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When are Private Standards more Stringent than Public Standards?

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Abstract

Retailers' private standards are increasingly important in addressing consumer concerns about safety, quality and social and environmental issues. Empirical evidence shows that these private standards are frequently more stringent than their public counterparts. This article develops a political economy model that may contribute to explaining this stylized fact. We show that if producers exercise their political power to persuade the government to impose a lower public standard, retailers may apply their market power to install a private standard at a higher level than the public one, depending on several factors.

Keywords: Private standards; public standards; political economy

JEL classifications: D72; L15

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Private standards, introduced by private companies, are increasingly important in the global market system (Henson and Hooker 2001; Henson 2004; Fulponi 2007). Retailers and producers have the possibility to introduce private standards in the same domains as in which the government imposes public standards, such as safety, quality, and social and environmental aspects of production, retail, and consumption.

Retailers and companies have a variety of motives to implement private standards. First, private standards may reduce consumers' uncertainty and information asymmetry about product characteristics such as safety, quality, and social and environmental aspects, thus increasing consumer demand. For example, Kirchhoff (2000) shows that firms may voluntarily reduce pollution to attract 'green' consumers if firms are able to signal their pollution abatement, for example through a private standard. A similar argument can be made for business to business transactions where the buyer is not a consumer but a private company. In such contexts, private standards allow to ensure and communicate product attributes about production, quality etc. which may facilitate firms to gear their activities to one another.

Second, firms may use private standards as strategic tools to differentiate their products, thus creating market segmentation and softening competition. A basic result from the vertical differentiation literature is that firms are able to reduce price competition and raise their profits by differentiating the (vertical) quality attribute of their products (see e.g. Spence 1976; Mussa and Rosen 1978; Tirole 1988). Such quality differences can be signaled by setting a private standard. Several other authors have shown that in a vertically differentiated market a minimum quality standard imposed by the government (a public standard) may raise welfare, depending on the type of

competition between producers (see e.g. Leland 1979; Ronnen 1991; Boom 1995; Crampes and Hollander 1995; Valletti 1995; Winfree and McCluskey 2005). If the minimum quality standard is not prohibitively high such that it does not exceed the highest quality voluntarily supplied by producers, firms differentiate their quality levels: some produce at the minimum quality level while others produce at a higher quality level. The latter firms can signal their higher quality by setting a private standard that is more stringent than the public minimum quality standard (see e.g. Arora and Gangopadhyay 1995).

Third, as demonstrated recently by Von Schlippenbach and Teichmann (2012), firms may use private standards strategically to improve bargaining power over their suppliers. Their analysis shows that if suppliers cannot adjust product quality in the short run, retailers may either undercut or surpass other retailers' standards to weaken their suppliers' outside options and bargaining power. The authors show that such strategic differentiation by retailers results in welfare losses compared to the social optimum and that in such a setting a minimum quality standard can be welfare improving.

Fourth, private standards may also serve to preempt government regulations. For example, Lutz *et al.* (2000) show – in a vertical differentiation model with minimum quality standards – that high-quality firms may have an incentive to commit to a quality level before public standards are set, in order to induce the regulator to weaken public standards. They demonstrate that this results in welfare losses as companies produce lower quality than would be the case if the public standard could not be preempted. In the same line of reasoning, McCluskey and Winfree (2009) argue that an important advantage of private over public standards is that the former are more flexible in response

to changes in consumer tastes and preferences, and to changes in technology. Therefore, by preempting public standards through setting their own private standards, firms may minimize the negative effect of standards on revenues. Flexible private standards also increase consumer welfare; thus, in contrast to Lutz et al. (2000), McCluskey and Winfree (2009) find a positive effect of private standards on welfare. From a political economy perspective, Maxwell *et al.* (2000) argue that firms may strategically preempt costly political action through voluntary private standards. They argue that a private standard raises consumers' welfare in the event that no public standard is imposed, which reduces consumers' incentives to lobby for a public standard in case political entry is costly for consumers. The authors show that this preempting private standard is more stringent than the public standard which would have been imposed in absence of the private standard.¹

Empirical evidence shows that 70% to 80% of retailers assess their own private standards slightly or significantly higher than public standards (see Figure 1). Animal welfare is a typical area where private standards often exceed public standards. McDonalds, for instance, imposes more stringent standards for the treatment of animals than what is prescribed by law, and several U.S. producer groups such as the American Meat Institute and the United Egg Producers issue voluntary guidelines on animal welfare (Mitchell, 2001). Fulponi (2006) notes that even though animal welfare is protected by both EU and national regulation, the majority of large European retailers reports that their animal welfare requirements are higher than those imposed by national legislation.

Food safety and quality is another typical area. Fulponi (2006) reports that 85% of the retailers maintain food safety and quality standards which are more stringent than

public standards, for example by imposing stricter norms for possible allergens or contaminants. Concerning genetically modified organisms (GMO), Vigani and Olper (2013) show that a majority of retailers in Europe are committed to selling GMO-free food, thus implementing a standard stricter than required by EU regulations.

So far, to the best of our knowledge, only two models may offer an explanation for this observation, i.e. why most retailers set their private standards at higher levels than what is required by law. First, the political economy model of Maxwell *et al.* (2000) shows that high private standards may preempt public standards if consumers' costs of getting politically organized are sufficiently high.² Second, the vertical differentiation literature argues that those retailers who set their private standard at a higher level than the public minimum quality standard aim at differentiating themselves from other retailers that sell at the minimum quality standard, thus raising profits by reducing competition. While this may be an appropriate description of some markets (e.g. organic food), the standard vertical differentiation framework seems less appropriate for analyzing the phenomenon that organizations such as the BRC (British Retail Consortium) or the GLOBALG.A.P. (Global Partnership for Good Agricultural Practice) introduce private standards that are more stringent than public standards, and that these relatively stringent private standards are adopted by almost all retailers in European countries. Another important example is the Global Food Safety Initiative (GFSI), a benchmarking organization where leading retailers collaborate in harmonizing private standards for food safety and/or sustainability (Fulponi 2007). Retailers thus seem to implement private standards which are simultaneously higher than the existing public standards but not significantly different from the standards adopted by their rivals. One

possible explanation would be that consumers have come to regard the stricter private standard as the *de facto* minimum (e.g. because of a lack of trust in the lower public standard), in which case retailers have no choice but to adopt the stricter private standard as if it were a minimum quality standard. This seems to be the case for “dolphin-safe” tuna fish, a voluntary standard which nevertheless is adopted by all players in the US market (Smith, 2009).³ However, while this explanation may hold true for some highly visible products and some characteristics, stricter private standards seem too pervasive to be attributable to such consumer perceptions alone.

The aim of this article is to provide an additional explanation for the observation that private standards may be set at higher levels than their public counterparts – even when implementation costs and consumer benefits do not differ between public and private standards. Our analysis highlights the possibility that an intermediary with market power may set its private standard at a higher level than the government’s optimal public standard if the retailer is able to shift the burden of the private standard’s implementation cost to producers. While producers lobby for a lower public standard, the retailer uses its market power to impose a higher private standard.

So far the literature has mostly considered two-agent models with ‘producers’ and ‘consumers’. However, focusing only on these two groups ignores important structural features of modern supply chains, which are often characterized by a large number of small producers and a few intermediaries (such as retail chains) which often exercise market power (Sexton et al., 2007). In reality, many private standards are set by these retailers or retailer groups – not by producers.⁴ In the U.S. beef industry, for instance, fast food restaurants and retail chains are responsible for the drive toward more stringent

traceability standards (Golan et al., 2004). Therefore we explicitly introduce a monopolist retailer that may set a private standard to regulate the same product characteristics as the government's public standard and show that this has important consequences for the analysis of private standards.⁵ In addition to the retailer's private standard, we assume there is a public standard which is determined in a political game where producers and the retailer have political power to influence the government's standard-setting process.

Our analysis yields several findings. Retailers' interests in setting private standards do not necessarily coincide with producers' or consumers' interests, and retailers' optimal private standards may not be optimal from the perspective of either producers or consumers. Most importantly, our analysis offers an explanation for the relative stringency of private standards vis-à-vis public standards. We show that if the retailer can inflict most of the costs of a higher standard on producers, the optimal retailer standard will be higher than the optimal standard for producers. Producers thus lobby for a lower public standard, but retailers impose a higher private standard. This outcome depends both on the retailer's market power and producers' political influence. We also show that other factors such as the standard's efficiency gain, implementation cost, and rent transfer from the retailer to producers affect the relative stringency of private versus public standards. Additionally, we show that side payments from producers to the retailer may align the retailer standard more with producer interests.

The assumption of an intermediary with market power setting its own private standard is particularly suited for the analysis of many agri-food industries, where retail chains set food quality and safety standards for their suppliers. However, other sectors such as consumer textiles and consumer electronics have a similar structure, with a

Western intermediary (e.g. Nike, Apple) setting private standards (e.g. labor standards) above the public standard for its suppliers in developing countries.⁶ To the extent that consumers are willing to pay extra for these higher standards while they impose costs on producers in developing countries, such standards may also be analyzed using the framework developed here.

The article is structured as follows. The next section specifies the different market players in our model, i.e. consumers, producers, and the monopolist retailer, and determines the market equilibrium for a given standard. We then turn to an analysis of how a standard affects the different market players. Subsequently, we determine the retailer's optimal private standard, and we model the government's decision-making process on public standards which determines the government's optimal public standard. We then compare the levels of the retailer's optimal private standard and the government's optimal public standard to show under which conditions the private standard is set at a higher level than the public one, and which factors influence these conditions. Next, we extend the model by allowing for side payments by producers to influence the retailer's private standard-setting behavior, and analyze how this affects our results. In the concluding section, we discuss to what extent retailers' market power is important to the results obtained here.

The Model

We consider a market setting where consumers are *ex ante* uncertain about some characteristics of the product (see also Leland 1979). Standards may thus improve upon the unregulated market equilibrium by guaranteeing the presence or absence of respectively positive or negative experience or credence characteristics (Nelson 1970;

Darby and Karni 1973) and by reducing asymmetric information between consumers and producers. Similar to most studies, we assume that the introduction of a standard involves implementation costs for producers (see e.g. Leland 1979; Ronnen 1991; Valletti 2000). We assume that private and public standards have intrinsically the same effects, i.e. that their impacts on consumer utility and production costs are not different, *ceteris paribus*, such that differences in levels of public and private standards are not attributable to intrinsic differences between public and private standards. We limit our analysis to a closed-economy model to refrain from potential standards-as-barriers-to-trade issues.

Consumers

Consider a standard which guarantees certain quality or safety features of a product. Such a standard positively affects utility as it reduces or solves information asymmetries. Therefore a standard induces consumers to buy more of the product through an increased willingness to pay, *ceteris paribus*. For example, consumers who perceive health problems with certain (potential) ingredients or production processes may increase consumption if they are guaranteed the absence of these elements. To model this, we assume a representative consumer utility function $u(x, s)$ where x is consumption of the good, and s is the (public or private) standard. A higher s refers to a more stringent standard. Consumer utility is increasing and concave both in consumption ($u_x > 0; u_{xx} < 0$) and the standard ($u_s > 0; u_{ss} < 0$).⁷ We assume that $u_{xs} > 0$, i.e. that an increase in the standard leads to a higher marginal utility of consumption. Moreover, to simplify our exposition we assume $u_{xxx} = 0$.⁸ The representative consumer maximizes consumer surplus Π^C by choosing consumption x :

$$\Pi^C = \max_x [u(x, s) - px] \quad (1)$$

where p is the consumer price. The first order condition (FOC) of this maximization problem is

$$\frac{\partial \Pi^C}{\partial x} = u_x - p = 0 \quad (2)$$

Rewriting Equation (2) gives

$$p = u_x(x, s) \quad (3)$$

which implicitly defines the inverse demand function $p(x, s)$. The inverse demand function is downward sloping with $p_x = u_{xx} < 0$. Since $p_s = u_{xs} > 0$, a higher standard moves the inverse demand function upwards. The reduced-form expression for consumer surplus is

$$\Pi^C(x, s) = u(x, s) - p(x, s)x \quad (4)$$

Producers

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 the specific factor owners, i.e. the producers. We assume that a standard imposes some production constraint or obligation which increases production costs. The intuition is that all standards can be defined as the prohibition to use a cheaper technology. Examples are the prohibition of child labor, GM technology or pesticides. Likewise, traceability standards can be

interpreted as a prohibition of cheaper production systems which do not allow tracing the production.

To model this, consider a representative producer with cost function $c(x, s)$ that depends on output and the standard.⁹ The cost function is assumed to be increasing and convex both in production ($c_x > 0; c_{xx} > 0$) and the standard ($c_s > 0; c_{ss} > 0$). We further assume that $c_{xs} > 0$, i.e. that a standard increases the marginal costs of production. Moreover, for simplicity we assume that $c_{xxx} = 0$.¹⁰ Producers are price takers, maximizing their profits Π^P by setting output x :

$$\Pi^P = \max_x [wx - c(x, s)] \quad (5)$$

where w is the producer price. The FOC of this maximization problem is

$$\frac{\partial \Pi^P}{\partial x} = w - c_x = 0 \quad (6)$$

Rewriting Equation (6) gives

$$w = c_x(x, s), \quad (7)$$

which implicitly defines the inverse supply function $w(x, s)$. The inverse supply function is upward sloping with $w_x = c_{xx} > 0$. Since $w_s = c_{xs} > 0$, a higher standard moves the inverse supply function upwards. The reduced-form expression for producer profits is

$$\Pi^P(x, s) = w(x, s)x - c(x, s). \quad (8)$$

In the remainder of the analysis we assume that production costs are sufficiently convex and consumer utility sufficiently concave in s to ensure global maxima.

The Retailer

We assume that output is sold by producers to consumers through one intermediary agent – a monopolist retailer. The retailer’s handling costs are normalized to zero. The monopolist retailer sets consumer and producer prices such that, under optimal price-taking behavior of consumers and producers, consumption and output equal at a level that maximizes the retailer’s profits Π^R . This is equivalent to maximizing the retailer’s profits with respect to quantity x using the inverse demand and supply functions (3) and (7) which represent the optimal price-taking behavior of consumers and producers and thus define consumer and producer prices for a given quantity. Formally, the retailer’s profits are

$$\Pi^R = \max_x [(p(x, s) - w(x, s))x] \quad (9)$$

where $p - w$ is the retailer’s margin.

The Market Equilibrium

The FOC of the retailer’s profit maximization is

$$\frac{\partial \Pi^R}{\partial x} = p - w + x(p_x - w_x) = 0, \quad (10)$$

and hence the equilibrium quantity $x^*(s)$, for a given level of the standard s , is

$$x^*(s) = \frac{u_x - c_x}{c_{xx} - u_{xx}} \quad (11)$$

Equation (11) is not a closed-form solution since the right-hand side depends on x . The denominator is always positive because the cost function is convex and the utility function concave in x . The numerator is positive if $u_x > c_x$, or according to Equations (3)

and (7), if $p > w$. This condition – which we assume to hold throughout the article – assures a positive retailer margin and profits. The reduced-form expressions for consumer surplus, producer profits, and retailer profits at market equilibrium are respectively

$$\Pi^C(s) = u(x^*(s), s) - p(x^*(s), s)x^*(s) \quad (12)$$

$$\Pi^P(s) = w(x^*(s), s)x^*(s) - c(x^*(s), s) \quad (13)$$

$$\Pi^R(s) = [p(x^*(s), s) - w(x^*(s), s)]x^*(s) \quad (14)$$

The Impact of a Standard

Before determining the optimal public and private standards and how they compare, it is instructive to analyze the effect of a marginal change in the standard (whether public or private) on the market equilibrium, the interests of the different market players, and social welfare. Using the implicit function theorem, the impact of a marginal change in the standard on the equilibrium quantity $x^*(s)$ is

$$x_s^* = \frac{1}{2} \frac{u_{xs} - c_{xs}}{c_{xx} - u_{xx}} + \frac{1}{2} x^* \frac{u_{xxs} - c_{xxs}}{c_{xx} - u_{xx}} \quad (15)$$

Equation (15) shows that the marginal impact of a standard on the equilibrium quantity consists of two effects. An increase in the standard leads to an upward shift in the inverse demand and supply functions (since $u_{xs} > 0$ and $c_{xs} > 0$) – the first term in Equation (15) captures the net effect of these shifts on the equilibrium quantity. An increase in the standard may also affect the slopes of the inverse demand and supply functions ($u_{xxs} \neq 0$ and/or $c_{xxs} \neq 0$). The second term in Equation (15) represents the effect on the equilibrium quantity of the change in slopes.

When $u_{xxs} = c_{xxs} = 0$, an increase in the standard only leads to parallel upward shifts in both demand and supply, which translate into parallel shifts upward, by the same distance, of respectively the retailer's marginal revenue and cost functions. If the

marginal revenue function shifts upward more (less) than the marginal cost function ($u_{xs} > c_{xs}$ respectively $u_{xs} < c_{xs}$), Equation (15) shows that the retailer responds to a higher standard by increasing (reducing) the traded quantity.¹¹

When u_{xxs} or c_{xxs} are different from zero, the rotation of the functions influences the effect of a standard on equilibrium quantity.¹² For instance, the second term in Equation (15) shows that a stronger counterclockwise rotation of the supply function ($c_{xxs} > 0$) will lead to a smaller positive (or more negative) output response.

In summary, Equation (15) shows that the standard's marginal impact on the equilibrium quantity may be positive or negative. The equilibrium quantity increases with a more stringent standard if the upward shift in the inverse demand function u_{xs} is larger than the upward shift in the inverse supply function c_{xs} and if this effect is not offset by the rotation of demand and supply. In particular, if demand rotates clockwise ($u_{xxs} < 0$) while supply rotates counterclockwise ($c_{xxs} > 0$), the effect of a standard on output will be less positive (or more negative) for given values of u_{xs} and c_{xs} .

Next, we derive the standard's marginal impact on the different market players' interests using the envelope theorem. The marginal change in consumer surplus $\Pi^C(s)$ is

$$\frac{\partial \Pi^C(s)}{\partial s} = u_s - x^*(s)(u_{xs} + u_{xx}x_s^*) \quad (16)$$

The first term, u_s , is the *efficiency gain*, i.e. the positive marginal utility impact because of reduced information asymmetries. This efficiency gain is larger (smaller) when the standard induces a clockwise (counterclockwise) rotation of demand than when demand shifts upward in parallel.¹³ A clockwise (counterclockwise) rotation entails a larger (smaller) efficiency gain because the change in willingness to pay *at the margin* – which determines the consumer price – is smaller (larger) than the increase in the *average*

willingness to pay. The second term of Equation (16), the marginal change in consumption expenditures $x^*(s)(u_{x_s} + u_{xx}x_s^*)$, is a consequence of both the higher willingness to pay for a product with a higher standard ($u_{x_s} > 0$) and the change in willingness to pay because of a marginal change in consumption x_s^* . The size of the latter change in willingness to pay is determined by the slope of the inverse demand function u_{xx} . Because the marginal change in consumption may be either positive or negative, consumption expenditures may increase or decrease with the standard. Hence the standard's marginal impact on consumer surplus is ambiguous. If the efficiency gain is larger than the marginal change in consumption expenditures, consumer surplus increases with the standard; and vice versa.

The marginal change in producer profits $\Pi^P(s)$ is

$$\frac{\partial \Pi^P(s)}{\partial s} = x^*(s)(c_{x_s} + c_{xx}x_s^*) - c_s \quad (17)$$

The last term, c_s , is the *implementation cost*, i.e. the marginal cost increase due to the prohibition of using a cheaper technology. This implementation cost is larger (smaller) when the standard induces a clockwise (counterclockwise) rotation of supply than when supply shifts upward in parallel.¹⁴ A clockwise (counterclockwise) rotation entails a larger (smaller) implementation cost because the producers' *average* costs increase faster than their *marginal* costs – which determine the producer price. The first term of Equation (17), $x^*(s)(c_{x_s} + c_{xx}x_s^*)$, is the marginal change in producer revenues which is a consequence of the higher marginal production costs due to a higher standard ($c_{x_s} > 0$) and the change in marginal production costs because of a marginal change in output x_s^* . The size of the latter change in marginal production costs is determined by the slope of the inverse supply function c_{xx} . Because the marginal change in output may be positive

or negative, producer revenues may increase or decrease with the standard. Hence, the marginal impact of a standard on producer profits is also ambiguous. When the implementation cost is smaller than the marginal change in producer revenues, producer profits increase with the standard; and vice versa.

The marginal change in the retailer's profits $\Pi^R(s)$ is

$$\frac{\partial \Pi^R(s)}{\partial s} = x^*(s)(u_{xs} - c_{xs}) \quad (18)$$

The factor $u_{xs} - c_{xs}$ is the marginal change in the retailer's margin and may be positive or negative, depending on the relative shifts of the inverse demand and supply functions. Hence the standard's marginal impact on the retailer's profits may be positive or negative. More specifically, the term $x^*(s)u_{xs}$ represents the marginal increase in the retailer's revenues because of the upward shift of the inverse demand function. As consumers' willingness to pay is higher for a product with a more stringent standard, a higher standard allows the retailer to set a higher consumer price for a given level of consumption x^* . The higher consumer price results in higher revenues for the retailer but also in higher consumption expenditures for consumers (see Equation (16)). We therefore define $x^*(s)u_{xs}$ as the *rent transfer* from consumers to the retailer due to a higher standard. Similarly, the term $x^*(s)c_{xs}$ is the marginal increase in the retailer's expenditures due to the upward shift in the inverse supply function. With a higher standard, the retailer pays a higher producer price for a given level of output x^* to compensate producers for their higher marginal production costs. The higher producer price results in higher expenditures for the retailer and in higher producer revenues (see Equation (17)). Hence, we define $x^*(s)c_{xs}$ as the *rent transfer* from the retailer to producers because of a stricter standard. Equation (18) thus shows that the retailer's

profits increase with a higher standard if the rent transfer from consumers is larger than the rent transfer to producers; and vice versa.

We can now also analyze the standard's marginal impact on social welfare $W(s)$ which is defined as the sum of consumer surplus, producer profits, and retailer profits:

$$W(s) = \Pi^C(s) + \Pi^P(s) + \Pi^R(s) \quad (19)$$

The marginal change in social welfare is

$$\frac{\partial W}{\partial s} = u_s - c_s + (u_x - c_x)x_s^* \quad (20)$$

and equals the direct welfare effects, i.e. the efficiency gain u_s minus the implementation cost c_s , plus an additional welfare gain (loss) if the equilibrium quantity increases (decreases). Therefore social welfare may increase or decrease with a higher standard, depending on the relative size of these factors.

In summary, it follows that all market players may gain or lose from a change in the standard, and that this change involves rent transfers between the different market players. Likewise, social welfare may either increase or decrease with a change in the standard, depending on the relative size of the efficiency gain, the implementation cost, and the different rent transfers.

Optimal Public and Private Standards

We analyze the optimal standard-setting behavior of both the retailer and the government. In line with most of the literature on minimum quality standards, we assume that the government moves first in setting its public standard.¹⁵ We solve the game by backward induction and determine first the retailer's optimal private standard for a given level of the public standard. Then we determine the government's optimal public standard to

finally compare the level of the retailer's optimal private standard s^R to the level of the government's optimal public standard s^G .

The Retailer's Optimal Private Standard

Being the only intermediary agent between producers and consumers, the retailer is able to unilaterally impose a private standard. The retailer maximizes profits by imposing a private standard, given the market equilibrium in Equation (11) that results from the retailer's own optimal price-setting behavior and the consumers' and producers' optimal price-taking behavior. Formally, the retailer's optimal private standard s^R is determined by the following FOC, subject to $s^R \geq s^G$:¹⁶

$$x^*(s^R)(u_{xs} - c_{xs}) = 0 \quad (21)$$

Equation (21) shows that $u_{xs}x^*(s^R) = c_{xs}x^*(s^R)$ at s^R . Referring to the discussion following Equation (18), Equation (21) indicates that the rent transfer from consumers to the retailer equals the rent transfer from the retailer to producers at s^R . This is intuitive: optimally, the retailer sets its private standard at a level where marginal revenues equal marginal expenditures from increasing the private standard. Additionally, abstracting from the trivial case where $x^*(s^R) = 0$, Equation (21) implies that $u_{xs} = c_{xs}$ at s^R , i.e. that the retailer sets its optimal private standard such that the shift in the inverse demand function is equal to the shift in the inverse supply function.

In general, the retailer's optimal private standard s^R does not coincide with the optimal standard for consumers and/or producers. The retailer standard s^R is optimal for consumers only if at s^R the standard's marginal effect on consumer surplus is zero. Equation (16) indicates that this only occurs if at s^R the efficiency gain u_s equals the

marginal increase in expenditure $(u_{xs} + u_{xx}x_s^*)x^*(s^R)$. Likewise, s^R is optimal for producers only if at s^R the marginal increase in producers' revenues $(c_{xs} + c_{xx}x_s^*)x^*(s^R)$ equals the implementation cost c_s . Hence, only under very specific circumstances – depending on the efficiency gain, implementation cost, and the different rent transfers – the interests of consumers and/or producers coincide with the retailer's interests. In any other case, the interests of the various market players differ. For instance, an increase in the standard may increase producers' average costs by more than their marginal costs. Since the marginal cost determines the producer price, this results in a decrease in producer surplus. The same increase in the standard may also increase the marginal willingness to pay of consumers by more than their average willingness to pay, thus reducing consumer surplus. In this scenario, the retailer would benefit from a strong increase in consumer price coupled with a modest increase in producer price; while the higher standard would increase retailer profits, it would decrease producer and consumer surplus.

Likewise, Equation (20) shows that the retailer's optimal private standard s^R equals the socially optimal standard s^W if and only if $u_s - c_s = (u_x - c_x)x_s^*$ at s^R . The cause for the potential welfare sub-optimality of the retailer's optimal private standard is that the retailer does not incorporate the direct utility and cost effects (u_s and c_s) into its profit maximizing behavior. The retailer only cares about maximizing the net rent transfer whereas the welfare calculus does take the net direct effects into account.

Importantly, even if the retailer's optimal private standard would be socially optimal, it need not be optimal for consumers and producers separately. Since s^R is optimal for the retailer, $\frac{\partial \Pi^R}{\partial s} \Big|_{s^R} = 0$; if s^R is also socially optimal it must be that $\frac{\partial W}{\partial s} \Big|_{s^R} =$

$\frac{\partial \Pi^C}{\partial s} \Big|_{s^R} + \frac{\partial \Pi^P}{\partial s} \Big|_{s^R} = 0$ and hence $\frac{\partial \Pi^C}{\partial s} \Big|_{s^R} = -\frac{\partial \Pi^P}{\partial s} \Big|_{s^R}$. Only if both of the latter derivatives are zero do the optimal standards coincide; that is, even if the private standard were socially optimal, it would not necessarily be optimal for consumers and producers.

The Government's Optimal Public Standard

We now analyze the public standard-setting behavior of a government that is interested in both interest group contributions and social welfare. For this purpose we build on the political economy model of public standards as developed in Swinnen and Vandemoortele (2011).

Consider a government that maximizes its own objective function which, following the approach of Grossman and Helpman (1994), consists of a weighted sum of contributions from interest groups and social 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 s . Without loss of generality, we assume that producers and the retailer are politically organized into separate interest groups that lobby simultaneously, but that consumers are not organized.¹⁷

The 'truthful' contribution schedules of the producers and retailer are of the form $C^k(s) = \max\{0, \Pi^k(s) - b^k | s \geq s^R\}$ with $k = P, R$.¹⁸ b^k is a constant, a minimum level of profits the interest groups do not wish to spend on lobbying. The government's objective function $\Pi^G(s)$ is a weighted sum of the interest group contributions, weighted by α^k , and social welfare, where α^k represents the relative lobbying strength of the interest groups:

$$\Pi^G(s) = \sum_k \alpha^k C^k(s) + W(s) \quad (22)$$

The government chooses the level of the public standard to maximize its objective function (22). Each possible level of the public standard corresponds to a certain level of producer and retailer profits, and hence also to a certain level of producer and retailer contributions. This is driven by the functional form and the truthfulness of the contribution schedules which imply that the government receives higher contributions from the producers' (retailer's) interest group if the public standard creates higher producer (retailer) profits. Conversely, the government receives less producer or retailer contributions if the public standard decreases their respective profits. Therefore maximizing the contributions from the producers' (retailer's) interest group by choosing the level of the public standard is equivalent to maximizing their respective profits, i.e.

$\frac{\partial c^k(s)}{\partial s} = \frac{\partial \Pi^k(s)}{\partial s}$ for $s \geq s^R$. The government thus chooses the level of the public standard to maximize the weighted sum of producer profits, retailer profits, and social welfare.¹⁹

The government's optimal public standard s^G is therefore determined by the following FOC, subject to $s^G \geq s^R$:

$$\begin{aligned} & \alpha^P [x^*(s^G)(c_{xx}x_s^* + c_{xs}) - c_s] + \alpha^R [x^*(s^G)(u_{xs} - c_{xs})] \\ & + [u_s - c_s + (u_x - c_x)x_s^*] = 0 \end{aligned} \quad (23)$$

FOC (23) implicitly defines s^G as a function of the lobbying strengths of the different interest groups α^k , the efficiency gain u_s , the implementation cost c_s , the rent transfers $x^*(s^G)u_{xs}$ and $x^*(s^G)c_{xs}$, and the marginal change in producer revenues $x^*(s^G)(c_{xx}x_s^* + c_{xs}) - c_s$, all evaluated at s^G .

A Comparison of the Retailer's Optimal Private Standard to the Government's Optimal Public Standard

We now compare the government's optimal public standard s^G to the retailer's optimal private standard s^R and analyze which factors determine their relative levels. Since production costs are sufficiently convex and consumer utility sufficiently concave in s to ensure that both Π^G and Π^R are concave in s , it suffices to determine the sign of the standard's marginal impact on the government's objective function at s^R , $\left. \frac{\partial \Pi^G(s)}{\partial s} \right|_{s^R}$.

Because of concavity, if $\left. \frac{\partial \Pi^G(s)}{\partial s} \right|_{s^R} > 0$ then $s^R < s^G$ and vice versa. Inserting into Equation (23) the results of Equation (21) that $u_{xs} = c_{xs}$ at s^R , the expression for the standard's marginal impact on the government's objective function at s^R is

$$\underbrace{u_s - c_s + (u_x - c_x)x_s^*}_{(1)} + \alpha^P \left[\underbrace{x^*(s^R)(c_{xx}x_s^* + c_{xs}) - c_s}_{(2)} \right], \quad (24)$$

which may be positive or negative. Part (1) of Equation (24) equals the marginal social welfare effect of the standard at s^R (see Equation (20)), and may be positive or negative. Part (2) represents the standard's marginal impact on producer profits at s^R . It consists of producers' marginal change in revenues at the government standard ($x^*(s^R)(c_{xx}x_s^* + c_{xs})$) minus the standard's implementation cost c_s , and is weighted by the political power of the producers' interest group, α^P . Part (2) may be positive or negative as well. Hence, *a priori*, it is not determined which of the two standards is more stringent. The retailer's optimal private standard may be higher or lower than the government's optimal public standard. We are particularly interested in the case where Equation (24) is negative, i.e. when the retailer's optimal private standard is more stringent than government's optimal public standard ($s^G < s^R$), and which factors affect this.²⁰

The key factors that lead to private standards being more stringent than public standards are summarized by Equation (24). First, the marginal change in producers' revenues $(x^*(s^R)(c_{xx}x_s^* + c_{xs}))$ plays an important role. If either $c_{xx}x_s^* + c_{xs}$ or $x^*(s^R)$ is smaller, the standard's marginal impact on producer profits at s^R (part (2) of Equation (24)) is more negative or less positive such that Equation (24) is more likely to be negative, and $s^G < s^R$. A low value of $(x^*(s^R)(c_{xx}x_s^* + c_{xs}))$ means that producers receive a smaller compensation for a higher standard. Ceteris paribus, producers thus bear a larger share of the implementation cost. The producers' interest group then lobbies in favor of a lower public standard and Equation (24) is more likely to be negative, i.e. $s^G < s^R$.

Second, when producer profits are marginally decreasing in the standard at s^R , i.e. when part (2) in Equation (24) is negative, a larger political power of the producers' interest group α^P increases the likelihood that Equation (24) is negative and $s^G < s^R$. In this case, producers lobby in favor of a public standard that is lower than the retailer's optimal private standard, and their larger political power means they can lobby more successfully, ceteris paribus, so that they are able to reduce the level of the government's optimal public standard.

Third, the size of the efficiency gain matters. If u_s is smaller, the marginal social welfare effect at s^R (part (1) of Equation (24)) is less positive or more negative. With a lower efficiency gain, Equation (24) is more likely to be negative such that $s^G < s^R$. A lower efficiency gain induces the government to set a lower public standard because of social welfare considerations, while the retailer does not take social welfare effects into account.

Fourth, the size of the implementation cost c_s affects both social welfare and producer profits. Equation (24) is more likely to be negative with a higher implementation cost, such that $s^G < s^R$. The intuition behind this result is that a higher implementation cost causes the government to set a lower public standard, not only because of social welfare considerations but also because the producers' interest group lobbies in favor of a lower public standard. In contrast, the retailer is not concerned with social welfare effects, so that the retailer's optimal private standard is not affected by a change in the implementation cost. Due to producer lobbying, a change in the implementation cost c_s has a larger impact on Equation (24) than a similar change in the efficiency gain u_s (but in opposite direction), *ceteris paribus*.

Under these conditions, it is more likely that the retailer sets its optimal private standard at a higher level than the government's optimal public standard. Hence these factors may explain the observation that in some sectors, private standards are more stringent than public ones. For instance, in a discussion of voluntary traceability standards in the U.S. food system, Golan et al. (2004) conclude that the extent and depth of these systems varies across industries, depending on varying costs, product characteristics and industry organization. Traceability standards are higher in the fresh fruit and vegetables industry, since fresh produce needs to be boxed early in the supply chain, which implies that traceability imposes only minor additional costs on producers compared to other industries.

Extension: Side Payments

So far we have assumed that producers cannot directly influence the retailer's private standard-setting behavior. However, if producers are able to form into an interest group that influences the government's public standard-setting process through contributions, it is also conceivable that they engage in direct negotiations with the retailer in order to influence the retailer's private standard-setting behavior. In general, as discussed earlier, producers' interests do not coincide with the retailer's interests. Therefore, if the retailer's private standard would be more stringent than the public one, producers may make side payments to convince the retailer of setting a private standard that is more aligned with the producers' interests.²¹ This section analyzes how side payments from producers to the retailer may affect the results of our model, i.e. how the level of the retailer's optimal private standard compares to the level of the government's optimal public standard when side payments are possible.

To analyze the impact of these side payments, we need to make some additional assumptions. We assume that, after the public standard has been set by the government, the producers' interest group offers the retailer a truthful side payment schedule that specifies how much producers are willing to pay the retailer for each potential level of the private standard. The producers' truthful side payment schedule is of the form $S(s) = \max\{0, \Pi^P(s) - \Pi^P(\max\{s^G, s^R\})\}$ for $s \geq s^G$. The schedule implies that producers are willing to make side payments equal to at most the difference between their profits under a private standard s and their profits under the standard that regulates the market in the absence of side payments, i.e. $\max\{s^G, s^R\}$, where s^R and s^G are defined by respectively Equations (21) and (23). The side payments are restricted to the interval $s \geq s^G$ because,

given that the market is regulated by the most stringent standard, side payments for a private standard that is lower than the public standard ($s < s^G$) would have no impact on producers' profits, and would not be truthful.

Taking into account the producers' potential side payments, the retailer now maximizes $\Pi^R(s) + S(s)$ when setting its private standard. The retailer's optimal private standard with side payments s^{RP} is then determined by the following FOC, subject to $s^{RP} \geq s^G$:²²

$$x^*(s^{RP})(u_{xs} + c_{xs}x_s^*) - c_s = 0 \quad (25)$$

Equation (25) is equivalent to maximizing the joint surplus of the retailer and the producers. Hence, when setting a private standard with potential side payments, the retailer also takes the standard's marginal impact on producer profits into account. By making side payments to the retailer, producers obtain that the retailer internalizes the effect of a private standard on producer profits in its private standard-setting behavior.

As a consequence, these side payments may also have an impact on how the levels of the government's optimal public standard and the retailer's private standard compare to one another. Before we compare these levels, we first determine the government's optimal public standard s^G in the presence of side payments. To account for the potential side payments, the truthful contribution schedules of the producers and the retailer are adjusted to respectively $C^P(s) = \max\{0, \Pi^P(s) - S(s^{RP}) - b^P | s \geq s^{RP}\}$ and $C^R(s) = \max\{0, \Pi^R(s) + S(s^{RP}) - b^R | s \geq s^{RP}\}$. The government's optimal public standard s^G is then determined by the following FOC, subject to $s^G \geq s^{RP}$:

$$\begin{aligned} \alpha^P[x^*(s^G)(c_{xx}x_s^* + c_{xs}) - c_s] + \alpha^R[x^*(s^G)(u_{xs} - c_{xs})] \\ + [u_s - c_s + (u_x - c_x)x_s^*] = 0 \end{aligned} \quad (26)$$

Because the interest group's contribution schedules are truthful, i.e. because the interest groups set their lobbying contributions in accordance with how their expected profits are *marginally* affected by the public standard, the side payments have no impact on the government's optimal public standard and the FOC in (26) is the same as without side payments in (23).

As earlier, to determine whether the retailer's optimal private standard with side payments is stricter than the government's optimal public standard, we need to determine the sign of the standard's marginal impact on the government's objective function at s^{RP} , i.e. $\frac{\partial \Pi^G(s)}{\partial s} \Big|_{s^{RP}}$. If $\frac{\partial \Pi^G(s)}{\partial s} \Big|_{s^{RP}} < 0$ then $s^G < s^{RP}$, and vice versa. Using Conditions (25) and (26), the expression for the standard's marginal impact on the government's objective function at s^{RP} is

$$\underbrace{u_s - c_s + (u_x - c_x)x_s^*}_{(1)} + (\alpha^P - \alpha^R) \left[\underbrace{x^*(s^{RP})(c_{xx}x_s^* + c_{xs}) - c_s}_{(2)} \right] \quad (27)$$

which may be positive or negative. Part (1) of Equation (27) is the standard's marginal impact on social welfare at s^{RP} , and can again be positive or negative. Part (2) of Equation (27) represents the standard's marginal impact on producer profits at s^{RP} which may also be positive or negative. The retailer's optimal private standard with side payments s^{RP} may thus be higher or lower than the government's optimal public standard s^G .

To examine how side payments affect the retailer's optimal private standard, it suffices to analyze whether producer profits are marginally increasing or decreasing in the retailer's optimal private standard *without* side payments, s^R . With side payments, the retailer's optimal private standard s^{RP} maximizes the joint surplus of producers and the

retailer, i.e. $\frac{\partial \Pi^P}{\partial s} \Big|_{s^{RP}} + \frac{\partial \Pi^R}{\partial s} \Big|_{s^{RP}} = 0$. If the joint surplus is marginally increasing at s^R , then $s^R < s^{RP}$; if the joint surplus is marginally decreasing at s^R , then $s^{RP} < s^R$. However, since s^R is optimal for the retailer, $\frac{\partial \Pi^R}{\partial s} \Big|_{s^R} = 0$. Hence, the joint surplus of producers and retailers is marginally increasing at s^R if and only if producer profits are marginally increasing at s^R and vice versa. The retailer's private standard thus moves in the direction preferred by producers.

The intuition behind the previous result is that if producer profits are marginally increasing at s^R , producers have an incentive to make side payments such that the retailer sets a higher private standard ($s^R < s^{RP}$). If $s^G < s^R$, then the private standard with side payments is further away from the public standard ($s^G < s^R < s^{RP}$). On the other hand, if $s^R < s^G$, i.e. if the retailer does not impose a private standard in the absence of side payments, producers' side payments may induce the retailer to set a private standard at a higher level than the public one, i.e. $s^R < s^G < s^{RP}$.

Conversely, if producer profits are marginally decreasing at s^R , and if the private standard without side payments is more stringent than the public standard ($s^G < s^R$), producers have an incentive to make side payments to the retailer to lower its private standard. These side payments reduce the level of the private standard set by the retailer ($s^{RP} < s^R$) and the private standard is set closer to the government's optimal public standard. If the side payments are sufficiently large, they may even prevent the retailer from setting a private standard. In that case, the standard that governs the market is the public standard s^G , and retailers receive side payments equal to $\Pi^P(s^G) - \Pi^P(s^R)$. If side

payments would not be allowed, the standard that governs the market would be s^R since $s^G < s^R$.

In summary, side payments bring the retailer's private standard closer in line with producer interests. The private standard with side payments s^{RP} will be higher than s^R if producer profits are marginally increasing at s^R , and lower if producer profits are marginally decreasing at s^R . Depending on circumstances, side payments may even reduce the private standard below the public standard, or may lead to the emergence of a private standard higher than the public standard where no such private standard existed before.

Conclusions

It is well documented that retailers' private standards are increasingly important in the global economy. Empirical evidence shows that these private standards are frequently more stringent than their public counterparts. Previously this phenomenon has been explained as the result of vertical differentiation or strategic standard setting to preempt public standards. This article provides an additional explanation which emphasizes that modern supply chains, particularly in agri-food but also in other sectors such as textiles, often consist of a large number of small producers supplying an intermediary with considerable market power. Under certain conditions, producers may use their political power to lobby for lower public standards, while the intermediary may use its market power to impose a higher private standard.

To focus on the role of intermediaries' market power in a private standard setting, we constructed a model in which a monopolist retailer acts as an intermediary between

consumers and producers. The quality characteristics of the product are regulated by a standard set by the government, while the retailer is able to introduce its own standard regulating the same characteristics. We assume these standards have intrinsically the same effects: a standard increases consumer utility, while it also increases costs for producers. We demonstrate that only under very specific circumstances the retailer's optimal private standard is also optimal from both the consumers' and producers' perspective. In any other case, the market players' interests differ.

We assume that the government's choice of public standard is influenced by interest groups. By comparing the retailer's optimal private standard to the government's optimal public standard, we show that several factors may cause the private standard to be more stringent than the public one. If producers receive a smaller compensation for an increase in the standard (which implies, *ceteris paribus*, that they bear a larger share of the implementation costs) and if producers have more political power, or if the utility gain to consumers of a higher standard is lower and/or if the implementation costs to producers are larger, the public standard is more likely to be lower than the retailer's private standard.

Given the conflict of interest between producers and the retailer, producers could offer side payments to induce the retailer to bring its private standard more in line with producer interests. These side payments do not affect the public standard, but they do change the retailer's optimal private standard. Side payments will increase the private standard if producers want a higher standard than the retailer, and vice versa. If producers want a lower standard, side payments may in extreme cases even induce the retailer to refrain from setting a private standard; if producers want a higher standard, side payments

may lead to the emergence of a private standard above the level of the public standard where none existed before.

Throughout, we have assumed that the intermediary is a monopolist on the consumer side and a monopsonist on the producer side. A different variation on the framework developed here would be to relax the assumption of market power on one side of the market only, or on both sides. It is straightforward to extend our analysis to the case where the retailer is a price taker on the consumer side but has monopsony power on the producer side, or the case where the retailer has market power over consumers but not over producers. In both cases, if the retailer is able to impose a private standard, there remains a conflict of interest among market players, and our results remain qualitatively the same.

Under the assumption that the retailer has no market power on either side, the results of the model would be equivalent to assuming the absence of any intermediary. The analysis would then follow that of Mérel and Sexton (2012), who study the optimal quality standard for a producer organization managing a geographical indication. Using specific functional forms for demand and costs, they show that the producer organization has an incentive to oversupply quality. Importantly, their assumption on the cost function is equivalent to the assumption of counter-clockwise rotations in supply, which we have shown to indeed increase producer surplus. Thus, their analysis confirms the implications of our model applied to the same context.

The assumption of a *single* intermediary with market power offers a tractable way of studying the implications of market power in the context of private standards. In reality, while the intermediaries in many sectors (e.g. retail) are typically highly

concentrated, the market structure is often better characterized as an oligopoly/oligopsony rather than as a monopoly/monopsony (Sexton et al., 2007). Relaxing our assumption of a single intermediary would however lead to a number of analytical challenges. Multiple intermediaries would vertically differentiate to reduce competition on the consumer side. To study the effects of vertical differentiation, more specific assumptions are needed about the structure of demand (e.g. using the standard vertical differentiation framework of Mussa and Rosen, 1978) and about the type of competition (e.g. Bertrand vs. Cournot competition) between intermediaries. The present analysis by contrast has the benefit of using only minimal assumptions about functional forms. Moreover, if different intermediaries set different quality levels, producers must choose with which intermediary to interact. Since different quality levels imply different costs, this might give rise to a segmentation of producers similar to the segmentation of consumers on the demand side.²³ The political game to determine the public standard would become more complex as a result, and is left for future research.

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Appendix

This appendix demonstrates that our assumption of politically unorganized consumers is not essential to our results. If we were to assume that consumers are organized and have a relative lobbying strength of α^C , the government's FOC would be

$$\alpha^P \frac{\partial \Pi^P(s^G)}{\partial s} + \alpha^C \frac{\partial \Pi^C(s^G)}{\partial s} + \alpha^R \frac{\partial \Pi^R(s^G)}{\partial s} + \left[\frac{\partial W(s^G)}{\partial s} \right] = 0$$

Using Equation (19) this can be rewritten as

$$\beta^P \frac{\partial \Pi^P(s^G)}{\partial s} + \beta^R \frac{\partial \Pi^R(s^G)}{\partial s} + \left[\frac{\partial W(s^G)}{\partial s} \right] = 0$$

where $\beta^P = \frac{\alpha^P - \alpha^C}{1 + \alpha^C}$ and $\beta^R = \frac{\alpha^R - \alpha^C}{1 + \alpha^C}$ denote the lobbying strength of respectively producers and retailers relative to consumers. This condition is equivalent to Equation (23).

The intuition is that the government maximizes a weighted sum, so what matters is not the *absolute* weight assigned to different lobbying groups but rather the *relative* weights. It is therefore always possible to normalize the bargaining weights. Our assumption that consumers have no bargaining strength is merely one way to arrive at such a normalization, so one could interpret α^P and α^R as the relative bargaining strength of producers and retailers relative to consumers.

Figures

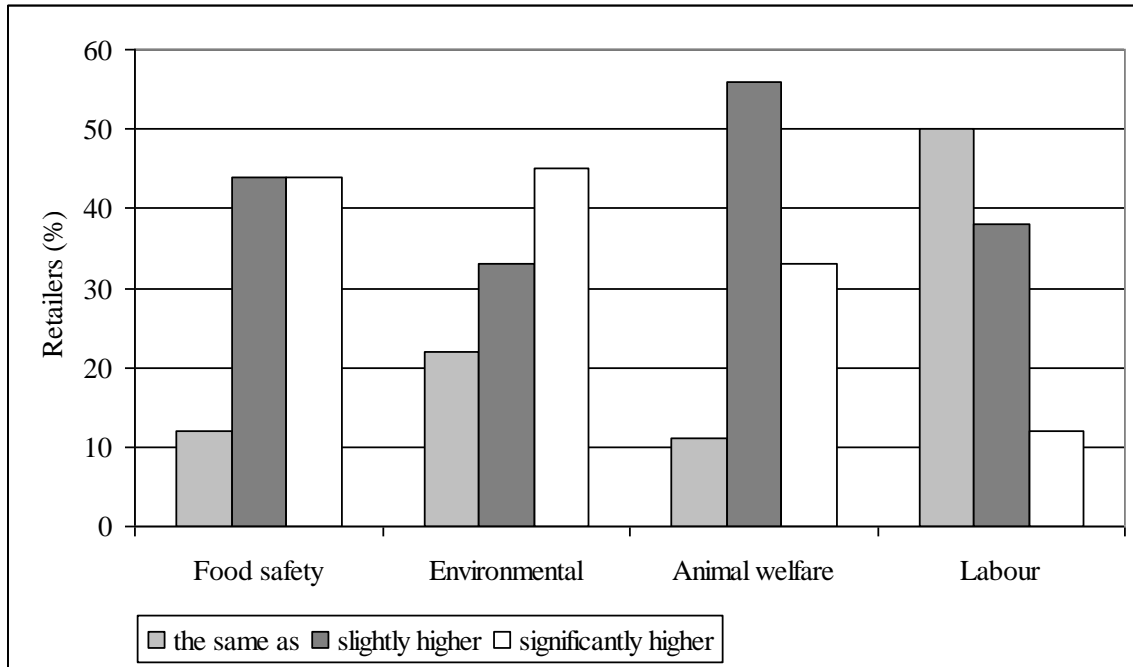


Figure 1. Retailers' self-assessed standards compared to those of government

(Source: Fulponi 2007)

Endnotes

¹ Instead of introducing private standards, a firm may favor the imposition of a public standard that applies to all firms, for instance if compliance is more costly for its rivals (Salop and Scheffman, 1983), if regulation increases marginal costs more than average costs (Maloney and McCormick, 1982), or if the standard imposes larger costs on foreign firms than on domestic firms, in which case standards can be used as protectionist instruments (Swinnen and Vandemoortele 2008, 2009, 2011).

² In the explanation of McCluskey and Winfree (2009), public standards are imposed (even though preempted by private standards) but at equal or higher levels than private standards.

³ We thank one of the anonymous referees for pointing this out.

⁴ One notable exception are geographical indication standards set by producer organizations (Mérel and Sexton, 2012).

⁵ We denote the third party as the ‘retailer’, but this market player may be any intermediate between producers and consumers, e.g. a processing firm. For our analysis, the third party’s relevant characteristics are that it acts as an intermediate between producers and consumers, and that it has some market power in exercising its function.

⁶ Both Nike and Apple are members of the Fair Labor Association (FLA), a private standard-setting organization which monitors members’ compliance with the FLA Workplace Code of Conduct.

⁷ In the remainder of the article, subscripts denote partial derivatives to x or s , and superscripts refer to consumers C , producers P , the retailer R , social welfare W , or the government G .

⁸ This assumption implies that the demand curve is linear. While this does not fundamentally affect our results, this assumption simplifies the exposition. The third derivative of the utility function does not have a straightforward intuitive meaning in our setting and it is not clear a priori whether this derivative should be negative or positive. Assuming u_{xxx} to be zero thus seems a reasonable simplification.

⁹ Since in equilibrium consumption equals output, we use the same symbol x for both output and consumption.

¹⁰ As with the analogous assumption for utility, this assumption implies that the supply curve is linear, which simplifies our exposition without fundamentally altering the results.

¹¹ Since utility is concave and costs are convex, the denominator in both terms of Equation (15) is always positive.

¹² If $u_{xxs} < 0$ ($u_{xxs} > 0$) an increase in the standard rotates the inverse demand function clockwise (counterclockwise), implying that the standard has a stronger (weaker) positive impact on utility derived from the first units of consumption. Likewise, if $c_{xxs} > 0$ ($c_{xxs} < 0$) an increase in the standard rotates the inverse supply curve counterclockwise (clockwise), implying that the higher standard raises marginal costs disproportionately more (less) at higher output levels – in other words, the standard raises marginal costs faster (slower) than average costs.

¹³ The efficiency gain u_s can be rewritten as $u_s = \int_0^{x^*(s)} u_{xs} dx + u_s(0, s)$. The integral equals $u_{xs}x^*(s)$ for parallel shifts in demand ($u_{xxs} = 0$), while $\int_0^{x^*(s)} u_{xs} dx > u_{xs}x^*(s)$ for clockwise rotations of demand ($u_{xxs} < 0$) and $\int_0^{x^*(s)} u_{xs} dx < u_{xs}x^*(s)$ for counterclockwise rotations of demand ($u_{xxs} > 0$).

¹⁴ The implementation cost c_s can be rewritten as $c_s = \int_0^{x^*(s)} c_{xs} dx + c_s(0, s)$. The integral equals $c_{xs}x^*(s)$ for parallel upward shifts in supply ($c_{xxs} = 0$), while $\int_0^{x^*(s)} c_{xs}(x, s) dx > c_{xs}x^*(s)$ for clockwise rotations of supply ($c_{xxs} < 0$) and $\int_0^{x^*(s)} c_{xs}(x, s) dx < c_{xs}x^*(s)$ for counterclockwise rotations of supply ($c_{xxs} > 0$).

¹⁵ Lutz *et al.* (2000) and McCluskey and Winfree (2009) assume that firms are the first movers in the standard-setting process, whereas other articles on minimum quality standards (such as Leland 1979; Ronnen 1991; Valletti 2000; Boom 1995) typically assume the government to be the first mover in setting minimum quality standards.

¹⁶ This condition reflects that the standard which effectively regulates the market is $s = \max\{s^G; s^R\}$. As second-mover, the retailer has no incentive to set a private standard lower than the public one, s^G , even if the retailer's optimal private standard is lower than the public standard. Hence, the retailer sets its private standard either at a higher level than or equal to the government's public standard (which is given at this stage), or the retailer refrains from setting a private standard.

¹⁷ Our assumption that consumers are not organized is not essential to the results, as we demonstrate in the Appendix, but it simplifies the exposition.

¹⁸ 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 model this implies that lobby groups set their lobbying contributions in accordance with their expected profits and how these are marginally affected by the public standard. We refer to Swinnen and Vandemoortele (2011) for a proof of the truthfulness of these contribution schedules. The contribution schedules are conditional on $s \geq s^R$ to reflect that the standard which effectively regulates the market is $s = \max\{s^G; s^R\}$. Contributions in favor of a public standard lower than the optimal private standard have no effect on the standard that regulates the market (s^R), and thus have no impact on the interest groups' profits. Hence contributions in the interval $s < s^R$ would not be truthful and therefore the contribution schedule is restricted to $s \geq s^R$. However, because the government moves first in setting its public standard, this restriction of the contribution schedules does not imply that the government is not able to set a public standard in the interval $s < s^R$.

¹⁹ Because the retailer is a monopolist, strong interactions between the government and the monopolist may exist. In the extreme case that the retail sector is a 'state monopoly' and that the government is only concerned with the state monopoly's profits (i.e. the monopolist retailer's profits), the public standard would be set at the retailer's optimal private standard and the government's optimal public standard would coincide with the retailer's optimal private standard. Our assumption that the monopolist has some positive political power α^R – which could be large – is less extreme.

²⁰ Naturally, these same factors – in opposite direction – lead to the reverse situation where the retailer's optimal private standard is less stringent, i.e. $s^R < s^G$. However, this

situation is not relevant since a private standard is redundant if less stringent than the public standard. Because the retailer moves second in setting its private standard, the retailer has no incentive to set a private standard that is lower than the public one. Hence, either the retailer sets its private standard at a higher level than the government's optimal public standard, or the retailer refrains from setting a private standard. As a consequence, the same factors as the ones we discuss (but in opposite direction) explain the absence of private standards in specific markets.

²¹ Our formal treatment ignores the question of how side payments are implemented in practice. For instance, the retailer and the producers might sign a contract stipulating the private standard, the producer price, and a lump-sum side payment made by the producers. Such two-part tariffs are a common feature of vertical relationships in developed economies (see e.g. Rey and Vergé, 2008). For simplicity, we assume producers' compensation to the retailer takes the form of a payment similar to the contributions made to politicians.

²² The standard that effectively regulates the market is now $s = \max\{s^G; s^{RP}\}$, and again the retailer has no incentive to set a private standard that is lower than the public one.

²³ In the model of Von Schlippenbach and Teichmann (2012) the duopolist retailers do not compete on quality; at most, their outputs are horizontally differentiated but not vertically. Thus, their model only looks at the producer side of the market. Moreover, while they show that a minimum quality standard can improve welfare, this standard is not set endogenously as in our model.