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 been considerable discussion of whether standards and regulations affect trade costs 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 national welfare. Standards and technical regulations are often portrayed as barriers to trade that restrict competition in the local economy by raising costs to foreign suppliers. The idea that standards can 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, possibly resulting 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 were administered 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 SPS agreement keeps the provision of use of "national standards" (tighter than international standard) ,developed Members have applied their own national standards (3,452 notifications) in 68 per cent of their total notifications. International standards (1,323 notifications; 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 prevalence of "national standards" was found to be correct in the case of developed countries. This could 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 of their notifications. However, the share of notifications following international standards (48 per cent) was not significantly lower. Only 1 per cent of these Members' notifications applied 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 rice

[11] Baldwin (2001)

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

from India or Singapore; importers demand for 50s yarn are some of the examples of 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 find mixed effects on overall welfare. Leland (1979) shows that, in general, the effect of a minimum quality standard on welfare is ambiguous, depending on consumers' sensitivity to 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 two negative 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 modeling its 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 both the 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 varied standards[13] and technical requirements on the good that is marketed in its market. Firstly we assume complying with standards has no effect on consumers' demand for 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***, is the 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-wise deviation from *Fj* due to the varied impact each firm receives from standards and technical regulations. *Di varies* across exporters (here, only country B) due to their difference in factors such as technology endowment and hence the ability to meet standards. Most studies consider that the introduction of standards implies compliance costs for 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.A Prohibitive 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 is Prohibitive in nature.**[17]

2.2.1.B Export 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

Welfare gain :- $(F_A + D_{2A})/3b$ (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 B i.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]

[18] Appendix 2.3

When j is importing country,

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

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

When j is exporting country,

$$Q_{ij_{\forall i \in j}} = a/2b \quad (2.3.7)$$

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.

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

Proof: -From equation 2.3.5,

$\frac{\partial Q_{ij}}{\partial F_j}\frac{F_j}{Q_{ij}} = (n-1)Fj/(a + (n-1)F_j + \sum_{i=1}^{n} D_{ij})$, 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 (of any exporting firm) 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

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

This expression is greater than 1 iff Dij exceeds some critical value,

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

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 to variable part of compliance 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 importing country(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:

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

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 no change in consumer surplus but the producer surplus will change by:

[19] see Appendix 2.4

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

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 preferences ordering. 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 θ is 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 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.

[20]Tirole (1988)

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 that assumption 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:-

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

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

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

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

The equilibrium outputs are:

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

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

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

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 to same amount 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, the importing 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 scale

then difference in standard will lead to the same result as the harmonized standards in all the markets. If the production technology shows increasing returns to scale 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:

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

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,

[21] Chen and Mattoo(2004)

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

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.A Effect 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]

$$E_{1B} < 3E_{1C} \quad (2.6.14)$$

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.

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

2.6.1.B Effect 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 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.

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

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 they wish 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. But many 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 become dominated by protectionists and those who would welcome trade retaliation and counter retaliation. However, transparency and harmonization of standards could become 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

[25] Chen and Mattoo(2004)

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 by the 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 externality linked 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

$$\frac{\partial \pi_1}{\partial Q_{1A}} = a - 2bQ_{1A} = 0 \quad \text{(A.2.1)}$$

$$\frac{\partial \pi_2}{\partial Q_{2A}} = a - bQ_{1A} - 2bQ_{2A} - F_A - D_{2A} = 0 \quad \text{(A.2.2)}$$

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

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:-

$a^2 / 4b + (a - 2 F_A - 2D_{2A})^2 / 9b$ (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 results have 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 /gain in 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,

$$Q_{ij} = \left(5a - \sqrt{a^2 - (12b * E_{ij})}\right)/12b \quad \text{(A.2.10)}$$

$$P_j = \left(5a - \sqrt{a^2 - (12b * E_{ij})}\right)/12 \quad \text{(A.2.11)}$$

After Harmonization,

$$Q_{ij} = \left(5a - \sqrt{a^2 - (6b * E_{ij})}\right)/12b \quad \text{(A.2.12)}$$

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