Lobbying, Trade and Product Standards

Katia Berti

European Commission

Directorate General Economic and Financial Affairs

and

Rod Falvey

Bond Business School

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Abstract

In this paper we investigate the effects of trade on the national minimum quality standards applied by two trading partners. We employ a simple partial equilibrium model in which national regulators may set a minimum quality standard for a product whose quality is unobservable to consumers prior to purchase. Both producers and consumers can benefit from a minimum standard, but the former prefer a lower standard to the latter. Because producers are organised and consumers are not, the standards set by national regulators may tend to unduly favour producer interests. Two cases are considered. In the first case only the Home country sets a standard, with the Foreign standard constant at the default value. We find that in autarky the Home country will have the higher standard, and once trade becomes possible the Home country will import the product when producer interests dominate in the standard setting and may export the product otherwise. Both countries gain from trade at the autarky standards. The home regulator cuts the standard if producer interests dominate and raises the standard otherwise. Home welfare falls if the standard is cut and increases otherwise. In the second case both countries set standards, but only the home standard-setting is subject to lobbying. Now the foreign country has the higher standard and the lower unit profits in autarky, and exports the product when trade is possible. Again both countries gain from trade at autarky standards and the home regulator cuts the standard if producer interests dominate and raises it otherwise. The foreign regulator always raises its standard. World welfare falls when the home standard is cut and rises otherwise.

1. Introduction

The global proliferation of product standards[1] combined with the global reduction in formal trade barriers has raised concerns that the former may be used as non-tariff barriers to replace the latter in the international trading system. Determining whether product standards are being applied in a 'protectionist' way is complicated by the lack of obvious 'free trade standards' to compare them with. Instead the focus has been on inferring their intent by investigating how standards are determined. For this a political economy approach is essential (Swinnen and Vandemoortele, 2012). Many standards start out as 'voluntary' standards, set by industry associations, and become de facto mandatory,[2] and even where government bodies directly set standards they are heavily reliant on information provided by the private sector. For this reason the analysis of standard setting should allow for lobbying by producers at least.

Standards can have a range of motivations, and the WTO (2005) classifies them into three broad categories - *compatibility standards* which are applied to complementary products in order to facilitate the exploitation of network externalities; *environmental standards* aimed at reducing (negative) environmental externalities; and *safety standards* applied in cases of information asymmetry between producers and consumers.[3] Given the extensive literature on externalities, our interest is on standards as instruments to deal with informational asymmetries, rather than externalities. We set up a simple partial equilibrium model of a product whose quality is unobservable to consumers at the time of purchase. To deal with the resulting "lemons problem" (Akerlof, 1970), the government may legislate a minimum quality standard whose level is set by a Regulatory Authority (RA).[4] Both

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[1] For example Perinorm, a database of the standards published by the main national and international standards' authorities, includes over 650,000 standards from 23 countries (Swann, 2010 and WTO, 2005).

[2] For example, GlobalGAP is a private organisation that sets voluntary standards for the certification of production processes for agricultural products. The WTO (2005) notes that "..a large number of organisations produce voluntary standards, some of which become mandatory by being referred to in technical rules and regulations drafted by government agencies." (p75); and "In the US local authorities, which typically lack the technical resources necessary to formulate standards, often adopt privately developed standards." (p90) "It is interesting to note that voluntary standards sometimes become de facto mandatory. In the United States, for example, wholesalers or retailers sometimes refuse to sell non-standard products because they do not wish to bear the responsibility in cases where products create problems." (p90).

[3] The MAST classification of Non-Tariff Measures, intended to be exhaustive, includes separate groups on sanitary and phytosanitary measures and technical barriers to trade that indicate the diverse nature of standards and their application. See van Tongeren et. al. (2009). The Codex Alimentarius Commission, established by the FAO and WHO, develops harmonized food standards, guidelines and codes of practice based on the best available science and informed by independent international risk assessment bodies.

[4] WTO (2005) notes that about 40% of the notifications under the TBT and SPS Agreements in 2004 were measures to protect human health and safety, and that the prevention of deceptive practices and consumer information and labelling were other reasons frequently given for new measures. "This suggests that many of the

consumers and producers can benefit from such a standard, but have different views over its optimal level. We assume that the RA acts to maximise an objective function in which the welfare of both groups feature, but in which producer interests may be over-represented. Adopting a political economy approach allows us to consider standard setting in a range of contexts, from the "ideal" of aggregate welfare maximisation, through (partial) regulatory capture by producer interests, to standard setting by private producer interests (industry associations).[5]

We assume that neither country has a natural competitive advantage in the product under consideration, so that if countries had identical policy regimes there will be no trade. In this paper it is differences in the policy regimes themselves that generate trade, and they do this not by creating a cost or competitive advantage, but by creating a divergence in unit profits in the two markets. In the absence of barriers to trade, producers respond by diverting output to the more profitable market until the unit profits are equalised. We consider two cases. In the first case it is the presence of a regulatory regime in one country and the absence of such a regime in the other country that results in trade. In the second case it is the presence of lobbying on the regulatory regime in one country and the absence of such lobbying in the other's regime that results in trade.

In each case we ask three questions. First, what is the pattern of trade caused by regulatory differences? Does having a higher product standard make a country more likely to import or to export the product? Second, what are the welfare effects of trade caused by regulatory differences? Given that at least one market is distorted, or there wouldn't be trade, do the standard gains from trade apply? Third, how are standard(s) adjusted in response to this trade and what are the welfare effects of this adjustment? Should we expect a 'race to the bottom (or top)'? Does the difference in standards tend to widen (or narrow)? Is the importer's response 'protectionist' and is the exporter's response 'export-promoting'?

The structure of the remainder of this paper is as follows. Section 2 sets up our model and derives the autarky outcomes. We then consider trade, the gains from trade and how

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technical regulations that have come into being in the past ten years are concerned with solving information asymmetry problems." (WTO, 2005, p.59).

[5] Our production structure is in fact very similar to Sturm (2006), where the standard setter (a politician in his case) places additional weight on the welfare of a sector-specific factor. But there the underlying case for intervention relates to a negative externality from consumption of the product. Sturm (2006) also employs a more elaborate standard-setting environment involving two-periods and (good or bad) politicians selecting policies (non-welfare-maximising standards or direct transfers) in a world with two possible states of nature (high-risk and low-risk) and an election at the start of the second period.

the opportunity to trade affects the standards set in Section 3. The final section presents our conclusions.

2. The analytical framework

2.1 The market structure

We begin with the closed economy. On the supply side, we assume that each unit of industry specific capital (K) when combined with labour can produce one unit of output. The "quality" of that unit (λ) is positively related to the number of workers employed in its production. If w is the wage, the unit cost function is

$$c(w, \lambda) = \frac{w\lambda^2}{2} \tag{1}$$

which is increasing in the wage and increasing and convex in quality. We assume a perfectly competitive market structure so that the wage and output price are taken as given by individual producers. Above some minimum level ($\underline{\lambda}$), quality is an unobservable product characteristic prior to purchase. The market is characterized by many small firms each producing an output indistinguishable from its competitors. Since producing higher quality is costly and higher quality cannot be identified by potential buyers, each firm has an incentive to set its quality at $\underline{\lambda}$. Given this, we assume that in the absence of regulatory intervention, the market equilibrium involves sales at the minimum quality only.

On the demand side, we assume "representative" price-taking individuals in each country with identical preferences such that:

$$u(X, \lambda) = \lambda \left[DX - \frac{X^2}{2} \right] \tag{2}$$

where X is the quantity consumed and D is a positive parameter.[6] This implies a demand function

$$X(p, \lambda) = D - \frac{p}{\lambda} \tag{3}$$

The quantity demanded falls as the quality-adjusted price (p/λ) increases. The total profits of the owners-producers are given by:

$$\Pi(p, \lambda) = K\{p - c(w, \lambda)\} = K \left[p - \frac{w\lambda^2}{2} \right] \tag{4}$$

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[6] One interpretation of λ is the probability that the product does not fail, with no utility being achieved in the event of failure. This utility function is multiplicative in product quality and in a quadratic function of the quantity of the product consumed. The consumer takes quality as given and chooses quantity. Quantity is subject to diminishing marginal utility, which becomes zero when $X = 2D$. The result is a tractable demand function (3) with standard properties.

2.2 The regulatory structure

The RA sets a *minimum* quality level that producers must comply with in order to be able to sell in the market. Although it is formally a minimum, there will be no incentive for any individual producer to choose a higher level, so that the RA is in fact setting the quality level in the market. We assume that the level of λ emerges from a political economy game of the type considered by Grossman and Helpman (1994, 1995). Consumers are not organised because of the strong incentive to free-ride within a large group. Producers are assumed to be sufficiently small in number to overcome the collective-action problem (even though large enough to be consistent with the assumption of perfect competition). Lobbying leads the RA to give greater weight to producers' interests than to consumers' interests in its objective function. While aggregate welfare $W(\lambda)$ is the sum of producers' profit and consumers' surplus ($S(\lambda) \equiv u(X, \lambda) - pX$), the optimum (autarky) equilibrium standard, (λ^0) is derived by maximizing

$$G = \Pi(\lambda) + AS(\lambda) \tag{5}$$

where $1 \geq A \geq 0$. This leads to the following first-order condition:

$$\frac{d\Pi}{d\lambda} = -A\frac{dS}{d\lambda} \tag{6}$$

In equilibrium the weighted gain for one social group induced by a marginal change in quality needs to be equal to the weighted loss for the other social group.

2.3 The autarky equilibrium

Equating demand from (3) with supply (K), gives the equilibrium autarky price:

$$p^0 = \lambda^0[D - K] = \lambda^0 H \tag{7}$$

which is increasing in product quality and 'market size' ($H \equiv D - K$). We then have

$$\Pi(\lambda^0) = \pi(\lambda^0)K = \lambda^0\left[H - \frac{w\lambda^0}{2}\right]K \quad \text{and} \quad S(\lambda^0) = \frac{\lambda^0 K^2}{2} \tag{8}$$

This in turn gives us

$$\frac{d\Pi}{d\lambda} = K[H - w\lambda^0] \quad \text{and} \quad \frac{dS}{d\lambda} = \frac{K^2}{2} \tag{9}$$

From (9) we see that consumer surplus is always increasing in λ. Given this, *in equilibrium* we must have profit decreasing in λ. The equilibrium is such that consumers prefer an even higher standard, whereas producers would opt for a lower standard (unless $A = 0$). Substituting (9) in (6) allows us to derive the autarky equilibrium quality standard:

$$\lambda^0 = \frac{H}{w} + A\frac{K}{2w} \tag{10}$$

Other things equal, the equilibrium quality standard is increasing in market size, supply, and the relative weight attached to consumers' interests, and decreasing in the cost of quality (w). The autarky equilibrium standard as a function of A is illustrated in Figure 1.

This solution can also be used to identify boundary cases. If the RA is only concerned with aggregate welfare maximisation (λ_W^0), or with contributions from the lobby group (λ_L^0), we find

$$\lambda_W^0 = \frac{D+H}{2w} > \lambda^0 > \frac{H}{w} = \lambda_L^0 \tag{11}$$

Since λ_L^0 is the standard that maximises profits, it is the standard that would be chosen by a self-regulating Industry Association, backed by government sanctions for producers who infringe on the standard. We assume that $\lambda_L^0 > \underline{\lambda}$, so that both producers and consumers support the establishment of a regulator, at least in principle.[7] It will be convenient to write $\underline{\lambda} \equiv \beta \frac{H}{w} = \beta \lambda_L^0$, where $1 > \beta > 0$.

2.4 Comparing the autarky outcomes

We assume that the two countries are identical in all respects, *except* that the home country has a minimum quality standard set by an RA. Thus the quality sold in the foreign country is $\underline{\lambda}$, with $p^{*0} = \underline{\lambda}H$, $\Pi^*(\underline{\lambda}) = \underline{\lambda}\left[H - \frac{w\underline{\lambda}}{2}\right]K$ and $S^*(\underline{\lambda}) = \frac{\underline{\lambda}K^2}{2}$. Given that $\lambda^0 > \underline{\lambda}$, it follows from (8) that $p^0 > p^{*0}$ and $S(\lambda^0) > S^*(\underline{\lambda})$. But total profits, and therefore unit profits, can be higher in either country, depending on λ^0 and hence A. To investigate further we use (10) to compare unit profits in the two countries yielding:

$$\pi(\lambda^0) - \pi^*(\underline{\lambda}) = [\lambda^0 - \underline{\lambda}]\left\{H - \frac{w}{2}[\lambda^0 + \underline{\lambda}]\right\} \tag{12}$$

Now $\lambda^0 > \underline{\lambda}$, λ^0 is increasing in A and $\pi(\lambda^0)$ is highest when $A = 0$. So unit profits will be equalised in the two countries if $H = \frac{w}{2}[\lambda^0 + \underline{\lambda}]$, which, after substituting for $\underline{\lambda}$ and for λ^0 from (10), will occur when $A = 2[1 - \beta]\frac{H}{K} \equiv \tilde{A}$, as long as $0 < \tilde{A} < 1$. Now $1 > \beta$ ensures that $\tilde{A} > 0$, while $\beta > 1 - \frac{K}{2H}$ ensures that $\tilde{A} < 1$. The second condition requires that the optimum standard for producers is not too much greater than the minimum standard. The range of A is then divided into two segments: $0 \le A < \tilde{A}$, where $\pi(\lambda^0) > \pi^*(\underline{\lambda})$; and $1 \ge A > \tilde{A}$ where $\pi(\lambda^0) < \pi^*(\underline{\lambda})$.

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[7] As a further comparator, the standard that maximises consumer surplus is the highest standard for which unit profits are non-negative. From (8) this is $\lambda_S^0 = 2\frac{H}{w} = 2\lambda_L^0$.

We summarise these results in:

> *Proposition 1: In the standard-setting country (a) the standard is above the minimum but is decreasing with the strength of lobbying influence; (b) consumer surplus is higher; and (c) unit profits are increasing with the strength of lobbying influence and may fall below those at the minimum standard if lobbying influence is weak enough.*

3. Trade when only one country sets a product standard

Our assumption is that sales in a market must meet the minimum quality standard of that market. Thus production for export will meet the standard of the importing market, regardless of whether it is higher or lower than the standard in the exporting country.[8] The potential for trade is generated by the difference in unit profits in autarky. In the range $0 \leq A < \tilde{A}$ foreign firms will wish to export to the home market (meeting its standard λ^0); while in the range $1 \geq A > \tilde{A}$ home firms will wish to export to the foreign market (at $\underline{\lambda}$). Given the home quality standard, a trading equilibrium will be achieved where unit profits are the same in the two markets.

We can now answer the question about the pattern of trade posed in the Introduction. In this case the standard-setting country, which has the higher standard, may be an importer or exporter of the product depending on the degree of lobbying influence. The more effective the lobbying, the lower the standard, the higher are home unit profits and the more likely the home country is to be an importer.

3.1 The equilibrium trade share

We begin by solving for the trade share for an arbitrary standard (λ) set by the home country. We suppose αK is the volume of home imports (or home exports if $\alpha < 0$), and now solve for the equilibrium trade share (α) given the standards ($\lambda, \underline{\lambda}$). From (3) the prices in the two markets in the trading equilibrium are given by

$$p = \lambda\{H - \alpha K\} \quad \text{and} \quad p^* = \underline{\lambda}\{H + \alpha K\} \tag{13}$$

The difference in quality-adjusted prices is then

$$\frac{p}{\lambda} - \frac{p^*}{\underline{\lambda}} = -2\alpha K \tag{14}$$

The quality adjusted price is higher in the exporting country. By substituting (13) in the expressions for unit profits we obtain the condition for equal unit profits in the two markets:

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[8] Thus the standard is assumed to apply to sales rather than production in the home market.

$$\pi(\lambda,\alpha) \equiv \lambda\left\{H - \alpha K - \frac{w\lambda}{2}\right\} = \underline{\lambda}\left\{H + \alpha K - \frac{w\underline{\lambda}}{2}\right\} \equiv \pi^*(\underline{\lambda},\alpha) \tag{15}$$

From this we derive the equilibrium trade share as

$$\alpha = \frac{\lambda - \underline{\lambda}}{K}\left\{\frac{H}{\lambda + \underline{\lambda}} - \frac{w}{2}\right\} \tag{16}$$

While α is nonlinear in product qualities, one can see that $\alpha = 0$ when $\lambda = \underline{\lambda}$ or when $\lambda = 2\frac{H}{w} - \underline{\lambda} = [2 - \beta]\frac{H}{w}$, and the latter occurs when $A = \tilde{A}$. The import share is highest at the profit maximising autarky standard.[9] Substituting (16) back into (15), we find that the common unit profit in the trading equilibrium is

$$\pi^T(\lambda,\underline{\lambda}) = \lambda\underline{\lambda}\left\{\frac{2H}{\lambda + \underline{\lambda}} - \frac{w}{2}\right\} \tag{17}$$

3.2 The gains from trade at autarky standards

We can now consider the second question posed in the Introduction. It is straightforward to show that if both countries open up to trade while maintaining their standards, both gain from trade through the usual channels.[10] In the importer, consumer surplus rises, profits fall and aggregate welfare increases. In the exporter consumer surplus falls, profits increase and aggregate welfare increases. Thus for the home country we have:

$$S^T(\lambda) - S^0(\lambda) = \lambda\frac{K^2}{2}\{[1 + \alpha]^2 - 1\} \tag{18A}$$

$$\Pi^T(\lambda) - \Pi^0(\lambda) = -\alpha\lambda K^2 \tag{18B}$$

$$\Delta W(\lambda) = [\alpha]^2\lambda\frac{K^2}{2} > 0 \tag{18C}$$

While in the foreign country:

$$S^{*T}(\underline{\lambda}) - S^{*0}(\underline{\lambda}) = \underline{\lambda}\frac{K^2}{2}\{[1 - \alpha]^2 - 1\} \tag{19A}$$

$$\Pi^{*T}(\underline{\lambda}) - \Pi^{*0}(\underline{\lambda}) = \alpha\underline{\lambda}K^2 \tag{19B}$$

$$\Delta W^*(\underline{\lambda}) = [\alpha]^2\underline{\lambda}\frac{K^2}{2} > 0 \tag{19C}$$

If the home RA is required to *ignore* trade when standard-setting (in which case it stays with the autarky standard) then trade brings gains to both countries regardless of the degree of

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[9] To examine how the volume of trade depends on λ (and hence A), consider $\frac{\partial\alpha}{\partial\lambda} = \frac{1}{K}\left\{\frac{2H\underline{\lambda}}{[\lambda + \underline{\lambda}]^2} - \frac{w}{2}\right\}$. Then $\frac{\partial\alpha}{\partial\lambda} = 0$ when $\lambda = [2\sqrt{\beta} - \beta]\frac{H}{w} \equiv \tilde{\lambda}$. Further $\lambda_L^0 - \tilde{\lambda} = [1 + \beta - 2\sqrt{\beta}]\frac{H}{w} = [1 - \sqrt{\beta}]^2\frac{H}{w} > 0$, so in the range of autarky standards, $\frac{\partial\alpha}{\partial\lambda} < 0$.

[10] Indeed this holds for any standards consistent with existence of an autarky and a trading equilibrium.

lobbying influence at home. But the latter does affect the size of the gains from trade. The key variables in determining the gains from trade at the autarky standards are the home standard, which is increasing in A, and the trade share. Note that if the home country's RA is maximising welfare, then the home gains from trade give it a welfare level higher than it would achieve if the foreign country also set its standard to maximise welfare (in which case there would be no trade).

3.3 The effects of trade on standards

We now explore how trade impacts on the standard chosen by the home RA. We begin by considering the important special case where the standard is set by an industry association which is only concerned with home firm profits ($A = 0$), since in this case we can obtain an analytic solution. Using (18), we have $\Pi^T(\lambda) = \pi^T(\lambda)K = \lambda\underline{\lambda}\left\{\frac{2H}{\lambda+\underline{\lambda}} - \frac{w}{2}\right\}K$. Thus $\frac{\partial\Pi^T(\lambda)}{\partial\lambda} = \underline{\lambda}\left\{\frac{2H\underline{\lambda}}{[\lambda+\underline{\lambda}]^2} - \frac{w}{2}\right\}K$, and home firms' profits are maximised when

$$\lambda_L^T = \left[2\sqrt{\beta} - \beta\right]\frac{H}{w} < \lambda_L^0 = \frac{H}{w}. \tag{20}$$

The corresponding trade share is $\alpha_L^T = \frac{\lambda_L^T - \underline{\lambda}}{K}\left\{\frac{1}{\sqrt{\beta}} - 1\right\}\frac{w}{2} > 0$. Where the standard is set by an Industry Association, opening up to trade will see imports of the product and a reduction in the standard.

The general RA objective function can be written as:

$$\underset{\lambda}{Max}\, G^T(\lambda) = \pi^T(\lambda)K + AS^T(\lambda) = \lambda\left\{H - \alpha K - \frac{w\lambda}{2}\right\}K + A\lambda\frac{K^2}{2}[1 + \alpha]^2 \tag{21}$$

We take the first order condition from (21) and break down the *implicit* solution into two terms as shown in

$$\lambda = \underbrace{\frac{H}{w} + \frac{A}{2}\frac{K}{w}}_{Autaky} + \underbrace{\alpha\left\{\frac{A}{2}[\alpha + 2] - 1\right\}\frac{K}{w} + \lambda\frac{K}{w}\{A[1 + \alpha] - 1\}\frac{d\alpha}{d\lambda}}_{Trade\ Share\ Effects} \tag{22}$$

The first term on the right of (22) gives us the autarky standard (λ^0) as in (10). This would continue to be the solution if the home RA ignored trade. The remaining term contains the trade share effects, including that an increase in the home standard reduces the home import share (i.e. $\frac{d\alpha}{d\lambda} < 0$). When one takes into account that the trade share is nonlinear in the home standard it is apparent that no closed form solution for the optimal home standard is available in the trading equilibrium. We therefore look to simulations to provide the relevant information.

We illustrate the simulation results in Figure 2, which shows the standard and welfare corresponding to autarky, the trade share and welfare at the autarky standards, and the trade

share and welfare at the standard chosen taking account of trade.[11] What is clear from these diagrams are the different outcomes when standards are set by an industry association and when the home RA takes some account of consumer surplus. Under an industry association (very low A), the home standard is reduced, which increases unit profits and encourages imports and home welfare falls relative to autarky. The difference in standards is narrowed and trade (home imports) is increased. While this response is clearly intended to 'protect' home firm profits, it would not typically be viewed as 'protectionist' since foreign firm profits are affected in the same way.

Otherwise, if the home RA takes some account of consumer surplus, the home standard is increased, the home import share is lower or the export share is higher and home welfare is higher than in autarky. The difference in standards is wider and, while the RA appears to adjust its standard in a protectionist or export-promoting way, we know that this adjustment reduces unit profits (and hence the trade adjustment is towards greater sales in the foreign country). The impact on the foreign country reflects only the gains from trade since the foreign standard remains unchanged from autarky. Foreign welfare is higher than in autarky as long as trade occurs, and the gains are larger at higher home standards (when the home country exports). We summarise these conclusions in:

> *Proposition 2: If countries open up to trade, but the home country maintains its autarky standard, then (a) both countries gain from trade; and (b) the home country will import the product if producer influence is strong, and export the product otherwise. Trade will induce a reduction in the home standard and a fall in home welfare relative to autarky if producer influence is very strong; and an increase in the home standard and home welfare otherwise. Foreign welfare is higher than in autarky.*

4. Trade when only one country is subject to lobbying

In the previous section we considered the case where only one country set a standard and examined how trade with a non-standard-setting country would affect its standard and welfare. We now turn to the case where both countries set standards, but lobbying takes place only in the home country, while the foreign country's standard is set to maximise its aggregate welfare. The analysis is similar to section 3, except that now both countries adjust their standards in

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[11] For the simulations we chose $H = K = 2$, $\beta = \frac{3}{4}$ and $w = 1$. These values imply $\underline{\lambda} = \frac{3}{2}$ and $\tilde{A} = \frac{1}{2}$. Since home welfare changes dominate foreign welfare changes, the diagram for world welfare looks identical to that for home welfare and is therefore omitted in the interests of brevity.

response to trade. Again we ask what determines the pattern of trade in this product and how does trade affect the standards chosen and the welfare levels attained?

The autarky standards follow directly from (10), with

$$\lambda^0 = \frac{H}{w} + A\frac{K}{2w}; \quad \lambda^{*0} = \frac{H}{w} + \frac{K}{2w} \quad \text{and so } \lambda^{*0} - \lambda^0 = [1 - A]\frac{K}{2w} > 0 \tag{23}$$

The foreign country has the higher standard and higher aggregate welfare in autarky, but has the lower unit profits (which are maximised when $A = 0$). Thus when trade is possible, the foreign country exports this product, and the usual gains from trade accrue at autarky standards – producers in the foreign (exporting) country gain, producers in the home (importing) country lose and vice versa for consumers. There is a net gain in each country. The foreign country benefits from the distortion introduced by home lobbying, with the gain being larger the bigger the distortion.

When we come to consider the effects of trade on standards, we now have the complication that both standards will adjust and we need to solve for them simultaneously. We assume that each RA chooses its standard taking the other standard as given. If we continue to let α represent the home import share, then the two RA's objective functions can be written as

Home: $\quad G^T(\lambda) = \pi^T(\lambda)K + AS^T(\lambda) = \lambda\left\{H - \alpha K - \frac{w\lambda}{2}\right\}K + A\lambda\frac{K^2}{2}[1 + \alpha]^2$ (24A)

Foreign: $\quad G^T(\lambda^*) = \pi^T(\lambda^*)K + S^T(\lambda^*) = \lambda^*\left\{H + \alpha K - \frac{w\lambda^*}{2}\right\}K + \lambda^*\frac{K^2}{2}[1 - \alpha]^2$ (24B)

The corresponding first order conditions are

Home: $\quad \frac{\partial G^T(\lambda)}{\partial \lambda} = \left\{[H - w\lambda] + \frac{AK}{2}[1 + \alpha]^2 - \alpha K + \lambda K(A[1 + \alpha] - 1)\frac{\partial \alpha}{\partial \lambda}\right\}K = 0$

Foreign: $\quad \frac{\partial G^T(\lambda^*)}{\partial \lambda^*} = \left\{[H - w\lambda^*] + \frac{K}{2}[1 - \alpha]^2 + \alpha K - \alpha\lambda^*K\frac{\partial \alpha}{\partial \lambda^*}\right\}K = 0$

with $\quad \alpha = \frac{\lambda - \underline{\lambda}}{K}\left\{\frac{H}{\lambda + \underline{\lambda}} - \frac{w}{2}\right\}; \quad \frac{\partial \alpha}{\partial \lambda} = \frac{1}{K}\left\{\frac{2H\lambda^*}{[\lambda + \lambda^*]^2} - \frac{w}{2}\right\}; \quad \text{and} \frac{\partial \alpha}{\partial \lambda^*} = -\frac{1}{K}\left\{\frac{2H\lambda}{[\lambda + \lambda^*]^2} - \frac{w}{2}\right\}.$

We seek the Nash equilibrium of the resulting game.

As before we obtain solutions through simulation and these are shown in Figure 4. Recall that the two countries are identical when the home RA maximises welfare ($A = 1$). In the foreign country trade creates export opportunities which bring overall gains but specifically benefit foreign firms to the disadvantage of foreign consumers. The foreign RA, which weights profits and consumer surplus equally, raises its standard to shift some of the gains to foreign consumers. In the home country trade (imports) brings overall gains but benefits consumers and disadvantages producers. If profits figure prominently in the Home RA's objective function (i.e. a low A), then the response is a cut in the home standard which benefits firms at the expense

of home consumers. At medium to high A, the increased consumer surplus through trade induces the home RA to increase the standard. This implies that the gap between the standards increases at low A and falls at medium to high A.

The result is that the home import share increases at low A and falls at medium to high A. The latter adjustment will appear 'protectionist', though we know it is the former adjustment that is aimed at increasing profits. Home welfare is below autarky when the home standard is cut and above autarky when the home standard is increased. Foreign welfare is always above autarky. The foreign country benefits, relative to autarky standards, when the home standard is cut as foreign firms share in the increase in profits. Likewise the foreign country loses relative to autarky standards when the home standard is increased. World welfare is lower when the home standard is cut and higher when the home standard is increased. The home welfare effects outweigh the foreign.

We summarise these results in:

Proposition 3: If both countries open up to trade but maintain their autarky standards, then (a) both countries gain from trade; and (b) the country with the higher standard exports the product. Trade will induce a reduction in the home standard and lower home welfare if producer influence is very strong and an increase in the home standard and home welfare otherwise. The foreign standard always rises and foreign welfare is higher than in autarky.

6. Conclusions

As noted in the Introduction, our objective in this paper has been to analyse the effects of (opening up to) trade on standard-setting in a political economy context, where the standards exist because of information asymmetries between buyers and sellers. We considered countries which were identical, except in their standard-setting regimes. If both countries chose to set standards in the same way there would be no incentive to trade because they would set the same standard. We considered two cases. The first illustrated trade between a standard-setting country and a country with no standard-setting regime. The second illustrated trade between two standard-setting countries, but with lobbying present in only one of them.

Our main conclusions are as follows. First, having a higher standard tends to be associated with exporting the product. This was unambiguously the case when both countries set standards, and while the single standard-setting country could import or export the product, the higher its standard the more likely it was to be an exporter. Second, opening up to trade

while maintaining standards at their autarky values leads to gains from trade for both countries through the standard channels. Finally, the adjustment of standards to the trading environment can lead to welfare losses relative to autarky if the producer influence over standard setting is very strong. Otherwise this adjustment raises welfare in the standard-setting country. The implication is that governments should pay particular attention to changes in standards set by industry associations in an open economy.

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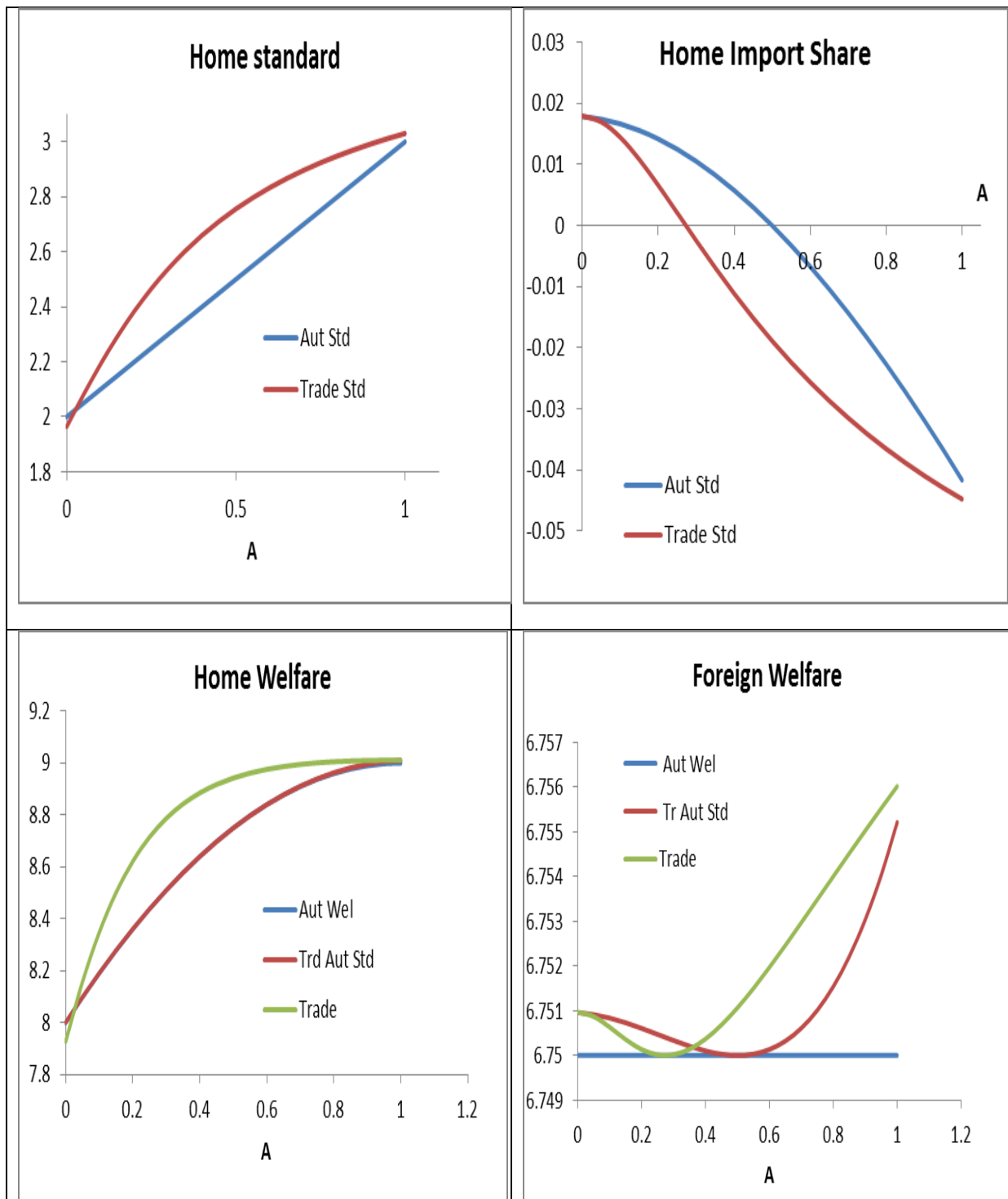Figure 2: Standards, Trade Share and Welfare with one Standard-Setter.

Figure 3: Standards, Trade Share and Welfare with two Standard-Setters.
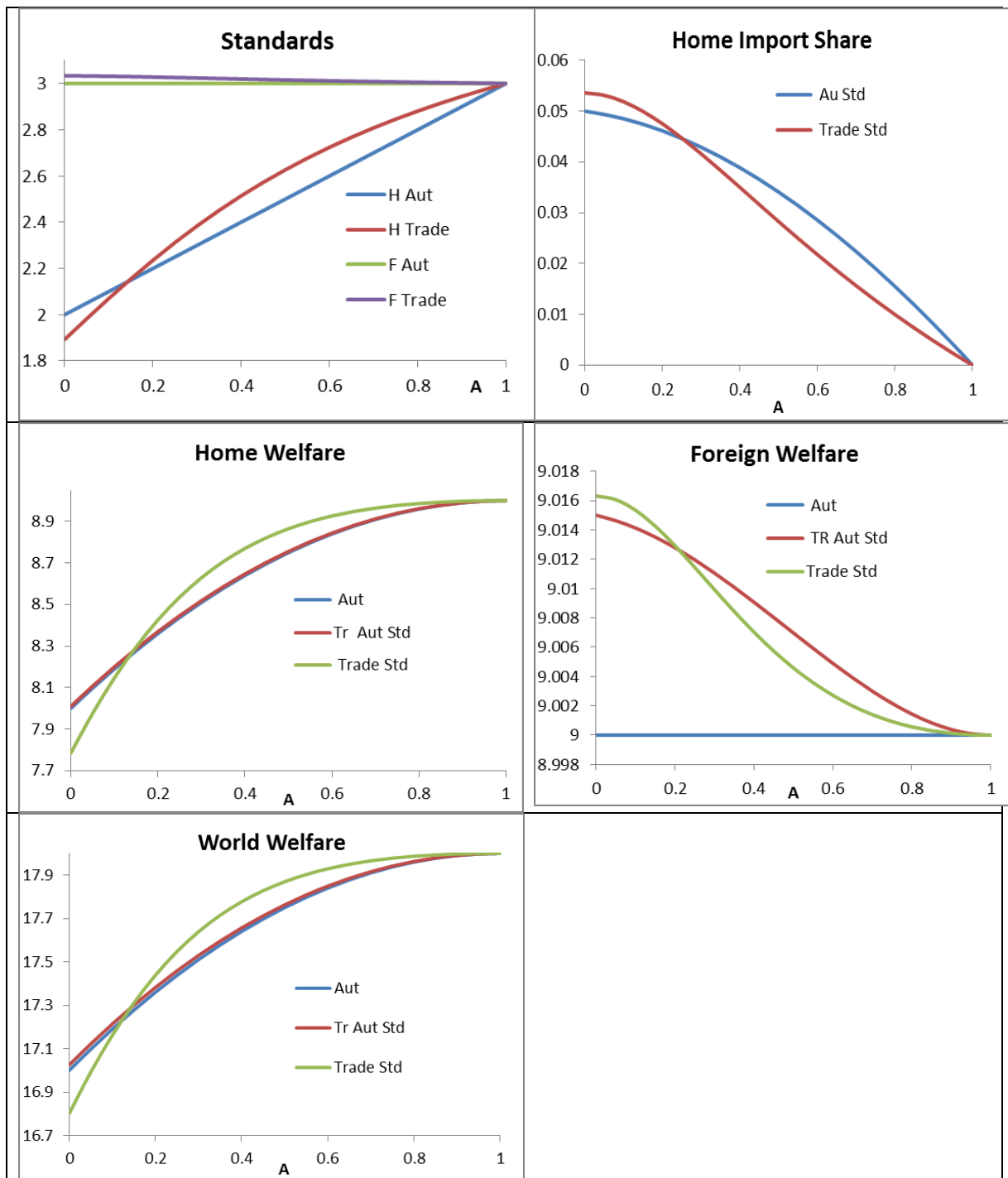
Figure 1

$$\lambda^0 = \frac{H}{w} + A\frac{K}{2w}$$