

Trade and the Political Economy of Food Standards

Johan F. M. Swinnen and Thijs Vandemoortele¹

(Original submitted June 2010, revision received October 2010, accepted December 2010.)

Abstract

This article presents a political economy model of public standards in an open economy. We use the model to derive the political optimum and to analyse different factors that have an influence on this political equilibrium. We analyse 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 labelled as protectionist measures.

Keywords: *Food and agriculture; political economy; regulation, public policy; standards; trade.*

JEL classifications: *Q18, P16, L15.*

Under the German [trade] law of 1880 imports of livestock were controlled for 'sanitary reasons'. By 1889 the government had all but closed the borders to imports of live animals. ... A law of 1900 prohibited imports of sausages, canned meat and meat with preservatives; imports of pickled and salted meat had to be in pieces of at least 4 kg; imports of meat (other than pickled or salted) had to consist of whole beef carcasses or half pig carcasses, could enter only at certain ports and on certain days, and were subject to high inspection fees. If the quality of imported meat was judged doubtful, it was destroyed, though domestic meat of similar quality could be sold.²

Tracy (1989)

¹Johan F. M. Swinnen and Thijs Vandemoortele are with LICOS Centre for Institutions and Economic Performance and Department of Economics, University of Leuven (KUL), Leuven, Belgium. E-mail: thijs.vandemoortele@econ.kuleuven.be for correspondence. We gratefully acknowledge useful comments from Gerald Willmann, Jim Vercaemmen, Frank van Tongeren, Jo Reynaerts and Frans Spinnewyn, and also from two anonymous reviewers and the editor. This research was financially support by Research Foundation – Flanders (FWO) and the KU Leuven Research Fund (EF) and Methusalem.

²Tracy (1989, pp. 91–92)

*Les frontières ne sont, pour ainsi dire, jamais plus ouvertes que quand vous les déclarez fermées.*³

Van Naemen (1897)

1. Introduction

A growing number of public standards are being introduced globally, in a broad range and rich variety of areas, including nutrition (e.g. low fat), health (e.g. low lead or pesticide residue), safety (e.g. no small toy parts, equipment safety measures), environment (e.g. organic, no genetically modified organisms, low carbon dioxide emission) and social concerns (e.g. no child labour).

Trade economists have mostly interpreted this growth in the number and form of public standards as a political economy response to the constraints being imposed by international trade agreements on traditional trade restrictions.⁴ As the use of tariffs is progressively more limited, new forms of non-tariff barriers (NTBs) are increasingly used (e.g. Baldwin, 2001; OECD, 2001; Sturm, 2006). In this interpretation, public standards are just a new form of NTBs and protection-in-disguise.⁵ For example, Fischer and Serra (2000) find that standards are biased against imports and favour domestic producers. Bredahl *et al.* (1987) illustrate this with the USA's implementation 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) argue that governments raise genetically modified (GM) food standards as protection against imports.⁶ Fulton and Giannakas (2004) point out that producers prefer GM labelling when they have low returns on GM food. In their infamous example, Otsuki *et al.* (2001) claim that an EU standard on aflatoxins reduced health risk by approximately 1.4 deaths per billion a year, while decreasing African exports of cereals, dried fruits and nuts to Europe by 64%.⁷

While some contributions in the literature on food standards and trade have a more nuanced view (e.g. Blandford and Fulponi, 1999; Roberts *et al.*, 1999; Cook and Fraser, 2008), the dominant perspective appears to be that standards are a new form of protectionism. Similarly, Krueger (1996) concludes that although it is not

³ 'The borders are, in a way of speaking, never more open than when you declare them closed'. (House of Representatives (18 November 1897), cited in Van Molle, 1989, p. 230). This was Member of Parliament Van Naemen's reaction to the Belgian government's 1897 decision to restrict imports of livestock because of 'the danger of imports of diseases'. From a health point of view, the official closing of the borders had a perverse effect as it induced massive smuggling without any health inspection.

⁴ In this article, we focus on public standards. For a discussion of the relation between public and private standards, see e.g. Henson (2006), McCluskey and Winfree (2009), Vandemoortele (2011).

⁵ For literature related to the effects of standards as barriers to trade, see for example Barrett (1994), Sykes (1995), Thilmany and Barrett (1997), Schleich (1999), Suwa-Eisenmann and Verdier (2002), Barrett and Yang (2001).

⁶ See also Baltzer (2010) who argues that domestic producers always favour more restrictive GM standards because of positive border costs.

⁷ The conclusions of Otsuki *et al.* (2001) are disputed in recent empirical work by Xiong and Beghin (2010).

possible to generalise about labour standards' effects, many economists argue that international labour standards are protectionist instruments.⁸

However, this trade-protection interpretation of public standards appears to conflict with some basic empirical observations. Many public standards, such as EU GM regulations, are introduced following demands by consumers, not producers. In fact, in many cases, producers have opposed their introduction. If public standards are merely protectionist instruments, producers would support their introduction and consumers would oppose them. 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. In the framework of Marette and Beghin (2010), a standard is anti-protectionist when foreign producers are more efficient than domestic producers in addressing consumption externalities according to the standard.

These observations are consistent with insights from the literature on the economics of quality standards. For example, 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.

This article integrates these different perspectives in an open economy framework and develops a formal political economy model of public standards. Our analysis has two specific objectives, which are addressed in two parts of the article. The first objective is to develop a political economy model of public standards in which both producers and consumers are actively and simultaneously lobbying. As we explain in more detail in the next section, in our model, standards benefit consumers because of the standards' guarantee that the product satisfies certain characteristics preferred by the consumer. Producers' production costs increase with implementation of the public standard. However, we show that either producers or consumers may gain or lose, depending on the resulting market prices in an open economy where importers also have to satisfy the standards. With these potential welfare effects, we derive the political equilibrium and we analyse how the equilibrium is affected by several political and economic characteristics.

Our second objective is to analyse if or when public standards are protectionist instruments. In this second part of the article, we compare the political equilibrium with the social optimum and we derive under which conditions public standards can be considered 'protectionism'. We show that politically optimal public standards may be either too high ('over-standardisation') or too low ('under-standardisation') – a situation which is similar to other forms of price and trade policy, which governments use to tax or subsidise certain sectors.

2. Conceptual Framework and Related Literature

A key issue is obviously how to model standards. The approaches in the literature differ importantly. Some (such as Bockstael, 1984) assume that consumers can

⁸ In an earlier contribution, Bockstael (1984) argues that the same holds for domestic quality standards. She argues that these are mainly redistributive instruments and do not enhance welfare – they protect certain producer interests.

costlessly observe product characteristics *ex ante*, whereas others (such as Leland, 1979) assume that consumers are *ex ante* uncertain about the characteristics of the product. In the latter case, standards can improve upon the unregulated market equilibrium by reducing the asymmetric information between consumers and producers. Yet, other studies (such as Copeland and Taylor, 1995; Fischer and Serra, 2000; Anderson *et al.*, 2004; Tian, 2003; Besley and Ghatak, 2007) model the effect of standards as their impact on consumption externalities.

We follow the approach of Leland (1979) by assuming that standards guarantee certain product features and thus affect consumer utility as they reduce or solve informational asymmetries and induce greater consumption of the product through an increased willingness to pay, *ceteris paribus*. For example, consumers who perceive health or quality problems with certain (potential) ingredients (e.g. pesticide residues, high fat content) or object to certain production processes (e.g. GM technology, child labour) may increase consumption if they are guaranteed the absence of these elements.

According to Roberts *et al.* (1999), standards can be classified into two broad categories: risk-reducing measures (such as food safety standards, plant health protection standards); non-risk-reducing measures (e.g. food quality standards, environmental conservation standards). Brom (2000) classifies standards into three categories: (i) standards that matter to all consumers, e.g. food safety standards; (ii) standards that matter to special groups of consumers because they are linked to personal life style choices, e.g. quality standards; and (iii) standards that regulate social and environmental issues based on the ethical values of a society. Many contributions in 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). In fact, several studies in the literature on minimum quality standards (e.g. Leland, 1979; Ronnen, 1991; Boom, 1995) illustrate their analyses with examples of safety standards.

In our analysis, we use a generic model of vertical differentiation in consumer preferences, which does not explicitly account for risk. This type of model has been introduced by Spence (1976), Mussa and Rosen (1978), and Tirole (1988), and is the standard approach in the literature on quality standards (see e.g. Ronnen, 1991; Boom, 1995; Jeanneret and Verdier, 1996; Valletti, 2000). This type of utility specification assumes that consumers are heterogeneous in their preferences for a public standard. This preference heterogeneity can be interpreted broadly and may relate to, for example, quality preferences (for non-risk-reducing standards), or risk aversion (for risk-reducing standards). This is consistent with studies that model safety standards without explicitly incorporating risk, but instead analysing increased willingness to pay of consumers for products with a safety standard (see e.g. Kinsey, 1993; Roberts *et al.*, 1999; Buzby, 2003; van Tongeren *et al.*, 2009).

That said, our model can easily be modified to integrate explicitly either risk considerations to analyse risk-reducing standards or public good externalities. Swinnen and Vandemoortele (2009) show how to extend the model to incorporate risk in consumer utility, assuming that a standard reduces the probability that a product contains undesired characteristics, or how to extend it to incorporate externalities. Another specification that our model can accommodate is related to standards that mitigate risk of contamination by imports (e.g. by invasive species, see Cook and Fraser, 2008). In this special case, standards impact directly on producers, while consumers' utility is only indirectly affected through changing prices. Our general

conclusions do not depend on these alternative specifications (extensions), or, in other words, on the category to which standards belong, or on the specific utility function chosen.⁹

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). We assume that a standard imposes some production constraints or obligations, which increase production and transaction costs. The idea behind this assumption is that all standards can be defined as the prohibition of using a cheaper technology. Examples are the prohibition of an existing technology (e.g. child labour) or of a technology that could potentially lower costs (e.g. GM technology). In addition, traceability standards can be interpreted as a prohibition of cheaper production systems which do not require tracing the production (process).

There are some aspects of the model where we use simplifying assumptions that need to be taken into consideration when interpreting the results and which could be the subject of future research to extend the model. First, as with most policies, administrative agencies may play an important role, for example, by trying to influence the decision-making (e.g. Pokrivcak *et al.*, 2006; Prendergast, 2007) or by their role in implementing or enforcing the policy (Swinnen, 1997a,b). For this reason, the agency itself may be the subject of lobbying by political agents. Additionally, an agency may prefer more stringent standards if a larger bureaucracy is required to govern such standards, leading to higher budgets for and control by the agency. Here, as in many political economy analyses, we abstract from the administrative agencies' potential additional objectives and impact on the standard's implementation and enforcement to focus our analysis on the relationship between a standard's impact on interest groups, the politically optimal standard, trade and potential protectionism.

Second, we model the general notion of 'consumers' as individual consumers. However, in reality, the consumer side may also represent food retailers (such as supermarkets) that have a commercial interest in standards. They may themselves have interests in certain standards or translate consumer demands for standards to the government and producers.

Third, our work is related to – but distinct from – the literature on the harmonisation of standards in the context of international trade agreements and regionalism, including studies on the WTO's sanitary and phyto-sanitary (SPS) agreement and trade disputes (see e.g. Hooker, 1999). For example, Chen and Mattoo (2008) analyse whether regional agreements on (the harmonisation of) standards enhance or reduce trade. Bredahl and Forsy (1989) study the harmonisation of SPS standards, and Baldwin (2001) discusses the WTO's role in this harmonisation process. In addition, Kinsey (1993), Bagwell and Staiger (2001), and Battigalli and Maggi (2003) look at the role of the WTO in regulating standards. Costinot (2008) compares the performance of the WTO's national treatment principle and the EU's mutual recognition principle with respect to product standards. An example of how strategic cross-country interactions can be integrated in our political economy framework is Swinnen and Vandemoortele's (2011) dynamic model of standard setting. In our analysis, we do not consider strategic interactions in standard-setting

⁹ Proof of this can be obtained from the authors.

between governments of different countries or harmonisation of standards across countries.

3. The Model

Assume that individuals consume at most one unit of the good and that their preferences are described by the following utility function (see Tirole, 1988):

$$u_i = \begin{cases} \phi_i(\varepsilon + s) - p & \text{if he buys the good with standards at price } p; \\ 0 & \text{if he does not buy,} \end{cases} \quad (1)$$

where ϕ_i is the preference parameter.¹⁰ Consumers with higher ϕ_i are more willing to pay for a product with a public standard s over and above the non-standardised value ε of the product.¹¹ A higher s refers to a more stringent standard. ϕ_i is uniformly distributed over the interval $[\phi - 1, \phi]$ with $\phi \geq 1$ and $i \in \{1, \dots, N\}$. Consumers with $\phi_i < p/(\varepsilon + s)$ do not consume this product which implies that the market is ‘uncovered’. The aggregate demand function¹² is:

$$c(p, s) = N(\phi - p/(\varepsilon + s)). \quad (2)$$

On the production side, we assume that production is a function of a sector-specific input factor that is available in inelastic supply. All profits made in the sector accrue to this specific factor. The representative firm’s unit cost function $g(q, s) = k(q, s) + t(s)$ depends on output produced (q) and the level of the standard in that sector (s), and is composed of production costs $k(q, s)$ and transaction costs $t(s)$. This approach has the advantage that it allows us to distinguish between standards that reinforce (dis)economies of scale ($k(q, s)$) and standards with scale neutral cost effects ($t(s)$). We do not model fixed implementation costs although this would not fundamentally alter our results. Standards may increase the production costs $k(q, s)$ because of the obligation to use a more expensive production technology ($\frac{\partial k}{\partial s} > 0$). Standards may also increase the transaction costs $t(s)$ because of control and enforcement costs related to the standard ($\frac{\partial t}{\partial s} > 0$).¹³ This implies that unit costs increase with higher standards ($\frac{\partial g}{\partial s} > 0$) for $s > 0$.¹⁴

¹⁰ As discussed in the previous section, the preference parameter can be interpreted as risk aversion in food safety issues. It is possible to model this explicitly. For example, Swinnen and Vandemoortele (2009) model the representative consumer’s expected utility function as $Eu(c, s) = [1 - \rho(s)]u(c) - \rho(s)d(c)$, where $u(c)$ is the utility of consumption if the product contains the characteristics desired by the consumer; $d(c)$ is the disutility of consumption if the good has inferior characteristics; and $\rho(s)$ is the probability of the latter outcome. A higher standard reduces the probability that a product contains inferior characteristics.

¹¹ We assume that the non-standard-related value ε and the public standard s are additively separable in the utility function, and that consumer preferences for ε and s follow the same distribution.

¹² For the remainder of this analysis, we assume that $p/(\varepsilon + s) \leq \phi$ holds such that aggregate consumption is always positive. The (exogenous) constant ε ensures that consumption is positive when the standard is zero.

¹³ We implicitly assume that control and enforcement costs are imposed on producers.

¹⁴ Modelling the cost of standards with a unit cost function that is increasing in the standard is consistent with e.g. Fischer and Serra (2000) and Tian (2003).

The model assumes a small open economy where domestic firms are price takers and domestic prices of imported goods equal world prices. We assume that when the country imposes a standard, the production costs of the imported goods also rise as the standard is also imposed on imported goods – and is equally enforced. This leads to a price increase, henceforth called the ‘marginal price effect’ of a standard ($\frac{\partial p}{\partial s} > 0$). More specifically, the unit cost function of foreign (f) producers is:

$$g^f(q^f, s) = k^f(q^f, s) + t^f(s),$$

where $k^f(q^f, s)$ are production costs, $t^f(s)$ transaction costs, and q^f is foreign production. The world price p equals the unit costs of the foreign producers and we have that $p(s) = g^f(q^f, s)$ and $\frac{\partial p}{\partial s} = \frac{\partial g^f}{\partial s}$.

A key result is that both producers and consumers may either gain or lose from (a change in) the standard. Consider first the producer effects. Producer profits are equal to

$$\Pi_p(s) = \max_q \{q \cdot (p(s) - g(q, s))\},$$

and by the envelope theorem, the marginal effect of a standard on producers’ profits $\Pi_p(s)$ is equal to

$$\frac{\partial \Pi_p}{\partial s} = q \cdot \left(\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right).$$

Producers’ profits decrease with an increase of the standard when the marginal unit cost increase $\frac{\partial g}{\partial s}$ is larger than the marginal price effect $\frac{\partial p}{\partial s}$. When the marginal unit cost increase is smaller than the marginal price effect, the sector-specific capital owners gain from an increase of the standard.

Aggregate consumer surplus can be written as:

$$\Pi_c(s) = N \int_{p/(\varepsilon+s)}^{\phi} u_i d\phi_i = N \frac{(\varepsilon+s)}{2} \left(\phi - \frac{p}{(\varepsilon+s)} \right)^2.$$

The impact of a marginal change in the standard on aggregate consumer surplus equals

$$\frac{\partial \Pi_c}{\partial s} = \frac{N}{2} \left(\phi^2 - \left(\frac{p}{\varepsilon+s} \right)^2 \right) - \frac{\partial p}{\partial s} c(p, s).$$

Aggregate consumer surplus increases with the standard if the marginal ‘consumption effect’ $\frac{N}{2} \left(\phi^2 - \left(\frac{p}{\varepsilon+s} \right)^2 \right)$ is larger than the marginal increase in the cost of consumption $\frac{\partial p}{\partial s} c(p, s)$. If the marginal increase in the cost of consumption outweighs the beneficial marginal consumption effect, aggregate consumer surplus decreases with the standard.

Finally, we define domestic welfare $W(s)$ as the sum of (domestic) producer profits and consumer surplus in this sector, i.e.

$$W(s) \equiv \Pi_p(s) + \Pi_c(s). \quad (3)$$

3.1. The political equilibrium

Consider a government that maximises its own objective function which, following the approach of Grossman and Helpman (1994), consists of a weighted sum of contributions from lobbies and domestic welfare. Similar to Grossman and Helpman (1994),

we restrict the set of policies available to politicians and only allow them to implement a public standard. We assume that both producers and consumers are politically organised and that they lobby simultaneously. This assumption differs from Grossman and Helpman (1994), Anderson *et al.* (2004) and Cadot *et al.* (2004). We believe that it is not realistic to assume that consumers are not organised – or do not effectively lobby – on issues related to product standards. There is substantive evidence that consumers and producers lobby governments on issues of public standards.¹⁵

The ‘truthful’¹⁶ contribution scheme of the specific-capital owners is equal to the function $C_p(s) = \max\{0; \Pi_p(s) - b_p\}$, in which the constant b_p represents the share of profits the producers do not want to invest in lobbying the government. One could also interpret this constant b_p as a minimum threshold, a level of profits or surplus below which producers believe the return from lobbying is less than its cost. Similarly, the ‘truthful’ contribution scheme of the consumers is of the form $C_c(s) = \max\{0; \Pi_c(s) - b_c\}$, with $\Pi_c(s)$ the aggregate consumer surplus as defined earlier. The constant b_c can be interpreted in the same way as in the contribution schedule of the specific-capital owners. The government’s objective function is a weighted sum of the contributions of producers (weighted by α_p), the contributions of consumers (weighted by α_c) and domestic welfare, where α_j ($j = p, c$) represents the relative lobbying strength:

$$V(s) = \alpha_p C_p(s) + \alpha_c C_c(s) + W(s). \quad (4)$$

The government chooses the level of the public standard to maximise its objective function (4). Each possible level of this standard corresponds to a certain level of producer profits and consumer surplus, and hence also to a certain level of producer and consumer contributions. This is driven by the functional form and the truthfulness of the contribution schemes. The government receives larger contributions from producers (consumers) if the imposed standard creates more profits (consumer surplus) for producers (consumers). Conversely, the government receives less producer or consumer contributions if the standard decreases respectively profits or consumer surplus. Therefore, maximising the contributions from producers (consumers) by choosing the level of standard is equivalent to maximising their profits (consumer surplus). The government thus chooses the level of standards that maximises the weighted sum of producer profits, consumer surplus and domestic welfare. The politically optimal standard, s^* , is therefore determined by the following first order condition,¹⁷ subject to $s^* \geq 0$:

¹⁵ In reality, consumer lobbying does not only occur through consumer organisations but also through political parties representing consumer interests. See also Gulati and Roy (2007) on lobbying of both producers and consumers with respect to environmental standards.

¹⁶ The common-agency literature (e.g. Bernheim and Whinston, 1986) states that a truthful contribution schedule reflects the true preferences of the interest group. In our political economy model, this implies that lobby groups set their lobbying contributions in accordance with their expected profits and how these are marginally affected by the standard. We refer to the Appendix for a proof of the truthfulness of the contribution schemes in our model.

¹⁷ We assume that the domestic unit cost function $g(q, s)$ and the world price $p(s)$ (i.e. the foreign unit cost function) are sufficiently convex in the standard ($\frac{\partial^2 g}{\partial s^2} > 0$, $\frac{\partial^2 p}{\partial s^2} = \frac{\partial^2 g^f}{\partial s^2} > 0$, see e.g. Ronnen, 1991; Valletti, 2000; Fischer and Serra, 2000) such that $V(s)$ is concave in s and that first order condition (5) determines a global maximum.

$$(1 + \alpha_p) \left[q^* \left(\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right) \right] + (1 + \alpha_c) \left[\frac{N}{2} \left(\phi^2 - \left(\frac{p^*}{\varepsilon + s^*} \right)^2 \right) - c^* \frac{\partial p}{\partial s} \right] = 0. \quad (5)$$

c^* and q^* denote respectively aggregate consumption and domestic production in the political optimum and p^* the equilibrium world price.

The first term in equation (5) captures the marginal impact of a public standard on producers' profits weighted by their lobbying strength $(1 + \alpha_p)$. As we explained earlier, this marginal impact may be positive or negative. The second term represents the weighted marginal impact of a public standard on aggregate consumer surplus, which may also be positive or negative.

Optimality condition (5) implicitly defines s^* as a function of several variables, such as lobbying strengths (α_j), consumer preferences (ϕ), and the marginal unit cost increase of domestic and foreign producers. The latter is reflected in the marginal price effect $\left(\frac{\partial p}{\partial s} \right)$. The impact of the exogenous variables (α_j, ϕ) on the optimal standard can be formally derived through comparative statics. We refer to the Appendix for the formal derivations and restrict ourselves here to the presentation and discussion of the effects.

First, it is obvious from condition (5) that a change in the political weights α_j ($j = p, c$), capturing exogenous differences in the political weights of lobby groups, affects s^* . When the political weight of a lobby group increases exogenously, it implies that its contributions are more effective in influencing the decisions of the government. However, the sign of the effect on s^* depends on the marginal benefit of s^* for the interest group. More specifically, an increase in α_j leads to a higher standard s^* ($\frac{\partial s^*}{\partial \alpha_j} > 0$), if and only if interest group j gains from increasing the standard beyond s^* , i.e. if $\frac{\partial \pi_j}{\partial s} > 0$ at s^* . In this case, the government sets the optimal standard at a higher level if α_j increases, and *vice versa*.

Second, an exogenous change in the preferences ϕ of consumers¹⁸ affects the politically optimal standard s^* . A shift in consumer preferences affects the aggregate demand and consumer surplus. Higher consumer preferences for quality, or higher risk aversion leads to higher consumer surplus and higher contributions in favour of public standards, which lead to higher public standards i.e. $\frac{\partial s^*}{\partial \phi} > 0$, and *vice versa*.¹⁹

Third, the marginal cost increases of domestic and foreign producers affect the politically optimal standards. Higher marginal unit costs of domestic producers ($\frac{\partial g}{\partial s}$) reduce the benefits of standards for domestic producers, *ceteris paribus*. This leads to lower standards, as producers reduce their contributions for public standards.

We model the domestic producers by a representative firm. One could interpret this representative firm as representing a set of homogenous firms or a set of heterogeneous firms, with average firm characteristics consistent with the representative firm's characteristics. Either interpretation yields the same result. Hence, our specification allows for firm size heterogeneity for a given average unit cost function.

¹⁸ Under our assumptions, a change in ϕ only affects the boundaries of the preference distribution, not the distribution itself. Therefore ϕ is a measure for the average consumer preferences.

¹⁹ This is conditional on $\phi > \frac{\partial p}{\partial s}$ at s^* . Violation of this condition implies that for the individual with the highest preference for quality ($\phi_i = \phi$), his willingness to pay for a marginal increase of the standard is negative at s^* . We abstract from this case.

The marginal unit cost increase of foreign producers is reflected in the marginal price effect of a public standard ($\frac{\partial g^f}{\partial s} = \frac{\partial p}{\partial s}$), as the international market price equals the unit costs of foreign producers. Notice that a higher marginal unit cost increase for foreign producers may increase or decrease the politically optimal standard, depending on other factors. On the one hand, the resulting higher marginal price effect reduces consumer benefits and their contributions. On the other hand, it increases profits and contributions of domestic producers. The size of these effects and the net effect depends on the relationship between domestic production and consumption and on the functional form of the various functions. As a result, standards may move in either direction with changes in the marginal cost increase of foreign producers, depending on the relative benefits and the political weights of the different lobby groups.

Finally, an important general implication from this discussion is that either consumers or producers may lobby in favour or against standards, and that the political equilibrium may be affected by various factors.

4. Public Standards and Protectionism

An important aspect of public standards which has attracted a lot of attention is their potential use as instruments of ‘protection in disguise’ (Vogel, 1995). This is also reflected in the rapid increase in notifications of new SPS measures to the WTO (see Figure 1). Among other things, member countries have to notify new SPS measures to the WTO when these measures have a significant effect on trade. This rapid increase in SPS measures notifications raises concerns about the potential protectionist nature of public standards. In fact, most studies on the political economy of standards in open economy models consider standards as protectionist instruments (Fischer and Serra, 2000; Anderson *et al.*, 2004; Sturm, 2006).

To analyse this issue with our model, it is important to clarify some key elements in the relationship between trade and standards. As we will show in this section, standards can be set to benefit (or ‘protect’) producer or consumer interests. Hence, it is important to first define ‘protectionism’ as producer protectionism. As with tariffs and trade restrictions, standards may either harm or benefit producers. We find that there is no *ex ante* reason to see standards as producer protectionism. We show that, while almost all standards affect trade, there is no simple relationship between ‘trade distortions’ and ‘producer protection’.

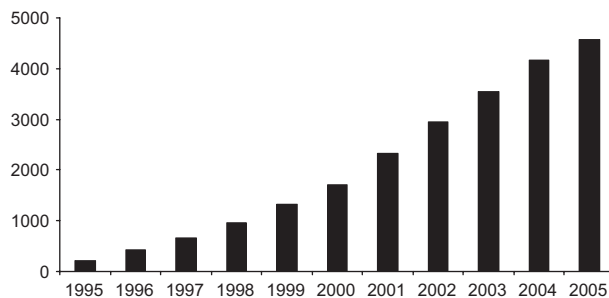


Figure 1. Notification of new sanitary and phyto-sanitary (SPS) measures to the WTO
Source: Henson (2006).

The rest of this section is organised as follows. We first identify the key factors that characterise the relationship between trade and standards and its effects. Then, we identify under which conditions standards reduce trade, i.e. act as ‘trade barriers’ or enhance trade, i.e. act as ‘trade catalysts’. Next, we identify when there is ‘over-standardisation’ and ‘under-standardisation’ and finally we combine these insights to evaluate the validity of the ‘standards-as-protection’ argument.

4.1. Comparative advantage and compliance with standards

Trade and the politically optimal standards are interrelated in several ways. Trade affects the net impact of standards on producers and consumers as reflected in expression (5) and hence the political contributions and their relative influence. For a given level of consumption (c), with larger imports ($m \equiv c - q$) and lower domestic production (q), the effect of standards on aggregate producer profits is smaller and hence producers’ contributions and influence on policy lower. In the extreme case without domestic production ($q = 0$), only consumer interests affect government policy. Formally, the first term in equation (5) drops out and the political equilibrium condition equals the optimality condition for consumers. *Vice versa*, for a given level of domestic production, more imports and higher consumption levels imply that the effects on total consumer surplus are larger and therefore consumer contributions and their influence on policy higher.

Standards may also affect the comparative advantage in production between domestic and foreign producers. There are two potential cost effects. At the political optimum s^* , the marginal effect of a standard on domestic producer profits is

$$\frac{\partial \Pi_p}{\partial s} = q^* \left(\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right) = q^* \left(\frac{\partial g^f}{\partial s} - \frac{\partial g}{\partial s} \right) = q^* \left[\left(\frac{\partial k^f}{\partial s} - \frac{\partial k}{\partial s} \right) + \left(\frac{\partial t^f}{\partial s} - \frac{\partial t}{\partial s} \right) \right].$$

First, standards may affect the production costs of domestic and foreign producers differently, i.e. $\frac{\partial k}{\partial s} \neq \frac{\partial k^f}{\partial s}$ at s^* . This is the argument used by Anderson *et al.* (2004) to explain why EU producers lobby against GM food: they argue that producers in countries such as the US and Brazil have a comparative production cost advantage in the use of GM technology and that it is therefore rational for EU producers to support (rather than oppose) cost increasing standards to ban GM food. This argument makes assumptions on the nature of the supply functions and the technology which may not hold in general. Standards increase production cost advantages when they reinforce scale economies (reflected in a downward pivot of the supply function), but not when they have a scale neutral impact or when they create scale diseconomies (causing an upward pivot of the supply function). Differences in these effects induce differences in reactions to standards by domestic producers. However, the effects are conditional. Producers oppose standards more (or support them less) if they have a comparative disadvantage and standards reinforce this ($\frac{\partial^2 k}{\partial q \partial s} > 0$), compared to when standards are scale neutral ($\frac{\partial^2 k}{\partial q \partial s} = 0$). The opposite holds when standards reduce the comparative disadvantage vis-à-vis foreign producers ($\frac{\partial^2 k}{\partial q \partial s} < 0$).²⁰

²⁰ Similarly, producers would support standards more (or oppose less) if they have a comparative advantage and standards reinforce this – and *vice versa*. However, our model focuses on the import case.

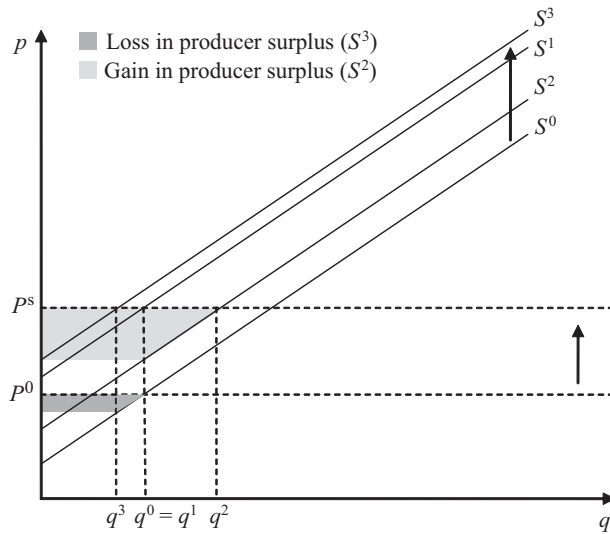


Figure 2. The possible effects of a public standard on domestic producers

Second, standards may also affect comparative advantages through differences in transaction costs (i.e. $\frac{\partial t}{\partial s} \neq \frac{\partial t^f}{\partial s}$ at s^*). The relative (domestic vs. foreign) impact of standards on production costs and transaction costs may be quite different. Countries with high production costs (importers) may be more efficient in implementing or complying with standards. In such cases, standards shift the cost difference between domestic producers and foreign producers in terms of the final cost of the product. As a consequence, such comparative cost advantage in transaction costs of complying with a standard (see e.g. Salop and Scheffman, 1983; and Baldwin, 2001 for examples) leads to higher producer contributions in favour of the standard, rather than against it ($\frac{\partial t}{\partial s} < \frac{\partial t^f}{\partial s}$ at s^*).²¹ Vice versa, when $\frac{\partial t}{\partial s} > \frac{\partial t^f}{\partial s}$ at s^* domestic producers contribute less in favour of the standard.

In Figure 2, we illustrate the case of different transaction costs. We use a simple graph with parallel shifts of supply curves to simplify the comparison of producer profits before and after the introduction of the standard (our theoretical model is more general). The increase in transaction costs is depicted by an upward shift in the supply curve (S) and the price effect by an upward shift in the horizontal supply function of the outside world that determines the price (P). When the shift in domestic supply (to S^1) is equal to the shift in the foreign supply (to P^s), producers' profits do not change; hence, they are indifferent. When the domestic transaction cost increase is smaller than the foreign one (represented by the shift to S^2), producers' profits increase because the price effect is larger than the transaction cost effect. The gain in profits is the light grey area and the politically optimal standard will be

²¹ While we do not formally model instrument choice here, if the government has the choice between different standards that induce the same effect on consumption, a government will be inclined to enforce a standard that is less costly for the domestic sector, or to forbid the use of a technology in which the domestic sector has a comparative disadvantage. Fischer and Serra (2000) argue therefore that governments tend to use minimum standards that are biased against imports.

higher than the consumers' optimum. In contrast, a large upward shift in supply (S^3) – implying higher transaction costs of implementing the standard – results in a decrease in producer profits. The resulting loss is the dark grey area and the politically optimal standard will be below the consumers' optimum.

Notice that, although these factors do relate standards and trade, they are ambiguous about standards being trade distorting or protectionist measures.

4.2. Standards as catalysts or barriers to trade?

In our model, standards (almost) always affect trade. Only in very special circumstances do standards not affect trade. This is when the effect on domestic production exactly offsets the effect on consumption. Define $D(c, s)$ as the inverse demand function with $D_c = \frac{\partial D}{\partial c} < 0$ and $D_s = \frac{\partial D}{\partial s} > 0$. Similarly, define $A(q, s)$ as the inverse supply function with $A_q = \frac{\partial A}{\partial q} > 0$ and $A_s = \frac{\partial A}{\partial s} > 0$. The effect of standards on trade (imports) is:

$$\frac{\partial m}{\partial s} = \frac{D_s}{|D_c|} + \frac{A_s}{A_q} - \left(\frac{A_q + |D_c|}{A_q |D_c|} \right) \frac{\partial p}{\partial s}. \quad (6)$$

Notice that the sign of expression (6) may be positive or negative. If the sign of (6) is negative, standards are 'trade barriers', i.e. they reduce trade. However, the sign of (6) can also be positive, and then imports increase and standards work as 'catalysts to trade'. This is the case when the marginal consumption gain (loss) from the standard is larger (smaller) than the marginal gain (loss) from the standard in domestic production. Moreover, as we discuss next, whether trade flows increase or decrease upon introduction of a standard in itself does not automatically relate to (and is not necessarily equivalent to) producer protectionism.

4.3. Over- and under-standardisation

To assess whether public standards are set at sub-optimal levels, we use the same framework to identify optimal policy as is used in evaluating tariffs in traditional trade theory, that is by comparing to the socially optimal trade policy. The political equilibrium is said to be suboptimal when the politically optimal tariff t^* differs from the socially optimal tariff $t^\#$. In a small open economy, this analysis leads to the well-known result that the socially optimal tariff level is zero and free trade is optimal, i.e. a positive tariff that constrains trade is harmful to social welfare.

Similarly, we compare the politically optimal standard s^* with the socially optimal standard $s^\#$ in a small open economy. To determine $s^\#$ we maximise the welfare function as defined in equation (3).²² The socially optimal standard $s^\#$ is determined by:²³

²² This is consistent with the standard definition in the international trade literature: the socially optimal policy maximises domestic welfare (see e.g. Dixit and Norman, 1980; Grossman and Rogoff, 1995; Feenstra, 2004; Gaisford and Kerr, 2007). Interestingly, Fischer and Serra (2000) define the socially optimal standard as a measure that maximises domestic welfare as if all producers were domestic. However, since in our model the effect of a standard on the world price equals the change in unit costs of foreign producers, their profits are not affected by the standard and our definition of the social optimum is equivalent to the definition of Fischer and Serra (2000).

²³ This first order condition is subject to $s^\# \geq 0$; otherwise $s^\# = 0$.

Table 1
Protectionist characteristics of standards with different political weights

$\alpha_p > \alpha_c$		$\alpha_c > \alpha_p$	
$\frac{\partial \Pi_p}{\partial s} > 0$ over-standardisation ($s^* > s^\#$)	$\frac{\partial \Pi_p}{\partial s} < 0$ under-standardisation ($s^* < s^\#$)	$\frac{\partial \Pi_c}{\partial s} > 0$ over-standardisation ($s^* > s^\#$)	$\frac{\partial \Pi_c}{\partial s} < 0$ under-standardisation ($s^* < s^\#$)
Protectionist	Protectionist if $s^\# > 0$	Not protectionist	Not protectionist

$$\left[q^\# \frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right] + \left[\frac{N}{2} \left(\phi^2 - \left(\frac{p^\#}{\varepsilon + s^\#} \right)^2 \right) - c^\# \frac{\partial p}{\partial s} \right] = 0. \tag{7}$$

$c^\#$ and $q^\#$ denote respectively aggregate consumption and domestic production in the social optimum and $p^\#$ the equilibrium world price. Analogous to condition (5), the first term in condition (7) captures the impact on producers and the last term shows the effect of a standard on total consumer surplus. The interpretation of the different effects is analogous to the discussion following condition (5).

It is clear from comparing respectively conditions (5) and (7) that the politically optimal standard s^* only equals the socially optimal standard $s^\#$ if $\alpha_p = \alpha_c$ in the political equilibrium, and/or if both $\frac{\partial \Pi_p}{\partial s}$ and $\frac{\partial \Pi_c}{\partial s}$ equal zero at $s^\#$. Notice that $s^\# > 0$ is possible.²⁴ In this case, trade flows may change from the imposition of the standard, but this change is socially optimal, i.e. it increases domestic welfare.

If the above condition is not fulfilled i.e. if α_p and α_c are different in the government’s objective function, the political and social outcomes are different.²⁵ Again, however, the diversion between both optima may be in either direction. Hence ‘over-standardisation’ ($s^* > s^\#$) or ‘under-standardisation’ ($s^* < s^\#$) may result (see Table 1 for an overview).

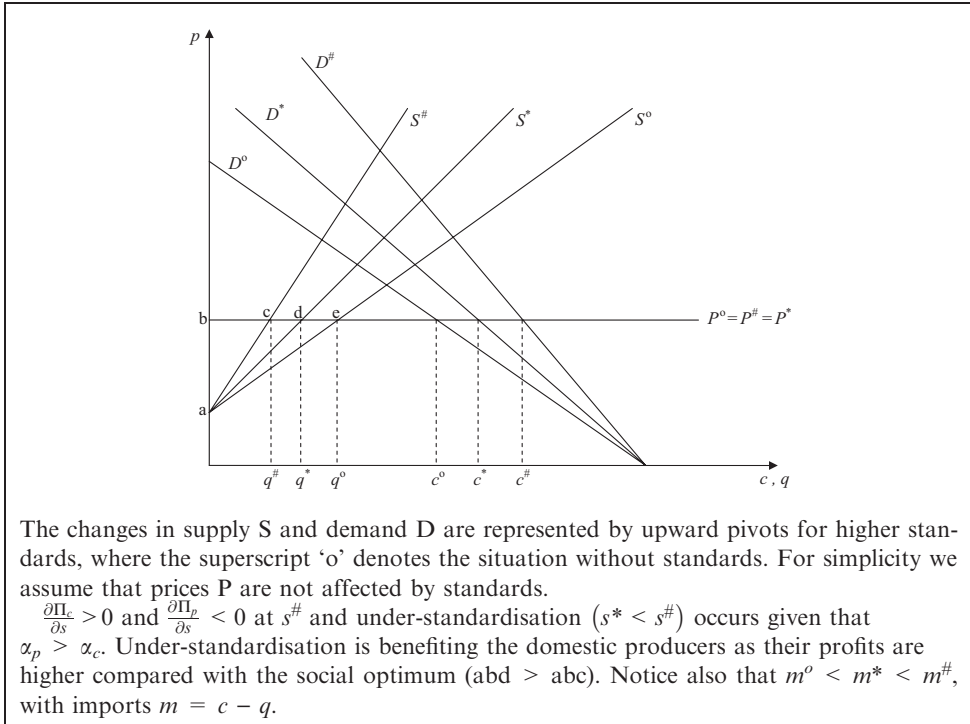
If $\alpha_p > \alpha_c$, over-standardisation ($s^* > s^\#$) results when producers’ profits increase with a higher standard ($\frac{\partial \Pi_p}{\partial s} > 0$) at $s^\#$ and under-standardisation otherwise. In this case, the over-standardisation creates higher profits for producers than in the social optimum. Hence, this over-standardisation distorts trade to the advantage of the domestic sector. Inversely with $\frac{\partial \Pi_p}{\partial s} < 0$ at $s^\#$, the resulting under-standardisation (given that $s^\# > 0$) reduces the negative effect of the standard on producers’ profits. Hence, domestic producers benefit from this under-standardisation such that it serves as protection in disguise. Box 1 illustrates the latter case, and shows that imports are smaller at the political optimum than at the social optimum, but still higher than without standards. Hence, the introduction of a protectionist standard may increase trade, albeit less than is socially optimal.

²⁴ This is, for example, consistent with the theoretical analysis of Lapan and Moschini (2004) who find that a standard prohibiting the sale of GM products in Europe may enhance European welfare.

²⁵ The only exception is when $\frac{\partial \Pi_p}{\partial s} = \frac{\partial \Pi_c}{\partial s} = 0$ at $s^\#$, i.e. when $s^\#$ is optimal for both lobby groups, even with different lobby weights. In that case, neither consumers nor producers have incentives to lobby for a different standard, and $s^* = s^\#$.

Box 1

Under-standardisation benefiting domestic producers



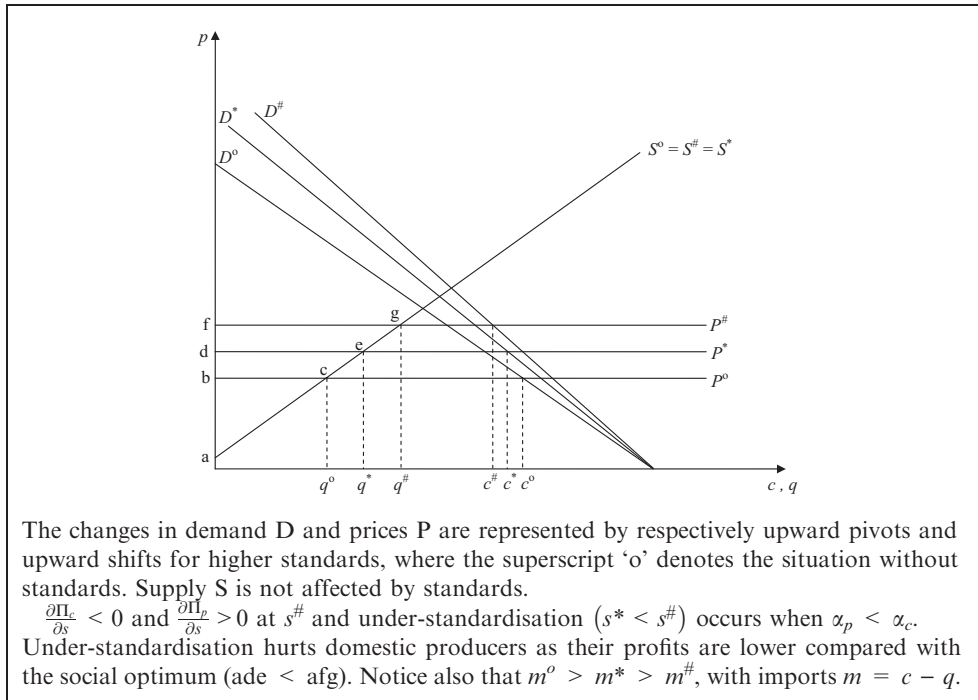
In a similar fashion, $\alpha_c > \alpha_p$ results in over-standardisation when $\frac{\partial \Pi_c}{\partial s} > 0$ and in under-standardisation when $\frac{\partial \Pi_c}{\partial s} < 0$ at $s^{\#}$. Whether these suboptimal standards are 'protectionist' or not depends on the impact of standards on producers. However, at $s^{\#}$, $\frac{\partial \Pi_p}{\partial s}$ and $\frac{\partial \Pi_c}{\partial s}$ always have opposite signs (except for the trivial case where both equal zero and $s^* = s^{\#}$). Hence, when over-standardisation results ($\frac{\partial \Pi_c}{\partial s} > 0$), producers are negatively affected by this over-standardisation with respect to their situation in the social optimum as $\frac{\partial \Pi_p}{\partial s} < 0$ at $s^{\#}$. The politically optimal standard s^* is then, although suboptimal, not 'protectionist'. *Vice versa*, producers are also hurt by under-standardisation ($\frac{\partial \Pi_c}{\partial s} < 0$) as $\frac{\partial \Pi_p}{\partial s} > 0$ at $s^{\#}$. Hence, in both cases, the suboptimal standards result in trade distortions that do not protect domestic producers. Box 2 provides an illustration of the latter case and shows that the politically optimal standard reduces trade albeit to a lower extent than would be socially optimal. Hence, the politically optimal standard acts as a barrier to trade although it does not protect the domestic producers' interests.

5. Conclusions

In this study, we have developed a formal model of the political economy of public standards. We use our theoretical model to derive the political optimum and to analyse the different factors that have an influence on this political equilibrium. Under the assumption of a small open economy and simultaneous consumer and producer lobbying, the political weights of the respective groups influence the politically

Box 2

Under-standardisation hurting domestic producers



optimal public standard and the direction and magnitude of these effects depend on the standards' relative benefits to the different interest groups. Higher domestic costs related to the standard decrease the level of the public standard whereas an increase in the costs of foreign producers related to the standard may increase or decrease the politically optimal standard.

We identify the key factors which characterise the relationship between trade and standards and its effects. Trade affects the net impact of standards on domestic producers and consumers and hence their political contributions. Standards may also affect the comparative production cost advantage between countries, which may lead to either higher or lower standards. Similarly, the relative (domestic vs. foreign) transaction (enforcement and control) costs of standards affect the politically optimal standard.

Finally, our model also provides an analytical framework to determine whether standards serve as protection in disguise, or not. We show that standards may be 'barriers' to trade but also 'catalysts' to trade, and that both 'under-' or 'over-standardisation' may occur, depending on a variety of factors. Our findings imply that the effects of specific standards should be analysed carefully before categorising them as protectionist instruments.

Several issues which we abstracted from in this analysis may be the subject of future research. First, we have focused on the government's decision process on standards, while not explicitly considering the potential influence of administrative agencies and bureaucracies on the implementation of the standard and on agenda-setting. Interest groups may try to recoup a legislative defeat by lobbying the administrative agencies that implement and enforce standards, thus potentially subverting original

legislative intent. Second, we have simplified the complexity of the food chain by only considering 'producers' and 'consumers' as interest groups. However, retailers and supermarkets may also have a commercial interest in (lobbying for) standards, as they may translate consumers demands for standards to producers and the government. Additionally, a standard may also come at a cost for retailers which would translate into a different optimal standard for retailers than that for consumers. Third, as in Grossman and Helpman (1994), we have analysed the political economy of the standard-setting process of only one government, without accounting for strategic interactions with other governments, potentially through international organisations. Similar to Grossman and Helpman (1995), one may extend our analysis to include several countries that negotiate at an international level, multilaterally or bilaterally, on harmonising or mutually recognising each others' standards, while governments cater to the interests of their domestic constituency and interest groups.

References

- Anderson, K., Damania, R. and Jackson, L. A. *Trade, Standards, and the Political Economy of Genetically Modified Food*, CEPR Discussion Papers 4526, (London: CEPR, 2004).
- Bagwell, K. and Staiger, R. 'Domestic policies, national sovereignty and international economic institutions', *Quarterly Journal of Economics*, Vol. 116, (2001) pp. 519–562.
- Baldwin, R. 'Regulatory protectionism, developing nations and a two-tier world trading system', in K. Maskus and J. S. Wilson (eds.), *Quantifying the Impact of Technical Barriers to Trade: Can it be Done?* (Chicago: Michigan University Press, 2001, pp. 59–94).
- Baltzer, K. *Minimum Quality Standards and International Trade*, FOI Working Paper 2010/15, (University of Copenhagen: Institute of Food and Resource Economics, 2010).
- Barrett, S. 'Strategic environmental policy and international trade', *Journal of Public Economics*, Vol. 54, (1994) pp. 325–338.
- Barrett, C. B. and Yang, Y. 'Rational incompatibility with international product standards', *Journal of International Economics*, Vol. 54, (2001) pp. 171–191.
- Battigalli, P. and Maggi, G. *International Agreements on Product Standards: An Incomplete-Contracting Theory*, NBER Working Paper (Cambridge, MA: National Bureau of Economic Research, 2003).
- Bernheim, B. D. and Whinston, M. D. 'Menu auctions, resource allocation, and economic influence', *Quarterly Journal of Economics*, Vol. 101, (1986) pp. 1–31.
- Besley, T. and Ghatak, M. 'Retailing public goods: The economics of corporate social responsibility'. *Journal of Public Economics*, Vol. 91, (2007) pp. 1645–1663.
- Blandford, D. and Fulponi, L. 'Emerging public concerns in agriculture: Domestic policies and international trade commitments', *European Review of Agricultural Economics*, Vol. 26, (1999) pp. 409–424.
- Bockstael, N. 'The welfare implications of minimum quality standards', *American Journal of Agricultural Economics*, Vol. 66, (1984) pp. 466–471.
- Boom, A. 'Asymmetric international minimum quality standards and vertical differentiation', *The Journal of Industrial Economics*, Vol. 43, (1995) pp. 101–119.
- Bredahl, M. E. and Forsy, K. W. 'Harmonizing phyto-sanitary and sanitary regulations', *The World Economy*, Vol. 12, (1989) pp. 189–206.
- Bredahl, M. E., Schmitz, A. and Hillman, J. 'Rent seeking in international trade: The great tomato war', *Journal of Agricultural Economics*, Vol. 69, (1987) pp. 1–10.
- Brom, F. W. A. 'Food, consumer concerns, and trust: Food ethics for a globalizing market', *Journal of Agriculture and Environmental Ethics*, Vol. 12, (2000) pp. 127–139.
- Buzby, J. C. *International Trade and Food Safety: Economic Theory and Case Studies*, U.S. Department of Agriculture, Agricultural Economic Report 828, 2003.

- Cadot, O., de Melo, J. and Olarreaga, M., 'Lobbying, counterlobbying, and the structure of tariff protection in poor and rich countries', *World Bank Economic Review*, Vol. 18, (2004) pp. 345–366.
- Chen, M. X. and Mattoo, A. 'Regionalism in standards: Good or bad for trade?' *Canadian Journal of Economics*, Vol. 41, (2008) pp. 838–863.
- Cook, D. C. and Fraser, R. W. 'Trade and invasive species risk mitigation: Reconciling WTO compliance with maximising the gains from trade', *Food Policy*, Vol. 33, (2008) pp. 176–184.
- Copeland, B. R. and Taylor, M. C. 'Trade and transboundary pollution', *American Economic Review*, Vol. 85, (1995) pp. 716–737.
- Costinot, A. 'A comparative institutional analysis of agreements on product standards', *Journal of International Economics*, Vol. 75, (2008) pp. 197–213.
- Dixit, A. and Norman, V. *Theory of International Trade* (Cambridge, UK: Cambridge University Press, 1980).
- Feenstra, R. 2004. *Advanced International Trade: Theory and Evidence* (Princeton, NJ: Princeton University Press, 2004).
- Fischer, R. and Serra, P. 'Standards and protection', *Journal of International Economics*, Vol. 52, (2000) pp. 377–400.
- Fulton, M. and Giannakas, K. 'Inserting GM products into the food chain: The market and welfare effects of different labelling and regulatory regimes', *American Journal of Agricultural Economics*, Vol. 86, (2004) pp. 42–60.
- Gaisford, J. D. and Kerr, W. A. *Handbook of International Trade Policy* (Cheltenham, UK: Edward Elgar Publishing, 2007).
- Grossman, G. M. and Helpman, E. 'Protection for sale', *American Economic Review*, Vol. 84, (1994) pp. 833–850.
- Grossman, G. M. and Helpman, E. 'Trade wars and trade talks', *Journal of Political Economy*, Vol. 103, (1995) pp. 675–708.
- Grossman, G. M. and Rogoff, K. S. *Handbook of International Economics, Vol. III* (North Holland: Elsevier, 1995).
- Gulati, S. and Roy, D. 'How standards drive taxes: The political economy of tailpipe pollution', *The B.E. Journal of Economic Analysis & Policy*, Vol. 7, (2007) Article 9.
- Henson, S. *The Role of Public and Private Standards in Regulating International Food Markets*, Paper Presented at the IATRC Summer Symposium: Food Regulation and Trade, Institutional Framework, Concepts of Analysis and Empirical Evidence, (Bonn, 28–30 May, 2006).
- 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. Swinnen (ed.), *Global Supply Chains, Standards, and the Poor* (Oxon, UK: CABI publications, 2007, pp. 26–41).
- Hooker, N. H. 'Food safety regulation and trade in food products', *Food Policy*, Vol. 24, (1999) pp. 653–668.
- Jeanneret, M. and Verdier, T. 'Standardization and protection in a vertical differentiation model', *European Journal of Political Economy*, Vol. 12, (1996) pp. 253–271.
- Kinsey, J. 'GATT and the economics of food safety', *Food Policy*, Vol. 18, (1993) pp. 163–176.
- Krueger, A. B. *Observations on International Labor Standards and Trade*, NBER Working Paper 5632 (Cambridge, MA: National Bureau of Economic Research, 1996).
- Lapan, H. E. and Moschini, G. 'Innovation and trade with endogenous market failure: The case of genetically modified products', *American Journal of Agricultural Economics*, Vol. 86, (2004) pp. 634–648.
- Leland, H. E. 'Quacks, lemons, and licensing: A theory of minimum quality standards', *Journal of Political Economy*, Vol. 87, (1979), pp. 1328–1346.
- Marette, S. and Beghin, J. C. 'Are standards always protectionist?' *Review of International Economics*, Vol. 18, (2010) pp. 179–192.
- McCluskey, J. J. and Winfree, J. A. 'Pre-empting public regulation with private food quality standards', *European Review of Agricultural Economics*, Vol. 36, (2009) pp. 525–539.

- Mussa, M. and Rosen, S. 'Monopoly and product quality' *Journal of Economic Theory*, Vol. 18, (1978) pp. 301–317.
- OECD. *Agricultural Policies in Emerging and Transition Economies: Special Focus on Non-Tariff Measures* (Paris: OECD, 2001).
- Otsuki, T., Wilson, J. S. and Sewadeh, M. 'Saving two in a billion: Quantifying the trade effect of European food safety standards on African exports', *Food Policy*, Vol. 26, (2001) pp. 495–514.
- Pokrivcak, J., Crombez, C. and Swinnen, J. F. M. 'The status quo bias and reform of the common agricultural policy: Impact of voting rules, the European Commission, and external changes', *European Review of Agricultural Economics*, Vol. 33, (2006), pp. 562–590.
- Prendergast, C. J. 'The motivation and bias of bureaucrats', *American Economic Review*, Vol. 97, (2007) pp. 180–196.
- Roberts, D., Josling, T. E. and Orden, D. *A Framework for Analyzing Technical Trade Barriers in Agricultural Markets* USDA Technical Bulletin 1876. (Washington, DC: US Department of Agriculture, 1999).
- Ronnen, U. 'Minimum quality standards, fixed costs, and competition', *RAND Journal of Economics*, Vol. 22, (1991) pp. 490–504.
- Salop, S. C. and Scheffman, D. T. 'Raising rivals' costs', *American Economic Review*, Vol. 73, (1983) pp. 267–271.
- Schleich, T. 'Environmental quality with endogenous domestic and trade policies', *European Journal of Political Economy*, Vol. 15, (1999) pp. 53–71.
- Spence, M. 'Product differentiation and welfare', *American Economic Review*, Vol. 66, (1976) pp. 407–414.
- Sturm, D. M. 'Product standards, trade disputes, and protectionism', *Canadian Journal of Economics*, Vol. 39, (2006) pp. 564–581.
- Suwa-Eisenmann, A. and Verdier, T. Reciprocity and the political economy of harmonization and mutual recognition of regulatory measures, CEPR Discussion Papers 3147 (London: CEPR, 2002).
- Swinnen, J. F. M. 'Does compensation for disruptions stimulate reforms? The case of agricultural reform in Central Europe', *European Review of Agricultural Economics*, Vol. 24, (1997a) pp. 249–266.
- Swinnen, J. F. M. *Political Economy of Agrarian Reform in Central and Eastern Europe* (London: Ashgate Publishing, 1997b).
- Swinnen, J. F. M. and Vandemoortele, T. 'Are food safety standards different from other food standards? A political economy perspective', *European Review of Agricultural Economics*, Vol. 36, (2009) pp. 507–523.
- Swinnen, J. F. M. and Vandemoortele, T. *On Butterflies and Frankenstein: A Dynamic Theory of Regulation*. LICOS Discussion Paper (LICOS: K.U. Leuven, 2011).
- Sykes, A. O. *Product Standards for Internationally Integrated Goods Markets* (Washington, DC: The Brookings Institution, 1995).
- Thilmany, D. D. and Barrett, C. B. 'Regulatory barriers in an integrating world food market', *Review of Agricultural Economics*, Vol. 19, (1997) pp. 91–107.
- Tian, H. 'Eco-labelling scheme, environmental protection, and protectionism', *Canadian Journal of Economics*, Vol. 36, (2003) pp. 608–633.
- Tirole, J. *The Theory of Industrial Organization* (Cambridge, MA: MIT Press, 1988).
- van Tongeren, F., Beghin, J. and Marette, S. *A Cost-Benefit Framework for the Assessment of Non-Tariff Measures in Agro-Food Trade*, OECD Food, Agriculture and Fisheries Working Papers 21 (Paris: OECD, 2009).
- Tracy, M. *Government and Agriculture in Western Europe, 1880–1988* (London: Granada, 1989).
- Valletti, T. M. 'Minimum quality standards under Cournot competition', *Journal of Regulatory Economics*, Vol. 18, (2000) pp. 235–245.
- Van Molle, L. *Katholieken en landbouw. Landbouwpolitiek in België, 1884–1914* (Leuven: Universitaire Pers Leuven, 1989).

- Vandemoortele, T. *Why are Private Standards More Stringent than Public Standards? A Political Economy Perspective*, LICOS Discussion Paper (LICOS, K.U. Leuven, 2011).
- Vogel, D. *Trading up: Consumer and Environmental Regulation in a Global Economy* (Cambridge, MA: Harvard University Press, 1995).
- Xiong, B. and Beghin, J. *Aflatoxin Redux: Does European Aflatoxin Regulation Hurt Groundnut Exporters from Africa?* Staff General Research Papers 31595 (Department of Economics, Iowa State University, Ames, 2010).

Appendix

A1. Proof of the truthfulness of the contribution schemes

Define J as the set of active lobby groups i.e. $J = \{p, c\}$, s^* as the politically optimal standard, and C_j^* as the optimal contribution scheme for lobby group j . Following lemma 2 of Bernheim and Whinston (1986) and proposition 1 of Grossman and Helpman (1994), the equilibrium $(\{C_j^*\}_{j \in J}, s^*)$ is a subgame-perfect Nash equilibrium of the standard-setting game if and only if:

- C_j^* is feasible for all $j \in J$;
- s^* maximises $\sum_{j \in J} \alpha_j C_j^*(s) + W(s)$;
- s^* maximises $\Pi_k(s) - C_k^*(s) + \sum_{j \in J} \alpha_j C_j^*(s) + W(s)$ for every $k \in J$
- for every $k \in J$ there exists a s^k that maximises $\sum_{j \in J} \alpha_j C_j^*(s) + W(s)$ such that $C_k^*(s^k) = 0$.

From condition (c) we derive the first order condition

$$\frac{\partial \Pi_k^*(s^*)}{\partial s} - \frac{\partial C_k^*(s^*)}{\partial s} + \sum_{j \in J} \alpha_j \frac{\partial C_j^*(s^*)}{\partial s} + \frac{\partial W(s^*)}{\partial s} = 0 \quad \text{for all } k \in J. \quad (\text{A1})$$

Maximisation of the government's objective function [condition (b)] requires the first order condition

$$\sum_{j \in J} \alpha_j \frac{\partial C_j^*(s^*)}{\partial s} + \frac{\partial W(s^*)}{\partial s} = 0. \quad (\text{A2})$$

Taken together, conditions (A1) and (A2) imply

$$\frac{\partial C_j^*(s^*)}{\partial s} = \frac{\partial \Pi_j(s^*)}{\partial s} \quad \text{for all } j \in J. \quad (\text{A3})$$

Condition (A3) proves that all contribution schemes are locally truthful around s^* . This implies in our political economy model that lobby groups set their contributions in accordance with their expected profits and how these are marginally affected by the standard.

A2. Proof of Condition (5)

Production: Domestic producers maximise profits by choosing the optimal quantity q . With $\Pi_p = q \cdot [p - g(q, s)]$ this results in the first order condition

$$\frac{\partial \Pi_p}{\partial q} = p - g(q, s) - q \frac{\partial g}{\partial q} = 0;$$

hence

$$p = g(q, s) + q \frac{\partial g}{\partial q}. \quad (\text{A4})$$

Expression (A4) defines the optimal behaviour of domestic producers in the equilibrium and implicitly defines q as a function $q(p, s)$. Deriving $\Pi_p(s)$ with respect to s , and making use of the envelope theorem and equilibrium condition (A4) results in

$$\frac{\partial \Pi_p}{\partial s} = \frac{\partial q}{\partial s} (p - g(q, s)) + q \left(\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} - \frac{\partial g}{\partial q} \frac{\partial q}{\partial s} \right) = q \left[\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right]. \quad (\text{A5})$$

Consumption: Only consumers with $\phi_i > p/(\varepsilon + s)$ consume the product. Hence, total consumer surplus is equal to

$$\Pi_c(s) = N \int_{p/(\varepsilon+s)}^{\phi} u_i d\phi_i = N \frac{(\varepsilon + s)}{2} \left(\phi - \frac{p}{(\varepsilon + s)} \right)^2.$$

Deriving $\Pi_c(s)$ with respect to s results in

$$\frac{\partial \Pi_c}{\partial s} = \frac{N}{2} \left(\phi^2 - \left(\frac{p}{\varepsilon + s} \right)^2 \right) - c \frac{\partial p}{\partial s}, \quad (\text{A6})$$

with $c(p, s) = N(\phi - p/(\varepsilon + s))$.

Government: The government's objective function is $V(s) = \alpha_p C_p(s) + \alpha_c C_c(s) + W(s)$ in which the political weights α_j are exogenously given. We have that $\frac{\partial V}{\partial s} = \alpha_p \frac{\partial C_p}{\partial s} + \alpha_c \frac{\partial C_c}{\partial s} + \frac{\partial W}{\partial s}$. From the functional form and the truthfulness of the contribution functions we have that $\frac{\partial C_p}{\partial s} = \frac{\partial \Pi_p}{\partial s}$ and $\frac{\partial C_c}{\partial s} = \frac{\partial \Pi_c}{\partial s}$ around the politically optimal s^* [see condition (A3)] and from equation (3) we find that $\frac{\partial W}{\partial s} = \frac{\partial \Pi_p}{\partial s} + \frac{\partial \Pi_c}{\partial s}$ so that $\frac{\partial V}{\partial s} = (1 + \alpha_p) \frac{\partial \Pi_p}{\partial s} + (1 + \alpha_c) \frac{\partial \Pi_c}{\partial s}$ around the optimum. The government maximises its objective function with respect to s ($\frac{\partial V}{\partial s} = 0$) subject to $s \geq 0$. Using the expressions (A5) and (A6) we obtain the result that:

$$\frac{\partial V}{\partial s} = (1 + \alpha_p) \left[q^* \left(\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s} \right) \right] + (1 + \alpha_c) \left[\frac{N}{2} \left(\phi^2 - \left(\frac{p^*}{\varepsilon + s^*} \right)^2 \right) - c^* \frac{\partial p}{\partial s} \right] = 0. \quad (\text{A7})$$

This first order condition determines the resulting standard under the condition that $s^* \geq 0$; in any other case $s^* = 0$. c^* and q^* denote respectively the consumption and domestic production in the optimum, with $c^* = N(\phi - p^*/(\varepsilon + s^*))$.

A3. Comparative Statics

Comparative statics analyses on s^* only applies to when $s^* > 0$ in condition (A7). For cases in which condition (A7) results in $s^* = 0$, comparative statics results are trivial and equal to zero.

Condition (A7) implicitly defines s^* as a function of several variables. Hence:

$$\frac{\partial s^*}{\partial x} = - \frac{\partial^2 V / \partial s \partial x}{\partial^2 V / \partial s^2}. \quad (\text{A8})$$

From our assumptions on the convexity of $g(q, s)$ and $p(s)$ in s , it follows that $\frac{\partial^2 V}{\partial s^2} < 0$.²⁶ Hence, the sign of $\frac{\partial s^*}{\partial x}$ is determined by (is the same as) the sign of $\frac{\partial^2 V}{\partial s \partial x}$.

²⁶ See footnote 17.

Political weight of producers α_p : $\frac{\partial^2 V}{\partial s \partial \alpha_p} = q^* (\frac{\partial p}{\partial s} - \frac{\partial g}{\partial s})$ which is equal to $\frac{\partial \Pi_p}{\partial s}$ at s^* . Therefore $\frac{\partial s^*}{\partial \alpha_p}$ has the same sign as $\frac{\partial \Pi_p}{\partial s}$ at s^* .

Political weight of consumers α_c : $\frac{\partial^2 V}{\partial s \partial \alpha_c} = \frac{N}{2} (\phi^2 - (\frac{p^*}{\epsilon + s^*})^2) - c^* \frac{\partial p}{\partial s}$ which is equal to $\frac{\partial \Pi_c}{\partial s}$ at s^* . Therefore $\frac{\partial s^*}{\partial \alpha_c}$ has the same sign as $\frac{\partial \Pi_c}{\partial s}$ at s^* .

Consumer preferences ϕ : $\frac{\partial^2 V}{\partial s \partial \phi} = (1 + \alpha_c)N(\phi - \frac{\partial p}{\partial s})$. This expression is positive, and hence $\frac{\partial s^*}{\partial \phi} > 0$, if $\phi > \frac{\partial p}{\partial s}$ at s^* . Violation of this condition would imply that the individual willingness to pay for a marginal increase of the standard is negative at s^* , even for the individual with the highest preference ($\phi_i = \phi$). We abstract from this case by assuming that this condition holds.

A4. Effect of a standard on imports m

Deriving consumption $c(p, s) = N(\phi - p/(\epsilon + s))$ with respect to s is equal to

$$\frac{\partial c}{\partial s} = \frac{N}{\epsilon + s} \left(\frac{p}{\epsilon + s} - \frac{\partial p}{\partial s} \right). \tag{A9}$$

Making use of the inverse demand function $D(c, s) = (\phi - c/N)(\epsilon + s)$ we can rewrite (A9) as:

$$\frac{\partial c}{\partial s} = \frac{D_s - \partial p / \partial s}{|D_c|}, \tag{A10}$$

with $D_c = \frac{\partial D}{\partial c} (< 0)$ and $D_s = \frac{\partial D}{\partial s} (> 0)$.

Similarly, deriving the equilibrium condition for producers [condition (A4)] with respect to s gives

$$\frac{\partial q}{\partial s} = \frac{\partial p / \partial s - \partial g / \partial s - q \cdot \partial^2 g / \partial q \partial s}{2 \cdot \partial g \partial q + q \cdot \partial^2 g / \partial q^2}. \tag{A11}$$

Making use of the inverse supply function $A(q, s) = g(q, s) + q \frac{\partial g}{\partial q}$ [see expression (A4)] we can rewrite (A11) as:

$$\frac{\partial q}{\partial s} = \frac{\partial p / \partial s - A_s}{A_q}, \tag{A12}$$

with $A_q = \frac{\partial A}{\partial q} > 0$ and $A_s = \frac{\partial A}{\partial s} > 0$.

Imports m are defined as $m \equiv c - q$, hence using expressions (A10) and (A12):

$$\frac{\partial m}{\partial s} = \frac{\partial(c - q)}{\partial s} = \frac{D_s}{|D_c|} + \frac{A_s}{A_q} - \left(\frac{A_q + |D_c|}{A_q |D_c|} \right) \frac{\partial p}{\partial s}, \tag{A13}$$

which cannot be signed unambiguously.