * * * * ***

[73] Discussed in section 4.2.1.2

## References:-


1. Acharyya,R.(2001), "Southern Export of Dirty "variety" and optimality ofEnvironmental Standards: Case of Consumption Pollution", Working Paper,Department of Economics, Jadavpur University, Kolkata
2. Anderson, K., Damania, R.,Jackson, L.A. (2004), "Trade, Standards, and the Political Economy of Genetically Modified Food",World Bank Policy Research working Paper 3395.Washington DC:The World Bank
3. Anderson, S.P and N Schmitt (2000), "Non-Tariff Barriers and TradeLiberalization",CESifo Working Paper, January
4. Baldwin, Robert E. (1970), "Nontariff Distortions of International Trade." The Brookings Institution, Washington
5. Baldwin, Richard E. (2000), "Regulatory Protectionism, Developing Nations and a Two-Tier World Trade System", Brookings Trade Forum, Washington D.C.; (reprinted in Maskus and Wilson (eds.), (2001), "Quantifying Trade Effects of Technical Barriers: Can it be done?" University of Michigan Press, Ann Arbor).
6. Baldwin,Richard(2001), "Regulatory Protectionism, Developing Nations and A two-Tier World Trade System, CEPR Discussion Paper No.2574
7. Baller, S. (2007), "Trade effects of regional standards liberalization: a heterogeneous firmsApproach", World Bank Policy Research Working Paper 4124.
8. Barrett,S.(1994), "The Welfare implications of minimum quality standards", American Journal of Agricultural Economics 66: 466-471

9. Beghin (2006), “Non–Tariff Barriers”, Working paper06 – WP438,Center for Agricultural and Rural Development, Iowa State University

10. Beghin, John, and Jean-Christophe Bureau. (2001), “Quantitative Policy Analysis ofSanitary, Phytosanitary and Technical Barriers to Trade”,EconomieInternationale87: 107-130.

11. Bocksteal , N.E.(1984), “The Welfare implications of minimum quality standards.”, American Journal of Agricultural Economics 66: 466-471

12. Boom , A. (1995), “Asymmetric international minimum quality standards and vertical differentiation.”, The Journal of Industrial Economics 18 (XLIII):101-120

13. Bora, B., Kuwahara, A., and Laird, S. (2002),“Quantification of Non-Tariff Measures, Policy Issues in International Trade and Commodities”, Study Series No. 18, UNCTAD, UNCTAD/ITCD/TAB/19.

14. Bredahl, M. E., Schmitz, A. and Hillman, J. “Rent seeking in international trade: The greattomato war.”, Journal of Agricultural Economics, Vol. 69:pp. 1–10.

15. Brom, F. W. A.(2000), “Food, consumer concerns, and trust: Food ethics for a globalizing market.”, Journal of Agriculture and Environmental Ethics, Vol. 12:pp. 127–139

16. Calvin, L., Krissoff, B.(1998), “Technical Barriers to Trade: A Case Study of Phytosanitary Barriers and U.S.-Japanese Apple Trade”, Journal of Agricultural and Resource Economics, 23(2): 351-366.

17. Castinot, A.(2008), “A Comparative Institutional Analysis on Agreements on Product Standards.”, Journal of International Economics, 75: pp197-213

18. Chen, Maggie X. and A. Mattoo (2004), "Regionalism in Standards: Good or Bad for Trade?" World Bank Policy Research Working Paper.

19. Chen, M.X.; Otsuki, T.; Wilson, J.S. (2006), "Do standard matters for export success?"World Bank Policy Research Working Paper:280.

20. Crivelli, P. Grochl,J. (2012), "SPS Measures &Trade :Implementation matters.", Staff Working Paper, ERSD 2012-05,World Trade Organization: Economic Research &Statistics Division.

21. Das ,Kasturi(2008), "Addressing SPS Challenges in India" CWS, Working Paper

22. Davis,ChristinaL.(2003), "Food Fights over Free Trade:How International Institutions Promote Agricultural Trade Liberalization", Princeton , NJ: Princeton University Press

23. Deardorff, A.V., and Stern, R.M., (1998), "Measurement of Nontariff Barriers Studies in International Economics", The University of Michigan Press. Ann Harbor.

24. Disdier A.C., Fontagne L. and Mimouni,M.(2007), "The impact of regulation onagricultural trade: Evidence from SPS and TBT Agreements."CEPII Working Paper,No. 2007-04. Centre d'EtudesProspectivesetd'InformationsInternationales, Paris.

25. Feenstra, R. (2004), "Advanced International Trade: Theory and Evidence", New Jersey: Princeton University Press, 496 p.

26. Fischer, R., and Serra, P, (2000), "Standards and Protection." Journal of International Economics 52: 377-400.

27. Fontagne, L., Mimouni, M. and J. M. Pasteels(2005), "Estimating the impact of environmental SPS and TBT on international trade", Integration and TradeJournal vol.28, no.19: pp.7-37.

28. Fugazza,M. and Maur, J. (2008), "Non Tariff Barriers in computable General equilibrium Modeling.", Policy Issues in International Trade and Commodities Study Series No:38,UNCTAD

29. Ganslandt; Mattias and J.R.Markusen (2001), "Standards and Related Regulations in International Trade: A Modeling Approach", Chapter 4 in Maskus and Wilson (eds.), (2002), "Quantifying Trade Effects of Technical Barriers: Can it be done?" – University of Michigan Press, Ann Arbor

30. Grossman,G.M.,Krueger,A.B.,(1995), "Economic Growth and the Environment", The Quarterly Journal of Economics,Vol.110,No2,pp.353-377

31. Henson,S. and Jaffee,S.(2007), "The costs and benefits from compliance with food safety standards for exports by developing countries: The case of fish and fishery products in J.Swinner(ed) Global Supply Chains, standards and the poor(Oxon, UK:CABI publication,pp-26-41)

32. Henson, Spencer, and John S. Wilson, eds. (2005), "The WTO and Technical Barriers toTrade", in the "Critical Perspectives on the Global Trading System and the WTOSeries", Northampton, MA: Edward Elgar Publishing Ltd.

33. Henson, Spencer and Rupert Loader. (2001), "Barriers to Agricultural Exports from Developing Countries: The Role of Sanitary and Phytosanitary Requirements." World Development29(1): 85-102

34. John C. Beghin and Jean-Christophe Bureau(2001), "Quantification of Sanitary, Phytosanitary, andTechnical Barriers to Trade for Trade Policy Analysis",Working Paper 01-WP 291,Center for Agricultural and Rural Development,Iowa State University.

35. Kennedy, PW.(1994), “Equilibrium pollution taxes in open economies with imperfectcompetition”, Journal of Environmental Economics and Management, 27: 49-63

36. Kono, Daniel Y. (2006), “Optimal Obfuscation: Democracy and Trade Policy Transparency.” American Political Science Review, 100(3): 369-384.

37. Kono, Daniel Y. (2009), “Protection for Whom? The Uses and abuses of SPS Standards in the WTO”, paper preparedfor the Oxford Princeton Conference on “Global Trade Ethics &Policies of WTO Reform,” Princeton , NJ, Feb 19,2009

38. KallummalMurali (2012), “SPS measures and possible market access implicationsfor agricultural trade in the Doha Round:An analysis of systemic issues.” ARTNeT Working Paper Series No. 116

39. Krugman, Paul R. (1980), “Scale Economies, Product Differentiation, and the Pattern of Trade”,American Economic Review70: 950-959

40. Krugman,P.R and Obsfeld, M.(2000), “International Economics Theory and Policy” Prentice Hall,2000

41. Lamb, Russell L. (2006), “Rent Seeking in U.S.-Mexican Avocado Trade.” Cato Journal, 26(1): 159-177.

42. Leland,H.E. (1979), “Quacks,Lemons and Licensing: ATheory of Minimum Quality Standards.” Journal of Political Economy, Vol87 pp1328-1348

43. Mantovani and M. Vancauteren (2003), “The Harmonization of Technical Barriers to Trade,Innovation and Export Behavior: Theory with an Application to EU Environmental Data.”

44. Marette, S. and Beghin, J. C. (2010), “Are standards always protectionist?”, Review of International Economics, Vol. 18:pp. 179–192.

45. Meyer, N.et al(2010), “Bilateral and Regional Trade Agreements and Technical Barriers to Trade: An African Perspective.” OECD Trade Policy Working Papers No. 96,OECD Publishing

46. Moenius (1999), “Three essays on Trade Barriers and Trade Volumes.” PhD dissertation; University of California, San Diego

47. OECD. (2005),“Analysis of Non-Tariff Barriers of Concern to Developing Countries”, OECD Trade Policy Working Paper No. 16. France: OECD

48. Otsuki, Tsunehiro, John S. Wilson, and MirvatSewadeh. (2001), “Saving Two in a Billion: Quantifying the Trade Effect of European Food Safety Standards on African Exports.” Food Policy, 26: 495-514

49. Roberts, D., Unnevehr, L.(2005), “Resolving trade disputes arising from trends in food safety regulation: the role of the multilateral governance framework”, World Trade Review, 4: 3, 469-497.

50. Roberts D., T. Josling, and D. Orden (1999), "A Framework for Analyzing Technical Trade Barriers inAgricultural Markets." Technical Bulletin No. 1876. Economic Research Service, US Departmentof Agriculture, Washington D.C.

51. Ronnen,U.,(1999), “Minimum quality standards, fixed costs, and competition.” Rand Journal of Economics, 22,490-504

52. Sawnney,A. (2005), “Quality Measures in Food Trade: The Indian Experience.” Blackwell Publishing Limited

53. Saquib,M.andTaneja,N.(2005), “Non-Tariff Barrier and India’s Exports:The case of ASEAN and Srilanka”. ICRIER, Working Paper no165

54. Suwa-Eisenmann,A. andVerdier,T.(2002), “Reciprocity and the Political economy of harmonization and mutual recognition of regulatory measures,CERP Discussion papers 3147 (London:CERP,2002)

55. Swann, G. P. (2010), “International standards and trade: A review of the empiricalliterature”, OECD Trade Policy Working Paper, No. 97, Paris. Available at http://dx.doi.org/10.1787/5kmdbg9xktwg-en.

56. Swann, Peter, P.Temple and M. Shurmer (1996), “Standards and Trade Performance: The UKExperience.” Economic Journal, 106.

57. Swinnen, J.F.M and Vandemoortele T. (2011), “Trade and the Political Economy ofFood Standards.” Journal of Agricultural Economics, Vol. 62:pp:259–280

58. Tian,H. (2003), “Eco-labeling scheme, environmental protection, and protectionism’, Canadian Journal of Economics, Vol. 36: pp. 608–633.

59. Tirole, J. (1998),“The Theory of Industrial Organization.” Cambridge, MA: MIT Press.

60. Thilmany, D. D. and Barrett, C. B. (1997), “Regulatory barriers in an integrating world food market.”,Review of Agricultural Economics, Vol. 19: pp. 91–107.

61. UNCTAD (2013), “Non-Tariff Measures to Trade:Economic and Policy Issues for Developing Countries”.UNCTAD

62. Valletti, T. M. (2000), “Minimum quality standards under Cournot competition.” Journal of Regulatory Economics, Vol. 18: pp. 235–245

63. Vancauteren, Marc and Weiserbs (2003), “The impact of the Removal of Technical Barriers to Trade on Border Effects and Intra-Trade in the European Union”, UniversitéCatholique de Louvain

64. Wilson, John S. and T. Otsuki (2004), "Standards and Technical Regulations and Firms in Developing Countries: New Evidence from a World Bank Technical Barriers to Trade Survey." World Bank, Washington D.C.

65. www.saarc-sec.org

66. www.wto.org

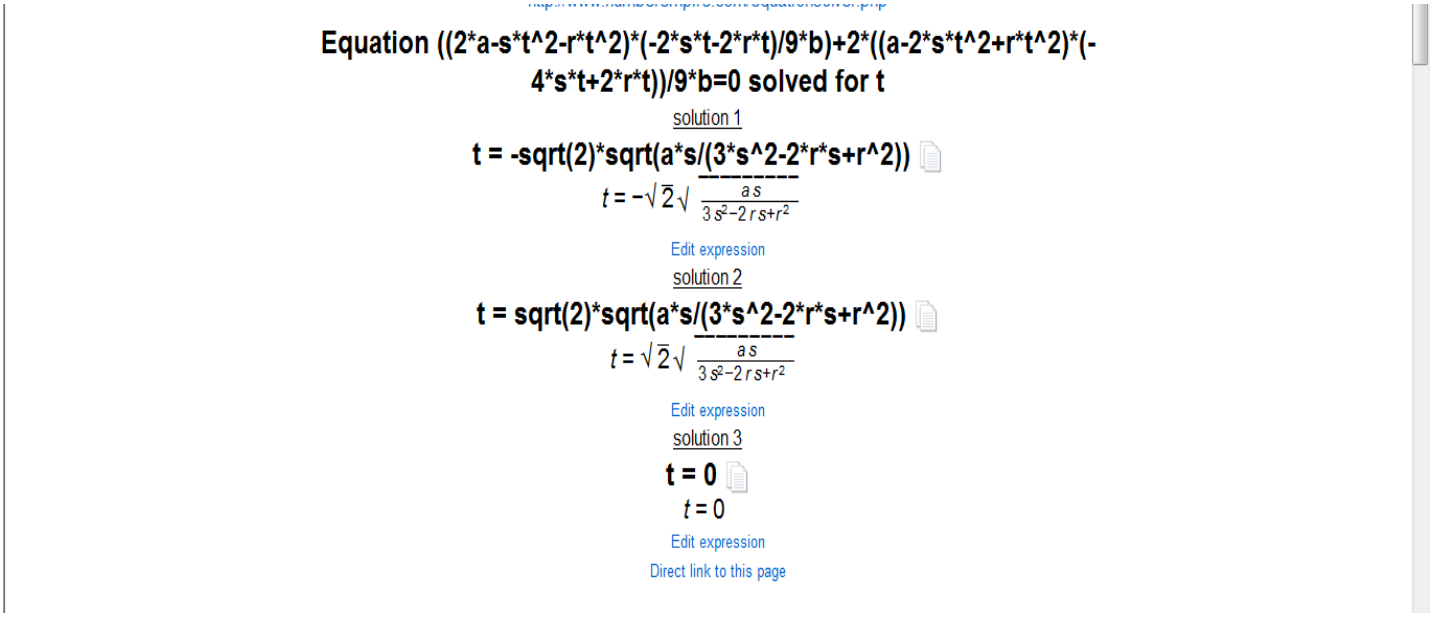
67. Zahniser, Steven. (2006), "U.S.-Mexico Agricultural Trade during the NAFTA Era." Paper prepared for the conference "Doha, NAFTA, and California Agriculture," sponsored by the Giannini Foundation, Sacramento, CA.

## Notations in Annexes:-

| Notation used in the thesis | Notation used in equation solver |
|---|---|
| $b'$ | b |
| b | k |
| $\overline{c_h}$ | r |
| $\overline{c_f}$ | s |
| $\overline{b}$ | m |
| $\tau$ | t |

# Annexure

## Annex 3.1



**Equation ((2*a-s*t^2-r*t^2)*(-2*s*t-2*r*t)/9*b)+2*((a-2*s*t^2+r*t^2)*(-4*s*t+2*r*t))/9*b=0 solved for t**

solution 1

**t = -sqrt(2)*sqrt(a*s/(3*s^2-2*r*s+r^2))**

$$t = -\sqrt{2}\sqrt{\frac{a\,s}{3\,s^2-2\,r\,s+r^2}}$$

Edit expression

solution 2

**t = sqrt(2)*sqrt(a*s/(3*s^2-2*r*s+r^2))**

$$t = \sqrt{2}\sqrt{\frac{a\,s}{3\,s^2-2\,r\,s+r^2}}$$

Edit expression

solution 3

**t = 0**

$$t = 0$$

Edit expression

Direct link to this page

## Annex 3.2

**Equation (((a-2*r*t^2+s*t^2)^2)/9*k)-3*((2*a*r*t^2-r^2*t^4)/8*b)=0 solved for t**

solution 1

**t = -sqrt(3^(3/2)*a*sqrt(-16*b*k*r*s+24*b*k*r^2+27*b^2*r^2)/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)-8*a*k*s/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+16*a*k*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+27*a*b*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2))**

$$t = -\sqrt{\frac{3^{\frac{3}{2}}\,a\sqrt{-16\,b\,k\,r\,s+24\,b\,k\,r^2+27\,b^2\,r^2}}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}-\frac{8\,a\,k\,s}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{16\,a\,k\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{27\,a\,b\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}}$$

Edit expression

solution 2

**t = sqrt(3^(3/2)*a*sqrt(-16*b*k*r*s+24*b*k*r^2+27*b^2*r^2)/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)-8*a*k*s/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+16*a*k*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+27*a*b*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2))**

$$t = \sqrt{\frac{3^{\frac{3}{2}}\,a\sqrt{-16\,b\,k\,r\,s+24\,b\,k\,r^2+27\,b^2\,r^2}}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}-\frac{8\,a\,k\,s}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{16\,a\,k\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{27\,a\,b\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}}$$

Edit expression

solution 3

**t = -sqrt(-3^(3/2)*a*sqrt(-16*b*k*r*s+24*b*k*r^2+27*b^2*r^2)/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)-8*a*k*s/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+16*a*k*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+27*a*b*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2))**

Edit expression

solution 4

**t = sqrt(-3^(3/2)*a*sqrt(-16*b*k*r*s+24*b*k*r^2+27*b^2*r^2)/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)-8*a*k*s/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+16*a*k*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2)+27*a*b*r/(8*k*s^2-32*k*r*s+32*k*r^2+27*b*r^2))**

$$t = \sqrt{-\frac{3^{\frac{3}{2}}\,a\sqrt{-16\,b\,k\,r\,s+24\,b\,k\,r^2+27\,b^2\,r^2}}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}-\frac{8\,a\,k\,s}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{16\,a\,k\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}+\frac{27\,a\,b\,r}{8\,k\,s^2-32\,k\,r\,s+32\,k\,r^2+27\,b\,r^2}}$$

Edit expression

Direct link to this page

## Annex 4.1

**Equation ((2*a-s*t^2-r*t^2)*(-2*s*t-2*r*t)/9*b)+2*(((a-2*s*t^2+r*t^2)*(-4*s*t+2*r*t))/9*b) +(2*m*t*(2*a-s*t^2-r*t^2)/3*b)+((m*t^2-d)*(-(2*s*t+2*r*t))/3*b)=0 solved for t**

solution 1

**t = -sqrt(-d*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)+2*a*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-d*r/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-2*a*m/(3*s^2-2*r*s-2*m*s+r^2-2*m*r))**

$$t = -\sqrt{-\frac{d\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}+\frac{2\,a\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{d\,r}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{2\,a\,m}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}}$$

Edit expression

solution 2

**t = sqrt(-d*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)+2*a*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-d*r/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-2*a*m/(3*s^2-2*r*s-2*m*s+r^2-2*m*r))**

$$t = \sqrt{-\frac{d\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}+\frac{2\,a\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{d\,r}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{2\,a\,m}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}}$$

Edit expression

solution 3

**t = 0**

$t = 0$

Edit expression

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# Annex 4.2

**Equation 2*(a-2*r*t^2+s*t^2)*(2*s*t-4*r*t)/9*b-3*(a-r*t^2)*r*t/2*b-r*t*(m*t^2-d)/b-r*t^2*(m*t)/b=0 solved for t**

solution 1

**t = -sqrt(-8*a*b^2*s/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r)-18*d*r/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r)+43*a*b^2*r/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r))**

$$t = -\sqrt{-\frac{8\,a\,b^2\,s}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}-\frac{18\,d\,r}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}+\frac{43\,a\,b^2\,r}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}}$$

Edit expression

solution 2

**t = sqrt(-8*a*b^2*s/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r)-18*d*r/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r)+43*a*b^2*r/(8*b^2*s^2-32*b^2*r*s+59*b^2*r^2-36*m*r))**

$$t = \sqrt{-\frac{8\,a\,b^2\,s}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}-\frac{18\,d\,r}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}+\frac{43\,a\,b^2\,r}{8\,b^2\,s^2-32\,b^2\,r\,s+59\,b^2\,r^2-36\,m\,r}}$$

Edit expression

solution 3

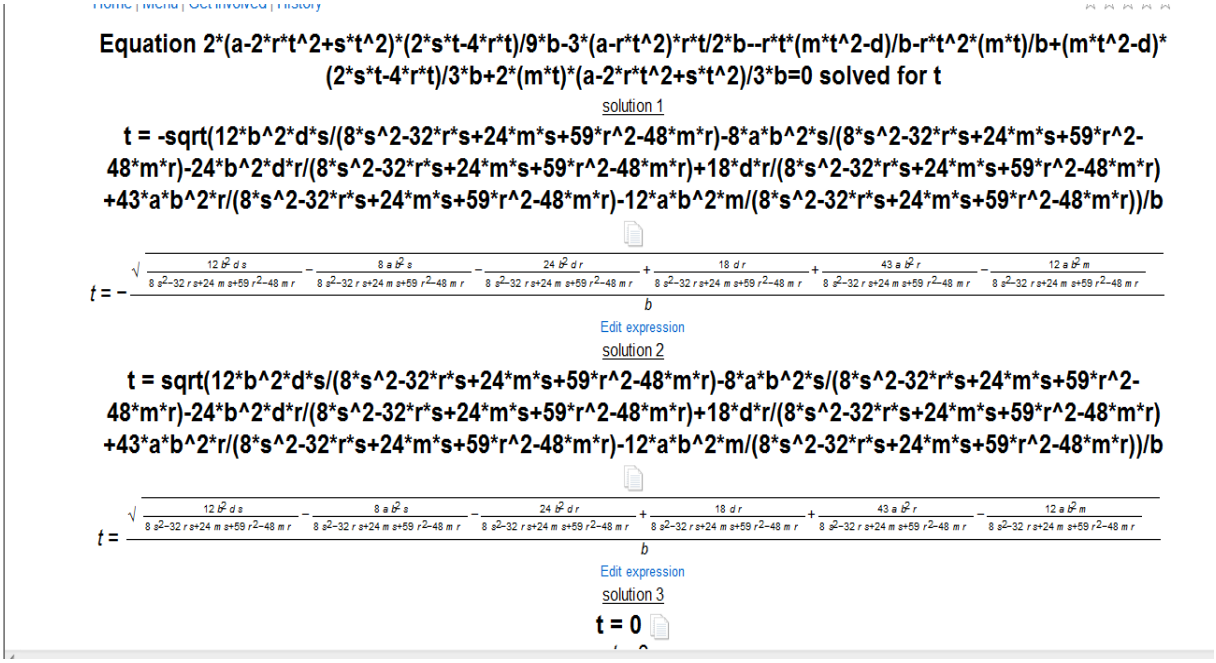
**t = 0**

$t = 0$

Edit expression

Direct link to this page

## Annex 4.3


Equation 2*(a-2*r*t^2+s*t^2)*(2*s*t-4*r*t)/9*b-3*(a-r*t^2)*r*t/2*b--r*t*(m*t^2-d)/b-r*t^2*(m*t)/b+(m*t^2-d)*(2*s*t-4*r*t)/3*b+2*(m*t)*(a-2*r*t^2+s*t^2)/3*b=0 solved for t
solution 1
t = -sqrt(12*b^2*d*s/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-8*a*b^2*s/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-24*b^2*d*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)+18*d*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)+43*a*b^2*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-12*a*b^2*m/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r))/b
Edit expression
solution 2
t = sqrt(12*b^2*d*s/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-8*a*b^2*s/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-24*b^2*d*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)+18*d*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)+43*a*b^2*r/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r)-12*a*b^2*m/(8*s^2-32*r*s+24*m*s+59*r^2-48*m*r))/b
Edit expression
solution 3
t = 0

## Annex 4.4

**Equation ((2*a-s*t^2-r*t^2)*(-2*s*t-2*r*t)/9*b)+2*(((a-2*s*t^2+r*t^2)*(-4*s*t+2*r*t))/9*b) +(2*m*t*(2*a-s*t^2-r*t^2)/3*b)+((m*t^2-d)*(-(2*s*t+2*r*t))/3*b)=0 solved for t**

solution 1

**t = -sqrt(-d*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)+2*a*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-d*r/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-2*a*m/(3*s^2-2*r*s-2*m*s+r^2-2*m*r))**

$$t = -\sqrt{-\frac{d\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}+\frac{2\,a\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{d\,r}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{2\,a\,m}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}}$$

Edit expression

solution 2

**t = sqrt(-d*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)+2*a*s/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-d*r/(3*s^2-2*r*s-2*m*s+r^2-2*m*r)-2*a*m/(3*s^2-2*r*s-2*m*s+r^2-2*m*r))**

$$t = \sqrt{-\frac{d\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}+\frac{2\,a\,s}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{d\,r}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}-\frac{2\,a\,m}{3\,s^2-2\,r\,s-2\,m\,s+r^2-2\,m\,r}}$$

Edit expression

solution 3

**t = 0**

$t = 0$

Edit expression

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