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Corporate social responsibility and supplier development*

Eva-Maria Scholz†

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Abstract. We study final good producers' incentives and capabilities for implementing corporate social responsibility (CSR) activities with their input suppliers via supplier codes of conduct (SCoC). In this context, we first analyze the implications of SCoC on the market equilibrium outcome in terms of the competition among final good producers as well as their supply relationships. We then derive the conditions under which SCoC are successfully implemented in the industry's supply chains and clarify their implications for consumer welfare. In this context, we study endogenous as well as exogenous standards and further contrast two scenarios in which the input supplier either price discriminates or sets a uniform input price. In the case of endogenous standards, SCoC are set to maximize final good producers' profits and, in equilibrium, are adopted in all supply chains. When standards are exogenous, either no, some or all final good producers successfully implement a SCoC. Here, the equilibrium may be characterized by an underprovision of SCoC, in the sense that not all final good producers that have incentives to adopt a SCoC also succeed to do so. In this context, we study the effectiveness and desirability of public and private initiatives that aim at overcoming this underprovision. In terms of the input supplier's pricing policy, we observe that input price discrimination may provide firms with greater incentives to adopt SCoC and, as a corollary, may maximize consumer surplus.

Keywords Corporate Social Responsibility, Cournot oligopoly, supply chains.
JEL classification D43, L13, L15, M14.

1 Introduction

Corporate Social Responsibility (CSR) is somewhat of a *catch-all-phrase* (Benabou and Tirole (2010, p.9)) for a variety of concepts whereby companies voluntarily integrate their stakeholders' social and environmental concerns in their business practices (European Commission (2001)). Over the past decade, CSR clearly has become a mainstream business strategy (The Economist, 2008, Kitzmueller and Shimshack (2012)). In 2008, approximately 80% of Fortune Global 250 companies issued reports that document their CSR efforts, a 60% increase from 2005 (KPMG International (2008)). Similarly, a survey by the Economist Intelligence Unit in 2007 reveals

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that $56,2\%$ of companies give a high to very high priority to corporate responsibility, compared to $34,1\%$ in 2004 (Economist Intelligence Unit (2007)).

These figures raise the question of why companies increasingly demonstrate their dedication to societal issues. According to the previously cited survey by the Economist Intelligence Unit, more than 53% of companies see corporate responsibility as a necessary cost of doing business. As an added benefit, it is seen as a way to gain a distinctive position in the market by, among other things, improving one's brand image and reputation ($52,9\%$) and meeting the expectations of potential and existing customers ($35,6\%$).[1] Indeed, research indicates that consumers' willingness to pay as well as their purchasing decisions, brand perception and loyalty depend on firms' CSR records (Kitzmueller and Shimshack (2012)).[2]

Observers note that consumers and other stakeholders increasingly hold companies responsible for the social performance of their supply chains (Ciliberti et al. (2008), Öberseder et al. (2013)). In response, companies develop best-practices for their suppliers, codified in the form of so-called Supplier Codes of Conduct (SCoC). The codes vary from firm to firm regarding their strictness and scope and typically combine company-specific requirements with elements taken from national legislation, industry initiatives (e.g., the Electronic Industry Citizenship Coalition Code of Conduct or the Pharmaceutical Supply Chain Initiative) and/or internationally recognized standards (e.g., the International Labour Organization (ILO) Conventions, the OECD Guidelines for Multinational Enterprises or the United Nation (UN) Guiding Principles on Business and Human Rights). Companies support and monitor the implementation of their SCoC by means of awareness building and training programs as well as supplier audits (potentially in combination with third-party monitoring and enforcement). Companies such as Bayer, IKEA or Microsoft, for example, have developed their individual SCoC that set strong standards in domains such as legal and regulatory compliance, ethical business practices, environment, labor, health and safety. The companies assist their suppliers in implementing the SCoC via diverse measures (among other, online classes, workshops, targeted support or annual, mandatory training programs); their enforcement is ensured by means of self-monitoring, online assessments and audits (typically in cooperation with third party verification organizations).

In light of this discussion, we study final good producers' incentives and capabilities for implementing SCoC in their supply chains. In a first step, we study the implications of SCoC for the market equilibrium outcome in terms of the competition among final good producers as well as their supply relationships. We then characterize the conditions under which SCoC are successfully implemented in the industry's supply chains.

In our analysis, we focus on a vertically separated industry with an upstream and a downstream sector. On the downstream sector, there are N final good producers that compete *à la Cournot* and source an essential input factor from a monopolistic upstream input supplier. We assume that a final good producer requires a units of the input factor in order to produce one

[1]Other perceived benefits of corporate responsibility include: commitment to decisions that are optimal in the long-run (42.2%), higher attractiveness to potential and existing employers (35.6%) and improved relationships with law makers and regulators (27.7%) (Economist Intelligence Unit (2007)).

[2]According to a study by Nielsen in 2014, 55% of consumers are willing to pay a *CSR premium*. Similarly, 70% of consumers in the UK are willing to a pay a premium for ethically superior products (Ipsos MORI (2003)).

unit of the final product (everything else being equal, higher values of a thus express a higher importance of the input factor in the production of a final product). Final products are horizontally undifferentiated. However, as will become clear in the following, SCoC introduce a vertical differentiation in the final product market as consumers, on average, are willing to pay more for products that are produced in a socially responsible way. More precisely, consumers are socially aware and evaluate products not only in terms of their *hard characteristics* (e.g., physical attributes or prices) but also in terms of their *soft characteristics* (e.g., social attributes). In our framework, final good producers may respond to consumers' social awareness by introducing a SCoC in their supply chain. All in all, we thus focus on final products' soft characteristics as reflected by the social attributes of the input factors that are used in their production.[3]

Clearly, for firms implementing a SCoC involves important costs (Ciliberti et al. (2008), Öberseder et al. (2013)). On the downstream sector, final good producers that decide to introduce a SCoC in their supply chain face fixed costs relative to the development of the standard as well as its implementation and enforcement upstream. On the upstream sector, implementing a SCoC involves fixed costs related to the re-organization and re-structuring of production processes, the participation in training sessions or audits and documentation. Upstream and downstream fixed costs are increasing and convex in the strictness of the SCoC, at potentially different rates for the two sectors (i.e., implementing a given SCoC may be more or less costly for either sector). We further assume that producing CSR-conform input factors is more costly than producing standard ones (and the more so the stricter the SCoC). Here, we discuss three different marginal cost structures. The first two cases focus on *specific SCoC*, meaning, the SCoC of a final good producer is specific to the supply relationship with the input supplier. For instance, Microsoft's SCoC explicitly states that suppliers "*[...] must adhere to the Supplier Code of Conduct* ***while conducting business with or on behalf of Microsoft***" (Microsoft Supplier Code of Conduct (US 2016), p.1). Similarly, Bayer's SCoC requires its suppliers *"[...] to ensure that products supplied to Bayer do not contain metals derived from minerals or their derivatives originated from conflict regions that directly or indirectly finance or benefit armed groups"* (Bayer Supplier Code of Conduct, p.4). Such SCoC clearly give the input supplier scope for price discrimination which it will exploit. In this scenario, final good producers consequently pay different input prices, depending on the strictness of their SCoC. For completeness, we briefly discuss the case of a uniform input price in an extension to the main framework.[4] The third case discusses *general SCoC*. Here, the SCoC of a final good producer applies to the entire upstream production structure and consequently raises the input supplier's marginal costs for all final good producers. Moreover, under general SCoC all final good producers receive an input

[3]Our set-up borrows from the literature on vertical differentiation under Cournot competition. Particularly relevant in the context of this paper are Manasakis et al. (2013, 2014) and Liu et al. (2015) who study different aspects related to firms' (environmental) CSR strategies. Of equal importance are Lambertini et al. (2015) or Garella and Petrakis (2008) who analyze the implications of consumers' perception of product quality. What sets our framework apart is, among other things, the fact that our model includes an upstream sector and accounts explicitly for consumers' social awareness.

[4]In our eyes, input price discrimination is the more realistic scenario. First, the input supplier is always strictly better off under input price discrimination (we show this formally in Section 7.3 of the Appendix). Second, any input price differences are based on cost differences in producing the respective input factors.

factor that not only conforms to their own SCoC but also to the ones of their competitors. Depending on their ability and/or willingness to communicate such external SCoC to consumers, final good producers may derive benefits from their competitors' SCoC via consumers' social preferences (*CSR spillovers*).[5]

In the following, we discuss the results of our analysis; unless mentioned otherwise the focus is on specific SCoC.

We first study the implications of SCoC on the market equilibrium outcome. We establish that under input price discrimination (IPD) final good producers that demand the implementation of a SCoC pay the benchmark input price (i.e., the input price in the absence of any SCoC) plus a *CSR premium*. This CSR premium increases in consumers' social awareness and the strictness of the SCoC. The CSR premium is passed on partially to consumers; in other words, consumers pay higher prices for products that are produced with socially responsible input factors. Whenever consumers display a sufficiently strong social awareness, the CSR premium to consumers outweighs the one in the input price. In this case, final good producers' profits increase in the strictness of their SCoC. On the aggregate, industry output increases in the importance of the input factor, consumers' social awareness, the number of final good producers with SCoC in their supply chains as well as in the strictness of the standard. Under a uniform input price (UIP), SCoC affect the market equilibrium in a similar way. The main difference is that all final good producers pay a CSR premium, which, however, is smaller than the one under IPD. As a corollary, final good producers with a SCoC realize greater profits under a UIP, and vice versa for final good producers without a SCoC and the input supplier.

The main part of this paper focuses on deriving the conditions under which SCoC are successfully implemented in the supply relationship between a final good producer and the input supplier. Here, we study endogenous as well as exogenous standards. Exogenous standards are defined exogenously, for instance, by the policy maker or a non-governmental organization. Endogenous standards are set by final good producers in order to maximize their individual profits. Under both types of standards, we assume that the input supplier has a veto power and may reject the implementation of a SCoC. This is based on the observation that the non-compliance with a SCoC rarely leads to the immediate termination of a supply contract. Instead, final good producers actively work with their non-complying suppliers to improve their social performance and support them technically and/or financially. The Swedish retailer IKEA, for instance, offers a grace period of at least 24 months to non-complying suppliers, provided they show a willingness to improve their social performance. During this time, IKEA supports its suppliers technically and financially: "*We tell the suppliers that 'we will give you all the time you need, we will provide you with all the help you need. And if it costs you money, we will discuss that as well'*" (Pedersen and Andersen (2006, p. 234)).

When standards are endogenous, all final good producers adopt a SCoC in their supply

[5]CSR spillovers are also addressed in Kopel (2009), although in the absence of an upstream sector. The author studies the implications of CSR spillovers in a duopoly model with vertically and horizontally differentiated products and price competition. The presence of CSR spillovers from the CSR leader to the CSR follower are shown to be crucial in determining whether socially responsible investments give rise to a first- or a second-mover advantage.

chain. In contrast, in the case of exogenous standards, either no, some or all final good producers successfully implement a SCoC. Here, the equilibrium may be characterized by an underprovision of SCoC. In this case, not all final good producers that have incentives to implement a SCoC also succeed to do so (in other words, the number of SCoC that is successfully implemented in equilibrium falls short the number of SCoC that is proposed by final good producers; there is thus an *excess demand* for SCoC). These results extend to the case of cost-sharing where the fixed costs of introducing a SCoC in a supply chain are shared between the input supplier and the final good producer.

All in all, we observe that firms have stronger incentives to implement a SCoC in their supply relationship the stronger consumers' social awareness and/or the higher the importance of the input factor in the production of the final products. In terms of the input supplier's pricing policy, we show that, in the case of exogenous standards, IPD may provide firms with greater incentives to implement a SCoC than a UIP. This is the case whenever the input supplier only derives small benefits from implementing a SCoC as the latter is adopted in only a small number of supply chains and further involves large implementation costs on the upstream, relative to the downstream, market. Compared to specific SCoC and a UIP, general SCoC may in- or decrease firms' adoption incentives. On the one hand, the input supplier faces higher total production costs, which are passed on to final good producers in form of a higher input price. This effect lowers upstream and downstream incentives. On the other hand, general SCoC, via their CSR spillovers, increase the total demand for the input factor. This, in turn, allows the input supplier to raise the input price and increases its adoption incentives. On the downstream market, CSR spillovers only increase incentives when the spillovers a final good producer receives are stronger than the ones it passes on to its competitors.

In a final step, we discuss the implications of SCoC for consumer welfare. We observe that SCoC have a positive impact on consumer surplus: everything else being equal, the latter increases in the strictness of the adopted standards and their uptake. The same applies with respect to consumers' social awareness. Regarding the input supplier's pricing policy, IPD maximizes consumer welfare whenever it provides firms with larger incentives to implement a SCoC compared to a UIP. In this context, we discuss the incentives, and the ability, of the policy maker and/or final good producers to overcome the previously mentioned underprovision of SCoC by subsidizing upstream implementation costs (and by this to increase consumer welfare). Although both initiatives may achieve their objective, they also have important drawbacks: the public initiative inflicts important costs on the policy maker which may not justify the benefits of a greater uptake of SCoC in terms of consumer welfare; the private initiative reduces firms' incentives to implement a SCoC in the first place.

Our paper has the following structure. In Section 2 we describe the modeling framework and its timing. Section 3 focuses on its analysis; we first derive the implications of SCoC for the market equilibrium outcome (Section 3.1) and then characterize the conditions under which SCoC are successfully implemented (Section 3.2). Section 4 discusses how SCoC impact consumer welfare. Section 5 studies three extensions to the main modeling framework that are related to the fixed costs of implementing a SCoC, the input supplier's pricing policy and the type of SCoC. Section 6 concludes.

2 The model

2.1 Description of the modeling framework

We consider N final good producers, D_i with $i \in \{1, \ldots, N\}$, who compete *à la Cournot* and source an essential production factor from a monopolistic upstream input supplier, U. Consumers in the market are socially aware and evaluate products not only in terms of their *hard characteristics* (e.g., physical attributes or prices) but also in terms of their *soft characteristics* (e.g., social attributes). More specifically, consumers care about whether a product is produced in a socially responsible way. In the given framework, final good producers may respond to consumers' social awareness by introducing a SCoC in their supply chain. Indeed, as mentioned previously, assuming responsibility for one's suppliers is an essential part of CSR and expected by a firm's stakeholders (Ciliberti et al. (2008), Öberseder et al. (2013)). All in all, we thus focus on final products' soft characteristics as reflected by the social attributes of the input factors that are used in their production.

In the following, we give more detailed information on our modeling framework and the implications of SCoC for firms and consumers.

Firms. On the downstream sector, N final good producers, D_i with $i \in \{1, \ldots, N\}$, compete *à la Cournot*, with q_i the production level of D_i. Downstream firms source an important production factor from the upstream market. Here, a final good producer requires $a \in [0, 1]$ units of the production factor to produce one unit of output (higher values of a thus reflect a higher importance of the production factor relative to the final product). We assume that any other inputs that are relevant in the production of the final products may be obtained from a perfectly competitive industry with zero marginal production costs and no SCoC. For simplicity, we further assume that downstream firms, apart from the input price, have zero marginal production costs. Nevertheless, final good producers that adopt a SCoC in their supply chain face important fixed costs relative to the development of the standard as well as its implementation and enforcement upstream (see, e.g., Ciliberti et al. (2008) or Öberseder et al. (2013) for further details). For a SCoC with standard e_i, those fixed costs are given by $c_d e_i^2$.

On the upstream sector, there is one input supplier, U, who sets the input price w_i. This input price is taken as given by the downstream firms. Whereas U produces standard input factors at zero marginal costs, CSR-conform input factors involve strictly positive marginal costs of e_i. We focus on the case in which the input supplier price discriminates (i.e., sets different input prices for different final good producers, depending on the strictness of their SCoC). This corresponds to the previously mentioned case of specific SCoC[6] with input price discrimination. In an extension, we also clarify the implications of a uniform input price (Section 5.2) and general SCoC (Section 5.3). The implementation of a SCoC further involves important fixed

[6]As a reminder, specific SCoC apply to the supply relationship between a final good producer and the input supplier: D_i's SCoC increases U's marginal production costs only when producing for D_i. General SCoC apply to the entire upstream production: D_i's SCoC increases U's marginal costs for all final good producers.

costs associated with, among other things, the re-organization and re-structuring of production processes, the participation in training sessions or audits as well as documentation. Total fixed costs are $c_u \sum_{i=1}^{N} e_i^2$.[7]

It follows that the profit functions of upstream and downstream firms are

$$\begin{aligned} \pi_u^{CSR} &= a \sum_{i=1}^{N} (w_i - e_i) q_i - c_u \sum_{i=1}^{N} e_i^2, \\ \pi_{d,i}^{CSR} &= \big(p_i(q_i, q_{-i}) - a w_i\big) q_i - c_d e_i^2, \end{aligned} \tag{1}$$

where $p_i(q_i, q_{-i})$ denotes the inverse demand function of final good producer D_i (we give more information below).

Consumers. There is a population of consumers with mass normalized to 1. Their representative utility function is

$$U = \underbrace{q_0 + \sum_{i=1}^{N} q_i - \frac{1}{2}\Big(\sum_{i=1}^{N} q_i^2 + \sum_{i=1}^{N}\sum_{j \neq i}^{N} q_i q_j\Big)}_{\textit{standard preferences}} + \underbrace{sa \sum_{i=1}^{N} q_i e_i}_{\textit{social preferences}}. \tag{2}$$

Consumers consequently have separable preferences over consumption (*standard preferences*) and for the products' social attributes (*social preferences*).[8] Here, q_i refers to the amount consumed (and produced) of product i and q_0 to the consumption of the composite good. Consumers' social preferences depend positively on s (consumers' social awareness), a (the importance of the input factor relative to the final product) and e_i (the CSR efforts specified in D_i's SCoC). Table 1 summarizes the parameters and variables of our model.

Consumers maximize their utility subject to their budget constraint $y = q_0 + \sum_{i=1}^{N} p_i q_i$ which gives rise to the following inverse demand functions

$$p_i(q_i, q_{-i}) = 1 + sae_i - q_i - q_{-i} \tag{3}$$

with $q_{-i} = \sum_{j \neq i}^{N} q_j$.[9] It is apparent that SCoC introduce a vertical differentiation in the product market: for given consumption levels, consumers' willingness to pay for product i increases in their social awareness, the importance of the input factor relative to the final product and its social characteristics. In other words, on average, consumers are willing to pay more for products that are produced in a socially responsible way.

[7]We abstract from explicitly modeling economies of scope in the implementation of SCoC upstream. Although there may be common elements to final good producers' SCoC, the input supplier faces important costs related to documentation or the participation in training sessions and audits (these costs apply even for identical SCoC). Note also that economies of scope may be seen as $c_u \leq 1$.

[8]The representation of consumers' preferences is based on Häckner (2000) and Manasakis et al. (2013, 2014). Notice that the representative consumer's utility depends linearly on firms' aggregate CSR efforts. As a corollary, consumers' consumption choices are based on products' relative prices and their social attributes (but not (directly) on their relative social attributes).

[9]We obtain 3 by maximizing the utility of the different consumer groups and then summing their inverse demand functions, accounting for their respective shares in the population. In other words, 3 is the weighted average of the inverse demand functions of the different consumer types.

D_i with $i \in \{1, \dots, N\}$	Downstream firms (final good producers).
U	Upstream firm (input supplier).
p_i	Final good price of D_i.
q_i	Production level of D_i.
$a \in [0, 1]$	Importance of the input factor relative to the final product/downstream transformation technology.
$s > 0$	Consumers' social awareness.
e_i	CSR standard specified in D_i's SCoC.

Table 1: Parameters and variables.

Timing. First, final good producers independently and simultaneously decide about their SCoC (in the case of exogenous SCoC final good producers decide whether or not to adopt the standard, in the case of endogenous SCoC final good producers set the standard to maximize their profits). Second, the input supplier observes the demanded level of CSR effort and decides whether or not to implement the SCoC in a given supply relationship. Third, once it is known in how many supply chains SCoC are successfully implemented, the input supplier sets the input price. Fourth, final good producers observe the input price and compete *à la Cournot*.

2.2 The benchmark case

To illustrate the timing, we briefly outline the benchmark case. We understand the benchmark case as the situation in which no downstream firm develops a SCoC, i.e., $e_i = 0 \; \forall i \in \{1, \dots, N\}$. In this case, consumers' inverse demand functions are

$$p_i(q_i, q_{-i}) = 1 - q_i - q_{-i}. \tag{4}$$

Whenever $e_i = 0 \; \forall i$, the model consequently reduces to a standard vertical Cournot model with N downstream firms and one upstream firm.

Final good producers compete *à la Cournot* and thus set their quantities q_i to maximize their *benchmark (b)* profits which are given by

$$\pi_{d,i}^b = \big(p_i(q_i, q_{-i}) - aw\big)q_i. \tag{5}$$

From the corresponding first-order conditions we obtain firms' derived demand for the input factor as

$$q(w) = \Big(\frac{1}{N+1}\Big)(1 - aw). \tag{6}$$

The upstream input supplier U sets the input price w to maximize

$$\pi_u^b = Nwaq(w). \tag{7}$$

The resulting input price is

$$w^b = \frac{1}{2a}. \tag{8}$$

From (4), (6) and (8) we derive the familiar equilibrium outcome[10]

$$q^b = \frac{1}{2(N+1)},\ p^b = \frac{N+2}{2(N+1)},\ \pi_d^b = \frac{1}{4(N+1)^2},\ \pi_u^b = \frac{N}{4(N+1)}. \tag{9}$$

3 Analysis

We start by analyzing the market stage, i.e., competition between final good producers and their supply relationship with the input supplier. In a next step, we then have a closer look at the conditions under which SCoC are successfully implemented in the industry's supply chains. As mentioned previously, the following analysis assumes input price discrimination and specific SCoC; a uniform input price and general SCoC are respectively discussed in Section 5.2 and Section 5.3.

3.1 Market stage

On the downstream market, D_i's inverse demand function is given by

$$p_i(q_i, q_{-i}) = 1 + sae_i - q_i - q_{-i} \tag{10}$$

where $e_i > 0$ if the firm implements a SCoC with standard e_i in its supply chain. Downstream firms set their quantities q_i to maximize

$$\pi_{d,i}^{CSR} = \big(p_i(q_i, q_{-i}) - aw_i\big)q_i \tag{11}$$

where w_i denotes the input price paid by D_i.[11] From the first-order conditions of the downstream firms' optimization problems we obtain D_i's derived demand function, i.e., the firm's demand for the input factor, $q_i(w_i, w_{-i})$ with

$$q_i(w_i, w_{-i}) = \Big(\frac{1}{N+1}\Big)\big[1 + Na(se_i - w_i) - a(se_{-i} - w_{-i})\big] \tag{12}$$

[10]Note that the equilibrium profits of upstream and downstream firms do not depend on the transformation technology a. The intuition behind this result becomes clear when looking at π_u^b and π_d^b, expressed as functions of a and w: $\pi_u^b = aw(1-aw)/(N+1)$ and $\pi_d^b = (p-aw)(1-aw)/(N+1)$. In the benchmark scenario, a and w are consequently perfect substitutes and one could re-write the model as one in which the input supplier sets a *total input price* t with $t = aw = 1/2$. When at least one final good producer introduces a SCoC, a starts to matter in terms of firms' equilibrium profits. This follows from two observations. First, U has strictly positive marginal production costs for producing CSR-conform input factors. As a corollary, a and w are no longer perfect substitutes. Instead, higher values of a increase U's marginal production costs for a given level of downstream production. Second, a is present in consumers' demand functions.

[11]For the input supplier, producing according to the standards set out in the final good producers' SCoC involves strictly positive marginal costs (that are further increasing in the strength of the standard). Different SCoC, i.e., $e_i \neq e_{-i}$, thus, give the input supplier scope for price discrimination, which it will exploit. This is why we assume that w_i is firm specific and as such only depends on the SCoC developed by D_i. In Section 5.2 we comment on the implications of a uniform input price.

where $w_{-i} = \sum_{j \neq i}^{N} w_j$ and $e_{-i} = \sum_{j \neq i}^{N} e_j$.

The input supplier sets w_i to maximize

$$\pi_u^{CSR} = a \sum_{i=1}^{N} (w_i - e_i) q_i(w_i, w_{-i}). \tag{13}$$

The resulting input price(s) are

$$w_i^{CSR} = w^b + \frac{(s+1)e_i}{2}. \tag{14}$$

We observe that final good producers that implement a SCoC in their supply chain pay the benchmark input price w^b plus a CSR premium $(s+1)e_i/2$ that increases in the demanded CSR effort e_i and consumers' social awareness s. The reason is that, first, higher values of se_i introduce a vertical differentiation in the product market (based on final products' soft characteristics) and make a downstream firm's inverse and derived demand schedules less price elastic: for given prices, higher values of se_i increase consumers' demand for the final products which in turn implies a higher demand for the input factor. Second, higher values of e_i also increase U's marginal production costs for CSR-conform input factors. Note that for $s > 1$, the input supplier passes on more than the costs of the SCoC to a downstream firm. In other words, for $s > 1$ the CSR premium exceeds U's marginal production costs. By this U extracts some of the extra profits that the downstream firms can make through vertical differentiation.

From (12) and (14) we derive

$$\begin{aligned} q_i^{CSR} &= q^b + \frac{a(s-1)(Ne_i - e_{-i})}{2(N+1)}, \\ Q^{CSR} &= Q^b + \frac{a(s-1)\sum_{i=1}^{N} e_i}{2(N+1)}. \end{aligned} \tag{15}$$

Note that for $s > 1$ final good producers' individual production levels q_i^{CSR} increase in the strictness of their own SCoC and decrease in their competitors' CSR efforts. This result is due to the fact that for $s > 1$ consumers' increased willingness to pay for socially responsible products is sufficiently large as to offset the CSR premium that is demanded by the input supplier, thereby incentivizing final good producers to increase their production. If, in addition to $s > 1$, a final good producer's own SCoC is sufficiently strict relative to the ones of its competitors, q_i^{CSR} also increases in the importance of the input factor and consumers' social awareness and further exceeds its benchmark value. On the aggregate, industry output is larger than in the benchmark case and increases in the importance of the input factor, consumers' social awareness and firms' aggregate CSR efforts provided $s > 1$.

Based on (15) we obtain p_i^{CSR}, D_i's final good price, as

$$p_i^{CSR} = p^b + \frac{2(N+1)ase_i - a(s-1)\sum_{i}^{N} e_i}{2(N+1)}. \tag{16}$$

From (16) it is clear that consumers bear part of the costs of firms' CSR efforts. As such, they may obtain final products that use socially responsible production factors at higher prices, compared to final products that are produced with standard inputs.

Based on these results, we obtain downstream and upstream firms' market profits

$$\begin{aligned} \pi_{d,i}^{CSR} &= \Big(\frac{1+a(s-1)(Ne_i - e_{-i})}{2(N+1)}\Big)^2, \\ \pi_u^{CSR} &= \frac{\sum_{i=1}^N \left[1+a(s-1)e_i\right]\left[1+a(s-1)(Ne_i - e_{-i})\right]}{4(N+1)}. \end{aligned} \tag{17}$$

Table 2 gives an overview of quantities, prices and profits for the case in which $R \leq N$ final good producers successfully implement a SCoC with standard e in their supply relationship with U.

	D_i with $i \in \{1, \ldots, R\}$	D_i with $i \in \{R+1, \ldots, N\}$
Individual quantities	$q^b + \frac{(N-R+1)a(s-1)e}{2(N+1)}$	$q^b - \frac{Ra(s-1)e}{2(N+1)}$
Aggregate output	$Q^b + \frac{Ra(s-1)e}{2(N+1)}$	
Input price	$w^b + \frac{(s+1)e}{2}$	w^b
Final good prices	$p^b + \frac{2(N+1)ase-Ra(s-1)e}{2(N+1)}$	$p^b - \frac{Ra(s-1)e}{2(N+1)}$
Downstream profits	$\left(\frac{1+(N-R+1)a(s-1)e}{2(N+1)}\right)^2$	$\left(\frac{1-Ra(s-1)e}{2(N+1)}\right)^2$
Upstream profits	$\frac{R[1+a(s-1)e]^2+(N-R)[1+R(a(s-1)e)^2]}{4(N+1)}$	

Table 2: Quantities, prices and market profits.

Lemma 1 summarizes the results.

Lemma 1 *Downstream firms that demand the implementation of a SCoC pay the benchmark input price plus a CSR premium, which increases in the strictness of their standard and consumers' social awareness. This CSR premium is passed on partially to consumers. As a result, consumers pay higher prices for products that are produced with socially responsible input factors (and vice versa). Moreover, provided consumers' social awareness is sufficiently strong, aggregate industry output exceeds its benchmark value and increases in the importance of the input factor, consumers' social awareness and firms' aggregate CSR efforts.*

3.2 Implementing SCoC

Naturally, an important question to ask is under which conditions SCoC are successfully implemented in the industry. To answer this question, we first have a look at the case of exogenous standards. In a second step, we then study endogenous standards which are set by the final good producers with the objective to maximize their individual profits.

For the analysis, we adopt the following parameter restrictions:

$$
\begin{gathered}
s > 1, \\
\min\left\{c_u, \left(\frac{N+1}{N}\right)c_d\right\} > \frac{Na^2(s-1)^2}{4(N+1)}, \\
1 > a(s-1)e_{-i} \text{ with } e_{-i} = \sum_{j\neq i}^{N} e_j.
\end{gathered} \tag{18}
$$

The first constraint is a necessary condition for the adoption of a SCoC in the absence of any implementation costs. The second constraint ensures the (strict) concavity of the upstream and downstream profit functions in the standard (i.e., the existence of an interior solution). Finally, the third constraint guarantees that the profits of final good producers without SCoC are strictly positive.

3.2.1 Exogenous standards

In our analysis of exogenous standards, we proceed in two steps. First, we have a closer look at the conditions under which upstream and downstream firms find it worthwhile to implement a SCoC with exogenously given standard e in their supply chains (i.e., we derive the adoption thresholds). Based on these conditions, we then characterize the equilibria of the game.

Adoption thresholds

In general, the existence of an equilibrium in which $R \leq N$ final good producers implement a SCoC with standard e in their supply relationship with U depends on three constraints.

First, a final good producer that implements a SCoC is indeed better off doing so, compared to its outside option. More formally, given that R final good producers implement a SCoC, the profits of a downstream firm with a SCoC, $\pi_{d,i,r}^{CSR}(R)$, exceed its profits without a SCoC, $\pi_{d,i,nr}^{CSR}(R)$, taking into account that in the latter case R is reduced by one. Meaning, e is such that $\pi_{d,i,r}^{CSR}(R) - c_d e^2 \geq \pi_{d,i,nr}^{CSR}(R-1)$ or

$$
e \leq \bar{e}_d(R) = \frac{2Na(s-1)}{4(N+1)^2 c_d - N\big[N-2(R-1)\big]a^2(s-1)^2}. \tag{19}
$$

In contrast, for $e > \bar{e}_d(R)$ any D_i with $i \in \{1, \ldots, R\}$ is better off not implementing a SCoC, given R of its competitors do so. The reason is that either i) consumers only display a weak social awareness, ii) the input factor only represents a minor part of the final product and/or iii) the SCoC is very strict and as such involves important costs of implementation.

Second, a final producer that does not implement a SCoC has no incentives to deviate to implementing one. That is, in analogy to the previous constraint, e is such that $\pi^{CSR}_{d,i,nr}(R) \geq \pi^{CSR}_{d,i,r}(R+1) - c_d e^2$ or

$$e \geq \underline{e}_d(R) = \frac{2Na(s-1)}{4(N+1)^2 c_d - N(N-2R)a^2(s-1)^2}. \tag{20}$$

Notice that for all $e < \underline{e}_d(R)$ any D_i with $i \in \{R+1, \dots, N\}$ is always better off implementing a SCoC, given R of its competitors do so. In analogy to the previous threshold, the reason is that either i) consumers display a sufficiently strong social awareness, ii) the input factor represents a too important part of the final product to ignore consumers' social awareness and/or iii) the SCoC is very lenient and thus involves only minor costs of development and enforcement.

Third, for the input supplier implementing a SCoC in all R supply relationships is optimal. This is the case for any e that is such that $\pi^{CSR}_u(R) - c_u Re^2 \geq \pi^{CSR}_u(R-1) - c_u(R-1)e^2$ or

$$e \leq \bar{e}_u(R) = \frac{2a(s-1)}{4(N+1)c_u - \big[N - 2(R-1)\big]a^2(s-1)^2}.^{12} \tag{21}$$

From (21) it is clear that final good producers when implementing a SCoC in their supply chain not only consider their own but also their input supplier's incentives and capabilities. The input supplier consequently also has some bargaining power with respect to the SCoC and not only with respect to the input price. We base this assumption on the observation that, according to the management literature, non-compliance with a SCoC rarely leads to the (immediate) termination of a supply contract. Instead, final good producers work with their suppliers to improve their social performance. As mentioned previously, the Swedish retailer IKEA, for instance, offers a grace period of at least 24 months to non-complying suppliers, provided they show a willingness to improve their social performance. During this time, IKEA supports its suppliers technically and financially.

Before characterizing the different equilibria of the game, we establish some important properties of the thresholds.

Lemma 2 *The thresholds defined in (19), (20) and (21) have the following properties. First, all thresholds are decreasing in R, i.e.,* $\partial \underline{e}_d(R)/\partial R < 0$, $\partial \bar{e}_d(R)/\partial R < 0$, $\partial \bar{e}_u(R)/\partial R < 0$. *Second,* $\bar{e}_d(R) > \underline{e}_d(R)$ *and* $\bar{e}_d(R) = \underline{e}_d(R-1)$. *Third,* $\bar{e}_d(R) \leq \bar{e}_u(R)$ *for* $c_u \leq \big(1 + \frac{1}{N}\big)c_d$. *Fourth,* $\bar{e}_u(R) \geq \underline{e}_d(R)$ *for* $a^2(s-1)^2 \geq 2(N+1)\big[c_u - (1+\frac{1}{N})c_d\big]$.

Note that as a corollary of Lemma 2, any SCoC that is proposed by a final good producer is

[12] From the derivation of $\bar{e}_u(R)$ it follows that we assume the input supplier to evaluate the proposed SCoC on an individual basis. Note also that our framework shares certain elements with the literature on coalition formation games. In parallel to the latter, two important *stability conditions* are that no final good producer with a SCoC in its supply chain finds it profitable to deviate to not implementing one, and vice versa for final good producers without a SCoC. In the terminology of D'Aspremont et al. (1983), those two conditions correspond to the requirements of *internal* and *external stability.* Note two important differences. First, in the present context, the decision of the input supplier (may) also matter for the successful implementation of a SCoC. Meaning, here there are *two* internal stability conditions, one on the upstream and one on the downstream market. Second, firms choose their strategies independently. That is, N final good producers are competing in quantities (and not $N - R + 1$).

accepted by the input supplier whenever $c_u \leq \left(1 + \frac{1}{N}\right)c_d$.[13]

Equilibrium conditions

Based on the adoption thresholds in (19), (20) and (21), we now derive the different equilibria of the game. In general, we may observe three types of equilibria: two symmetric ones in which either no or all final good producers adopt a SCoC, i.e., $R^* = 0$ or $R^* = N$, as well as an asymmetric one in which $R^* \in \{1, \ldots, N-1\}$ final good producers successfully implement a SCoC. Which equilibrium applies depends on the value of e relative to the three thresholds defined above. Proposition 1 summarizes the results of the equilibrium analysis.

Proposition 1 *Assume $R \leq N$ final good producer consider implementing a SCoC with standard e in their supply chains. Any standard with $e^*_{ex} > \min\left\{\bar{e}_d(1), \bar{e}_u(1)\right\}$ or $e^*_{ex} \leq \min\left\{\bar{e}_d(N), \bar{e}_u(N)\right\}$ is adopted by respectively $R^* = 0$ or $R^* = N$ firms; for $e^*_{ex} \in \left(\min\left\{\bar{e}_d(R^*+1), \bar{e}_u(R^*+1)\right\}, \min\left\{\bar{e}_d(R^*), \bar{e}_u(R^*)\right\}\right]$ SCoC are successfully implemented by $R^* \in \{1, \ldots, N-1\}$ final good producers. For intermediate to high values of c_u relative to c_d an underprovision of SCoC emerges for $e^*_{ex} \in \left(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\right]$ and $R^* \in \{0, \ldots, N-1\}$. For these values, not all final good producers that have incentives to implement a SCoC succeed to do so in equilibrium and, as a result, the number of SCoC that is successfully implemented in equilibrium is lower than the one that is proposed by the downstream market.*

Proof See Section 7.1 in the Appendix.

From Proposition 1 it follows that SCoC with either sufficiently weak or strong standards are implemented in respectively all or none of the industry's supply chains. For intermediate values of the standard, a subset of firms introduces a SCoC. Note that the equilibrium may be characterized by an *underprovision* of SCoC. For intermediate values of the standard together with sufficiently high upstream relative to downstream implementation costs not all final good producers that have incentives to implement a SCoC also succeed to do so (in other words, for these parameter values the number of SCoC that is accepted by the input supplier, and hence implemented in equilibrium, is lower than the number of SCoC that is proposed by the downstream market). The reason is that for these parameter values the input supplier exercises its veto power and blocks the implementation efforts of some final good producers.[14]

To give some intuition for these results, we now discuss Proposition 1 by means of a duopoly example (a discussion of the oligopolistic case can be found in the proof to Proposition 1 in the

[13] For sufficiently low values of c_u relative to c_d our model thus features a *ceiling effect*, which, in the given context, captures the fact that input suppliers may see the demanded level of CSR effort as the ceiling, rather than the floor for desired conduct (see Baden et al. (2009) and Michael (2006)). Although final good producers express their interest in procuring CSR-conform input factors (and actively support the implementation of SCoC with their input suppliers), they remain sensitive regarding the input price. Input suppliers are consequently hesitant to invest in SCoC, out of fear that final good producers are unwilling to pay higher input prices (and ultimately switch to lower cost alternatives).

[14] In Section 4 and Section 5.1 we discuss the effectiveness and desirability of respectively public and private initiatives to overcome this underprovision.

Appendix). In an industry with size $N = 2$, a SCoC with standard e is implemented in $R \leq 2$ supply chains where

$$R^* = \begin{cases} 2 \quad if \quad e^*_{ex} \leq \min\left\{\frac{a(s-1)}{6c_u}, \frac{a(s-1)}{9c_d}\right\}, \\ 1 \quad if \quad e^*_{ex} \in \left(\frac{a(s-1)}{9c_d}, \min\{\frac{a(s-1)}{6c_u-a^2(s-1)^2}, \frac{a(s-1)}{9c_d-a^2(s-1)^2}\}\right], \\ 0 \quad if \quad e^*_{ex} > \min\left\{\frac{a(s-1)}{6c_u-a^2(s-1)^2}, \frac{a(s-1)}{9c_d-a^2(s-1)^2}\right\}. \end{cases} \tag{22}$$

For the following discussion it is helpful to distinguish between three cases that depend on the value of $c_u - 3c_d/2$. The value can be interpreted as the disadvantage of the input supplier relative to a final good producer in terms of the fixed implementation costs for a SCoC with standard e. The size of $c_u - 3c_d/2$ has two important implications. First, it determines whether upstream or downstream incentives define the critical thresholds on e (i.e., whether $\bar{e}_d(R)$ or $\bar{e}_u(R)$ are binding). Second, it determines the presence and extent of an underprovision of SCoC that results from an imbalance of upstream and downstream incentives.

Case 1: $c_u - 3c_d/2 \leq 0$. For $c_u \leq 3c_d/2$, the input supplier is at most at a minor cost-disadvantage relative to the final good producer when implementing a SCoC in their supply relationship. In fact, in the given case, c_u is sufficiently low relative to c_d such that the input supplier has relatively higher incentives to implement the SCoC compared to the final good producer. As a corollary, downstream incentives are binding, i.e., $\bar{e}_d(R) = \min\left\{\bar{e}_d(R), \bar{e}_u(R)\right\}$. Figure 1 illustrates Case 1.

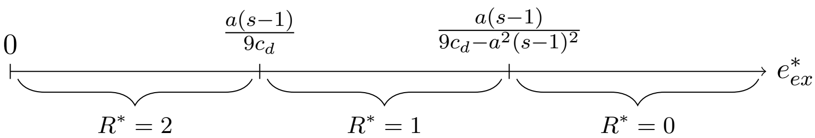

Figure 1: Case 1: $c_u - \frac{3}{2}c_d \leq 0$.

As mentioned previously, SCoC with small standards are implemented by both final good producers, intermediate to large standards by at most one of the two final good producers. This is intuitive, taking into account that the higher the number of final good producers that adopts a SCoC, the lower their market profits and the less likely it is that the latter justify the fixed costs of implementing a SCoC.

Case 2i: $c_u - 3c_d/2 \in \left(0, \frac{a^2(s-1)^2}{6}\right]$. In the given case, the input supplier is at a minor to intermediate cost-disadvantage relative to the final good producer. As a result, the input supplier's incentives are lower than in the previous case and become binding, i.e., $\bar{e}_u(R) = \min\left\{\bar{e}_d(R), \bar{e}_u(R)\right\}$.

From Figure 2 it is clear that generally the same logic as in the previous case applies; small standards are implemented by all final good producers, intermediate to large standards by at most a subset of the industry. Nevertheless, in contrast to Case 1, we also observe an underprovision of SCoC (shaded intervals in Figure 2). For instance, for $e^*_{ex} \in \left(\frac{a(s-1)}{6c_u}, \frac{a(s-1)}{9c_d}\right]$, both final good producers are interested in implementing a SCoC in their supply chain, however,

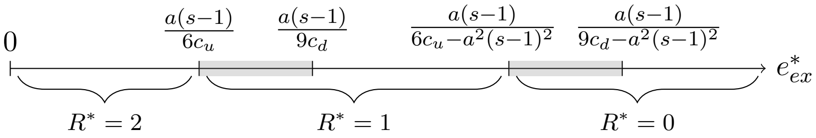

Figure 2: Case 2i: $c_u - \frac{3}{2}c_d \in \big(0, \frac{a^2(s-1)^2}{6}\big]$.

the input supplier is only willing to do so in one. More generally, as c_u rises relative to c_d, the input supplier becomes more likely to reject a SCoC that is proposed by a final good producer. As a corollary, for the input supplier to implement a SCoC in any given number of supply chains, e needs to fall as c_u rises. At the same time, as e falls, implementation costs also fall on the downstream market. It thus becomes less likely that a final good producer is better off not implementing a SCoC (in other words, the external stability condition on the downstream market is more likely to fail). That is, as c_u rises relative to c_d, it becomes more and more likely that one observes an underprovision of SCoC that is based on a mismatch between upstream and downstream incentives; meaning, not all final good producers that are interested in implementing a SCoC in their supply chain succeed to do so. In Case 2i, overcoming this underprovision would allow an increase of R^* by at most one.

Case 2ii: $c_u - 3c_d/2 > \frac{a^2(s-1)^2}{6}$. Here, the input supplier is at a significant disadvantage relative to the input supplier and upstream incentives continue to be binding. As a result, the previously mentioned undeprovision of SCoC extends to the entire interval of the asymmetric equilibrium (and, potentially, further). Note that this implies that, in the present case, an asymmetric equilibrium emerges solely because upstream incentives fall short the ones on the downstream market. In Figure 3, for example, any SCoC with $e^*_{ex} \in \big(\frac{a(s-1)}{6c_u-a^2(s-1)^2}, \frac{a(s-1)}{9c_d}\big]$ would be implemented by two final good producers. The input supplier, however, blocks both efforts. Note that in the given case, R^* could be increased by at least one if one was to align upstream and downstream incentives.

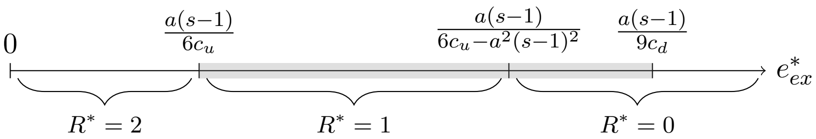

Figure 3: Case 2ii: $c_u - \frac{3}{2}c_d > \frac{a^2(s-1)^2}{6}$.

3.2.2 Endogenous standards

In the case of endogenous standards, SCoC are designed by final good producers to maximize their individual profits. We make this modeling choice for two reasons. First, SCoC are a means for final good producers to transfer their own CSR standards to their input suppliers in order to ensure a socially responsible supply chain. Cooperation between final good producers and their input suppliers thus typically does not concern the setting of the standard, but rather its implementation. Second, industry-wide SCoC do exist. Examples are, among others, the codes of conduct developed by the Electronic Industry Citizenship Coalition (EICC) or the Pharmaceutical Supply-Chain Initiative (PSCI). However, final good producers typically adopt theses codes as a part of their SCoC, together with other, company-specific, rules and guidelines (see, for example, Bayer AG (2016) or Sony Corporation (2016)).

The timing is the following. Final good producers, simultaneously and independently, decide about the strictness of their SCoC and propose them to the input supplier. The input supplier then either implements or rejects the proposed standard. As in the case of exogenous SCoC, we assume that the input supplier evaluates the proposed SCoC on an individual basis and that there is no renegotiation of a SCoC.[15] It follows that the optimal standard e^*_{end} is such that it maximizes a final good producer's profits, given the input supplier's incentive constraint:

$$\begin{aligned} &\max_{e_i} \pi^{CSR}_{d,i}(e_i, e_{-i}) - c_d e_i^2, \\ &\text{s.t. } \pi^{CSR}_u(e_i, e_{-i}) - \pi^{CSR}_u(e_{-i}) \geq c_u e_i^2. \end{aligned} \tag{23}$$

Given the previously derived results for $\pi^{CSR}_{d,i}$ and π^{CSR}_u, and the assumption that $c_d > \frac{N^2a^2(s-1)^2}{4(N+1)^2}$, we obtain

$$\begin{aligned} e_i(e_{-i}) &= \frac{Na(s-1)\left[1-a(s-1)e_{-i}\right]}{4(N+1)^2c_d - N^2a^2(s-1)^2}, \\ e_i \leq \bar{e}_u(e_{-i}) &= \frac{2a(s-1)\left[1-a(s-1)e_{-i}\right]}{4(N+1)c_u - Na^2(s-1)^2}. \end{aligned} \tag{24}$$

Here, $e_i(e_{-i})$ gives the profit-maximizing level of D_i's standard, given its competitors' standards; $\bar{e}_u(e_{-i})$ defines an upper bound on e_i that is such that any $e_i \leq \bar{e}_u(e_{-i})$ is adopted by the input supplier, again, given the standards of D_i's competitors. Note that $e_i(e_{-i})$ and $\bar{e}_u(e_{-i})$ are both decreasing in e_{-i}: the stricter the standards of D_i's competitors, the less the final good producer invests in its own standard (standards are strategic substitutes). Moreover, given our assumption that $1 > a(s-1)e_{-i}$ (the profits of a final good producer without a SCoC are strictly positive) $e_i(e_{-i})$ and $\bar{e}_u(e_{-i})$ are both strictly positive.

It follows that the equilibrium is symmetric with $e^*_{end} = \min\left\{e^*_d, \bar{e}_u(N)\right\}$ where

$$\begin{aligned} e^*_d &= \frac{Na(s-1)}{4(N+1)^2c_d - Na^2(s-1)^2}, \\ \bar{e}_u(N) &= \frac{2a(s-1)}{4(N+1)c_u - a^2(s-1)^2(N-2)}. \end{aligned} \tag{25}$$

At this point it is instructive to comment further on why no asymmetric equilibrium emerges

[15] This assumption has two important implications. First, once U rejects a SCoC, final good producers do not revise the latter. Second, when U decides whether or not to adopt D_i's SCoC, it takes the SCoC of all other final good producers as given. This implies that D_i sets e_i to maximize its profits, taking into account its competitors' strategies as well as U's incentive constraint. Here, D_i considers that U takes e_{-i} as given when deciding whether or not to implement e_i. As a corollary, D_i only takes into account the direct effect of e_i on U's incentive constraint and not its indirect via e_{-i}.

when standards are endogenous. Generally, an asymmetric equilibrium may emerge for either of two reasons. First, the input supplier may only be willing to implement the standard in $R < N$ supply relationships. This case can be ruled out in the given context as final good producers take U's incentives into account in their standard setting process (i.e, they only propose standards that satisfy U's incentive constraint). Furthermore, a final good producer is unable to increase the input supplier's costs associated with the implementation of its SCoC to such an extent that U only implements a SCoC with this firm.[16] Second, some final good producers may be better off not implementing a SCoC. This is the case whenever the standard is sufficiently strict such that the increased market revenues under a SCoC, relative to no SCoC, do not justify the implementation costs. This condition is given by $c_d e^*(R+1)^2 \geq \pi^{CSR}_{d,i,r}(e^*(R+1), R+1) - \pi^{CSR}_{d,i,nr}(e^*(R), R)$. Note that whereas $e^*(R+1) = e^*(R)$ under exogenous standards, $\partial e^*(R)/\partial R < 0$ under endogenous standards. In particular, $e^*(R)$ decreases sufficiently in response to an increase in R such that the adoption of the standard always becomes worthwhile for a final good producer.

Similar to the case of exogenous standards, the relationship between c_u and c_d defines whether upstream or downstream incentives determine the size of the standard that is adopted in equilibrium. In particular, $\min\left\{e^*_d, \bar{e}_u(N)\right\} = e^*_d$ whenever

$$c_u \leq 2\Big(1 + \frac{1}{N}\Big)c_d - \frac{Na^2(s-1)^2}{4(N+1)}. \tag{26}$$

That is, downstream incentives are binding for sufficiently high values of c_d (relative to c_u) and/or low values of a and s (so that the input is only of minor importance for final good producers' production processes and/or consumers display weak social concerns).

Proposition 2 *When final good producers, independently and simultaneously, decide about the strength of their SCoC, the equilibrium is symmetric with $R^* = N$ and $e^*_{end} = \min\left\{e^*_d, \bar{e}_u(N)\right\}$.*

4 Consumer welfare

In the following, we analyze the impact of SCoC on consumer welfare. In this context, we also discuss the effectiveness and desirability of a public policy initiative that aims at overcoming the previously mentioned equilibrium underprovision of SCoC that may arise for exogenous standards.

[16]Take the case of a downstream duopoly where D_H and D_L respectively propose e_H and e_L, with $e_H > e_L$. For U to be better off implementing e_H on its own, two constraints, $\pi_u(e_H, e_L) - \pi_u(e_H, 0) < c_u e_L^2$ (U is better off implementing e_H than e_H and e_L) and $\pi_u(e_H, 0) - \pi_u(0,0) \geq c_u e_H^2$ (U is better off implementing e_H compared to implementing no SCoC), have to be satisfied. The conditions are respectively given by $e_L \geq \bar{e}_u(e_H) = a(s-1)[1 - a(s-1)e_H]/[6c_u - a^2(s-1)^2]$ and $e_H \leq a(s-1)/[6c_u - a^2(s-1)^2]$. Although $\partial \bar{e}_u(e_H)/\partial e_H < 0$, $\bar{e}_u(e_H)$ remains strictly positive. This in turn implies that there is always a strictly positive e_L that is accepted by U. Given that D_L is better off with $e_L > 0$ than $e_L = 0$, the final good producer will react to a very strict e_H by proposing a very lenient e_L, satisfying $e_L \leq \bar{e}_u(e_L)$.

In our modeling framework, consumer surplus is

$$CS = \sum_{i=1}^{N} q_i - \frac{1}{2}\Big(\sum_{i=1}^{N} q_i^2 + \sum_{i=1}^{N}\sum_{j\neq i}^{N} q_j\Big) + sa\sum_{i=1}^{N} q_i e_i - \sum_{i=1}^{N} p_i q_i \tag{27}$$

with $p_i = 1 + sae_i - \sum_{i=1}^{N} q_i$. The expression simplifies to

$$CS = \frac{\Big(\sum_{i=1}^{N} q_i\Big)^2}{2}. \tag{28}$$

As a result, consumer surplus in the benchmark, exogenous and endogenous case are

$$\begin{aligned} CS^b &= \frac{N^2}{8(N+1)^2}, \\ CS_{ex}^{CSR} &= CS^b * \Big\{1 + a(s-1)\frac{R^*}{N}e_{ex}^*\Big\}^2, \\ CS_{end}^{CSR} &= CS^b * \Big\{1 + a(s-1)e_{end}^*\Big\}^2, \end{aligned} \tag{29}$$

where e_{ex}^* and e_{end}^* respectively correspond to the exo- and endogenous standards that are implemented in equilibrium.

Clearly, the introduction of SCoC has a positive effect on consumer welfare. As such, consumer surplus is larger in the presence of SCoC than in their absence and, everything else being equal, increases in the strictness of the adopted standards (and, in the exogenous case, also in their uptake).

In the exogenous case, however, R^* and e_{ex}^*, depend negatively on one another: an increase in R^* goes hand in hand with a decrease of the maximal exogenous standard that can be implemented in equilibrium (i.e., $\bar{e}_d(R^*)$ and $\bar{e}_u(R^*)$ both decrease in R^*). As a result, consumer surplus in the exogenous case may in- or decrease in R^*. One exception are those standards for which the previously discussed underprovision of SCoC is present. As a reminder, for $c_u \geq \big(1 + \frac{1}{N}\big)c_d$ an underprovision of SCoC occurs for $e_{ex}^* \in \big(\bar{e}_u(R^* + 1), \bar{e}_d(R^* + 1)\big]$ and $R^* \in \{0, \ldots, N-1\}$. For these parameter values, SCoC are implemented in R^* supply chains, but are demanded from at least R^*+1 final good producers. This implies that within these intervals, R^* could be implemented in at least one more supply chain without lowering the strictness of the standard. All in all, overcoming the underprovision would lead to a gain in consumer surplus of

$$\Delta CS_{ex}^{CSR} = \frac{\mathcal{I}a(s-1)e_{ex}^*}{8(N+1)^2}\Big\{2N + ae_{ex}^*(s-1)(\mathcal{I} + 2R^*)\Big\} \tag{30}$$

where $\mathcal{I} \in \{1, \ldots, N-1\}$ denotes the additional number of final good producers that succeeds to implement a SCoC. To achieve this, it is necessary to align upstream and downstream incentives, for instance, via a public policy initiative that subsidizes c_u so that the input supplier's fixed implementation costs reduce to $(1-\phi)c_u(R^* + \mathcal{I})e_{ex}^{*2}$ where $\phi \in [0, 1]$.[17] Note that upstream

[17] In Section 5.1 we analyze final good producers' incentives for overcoming this underprovision of SCoC privately,

incentives are perfectly aligned with downstream incentives when $1-\phi=\left(1+\frac{1}{N}\right)c_d/c_u$.

Although the policy increases consumer surplus, it also implies costs for the policy maker. These costs amount to[18]

$$C_{pm}=\phi c_u(R^*+\mathcal{I})e_{ex}^{*2}. \tag{31}$$

Comparing (30) and (31) it is clear that the gain in consumer surplus is more likely to outweigh the policy maker's costs whenever the input factor makes up an important part of the final product and consumers display strong social concerns. Similarly, for $\phi=1-\left(1+\frac{1}{N}\right)c_d/c_u$, $\Delta CS_{ex}^{CSR}\geq C_{pm}$ is more likely to hold for low values of c_u relative to c_d (i.e., when the disadvantage of the input supplier relative to a final good producer in terms of the fixed costs of implementing a SCoC is not too pronounced).

We now discuss this policy option further by means of the duopoly example developed in Section 3.2.1. For simplicity we set $a=1$ and $s=2$ so that $a(s-1)=1$. The following discussion focuses on $c_u-3c_d/2\in\left(0,\frac{1}{6}\right]$ and $e_{ex}^*\in\left(\frac{1}{6c_u},\frac{1}{9c_d}\right]$ (see Figure 2). In the given parameter range, $R^*=1$ although both final good producers have incentives to implement a SCoC. As discussed in the preceding paragraph, the policy maker is able to increase R^* by one (i.e., $\mathcal{I}=1$) for the entire range of e_{ex}^* by subsidizing upstream implementation costs by $\phi=1-3c_d/2c_u$. On the one hand, the policy, by increasing R^*, results in an increase in consumer surplus of $\Delta CS_{ex}^{CSR}=e_{ex}^*(4+3e_{ex}^*)/72$. On the other hand, it implies costs of $C_{pm}=(2c_u-3c_d)e_{ex}^{*2}$ for the policy maker. Comparing ΔCS_{ex}^{CSR} and C_{pm}, we observe that the gain in consumer surplus outweighs the policy maker's costs, unless the policy involves significant subsides (see Figure 4; analytical details are provided in the Appendix).

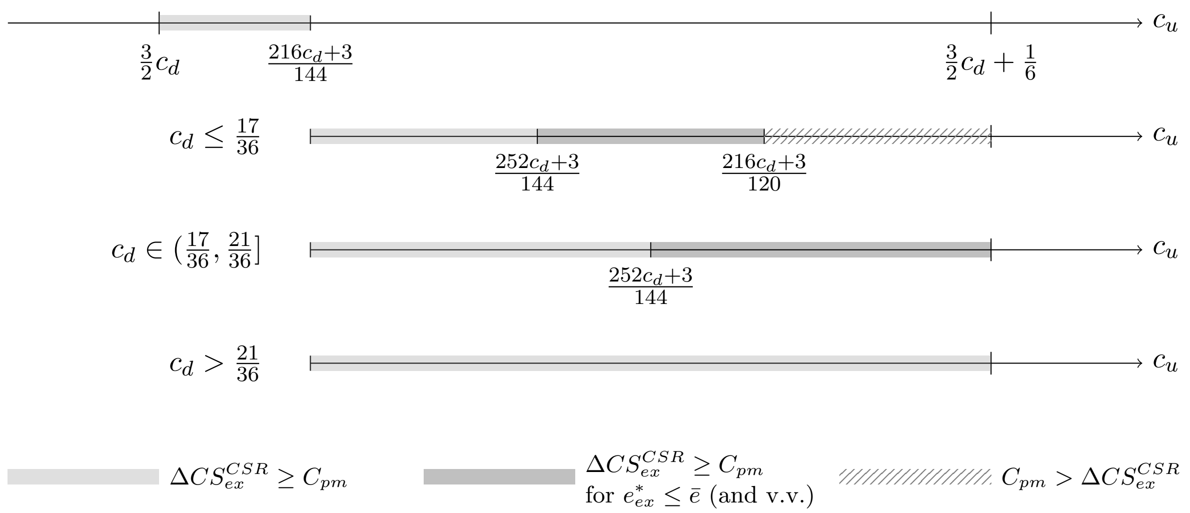

Figure 4: Public policy initative: consumer welfare versus policy costs.

by subsidizing the upstream implementation costs for their SCoC.

[18] We only consider the direct costs of the policy, but abstract from the welfare costs to society that occur in raising the revenues necessary to fund the subsidy (marginal costs of public funds).

5 Extensions

In this section, we study three extensions to the main framework. The first extension analyzes a scenario in which the total fixed costs of implementing a SCoC in a supply chain are shared between the final good producer and the input supplier (Section 5.1). In this context, we also study final good producers' incentives, as well as their ability, to overcome the previously mentioned underprovision of SCoC privately, by supporting the input supplier's implementation efforts financially. In the second extension, we clarify the implications of a uniform input price in terms of the uptake of SCoC and consumer welfare (Section 5.2). The third extension briefly discusses general SCoC (Section 5.3).[19]

5.1 Cost sharing and private subsidies

So far, we do not assume any particular relationship between c_u and c_d. In the following, we analyze the case in which $c_d + c_u = 1$. This corresponds to a scenario in which total fixed costs of implementing a SCoC in a supply chain are e_i^2 and shared by D_i and U according to c_d and $c_u = 1 - c_d$. That is, D_i and U respectively assume $c_d e_i^2$ and $c_u e_i^2 = (1 - c_d)e_i^2$ of the total fixed implementation costs.

Note first that Proposition 1 and Proposition 2 continue to apply. Among other things, this implies that under exogenous SCoC we may again observe an underprovison of SCoC. In the given scenario this is the case whenever a final good producer takes on an only minor share of total implementation costs, here $c_d \leq N/(2N + 1)$, together with $e^*_{ex} \in \big(\bar{e}_u(R^* + 1), \bar{e}_d(R^* + 1)\big]$ and $R^* \in \{0, \ldots, N - 1\}$.

In Section 4, we discuss how this underprovision of SCoC may be overcome via a public policy initiative that subsidizes the input supplier's fixed implementation costs. In the following, we clarify whether it may also be overcome privately. Meaning, we analyze whether final good producers have incentives to subsidize the input supplier by taking on a larger part of total implementation costs, thereby reducing the share that is borne by the input supplier. In particular, we assume that a final good producer may propose a subsidy ϕ_i to the input supplier which increases its own share of total implementation costs to $c_d + \phi_i$ and reduces the input supplier's share to $1 - (c_d + \phi_i)$. Here, we study two scenarios that differ in their timing. In the first scenario, final good producers propose the subsidy together with their SCoC; that is before the input supplier decides whether or not to implement the latter. In the second scenario, final good producers propose the subsidy after the input supplier's decision.[20]

Before analyzing both scenarios in detail, we have a closer look at how subsidies impact upstream as well as downstream incentives.

First, it is instructive to recall the input supplier's decision process. When deciding whether or not to implement a given SCoC, the input supplier compares the gain in incremental profits

[19] To recall, in contrast to a specific SCoC, a general SCoC applies to the entire upstream production structure and consequently raises the input supplier's production costs for all final good producers. Moreover, all final good producers receive a production factor that conforms to their own as well as to their competitors' SCoC.

[20] In our eyes, the latter case is closer to reality as final good producers, typically, support their *non-complying* suppliers.

from adopting an additional SCoC, $\pi_u^{CSR}(R) - \pi_u^{CSR}(R-1)$, with the fixed costs of doing so, $(1-c_d)e_i^2$. Whenever incremental profits outweigh incremental (fixed) costs, $\pi_u^{CSR}(R)-\pi_u^{CSR}(R-1) \geq (1-c_d)e_i^2$, the input supplier implements the proposed SCoC. By offering a subsidy, final good producers reduce the input supplier's implementation costs to $[1-(c_d+\phi)]e_i^2$, thus making an adoption of their SCoC more likely. Here, it is important to note that, for a given R, subsidies only affect fixed implementation costs, but not incremental profits. As a corollary, when U decides whether or not to adopt D_i's SCoC, its decision only depends on D_i's, but not D_{-i}'s, subsidy.[21]

Second, in contrast to public subsidies, private subsidies not only affect upstream but also downstream incentives. When deciding whether or not to propose a given SCoC, final good producers contrast the incremental gain in profits, $\pi_{d,i,r}^{CSR}(R) - \pi_{d,i,nr}^{CSR}(R-1)$, with the fixed implementation costs, $c_d e_i^2$. A SCoC is proposed to the input supplier whenever $\pi_{d,i,r}^{CSR}(R) - \pi_{d,i,nr}^{CSR}(R-1) \geq c_d e_i^2$. It is immediate that subsidies, for a given SCoC, increase final good producers' fixed implementation costs to $(c_d+\phi_i)e_i^2$ and, by this, lower their adoption incentives.

This implies that in the case of private subsidies, the underprovision of SCoC may be overcome as upstream incentives increase and downstream incentives decrease. In other words, the critical interval, $\left(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\right]$, shrinks, not only because $\bar{e}_u(R^*+1)$ increases (as it is the case under public subsidies) but also because $\bar{e}_d(R^*+1)$ decreases.[22] Upstream and downstream incentives coincide whenever $c_d + \phi_i = N/(2N+1)$. That is, for $c_d + \phi_i = N/(2N+1)$, any SCoC that is proposed by a final good producer, is also implemented by the input supplier.

Against this background, we now study the two previously introduced scenarios (to recall, in the first scenario, final good producers propose the subsidy together with their SCoC; in the second scenario, it is proposed after the input supplier's decision). Here, we illustrate the discussion via the duopoly example that we developed in Section 3.2.1. As in our analysis of public subsidies, we focus on Case 2i, i.e., on $c_d \in \left[\frac{2}{5}\left[1 - \frac{a(s-1)}{6}\right], \frac{2}{5}\right)$ (see also Figure 2). Moreover, we assume that $e_{ex}^* \in \left(\frac{a(s-1)}{6(1-c_d)}, \frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}\right]$.[23] In the given parameter range, both final good producers have incentives to implement a SCoC, whereas the input supplier is better off adopting the SCoC in only one supply chain.

In the first scenario, D_1 and D_2 propose a SCoC with standard e and, potentially, a subsidy ϕ_i. In analogy to our discussion of public subsidies, we assume that the subsidy is such that it perfectly aligns upstream and downstream incentives, i.e., $c_d + \phi_i = 2/5$. In other words, the subsidy is such that any given standard that is proposed downstream is accepted upstream (this turns out to be the subsidy that final good producers propose in equilibrium).

In the given scenario, there are three cases: either no, one or both final good producers propose a subsidy together with their SCoC (Table 3 summarizes the corresponding normal

[21]As will become clear in the following analysis, this also rules out a scenario in which final good producers are able to free-ride on their competitors' investments.

[22]Under cost sharing and private subsidies, the critical thresholds can be obtained by replacing c_u by $1-(c_d+\phi_i)$ and c_d by $c_d+\phi_i$ in (19) and (21).

[23]Note that we focus on $e_{ex}^* \in \left(\frac{a(s-1)}{6(1-c_d)}, \frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}\right]$ and not on $e_{ex}^* \in \left(\frac{a(s-1)}{6(1-c_d)}, \frac{a(s-1)}{9c_d}\right]$. This is related to the fact that subsidies reduce downstream incentives; for any $e_{ex}^* \in \left(\frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}, \frac{a(s-1)}{9c_d}\right]$ only one final good producer proposes a SCoC.

form game).

In the first case, no final good producer proposes a subsidy to U. This is equivalent to the framework analyzed so far. As such, $\pi_u^{CSR}(R) - \pi_u^{CSR}(R-1) \geq (1-c_d)e_{ex}^{*2}$ only for $R = 1$. The input supplier consequently picks one final good producer at random and, in equilibrium, either D_1 or D_2 succeeds to implement a SCoC with equal probability. It follows that a final good producer realizes expected profits of $\pi_{d,i}^{e}(1) = \pi_{d,i,r}^{CSR}(1)/2 - c_d e_{ex}^{*2}/2 + \pi_{d,i,nr}^{CSR}(1)/2$ (with $\pi_{d,i,r}^{CSR}(1)$ and $\pi_{d,i,nr}^{CSR}(1)$ as in Table 2).

In the second case, only one final good producer, say D_1, proposes a subsidy. Meaning, D_1 proposes e_{ex}^* and ϕ, its competitor D_2 only e_{ex}^*. In the given context, the input supplier has four options: implement the SCoC in no, only D_1's, only D_2's or D_1's and D_2's supply chain. In the given range for e_{ex}^*, U is always better off implementing the SCoC in at least one supply chain. Comparing implementing only D_1's SCoC to implementing only D_2's SCoC, it is immediate that U is better off implementing D_1's SCoC: both SCoC are equivalent in terms of their incremental profits, however, the one of D_1 is cheaper to implement. Finally, comparing implementing D_1's SCoC on its own, $\pi_u^{CSR}(1) - \left[1-(c_d+\phi)\right]e_{ex}^{*2}$, to implementing it together with D_2's SCoC, $\pi_u^{CSR}(2) - \left[1-(c_d+\phi)\right]e_{ex}^{*2} - (1-c_d)e_{ex}^{*2}$, it becomes clear that in the given parameter range the incremental gain in profits from D_2's SCoC does not justify its additional implementation costs. To summarize, when only one final good producer proposes a subsidy, the input supplier implements a SCoC only in this supply chain. Total profits of D_1 and D_2 are respectively given by $\pi_{d,1,r}^{CSR}(1) - (c_d+\phi)e_{ex}^{*2}$ and $\pi_{d,2,nr}^{CSR}(1)$.

In the third case, both final good producers propose a subsidy together with their SCoC. From the discussion of the second case, it is clear that both final good producers succeed to implement their SCoC and consequently realize total profits of $\pi_{d,i,r}^{CSR}(2) - (c_d+\phi)e_{ex}^{*2}$.

	$\phi = 0$	$\phi > 0$
$\phi = 0$	$\pi_{d,i}^{e}(1), \pi_{d,i}^{e}(1)$	$\pi_{d,i,nr}^{CSR}(1), \pi_{d,i,r}^{CSR}(1) - (c_d+\phi)e_{ex}^{*2}$
$\phi > 0$	$\pi_{d,i,r}^{CSR}(1) - (c_d+\phi)e_{ex}^{*2}, \pi_{d,i,nr}^{CSR}(1)$	$\pi_{d,i,r}^{CSR}(2) - (c_d+\phi)e_{ex}^{*2}, \pi_{d,i,r}^{CSR}(2) - (c_d+\phi)e_{ex}^{*2}$

Table 3: Private subsidies: firms' equilibrium strategies.

Given our parameter restrictions, $\pi_{d,i}^{e}(1) \leq \pi_{d,i,r}^{CSR}(1) - (c_d+\phi)e_{ex}^{*2}$ and $\pi_{d,i,r}^{CSR}(2) - (c_d + \phi)e_{ex}^{*2} \geq \pi_{d,i,nr}^{CSR}(1)$. It follows that in equilibrium both final good producers propose a subsidy $\phi = 2/5 - c_d$[24] and successfully implement any SCoC with $e \leq a(s-1)/9(c_d+\phi) = 5a(s-1)/18$ in their supply chain.

In the second scenario, final good producers may propose a subsidy after observing the input supplier's adoption decision. It is clear that in the given context only final good producers that do not succeed to implement their SCoC without a subsidy will do so. Comparing final good producers' incremental gains from proposing a subsidy, $\pi_{d,i,r}^{CSR}(2) - \pi_{d,i,nr}^{CSR}(1)$, to the incremental

[24]From the discussion of the second case it is clear that final good producers propose $\phi = 2/5 - c_d = \phi_{max}$ in equilibrium. The reason is that the input supplier implements the SCoC with the highest subsidy.

costs of doing so, $(c_d+\phi)e_{ex}^{*2}$, it follows that final good producers are always better off proposing a subsidy.[25]

5.2 A uniform input price

We now clarify the implications of the input supplier's pricing policy. The modeling framework is essentially equivalent to the one studied so far, with the exception that all final good producers pay the same input price w, irrespective of the strictness of their SCoC (i.e., U does not price discriminate, but sets a uniform input price). In the following sections, we discuss the implications of a uniform input price for firms' incentives to implement SCoC under exo- and endogenous standards as well as for consumer welfare.

5.2.1 Market stage

Intuitively, the main difference between a scenario with input price discrimination (IPD) and a uniform input price (UIP) is linked to the input price itself. In the given context, final good producers pay one and the same input price, irrespective of whether or not they adopt a SCoC. As a corollary, the previously identified CSR premium now applies to all final good producers. Nevertheless, for $R \in \{1, \dots, N\}$ it is weakly smaller than under IPD. All in all, the UIP is thus smaller (larger) than the one paid by final good producers with (without) a SCoC under IPD.[26]

If one compares upstream and downstream profits across the cases of IPD and a UIP, one observes that final good producers with (without) SCoC are better off under a UIP (IPD); the input supplier prefers to price discriminate.

5.2.2 Exogenous standards

In a first step, we focus on either the downstream or the upstream market and compare the two pricing policies (a UIP and IPD). In a second step, we then clarify which pricing policy provides greater incentives for the implementation of SCoC.

Let us start with the adoption incentives on the downstream market. As explained previously, under a UIP U's pricing power is constrained by the derived demand of final good producers without a SCoC. As a corollary, final good producers with (without) a SCoC pay a lower (higher) input price than under IPD. It is thus clear that a UIP increases downstream incentives for adopting a SCoC. To see this, note that $\bar{e}_d^{IPD}(R) \geq \bar{e}_d^{UIP}(R)$ if and only if

$$\pi_{d,i,r}^{IPD}(R) - \pi_{d,i,r}^{UIP}(R) \geq \pi_{d,i,nr}^{IPD}(R-1) - \pi_{d,i,nr}^{UIP}(R-1). \tag{32}$$

[25] In this context, we want to stress the importance of the assumption that $e_{ex}^* \in \left(\frac{a(s-1)}{6(1-c_d)}, \frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}\right]$. Assume that D_1 and D_2 propose a SCoC with $e_{ex}^* \in \left(\frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}, \frac{a(s-1)}{9c_d}\right]$. This SCoC is implemented in only one supply chain, say in the one of D_1. D_2 then has no incentives to propose a subsidy (this is only profitable for $e_{ex}^* \leq \frac{a(s-1)}{9(c_d+\max\{\phi_i,\phi_{-i}\})}$). This is, of course, based on the assumption that final good producers do not renegotiate their standards.

[26] The intuition behind this result is that under a UIP the input supplier's pricing power is constrained by the derived demand from final good producers without a SCoC. As a corollary, the CSR premium in the input price still exceeds the input supplier's marginal production costs, although to a lower extent (for $R < N$) (see the Appendix for further details).

Here, the LHS of (32) is weakly negative (with $LHS = 0$ at $R = N$), whereas the RHS is weakly positive (with $RHS = 0$ at $R = 1$) (this follows directly from the previously developed results regarding the input price under the two different pricing policies). In other words, under a UIP, final good producers with a SCoC realize higher profits and have a lower outside option than under IPD. It is thus clear that (32) is never satisfied and $\bar{e}_d^{UIP}(R) > \bar{e}_d^{IPD}(R)$.

Lemma 3 *A UIP maximizes downstream incentives for adopting a SCoC, i.e.,* $\bar{e}_d^{UIP}(R) > \bar{e}_d^{IPD}(R)$.

The input supplier's incentives, however, may be maximized under either pricing policy. In particular, $\bar{e}_u^{IPD}(R) \geq \bar{e}_u^{UIP}(R)$ if and only if

$$\pi_u^{IPD}(R) - \pi_u^{UIP}(R) \geq \pi_u^{IPD}(R-1) - \pi_u^{UIP}(R-1). \tag{33}$$

Here, the LHS and RHS of (33) are weakly positive (with $LHS = 0$ at $R = N$ and $RHS = 0$ at $R = 1$). It follows that $\bar{e}_u^{IPD}(R = N) < \bar{e}_u^{UIP}(R = N)$, whereas $\bar{e}_u^{IPD}(R = 1) \geq \bar{e}_u^{UIP}(R = 1)$. The intuition behind these results is that for $R = N$ ($R = 1$) the input supplier has no basis for input price discrimination when accepting (refusing) to implement the SCoC in the demanded R supply chains. For $R = N$, U's profits are therefore the same under both pricing policies, whereas its outside option is strictly larger under IPD than a UIP. For $R = 1$, profits are strictly larger under IPD, while U's outside option is equivalent under both pricing policies.

All in all, a UIP gives the input supplier greater incentives to adopt a SCoC than IPD for sufficiently large values of R (with $R \geq \bar{R} = (N+1)/2$). The reason is that for high values of R the UIP is close to the one that is demanded from final good producers with a SCoC under IPD (and further paid by all final good producers). Differences in profits across both pricing policies are hence negligible and dominated by differences in U's outside option, which is lower under a UIP (we give more information in Section 7.3 in the Appendix).

Lemma 4 *A UIP maximizes upstream incentives for adopting a SCoC, i.e.,* $\bar{e}_u^{UIP}(R) \geq \bar{e}_u^{IPD}(R)$, *if and only if* $R \geq \bar{R}$ *(where* $\bar{R} = \frac{N+1}{2}$*).*

Based on the results developed in Lemma 3 and 4, we now clarify whether a UIP or IPD provides greater incentives for the adoption of a SCoC. Note that Lemma 3 and 4 on their own are not necessarily sufficient to answer this question. The reason is that upstream, or downstream, incentives are not always binding under both IPD and a UIP. Instead, there are cases in which upstream incentives are binding under IPD, while downstream incentives are binding under a UIP (and vice versa).

Proposition 3 *When standards are exogenous, IPD increases the likelihood that a standard is adopted by a given number of firms whenever* R *is sufficiently low and* c_u *sufficiently large relative to* c_d.

Proof See Section 7.3 in the Appendix.

Proposition 3 makes clear that IPD may maximise firms' adoption incentives whenever two conditions are simultaneously met: i) SCoC are only implemented in a small number of supply chains and ii) the input supplier is at a sufficiently strong disadvantage relative to the downstream market with respect to the fixed implementation costs of a SCoC.

We illustrate the result in Proposition 3 by means of a duopoly example. Table 4 displays the adoption thresholds under IPD and a UIP.

	Input price discrimination	Uniform input price
$\bar{e}_d(R)$	$\frac{a(s-1)}{9c_d-(2-R)a^2(s-1)^2}$	$\frac{4a(7s-1)}{144c_d-(2R-1)a^2(5s+1)^2+24a^2s[R(5s+1)-6s]}$
$\bar{e}_u(R)$	$\frac{a(s-1)}{6c_u-(2-R)a^2(s-1)^2}$	$\frac{4a(s-1)}{24c_u-(2R-1)a^2(s-1)^2+12a^2s(3-2R)}$

Table 4: Adoption thresholds under IPD and a UIP ($N = 2$).

From the discussion above it is clear that for $R = 2 = N$ a UIP gives larger incentives than IPD (see Lemma 3 and 4). The following analysis thus focuses on $R = 1 < N$. The situation is illustrated in Figure 5.

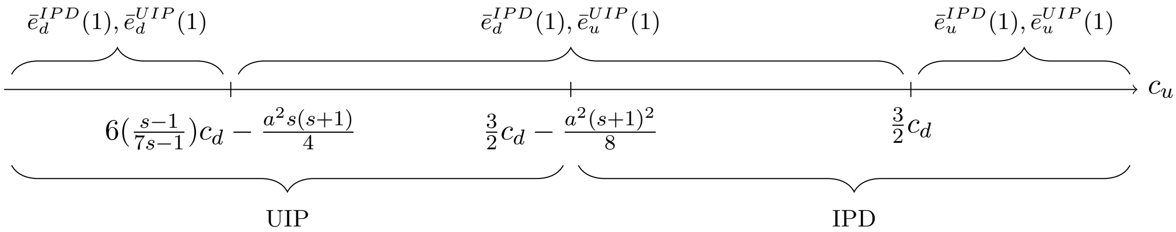

Figure 5: Adoption thresholds under IPD and a UIP ($N = 2$).

Note first that for $R = 1$ one can distinguish three cases that depend on whether upstream or downstream incentives are binding under the different pricing policies: 1) $\bar{e}_d^{IPD}(1)$ and $\bar{e}_d^{UIP}(1)$ for sufficiently low values of c_u relative to c_d, 2) $\bar{e}_d^{IPD}(1)$ and $\bar{e}_u^{UIP}(1)$ for intermediate values of c_u relative to c_d and 3) $\bar{e}_u^{IPD}(1)$ and $\bar{e}_u^{UIP}(1)$ for sufficiently high values of c_u relative to c_d.[27]

Second, there are two cases in which IPD maximizes firms' adoption incentives. First, whenever c_u is sufficiently high for upstream incentives to be binding, irrespective of the pricing policy (i.e., $c_u \geq 3c_d/2$), IPD provides greater incentives than a UIP (for $R = 1$ and $N = 2$, $R < \bar{R}$ is always satisfied). Second, for values of c_u that are sufficiently high for upstream incentives to be binding under a UIP, but sufficiently low for downstream incentives to be binding under IPD, either a UIP or IPD may maximize adoption incentives, depending on c_u relative to c_d. In particular, for $c_u \geq 3c_d/2 - a^2(s+1)^2/8$, $\bar{e}_u^{UIP}(1) \leq \bar{e}_d^{IPD}(1)$ and IPD provides greater incentives for the implementation of SCoC than a UIP. To summarize, whenever the input supplier is at a sufficiently large disadvantage relative to a final good producer in terms

[27]For $R = 1$ and $N = 2$ a case in which $\bar{e}_u^{IPD}(1)$ and $\bar{e}_d^{UIP}(1)$ are binding does not exist. This follows from the fact that i) for $R = 1$ and $N = 2$ a UIP always gives the input supplier lower incentives to implement a SCoC than IPD: $\bar{e}_u^{UIP}(1) < \bar{e}_u^{IPD}(1)$, ii) $\bar{e}_u^{IPD}(1)$ is binding: $\bar{e}_u^{IPD}(1) < \bar{e}_d^{IPD}(1)$ and iii) $\bar{e}_d^{IPD}(1) < \bar{e}_d^{UIP}(1)$. Taken together i), ii) and iii) imply that for $R = 1$ and $N = 2$ $\bar{e}_u^{UIP}(1)$ is binding whenever $\bar{e}_u^{IPD}(1)$ is binding.

of the benefits/costs of introducing a SCoC, IPD maximizes adoption incentives.

5.2.3 Endogenous standards

When final good producers set the strictness of their standards to maximize their individual profits, the equilibrium is characterized by $R^* = N$ and $e^* \in \{e_d^*, \bar{e}_u(N)\}$ (where e_d^* and $\bar{e}_u(N)$ are derived as under IPD).

Comparing the optimal standards across pricing policies, we observe that a UIP always maximizes adoption incentives. The intuition behind this result goes along the following lines. Downstream firms have incentives to set stricter standards under a UIP, compared to IPD, for two reasons. First, under a UIP, the input supplier's pricing power is constrained by the set of final good producers that does not adopt a SCoC. As a corollary, final good producers with a SCoC pay a lower input price, which further increases at a lower rate in the strictness of the standard than under IPD. Second, the (uniform) input price applies to all final good producers. Stricter standards by one final good producer consequently not only increase this firm's costs but also the ones of its competitors. Moreover, upstream incentives are maximized under a UIP. The reason is that the input supplier's outside option (profits when refusing to implement the SCoC in the demanded number of supply chains) is strictly larger under IPD, whereas its profits are equivalent across policies (see also Lemma 4 and the related discussion).

Proposition 4 *When final good producers, independently and simultaneously, decide about the strength of their SCoC, a UIP provides greater incentives for the adoption of SCoC compared to IPD.*

Proof See Section 7.3 in the Appendix.

5.2.4 Consumer welfare

There are two main reasons for why consumer surplus may vary with the input supplier's pricing policy: differences in final good prices and/or differences related to the SCoC, such as their strictness or uptake.

For given standards, aggregate output and final good prices are equivalent under both pricing polices (see the Appendix for further details). As a corollary, any differences in consumer surplus stem from differences in firms' adoption incentives.

From Proposition 3 it follows that in the case of exogenous standards, any given $R < \bar{R}$ may be achieved with stricter standards under IPD. This implies that in the given context consumer surplus is maximized under IPD, whenever this pricing policy maximizes firms' adoption incentives. In contrast, Proposition 4 makes clear that in the case of endogenous standards, a UIP always maximizes consumer surplus.

5.3 General SCoC and spillovers

Up to now, our analysis focuses on specific SCoC. As a consequence, D_i's SCoC only matters for its own supply relationship with the input supplier but is otherwise irrelevant for U's operations.

In the following, we briefly discuss the implications of general SCoC for firms' incentives to implement SCoC.[28]

When SCoC are general, D_i's SCoC affects the entire production structure of the input supplier and therefore raises its production costs for each downstream firm. To illustrate this, consider the case of a downstream duopoly and assume that D_1 introduces a SCoC with standard e_1 (D_2 does not introduce a SCoC). Under specific SCoC, U's total production costs are aq_1e_1, whereas under general SCoC they are $a(q_1+q_2)e_1$. General SCoC thus raise the input supplier's total production costs and by this the input price (compared to the UIP under specific SCoC). This, of course, is based on the assumption that final good producers' SCoC are sufficiently *unique*. If, for instance, all final good producers were to introduce identical SCoC, U's marginal costs would be equivalent under specific and general SCoC; in contrast, when only a subset of final good producers implements a SCoC or the SCoC differ in their strictness U faces higher total production costs under general than specific SCoC.[29]

Another implication of general as compared to specific SCoC is that all final good producers receive an input factor that not only conforms to their own but also to their competitors' SCoC. In the previously introduced duopoly example, D_1 and D_2, therefore, receive an input factor that is produced according to D_1's SCoC. Depending on its ability (or willingness) to communicate this *external SCoC* to consumers, D_2 might hence be able to benefit from consumers' social preferences, although it does not introduce a SCoC itself. In the context of a more general setting, this again depends on the assumption of sufficiently unique SCoC.

Against this background, we now briefly discuss the implications of general SCoC on final good producers' incentives and capabilities to implement a SCoC in their supply chain. Here, we focus on a duopoly example. Final good producers' inverse demand functions are given by

$$p_i = 1 + sa(e_i + \theta e_{-i}) - q_i - q_{-i} \tag{34}$$

where $\theta \in [0,1]$ measures in how far a final good producer is able to benefit from its competitor's SCoC (for simplicity, we assume that $\theta_i = \theta \ \forall i$). In the following, we will refer to θ as the spillovers on the downstream market. The input supplier has total production costs of

$$a \sum_{i=1}^{2} q_i \max_{i \in \{1,2\}} \{e_i\}. \tag{35}$$

In the following analysis we assume that the input supplier sets a UIP. This input price is given

[28] The following discussion has a more informal character. An in-depth analysis of general SCoC is left for future research.

[29] In our analysis we assume that the greater implementation and production costs of stricter SCoC stem from their additional rules and guidelines. Moreover, we assume that stricter SCoC contain all the elements of weaker SCoC next to some additional regulation.

by

$$w^{CSR} = w^{UIP} + \underbrace{\frac{s\theta \sum_{i=1}^{2} e_i}{4}}_{spillover\ effect} + \underbrace{\frac{2 \max\limits_{i\in\{1,2\}} \{e_i\} - \sum_{i=1}^{2} e_i}{4}}_{cost\ effect} \tag{36}$$

where w^{UIP} denotes the UIP under specific SCoC.

Moreover,

$$\begin{aligned} q_i^{CSR} &= q_i^{UIP} + \frac{a}{12}\Big[\underbrace{s\theta(7e_{-i} - 5e_i)}_{spillover\ effect} - \underbrace{(2 \max_{i\in\{1,2\}} \{e_i\} - \sum_{i=1}^{2} e_i)}_{cost\ effect}\Big], \\ Q^{CSR} &= Q^{UIP} + \frac{a}{6}\Big[\underbrace{s\theta \sum_{i=1}^{N} e_i}_{spillover\ effect} - \underbrace{(2 \max_{i\in\{1,2\}} \{e_i\} - \sum_{i=1}^{2} e_i)}_{cost\ effect}\Big]. \end{aligned} \tag{37}$$

In (37), q_i^{UIP} and Q^{UIP} denote the individual and aggregate production levels on the downstream market in the case of specific SCoC and a UIP.

From the previous discussion, it is clear that general SCoC impact the market equilibrium outcome via two channels: a *spillover effect* and a *cost effect*. The two channels respectively summarize the implications of general SCoC in terms of final good producers' inverse demand functions and the input supplier's cost structure; (36) and (37) illustrate their implications on the input price and final good producers' individual and aggregate production decisions.

Via the cost effect, general SCoC lower firms' incentives to adopt a given standard, relative to a scenario with specific SCoC and a UIP (or, in the endogenous case, motivate them to set a less stringent standard): the input supplier takes into account that the adoption of a SCoC raises its production costs for all final good producers (as compared to for only one final good producer); similarly, a final good producer considers that the implementation of a SCoC raises the input price substantially, and thus makes the adoption less attractive.

The implications of the spillover effect are less clear-cut. On the upstream market, the spillover effect clearly increases the input supplier's incentives to introduce a SCoC: spillovers increase the demand for the input factor and allow the input supplier to set a higher input price. On the downstream market, the result depends on the relative strength of two effects. On the one hand, final good producers benefit from the presence of spillovers via their competitors' SCoC (positive effect via *received spillovers*). On the other hand, they also face stronger competitors (negative effect via *emitted spillovers*). All in all, the spillover effect increases final good producers' incentives to adopt a SCoC, whenever the spillovers a firm receives via its competitors' SCoC are sufficiently important to compensate for the ones it emits.

6 Conclusion

Over the past decade, Corporate Social Responsibility (CSR), a concept whereby companies voluntarily integrate their stakeholders' social environmental concerns in their business practices (European Commission (2001)), has become a central element of corporate strategy. Here, particularly the social performance of firms' supply chains increasingly takes center stage. In an effort to transfer socially responsible behavior upstream, firms develop social criteria, codified in the form of supplier codes of conduct (SCoC), which they expect their input suppliers to fulfill. In this paper, we clarify the implications of SCoC for the market equilibrium outcome and analyze final good producers' incentives and capabilities for implementing a SCoC with their input supplier.

Our analysis makes clear that the successful implementation of a SCoC in a given supply chain primarily depends on its type and strictness. As such, whenever firms design their SCoC to maximize their individual profits, the latter are implemented in all of the industry's supply chains. In contrast, exogenously defined SCoC may be adopted in only some or even no supply relationship, provided they demand a sufficiently high level of CSR effort. Here, the uptake of SCoC may be insufficient, in the sense that not all final good producers that propose a SCoC to the input supplier also succeed to implement it (underprovision of SCoC). In this context, we study a public and a private policy initiative, which both aim to overcome this underprovision by subsidizing the input supplier's implementation costs. Although both policies may achieve their objective, and, as a result, lead to a gain in consumer surplus, they also have their drawbacks: public subsidies inflict important costs on the policy maker, that may not justify the resulting gain in consumer surplus; private subsidies reduce final good producers' incentives to propose a SCoC in the first place. Also the input supplier's pricing policy has important consequences for the successful implementation of SCoC. In particular, we show that input price discrimination may provide firms with greater incentives to implement a SCoC and, as a result, may maximize consumer welfare.

Several extensions of our setup come to mind. First, we assume that final good producers introduce SCoC to cater to consumers' social preferences. Although the latter is an important, and well-documented, motive, final good producers may also introduce SCoC to insure themselves against the reputational damage that may result from a (ethical) misconduct of their input suppliers.[30] In this context, it would be interesting to introduce imperfect information on sides of final good producers regarding the input supplier's implementation efforts. Second, we assume consumers to be perfectly informed regarding firms' CSR activities. In reality, however, consumers typically do not observe these activities directly, but only via signals such as advertisement, public relations campaigns or packaging. In our eyes, it would be important to clarify the implications of consumers' information structure for the successful implementation of SCoC. A more in-depth analysis of the topic may further address final good producers' incentives to

[30]See, for instance, Giraud-Héraud et al. (2012) who study joint private safety standards in a vertical Cournot oligopoly. In their framework, input suppliers may fail to provide safe inputs to the downstream market. In this case, demand drops to zero in the case of a crisis. The probability that a crisis occurs is endogenous and decreases with the level of upstream investment.

invest in *green advertising*.[31] Finally, the main part of this paper focuses on specific SCoC, i.e., on SCoC that are specific to the supply relationship between a final good producer and the input supplier. In an extension, we briefly address general SCoC, which apply to the entire upstream production structure. It would be interesting to study this topic in further detail and, among other things, clarify final good producers' strategic incentives to invest in similar or less similar SCoC.

7 Appendix

7.1 Implementing SCoC

Proof of Proposition 1 From the analysis in Section 3.2.1 it follows that for $e \in \left(\underline{e}_d(R), \bar{e}_d(R)\right]$ R final good producers have incentives to implement a SCoC in their supply chain; for $e \leq \bar{e}_u(R)$ the same applies for the input supplier. However, the ranking of $\underline{e}_d(R)$, $\bar{e}_d(R)$ and $\bar{e}_u(R)$ is not clear-cut. Instead, depending on the value of c_u relative to c_d we may be in either of three cases and consequently need to discuss the equilibrium conditions for each of them. Figure 6 illustrates the three different scenarios (see also Lemma 2).

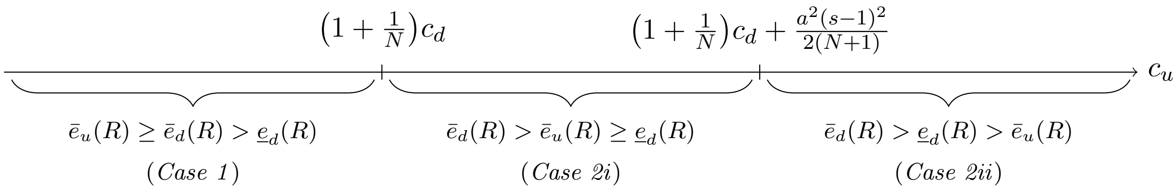

Figure 6: Ranking of the adoption thresholds.

Case 1: $c_u \leq \left(1+\frac{1}{N}\right)c_d: \ \bar{e}_u(R) \geq \bar{e}_d(R) > \underline{e}_d(R)$.

As discussed previously, for $c_u \leq \left(1+\frac{1}{N}\right)c_d$ any SCoC that is proposed by a final good producer is also accepted upstream. The relevant adoption thresholds are consequently given by $\bar{e}_d(R)$ and $\underline{e}_d(R)$. The following discussion is illustrated in Figure 7. The figure represents the previously developed thresholds – $\bar{e}_d(R), \underline{e}_d(R), \bar{e}_u(R)$ – as a function of R. The shaded regions correspond to the different equilibria (for integer values of R).

First, the unique symmetric equilibrium in which $R^* = 0$ is characterized by $e > \underline{e}_d(0) = \bar{e}_d(1)$. Meaning, any SCoC with standard e such that $e > \underline{e}_d(0) = \bar{e}_d(1)$ is not implemented in the industry. This is clear from the definition of the thresholds: for $e > \underline{e}_d(0) = \bar{e}_d(1)$ all final good producers are better off not implementing a SCoC (compared to being the only firm with a SCoC in place).

[31] See, among others, the work by Arguedas and Blanco (2014) or Lyon and Maxwell (2011). In Lyon and Maxwell (2011) a firm strategically discloses information about the environmental impact of its activities. A non-governmental organization may verify the firm's claims and penalize it if it fails to fully disclose its environmental performance. Arguedas and Blanco (2014) study firms' incentives to voluntarily certify their CSR activities in a framework where firms may pretend to be socially responsible and consumers form beliefs about the credibility of firms' CSR claims.

Second, $e \leq \bar{e}_d(N) = \underline{e}_d(N-1)$ is the unique symmetric equilibrium in which $R^* = N$. That is, any SCoC with standard e satisfying $e \leq \bar{e}_d(N) = \underline{e}_d(N-1)$ is implemented by the entire downstream market. Similar to the previous case, for $e \leq \bar{e}_d(N) = \underline{e}_d(N-1)$ all final good producers are better off implementing a SCoC (compared to being the only firm without a SCoC).

Third, $e \in \big(\bar{e}_d(R^*+1), \bar{e}_d(R^*)\big]$ is the unique asymmetric equilibrium in which $R^* \in \{1, \ldots, N-1\}$ (note that $\bar{e}_d(R^*+1) = \underline{e}_d(R^*)$). Meaning, for $e \in \big(\bar{e}_d(R^*+1), \bar{e}_d(R^*)\big]$ R^* final good producers are always better off implementing a SCoC, given $N - R^*$ of their competitors do not (and vice versa for the $N - R^*$ final good producers that do not implement a SCoC).

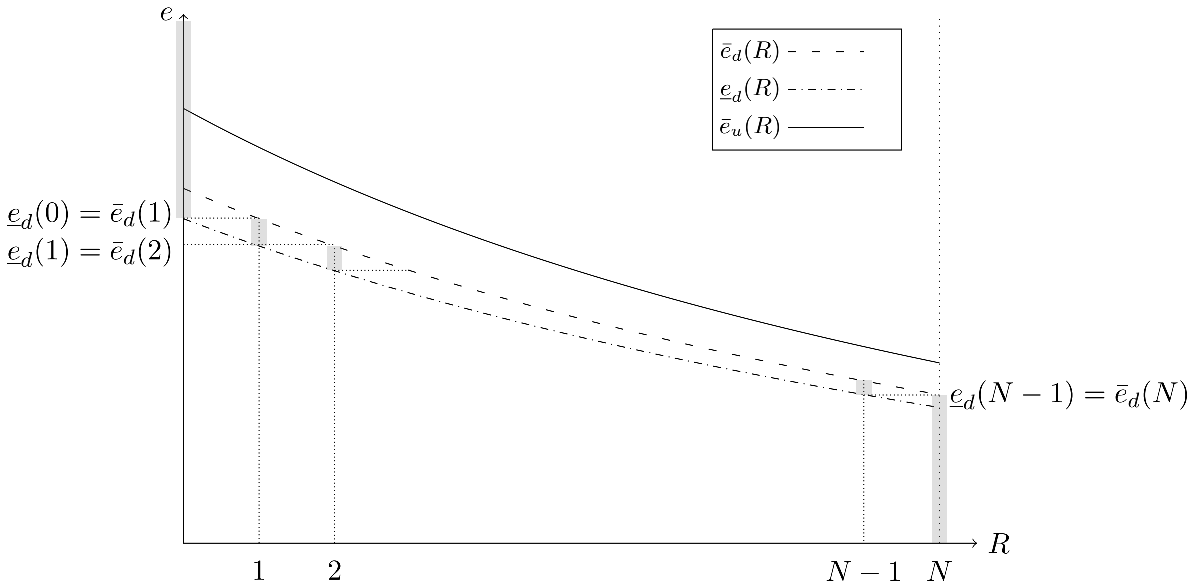

Figure 7: Equilibrium conditions (Case 1).

Result 1 *Assume that c_u is sufficiently low relative to c_d such that $\bar{e}_u(R) \geq \bar{e}_d(R) > \underline{e}_d(R)$. In that case, any SCoC with standard e^*_{ex} satisfying either $e^*_{ex} > \underline{e}_d(0) = \bar{e}_d(1)$ or $e^*_{ex} \leq \bar{e}_d(N) = \underline{e}_d(N-1)$ is successfully implemented in respectively $R^* = 0$ or $R^* = N$ supply chains (symmetric equilibria); for $e^*_{ex} \in \big(\bar{e}_d(R^*+1), \bar{e}_d(R^*)\big]$ the equilibrium is asymmetric with $R^* \in \{1, \ldots, N-1\}$.*

Case 2i: $c_u \in \Big(\big(1 + \frac{1}{N}\big)c_d, \big(1 + \frac{1}{N}\big)c_d + \frac{a^2(s-1)^2}{2(N+1)}\Big]$**:** $\bar{e}_d(R) > \bar{e}_u(R) \geq \underline{e}_d(R)$.

In Case 2i (and 2ii) c_u is sufficiently important such that $\bar{e}_d(R) > \bar{e}_u(R)$. As a corollary, the input supplier's *veto power* matters for the equilibrium conditions. Meaning, in Cases 2i and 2ii U may block the successful implementation of a SCoC. The following discussion is illustrated in Figure 9.

First, the unique equilibrium in which $R^* = 0$ is such that $e > \bar{e}_u(1)$. Generally, there may be an equilibrium with $R^* = 0$ for either $e > \underline{e}_d(0) = \bar{e}_d(1)$ or $e > \bar{e}_u(1)$. From $\underline{e}_d(0) = \bar{e}_d(1) > \bar{e}_u(1)$ (see Lemma 2) it follows that $\bar{e}_u(1)$ is the relevant threshold. For $e > \bar{e}_u(1)$ the input supplier is strictly better off implementing the SCoC in none of its supply relationships and thus blocks any potential implementation efforts by a final good producer.

Second, by a similar argument it follows that the unique equilibrium in which $R^* = N$ is characterized by $e \leq \bar{e}_u(N)$.

Third, any SCoC with standard e such that $e \in \big(\bar{e}_u(R^*+1), \bar{e}_u(R^*)\big]$ is successfully implemented by $R^* \in \{1, \dots N-1\}$ final good producers.

In Case 2i (and 2ii) an underprovision of SCoC occurs. As such, the number of SCoC that is implemented in equilibrium, R^*, may fall short the one that is proposed by final good producers. We now discuss this underprovision of SCoC in further detail. In the given case, Case 2i, c_u is sufficiently high relative to c_d such that $\bar{e}_d(R) > \bar{e}_u(R) \geq \underline{e}_d(R)$. The ranking is illustrated in Figure 8.

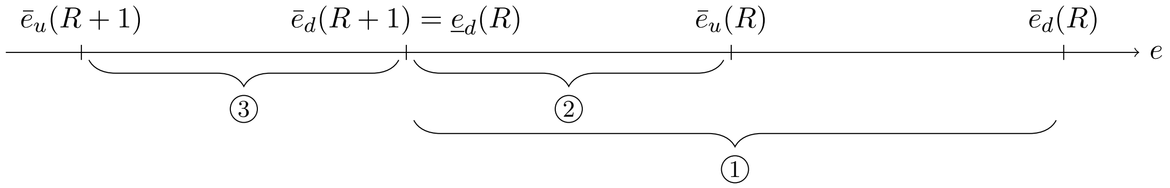

Figure 8: Ranking of adoption thresholds (Case 2i).

In interval ① in Figure 8, R final good producers propose to implement a SCoC. However, only those SCoC that are sufficiently low and fall into ② get implemented in R supply chains in equilibrium (stricter SCoC are implemented in at most $R-1$ supply chains). In interval ③, $R+1$ final good producers propose to implement a SCoC; the input supplier, however, only has incentives to do so in R supply relationships. Here, we assume that U draws R supply relationships at random out of the $R+1$ final good producers that propose a SCoC. As a corollary, for $e \in \big(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\big]$ (interval ③) the equilibrium is characterized by an underprovision of SCoC as the number of SCoC that is successfully implemented falls short the potential one that is proposed by the downstream market (also illustrated for $e \in \big(\bar{e}_u(N), \bar{e}_d(N)\big]$ in Figure 9). Note that an alignment of upstream and downstream incentives increases R^* by at most one.[32]

To summarize, any $e \in \big(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\big]$ with $R^* \in \{0, \dots, N-1\}$ is characterized by an underprovision of SCoC as the number of SCoC that are implemented in equilibrium, R^*, could be increased by one via an alignment of upstream and downstream incentives.

Result 2 *Assume that c_u is sufficiently high relative to c_d such that $\bar{e}_d(R) > \bar{e}_u(R) \geq \underline{e}_d(R)$. In that case, any SCoC with standard e^*_{ex} such that $e^*_{ex} > \bar{e}_u(1)$ or $e^*_{ex} \leq \bar{e}_u(N)$ is implemented by respectively $R^* = 0$ or $R^* = N$ firms. Any $e^*_{ex} \in \big(\bar{e}_u(R^*+1), \bar{e}_u(R^*)\big]$ is successfully implemented by $R^* \in \{1, \dots, N-1\}$ final good producers. For $e^*_{ex} \in \big(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\big]$ and $R^* \in \{0, \dots, N-1\}$ the equilibrium is characterized by an underprovision of SCoC as the number of*

[32]Take $\mathcal{I} \in \{1, \dots, N-1\}$. We now show that here is no e such that $e \in \big(\bar{e}_u(R+1), \bar{e}_d(R+1+\mathcal{I})\big]$ (i.e., such that $R+1+\mathcal{I}$ final good producers want to adopt a SCoC, but that U is only willing to do so in R supply relationships). Note first that $\bar{e}_d(R+1+\mathcal{I}) = \underline{e}_d(R+\mathcal{I})$. Moreover, in Case 2i $\underline{e}_d(R) \leq \bar{e}_u(R)$ holds $\forall$ R. Given that i) $\mathcal{I} \geq 1$ and ii) $\partial \underline{e}_d(R)/\partial R < 0$ it is immediate that $\bar{e}_d(R+1+\mathcal{I}) = \underline{e}_d(R+\mathcal{I}) \geq \bar{e}_u(R+1)$ can never hold.

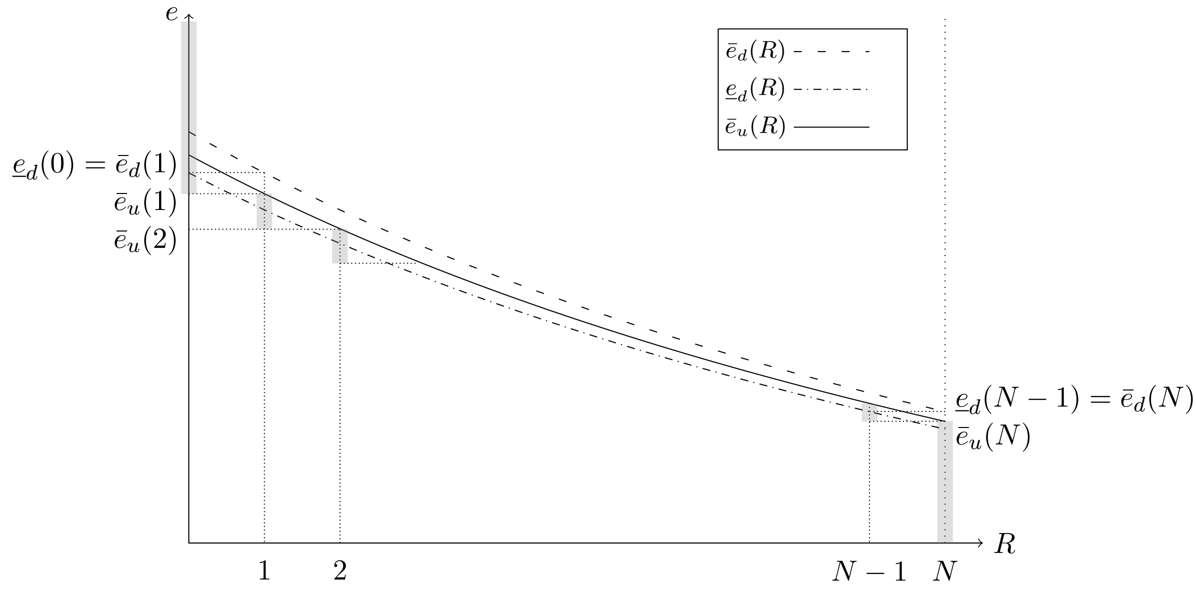

Figure 9: Equilibrium conditions (Case 2i).

SCoC that is successfully implemented, R^*, falls short the one that is proposed by the downstream market, R^*+1.

Case 2ii: $c_u > \left(1+\frac{1}{N}\right)c_d + \frac{a^2(s-1)^2}{2(N+1)}$**:** $\bar{e}_d(R) > \underline{e}_d(R) > \bar{e}_u(R)$.

By a similar argument to Case 2i, one can establish that $e > \underline{e}_u(1)$ and $e \leq \bar{e}_u(N)$ are the unique symmetric equilibria in which respectively $R^* = 0$ and $R^* = N$ final good producers successfully implement a SCoC (see Figure 10 for a graphical representation). Moreover, any $e \in \left(\bar{e}_u(R^*+1), \bar{e}_u(R^*)\right]$ is adopted by $R^* \in \{1, \dots, N-1\}$ firms.

As in the previous case, there is an underprovision of SCoC for $e^* \in \left(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\right]$ and $R^* \in \{0, \dots, N-1\}$ that follows from the fact that downstream incentives exceed upstream incentives. Notice that compared to Case 2i, overcoming the underprovision of SCoC may increase R^* by more than one.

Result 3 *Assume that c_u is sufficiently high relative to c_d such that $\bar{e}_d(R) > \underline{e}_d(R) > \bar{e}_u(R)$. In that case, any SCoC with standard e^*_{ex} such that $e^*_{ex} > \bar{e}_u(1)$ or $e^*_{ex} \leq \bar{e}_u(N)$ is successfully implemented in the supply chains of respectively $R^* = 0$ or $R^* = N$ final good producers; standards with $e^*_{ex} \in \left(\bar{e}_u(R^*+1), \bar{e}_u(R^*)\right]$ are introduced in $R^* \in \{1, \dots, N-1\}$ supply chains. For $e^*_{ex} \in \left(\bar{e}_u(R^*+1), \bar{e}_d(R^*+1)\right]$ and $R^* \in \{0, \dots, N-1\}$ the before-mentioned underprovision of SCoC is present and the number of ScoC that is implemented in equilibrium, R^*, falls short the one that is proposed by the downstream market by at least one.*

From Result 1, 2 and 3 Proposition 1 directly follows. □

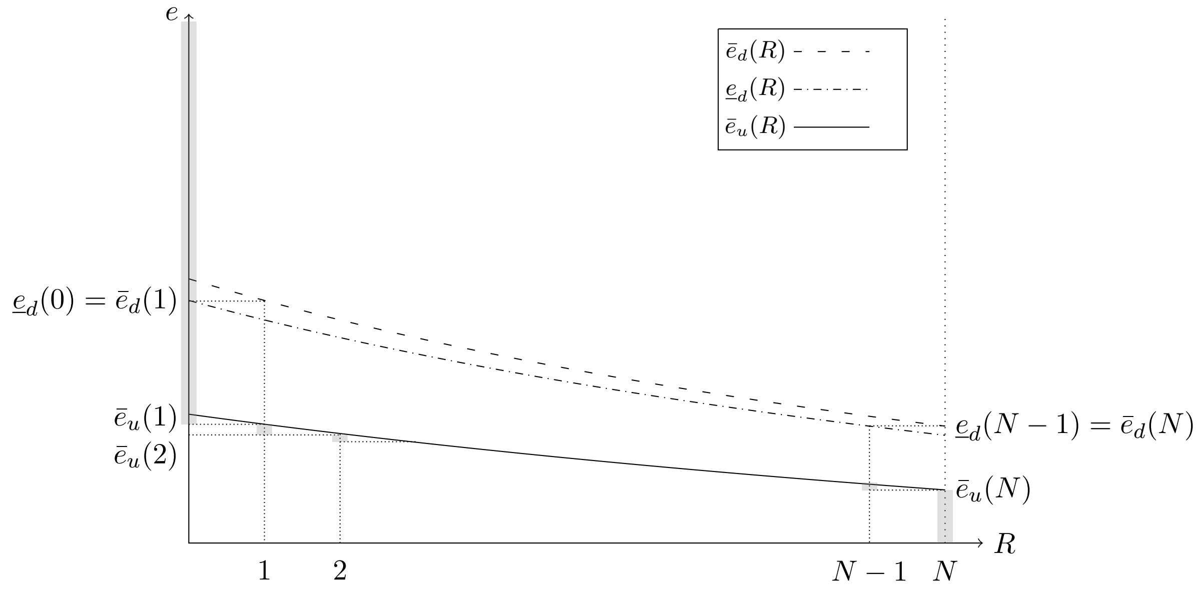

Figure 10: Equilibrium conditions (Case 2ii).

7.2 Consumer welfare

Take $N = 2$, $a = 1$ and $s = 2$. We focus on $c_u \in \left(\frac{3}{2}c_d, \frac{3}{2}c_d + \frac{1}{6}\right]$ and $e^*_{ex} \in \left(\frac{1}{6c_u}, \frac{1}{9c_d}\right]$; a parameter range in which $R^* = 1$, although both final good producers have incentives to implement a SCoC in their supply chains (this result is developed in detail in Section 3.2.1). The policy maker is able to increase R^* from $R^* = 1$ to $R^* = 2$ by subsidizing upstream implementation costs by $\phi = 1 - 3c_d/2c_u$ (alignment of upstream and downstream incentives). The resulting increase in consumer surplus, ΔCS^{CSR}_{ex}, and costs to the policy maker, C_{pm}, are

$$\begin{aligned} \Delta CS^{CSR}_{ex} &= \frac{e^*_{ex}(4 + 3e^*_{ex})}{72}, \\ C_{pm} &= (2c_u - 3c_d)e^{*2}_{ex}. \end{aligned} \tag{38}$$

It is clear that $\Delta CS^{CSR}_{ex} \geq C_{pm}$ if and only if

$$4 \geq e^*_{ex}\big[72(2c_u - 3c_d) - 3\big]. \tag{39}$$

We now derive the conditions under which (39) is satisfied.

Case 1: $72(2c_u - 3c_d) - 3 \leq 0$ *or* $c_u \leq \frac{216c_d+3}{144} = \frac{3}{2}c_d + \frac{1}{48}$. When $c_u \leq \frac{216c_d+3}{144}$, the RHS of (39) is non-positive so that (39) is always satisfied. It immediately follows that $\Delta CS^{CSR}_{ex} \geq C_{pm}$ for $c_u \in \left(\frac{3}{2}c_d, \frac{3}{2}c_d + \frac{1}{48}\right]$.

Case 2: $72(2c_u - 3c_d) - 3 > 0$ *or* $c_u > \frac{216c_d+3}{144} = \frac{3}{2}c_d + \frac{1}{48}$. In that case, the RHS of (39) is strictly positive and $\Delta CS^{CSR}_{ex} \geq C_{pm}$ for $e \leq \bar{e} = \frac{4}{72(2c_u - 3c_d) - 3}$. We now verify that $\bar{e}$ lies within $e^*_{ex} \in \left(\frac{1}{6c_u}, \frac{1}{9c_d}\right]$. Note that if $\bar{e} < \frac{1}{6c_u}$, $C_{pm} > \Delta CS^{CSR}_{ex}$ irrespective of the value of e^*_{ex}. For $\bar{e} > \frac{1}{9c_d}$, $\Delta CS^{CSR}_{ex} > C_{pm}$ $\forall e^*_{ex} \in \left(\frac{1}{6c_u}, \frac{1}{9c_d}\right]$.

- $\bar{e} \geq \frac{1}{6c_u}$?

It is readily verified that $\bar{e} \geq \frac{1}{6c_u}$ if and only if $c_u \leq \frac{216c_d+3}{120}$. Does this threshold lie within the relevant parameter range for c_u, i.e., within $\left(\frac{216c_d+3}{144}, \frac{3}{2}c_d + \frac{1}{6}\right]$? Clearly, $\frac{216c_d+3}{120} > \frac{216c_d+3}{144}$ so that the lower bound is always satisfied. The upper bound is satisfied, i.e., $\frac{216c_d+3}{120} \leq \frac{3}{2}c_d + \frac{1}{6}$, for $c_d \leq \frac{17}{36}$. It follows that $\bar{e} \geq \frac{1}{6c_u}$ for either $c_d > \frac{17}{36}$ or $c_d \leq \frac{17}{36}$ and $c_u \in \left(\frac{216c_d+3}{144}, \frac{216c_d+3}{120}\right]$. In contrast, $\bar{e} < \frac{1}{6c_u}$, and by this $C_{pm} > \Delta CS_{ex}^{CSR}$, for $c_d \leq \frac{17}{36}$ and $c_u \in \left(\frac{216c_d+3}{120}, \frac{3}{2}c_d + \frac{1}{6}\right]$.

- $\bar{e} \leq \frac{1}{9c_d}$?

Note that $\bar{e} > \frac{1}{9c_d}$ if and only if $c_u < \frac{252c_d+3}{144}$. Does this threshold satisfy the constraints on c_u, i.e., $c_u \in \left(\frac{216c_d+3}{144}, \frac{3}{2}c_d + \frac{1}{6}\right]$? Clearly, $\frac{252c_d+3}{144} > \frac{216c_d+3}{144}$. Moreover, $\frac{252c_d+3}{144} \leq \frac{3}{2}c_d + \frac{1}{6}$ for $c_d \leq \frac{7}{12}$ and vice versa. It follows that $\bar{e} > \frac{1}{9c_d}$, and by this $\Delta CS_{ex}^{CSR} > C_{pm}$, for either $c_d > \frac{7}{12}$ or $c_d \leq \frac{7}{12}$ and $c_u \in \left(\frac{216c_d+3}{144}, \frac{252c_d+3}{144}\right]$. In contrast, $\bar{e} \leq \frac{1}{9c_d}$ for $c_d \leq \frac{7}{12}$ and $c_u \in \left(\frac{252c_d+3}{144}, \frac{2}{3}c_d + \frac{1}{6}\right]$.

Summarizing the results, it follows that $\Delta CS_{ex}^{CSR} \geq C_{pm}$ for

- $c_u \in \left(\frac{3}{2}c_d, \frac{216c_d+3}{144}\right]$;
- $c_d \leq \frac{17}{36}$ and
  - $c_u \in \left(\frac{216c_d+3}{144}, \frac{252c_d+3}{144}\right]$,
  - $c_u \in \left(\frac{252c_d+3}{144}, \frac{216c_d+3}{120}\right]$ and $e^*_{ex} \in \left(\frac{1}{6c_u}, \bar{e}\right]$;
- $c_d \in \left(\frac{17}{36}, \frac{21}{36}\right]$ and
  - $c_u \in \left(\frac{216c_d+3}{144}, \frac{252c_d+3}{144}\right]$,
  - $c_u \in \left(\frac{252c_d+3}{144}, \frac{3}{2}c_d + \frac{1}{6}\right]$ and $e^*_{ex} \in \left(\frac{1}{6c_u}, \bar{e}\right]$;
- $c_d > \frac{21}{36}$.

In contrast, $C_{pm} > \Delta CS_{ex}^{CSR}$ for

- $c_d < \frac{17}{36}$ and
  - $c_u \in \left(\frac{252c_d+3}{144}, \frac{216c_d+3}{120}\right]$ and $e \in \left(\bar{e}, \frac{1}{9c_d}\right]$,
  - $c_u \in \left(\frac{216c_d+3}{120}, \frac{3}{2}c_d + \frac{1}{6}\right]$;
- $c_d \in \left[\frac{17}{36}, \frac{21}{36}\right)$ and $c_u \in \left(\frac{252c_d+3}{144}, \frac{3}{2}c_d + \frac{1}{6}\right]$.

7.3 A uniform input price

7.3.1 Market stage

In the absence of input price discrimination, final good producers set their quantities q_i to maximize

$$\pi_{d,i}^{CSR} = \big(p_i(q_i, q_{-i}) - aw\big)q_i \tag{40}$$

with $p_i(q_i, q_{-i}) = 1 + sae_i - q_i - q_{-i}$, $q_{-i} = \sum_{j=1,\neq i}^{N} q_j$ and $e_{-i} = \sum_{j=1,\neq i}^{N} e_j$. It is readily derived that this yields

$$q_i(w) = \left(\frac{1}{N+1}\right)\left[1 + as(Ne_i - e_{-i}) - aw\right]. \tag{41}$$

Given (41), the input supplier sets the input price w to maximize

$$\pi_u^{CSR} = a\sum_{i=1}^{N}(w - e_i)q_i(w). \tag{42}$$

This in turn implies that

$$w^{CSR} = w^b + \frac{(s+1)\sum_{i=1}^{N} e_i}{2N}. \tag{43}$$

Based on (43) we obtain

$$\begin{aligned} q_i^{CSR} &= q^b + \frac{as\left[2N(N+1)e_i - (2N+1)\sum_{i=1}^{N} e_i\right] - a\sum_{i=1}^{N} e_i}{2N(N+1)}, \\ Q^{CSR} &= Q^b + \frac{a(s-1)\sum_{i=1}^{N} e_i}{2(N+1)}, \end{aligned} \tag{44}$$

and

$$p_i^{CSR} = p^b + \frac{2(N+1)ase_i - a(s-1)\sum_{i=1}^{N} e_i}{2(N+1)}. \tag{45}$$

Table 5 summarizes the market equilibrium outcome for the case in which R firms adopt an exogenous SCoC with standard e (see Table 4 for the corresponding equilibrium quantities, prices and market profits under input price discrimination).

Exogenous standards

Upstream incentives (Lemma 4). Denote the input supplier's profits under IPD and a UIP by $\pi_u^{IPD}(R)$ and $\pi_u^{UIP}(R)$. It follows that $\pi_u^{IPD}(R) - \pi_u^{UIP}(R) \geq 0$ if and only if

$$\frac{R(N-R)}{4N}a^2(se+e)^2 \geq 0. \tag{46}$$

From (46) several implications follow (see also Figure 11).

- First, $\pi_u^{IPD}(R) - \pi_u^{UIP}(R) \geq 0$ $\forall R \leq N$. In particular, $\pi_u^{IPD}(R) - \pi_u^{UIP}(R) > 0$ for any $R \in \{1, \ldots, N-1\}$ and $\pi_u^{IPD}(R) - \pi_u^{UIP}(R) = 0$ for $R \in \{1, N\}$.
- Second, $\pi_u^{IPD}(R) - \pi_u^{UIP}(R)$ increases in R if and only if $R \leq N/2$ and is maximized at $R = N/2$.
- Third, $\pi_u^{IPD}(R) - \pi_u^{UIP}(R) = \pi_u^{IPD}(R-1) - \pi_u^{UIP}(R-1)$ at $R = (N+1)/2$.

	D_i with $i \in \{1, \dots, R\}$	D_i with $i \in \{R+1, \dots, N\}$
Individual quantities	$q^b + \frac{a[s(2N(N+1)-R(2N+1))e-Re]}{2(N+1)}$	$q^b - \frac{Ra[s(2N+1)e+e]}{2(N+1)}$
Aggregate output	$Q^b + \frac{Ra(s-1)e}{2(N+1)}$	
Input price	$w^b + \frac{R(s+1)e}{2N}$	
Final good prices	$p^b + \frac{2(N+1)ase-Ra(s-1)e}{2(N+1)}$	$p^b - \frac{Ra(s-1)e}{2(N+1)}$
Downstream profits	$\left(\frac{N+a[s(2N(N+1)-R(2N+1))e-Re]}{2N(N+1)}\right)^2$	$\left(\frac{N-Ra[s(2N+1)e+e]}{2N(N+1)}\right)^2$
Upstream profits	$\frac{[N+Ra(s-1)e]^2-4(N+1)(N-R)Ra^2se^2}{4N(N+1)}$	

Table 5: Quantities, prices and market profits under a UIP.

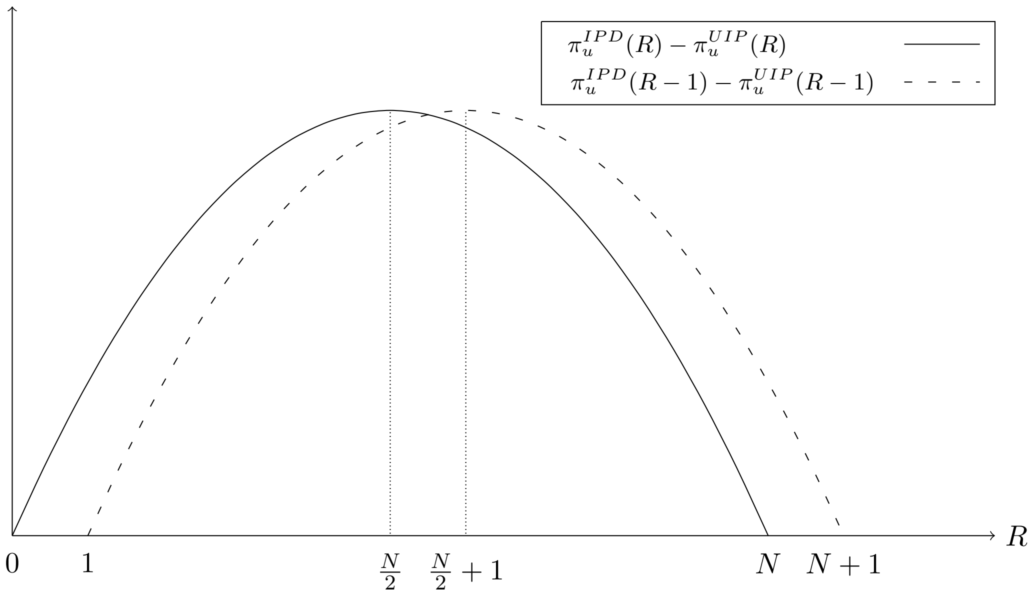

Figure 11: Upstream adoption incentives: IPD versus a UIP.

Proof of Proposition 3 To determine which pricing policy maximizes firms' incentives for implementing SCoC, we need to distinguish four cases that depend on which standard is binding under a UIP and IPD.

Case 1: $\bar{e}_u(R)$ is binding under IPD and a UIP. From Lemma 3 it directly follows that a UIP provides greater incentives than IPD whenever $R \geq \bar{R}$ (and vice versa for $R < \bar{R}$).

Case 2: $\bar{e}_d(R)$ is binding under IPD and a UIP. From Lemma 4 it is clear that firms' incentives are always maximized under IPD.

Case 3: $\bar{e}_u(R)$ is binding under IPD, $\bar{e}_d(R)$ is binding under a UIP. This implies that $\bar{e}_u^{IPD}(R) < \bar{e}_d^{IPD}(R)$ and $\bar{e}_d^{UIP}(R) < \bar{e}_u^{UIP}(R)$. We further know from Lemma 4 that $\bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R)$ is always true. Combining the three inequalities it follows that in Case 3 the only possible ranking of the adoption thresholds is $\bar{e}_u^{IPD}(R) < \bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R) < \bar{e}_u^{UIP}(R)$. Note that for the latter to be true, $R \geq \bar{R}$ has to hold; otherwise $\bar{e}_u^{IPD}(R) > \bar{e}_u^{UIP}(R)$ and Case 3 does not exist. As a consequence, for $R \geq \bar{R}$ $\bar{e}_u^{IPD}(R) < \bar{e}_d^{UIP}(R)$ and a UIP gives firms larger incentives to implement SCoC than IPD.

Case 4: $\bar{e}_d(R)$ is binding under IPD, $\bar{e}_u(R)$ is binding under a UIP. This implies that $\bar{e}_d^{IPD}(R) < \bar{e}_u^{IPD}(R)$ and $\bar{e}_u^{UIP}(R) < \bar{e}_d^{UIP}(R)$. We further know from Lemma 4 that $\bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R)$ always holds. To determine which pricing policy provides firms with greater incentives to adopt a SCoC, i.e., the ranking of $\bar{e}_d^{IPD}(R)$ and $\bar{e}_u^{UIP}(R)$, we have to order the four thresholds. Given that $\bar{e}_d^{IPD}(R) < \bar{e}_u^{IPD}(R)$ and $\bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R)$ have to hold it follows that $\bar{e}_d^{IPD}(R)$ is either the lowest or the second lowest of the four threshold.

(i) Assume first that $\bar{e}_d^{IPD}(R)$ is the lowest of the four threshold. In that case, $\bar{e}_d^{IPD}(R) < \bar{e}_u^{UIP}(R)$ automatically holds and a UIP gives larger incentives than IPD.

(ii) Assume now that $\bar{e}_d^{IPD}(R)$ is the second lowest of the four thresholds. Given that $\bar{e}_d^{IPD}(R) < \bar{e}_u^{IPD}(R)$ and $\bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R)$ have to hold, it directly follows that $\bar{e}_u^{UIP}(R)$ is the lowest threshold. Note, that this implies that $R \geq \bar{R}$ has to be satisfied for this case to exist. As a corollary, $\bar{e}_u^{UIP}(R) < \bar{e}_d^{IPD}(R)$ and IPD provides greater incentives than a UIP.

From the analysis it is clear that $R < \bar{R}$ is a necessary condition for IPD to maximize firms' adoption incentives: unless $R < \bar{R}$ there exists no ranking of the adoption thresholds that is such that either $\bar{e}_u^{UIP}(R) < \bar{e}_u^{IPD}(R)$ (Case 1) or $\bar{e}_u^{UIP}(R) < \bar{e}_d^{IPD}(R)$ (Case 4ii). We therefore assume that $R < \bar{R}$ for the following discussion.

It remains to clarify under what conditions Case 1 or Case 4ii apply. Here, the relative size of c_u to c_d is crucial as it determines which standard is binding under either pricing policy. As such, whenever c_u is sufficiently large, $c_u \geq \bar{c}_1$, $\bar{e}_u^{UIP} \leq \bar{e}_d^{UIP}$ and Case 4 applies; for $c_u \geq \bar{c}_2$, with $\bar{c}_2 > \bar{c}_1$ for $R < \bar{R}$[33], $\bar{e}_u^{IPD}(R) \leq \bar{e}_d^{IPD}(R)$ and we are in Case 1. From the discussion of Case 1 it is immediate that for $c_u \geq \bar{c}_2$ and $R < \bar{R}$ IPD maximizes firms' adoption incentives. Note, however, that $c_u \in [\bar{c}_1, \bar{c}_2)$ and $R < \bar{R}$ are not sufficient to guarantee that IPD maximizes adoption incentives. Instead, c_u needs to rise above $\bar{c}_1$ so that $\bar{e}_u^{UIP}(R)$ falls below $\bar{e}_d^{IPD}(R)$ and Case 4ii applies.[34] It follows that for $c_u \geq \bar{c}_1'$ and $R < \bar{R}$ IPD maximizes firms' incentives to implement SCoC in their supply chains. □

[33]To show that $\bar{c}_2 > \bar{c}_1$ we need to show that the critical threshold of c_u that ensures that $\bar{e}_d^{IPD}(R) > \bar{e}_u^{IPD}(R)$ is larger than the one that guarantees $\bar{e}_d^{UIP}(R) > \bar{e}_u^{UIP}(R)$ (in that case, $\bar{e}_u(R)$ is binding under a UIP and IPD only for sufficiently large values of c_u; for smaller values, only $\bar{e}_u^{UIP}(R)$ may be binding). Assume that $\bar{e}_d^{IPD}(R) > \bar{e}_u^{IPD}(R)$. Can $\bar{e}_u^{UIP}(R) \geq \bar{e}_d^{UIP}(R)$ be satisfied? Given that $\bar{e}_d^{UIP}(R) < \bar{e}_d^{IPD}(R)$ and $\bar{e}_u^{IPD}(R) > \bar{e}_u^{UIP}(R)$ for $R < \bar{R}$, the only possible ranking of the four thresholds is $\bar{e}_d^{UIP}(R) > \bar{e}_d^{IPD}(R) > \bar{e}_u^{IPD}(R) > \bar{e}_u^{UIP}(R)$. This, however, contradicts $\bar{e}_u^{UIP}(R) \geq \bar{e}_d^{UIP}(R)$. It follows that $\bar{e}_u^{UIP}(R) < \bar{e}_d^{UIP}(R)$ whenever $\bar{e}_d^{IPD}(R) > \bar{e}_u^{IPD}(R)$.

[34]First: $\bar{c}_1' > \bar{c}_1$. Assume that $c > \bar{c}_1'$ so that $\bar{e}_u^{UIP}(R) < \bar{e}_d^{IPD}(R)$. Then it directly follows that $\bar{e}_u^{UIP}(R) < \bar{e}_d^{UIP}(R)$ given that $\bar{e}_d^{IPD}(R) < \bar{e}_d^{UIP}(R)$ is always satisfied. That is, for $c > \bar{c}_1'$ $\bar{e}_u^{UIP}$ is binding which implies that $c > \bar{c}_1$. Second: $\bar{c}_1' < \bar{c}_2$. Assume that $c > \bar{c}_2$ so that $\bar{e}_u^{IPD}(R) < \bar{e}_d^{IPD}(R)$. Given that $\bar{e}_u^{UIP}(R) < \bar{e}_u^{IPD}(R)$ for $R < \bar{R}$, it directly follows that $\bar{c}_1' < \bar{c}_2$ is also satisfied.

Endogenous standards

Proof of Proposition 4 Similar to the Proof of Proposition 3, we distinguish four cases that depend on which standard is binding under IPD and a UIP.

Case 1: $\bar{e}_u(N)$ is binding under IPD and a UIP. From Lemma 3 it immediately follows that in the given case a UIP always provides greater incentives than IPD.

Case 2: e_d^* is binding under IPD and a UIP. Comparing the optimal standards across pricing policies it follows that a UIP maximizes firms' adoption incentives in the given case.[35]

Case 3: $\bar{e}_u(N)$ is binding under IPD, e_d^* is binding under a UIP. The given case is characterized by $\bar{e}_u^{IPD}(N) < e_d^*$ and $e_d^{*,UIP} < \bar{e}_u^{UIP}(N)$. Given that $e_d^{*,IPD} < e_d^{*,UIP}$ is always satisfied it follows that $\bar{e}_u^{IPD}(N) < e_d^{*,UIP}$. That is, in the given case, firms' incentives are maximized under a UIP.

Case 4: e_d^* is binding under IPD, $\bar{e}_u(N)$ is binding under a UIP. In the given context, $e_d^{*,IPD} < \bar{e}_u^{IPD}(N)$ and $\bar{e}_u^{UIP}(N) < e_d^{*,UIP}$. Given that $\bar{e}_u^{IPD}(N) < \bar{e}_u^{UIP}(N)$ is always satisfied, it follows that $e_d^{*,IPD} < \bar{e}_u^{UIP}(N)$. In other words, in the given case firms' incentives are maximized under a UIP.

All in all, a UIP thus always provides firms with greater incentives to implement SCoC than IPD. □

References

Arguedas, C., Blanco, E., 2014. On Fraud and Certification of Corporate Social Responsibility. Economic Analysis Working Paper Series (2/2014).

Baden, D. A., Harwood, I. A., Woodward, D. G., 2009. The effect of buyer pressure on suppliers in SME to demonstrate CSR practices: An added incentive or counter productive? European Management Journal 27 (6), 429–441.

Bayer AG, 2016. Bayer Supplier Code of Conduct.
URL http://www.bayer.com/en/supplier-code-of-conduct.aspx

Benabou, R., Tirole, J., 2010. Individual and Corporate Social Responsibility. Economica 77 (305), 1–19.

Ciliberti, F., Pontrandolfo, P., Scozzi, B., 2008. Investigating corporate social responsibility in supply chains: a SME perspective. Journal of Cleaner Production 16 (15), 1579–1588.

Commission of the European Communities, 2001. Green Paper: Promoting a European framework for Corporate Social Responsibility (COM (2001) 366 final).

D'Aspremont, C., Jacquemin, A., Gabszewicz, J. J., Weymark, J. A., 1983. On the Stability of Collusive Price Leadership. The Canadian Journal of Economics 16 (1), 17–25.

[35]Under a UIP, $e_d^* = \frac{a[s(2N^2-1)-1]}{4N(N+1)^2 c_d - a^2[s(2N^2-1)-1](s-1)}$; under IPD $e_d^* = \frac{Na(s-1)}{4(N+1)c_d - Na^2(s-1)^2}$.

Economist Intelligence Unit, 2007. Global Business Barometer.
URL www.economist.com/media/pdf/20080116CSRResults.pdf

Garella, P. G., Petrakis, E., 2008. Minimum quality standards and cconsumer' information. Economic Theory 36 (2), 283–302.

Giraud-Héraud, E., Hammoudi, A., Hoffmann, R., Soler, L.-G., 2012. Joint Private Safety Standards and Vertical Relationships in Food Retailing. Journal of Economics & Management Strategy 21 (1), 179–212.

Häckner, J., 2000. A note on price and quantity competition in differentiated oligopolies. Journal of Economic Theory 93 (2), 233–239.

Ipsos MORI, 2003. Ethical Companies.
URL www.ipsos-mori.com/researchpublications/researcharchive/849/Ethical-Companies.aspx

Kitzmueller, M., Shimshack, J., 2012. Economic Perspectives on Corporate Social Responsibility. Journal of Economic Literature 50 (1), 51–84.

Kopel, M., 2009. Strategic CSR, Spillovers, and First-Mover Advantage. Discussion Paper Series in Economics and Management (10-04).

KPMG International, 2008. KPMG International Survey of Corporate Responsibility Reporting 2008 (RRD-105984).

Lambertini, L., Pignataro, G., Tampieri, A., 2015. The effects of Environmental Quality Misperception on Investments and Regulation. CREA Discussion Paper 01, Center for Research in Economics and Management, University of Luxembourg.

Liu, C.-C., Wang, L. F. S., Lee, S.-H., 2015. Strategic environmental corporate social responsibility in a differentiated duopoly market. Economics Letters 129, 108–111.

Lyon, T. P., Maxwell, J. W., 2011. GreeGreen: Corporate Environmental Disclosure under Threat of Entry. Journal of Economics & Management Strategy 20 (1), 3–41.

Manasakis, C., Mitrokostas, E., Petrakis, E., 2013. Certification of corporate social responsibility activities in oligopolistic markets. Canadian Journal of Economics 46 (1), 282–309.

Manasakis, C., Mitrokostas, E., Petrakis, E., 2014. Strategic Corporate Social Responsibility Activities and Corporate Governance in Imperfectly Competitive Markets. Managerial and Decision Economics 35 (7), 460–473.

Michael, M. L., 2006. Business ethics: The law of rules. Business Ethics Quarterly 16 (4), 475–504.

Microsoft, 2016. Microsoft Supplier Code of Conduct (US 2016).
URL https://www.microsoft.com/en-us/procurement/supplier-conduct.aspx

Nielsen, 2014. Doing Well By Doing Good.
URL www.nielsen.com/us/en/insights/reports/2014/doing-well-by-doing-good.html

Öberseder, M., Schlegelmilch, B. B., Murphy, P. E., 2013. CSR practices and consumer perceptions. Journal of Business Research 66 (10), 1839–1851.

Sony Corporation, 2016. Sony Supply Chain Code of Conduct.
URL http://www.sony.net/SonyInfo/csr_report/sourcing/supplychain/