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Indirect influence, lobbies interdependence and ecological protectionism

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Abstract

This paper analyzes the setting of sustainability standards, such as those recently implemented in Europe and in the United States, as a political compromise pressured by the lobbying of competing industries and under the indirect influence of ecologists. Using a common agency model of lobbying, we extend the Yandle's theory of 'Bootleggers and Baptists' of interdependence between interest groups. Paradoxically, the indirect and information-based influence of ecologists can lead to a less constraining standard. We show, in a context of trade liberalization, that this influence leads nonetheless to a tightening of standards in large countries.

Key words: informational lobbying, indirect influence, common agency, sustainability standard, environmental regulation, biofuels

JEL Classification: D72, F18, Q28

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1 Introduction

The rise of oil prices, the battle against climate change and the willingness to advance economic development in rural areas have led policy makers to promote the production and use of biofuels worldwide.[1] In order to support the production of biofuels, countries have adopted a panel of policy regulations ranging from subsidies to tariff. According to the International Food and Agricultural Policy Council (IPC), US subsidies of biofuels amounted to US$7 billion a year, compared to nearly US$5 billion in the European Union (Robbins, 2011). Domestic biofuels industries are also protected from foreign competition. For instance, the European Union and the United States have imposed import duties and other restrictions on foreign bioethanol, biodiesel and their agricultural inputs. Concerning the bioethanol imports, 45 per cent of the European imports in 2005 were under the MFN (Most Favored Nations) regime, with an import tariff equivalent to a 63 per cent ad valorem tariff. The United States charge a 2.5 per cent ad valorem tariff (Walter et al., 2007). In addition, the European biodiesel market is protected by a low ad valorem import tariff of 6.5 per cent (Doornbosch and Steenblik, 2007). Nevertheless, several scientific studies have warned that promoting biofuels may result in negative ecological impacts, such as changing land use patterns and inducing additional greenhouse gas (GHG) emissions (EEA, 2006; JRC/IES/CONCAWE, 2007). In the second half of the 2000s, the U.S. and E.U. thus set out environmental standards on biofuels, based on production methods. In 2007, the U.S. revised the Renewable Fuels Standard (RFS-2) requiring that the production and use of ethanol release 20 per cent less greenhouse gas than gasoline (Lawrence, 2010). In 2008, the EU passed the Renewable Energy Directive (RED) requiring that biofuels must contribute at least 35 per cent less carbon emissions than fossil fuels and that they do not originate from land with either high biodiversity value and/or high carbon stock such as forests and wetlands (Swinbank, 2009). The Renewable Energy Directive sets out sustainability criteria so that biofuel production cannot threaten biodiversity or compromise production of food, thus raising the environmental

[1] In 2008, the two leading ethanol producers were the United States and Brazil, representing 91 per cent of the world production (FAPRI, (2009)). As far as the world biodiesel production is concerned, the E.U. produces about two-thirds of it, with Germany, France, Italy and Spain being the top E.U. producers.

sustainability requirements for importation of biofuels and materials to the European market.[2] Interestingly, when biofuels were initially introduced, they seemed to provide significant GHG emissions benefits and environmentalists supported them. However, the perspective of environmentalists on biofuels has changed since 2007. Many studies doubted the biofuels' contributions to GHG emissions reductions and the suggestion that biofuels may lead to deforestation have led environmentalists to hold negative attitudes towards first-generation biofuels, while holding more positive ones about second-generation biofuels. Indeed, first generation biofuels, especially corn-based ethanol, are increasingly controversial. For instance, critics have warned that fertilizer required to grow these crops worsens water pollution (EWG, 2008) and that corn-based ethanol actually generates as much or more greenhouse gas emissions as gasoline from fossil fuels (Farell et al., 2006). Aiming at improving the environmental conditions of biofuels production process, these sustainability standards were unsurprisingly demanded by ecologist groups such as the Natural Resources Defense Council in the U.S. (Lawrence, 2010), the WWF and Transport & Environment in Europe (T&E, 2009; WWF, 2006, 2007). In 2006 and 2007, the WWF welcomed the blending objectives of the RED directive proposal specifying that by 2020, biofuels will represent 10 per cent of road transportation fuel consumption. It also supported sustainability standards, explaining that compliance with them is a fair and necessary condition if one wants imported biofuels to be eligible for tax exemptions and other support policies implemented in Europe. The WWF (2006) also considered that sustainability standards are compatible with WTO imports regulations.

Such evolution of environmentalists' attitude towards biofuels promotion draws the attention on their ability to affect the environmental policy making through indirect political influence. Here, indirect political influence refers to informational lobbying (Austen-Smith, 1997). Interest groups try to influence the government through persuading the public opinion. They send information and messages through the mass media in order to gather enough political support in favor of a specific issue.[3] Hillman and Hitt (1999) name 'constituency building' such a lobbying

[2] The reader may refer to the original document at:
http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:EN:PDF.

[3] Although environmental groups engage in direct influence through campaign contribution, most of their activism rely on direct mailing, organizing political protests and educating the public. The National Audubon Society, for example, sends millions of letters each year through direct mailing (Mitchell et al., 1992). The recent revolution in communication technology has also a huge impact on the way that interest groups communicate with the public.

strategy in which political decision makers are targeted indirectly by working through individual constituents or voters.

Sustainability standards were also supported by industry and farm groups, consumer associations and unions, but for different motives, thus raising ambiguity regarding the true purpose of the policy (Lawrence, 2010). Bureau et al. (2009) explain that decisions favoring local biofuels production were motivated, in Europe at that time, by the objective of maintaining farmers' revenue, compensating the export subsidies reductions imposed by the WTO, and also by the prospect of further trade liberalization under the Doha Round of multilateral negotiations.

The European Parliament's industry committee, representing the voice of industrial interests, even pushed for more ambitious sustainability criteria (Swinbank, 2009). A likely explanation for these positions is that sustainability standards could compensate a lack of competitiveness. Indeed, on U.S. and European markets, domestically produced biofuels are less competitive than those imported from Latin America and Southeast Asia. Bruhwiler and Hauser (2008) explain that, thanks to its geographical conditions and cheaper labor, Brazil has a clear cost advantage. As an example, they estimate that U.S. production costs of ethanol are about 150 per cent higher than the Brazilian equivalent, and Europe's costs are significantly higher. Erixon (2009) adds that European biodiesels production, based on rapeseed growing, was particularly in need of further protection in the 2000s because it was relatively less supported than ethanol production and was suffering from international competition. Indeed, according to Smeets and Faij (2010), sustainability standards are more costly for producers located in emerging countries than for their American and European counterparts. For example, costs could be raised by 42 per cent in Brazil. This unequal treatment helps to understand why, in December 2009, Indonesia and Malaysia objected to the introduction of sustainability criteria in the RED directive and threatened to file a case to the WTO against the EU. These countries denounced this provision as a Non-Tariff-Barrier only aimed at restricting imports of palm oil for biofuel production, and in order to support even further the domestic production of rapeseed oil (Junginger et al., 2011).

E.U. and U.S. biofuel policy seem to be an example of how trade policy has moved away from tariffs towards subsidies and in the direction of sustainability standards where the latter may be strategically supported by interest groups willing to get trade protection on their domestic market. Besides, Erixon (2009) points out that for the protectionist-leaning government, such

measures are more appealing because there are fewer and weaker WTO disciplines on standards than there are for tariffs. In addition, the rules of WTO which are anterior to the emergence of the biofuels industry create a favourable institutional context leading to such *ecological protectionism* (Vera 2008).

In this paper, we provide a political economy model aiming at addressing current trends in biofuel policies, and especially the emergence of sustainability standard for biofuels production. Formally, we analyze the strategic use of an environmental standard regulating the production externality of two biofuels industries that compete for direct political influence, and in presence of the indirect information-based influence of an ecologist group. The rest of the paper is organized as follows: Section two provides a brief literature review. Section three presents the economic framework which is a duopoly with a domestic industry and a foreign one producing the same good (an equivalent biofuel) in two different countries. They compete in a same domestic market which is protected by an import tariff, whereas the foreign industry has lower production costs (this fits the case of Brazilian producers willing to export to Europe, for example). The fourth section develops the political model based on the common agency model of lobbying (Grossman and Helpman, 1994). Biofuels industries are represented by lobbies with opposed trade interests and an ecologist group is concerned with the production externality in both countries, behaving like super green (Hillman and Ursprung, 1994). Our political model analyzes the setting of a sustainability standard by the domestic country, as a political compromise pressured by the two industries' lobbying, and under the indirect influence of the ecologist group. In the tradition of Buchanan and Tullock (1975), we assume that the domestic industry lobby for a sustainability standard that matches its production technology and that raises the production costs of the foreign industry only. In the fifth section, we show how the equilibrium standard deviates from its socially optimal level depending on the level of indirect influence of the environmentalists. We also investigate how the dynamic of the equilibrium standard responds to the relative lobbying efficiency of the two industries. In addition, we derive specific conditions under which interest groups' influence is not socially distortive. The results primarily lay on the interaction between direct lobbying and the ecologists' indirect influence. In the sixth section we investigate the effects of trade liberalization, and we show that for a large

country, when indirect influence is strong, trade liberalization leads to tighten the standard and soften it for a small country. Section seven concludes and discusses the results.

2 Literature review

Studies have analyzed the strategic use of environmental policy for trade purpose, such as Fisher and Serra (2000), Tian (2003), Greaker (2006) and Essaji (2010) among others. However, these authors do not consider the influence of interest groups on environmental regulation, as it was initiated by Buchanan and Tullock (1975). Our work is related to previous ones by Anderson et al. (2004), Bommer and Schulze (1999), Fredriksson (1999) and Lai (2006) who model the influence of interest groups' lobbying on the design of environmental policy in the context of trade liberalization.[4] Discussing the case of genetically modified organisms, Anderson et al. (2004) analyze, like us, the choice of environmental standards when domestic and foreign lobbies compete for influence. However, they consider a consumption externality and no environmental groups. This is different from Bommer and Schulze (1999) and Fredriksson (1999) who include environmental interests in the lobbying model and focus on the environmental regulation of a production externality. However, their lobbies are only local. In addition, in Bommer and Schulze (1999), the environmental groups do not explicitly and actively lobby, but are integrated in the political economy model through their utility function that is considered an argument in the political support function of the regulator. This approach does not permit an analysis of the interdependence between pressure groups which is our purpose here. Close to our study is Lai (2006) who analyzes the choice of an environmental standard when ecologist and foreign industry lobbies are competing for political influence. There are, nonetheless, two major differences. Lai (2006) considers a consumption externality and environmental groups behave like industry lobbies by offering money contributions in order to influence an incumbent government.

Our approach follows and draws from Yu (2005) who develops a model of direct and indirect political influence on environmental policy making. Like him, interdependence effects between

[4] Note that the literature on the political economy of biofuels is at his early stage (Zilberman et al. (2014), as such, our contribution extends the literature on strategic use of environmental policy for trade purpose.

direct and indirect lobbying are the main focus of the paper, but we analyze it in a different framework. Whereas Yu considers direct and indirect influences exerted by one industry lobby and one ecologist group that are opposed, we consider two industries that are opposed and an ecologist group that is implicitly supportive of one of the industries. In addition, we assume that industry lobbies and the ecologist group implement different lobbying strategies, as the latter exerts indirect political influence, whereas the former specializes in direct lobbying and offer political campaign contributions.[5]

Likewise, we analyze the interdependence between the direct lobbying of industries and the indirect influence of ecologists and this approach draws from Yandle's theory of 'Bootleggers and Baptists' (B&B theory) (Yandle, 1983, 1984, 1989; Shogren, 1990). Bootleggers are rent-seekers for themselves, whereas Baptists are concerned with social welfare, and both form an uneasy coalition supporting the same regulation, but for different motives. The Baptists have a perceived moral mandate and their lobbying acts as a smokescreen (Shogren, 1990) that benefits the Bootleggers by hiding (from the public's perception) their private rent-seeking objective. This also benefits politicians by giving a public interest justification to their regulation and thus lowering suspicion of special interest favoritism.

In our case, Bootleggers are represented by the domestic industry, and the ecologists, concerned with the side effects of biofuels production, refer to the Baptists. All groups exert political influence in the domestic country. The ecologist group and the domestic industry lobby both support high environmental standards. The former expects that this will be detrimental to production and pollution abroad as well as in the home country. The latter, seeking to get trade protection, expects that this will discourage foreign production of biofuels. The foreign industry lobby supports low standards as it is willing to export more. Such formalization of interest groups coalition have been the focus of many influential scholarly contributions. For instance, Shogren (1990) formalizes the interdependence between Bootleggers and Baptists, assuming that the former subsidize the latter. Hillman and Ursprung (1994) have a similar approach in which protectionist industry groups subsidize ecologists, and thus instrument their lobbying. Here, we

[5] As Yu (2005) pointed out, most environmental groups, however, do not make political contributions. Although some make political contributions, the amount is very small relative to their budget. For instance, in the election cycle of 1990 the Sierra Club, the biggest environmentalist donor that regularly makes political donations, donated U.S.$ 410,651, which is less than 6 per cent of its budget for that period.

assume that there is not such cross-subsidization. Ecologists exert indirect influence (informational lobbying, constituency building) and this benefits implicitly the domestic industry lobby. Similar to our approach, Feldmann and Bennedsen (2006) model interest groups that influence political decision-makers by offering contributions and by providing relevant information that sways the decision in the group's favor. They show that an information externality raises the cost of offering contributions and show that this indirect search cost reduces the group's incentive to gather information when contributions are allowed. However, our modelling shows that the information disseminated by ecologists benefits the domestic industry lobby as it gives him incentives to reduce its political contribution.

3 The economic framework

Following Fisher and Serra (2000) and Essaji (2010), we consider a model with two countries and two competing industries producing the same good. It is produced by a foreign industry in a quantity *x*, and by a domestic industry in a quantity *y*, and such that the total quantity available on the domestic market is $q = x + y$. This means that the foreign industry exports all its output and the domestic industry doesn't export at all.[6] The domestic country is populated by N identical consumers and such that each individual is endowed with one unit of labor.

The utility function of a representative consumer is given by:

$$U = u\left[q^i\right] + Z - \mu\,(m)\frac{L(\theta)}{N} \tag{1}$$

With $\mu\,(m)\frac{L(\theta)}{N}$ representing a perceived disutility function and q^i the individual consumption of the good at price p. We assume that consumers are indifferent regarding the origin of the good. The aggregate consumption in the home country is therefore $q = \sum_i^N q^i = Nq^i = x + y$. Z is the consumption of the numeraire good with the world and domestic prices equal to one. The good is desired and consumed for environmental motives, such as mitigating greenhouse gas

[6] This assumption is for ease of the presentation. In addition, in Europe, the production of biofuels is oriented towards domestic consumption. We could alternatively assume that the foreign industry also produces for its home market, and with a strict independence with the export oriented production.

emissions in the case of biofuels. However, its local production has, in both countries, side effects that are environmentally and socially harmful, and these side effects are imperfectly perceived by consumers. Depending on their level of knowledge of the issue, individuals have a disutility $\mu\frac{L}{N}$. that has two arguments, μ and L. The first argument, μ, is the perception level of the harmful side effects, with $\mu \in [1; +\infty[$, and it is increasing in the quantity of information *m* delivered by environmental groups, such that $\mu = \mu(m)$, with $\frac{\partial \mu}{\partial m} > 0$ and $m \in [1; +\infty[$. The second argument, *L(θ)* is a decreasing function of the 'sustainability' standard θ. It is set by the domestic government in order to address the negative production externalities occurring in both countries. θ is treated as a continuous variable with $L_\theta = \frac{\partial L}{\partial \theta} \leq 0$ capturing the fact that when θ increases, the perceived disutility decreases. Ecologists produce and diffuse information through their activism in order to draw public opinion and to change its perception about an environmental issue (the side effects of biofuel production) and the effectiveness of sustainability standards. Their ultimate purpose is to influence, indirectly, public authorities and their decision making. For this purpose, ecologists inform, educate and leverage public opinion by releasing information and advertising through mass media (Yu, 2005). When the ecologists are active, consumers become more informed about the side effects of biofuels production (μ increases) and therefore more sensitive to the effect of θ on $L(\theta)$ such that $L_\theta \leq 0$.[7] There is no limit in *m* as we assume that ecologists may eventually try to exaggerate the issue or its consequences for strategic purpose, but this dimension is left outside the paper.[8] As the focus of the paper is the interdependence between direct and indirect lobbying, we model ecologist's behavior as exogenous for simplicity. The variables *m* and μ, are therefore given exogenously. If a production, either domestic or foreign, does not comply at least with the minimum standard, it cannot be imported and/or commercialized on the domestic market. We also assume that the

[7] This assumption captures the fact that the awareness of environmental policy and its effectiveness is mainly driven by environmental groups' public campaign. In support of this assumption, Delshad et al. (2010) provide, to our knowledge, the most updated study about public attitudes regarding specific biofuel technologies. Similarly, assessing European's public perception towards bioenergy, a recent survey showed that 72 per cent of the Europeans supported biofuels and 83 per cent supported the development of sustainable biofuels in Europe (Eurobarometer, 2010). This increasing support for sustainable biofuels is likely to be the result of environmentalist's public campaign towards the side effects of biofuels since 2007.

[8] For a discussion of strategic use of voter's ignorance about environmental issues by environmentalists, see Jaeck (2011). He shows that climate change regulations may be the result of environmental activists seeking to bias voter's beliefs over climate change issues.

minimum standard has no effect on the demand for the polluting good. There is a preexisting tariff, *t*, on the imports of the good *x*, and the domestic government rebates the revenue to each consumer through a lump sum transfer, $\frac{tx}{N}$, per capita. We assume that, *t*, is not prohibitive, and the foreign industry is not discouraged to export. The budget constraint of a representative consumer is given by $p\,q^i + Z = w + \frac{tx}{N}$, with w representing the individual labor income. Utility maximization on the part of a representative consumer requires that:

$$U'\left[q^i\right] = p(q) = K - vq, \text{ with } K > 0 \tag{2}$$

Equation (2) is the individual inverse demand function of the good, whatever its origin, with $v > 0$ and K representing the market size.[9] In the model, two industries are competing on this market, and similar to Fisher and Serra (2000) we assume that without sustainability standards the foreign industry enjoys a cost advantage. This assumption captures the fact that without sustainability standards, producers from developing countries are more efficient than E.U. producers (Bruhwiler and Hauser, 2008). However, the inclusion of sustainability standards affects differently the industries' marginal costs. The domestic and foreign industries have unit production costs c^d and $c^f(\theta)$ respectively, with $c^d > 0$, $c^f(\theta) > 0$ and $c^d > c^f(\theta)$ whatever θ is. The minimum standard θ, $\theta \in [0; \theta^m]$, raises the production cost of the foreign industry only, such that its marginal cost $c^f_\theta > 0$. This corresponds to a situation in which the standard is designed by the government so as to fit exactly the production technology of the domestic industry. Thereby, and given that the two competing industries have different production technologies, only the foreign one has to incur adaptation costs, whereas $c^d_\theta = 0$.[10]

Industries maximize their profit functions and solve the following problems:

$$\max_y \pi^d = p(q)y - c^d y \tag{3}$$

$$\max_x \pi^f = p(q)x - c^f(\theta)x - tx \tag{4}$$

[9] Following Tanguay (2001) and Essaji (2010) we assume that the demand structure is linear.

[10] Although studies have shown that sustainability requirements affect producers from both E.U. and developing countries, they are nonetheless much more detrimental to the latter (Smeets and Faaij, 2010). Therefore, to capture this unequal effect on production costs and for the ease of exposition, we assume that sustainability standards affect the foreign industry's marginal cost only.

With π^d and π^f representing the domestic and foreign industries' profits respectively. The first order conditions for the domestic and foreign industries, given the Cournot conjecture, are respectively:

$$P'(q)\,y + p(q) - c^d = 0 \tag{5}$$

$$P'(q)\,x + p(q) - c^f(\theta) - t = 0 \tag{6}$$

Fully differentiating (5) and (6) yields:[11]

$$\frac{\partial x}{\partial \theta} = x_\theta = \frac{(p'+\alpha)c^f_\theta(\theta)}{p'(p'+\alpha+\beta)} < 0 \tag{7}$$

$$\frac{\partial y}{\partial \theta} = y_\theta = -\frac{\alpha\, c^f_\theta(\theta)}{p'(p'+\alpha+\beta)} > 0 \tag{8}$$

$$\frac{\partial x}{\partial t} = x_t = \frac{p'+\alpha}{p'(p'+\alpha+\beta)} < 0 \tag{9}$$

$$\frac{\partial y}{\partial t} = y_t = \frac{-\alpha}{p'(p'+\alpha+\beta)} > 0 \tag{10}$$

Equations (7) and (8) show respectively that an increase in the standard reduces the foreign industry output and raises the domestic firm's output. Equations (9) and (10) show respectively that an increase in the tariff reduces the output of the foreign industry and raises the output of the domestic firm. Using the profit functions π^d and π^f given in (3) and (4) and the indirect demand function given in (2), we get the following equilibrium quantities:

$$x^* = \frac{1}{3v}(K - 2c^f(\theta) + c^d - 2t) \tag{11}$$

$$y^* = \frac{1}{3v}(K - 2c^d + c^f(\theta) + t) \tag{12}$$

[11] These results are obtained by applying the Cramer's rule, with $\alpha = p' + p''y < 0$ and $\beta = p' + p''x < 0$ and $p'(p' + \alpha + \beta) > 0$.

In the rest of the paper, for ease of presentation, we write $a = K - 2c^f(\theta) + c^d - 2t$, and $b = K - 2c^d + c^f(\theta) + t$, with $a \geq 0$ and $b \geq 0$, given that $x^* \geq 0$ and $y^* \geq 0$ necessarily. Using (11) and (12) to rearrange the indirect demand function, we obtain the equilibrium price as a function such that:

$$p(q) = \frac{1}{3}(K + c^f(\theta) + c^d + t) \tag{13}$$

Using this relation with (11) and (12) in the profit function, and taking the partial derivatives of profit functions, we obtain the following relations:

$$\frac{\partial \pi^d}{\partial \theta} = \pi_\theta^d = \frac{2b}{9v} c_\theta^f \tag{14}$$

$$\frac{\partial \pi^f}{\partial \theta} = \pi_\theta^f = -\frac{4a}{9v} c_\theta^f \tag{15}$$

From equations (14) and (15) we see that $\pi_\theta^d \geq 0$ and $\pi_\theta^f \leq 0$, meaning that an increase in the standard raises (reduces) the profit of the domestic (foreign) firm. Indeed, a rise in the standard raises the foreign firm's marginal cost, leading to a drop in its production and profit. By the same reasoning, the domestic firm's profit increases.

4 The political process

We assume that the formation of the sustainability standard θ is influenced by interest groups whereas the trade policy, t, is set exogenously. The domestic and foreign industries form distinct lobbies j, with $j = \{d; f\}$ that offer political contributions to the government. This money is for 'direct political influence' as it supports the electoral campaign for the reelection of an incumbent government. As a reward, lobbies expect to obtain a better access to the legislator (Grossman and Helpman, 1994). In our case, both industry lobbies are concerned with θ, but with opposed interests, and therefore, they compete for influence.

In addition, environmental interest groups exert an 'indirect political influence' (Yu, 2005), as we have already characterized it. They do it through their activism and information disclosure about the environmental side effects of biofuel production and about the effect of implementing a sustainability standard on production. Poorly informed consumers are sensitive to ecologists' activism and message and this rests on assumptions of information asymmetry and rational ignorance (Mueller, 1989).[12] Indeed, consumers use this disclosed information in order to form their disutility $\mu\frac{L}{N}$, as already mentioned. We assume that consumers are too numerous to overcome the free-rider problem and cannot coordinate a lobbying action. In order to analyze how industry lobbies' contributions impact the equilibrium sustainability standard, we use a common agency model of lobbying (Grossman and Helpman, 1994) which is a two-stages game. During the first stage, each lobby presents to the government a contribution schedule, $r(\theta)$, which is contingent upon the standard. In the subsequent stage, the government chooses the environmental policy and collects the political contributions.

The gross welfare function of each lobby group j, is the profit of the industry it represents, as expressed in relation (14) and (15). Each lobby tailors its contribution schedule so as to maximize its net welfare, which is the difference between its gross welfare and its contribution. Then, the government chooses the policy that maximizes a weighted sum of the aggregate domestic social welfare and of the contributions offered to him. Following Grossman and Helpman (1994), we assume that contribution schedules are globally truthful, as they reflect everywhere the group's true welfare (Bernheim and Winston, 1989). With this global-truthfulness assumption, the political equilibrium is the solution of a program in which the domestic government aims at maximizing an objective function which is the weighted sum of the aggregate domestic social welfare W and the lobbies' contributions. It is such that:[13]

$$max_\theta\, G = \varphi^d \pi^d + \varphi^f \pi^f + W \qquad (16)$$

[12] In line with the traditional assumption in a common agency setting, we assume that consumers are rationally ignorant about the side effects of biofuels production, as gathering information about such complex issues is costly. However, they are able to learn and they revise their beliefs under the influence of environmental groups' public campaign. In support of this assumption, Delshad et al. (2010) provide evidences about the influential role played by environmentalists in shaping public opinion concerning the side effects of biofuels technologies.

[13] Without the global-truthfulness assumption, the objective function of the government is $G = \varphi^d r^d + \varphi^f r^f + W$ .With the help of the global-truthfulness property, the original objective function can be rewritten as equation (16).

The parameter $\varphi^j \in [0,1]$ may be interpreted either as the weight attached by the government to the contribution it gets from lobbying group *j*, or as the lobbying efficiency of group *j* that is conditioned by exogenous factors such as political skills. Thus, φ^j represents the interest group's ability to influence policymakers. A higher value of φ^j means that the lobby *j* can better influence the government who, as a consequence, attaches a higher weight to the contribution offered by lobby *j*. We assume that interest groups can have different lobbying efficiencies (Gawande et al. 2006).[14] There is no reason here to presume that one group is more efficient than the other in terms of lobbying, and φ^d can be either greater or lower than φ^f. The domestic aggregate social welfare W has two components, the domestic industry's profit π^d and the consumers' aggregate welfare W^c which is such that:[15]

$$W^c = N\,u\left[\,q^i\right] - p(q)x - p(q)y + Nw + tx - \mu L(\theta) \tag{17}$$

The domestic social welfare function, W is thus:

$$\mathrm{W} = N\,u[x_i + y_i\,] - p(q)x - p(q)y + Nw + tx - \mu L(\theta) + \pi^d \tag{18}$$

Equation (18) shows that domestic social welfare is the sum of the consumer's surplus, labor income, tariff revenue, the domestic industry's profit, less the perceived environmental disutility. Solving the program (16) with respect to θ, we obtain the first-order condition of government optimization:

$$G_\theta = \varphi^d \pi_\theta^d + \varphi^f \pi_\theta^f + W_\theta = 0 \tag{19}$$

[14] As an illustration, Gawande et al. (2006) and Kee et.al (2007) have shown that foreign lobbies impact significantly the setting of tariffs and non-tariff trade barriers in the U.S.

[15] As we consider ecologist's influence exogenously given, we do not integrate ecologist's welfare in the aggregate social welfare function.

G_θ measures the change in the government's objective function induced by a marginal tightening of the standard θ. The second-order condition requires that this variation is decreasing in θ and such that $G_{\theta\theta} < 0$. The relation (19) contains a key characteristic of the model. Around the truthful equilibrium, a policy change induces a variation in each lobby's contribution that is exactly equal to the variation in this lobby's gross welfare. More specifically, a marginal increase in θ induces variations in the domestic and foreign industries' contributions by amounts of π_θ^d and π_θ^f respectively. In what follows, we define the marginal profits π_θ^f and π_θ^d as the foreign and domestic industries' marginal willingness to contribute (MWTC) for a marginal change in the sustainability standard θ. Since $\pi_\theta^d > 0$ and $\pi_\theta^f < 0$, the domestic industry's contribution increases with the standard as it seeks to enact barrier from competition and the foreign industry's competition decreases with the standard as it is willing to export more. Equation (19) states that the political equilibrium standard is chosen as a tradeoff between social welfare and political contributions from interest groups.

5 Political equilibrium policy

Our primary focus is to compare the two equilibria θ^* and θ^O. θ^* is the socially optimal standard which corresponds to an equilibrium when there are no direct lobbying nor indirect influence ($\mu = 0$). θ^O is the political equilibrium environmental standard when there is indirect and/or direct influence. Analyzing the deviation between θ^O and θ^* will provide us with a better understanding of the distortion resulting from direct and indirect political influence. Using (13), (14) and (18), we first set out the socially optimal standard which is the solution to the following first-order condition:

$$W_\theta(\theta^*) = -\frac{1}{3} c_\theta^f(\theta^*)\,(x + y) + t x_\theta - \mu L_\theta + \pi_\theta^d(\theta^*) = 0 \qquad (20)$$

The second order condition requires that $W_{\theta\theta} < 0$. Following a tightening of the standard, the first term in equation (20) measures the loss in consumer's surplus, the second term measures the decrease in tariff revenues, the third term reflects the reduction in the environmental disutility,

and the last terms represents the variation in the domestic industry's profit. The three first terms are the components of $W_\theta^c = \frac{\partial w^c}{\partial \theta}$ which is the marginal aggregate welfare of consumers following a change in the standard.

From (20), we get the domestic industry's marginal profit induced by a variation of θ around the social optimum. It is such that:

$$\pi_\theta^d(\theta^*) = \frac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) - tx_\theta + \mu L_\theta \qquad (21)$$

This is the domestic industry's MWTC for a change in θ around the social optimum θ*. It is interesting to observe that $\partial \pi_\theta^d \big/ \partial \mu = L_\theta < 0$. When ecologists' indirect influence increases, thus raising consumers' perceived disutility, the domestic industry's MWTC decreases. This is one of the underlying mechanisms at play that will help us to understand the interdependence between 'Bootleggers and Baptists'. In order to compare θ^O and θ^*, we analyze the relation (19) for $\theta = \theta^*$ and given the first order condition $W_\theta(\theta^*) = 0$, we obtain:

$$G_\theta(\theta^*) = \varphi^d \pi_\theta^d\,(\theta^*) + \varphi^f \pi_\theta^f(\theta^*) \qquad (22)$$

We must have $G_{\theta\theta} < 0$ as the second order condition. In (22), if $G_\theta(\theta^*)$ is positive (negative), the equilibrium standard is stricter (lower) than the social optimum. It is equal and $\theta^0 = \theta^*$ when $G_\theta(\theta^*) = 0$. If $\varphi^f = 0,\ \varphi^d > 0$, then $G_\theta(\theta^*) = \varphi^d \pi_\theta^d(\theta^*) > 0$. When the domestic firm is the only one lobbying actively, the equilibrium standard is superior than the optimal standard. If $\varphi^d = 0,\ \varphi^f > 0,\ G_\theta(\theta^*) = \varphi^f \pi_\theta^f(\theta^*) < 0$. When the foreign firm is the only one lobbying actively, the equilibrium standard is less than the optimal standard.

Thanks to the environmentalist's activism and information disclosure, consumers are better informed about the adverse effects of biofuels production, exhibiting a perceived disutility $\mu\, L(\theta)$ with $\mu \in [\,1; +\infty[$. They also become aware that a sustainability standard can mitigate

the environmental externality such that $L_\theta < 0$. We first consider that the two industry lobbies have the same political efficiency such that $\varphi^f = \varphi^d$.

Proposition 1: *When ecologists' indirect influence is active and industry lobbies have the same political efficiency, there is a critical level of ecologists' activism for which the lobbies' direct influence is not socially distortive.*

From equation (22), when $\varphi^f = \varphi^d$, the equation becomes:

$$G_\theta(\theta^*) = \varphi^f \left[\frac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) - tx_\theta + \mu L_\theta - \frac{4a}{9v} c_\theta^f(\theta^*)\right] \quad (23)$$

From (23), the sign of $G_\theta(\theta^*)$ depends on the sign of $\left[\frac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) - tx_\theta + \mu L_\theta - \frac{4a}{9v} c_\theta^f(\theta^*)\right]$ with $a = K - 2c^f(\theta) + c^d - 2t$. Therefore, when the market size is sufficiently small, meaning when $K < \frac{3}{4}\, v\,(x+y) + 2\,c^f(\theta) + c^d - 2\,t$, we have $[\frac{1}{3}\,(x+y) - \frac{4a}{9v}] > 0$ and we get $G_\theta(\theta^*) = 0$ for $\mu = \frac{c_\theta^f(\theta^*)\left[\frac{1}{3}(x+y) - \frac{4a}{9v}\right] - tx_\theta}{|L_\theta|} = \mu_1$.[16] Therefore when the level of indirect influence is such that $\mu = \mu_1$, the equilibrium standard equals the socially optimal one and the industries' direct influence is not socially distortive. The intuition behind this result lies with the industries' relative (MWTC) for a marginal change in θ. Indeed, under θ^*, the government has to balance the impact of strengthening the sustainability standard on the domestic industry's MWTC, $\pi_\theta^d(\theta^*)$ and the welfare of consumers, $W_\theta^c(\theta^*)$. Since $\pi_\theta^d(\theta^*) > 0$ and $W_\theta^c(\theta^*) = -\frac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) + tx_\theta - \mu L_\theta < 0$, $W_\theta(\theta^*) = \pi_\theta^d(\theta^*) + W_\theta^c(\theta^*) = 0$ is fulfilled.[17]

[16] Similarly, it is easy to show that for a large market size, $K > \frac{3}{4}\, v\,(x+y) + 2\,c^f(\theta) + c^d - 2\,t$, we have $[\frac{1}{3}\,(x+y) - \frac{4a}{9v}] < 0$ and we get $G_\theta(\theta^*) = 0$ for $\mu = \frac{-c_\theta^f(\theta^*)\left|\frac{1}{3}(x+y) - \frac{4a}{9v}\right| - tx_\theta}{|L_\theta|} = \mu_2$. Note that $\mu_2 < \mu_1$ suggesting that when the market size is small, a higher level of indirect influence is necessary to reach a socially optimal standard.

[17] Note that such condition holds for, $W_\theta^c(\theta^*) < 0$, namely for $\mu < \mu_3 = \frac{\left|-\frac{1}{3}(x+y)c_\theta^f(\theta^*) + tx_\theta\right|}{|L_\theta|}$ and we have $\mu_1 < \mu_3$. Similarly, it is easy to show that $\mu_2 < \mu_3$.

From equation (22), $G_\theta(\theta^*) = 0$ implies that $\pi_\theta^d(\theta^*) = \left|\pi_\theta^f(\theta^*)\right|$, the domestic industry's MWTC should exactly balance the foreign industry's one, this occurs for $\mu = \mu_1 = \frac{c_\theta^f(\theta^*)\left[\frac{1}{3}(x+y)-\frac{4a}{9v}\right]-tx_\theta}{|L_\theta|}$.

Corollary: *When the lobbies' direct influence is not distortive, the equilibrium standard deviates from its socially optimal level under the influence of ecologists' activism.*

As mentioned in proposition 1, the sign of $G_\theta(\theta^*)$ depends on the sign of $\left[\frac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) - tx_\theta + \mu L_\theta - \frac{4a}{9v} c_\theta^f(\theta^*)\right]$ with a = $K - 2c^f(\theta) + c^d - 2t$. For a market size that is sufficiently small, $K < \frac{3}{4}\, v\,(x+y) + 2c^f(\theta) + c^d - 2t$, we have $G_\theta(\theta^*) < 0$ for $\mu > \mu_1$.[18] In that particular case, the equilibrium standard is lower than the socially optimal standard. Indeed, from equation (22), $G_\theta(\theta^*) < 0$ when the domestic industry's MWTC is lower than the foreign industry's one, $\pi_\theta^d(\theta^*) < \left|\pi_\theta^f(\theta^*)\right|$. Such a result occurs for $\mu > \mu_1$. Indeed, recall that the indirect influence exerted by ecologists, enhances the domestic industry to reduce its contribution, $\partial\pi_\theta^d / \partial\mu = L_\theta < 0$, as previously mentioned. Therefore, in an initial context where the direct influence is not distortive ($\mu = \mu_1$), the ecologists' activism leads the domestic industry to contribute relatively less than the foreign one, and everything else being equal, the equilibrium standard becomes less constraining than the optimal one.[19] This result evidences the 'interdependence' occurring between the direct and indirect influences exerted by the domestic industry lobby and the ecologist's activism respectively. If the two interest groups share the same objectives, as it is assumed here, the domestic industry benefits from the ecologists' indirect influence through its effect on public opinion. This is an application of Yandle's B&B theory. Close to our result, Shogren (1990) models the interaction between groups practicing direct lobbying, and he underlines the 'moral caution' effect of one group over the other. This effect

[18] Similarly, when the market size is sufficiently large, $K > \frac{3}{4}\, v\,(x+y) + 2c^f(\theta) + c^d - 2t$, $G_\theta(\theta^*) < 0$ for $\mu > \mu_2$ and $G_\theta(\theta^*) > 0$ for $\mu < \mu_2$.

[19] Note that from (23) and noting $G_\theta(\theta^*) = \omega$, we have $\frac{\partial\omega}{\partial\mu} = \varphi^d L_\theta < 0$ everything else being equal, an increase in the ecologists' influence leads to a decrease in the equilibrium standard.

enables the industry lobby to gain higher political support and thereby, to reduce its money contribution, everything else being constant. However, contrary to Yandle's B&B theory that shows how environmental regulations may become more constraining, one of our results shows the opposite. This paradoxical outcome lies with the market structure in which the direct influence occurs. Indeed, in a duopoly context where the two lobbies have diverging interest, the ecologist's influence leads to a laxer standard as the drop in the industry lobby's contribution is not fully compensated by the ecologists' 'moral caution' effect, leading the foreign lobby to win the political battle. By analogy, the equilibrium standard is higher than the socially optimal standard, $G_\theta(\theta^*) > 0$ for $\mu < \mu_1$. In that case, when $\mu = \mu_1$, a reduction in ecologists' activism leads the domestic industry to contribute relatively more than the foreign one, and everything else being equal, the equilibrium standard becomes more constraining than the optimal one. Interestingly, these results have important implications as for the ability of the ecologist's influence to enhance the equilibrium standard converge to or diverge from the socially optimal one. Indeed, recall that $\frac{\partial \omega}{\partial \mu} = \varphi^d L_\theta < 0$, if the equilibrium standard is initially lower than the optimal one, an increase (a decrease) in the ecologists' influence exacerbates (enhances) the divergence from (the convergence to) the optimum.[20] Consequently, the interdependence between direct and indirect political influence will impact differently the political equilibrium depending on the initial distribution of the lobbies' political contributions.

We consider now the case where industry lobbies have different political efficiencies, such that $\varphi^f \neq \varphi^d$. In that context, we analyze how the relative political efficiencies affect the dynamic of the equilibrium standard. Combining (15) and (21) in (22) and noting $\Phi = \frac{\varphi^d}{\varphi^f}$ we get:

$$G_\theta(\theta^*) = \omega = \Phi\varphi^f\left[\tfrac{1}{3}\, c_\theta^f(\theta^*)\,(x+y) - tx_\theta + \mu L_\theta\right] + \frac{\varphi^d}{\Phi}\left[-\frac{4a}{9v} c_\theta^f(\theta^*)\right] \quad (24)$$

Proposition 2: *In a context of indirect influence, an increase in the domestic industry's relative political efficiency leads to a tightening of the equilibrium standard.*

[20] Similarly, if the equilibrium standard is initially higher than the optimal one, an increase (a decrease) in the ecologists' influence makes the equilibrium standard converge to (diverge from) the socially optimal level.

From equation (24), we get: $\frac{\partial \omega}{\partial \Phi} = \varphi^f[\frac{1}{3}\ c_\theta^f(\theta^*)\ (x+y) - tx_\theta + \mu L_\theta] + \frac{\varphi^d}{\Phi^2}[-\frac{4a}{9v}c_\theta^f(\theta^*)]$ and $\frac{\partial \omega}{\partial \Phi} > 0$, meaning that as the domestic lobby is getting more efficient relative to the foreign one, the equilibrium standard becomes more constraining, everything else being equal.[21] Two diverging mechanisms are at play here, and their conjunction explains the result. The first is the 'interdependence' effect, inducing a softening of the standard, as exposed in the corollary of proposition 1. The second mechanism is the gross effect of the rising political efficiency of the domestic lobby relative to the foreign one. It helps the domestic lobby to obtain a tighter standard, everything else being equal. The conjunction of these two mechanisms leads to a tightening of the equilibrium standard. Indeed the domestic lobby reduces his political contribution as it benefits from the interdependence effect ($\partial \pi_\theta^d / \partial \mu < 0$). However, the drop in his contribution is more than compensated by the rise in his political efficiency, and thereby, it obtains a more constraining standard.

6 The effect of trade liberalization

This section investigates the effect of a tariff cut on the sustainability standard. We assume that the domestic country is under the exogenous pressure of the WTO and is forced to lower its tariff on biofuels imports. For ease of the presentation, and without loss of generality, we assume that $L_{\theta\theta} > 0$ and $c_{\theta\theta}^f(\theta) = 0$. Under these assumptions one can obtain the second order condition of the government's optimization as:

$$G_{\theta\theta} = \frac{(\varphi^d + 8\varphi^f + 9)\left[c_\theta^f(\theta)\right]^2}{9v} - \frac{1}{3}\ c_\theta^f(\theta)\ (x_\theta + y_\theta) - \mu L_{\theta\theta} \qquad (25)$$

From equation (7) and (8) we get $|x_\theta| > y_\theta$, and therefore, $G_{\theta\theta} < 0$ if:[22]

[21] See proof proposition 2 in the appendix.
[22] Note that this relation fulfills the second-order conditions of the government's optimization.

$$\mu > \frac{\frac{\left(\varphi^{d}+8\varphi^{f}+9\right)\left[c_{\theta}^{f}(\theta)\right]^{2}}{9v} - \frac{1}{3}c_{\theta}^{f}(\theta)\,(x_{\theta}+y_{\theta})}{L_{\theta\theta}} = \mu_4 \quad (26)$$

Since $\frac{d\theta^O}{dt} = \frac{-G_{\theta t}}{G_{\theta\theta}}$, we need to know the sign of $G_{\theta t}$ so as to understand the effects of a change in *t* on the sustainability standard.[23] With $G_{\theta\theta} < 0$, $\frac{d\theta^O}{dt}$ and $G_{\theta t}$ have the same sign. Differentiating G_θ with respect to *t* and rearranging yields:

$$G_{\theta t} = Nx_\theta + \frac{1}{3}c_{\theta}^{f}(\theta)\left[\frac{1}{3v}(\varphi^d + 8\varphi^f + 9) - x_t - y_t\right] \quad (27)$$

Proposition 3: *In presence of a strong indirect influence of ecologists, in large countries, a tariff cut leads to a tightening of the sustainability standard. Conversely, the standard is less constraining in small countries. These results are independent from the lobbies' relative efficiency.*

The tariff cut impacts the equilibrium standard through an effect on the government's marginal benefit G_θ. This last effect has two components. The first corresponds to the term Nx_θ on the right hand-side of (27). This is a 'tariff revenue' effect and it is negative as a drop in tariff revenues raises G_θ, meaning that the government has a stronger incentive to tighten the standard. Note that the magnitude of this effect increases with the size of the population *N*, which measures country size. The second term $\frac{1}{3}c_\theta^f(\theta)\left[\frac{1}{3v}(\varphi^d + 8\varphi^f + 9) - x_t - y_t\right]$ is a 'quantity effect' that is positive given that $|x_t| > y_t$ and $(x_t + y_t) < 0$ from (9) and (10). This sign is independent from the lobbies' relative efficiency. The tariff reduction induces higher profits for the foreign industry, through a rise in its exports. This, in turn, reduces G_θ as the foreign industry is eager to lower its contribution for a lax standard, as long as its profits are high enough. This effect leads the government to lower the standard. The total effect of a tariff cut on G_θ, depends on the domestic country size (i.e. its population *N*).

[23] With $G_{\theta t} = \frac{\partial G_\theta}{\partial t}$ and $G_{\theta\theta} = \frac{\partial G_\theta}{\partial \theta}$. $\frac{dG_\theta}{dt} = G_{\theta t}\frac{dt}{dt} + G_{\theta\theta}\frac{d\theta^O}{dt}$ = 0 and therefore $dG_\theta = G_{\theta t}$ dt + $G_{\theta\theta}\, d\theta^O$ = 0.

When it is relatively small, $N < \frac{\frac{\left(\varphi^{d}+1\right) c_{f}'(\theta)}{9v}+\frac{8\left(\varphi^{f}+1\right) c_{f}'(\theta)}{9v}-\frac{1}{3} c_{f}'(\theta)\left(x_t+y_t\right)}{x_\theta}$, we have $G_{\theta t} > 0$ and the standard is relaxed as the tariff is cut. This is because the 'quantity effect' overcomes the 'revenue effect'. Indeed, the foreign industry may expect rises in its exports and profits thanks to the tariff reduction. However, these rises are constrained by the population' small size, and this motivates the foreign lobby to increase its 'political contribution' to obtain a less constraining sustainability standard, thus compensating the profit reduction due to the weak size of the population. The foreign industry contributes relatively more that the domestic one who is motivated to lower its own contribution given the strong indirect influence ($\mu > \mu_4$).

On the contrary, when N is large enough, $N > \frac{\frac{\left(\varphi^{d}+1\right) c_{f}'(\theta)}{9v}+\frac{8\left(\varphi^{f}+1\right) c_{f}'(\theta)}{9v}-\frac{1}{3} c_{f}'(\theta)\left(x_t+y_t\right)}{x_\theta}$, the standard is tightened as the tariff is cut. Indeed, the 'tariff revenue effect' overcomes the 'quantity effect'. The foreign industry's marginal willingness to contribute that would be necessary to maintain its profits at a high level, is reduced due to a larger population, and therefore, she contributes relatively less than the domestic industry. Note that this result is independent from lobbies' relative efficiency.

7 Conclusion

This paper has proposed a political economy model aiming at describing the recent emergence of sustainability standards for biofuels production in Europe and in the United States. Using a common agency model of politics (Grossman and Helpman, 1994), we have accounted for the direct lobbying of two industries with opposed interest (a domestic and a foreign one), and for the indirect influence exerted by ecologist groups through the information level of the public opinion. This latter assumption takes into consideration the impact of environmentalists' public campaigns against biofuels since 2007. Ecologists are concerned with a negative production externality (the side effects of biofuels production), whereas both industrial sectors compete on the same domestic market. In a context of unchanged trade policy, we showed that when the direct influence of industry lobbies is not distortive and the two lobbies hold the same political efficiency, the equilibrium standard may paradoxically

deviate from the socially optimal one and become less constraining. This counter-intuitive result is explained by the interdependence effect that we have evidenced between the direct and indirect influences exerted by the domestic industry and ecologists lobbies, respectively. When the two interest groups share the same objective, the domestic industry can reduce her direct lobbying effort as it is compensated by the ecologists' 'constituency building' over the public opinion (Hillman and Hitt, 1999) or their 'moral caution' (Shogren, 1990). This is an application of Yandle's 'Bootleggers and Baptists' theory as it enables the domestic lobby to benefit from the ecologists' indirect support, and to reduce his political contribution. The interdependence effect induces the domestic lobby to cut his contribution leading to a less constraining equilibrium standard. Indeed, as we modelled a duopoly context where the two lobbies have opposed interest, the drop in the industry lobby's contribution is not fully compensated by the ecologists' 'moral caution's effect, thereby enhancing the foreign lobby to win the political contest. Interestingly, this result has important implications concerning the ability of environmentalists' public campaign to reduce existing political distortions. Indeed, we showed that, depending on the initial balance of power between the industry lobbies, the ecologist's indirect influence may be fine-tuned adequately to reduce political distortions. In addition, we demonstrated the existence of a critical level of ecologists' activism for which the lobbies' direct influence is not socially distortive. Then, from the standpoint of the domestic lobby seeking to get protection from international competition, our results highlighted that increasing indirect influence may be detrimental, as it leads to a less constraining standard. However, we demonstrated that, in the presence of indirect influence, an increase in the domestic lobby's relative political efficiency compensates for the drop in his contribution, resulting in a more constraining standard. In a context of trade liberalization (tariff cut), we show that for a large country, the interdependence effect induced by the strong indirect influence does not lead to a less constraining standard as our previous analysis would predict, but to a more constraining one. This result occurs because, in that particular context, the drop in the foreign lobby's contribution outweighs the interdependence effect. On the contrary, in a case of a small country, the standard becomes less constraining due to the combined occurrence of the interdependence effect and the increasing foreign lobby's contribution.

Our analysis and its results improve the understanding of the impact of interest groups' lobbying, given its interdependences, on the making of trade related environmental policies. Our contribution fits the case of sustainability standards on biofuels adopted in the E.U. and the U.S., and that have been denounced as a hidden form of trade protection. First, proposition 2 provides an explanation for the emergence of sustainability standards in Europe. The latter may have been the result of increasing ecologists' indirect influence against biofuels production since 2007, in a context where European domestic lobbies have greater political skills compare to foreign ones. As such, this theoretical result opens the way for further empirical investigation. Second, proposition 3 predict that, in a context of growing indirect ecologists' influence, further trade liberalization in the biofuels sector as a result of a worldwide growing demand for biofuels, might lead to a tightening of sustainability standards in large countries. Third, we have shown that the interaction between direct and indirect political influence may lead to optimal outcomes under specific conditions. In a context of interest groups' influence, effective information disclosure policies and financial support to environmental groups' activities may thus be fine-tuned to reduce political distortions, and thereby achieve optimal outcomes. Our analysis could to be extended and improved in many directions. First, our main focus is on ecologists' indirect influence and their interdependence with industry lobbies, and we have considered that the presence of ecologists is exogenous in the model. An alternative direction for future research would be to consider the political weight of environmentalists as endogenous, following for example Fredriksson et al. (2005), who account for the number of environmental lobby groups and the degree of democratic participation in a country. In our case, this would enable us to render *m* endogenous, the quantity of information delivered by ecologist groups. Second, modelling biofuels subsidies and analyzing their interaction with sustainability standard in such a political economy context would be a promising extension to describe future trends in biofuels policies.

Appendix

Proof proposition 2:

From (24), we get:

$\frac{\partial \omega}{\partial \Phi} = \varphi^f [\frac{1}{3}\ c_{\theta}^{f}(\theta^*)\ (x + y) - t x_\theta + \mu L_\theta] + \frac{\varphi^d}{\Phi^2}[-\frac{4a}{9v} c_\theta^f(\theta^*)]$

This rewrites:

$$\frac{\partial \omega}{\partial \Phi} = \varphi^f \left[\frac{1}{3}\ c_{\theta}^{f}(\theta^*)\ (x + y) - t x_\theta\right] + \frac{\varphi^d}{\Phi}\left[\mu L_\theta + \frac{-\frac{4a}{9v} c_\theta^f(\theta^*)}{\Phi}\right]$$

As $\frac{1}{3}\ c_{\theta}^{f}(\theta^*)\ (x + y) - t x_\theta > 0$ and $\mu L_\theta + \left[\frac{-\frac{4a}{9v} c_\theta^f(\theta^*)}{\Phi}\right] < 0$, $\frac{\partial \omega}{\partial \Phi} > 0$ if:

$$\varphi^f \left[\frac{1}{3}\ c_{\theta}^{f}(\theta^*)\ (x + y) - t x_\theta\right] > \frac{\varphi^d}{\Phi}\left\{\mu L_\theta + \left[\frac{-\frac{4a}{9v} c_\theta^f(\theta^*)}{\Phi}\right]\right\}$$

This rewrites:

$$\frac{1}{3}\ c_{\theta}^{f}(\theta^*)\ (x + y) - t x_\theta - \left[\frac{-\frac{4a}{9v} c_\theta^f(\theta^*)}{\Phi}\right] > \mu L_\theta$$

And after arrangement, it becomes $\frac{\partial \omega}{\partial \Phi} > 0$ if:

$$\frac{\left[\frac{1}{3} c_{\theta}^{f}(\theta^*)\ (x+y) - t x_\theta + \frac{4a}{9v\Phi} c_{\theta}^{f}(\theta^*)\right]}{|L_\theta|} = A > \mu$$

Recall that the condition $W_\theta(\theta^*) = \pi_\theta^d(\theta^*) + W_\theta^c(\theta^*) = 0$ is fulfilled for $\mu < \mu_3 = \frac{\left|-\frac{1}{3}(x+y) c_{\theta}^{f}(\theta^*) + t x_\theta\right|}{|L_\theta|}$ and having $\mu_3 <$ A, the case where $\frac{\partial \omega}{\partial \Phi} < 0$ ($\mu > A$) is impossible.

Therefore we consider only the case where $\frac{\partial \omega}{\partial \Phi} > 0$ ($\mu < \mu_3 <$ A).

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