Corporate Social Responsibility by Joint Agreement

Revision June 2023

Maarten Pieter Schinkel[1]
Leonard Treuren[1]

1 University of Amsterdam and Tinbergen Institute

Corporate Social Responsibility by Joint Agreement[*]

Maarten Pieter Schinkel[†] and Leonard Treuren[‡]

June 2023

Abstract

Industry-wide voluntary agreements are touted as a means for corporations to take more corporate social responsibility (CSR). We study what type of joint CSR agreement induces competitors to increase CSR efforts in a model of oligopolistic competition with differentiated products. Consumers have a higher willingness to pay for more responsibly produced goods and services. Firms are driven by profit, and are also possibly intrinsically motivated, to invest in CSR. We find that cooperative agreements directly on the level of CSR *reduce* CSR efforts compared to competition. Such agreements throttle both for-profit and intrinsic motivation for CSR. CSR efforts only increase if agreements are permitted *solely* on output. Such production agreements, however, reduce total welfare in the market and raise antitrust concerns. Taking externalities into account may help justify a production agreement under a broader welfare standard, but not agreements on CSR directly. Simply setting a higher mandatory CSR standard by regulation while preserving competition always gives higher within-market welfare.

Keywords: CSR, collaboration, voluntary agreement, cartel, antitrust, externalities, regulation

JEL Codes: K21, L13, L40, Q01

---

1 Introduction

There is a surging call for corporations to step in where governments fail and take responsibility for pressing social objectives such as diverting climate change, assuring fair trade that respects human rights and animal welfare, or promoting public health. A prominent contemporary idea is that, in light of the enormity of the transition and the costs that come with it, agreements amongst competitors are needed to induce impactful corporate social responsibility (CSR) efforts. If the company that pioneers in more responsible ways of doing business risks losing its customers to rivals and not making up for additional costs, none may dare to initiate CSR in competition. Private coordination may also be a solution where public authorities do not provide the orchestration required for the provision of common goods – for lack of legal instruments, for example, or political power. Nidumolu et al. (2014) claim that business collaboration is imperative to advancing sustainability. Kotchen and Segerson (2019) advocate voluntary collective agreements to solve commons problems in natural resource sectors such as forestry and fishery. Henderson (2020) calls for "industry-wide cooperation", and Polman and Winston (2021) tout "pre-competitive collaboration" to stop environmental degradation and economic inequality.

Private practice is moving ahead with such joint agreements on CSR goals. The *Business Roundtable* unites close to two hundred companies to "share a fundamental commitment to all of our stakeholders", including sustainability as a collective effort. In the UN-convened *Net-Zero Insurance Alliance* (NZIA), major banks and insurers worldwide align their assets and underwriting portfolios to net-zero greenhouse gas emissions by 2050. Initiatives such as *Imagine* and the *Consumer Goods Forum* are industry-wide collaboration fora that aspire to tackle climate change and global inequality. Concrete collectives are chocolate producers wanting jointly to improve the livelihood of cocoa farmers under the tutelage of the *Fair Trade Advocacy Office*, garment labels joining forces to ban plastics in the *Fashion Pact*, truck manufacturers pledging to phase out diesel engines under the ACEA umbrella, and soft drink suppliers needing a joint agreement to remove the plastic handles from their six-packs.[1] Earlier cases of collaboration to stimulate CSR by voluntary agreements are given in Alberini and Segerson (2002), Lyon and Maxwell (2004) and Peloza and Falkenberg (2009).

Cooperative CSR initiatives amongst competitors can raise antitrust concerns and liabilities that may hold companies back. The International Chamber of Commerce (2022) finds competition policy a barrier to climate action "chilling business initiatives to work together to help fight climate change". As a resolve, advocate competition law scholars have pointed out possibilities to exempt agreements that promote sustainability benefits from the cartel prohibition.[2] Under the US statutes on competition, the pursuit of wider public

---

[1]See businessroundtable.org/sustainability, unepfi.org/net-zero-alliance, imagine.one, theconsumergoods-forum.com, fairtrade-advocacy.org., thefashionpact.org, acea.be., and acm.nl, respectively.

[2]See Scott (2016) for cartel exemption possibilities under US antitrust law, and Holmes (2020) under

interests traditionally has had little traction as an antitrust defense.[3] In the EU, more legal room for maneuver is being created under Article 101 TFEU. The European Commission gave guidelines in response to calls for clarity on when collaboration between competitors to promote sustainability efforts would be permitted.[4] Anticompetitive agreements can be exempted from cartel law if they do not "eliminate" competition on all market dimensions and are "indispensable" to generating the projected CSR benefits, of which consumers should receive a "fair share" that outweighs the harm caused by the agreement. Some member states are more receptive to 'green cartel' exemptions.[5] For joint sustainability initiatives on agricultural products, the EU adopted a wider exclusion with no demands for benefits to consumers.[6] Still, very few exemptions of 'green cartels' have been given in Europe so far.[7]

The central premise of advocates of allowing anticompetitive agreements to promote CSR is that corporations will take *more* social responsibility when they can agree to compete *less*. However, studies on the relationship between market competition and CSR efforts suggest predominantly the opposite: *more* competition leads to more CRS. Fernández-Kranz and Santaló (2010) and Flammer (2015b) establish with variations in import duties and market concentration that stronger competition increases CSR efforts. Delmas and Montes-Sancho (2010) concludes that voluntary climate agreements in the US were largely ineffective. Simon and Prince (2016) find that a reduction in industrial concentration in the US is associated with lower toxic releases at the factory level. Aghion et al. (2023) report that firms more frequently engage in green innovation if consumers prefer sustainability, and increasingly so in more competitive markets. Ding et al. (2020) show that stricter competition law regimes are associated with higher CSR, in particular in countries where consumers care more about environmental and human rights issues. This contrast raises concerns that the emerging practice and policy initiatives for collaborative CSR may be misguided.

In this paper, we study what type(s) of joint CSR agreements amongst competitors, if

---

European competition law.

[3] See Werden (2014). US courts have generally refused to consider social welfare defenses to collusion since *National Society of Professional Engineers v. United States, 435 U.S. 679 (1978)*, in which 'public safety' justifications were rejected.

[4] See Chapter 9 in European Commission (2023) and the contributions in Holmes et al. (2021).

[5] The Dutch Authority for Consumers and Markets (ACM) interprets the EU Treaty as not requiring that consumers are fully compensated by the benefits of an anticompetitive sustainability agreement, and is willing to count benefits to others instead, who are not buyers of the products concerned (ACM, 2021). The British Consumer and Market Authority (CMA) is comparably open to condoning "climate change agreements" (CMA, 2023).

[6] Article 210a of Regulation 1308/2010 establishing a common organisation of the markets (CMO) in agricultural products. Even price and quota agreements can be part of the effort, for example when consumers are unwilling to pay more for sustainably produced foods. Pesticide-free strawberries are a lead example, on which an overcharge can be agreed that covers cost and risk of blemishing.

[7] A precedent was set in *Case IV.F.1/36.718 – CECED, 24 January 1999*, in which the European Commission allowed washing machine producers to collectively take their least energy-efficient models off the market. See Ahmed and Segerson (2011).

any, advance CSR activities in a model of strategic CSR.[8] Consumers appreciate companies taking more social responsibility and have a higher willingness to pay for their products. This may result from increased individual use value, such as organic foods being healthier, as well as from buyers' appreciation of collective benefits, such as cleaner air, or of the positive impact of their more responsible consumption on others, who are concerned for example about animal abuse or deforestation.[9] This implies that a firm's costly CSR efforts translate into a higher demand for its products and higher consumer welfare. Firms are initially in oligopolistic competition with goods that are differentiated, including also by the CSR profile of their manufacturer. We study three types of joint CSR agreements: agreements on CSR with remaining product market competition, agreements on production with remaining CSR competition, and agreements on both CSR efforts and production.

In our model, each firm first commits to a CSR level and subsequently decides how much to produce. This is in line with the 'pre-competitive' nature of the collaborations proposed. We analyze the effects of the different types of joint agreements on CSR efforts, production, and welfare. The model extends the duopoly case of Schinkel and Spiegel (2017) on sustainability efforts to an n-firm analysis with varying consumer willingness to buy from firms that invest more in CSR, relative to its effect on the marginal cost of production. Furthermore, we introduce firm-side intrinsic motivation for CSR efforts into the model.[10] We also consider price competition, partial cooperation involving only m-out-of-n competitors in the market, and an alternative demand system in which CSR is valued directly. These features allow us to rebut arguments put forward by proponents of CSR agreements that high transition cost, a low willingness to pay that does not cover social cost, higher marginal costs of production, and intrinsic socially responsible boards or owners would justify allowing collaboration, or that our conclusion would be model-specific.[11]

A robust finding is that joint agreements that involve CSR levels directly – either agreements on CSR efforts alone or together with coordinated production – *reduce* CSR efforts compared to competition with allowing such agreements. This is true for any positive willingness to pay for CSR, no matter how small. The reason is that CSR coordination eliminates CSR as a dimension of competition, which allows firms to profit from lower CSR investment costs. These findings hold irrespective of the strength of any intrinsic motivation for CSR

---

[8]CSR as a product differentiation strategy is studied in Bansal and Roth (2000), Baron (2001), McWilliams and Siegel (2001), and Porter and Kramer (2006). Du et al. (2011) identify CSR as a challenger's competitive weapon against a market leader.

[9]Numerous studies find that willingness to pay positively depends on the degree of CSR a firm engages in, including Casadesus-Masanell et al. (2009), Kitzmueller and Shimshack (2012), Servaes and Tamayo (2013), Flammer (2015a), and Delmas and Colgan (2018). See also European Commission (2023), Section 9.4.3.

[10]Bénabou and Tirole (2010) set out how firms may act responsibly for reasons ranging from pure profit to pure intrinsic motivation. Hart and Zingales (2017a,b) point out that firms are right also to pursue CSR objectives that contribute negatively to monetary profit when their shareholders are prosocial.

[11]See Dolmans (2021) and ACM (2021).

that a company may act on. Coordination reduces the additional CSR due to intrinsic motivation too. If CSR is to be increased by collaboration, only permitting coordination of output volumes (or prices) delivers. The reason for this in essence is that such a production agreement increases the total rents from CSR investments, while maintaining competition for those rents by each firm investing more in CSR independently.

Output (and price) agreements, however, are particularly problematic under the antitrust laws. Moreover, whenever firms have an incentive to form joint agreements, we find that within-market welfare is reduced. No joint agreement exists that simultaneously increases CSR levels, consumer welfare ánd profit over the competitive situation. This means that it is not possible to compensate consumers for the harm they would suffer from the agreement with the value of the sustainability benefits that it generates – which is the current interpretation of the European cartel law exemption requirement that consumers receive a "fair share" of the benefits. Therefore, if CSR is to be promoted by anticompetitive agreements, the full consumer compensation requirement must be relaxed. In their place, CSR benefits can be taken into account that materialize elsewhere, outside the relevant market and with others who are not buyers of the products concerned.[12] In the cases concerned, which are about reducing negative externalities and creating positive ones, such 'out-of-market' benefits are likely to exist. For example can substantial emissions' reductions in one country benefit others as well, and will vegetarians also appreciate a better rearing of livestock.

We show, however, that taking out-of-market benefits to non-buyers into account does not justify CSR agreements. Production agreements decrease negative production externalities, while CSR agreements, which result in higher output as well as less CSR, do not. Government regulation is typically the better alternative: within-market total welfare is always higher when the government simply mandates the CSR efforts that a production agreement would provide. Our findings should warn activist CEOs, corporate lawyers, and others who propose collaborative CSR with the best intentions. Those advocates better advise that companies remain in competition on strategic CSR, whenever consumers have at least some willingness to pay. Also when there is no (or even negative) appreciation of more responsibly manufactured goods and services are CSR collectives ineffective in improving CSR. Moreover, any genuine cases will be hard to identify and control. Antitrust authorities should therefore be sceptical and dismissive of applications for a cartel law exemption of agreements claiming to promote CRS.

We contribute to a theoretical literature on the relationship between competition and CSR efforts. Kotchen (2006) and Besley and Ghatak (2007) model CSR as public good provision by private firms. Bagnoli and Watts (2003) find that competition for socially responsible consumers results in private provision of public goods, but at a rate that varies inversely with competition in the private goods market. Gans and Groves (2012) model

---

[12]This is what the Dutch competition authority proposes in ACM (2021). See Schinkel and Treuren (2021) for a critical review.

carbon offsetting as a private public good contribution to find that offsets generally decrease net emissions in competitive markets, but may not when "dirty" producers have market power. Calveras and Ganuza (2016) study imperfectly observable CSR in a model where firms first decide between clean or dirty technology and subsequently compete in the output market. When firms are in Cournot competition, as opposed to Bertrand competition, a higher degree of CSR observability is required to sustain a given level of CSR.[13] Dewatripont and Tirole (2022) analyze various market models assuming that for-profit firms internalize (part of) their effects on social welfare. They conclude that whether competition is green or grey depends on the effect of "cutting ethical corners" on demand. Yet in free markets, the intensity of competition does not affect ethical behavior.

Note that the motivating examples and policy proposals consider the role of corporate collaboration in transitioning to higher CSR levels through the implementation of known ways of producing more sustainably. They are *not* about research and development of new technologies.[14] R&D investments are often characterized by positive spillover effects, by which one firm benefits from another firm's innovation. If such spillovers are substantial, they may discourage unilateral investments, so that research joint-ventures (RJVs) can increase R&D efforts above competitive levels.[15] This is one reason why broad exemption clauses exist for RJVs.[16] Also cooperative research into more socially responsible and environmentally friendly production methods can benefit from this. The types of joint agreements considered here, however, have little spillovers, which we therefore ignore in the main analysis.

The remainder of the paper is organized as follows. In the next section, the model of competition in CSR efforts and quantities is introduced. In Section 3, we analyze what level of CSR results under three different types of joint agreements and model extensions that address several support arguments for collaborative CSR. In Section 4, we study profits and within-market welfare effects. Section 5 discusses the sense of also taking out-of-market benefits into account, and briefly considers regulation as policy alternative. Section 6 concludes. Proofs of the main results are given in Appendix A. In Appendices B to F, we study their robustness by allowing for CSR efforts to impact marginal costs, varying willingness to pay for CSR, firm-side intrinsic motivation, price- instead of quantity-setting, an alternative demand system, and partial CSR agreements that do not involve all competitors.

---

[13]Calveras and Ganuza (2018) distinguish between observable external CSR and internal productivity-enhancing CSR and find that both forms help firms differentiate their products by enhancing product quality.

[14]Lenox and Chatterji (2018) focus on the role of business and competitive markets, in collaboration with different levels of government, as a catalyst for green innovation and change. Gans (2012) shows that the right interaction with policy is crucial.

[15]Seminal contributions are d'Aspremont and Jacquemin (1988) and Kamien et al. (1992). For analyses in line with our semi-collusion modelling approach, see Fershtman and Gandal (1994), Brod and Shivakumar (1999), Matsui (1989), Fershtman and Pakes (2000), and Symeonidis (2000).

[16]When spillovers are substantial, so that firms have an incentive to free-ride, the design of stable voluntary agreements is not obvious. See Brau and Carraro (2011).

2   A model of strategic CSR investments

Consider a market in which n firms, labeled $i = 1, ..., n$, each sell a product that is differentiated, including by the firm's standard of corporate social responsibility $v_i \geq 0$. An increase in v_i can represent, for example, that firm i's product is manufactured using fewer natural resources, lower emissions production technologies, or a higher standard of care for workers and farm animals in the supply chain. The preferences of a representative consumer over these products, consumed in quantities $\mathbf{q} = q_1, ..., q_n$, are described by the utility function

$$U(\mathbf{q}, \mathbf{v}, m) = \sum_{i=1}^{n}(\alpha + v_i)q_i - \frac{1}{2}\left(\sum_{i=1}^{n} q_i^2 + 2\gamma \sum_{i=1}^{n}\sum_{i>j} q_i q_j\right) + m, \tag{1}$$

in which $\mathbf{v} = v_1, ..., v_n$ are the firms' CSR levels, $\alpha > 0$ is a utility parameter, $\gamma \in (0, 1)$ measures the degree of symmetric horizontal product differentiation on other dimensions than CSR, and $m \geq 0$ is expenditure on any other goods.

These consumer preferences yield the following demand system from maximizing $U(\mathbf{q}, \mathbf{v}, m)$ subject to the budget constraint $\sum_{i=1}^{n} p_i q_i + m \leq I$, where p_i is the price of good i and I is representative income

$$p_i(\mathbf{q}, v_i) = \alpha + v_i - q_i - \gamma \sum_{i \neq j}^{n} q_j, \quad i = 1, ..., n. \tag{2}$$

Market demand captures that consumers are willing to pay more for products of firms that invest in higher CSR levels by v_i increasing the intercepts. For analytical convenience, p_i increases one-to-one in v_i and we discuss varying net willingness to pay for more responsibly produced goods and services as an extension below. Higher values of γ reflect that consumers consider the products to be closer substitutes.

The demand model captures two dimensions of product differentiation: horizontal differentiation through γ, which originates in the consumer's preference for certain product characteristics that are taken to be exogenous to firms' decisions, and vertical differentiation, through CSR level v_i, which arises endogenously as a consequence of a firm's CSR investments. This latter part is different from standard industrial organization theory, where firms are typically modelled as controlling only their price or quantity, given their product types. That a company makes itself more attractive to consumers and increases the demand for its products by raising its CSR profile captures the kind of product differentiation in leading examples such as fair-trade chocolate, organic clothing, or green electricity.

The quasilinear quadratic utility founded linear demand system in equation (2) allows for tractable analyses of strategic CSR investments by an arbitrary number of firms in varying market circumstances and under different conduct assumptions.[17]   A maintained

---

[17]This demand system has a long tradition in industrial organization. It was originally proposed in Shubik and Levitan (1980). See Choné and Linnemer (2020) for an overview.

assumption is absence of income effects with respect to the remaining purchases of the consumer, which are captured in the linear addition m. This feature makes the model less suited for studying expenses on products that are costly relative to households' budgets, such as the purchase of CO2 neutral residential real estate or an electric car, which might elicit general equilibrium effects. The cases that motivate our analyses, however, are purchases of more responsibly produced household consumption goods, where individual income effects play only a relatively small role.

For companies, investing in the transition to a higher level of CSR can increases revenues, but it also has cost implications. Many of the motivating calls for collaborative CSR concern the need for firms to make a transition by implementing known alternative production methods. For example, installing CO2 filters, switching to biological control agents rather than pesticides, or banning child labor from the supply chain. Such transitions are likely to come at a fixed cost that increases with the level of CSR efforts – also net of benefits such as firms with higher CSR scores having better access to capital and cheaper equity financing, due to a growing reluctance of consumers and investors to fund grey production.[18]

Let $\frac{tv_i^2}{2}$ be the fixed cost of CSR effort v_i ($t \geq 1$). Firm i's profit is then given by

$$\pi_i\left(\mathbf{q}, v_i\right) = \left(\alpha + v_i - q_i - \gamma \sum_{i \neq j}^{n} q_j - c\right) q_i - \frac{tv_i^2}{2}, \tag{3}$$

where c is the marginal cost of production – variations in which depending on a firm's CSR level are considered as an extension.

That consumers have an appreciation for CSR and prefer to buy from companies that invest in responsible business methods, induces the firms to make an effort, even when costly. In case customers have no willingness to pay for CSR at all, profit-maximizing companies have no reason to invest in CSR, regardless of the competitive regime. Hence, the incentive to increase demand by investing in CSR is central to our analysis. In keeping with the motivation behind initiatives to allow CSR collaborations, our point of departure is that CSR is too low in competition and in social need of stimulation. By their nature, CSR efforts generate wide welfare gains – such as a cleaner environment, fairer conditions of trade, and healthier living conditions, that everyone can appreciate. We also assume a given standard of regulation and do not model an explicit regulatory role for government. Lobbying for or against higher CRS standards is not considered, nor are corporate strategies of investing in CSR to preempt government regulation.[19]

The interaction between the n firms involves two stages. In Stage 1, firms simultaneously

---

[18]See Sharfman and Fernando (2008), El Ghoul et al. (2011), and Cheng et al. (2014).

[19]Lutz et al. (2000) show how self-regulated quality standards can weaken and delay better regulation. Innes and Sam (2008) finds that firms voluntarily reduce pollution in an attempt to relax future regulatory scrutiny. Malhotra et al. (2019) argue that firms can use modest private regulation to preempt more stringent public regulations.

choose their CSR efforts, which are assumed to be fully observable by consumers and firms. In Stage 2, given their CSR levels $\mathbf{v}$, firms simultaneously decide how much to produce. Note that our sequential setup implies that all firms have committed to their CSR efforts by the time they decide on production (or prices). In our motivating examples, strategic company commitment to transit into more sustainable sourcing and manufacturing precedes production volume and sales decisions. A company's CSR investments are costly to reverse and have strategic commitment value.

To study whether and how allowing competitors to make voluntary joint agreements increases their CSR efforts, we compare equilibrium CSR levels and outputs under three types of agreements to the benchmark of normal competition – i.e., when there is no anticompetitive agreement exempted from the cartel prohibition and the firms make their decisions non-cooperatively. We focus on symmetric solutions, which is without loss of generality as firms' first-order conditions permit only a single interior solution. Firms play pure strategies, as we are interested in modeling a perfect information game, where firms do not have a probability distribution over their rivals' actions.

In the non-cooperative benchmark, each firm i selects both strategic variables v_i and q_i independently, taking its rivals' decisions as given. Firms compete on CSR in the sense that a firm makes itself more attractive to consumers by increasing its CSR efforts, allowing it to steal customers from its competitors. This business-stealing effect induces companies to invest in CSR. Given these investments, the firms subsequently compete in quantities. This 'competitive' benchmark is denoted by superscript $*$, its Nash-equilibrium by (v^*, q^*).

In a 'CSR agreement' (denoted by csr), the firms cooperatively decide on the CSR efforts they each take and subsequently compete in quantities (or prices). This type of agreement is proposed in practice to stimulate CSR, as set out in Section 1. They are level standard agreements, for example on workplace safety for suppliers in low-wage countries, or rearing conditions for livestock. Likewise, in a carbon cost internalization agreement, producers collectively decide how much each party commits to costing in its emissions value and subsequently are free to decide on their output and prices. The solution is indicated by (v^{csr}, q^{csr}).

In a 'production agreement' (denoted by p), the firms coordinate their output volumes while still independently deciding on their CSR efforts. This is the opposite of a CSR agreement and essentially classic cartel behavior. Note, however, that since the firms also compete in CSR efforts, this type of agreement does not fully eliminate competition. To the best of our knowledge, none of the advocates of using joint agreements to stimulate higher CSR efforts has so far advocated sole output coordination, without coordination on the level of CSR efforts also. Yet pure output- or price-fixing agreements may come in view where CSR objectives are overriding, as in EU agricultural policy. The solution is indicated by (v^p, q^p).

Finally, in a 'full agreement' (denoted by f), the firms decide cooperatively on both

their CSR efforts and output levels, thereby eliminating competition on both dimensions. The combination has been suggested as acceptable for the promotion of sustainability in agricultural products, such as pesticide-free strawberries for which consumers are unwilling to pay. Moreover, full agreements may result in practice from allowing CSR or production agreements, because once firms can coordinate one dimension of competition, it gives them a forum for discussion that it tempting to abuse to agree on other dimensions of competition as well.[20] The solution is indicated by $\left(v^f, q^f\right)$.

In all cases of an agreement against competition, whether on higher or lower CRS efforts or quantities, or both, the members of the agreement will typically have incentives to unilaterally deviate to different CSR efforts and production volumes than agreed upon. This lure of freeriding is a classic threat to the stability of coordination agreements. Exempted from cartel law, however, the joint agreements here concerned can in principle be contracted to be legally binding before a court. Thus enforceable, the internal and external stability problems that play in illegal market coordination can be ignored. Defection to less CSR or more output than agreed would be a breach of contract that sufficiently large liabilities should be able to prevent.

3   Joint agreements to promote CSR

Our central result compares CSR levels across competitive regimes.[21]

Proposition 1. *CSR agreements and full agreements decrease CSR levels, compared to the competitive benchmark. CSR agreements deliver the least CSR of all regimes. Only production agreements increase CSR levels. Formally:* $v^p > v^* > v^f > v^{csr}$.

Proof. See Appendix A. ∎

Proposition 1 stems from the incentives to increase CSR efforts. An increase in CSR allows firms to set higher prices, all else equal, as can be seen from equation (2). This is the *demand effect*. An increase in CSR also makes a firm relatively more attractive to consumers, allowing it to capture rivals' consumers – which is the *business stealing effect*. As demand and cost structures are symmetric across firms, all firms face the same demand and business stealing incentives in a particular competitive regime. In equilibrium, therefore, all firms invest the same amount in CSR and business stealing cancels out so that there is one CSR

---

[20]Examples of well-intended cooperation in RJVs sliding to collusion are given in Duso et al. (2014) and Sovinsky (2022).

[21]All results restrict parameters such that the first- and second-order conditions of firms' maximization problems in both Stage 1 and Stage 2 are satisfied, and interior solutions are guaranteed. In case a result relies on further restricting the parameter space, this is stated in the relevant proposition.

level per competitive regime. Of course, were one firm to ignore business stealing incentives and reduce CSR, that firm would lose customers to its rivals.

Proposition 1 states that the only joint agreement that increases CSR investments is a production agreement. When firms jointly select output, they reduce conditional quantities in Stage 2 of the game, increasing price-cost margins. Each additional customer is now worth more than in the benchmark case, increasing business stealing incentives in Stage 1 and, hence, CSR investments. When firms jointly select CSR – a CSR agreement – each firms reduces its investments as they internalize that such investments reduce other firms' profit through the business stealing effect. Firms in a full agreement jointly determine both output and investments, entirely eliminating business stealing so CSR is determined solely by the demand effect and, hence, lower than in the non-cooperative benchmark.

We next provide a more formal and detailed analysis of the incentives shaping Proposition 1. We do this in a more general setting than the demand model introduced in equation (2), which has two advantages. First, it is more insightful than identifying the various incentives to invest in our lengthy parametric expressions. Second, this approach makes apparent the requirements ensuring that our results generalize to other demand systems.

Consider the reduced form profit in Stage 1 for any firm i

$$\pi_i(\mathbf{q}(\mathbf{v}), v_i), \tag{4}$$

where $\mathbf{q}(\mathbf{v}) = q_1(\mathbf{v}), \ldots, q_n(\mathbf{v})$ are the conditional quantities, conditional on the choices of CSR in Stage 1, that solve Stage 2. In all four regimes $r \in \{*, csr, p, f\}$, firm i chooses v_i in Stage 1 according to

$$\max_{v_i} \ \pi_i(\mathbf{q}(\mathbf{v}), v_i) + \psi \sum_{i \neq j}^{n} \pi_j(\mathbf{q}(\mathbf{v}), v_j), \tag{5}$$

where $\psi = 1$ if CSR levels are chosen cooperatively in Stage 1 (in $r = csr$ or $r = f$) and $\psi = 0$ otherwise (in $r = *$ or $r = p$).

If firms select quantities non-cooperatively in the Stage 2, then $\forall i$, $\frac{\partial \pi_i}{\partial q_i} = 0$ and $q_i(\mathbf{v}) = q_i^*(\mathbf{v})$, where $q_i^*(\mathbf{v})$ is the Nash-equilibrium conditional quantity. If firms select quantities cooperatively in Stage 2, then, $\sum_i \frac{\partial \pi_i}{\partial q_j} = 0 \ \forall j$, and $q_i(\mathbf{v}) = q_i^c(\mathbf{v})$, where $q_i^c(\mathbf{v})$ is the cooperative conditional quantity (in either $r = p$ or $r = f$, that is). The first-order condition for firm i choosing v_i in the non-cooperative benchmark is

$$\sum_{i \neq j}^{n} \frac{\partial \pi_i}{\partial q_j} \frac{\partial q_j^*}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} = 0. \tag{6}$$

For a CSR agreement, it is

$$\sum_{i \neq j}^{n} \frac{\partial \pi_i}{\partial q_j} \frac{\partial q_j^*}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} + \sum_{i \neq j}^{n} \left(\sum_{i \neq j \neq k}^{n} \frac{\partial \pi_j}{\partial q_k} \frac{\partial q_k^*}{\partial v_i} + \frac{\partial \pi_j}{\partial q_i} \frac{\partial q_i^*}{\partial v_i} \right) = 0, \tag{7}$$

for a production agreement

$$\sum_{i\neq j}^{n} \frac{\partial \pi_i}{\partial q_j}\frac{\partial q_j^c}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} + \frac{\partial \pi_i}{\partial q_i}\frac{\partial q_i^c}{\partial v_i} = 0, \tag{8}$$

and for a full agreement

$$\frac{\partial \pi_i}{\partial v_i} = 0. \tag{9}$$

Equation (6) reveals the two incentives to invest in CSR that exist in the non-cooperative benchmark. The first term in equation (6) is the business stealing effect. By increasing its CSR level, a firm becomes relatively more attractive to consumers, and the quantity of all other firms decreases as a result. The second term in equation (6) is the demand effect. Increasing its CSR level allows a firm to increase its price, holding quantity constant. Because firms select quantities to maximize their conditional profit in Stage 2, $\frac{\partial \pi_i}{\partial q_i} = 0 \; \forall i$, implying that each firm ignores the effect of CSR investment on own profit mediated by changes in own quantity.

The terms in brackets in equation (7) show the additional (dis)incentives to invest in CSR that exist for a CSR agreement. For $n \geq 3$, the business stealing effect imposes both positive and negative externalities on the profit of the firms in a CSR agreement. Firm i's investment in CSR decreases firm j's profit by increasing firm i's quantity, but increases firm j's profit by reducing quantities of all firms k ($i \neq j \neq k$). If $|\frac{\partial \pi_j}{\partial q_i}\frac{\partial q_i^*}{\partial v_i}| > \sum_{i\neq j\neq k}^{n} |\frac{\partial \pi_j}{\partial q_k}\frac{\partial q_k^*}{\partial v_i}|$, the negative externality dominates and a CSR agreement reduces CSR levels compared to the non-cooperative benchmark. Intuitively, the requirement for $v^* > v^{csr}$ is that firm i's CSR level influences firm i's quantity sufficiently more than it influences the quantity of all other firms, which is the case in our demand model.

A production agreement sets quantities cooperatively in Stage 2 such that $\sum_{i=1}^{n} \frac{\partial \pi_i}{\partial q_j} = 0$ $\forall j$. This implies that $\frac{\partial \pi_i}{\partial q_i} > 0$, as $\frac{\partial \pi_i}{\partial q_j} < 0$ ($i \neq j$). Firms in a production agreement take into account this positive effect of investing in CSR on own quantity, shown in the final term of equation (8). A production agreement increases price-cost margins, making it more profitable to attract extra consumers by investing in CSR. If, like in our model, $|\frac{\partial q_j^c}{\partial v_i}|$ is not too much smaller than $|\frac{\partial q_j^*}{\partial v_i}|$ ($i \neq j$), then it follows that $v^p > v^*$.

A full agreement controls both quantity and CSR levels, so that it completely eliminates the business stealing effect, and CSR investment is only driven by the demand effect. Equation (9) can be written as $\sum_{i\neq j}^{n} \frac{\partial \pi_i}{\partial q_j}\frac{\partial q_j^*}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} - \sum_{i\neq j}^{n} \frac{\partial \pi_i}{\partial q_j}\frac{\partial q_j^*}{\partial v_i} = 0$. As long as $\frac{\partial \pi_i}{\partial q_j}\frac{\partial q_j^*}{\partial v_i} > 0$, comparing equation (6) to equation (9) shows that $v^* > v^f$. If $|\frac{\partial \pi_j}{\partial q_i}\frac{\partial q_i^*}{\partial v_i}| - \sum_{i\neq j\neq k}^{n} |\frac{\partial \pi_j}{\partial q_k}\frac{\partial q_k^*}{\partial v_i}| > |\sum_{i\neq j}^{n} \frac{\partial \pi_i}{\partial q_j}\frac{\partial q_j^*}{\partial v_i}|$, we have $v^f > v^{csr}$. This condition, which hold for our demand model, requires firm i's CSR level to influence firm i's demand sufficiently more than the demand of all other firms.

Our finding that if the cartel prohibition is to be relaxed for the purpose of raising CSR efforts, not *CSR* agreements should be exempted – because CSR agreements in fact *reduce*

CSR efforts – but *production* agreements stands in stark contrast to the current policy proposals and emerging practice. These initiatives are about joint agreements on CSR goals, not (primarily) output or prices. In order to verify the generality of this main result, we examine several variations of the baseline model that address arguments put forward by proponents of allowing CSR agreements, or are otherwise relevant in the competition policy context.[22] As we will see, the ranking of CSR levels in Proposition 1 is unchanged in all variations. This means that our results are robust against alleged conditions in favor of collaborative CSR, which cautions against the use of CSR agreements to increase CSR efforts.

Limited willingness to pay for CSR and CSR-dependent marginal costs. Collaboration on CSR has been argued to be needed because consumers exhibit low willingness to pay for the costly CSR efforts, that is insufficient for companies to afford CSR efforts in competition.[23] To investigate this claim, we scale the willingness to pay for CSR by multiplying v_i in equation (2) by $\beta > 0$, so that it no longer increases one-to-one with the level of CSR effort v_i. Naturally, if consumers have no positive (or even negative) willingness to pay for CSR, so that there is no demand for more responsibly produced goods, CSR efforts, if any, will be independent of the competitive regime, so that cartel exemptions are ineffective in trying to raise them.

This slight generalization also allows for analyzing the effect of CSR investments affecting the marginal costs of production. Typically, paying fairer wages or applying biological pesticides will increase per unit production costs. However, sustainable sourcing can also increase crop yields and productivity.[24] Increasingly, employees are found willing to accept lower wages working for socially driven companies.[25] CSR projects can also be awarded government subsidies. Let the total marginal cost of production at CSR level v_i be given by $c(1 + \kappa v_i)$, in which $\kappa \geq 0$ ($\kappa < 0$) is the increase (decrease) in the marginal costs of production resulting from higher CSR effort.

Including both limited willingness to pay and CSR-dependent marginal costs, the profit of each firm i is

$$\pi_i^\delta (\mathbf{q}, v_i) = \left(\alpha + \delta v_i - q_i - \gamma \sum_{i \neq j}^n q_j - c \right) q_i - \frac{t v_i^2}{2}, \tag{10}$$

where $\delta = \beta - \kappa c$ is the net effect of willingness to pay for CSR and CSR-induced marginal cost changes on firm i's price-cost margin $p_i - c$. Obviously, for negligible cost increases, small values of δ reflect low willingness to pay for products of companies that take high CSR

---

[22] A detailed treatment of these extensions discussed in this section is in Appendices B to E.

[23] One reason for low willingness to pay for CSR efforts could be that those efforts are imperfectly observable. Calveras and Ganuza (2018) study imperfectly observable CSR.

[24] Ignatius (2012) points out higher fertility of sustainable farming, and Flammer (2015a) reports higher labor productivity in more sustainable companies.

[25] See de Bettignies et al. (2020) and Krueger et al. (2021).

efforts. The value of δ remains positive as long as any marginal cost increases resulting from a higher CSR efforts are matched by a sufficiently strong consumer willingness to pay for them. This certainly need not be the case when more responsible production raises unit production expenses more than buyer appreciation. Nevertheless, we restrict $\delta > 0$, as when $\delta \leq 0$, CSR levels only enter the profit function as a cost, so that no firm would invest in CSR regardless of the competitive regime.

Comparing CSR levels derived from the profit function in equation (10) across the four competitive regimes, we find that the ranking in Proposition 1 is maintained, also if consumers' willingness to pay is low – see Proposition B1 in Appendix B. Scaling the net appropriability of CSR investments (by δ) simply scales all investment incentives related to CSR discussed following Proposition 1. Therefore, while the ranking of CSR always follows that of Proposition 1, the larger is δ, the larger is the difference between CSR investments in different competitive regimes – see Proposition B2 in Appendix B. If δ gets close to zero, meaning that willingness to pay increases little to no more than the marginal costs following CSR investments, the CSR levels in all four regimes converge to zero.

Intrinsic motivation to invest in CSR. In addition to immediate for-profit objectives, companies might be more intrinsically motivated to take responsibility for a wider set of stakeholders and invest in CSR. Forward-looking corporations may realize that contributing to society builds goodwill and a reputation that will pay off in the long run, even when current demand is small. Former Unilever CEO Paul Polman, for example, teaches that a company can only be successful when its long-run planning is "close to society".[26] Companies increasingly face civil society pressures from activists and NGOs, as well as investors. Large investment funds, such as Blackrock and Vanguard, seem to follow the call by making public commitments to reduce emissions.[27] Slacking CSR also heightens legal liability risks, therefore.

By-passing principal-agent complexities or other issues that may be behind such motivation, we extend firm i's objective function with an additive term representing direct CSR motivation. The objective function of firm i is

$$\pi_i(\mathbf{q}, v_i) + \theta v_i, \tag{11}$$

in which $\theta > 0$ is a scaling parameter that expresses each firm's valuation of CSR for intrinsic reasons and $\pi_i(\mathbf{q}, v_i)$ is given by equation (3). This additive intrinsic appreciation for CSR efforts captures a variety of reasons for companies to put weight on social issues beyond their explicit profit motive, ranging from a leader's genuine intrinsic willingness to do good to reputational gains that are not directly reflected in expanded demand. Note that it is analytically equivalent to a reduction in fixed costs – which could be the result, for example,

---

[26]See Polman and Winston (2021). Chatterji and Toffel (2019) refer to this as "CEO activism".

[27]See Azar et al. (2021) and the *Net-Zero Insurance Alliance* at unepfi.org/net-zero-alliance.

of a lump-sum government subsidy to encourage CSR.[28] Essentially, it is assumed that firms are willing to take a profit loss to obtain a stronger CSR profile.

We find that the ranking of CSR levels across the different competitive regimes is unaffected when firms are also intrinsically motivated to invest in CSR – see Proposition C1 in Appendix C. Still, the CSR agreements reduce CSR levels compared to the non-cooperative benchmark, and the only agreement that will increase CSR efforts is on production. The main reason that our baseline results are robust to intrinsic motivation is that the intrinsic motivation term θ in equation (11) does not depend on price or quantity – this is discussed in more detail in Appendix C. Independent of market outcomes, the added incentive to invest in CSR does not change CSR efforts between the competitive regime.

A stronger intrinsic motivation does translate into more CSR efforts within each competitive regime, and differently so. In particular will CSR efforts increase less in the strength of intrinsic motivation in a CRS agreement than in a production agreement. Moreover, the stronger the direct motivation for CSR, the higher the CSR levels chosen non-cooperatively compared to collaboratively. This makes CSR agreements ever more ineffective as social awareness rises. Joint agreements on CSR essentially undermine any intrinsic motivation for corporate social responsibility, also when that motivation is strong. CSR agreements are never better than the competitive benchmark, not even when corporations are directly motivated to do good.

Price competition. The baseline model in Section 2 assumes that firms set their outputs in Stage 2 – and equilibrium prices follow from demand. In principle, whether competition is on quantities or prices should be equivalent for the question which regime best promotes CSR, but this is not obvious. Cournot and Bertrand outcomes are know to different principally. More concretely is it known from the literature on R&D joint-ventures that the amount of research that firms in competition engage in can depend on whether they compete in prices or quantities.[29] To verify our findings in case of price competition, still relying on demand system (2), we investigate how CSR levels compare across competitive regimes when firms select investments in Stage 1 and set prices in Stage 2. The CSR ranking in Proposition 1 indeed continues to hold – see Proposition D1 in Appendix D. The reason is that the investment incentives discussed following Proposition 1 do not depend on whether the firms set strategic substitutes or strategic complements in Stage 2 of the game.

Partial agreements with remaining competition. The joint agreements considered so far contained all n firms in the market. In practice, horizontal agreements may involve only a subset of the companies, leaving a competitive fringe. This can be one way also

---

[28]The analyses below carry through also when intrinsic motivation is a smooth increasing function of CSR. See Appendix C.

[29]See Lin and Saggi (2002).

for a joint agreement that projects to promote CSR to satisfy the exemption requirement under Article 101(3) TFEU that competition is not eliminated. The existence of remaining competition in CSR efforts and output affects the incentives of the competitors that make joint agreements. In an extension of our baseline model, we study outcomes when $m < n$ firms form an agreement, while the remaining $n - m$ firms remain independent competitors that unilaterally chose their CSR efforts and output level. Appendix E contains the results.

The main results from our baseline follow through: firms in a partial CSR agreement or partial full agreement still reduce their CSR efforts compared to the non-cooperative benchmark, while a partial production agreement still induces participants to increase their CSR efforts. Residual competition reduces the possibilities for firms to benefit from an agreement, which causes all outcomes to lie between the non-cooperative outcome and the outcome with a market-wide agreement. Therefore, partial agreements on CSR reduce CSR compared to the benchmark, but by less than market-wide agreements directly on CSR. Likewise, partial agreements on production increase CSR and reduce conditional quantities compared to the benchmark, but not by as much as market-wide production agreements.

4   Profits, consumer and total welfare effects

Competitors will not voluntarily form any joint agreements, whether effective to increase CSR or not, if doing so does not increase profits. Let $\pi(q^r, v^r)$ denote profit in regime $r \in \{*, csr, p, f\}$. First, we establish that $\pi\left(q^f, v^f\right) > \pi\left(q^{csr}, v^{csr}\right) > \pi\left(q^*, v^*\right)$. The reason for this ordering is as follows. Firms in a CSR agreement know that quantities will be set non-cooperatively in Stage 2, and can therefore always ensure minimally profits $\pi\left(q^*, v^*\right)$ by jointly setting the non-cooperative CSR levels that replicate the competitive benchmark. Instead, they prefer to increase their profits by reducing their CSR investments, as established before. Likewise, a full agreement controls both the conditional quantity in Stage 2 and investments in Stage 1, and therefore can always replicate the outcome of a CSR agreement. Since, however, the firms in a full agreement also control output, they prefer to restrict it in Stage 2, thereby increasing profit compared to a CSR agreement.

Second, we note that a production agreement could either increase or decrease profit compared to the non-cooperative benchmark. Firms only profit from engaging in a production agreement if their products are sufficiently differentiated, or otherwise if investing in CSR is sufficiently expensive. The reason is that if products are more similar (γ is high) or investing in CSR is cheaper (r is low), business stealing incentives are very strong in production agreements. This causes firms in a production agreement to engage in an unprofitable 'arms race' in CSR efforts, as, in equilibrium, business stealing efforts between firms cancel out such that only the costs remain.[30] Under a production agreement, the participants cannot

---

[30]The possibility that firms over-invest in either cost-reducing R&D or capacity in a non-cooperative first

replicate the competitive benchmark, because when they jointly determine their outputs, CSR investments have already been committed to. Allocating more output to firms with higher CSR levels then is optimal, which creates incentives to invest heavily in CSR. Finally, $\pi\left(q^f, v^f\right) > \pi\left(q^p, v^p\right)$, as a full agreement controls both output and CSR levels and can, therefore, always replicate the outcome of a production agreement.

These profit orderings have at least two relevant policy implications. First, if incentives to subsequently invest in CSR are strong (γ high, r low), companies will not voluntarily enter into a production agreement – which we found to be the only type of joint agreement that can actually raise CSR efforts. Second, as profits are always higher in a full agreement than in either a CSR or a production agreement, firms will prefer to coordinate both output and CSR investments rather than only one of the two strategic variables. Allowed to form agreements on only one dimension of competition, it is profitable for the members of that agreement, be it on CSR or production, to try to collude on the remaining dimension(s) too. Such full elimination of competition would be illegal and therefore require to be stabilized against defection. The risk that joint initiatives to promote CSR may slip into full collusion would need to be strictly policed, or CSR levels may end up lower than in competition even for a production agreement. The policy presents a risk of abuse by companies colluding under the guise of corporate social responsibility.

Next, we turn to the within-market welfare effects of the different joint agreements. Of particular interest is the welfare of the consumers of the products concerned, since consumer welfare is the prime competition policy objective in general, and the European cartel prohibition specifically requires for exemption of any type of joint agreement that it does not make consumers worse off. Consumer surplus follows from substituting demand (2) into utility (1)

$$CS(\mathbf{q}) = \frac{1}{2}\left(\sum_{i=1}^{n} q_i^2 + 2\gamma \sum_{i=1}^{n}\sum_{i>j} q_i q_j\right). \tag{12}$$

Note that CSR does not directly affect consumer surplus, because the additional utility from higher CSR efforts in equation (1) is cancelled out by matching price increases in demand (2). However, CSR levels do have an effect on consumer welfare through the way in which the firms' quantities depend on their CSR efforts. As quantities are symmetric in equilibrium, consumer surplus reduces to $CS(q^r) = \frac{n}{2}(\gamma(n-1)+1)(q^r)^2$, where $r \in \{*, csr, p, f\}$, so that the ranking of consumer welfare across different competitive regimes corresponds to the ranking of quantities q^r.

The competitive regimes typically differ in both the conditional quantities that are set in Stage 2 and the CSR investments that are made in Stage 1. Therefore, we cannot simply infer the ranking of consumer welfare across regimes from the ranking of CSR levels in

---

stage is also found in Fershtman and Gandal (1994), and Brod and Shivakumar (1999) when spillovers are low. Competition can even be such a strong force, that the firms are whipped up to invest more in CSR than is optimal from a within-market total welfare point of view.

Proposition 1. It is, however, straightforward to establish the consumer welfare ranking of regimes that reduce CSR investments.

Proposition 2.1. *Joint agreements that fail to increase CSR efforts always harm consumers compared to the non-cooperative benchmark, more so if firms also coordinate their output. Formally: $CS(q^*) > CS(q^{csr}) > CS(q^f)$.*

Proof. See Appendix A. ∎

Proposition 2.1 states that consumers suffer if firms are allowed to coordinate their CSR investments, either only or together with their outputs. A full agreement reduces consumer welfare on two accounts compared to the non-cooperative benchmark: it reduces conditional quantities in Stage 2 and CSR levels in Stage 1. A CSR agreement produces the non-cooperative quantity *conditional* on CSR levels in in Stage 2, but reduces CSR levels in Stage 1, reducing consumer welfare on one account compared to the non-cooperative benchmark. Note that the welfare order is not a consequence of how quantity and CSR enter utility function (1), as neither regime increases the conditional quantity compared to the non-cooperative benchmark and both regimes reduce CSR efforts.

To compare the different regimes on their welfare implications, first note that if CSR efforts are identical across firms and equal to v, conditional quantities are given by

$$q^*(v) = \frac{A + v}{\gamma(n-1) + 2} \text{ and } q^c(v) = \frac{A + v}{2(\gamma(n-1) + 1)}, \tag{13}$$

where $q^*(v)$ is the conditional quantity if firms select quantities non-cooperatively in Stage 2, $q^c(v)$ is the conditional quantity if firms select quantities cooperatively in Stage 2, and $A = \alpha - c$. The difference in consumer surplus between a CSR agreement and the non-cooperative benchmark can be written as $|\frac{\partial CS}{\partial q} \frac{\partial q^*}{\partial v} \Delta v^{csr}|$, where Δv^{csr} is $v^{csr} - v^* < 0$, and the difference in consumer surplus between a full agreement and the non-cooperative benchmark can be written as $|\frac{\partial CS}{\partial q}(\frac{\partial q^c}{\partial v} \Delta v^f + \Delta q^f)|$, where Δv^f is $v^f - v^* < 0$ and Δq^f is $q^f(v^*) - q^*(v^*) < 0$. As long as $|\frac{\partial q^*}{\partial v} \Delta v^{csr}| < |\frac{\partial q^c}{\partial v} \Delta v^f + \Delta q^f|$, a full agreement reduces consumer surplus by more than a CSR agreement, which is always the case for our demand system.

Production agreements are the only type of joint agreement that actually increase CSR. They give rise to two related trade-offs. First, consumers benefit from increased CSR efforts, but are harmed from reduced conditional output and, therefore, higher prices. The balancing of these two opposing effects determines consumer welfare. Second, as explained above, firms are induced to increase their CSR efforts when they compete strongly on that dimension, which works to increase consumer welfare but lower firms profits. In most cases, consumer welfare decreases, whereas in those cases in which consumer welfare increases, profits decrease. The following result makes this precise.

18

Proposition 2.2. *A production agreement reduces consumer welfare compared to the non-cooperative benchmark, except in duopoly when incentives to invest in CSR are high. However, firms will not voluntarily form production agreements that benefit consumers, as when consumers benefit firms are always worse off than in the benchmark. Formally: $CS(q^*) > CS(q^p)$, unless $n = 2$ and $t < \frac{4-2\gamma+\gamma^2}{2(1-\gamma)(4-\gamma^2)}$, in which case $CS(q^*) < CS(q^p)$ and $\pi(q^*, v^*) > \pi(q^p, v^p)$.*

Proof. See Appendix A. ∎

Proposition 2.2 states that consumer welfare is never served by allowing voluntary production agreements. While a production agreement increases CSR efforts, the reduction in conditional quantities is large enough to reduce consumer welfare compared to competition, except for a small set of duopolies where investment incentives are high – i.e., if γ and t are close to 1. In that case, however, all firms invest so much in CSR that their profits are lower than in the non-cooperative benchmark, so that the agreement will not voluntarily form.[31] Hence, consumers are worse off with any production agreement that firms are willing to engage in, despite the higher CSR levels.

The intuition for this result is as follows. From Proposition 1 we know that in all cases $\Delta v^p = v^p - v^* > 0$. Comparing conditional quantities (13) above shows that a production agreement reduces output conditional on CSR levels, and therefore $\Delta q^p = q^c(v^*) - q^*(v^*) < 0$. The total difference in consumer surplus between a production agreement and the non-cooperative benchmark is therefore given by $|\frac{\partial CS}{\partial q}(\frac{\partial q^c}{\partial v}\Delta v^p + \Delta q^p)|$. In a duopoly, if goods are similar and investing in CSR is cheap, $t < \frac{4-2\gamma+\gamma^2}{2(1-\gamma)(4-\gamma^2)}$, the business stealing effect is very strong and Δv^p becomes so large that the net effect on consumer surplus is positive. Firms are induced to invest unprofitably much in CSR efforts, so that they would not voluntarily form the agreement. As n increases, the responsiveness of quantity to CSR levels diminishes, and even when Δv^{pc} is high, consumer surplus is lower compared to the non-cooperative benchmark.

To see the consumer welfare trade-off, note that the difference in total quantity between a production agreement and the non-cooperative benchmark, conditional on a fixed CSR level $\overline{v}$ is given by

$$n(q^*(\overline{v}) - q^c(\overline{v})) = (A + \overline{v})\frac{\gamma n(n-1)}{2(\gamma(n-1)+2)(\gamma(n-1)+1)}, \tag{14}$$

which monotonically increases to $(A + \overline{v})\frac{1}{2\gamma}$ as n goes to infinity. This implies that a production agreement hurts consumers by reducing conditional quantities regardless of market size, and that this negative effect on consumer surplus increases in n. From Proposition 1 we

---

know that $v^p > v^*$, but whether this also results in increased consumer surplus depends on the responsiveness of quantity to CSR levels in both competitive regimes. The conditional quantities in equations (13) show that output is less responsive to CSR levels in a production agreement than in the non-cooperative benchmark and that this difference in responsiveness is increasing in n. In a duopoly, the responsiveness of quantity to CSR levels is highest, so high in fact that when investing is sufficiently cheap, a production agreement's CSR level might lead to a higher quantity compared to the non-cooperative benchmark. However, as n increases, the responsiveness of quantity to CSR levels quickly drops off, and the reduction of conditional quantities eventually dominates the increase in CSR levels.

To know under what circumstances consumer compensation for allowing an agreement is possible, we consider within-market total welfare in regime r ($r \in \{*, csr, p, f\}$) as the sum

$$W(q^r, v^r) = CS(q^r) + n\pi(q^r, v^r).$$

We find that with-in welfare compares as follows across the competitive regimes.

Proposition 3.1. *Allowing firms to coordinate their CSR investments reduces within-market total welfare compared to the non-cooperative benchmark, more so if firms also coordinate output. Formally:* $W(q^*, v^*) > W(q^{csr}, v^{csr}) > W(q^f, v^f)$.

Proof. See Appendix A. ∎

Proposition 3.1 states that allowing firms to jointly decide on their CSR investments will lead to lower within-market welfare, regardless of whether they also coordinate their output. The reason is that coordination results in a deadweight loss, so that increased firm profits can never compensate for lost consumer surplus. Our results unambiguously caution against the use of CSR agreements to increase CSR efforts when consumers are willing to pay for CSR. Not only will such agreements reduce CSR efforts, they will also hurt consumers and reduce within-market total welfare. Unsurprisingly, given Proposition 1, competition is unambiguously the superior regime amongst the three: it produces both higher CSR and higher output, hence higher total within-market welfare.

The within-market total welfare effects of a production agreement are given in the following proposition.

Proposition 3.2. *A production agreement always reduces within-market welfare compared to the non-cooperative benchmark. Formally:* $W(q^*, v^*) > W(q^p, v^p)$.

Proof. See Appendix A. ∎

Proposition 3.2 confirms that for the only type of joint agreement that actually stimulates CSR efforts, production agreements, it is not possible for the firms involved to compensate consumers from the benefits of being allowed to coordinate their quantities. Yet from Proposition 2.2 we know that production agreements hurt consumer welfare. Together, propositions 3.1 and 3.2 show that joint agreements always reduce within-market total welfare. The reason is straightforward: any reduction of competition inescapably creates a deadweight loss. For full and CSR agreements this within-market welfare loss always comes at the cost of consumers. A production agreement trades off consumer welfare with profit, although it also always lowers within-market welfare.

Robustness of our welfare results to pro-policy conditions is particularly relevant for production agreements, which are the only type of agreements that actually increases CSR efforts, but decrease conditional quantities. The relative strength of these forces and the way in which they trade off in the consumer's utility function determine their welfare ranking.[32] To shed light on the robustness of the consumer welfare comparison between a production agreement and the non-cooperative benchmark when CSR levels directly impact consumer welfare, we revisit the welfare comparison in the model of product differentiation in Salop (1979).

Consider a continuum of consumers i who maximize indirect utility

$$V_i = \alpha_S + v_i - \tau |l_i - x| - p_i, \tag{15}$$

where l_i indicates the most preferred option of consumer i, $\tau > 0$ scales the utility consequences of purchasing goods that are less favored, and $\alpha_S > 0$ is a utility parameter. Consumer welfare results from aggregating the indirect utility of all consumers. Note that consumer welfare is directly and positively influenced by CSR levels. In (15), the balancing of price and CSR is crucial in determining consumer welfare, while in our baseline quasi-linear quadratic utility model, price and direct effects of CSR cancel out in consumer surplus. We find, however, that consumer welfare results are not specific to our baseline model – see Proposition F2 in Appendix F. Allowing coordination in the output market, but not in CSR investments, can only increases consumer welfare when goods are very similar (τ is small), and investing is cheap (t is small). As before, business stealing incentives drive these results.

When firms select price instead of quantity in Stage 2, *all* agreements reduce consumer welfare compared to the non-cooperative benchmark – see Propositions D2.1 and D2.2 in Appendix D. The reason is that price setting generates a more competitive benchmark outcome, leaving more consumer surplus than in case of quantity setting, because prices are strategic complements. As a result, the reduction in consumer surplus that results from coordination in the output market is so large, that it can not be offset by higher CSR levels.

---

[32] As this trade-off is absent for CSR and full agreements, and as a deadweight loss is always present for all joint agreements, robustness of our other welfare results follows more easily. Details on all welfare extensions are in Appendices D to F.

The consumer welfare results also generalize to partial agreements – see Appendix E. Firms in a production agreement reduce their output compared to the non-cooperative benchmark, unless the agreement consists of two firms with a competitive fringe of no more than three firms, and incentives to invest in CSR are high (t is low and γ is high). As in the case of market-wide agreement, whenever a production agreement benefits consumers it always hurts firms. An analytical comparison of consumer and within-market total welfare when marginal costs depend on CSR levels and firms have intrinsic motivation is, unfortunately, not feasible for the model with n firms.

5   Out-of-market benefits and regulation

With production agreements being the only type of voluntary horizontal agreement that actually stimulates CSR efforts, yet without sufficient benefits to compensate consumers, the antitrust laws are a major obstacle to collaborative CSR initiatives. Quota-setting, market-sharing, and price-fixing are hard core cartel offences and not what most proponents of collaborative CSR seem to have in mind to allow. Moreover, the European Commission requires that the buyers of the products covered by the agreement need to appreciate the companies' stronger commitment to CSR sufficiently to justify the higher prices in the production (or price) agreement (European Commission, 2023, recital 569). Therefore, even if production agreements would ever become an acceptable means to advance CSR efforts, the consumer compensation requirement would need to be relaxed before they could be exempted from the cartel prohibition. That may be justified on the grounds of benefits of the agreement to others, who are not buyers of the products concerned.

Basing cartel exemptions on out-of-market benefits to non-buyers is indeed the approach of the Dutch competition authority to open up its cartel prohibition to sustainability agreements (ACM, 2021, recital 4). The ACM uniquely interprets "a fair share" of the benefits for consumers as an appreciation that can be less than fully compensating, and adds "externality benefits" to third parties to the agreement. Note however that this approach risks eroding the standard. Given that the benefits aimed at, such as reducing climate change or exploitation, affect very many people, also a very small CSR advance may meet the compensation requirement if it is appreciated by sufficiently many non-buyers. After all, companies have incentives to increase their costly CSR efforts only by the minimum amount that is necessary to pass the compensation requirement and obtain the competition authority's approval. Taking more beneficiaries into account on the benefits side of the exemption decision lowers the required amount of CSR and thus risks watering down CSR initiatives.[33]

---

[33]See Schinkel and Treuren (2021) for an elaborate discussion of this risk of 'cartel green-washing'. Allowing consumers to be harmed while valuing non-consumer benefits also introduces welfare redistribution into competition policy, which is political. Moreover, out-of-market benefits are even more difficult to assess, increasing the risk of abuse by companies colluding under the guise of corporate social responsibility and

Adding out-of-market benefits does not alter our results on the relative effectiveness of joint agreements on CSR. To see its effects in our analysis, consider a negative production externality to non-consumers

$$E\left(\mathbf{q}, \mathbf{v}\right) = \sum_{i=1}^{n} \frac{q_i}{v_i}. \qquad (16)$$

This specification has the appealing feature that for each firm, the increase of this negative externality due to producing one more unit of output is decreasing in that firm's CSR level. In addition, the marginal positive effect of a firm's CSR level on the negative externality that its production generates is decreasing in that firm's CSR level. Let the reduction of externalities in regime r compared to the non-cooperative benchmark be $\Delta E(q^r, v^r) = n(\frac{q^*}{v^*} - \frac{q^r}{v^r})$. These reductions compare across the different competitive regimes as follows.

Proposition 4. *Production agreements decrease negative externalities, while full agreements and CSR agreements increase such externalities, compared to the non-cooperative benchmark. CSR agreements deliver the highest amount of negative externalities. Formally:* $\Delta E(q^p, v^p) > 0 > \Delta E(q^f, v^f) > \Delta E(q^{csr}, v^{csr})$

Proof. See Appendix A. ∎

Taking out-of-market benefits into account does not make CSR agreements a good idea. Only production agreements decrease negative externalities. This is intuitive since a production agreement was found to be the only type of joint agreement that increases CSR efforts while at the same time reducing conditional quantities. $\Delta E\left(q^p, v^p\right) > 0$ holds as long as the externalities become larger in output and smaller in CSR. CSR agreements and full agreements also reduce output, but they decrease CSR levels. Which effect on negative externalities dominates depends on the relative weights given in the externality function to changes in CSR levels and changes in output. $\Delta E\left(q^{csr}, v^{csr}\right) < 0$ and $\Delta E\left(q^f, v^f\right) < 0$ hold more generally for externalities that increase in output and decrease in CSR efforts, as long as the externality is a function of $\frac{q^r}{v^r}$.

Alternatively, rather than expressing CSR as decreasing a negative production externality, as in (16), CSR efforts could bring about a positive externality that is appreciated by non-buyers. For instance, consider a positive externality of the form $e(v) > 0$ with $\frac{\partial e(v)}{\partial v} > 0$. Then again, by Proposition 1, only a production agreement would increase these positive externalities compared to the non-cooperative benchmark. The conclusion remains that if a joint agreement is exempted from cartel law at all, it better be a production agreement,

---

undermining the effectiveness of competition policy. See also Tirole (2023).

or CSR is reduced rather than promoted. Adding out-of-market benefits does not help to justify exempting CSR agreements.

A cartel law exemption also requires that the restriction of competition is 'indispensable' to obtain the benefits, in the sense that there is no other way of achieving the claimed sustainability benefits that is "economically practicable and less restrictive" of competition (European Commission, 2023, recital 561). Our findings imply that CSR agreements are not indispensable for stimulating CSR whenever there is a willingness among consumers to buy from firms that invest more in CSR – on the contrary. Still, in practice some projected advance may be enough to meet the requirement. A broader interpretation of necessity is that the advance in CSR standard cannot be mandated by vertically implemented forms of government regulation – or possibly enforced self-regulation, for example by an isolated part of a trade-association overseen by an agency or independent NGO. A regulated mandatory minimum CSR effort level is certainly less restrictive of competition than a production agreement. Consider its welfare implications in our model.

For any industry-wide regulated CSR level $v > 0$, let $W(q^*(v), v)$ be within-market welfare if the conditional quantities are set non-cooperatively, and let $W(q^c(v), v)$ be within-market welfare if the conditional quantities are set cooperatively – in either a production agreement or a full agreement. We then obtain the following result.

Proposition 5. *For a given CSR level, within-market total welfare is always higher if conditional quantities are set non-cooperatively than if they are set cooperatively. Formally: $W(q^*(v), v) > W(q^c(v), v)$ for all $v > 0$*

Proof. See Appendix A. ∎

Proposition 5 establishes that regulation is the better alternative to excusing collusion. Within-market total welfare is higher if the government regulates v^p, than if it allows a production agreement that delivers the same CSR level v^p. Hence, there is no necessity to restrict competition to stimulate CSR. On the contrary: it is an inferior tool since any level of CSR that government deems an improvement ($v > v^*$) is better imposed than left to an output-coordinating agreement. Moreover, governments can easily be more ambitious and set higher CSR goals to account for externality benefits. Of course, we model no costs of ensuring compliance with the regulated CSR level. Yet neither did we consider the costs of ensuring that a production agreement delivers and does not morph into a more profitable full agreement that, we found, reduces CSR. Government failure is often pointed at by proponents of allowing for collaborate CSR as a second-best alternative. However, for regulation to be less appealing than allowing a production agreement, it must be so much more costly that the welfare gap in Proposition 5 is overcome.

6   Concluding remarks

At first sight, CSR agreements may appear sympathetic, but whenever consumers are more inclined to buy from companies with a stronger CSR stand, joint agreements on CSR turn out to reduce CSR efforts. The reason is that firms steal business from their rivals by showing CSR, and when firms jointly decide on their costly CSR efforts, this dimension of competition is eliminated. If incentives to invest in CSR need strengthening by reducing competition, coordination should not be permitted on CSR efforts directly, but only on output (or prices). Collusion on the output market stimulates CSR efforts indirectly: it increases profit per consumer, making it even more attractive for the firms to strengthen their CSR profile and attract additional customers. Neither low willingness to pay for CSR with consumers, nor intrinsic motivations for CSR with firms, provide reasons to think that companies will increase their CSR investments if they can jointly decide on them. Also coordination of both CSR *and* output (or prices), which companies allowed to form CSR agreements have incentives to engage in, reduce CSR compared to maintaining competition.

We conclude that CSR agreements are better avoided altogether if the goal is to stimulate firms to take more responsibility for environmental and social objectives. They are counterproductive while carrying numerous risks to social welfare. These findings are in stark contrast to the business literature as well as practice calls claiming that collaboration would be imperative to stimulate CSR efforts. Our results should be a warning to all those who advocate CSR agreements with the best intentions. Collaborative CSR is unlikely to deliver. The policy paradox is that society can only induce companies to invest more in CSR than they do in competition by allowing them to reap the benefits of their additional CSR efforts. Corporate appeals to collaborative CSR are therefore best met with some reservations: competition is likely a stronger driver of CSR efforts than cooperation.

In favor of CSR agreements, it may be argued that there are positive spillovers from one company's CSR investments to the others, benefiting them. When such spillovers are significant, private CSR investments are discouraged when the firms are in competition, as the benefits leak away to competitors, so that a joint agreement on CSR can increase CSR efforts. However, to change our qualitative findings, such spillovers must be large enough to counteract the negative incentive effect on CSR investments from eliminating business-stealing with more responsibly manufactured products, which always exists. As discussed in the introduction, it is unclear why there would be sizable spillovers in the cases concerned, which are about transitioning to known cleaner or fairer production methods. Instead, one would expect early movers to benefit from building a reputation with customers and financiers as a responsible company. It does not suffice that firms may realize that they too will suffer from climate change or revolts against social injustices – not even as an existential threat. These global issues seem too immense for even the largest multinational companies to internalize sufficiently strongly.

Companies that are serious about their CSR can go ahead and competitively offer more responsibly produced goods rather than seek exemptions for anticompetitive agreements. This will trigger others to follow suit. Those who still perceive that they are discouraged from pursuing CSR initiatives by antitrust liability concerns are better advised to lobby their regulators to implement higher CSR standards than their competition authority for a cartel exemption. Government regulation seems superior to collaborative self-regulation, which is demanding on the limited information and abilities, time and budgets of competition authorities. Before rushing ahead to relax the cartel laws based on unproven claims that collaboration would be needed to advance CSR, additional comparative study of regulatory approaches to CSR stimulation should be done.

Corporate social responsibility certainly can play an important role in resolving pressing social problems, such as climate change and unfair business practices, that require urgent and drastic action that governments often fail to take. However, there is no compelling evidence that business collaboration in restraint of competition would induce companies to take up this role. Instead, competition strengthens firms' incentives to do well by doing good if consumers value CSR positively – and if they don't, collaboration does not perform better either. Growing consumer awareness makes consumers turn away from products that are perceived as unjust, unfair, or unsustainably manufactured. Increasing willingness to buy from and invest in companies that are serious about their CSR is a force that compels corporations to take more responsibility for environmental and social objectives. It allows competitors to monetize a comparative advantage in CSR on their rivals. The strategic CSR business model is an engine for corporate social performance that is better given free rein and not throttled by corporate collaboration that risks collusion. While voluntary collective agreements have their merits in other contexts, such as creating R&D synergies and setting compatibility standards, we submit that agreements on CSR efforts weaken competition as an important driver of corporate social efforts.

References

Aghion, P., Bénabou, R., Martin, R., and Roulet, A. (2023). Environmental preferences and technological choices: Is market competition clean or dirty? *American Economic Review: Insights*, 5(1):1–19.

Ahmed, R. and Segerson, K. (2011). Collective voluntary agreements to eliminate polluting products. *Resource and Energy Economics*, 33(3):572–588.

Alberini, A. and Segerson, K. (2002). Assessing voluntary programs to improve environmental quality. *Environmental and Resource Economics*, 22(1):157–184.

Authority for Consumers and Markets (2021). Draft guidelines for sustainability agreements: Opportunities within competition law, 26 January.

Azar, J., Duro, M., Kadach, I., and Ormazabal, G. (2021). The big three and corporate carbon emissions around the world. *Journal of Financial Economics*, 142(2):674–696.

Bagnoli, M. and Watts, S. G. (2003). Selling to socially responsible consumers: Competition and the private provision of public goods. *Journal of Economics & Management Strategy*, 12(3):419–445.

Bansal, P. and Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of Management Journal*, 43(4):717–736.

Baron, D. P. (2001). Private politics, corporate social responsibility, and integrated strategy. *Journal of Economics & Management Strategy*, 10(1):7–45.

Bénabou, R. and Tirole, J. (2010). Individual and corporate social responsibility. *Economica*, 77(305):1–19.

Besley, T. and Ghatak, M. (2007). Retailing public goods: The economics of corporate social responsibility. *Journal of Public Economics*, 91(9):1645–1663.

Brau, R. and Carraro, C. (2011). The design of voluntary agreements in oligopolistic markets. *Journal of Regulatory Economics*, 39(2):111–142.

Brod, A. and Shivakumar, R. (1999). Advantageous semi-collusion. *Journal of Industrial Economics*, 47(2):221–230.

Calveras, A. and Ganuza, J.-J. (2016). The role of public information in corporate social responsibility. *Journal of Economics & Management Strategy*, 25(4):990–1017.

Calveras, A. and Ganuza, J.-J. (2018). Corporate social responsibility and product quality. *Journal of Economics & Management Strategy*, 27(4):804–829.

Casadesus-Masanell, R., Crooke, M., Reinhardt, F., and Vasishth, V. (2009). Households' willingness to pay for "green" goods: Evidence from Patagonia's introduction of organic cotton sportswear. *Journal of Economics & Management Strategy*, 18(1):203–233.

Chatterji, A. K. and Toffel, M. W. (2019). Assessing the impact of CEO activism. *Organization & Environment*, 32(2):159–185.

Cheng, B., Ioannou, I., and Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 35(1):1–23.

Choné, P. and Linnemer, L. (2020). Linear demand systems for differentiated goods: Overview and user's guide. *International Journal of Industrial Organization*, 73:102663.

Competition and Markets Authority (2023). Draft guidance on the application of the Chapter I prohibition in the Competition Act 1998 to environmental sustainability agreements, 28 February.

d'Aspremont, C. and Jacquemin, A. (1988). Cooperative and noncooperative R&D in duopoly with spillovers. *American Economic Review*, 78(5):1133–1137.

de Bettignies, J.-E., Liu, H. F., and Robinson, D. T. (2020). Corporate social responsibility and imperfect regulatory oversight: Theory and evidence from greenhouse gas emissions disclosures. (no. w28159) National Bureau of Economic Research.

Delmas, M. A. and Colgan, D. (2018). *The Green Bundle.* Stanford University Press.

Delmas, M. A. and Montes-Sancho, M. J. (2010). Voluntary agreements to improve environmental quality: Symbolic and substantive cooperation. *Strategic Management Journal*, 31(6):575–601.

Dewatripont, M. and Tirole, J. (2022). The morality of markets. *mimeo.*

Ding, W., Levine, R., Lin, C., and Xie, W. (2020). Competition laws, norms and corporate social responsibility. (no. w27493) National Bureau of Economic Research.

Dolmans, M. (2021). Sustainable competition policy and the "polluter pays" principle. In Holmes, S., Middelschulte, D., and Snoep, M., editors, *Competition Law, Climate Change & Environmental Sustainability.* Concurrences.

Du, S., Bhattacharya, C. B., and Sen, S. (2011). Corporate social responsibility and competitive advantage: Overcoming the trust barrier. *Management Science*, 57(9):1528–1545.

Duso, T., Röller, L.-H., and Seldeslachts, J. (2014). Collusion through joint R&D: An empirical assessment. *Review of Economics and Statistics*, 96(2):349–370.

El Ghoul, S., Guedhami, O., Kwok, C. C., and Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, 35(9):2388–2406.

European Commission (2023). Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements, released 1 June 2023, forthcoming in the *Official Journal.*

Fernández-Kranz, D. and Santaló, J. (2010). When necessity becomes a virtue: The effect of product market competition on corporate social responsibility. *Journal of Economics & Management Strategy*, 19(2):453–487.

Fershtman, C. and Gandal, N. (1994). Disadvantageous semicollusion. *International Journal of Industrial Organization*, 12(2):141–154.

Fershtman, C. and Pakes, A. (2000). A dynamic oligopoly with collusion and price wars. *RAND Journal of Economics*, 31(2):207–236.

Flammer, C. (2015a). Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach. *Management Science*, 61(11):2549–2568.

Flammer, C. (2015b). Does product market competition foster corporate social responsibility? Evidence from trade liberalization. *Strategic Management Journal*, 36(10):1469–1485.

Gans, J. S. (2012). Innovation and climate change policy. *American Economic Journal: Economic Policy*, 4(4):125–45.

Gans, J. S. and Groves, V. (2012). Carbon offset provision with guilt-ridden consumers. *Journal of Economics & Management Strategy*, 21(1):243–269.

Hart, O. and Zingales, L. (2017a). Companies should maximize shareholder welfare not market value. *Journal of Law, Finance, and Accounting*, 2(2):247–275.

Hart, O. and Zingales, L. (2017b). Serving shareholders doesn't mean putting profit above all else. *Harvard Business Review*, 12:2–6.

Henderson, R. (2020). *Reimagining Capitalism In A World On Fire*. Public Affairs.

Holmes, S. (2020). Climate change, sustainability, and competition law. *Journal of Antitrust Enforcement*, 8(2):354–405.

Holmes, S., Middelschulte, D., and Snoep, M., editors (2021). *Competition Law, Climate Change & Environmental Sustainability*. Concurrences.

Ignatius, A. (2012). Captain planet. *Harvard Business Review*, 90(6):112–118.

Innes, R. and Sam, A. G. (2008). Voluntary pollution reductions and the enforcement of environmental law: An empirical study of the 33/50 program. *Journal of Law and Economics*, 51(2):271–296.

International Chamber of Commerce (2022). *When chilling contributes to warming: How competition policy acts as a barrier to climate action*.

Kamien, M. I., Muller, E., and Zang, I. (1992). Research joint ventures and R&D cartels. *American Economic Review*, 82(5):1293–1306.

Kitzmueller, M. and Shimshack, J. (2012). Economic perspectives on corporate social responsibility. *Journal of Economic Literature*, 50(1):51–84.

Kotchen, M. J. (2006). Green markets and private provision of public goods. *Journal of Political Economy*, 114(4):816–834.

Kotchen, M. J. and Segerson, K. (2019). On the use of group performance and rights for environmental protection and resource management. *Proceedings of the National Academy of Sciences*, 116(12):5285–5292.

Krueger, P., Metzger, D., and Wu, J. (2021). The sustainability wage gap. Swiss Finance Institute Research Paper Series no. 21-17.

Lenox, M. and Chatterji, A. K. (2018). *Can Business Save The Earth? Innovating Our Way To Sustainability*. Stanford University Press.

Lin, P. and Saggi, K. (2002). Product differentiation, process R&D, and the nature of market competition. *European Economic Review*, 46(1):201–211.

Lutz, S., Lyon, T. P., and Maxwell, J. W. (2000). Quality leadership when regulatory standards are forthcoming. *Journal of Industrial Economics*, 48(3):331–348.

Lyon, T. P. and Maxwell, J. W. (2004). *Corporate Environmentalism and Public Policy*. Cambridge University Press.

Malhotra, N., Monin, B., and Tomz, M. (2019). Does private regulation preempt public regulation? *American Political Science Review*, 113(1):19–37.

Matsui, A. (1989). Consumer-benefited cartels under strategic capital investment competition. *International Journal of Industrial Organization*, 7(4):451–470.

McWilliams, A. and Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26(1):117–127.

Nidumolu, R., Ellison, J., Whalen, J., and Billman, E. (2014). The collaboration imperative. *Harvard Business Review*, 92(4):76–84.

Peloza, J. and Falkenberg, L. (2009). The role of collaboration in achieving corporate social responsibility objectives. *California Management Review*, 51(3):95–113.

Polman, P. and Winston, A. (2021). *Net Positive: How Courageous Companies Thrive by Giving More Than They Take*. Harvard Business Review Press.

Porter, M. and Kramer, M. (2006). Strategy and society: The link between competitive advantage and corporate social responsibility-response. *Harvard Business Review*, 85(5):139.

Salop, S. C. (1979). Monopolistic competition with outside goods. *Bell Journal of Economics*, 10(1):141–156.

Schinkel, M. P. and Spiegel, Y. (2017). Can collusion promote sustainable consumption and production? *International Journal of Industrial Organization*, 53:371–398.

Schinkel, M. P., Spiegel, Y., and Treuren, L. (2022). Production agreements, sustainability investments, and consumer welfare. *Economics Letters*, 216:110564.

Schinkel, M. P. and Treuren, L. (2021). Green antitrust: Friendly fire in the fight against climate change. In Holmes, S., Middelschulte, D., and Snoep, M., editors, *Competition Law, Climate Change & Environmental Sustainability*. Concurrences.

Scott, I. (2016). Antitrust and socially responsible collaboration: A chilling combination. *American Business Law Journal*, 53(1):97–144.

Servaes, H. and Tamayo, A. (2013). The impact of corporate social responsibility on firm value: The role of customer awareness. *Management Science*, 59(5):1045–1061.

Sharfman, M. P. and Fernando, C. S. (2008). Environmental risk management and the cost of capital. *Strategic Management Journal*, 29(6):569–592.

Shubik, M. and Levitan, R. (1980). *Market Structure and Behavior*. Harvard University Press.

Simon, D. H. and Prince, J. T. (2016). The effect of competition on toxic pollution releases. *Journal of Environmental Economics and Management*, 79:40–54.

Sovinsky, M. (2022). Do research joint ventures serve a collusive function? *Journal of the European Economic Association*, 20(1):430–475.

Symeonidis, G. (2000). Price and nonprice competition with endogenous market structure. *Journal of Economics & Management Strategy*, 9(1):53–83.

Tirole, J. (2023). Socially responsible agencies. *Competition Law & Policy Debate*, 7(4):171–177.

Treuren, L. and Schinkel, M. P. (2018). Can collusion promote sustainable consumption and production? Not beneficially beyond duopoly. Amsterdam Center for Law and Economics. Working Paper No. 2018-01.

Werden, G. J. (2014). Antitrust's rule of reason: Only competition matters. *Antitrust Law Journal*, 79:713–759.

Appendices

A Proofs of propositions

Proof of Proposition 1. Define $A = \alpha - c$, $\beta_1 = \gamma(n-1) + 2$, $\beta_2 = \gamma(n-2) + 2$, and $\beta_3 = \gamma(n-3) + 2$. In Stage 2, firms in the non-cooperative benchmark or a CSR agreement maximize (3) with respect to q_i, resulting in Nash-equilibrium conditional quantities

$$q_i^*(\mathbf{v}) = \frac{\beta_2(A + v_i) - \gamma \sum_{i \neq j}^n (A + v_j)}{(2 - \gamma)\beta_1}, \quad i = 1, ..., n, \tag{17}$$

while firms in a production agreement or a full agreement choose quantities to maximize the sum of members' profit, conditional on $\mathbf{v}$, resulting in conditional quantities (superscript c for "coordinated")

$$q_i^c(\mathbf{v}) = \frac{(1 - \gamma)A + (\beta_2 - 1)v_i - \gamma \sum_{i \neq j}^n v_j}{2(1 - \gamma)(\beta_1 - 1)}, \quad i = 1, ..., n. \tag{18}$$

In Stage 1, firms in the non-cooperative benchmark pick v_i to maximize $\pi_i(\mathbf{q}^*(\mathbf{v}), v_i)$, resulting in Nash-equilibrium CSR level

$$v^* = A \frac{2\beta_2}{t(2 - \gamma)\beta_1^2 - 2\beta_2}. \tag{19}$$

Firms in a CSR agreement select $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{q}^*(\mathbf{v}), v_i)$ in Stage 1, resulting in CSR level

$$v^{csr} = A \frac{2}{t\beta_1^2 - 2}. \tag{20}$$

Members of a production agreement determine v_i by maximizing $\pi_i(\mathbf{q}^c(\mathbf{v}), v_i)$, so that the CSR level is

$$v^p = A \frac{\beta_3}{4t(1 - \gamma)(\beta_1 - 1) - \beta_3}. \tag{21}$$

A full agreement chooses $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{q}^c(\mathbf{v}), v_i)$ in Stage 1. The resulting CSR level is

$$v^f = A \frac{1}{2t(\beta_1 - 1) - 1}. \tag{22}$$

Note that conditional quantities (17) and (18) are symmetric by implication. To ensure that all second-order conditions hold, and restricting our attention to interior solutions, in all proofs in this appendix we impose $8t(1 - \gamma)^2(\beta_1 - 1) - \beta_3^2 > 0$. The ranking follows from

$$v^p - v^* = A \frac{\gamma^2 t(n-1)(4n + 2\gamma(n-1)(n-2) - \gamma^2(n-1)(n-3))}{(4t(1 - \gamma)(\beta_1 - 1) - \beta_3)(t(2 - \gamma)\beta_1^2 - 2\beta_2)} > 0,$$

$$v^* - v^f = A \frac{\gamma t(1-n)(4 + \gamma(2 + \gamma)(n-1))}{(2t(\beta_1 - 1) - 1)(t(2 - \gamma)\beta_1^2 - 2\beta_2)} > 0, \text{ and}$$

$$v^f - v^{csr} = A \frac{t(\beta_1 - 2)^2}{(2t(\beta_1 - 1) - 1)(t\beta_1^2 - 2)} > 0. \blacksquare$$

Proof of Proposition 2.1. In competitive regime r, $r \in \{*, csr, p, f\}$, consumer surplus (12) can be written as $CS(q^r) = \frac{n}{2}(\gamma(n-1)+1)(q^r)^2$ as quantities and CSR levels are symmetric. Therefore, the ranking of consumer surpluses is equivalent to that of quantities. From equations (17) to (21), it follows that

$$q^* - q^{csr} = At\frac{2\gamma(n-1)\beta_1}{(t\beta_1^2 - 2)(t(2-\gamma)\beta_1^2 - 2\beta_2)} > 0,$$

and

$$q^{csr} - q^f = At\frac{\gamma(n-1)(t\beta_1 - 1)}{(t\beta_1^2 - 2)(2t(\beta_1 - 1) - 1)} > 0. \ \blacksquare$$

Proof of Proposition 2.2. From equations (17) to (21), it follows that

$$q^p - q^* = At\frac{\gamma(1-n)(2t(\gamma-2)(\gamma-1)\beta_1 + \gamma(\gamma-2)(n-3) - 4)}{(4t(\gamma-1)(\beta_1-1) + \beta_3)(t(\gamma-2)\beta_1^2 + 2\beta_2)},$$

which is always negative for $n > 2$, and positive for $n = 2$ as long as $t < \frac{4-2\gamma+\gamma^2}{2(1-\gamma)(4-\gamma^2)}$. Nash-equilibrium profit of a firm in the non-cooperative benchmark follows from substituting equations (17) and (19) into equation (3)

$$\pi(q^*, v^*) = A^2 t\frac{t(\gamma-2)^2\beta_1^2 - 2\beta_2^2}{(t(\gamma-2)\beta_1^2 + 2\beta_2)^2}. \tag{23}$$

Profit of a firm in a production agreement follows from substituting equations (18) and (21) into equation (3)

$$\pi(q^p, v^p) = A^2 t\frac{8t(\gamma-1)^2(\beta_1-1) - \beta_3^2}{2(4t(\gamma-1)(\beta_1-1) + \beta_3)^2}. \tag{24}$$

Imposing $n = 2$ and $t < \frac{4-2\gamma+\gamma^2}{2(1-\gamma)(4-\gamma^2)}$ gives $\pi(q^*, v^*) > \pi(q^p, v^p)$. $\blacksquare$

Proof of Proposition 3.1. Substituting equations (17) and (19) into equations (3) and (12), and then adding total profit of all firms to consumer surplus gives Nash-equilibrium welfare in the non-cooperative benchmark

$$W(q^*, v^*) = A^2 nt\frac{t(\gamma-2)^2(\beta_1+1)\beta_1^2 - 4\beta_2^2}{2(t(\gamma-2)\beta_1^2 + 2\beta_2)^2}. \tag{25}$$

Substituting equations (17) and (20) into equations (3) and (12), and then adding total profit of all firms to consumer surplus gives welfare in a CSR agreement

$$W(q^{csr}, v^{csr}) = A^2 nt\frac{t(\beta_1+1)\beta_1^2 - 4}{2(t\beta_1^2 - 2)^2}. \tag{26}$$

Substituting equations (18) and (22) into equations (3) and (12), and then adding total profit of all firms to consumer surplus gives welfare in a full agreement

$$W(q^f, v^f) = A^2 nt\frac{3t(\beta_1-1) - 1}{2(2t(\beta_1-1) - 1)^2}. \tag{27}$$

33

Straightforward calculations deliver $W(q^*, v^*) - W(q^{csr}, v^{csr}) > 0$, and $W(q^{csr}, v^{csr}) - W(q^f, v^f) > 0$. ∎

Proof of Proposition 3.2. Substituting equations (18) and (21) into equations (3) and (12), and then adding total profit of all firms to consumer surplus gives welfare in a production agreement

$$W(q^p, v^p) = A^2 n t \frac{12t(\gamma - 1)^2(\beta_1 - 1) - \beta_3^2}{2(4t(\gamma - 1)(\beta_1 - 1) + \beta_3)^2}. \tag{28}$$

Comparing equation (25) to equation (28) shows that $W(q^*, v^*) > W(q^p, v^p)$. ∎

Proof of Proposition 4. We have $E(q^r, v^r) = n\frac{q^r}{v^r}$, $r \in \{*, csr, p, f\}$, as quantities and CSR levels are symmetric, so that the ranking of externalities across competitive regimes corresponds to the ranking of the ratio of quantity to CSR level. Substituting equations (17) to (22) in $E(q^r, v^r)$ and taking differences gives

$$
\begin{aligned}
E(q^{csr}, v^{csr}) - E(q^f, v^f) &= \frac{\gamma t n(n-1)}{2} > 0, \\
E(q^f, v^f) - E(q^*, v^*) &= \frac{\gamma^2 t n(n-1)}{2\beta_2} > 0, \text{ and} \\
E(q^*, v^*) - E(q^p, v^p) &= \frac{\gamma t n(n-1)(\gamma(2-\gamma)(n-3) + 4)}{2\beta_2\beta_3} > 0,
\end{aligned}
$$

from which the ranking follows. ∎

Proof of Proposition 5. Substituting equation (17) into equations (3) and (12), imposing $v_i = v$ $\forall i$, and adding total profit of all firms to consumer surplus, gives welfare when quantities are chosen non-cooperatively and CSR levels are regulated to v

$$W(q^*(v), v) = n\frac{3A^2 + 6Av + (3 - 4t(\beta_1 - 1))v^2}{8(\beta_1 - 1)}. \tag{29}$$

Substituting equation (18) into equations (3) and (12), imposing $v_i = v$ $\forall i$, and adding total profit of all firms to consumer surplus, gives welfare when quantities are chosen cooperatively and CSR levels are regulated to v

$$W(q^c(v), v) = n\frac{3A^2 + 6Av + \gamma(n-1)(A+v)^2 + (3 - t\beta_1^2)v^2}{2\beta_1^2}. \tag{30}$$

Subtracting equation (30) from equation (29) gives

$$W(q^*(v), v) - W(q^c(v), v) = (A + v)^2 \frac{\gamma n(n-1)(\beta_1 + 2)}{8(\beta_1 - 1)\beta_1^2} > 0. ∎$$

B Limited willingness to pay and CSR-dependent marginal costs

This appendix verifies that our main result on CSR efforts is robust to allowing CSR investments to affect marginal costs, and varying the willingness to pay for CSR. Recall that we assume $\delta > 0$ – increased willingness to pay compensates for any marginal cost increase of CSR investments – and denote outcomes based on equation (10) by subscript δ. From comparing CSR levels derived from the profit function in equation (10) across the four regimes, we find that the ranking in Proposition 1 is maintained.

Proposition B1. *CSR agreements and full agreements decrease CSR levels, compared to the competitive benchmark. CSR agreements deliver the least CSR of all regimes. Only production agreements increase CSR levels. Formally: $v_\delta^p > v_\delta^* > v_\delta^f > v_\delta^{csr}$.*

Proof. In Stage 2, firms in the non-cooperative benchmark or a CSR agreement maximize (10) with respect to q_i, resulting in Nash-equilibrium conditional quantities

$$q_{\delta,i}^*(\mathbf{v}) = \frac{\beta_2(A + \delta v_i) - \gamma \sum_{i \neq j}^n (A + \delta v_j)}{(2 - \gamma)\beta_1}, \quad i = 1, ..., n, \tag{31}$$

while firms in a production agreement or a full agreement choose quantities to maximize the sum of members' profit, conditional on $\mathbf{v}$, resulting in conditional quantities

$$q_{\delta,i}^c(\mathbf{v}) = \frac{(\beta_2 - 1)(A + \delta v_i) - \gamma \sum_{i \neq j}^n (A + \delta v_j)}{2(1 - \gamma)(\beta_1 - 1)} \quad i = 1, ..., n. \tag{32}$$

Let $\mathbf{q}_\delta^* = q_{\delta,1}^*(\mathbf{v}), q_{\delta,2}^*(\mathbf{v}), \ldots, q_{\delta,n}^*(\mathbf{v})$. In Stage 1, firms in the non-cooperative benchmark pick v_i to maximize $\pi_i(\mathbf{q}_\delta^*(\mathbf{v}), v_i)$, resulting in Nash-equilibrium CSR level

$$v_\delta^* = A \frac{2\delta\beta_2}{t(2 - \gamma)\beta_1^2 - 2\delta^2\beta_2}. \tag{33}$$

A CSR agreement chooses $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{q}_\delta^*(\mathbf{v}), v_i)$ in Stage 1, so that the CSR level is

$$v_\delta^{csr} = A \frac{2\delta}{t\beta_1^2 - 2\delta^2}. \tag{34}$$

Let $\mathbf{q}_\delta^c = q_{\delta,1}^c(\mathbf{v}), q_{\delta,2}^c(\mathbf{v}), \ldots, q_{\delta,n}^c(\mathbf{v})$. Members of a production agreement determine v_i by maximizing $\pi_i(\mathbf{q}_\delta^c(\mathbf{v}), v_i)$, so that the CSR level is

$$v_\delta^p = A \frac{\delta\beta_3}{4t(1 - \gamma)(\beta_1 - 1) - \delta^2\beta_3}. \tag{35}$$

Finally, a full agreement chooses $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{q}_\delta^c(\mathbf{v}), v_i)$ in Stage 1. The resulting CSR level is

$$v_\delta^f = A \frac{\delta}{2t(\beta_1 - 1) - 1}. \tag{36}$$

The ranking follows from

$$v_\delta^p - v_\delta^* = \delta A \frac{\gamma^2 t(n-1)(4n + 2\gamma(n-1)(n-2) - \gamma^2(n-1)(n-3))}{(4t(1-\gamma)(\beta_1 - 1) - \delta^2 \beta_3)(t(2-\gamma)\beta_1^2 - 2\delta^2 \beta_2)} > 0,$$

$$v_\delta^* - v_\delta^f = \delta A \frac{\gamma t(1-n)(4 + \gamma(2+\gamma)(n-1))}{(2t(\beta_1 - 1) - \delta^2)(t(2-\gamma)\beta_1^2 - 2\delta^2 \beta_2)} > 0, \text{ and}$$

$$v_\delta^f - v_\delta^{csr} = \delta A \frac{t(\beta_1 - 2)^2}{(2t(\beta_1 - 1) - \delta^2)(t\beta_1^2 - 2\delta^2)} > 0. \ \blacksquare$$

The ranking op CSR levels given in Proposition 1 holds whenever consumers have at least some positive willingness to pay for more responsibly manufactured products over and above any marginal cost increase from the CSR advance, no matter how little that net willingness to pay is. When this is the case, corporations will each take more CSR efforts in competition than when they can coordinate their CSR actions.

The generality of this result can be seen again from the first-order conditions given in equations (6) to (9): these expressions are identical when based on equation (10). Scaling the willingness to pay for CSR net of marginal cost changes – scaling δ – simply scales all incentives related to CSR, as is made precise in the following proposition.

Proposition B2. *The larger is the willingness to pay for CSR net of marginal cost increases, the larger are the differences between CSR efforts in the four competitive regimes that we consider. Formally:* $\frac{\partial(v_\delta^p - v_\delta^*)}{\partial \delta} > 0$, $\frac{\partial(v_\delta^* - v_\delta^f)}{\partial \delta} > 0$, *and* $\frac{\partial(v_\delta^f - v_\delta^{csr})}{\partial \delta} > 0$.

Proof. The difference $v_\delta^p - v_\delta^*$ is constructed from equations (35) and (33). Taking the derivative with respect to δ gives

$$\frac{\partial(v_\delta^p - v_\delta^*)}{\partial \delta} = \frac{A\beta_3(4t(1-\gamma)(\beta_1 - 1) + \delta^2 \beta_3)}{(4t(\gamma - 1)(\beta_1 - 1) + \delta^2 \beta_3)^2} + \frac{2A\beta_2(t(\gamma - 2)\beta_1^2 - 2\delta^2 \beta_2)}{(t(\gamma - 2)\beta_1^2 + 2\delta^2 \beta_2)^2} > 0.$$

The difference $v_\delta^* - v_\delta^f$ is constructed from equations (33) and (36). Taking the derivative with respect to δ gives

$$\frac{\partial(v_\delta^* - v_\delta^f)}{\partial \delta} = \frac{2A\beta_2(t(2-\gamma)\beta_1^2 + 2\delta^2 \beta_2)}{(t(\gamma - 2)\beta_1^2 + 2\delta^2 \beta_2)^2} - \frac{A(\delta^2 + 2t(\beta_1 - 1))}{(\delta^2 - 2t(\beta_1 - 1))^2} > 0.$$

The difference $v_\delta^f - v_\delta^{csr}$ is constructed from equations (36) and (34). Taking the derivative with respect to δ gives

$$\frac{\partial(v_\delta^f - v_\delta^{csr})}{\partial \delta} = \frac{A(\delta^2 + 2t(\beta_1 - 1))}{(\delta^2 - 2t(\beta_1 - 1))^2} - \frac{2A(t\beta_1^2 + 2\delta^2)}{(t\beta_1^2 - 2\delta^2)^2} > 0. \ \blacksquare$$

As the effect of CSR efforts on a firm's price-cost margin increases, the differences between CSR levels in the different regimes increase. Increases in δ magnify the business stealing

effect, further increasing incentives for CSR investments in a production agreement and decreasing incentives for CSR investments when firms coordinate such investments. If δ decreases, for instance due to increased marginal costs following CSR investments, the CSR levels in the different regimes converge.

The conclusion remains that CSR agreements do not stimulate CSR efforts compared to the non-cooperative benchmark: only production agreements do. There is no hold-up of CSR efforts due to "low" willingness to pay for the products and services of companies that a CSR agreement can overcome. Whenever firms can monetize their CSR efforts by attracting more business or increasing their margin, even if only a little, their incentives to invest in CSR are always stronger when they compete than when they are allowed to make CSR agreements. The crucial insight is that the difference in CSR efforts between competition and CSR cooperation is positive whenever there is a (net) positive willingness to pay. Moreover, if consumers have no positive (net) willingness to pay for CSR ($\delta \leq 0$), coordination will not induce companies to invest in CSR either.

C Intrinsic motivation for CSR

This appendix verifies that our main result on CSR efforts is robust to allowing firm to have intrinsic motivation to invest in CSR, in addition to profit motives. Results are based on the objective function in equation (11) in the main text, where we assume that firms have intrinsic motivation ($\theta > 0$).

In Stage 2 of the game, nothing changes compared to the baseline model as the intrinsic motivation term in (11) does not depend on output. Therefore, conditional quantities v are still given by $q_i^*(\mathbf{v})$ if firms independently set quantities, and $q_i^c(\mathbf{v})$ if firms jointly set quantities. In Stage 1 of all four competitive regimes, firm i now picks v_i to maximize

$$\pi_i(\mathbf{q}(\mathbf{v}), v_i) + \theta v_i + \psi \sum_{i \neq j}^{n} (\pi_j(\mathbf{q}(\mathbf{v}), v_j) + \theta v_j), \tag{37}$$

where $\psi = 1$ if CSR levels are chosen cooperatively in Stage 1, and $\psi = 0$ otherwise. It is immediate from (37) that firms will invest more in CSR if they are intrinsically motivated than if they solely maximize profit ($\theta = 0$). The resulting CSR levels, denoted by a subscript I, compare as follows.

Proposition C1. *CSR agreements and full agreements decrease CSR levels, compared to the competitive benchmark. CSR agreements deliver the least CSR of all regimes. Only production agreements increase CSR levels. Formally: $v_I^p > v_I^* > v_I^f > v_I^{csr}$.*

Proof. Intrinsic motivation does not affect the conditional quantities that solve Stage 2 of the game. In Stage 2, firm i in the non-cooperative benchmark or a CSR agreement

maximizes objective function (11) with respect to q_i, resulting in conditional quantity given by equation (17). Firm i in a production agreement or a full agreement choose quantities to maximize $\sum_{i=1}^{n} (\pi_i(\mathbf{q}, v_i) + \theta v_i)$ resulting in conditional quantity given by equation (18).

In Stage 1, firms in the non-cooperative benchmark pick v_i to maximize $\pi_i(\mathbf{q}^*(\mathbf{v}), v_i) + \theta v_i$, resulting in Nash-equilibrium CSR level

$$v_I^* = v^* + \frac{(2-\gamma)\beta_1^2\theta}{t(2-\gamma)\beta_1^2 - 2\beta_2} = \frac{2\beta_2 A + (2-\gamma)\beta_1^2\theta}{t(2-\gamma)\beta_1^2 - 2\beta_2}. \tag{38}$$

Firms in a CSR agreement choose $\mathbf{v}$ to maximize $\sum_{i=1}^{n} (\pi_i(\mathbf{q}^*(\mathbf{v}), v_i) + \theta v_i)$ in Stage 1, with the resulting CSR level given by

$$v_I^{csr} = v^{csr} + \frac{\beta_1^2\theta}{t\beta_1^2 - 2} = \frac{2A + \beta_1^2\theta}{t\beta_1^2 - 2}. \tag{39}$$

The members of a production agreement determine v_i by maximizing $\pi_i(\mathbf{q}^c(\mathbf{v}), v_i) + \theta v_i$, so that the CSR level is

$$v_I^p = v^p + \frac{4(1-\gamma)(\beta_1 - 1)\theta}{4t(1-\gamma)(\beta_1 - 1) - \beta_3} = \frac{\beta_3 A + 4(1-\gamma)(\beta_1 - 1)\theta}{4t(1-\gamma)(\beta_1 - 1) - \beta_3}. \tag{40}$$

Finally, firms in a full agreement choose $\mathbf{v}$ to maximize $\sum_{i=1}^{n} (\pi_i(\mathbf{q}^c(\mathbf{v}), v_i) + \theta v_i)$ in Stage 1. The resulting CSR level is

$$v_I^f = v^f + \frac{2(\beta_1 - 1)\theta}{2t(\beta_1 - 1) - 1} = \frac{A + 2(\beta_1 - 1)\theta}{2t(\beta_1 - 1) - 1}. \tag{41}$$

The ranking follows from

$$v_I^p - v_I^* = (At + \theta)\frac{\gamma^2(n-1)(\gamma^2(n-1)(n-3) - 2\gamma(n-1)(n-2) - 4n)}{(4t(\gamma-1)(\beta_1-1) + \beta_3)(t(2-\gamma)\beta_1^2 - 2\beta_2)} > 0,$$

$$v_I^* - v_I^f = (At + \theta)\frac{\gamma(n-1)(\gamma(2+\gamma)(n-1) + 4)}{(2t(\beta_1-1) - 1)(t(2-\gamma)\beta_1^2 - 2\beta_2)} > 0, \text{ and}$$

$$v_I^f - v_I^{csr} = (At + \theta)\frac{\gamma^2(n-1)^2}{(2t(\beta_1-1) - 1)(t\beta_1^2 - 2)} > 0. \blacksquare$$

We find that the ranking of CSR levels across the different competitive regimes in Proposition 1 is unaffected when firms are intrinsically motivated to increase CSR, in addition to having a profit motive. Still, the only agreement that will increase CSR levels compared to the non-cooperative benchmark is a production agreement.

The reason for this is as follows. Adding θ to the left-hand side of the first-order conditions given in equations (6) to (9) gives the first-order conditions when firms are also intrinsically motivated. These conditions show that the added incentive to invest in CSR due to intrinsic motivation is identical for all competitive regimes. However, the lost profit

from increasing CSR above the profit-maximizing level is not identical in all competitive regimes. In a production agreement, this lost profit is lowest as $\frac{\partial \pi_i}{\partial q_i} > 0$ and $\frac{\partial q_i^c}{\partial v_i} > 0$, so that the reduction in profit from pushing CSR efforts above the profit-maximizing amount is somewhat mitigated. For a CSR agreement, the lost profit of a given CSR increase is highest, as each CSR increase decreases profit for all members of the agreement, which is exactly the externality a CSR agreement is trying to avoid. Therefore, the difference in CSR efforts between a firm with and without a given level of intrinsic motivation is lower in a CSR agreement than in the other competitive regimes. A full agreement combines both effects, although the negative externality of CSR on the profit of all other firms in the agreement dominates. To see the generality of this result, note that the above arguments also carry through when intrinsic motivation is a smooth function of CSR, $f(v_i)$, in which case the term $\frac{\partial f(v_i)}{\partial v_i}$ is added to the left-hand side of first-order conditions (6) to (9).

Proposition C2. *The differences between the CSR levels of the different competitive regimes are increasing in the level of intrinsic motivation, as formalized in the next proposition. Formally:* $\frac{\partial (v_I^p - v_I^*)}{\partial \theta} > 0$, $\frac{\partial (v_I^* - v_I^f)}{\partial \theta} > 0$, *and* $\frac{\partial (v_I^f - v_I^{csr})}{\partial \theta} > 0$.

Proof. The difference $v_I^p - v_I^*$ is constructed from equations (40) and (38). Taking the derivative with respect to θ gives

$$\frac{\partial (v_I^p - v_I^*)}{\partial \theta} = \frac{\gamma^2 (n-1)(4n + 2\gamma(n-1)(n-2) - \gamma^2(n-1)(n-3))}{(4t(\gamma-1)(\beta_1-1) + \beta_3)(t(\gamma-2)\beta_1^2 + 2\beta_2)} > 0.$$

The difference $v_I^* - v_I^f$ is constructed from equations (38) and (41). Taking the derivative with respect to θ gives

$$\frac{\partial (v_I^* - v_I^f)}{\partial \theta} = \frac{\gamma(1-n)(\gamma(2+\gamma)(n-1) + 4)}{(2t(\beta_1-1) - 1)(t(\gamma-2)\beta_1^2 + 2\beta_2)} > 0.$$

The difference $v_I^f - v_I^{csr}$ is constructed from equations (41) and (39). Taking the derivative with respect to θ gives

$$\frac{\partial (v_I^f - v_I^{csr})}{\partial \theta} = \frac{\gamma^2 (n-1)^2}{(2t(\beta_1-1) - 1)(t\beta_1^2 - 2)} > 0. \blacksquare$$

The stronger the direct motivation for CSR, the higher the CSR levels selected non-cooperatively compared to CSR levels selected in coordination. The mechanisms underlying this result are those discussed in the previous paragraph. Therefore, allowing joint CSR agreements is an increasingly ineffective way of inducing CSR efforts when companies' intrinsic motivation becomes a more important driver of CSR efforts. This is true for all finite θ – for some sufficiently high value of which, of course, immediate profit become negative. At best, do all regimes converge on the same infinite CSR efforts – and infinite immediate

losses – in the limit of θ going to infinity so that for-profit motivation is no longer part of a company's objective – for any positive willingness to pay. The conclusion that joint CSR agreements are also not better than the competitive benchmark when corporations are directly motivated to invest in CSR efforts extends to cases where consumers have no willingness to pay for CSR, so that v_i does not enter demand. CSR efforts are then determined solely by intrinsic motivation so the competitive regime is irrelevant.

D Price setting

In this appendix, we verify that our results on CSR levels carry through when firms set prices in Stage 2 instead of quantities. An agreement in Stage 2 only, now titled a "price agreement", remains the sole agreement that increases CSR levels compared to the non-cooperative benchmark. However, none of the agreements can increase consumer surplus.

We start by deriving the profit function of the price setting game. Summing over all firms, demand (2) is

$$\sum_{i=1}^{n} p_i = \sum_{i=1}^{n}(\alpha + v_i) - (\beta_1 - 1)\sum_{i=1}^{n} q_i. \tag{42}$$

Noting that $\sum_{i \neq j}^{n} q_j = \sum_{k=1}^{n} q_k - q_i$, and substituting for $\sum_{i \neq j}^{n} q_j$ into equation (2), the quantity of each firm i can be written as

$$q_i(\mathbf{p}, \mathbf{v}) = \frac{(\beta_2 - 1)(\alpha + v_i - p_i) - \gamma \sum_{i \neq j}^{n}(\alpha + v_j - p_j)}{(1 - \gamma)(\beta_1 - 1)}, \tag{43}$$

where $\mathbf{p} = p_1, p_2, \ldots, p_n$. The profit of each firm i is given by

$$\pi_i(\mathbf{p}, \mathbf{v}) = (p_i - c)\left(\frac{(\beta_2 - 1)(\alpha + v_i - p_i) - \gamma \sum_{i \neq j}^{n}(\alpha + v_j - p_j)}{(1 - \gamma)(\beta_1 - 1)}\right) - \frac{tv_i^2}{2}. \tag{44}$$

Equation (44) makes clear that each firm's profit is directly affected by the CSR levels of all other firms, in contrast to the quantity setting game where profit (3) depends only on the other firms' CSR levels indirectly through the conditional quantities that solve Stage 2 of the game. Firms play a two-stage game. In Stage 1 each firm selects its CSR level v_i. In Stage 2, given CSR levels $\mathbf{v}$, each firm selects its price p_i.

Comparing CSR levels – denoting the price setting game with subscript B – across the four competitive regimes gives the following result.

Proposition D1. *CSR agreements and full agreements decrease CSR levels, compared to the competitive benchmark. CSR agreements deliver the least CSR of all regimes. Only production agreements increase CSR levels. Formally:* $v_B^p > v_B^* > v_B^f > v_B^{csr}$.

Proof. In Stage 2, firms in the non-cooperative benchmark or a CSR agreement maximize (44) with respect to p_i, resulting in Nash-equilibrium conditional price of firm i

$$p_i^*(\mathbf{v}) = \frac{(\beta_3(\beta_2 - 1) + \gamma(1 - \gamma))(\alpha + v_i) - \gamma(\beta_2 - 1)\sum_{i \neq j}^n(\alpha + v_j) + (\gamma(2n - 3) + 2)(\beta_2 - 1)c}{(\gamma(2n - 3) + 2)\beta_3},$$

(45)

while firms in a price agreement or a full agreement choose prices to maximize the sum of members' profit, conditional on $\mathbf{v}$, resulting in conditional price

$$p_i^c(v_i) = \frac{\alpha + v_i + k}{2}, \quad i = 1, ..., n.$$

(46)

Let $\mathbf{p}^*(\mathbf{v}) = p_1^*(\mathbf{v}), p_2^*(\mathbf{v}), \ldots, p_n^*(\mathbf{v})$. In Stage 1, firms in the non-cooperative benchmark pick v_i to maximize $\pi_i(\mathbf{p}^*(\mathbf{v}), \mathbf{v})$, resulting in Nash-equilibrium CSR level

$$v_B^* = A\frac{2(\gamma(n - 2) + 1)(\gamma^2 n^2 - 5\gamma^2 n + 5\gamma^2 + 3\gamma n - 6\gamma + 2)}{t(\gamma(2n - 3) + 2)(\beta_1 - 1)\beta_3^2 - 2(\gamma(n - 2) + 1)(\gamma^2 n^2 - 5\gamma^2 n + 5\gamma^2 + 3\gamma n - 6\gamma + 2)}.$$

(47)

Firms in a CSR agreement select $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{p}^*(\mathbf{v}), \mathbf{v})$ in Stage 1, resulting in CSR level

$$v_B^{csr} = A\frac{2(1 - \gamma)(\beta_2 - 1)}{t(\beta_1 - 1)\beta_3^2 - 2(1 - \gamma)(\beta_2 - 1)}.$$

(48)

Let $\mathbf{p}^c(\mathbf{v}) = p_1^c(v_1), p_2^c(v_2), \ldots, p_n^c(v_n)$. Members of a price agreement determine v_i by maximizing $\pi_i(\mathbf{p}^c(\mathbf{v}), \mathbf{v})$, so that the CSR level is

$$v_B^p = A\frac{\beta_3}{4t(1 - \gamma)(\beta_1 - 1) - \beta_3}.$$

(49)

A full agreement chooses $\mathbf{v}$ to maximize $\sum_{i=1}^n \pi_i(\mathbf{p}^c(\mathbf{v}), \mathbf{v})$ in Stage 1. The resulting CSR level is

$$v_B^f = A\frac{1}{2t(\beta_1 - 1) - 1}.$$

(50)

Note that conditional prices (45) and (46) are symmetric by implication. To ensure that all second-order conditions hold, and restricting our attention to interior solutions, in all proofs in this appendix we impose $8t(1 - \gamma)^2(\beta_1 - 1) - \beta_3^2 > 0$. The ranking follows from

$$v_B^p - v_B^* = A\frac{t\gamma^2(1 - n)(\beta_1 - 1)(\gamma^2(n(n - 2)(2n - 7) - 1) + 2\gamma n(3n - 7) + 4n)}{(4t(\gamma - 1)(\beta_1 - 1) + \beta_3)(t(\gamma(2n - 3) + 2)(\beta_1 - 1)\beta_3^2 - 2(\beta_2 - 1)(\gamma(n(\gamma(n - 5) + 3) + 5\gamma - 6) + 2))} > 0,$$

$$v_B^* - v_B^f = A\frac{t\gamma(n - 1)(\beta_1 - 1)(\gamma(n(\gamma(2n - 11) + 6) + 13\gamma - 14) + 4)}{(2t(\beta_1 - 1) - 1)(t(\gamma(2n - 3) + 2)(\beta_1 - 1)\beta_3^2 - 2(\beta_2 - 1)(\gamma(n(\gamma(n - 5) + 3) + 5\gamma - 6) + 2))} > 0, \text{ and}$$

$$v_B^f - v_B^{csr} = A\frac{t\gamma^2(n - 1)^2(\beta_1 - 1)}{(2t(\beta_1 - 1) - 1)(t(\beta_1 - 1)\beta_3^2 + 2(\gamma - 1)(\beta_2 - 1))} > 0.$$

■

Proposition D1 verifies that the ranking of CSR levels across competitive agreements is independent of whether firms select prices or quantities in Stage 2. As with Proposition 1, the business stealing effect is the driving force behind Proposition D1.

As a CSR agreement does not adjust conditional prices, and by Proposition D1 reduces CSR levels compared to the benchmark, consumer welfare always decreases with a CSR agreement. Comparing conditional prices (45) and (46) shows that a full agreement increases conditional prices compared to the benchmark. By Proposition D1, a full agreement reduces CSR levels so that consumer welfare is reduced on two accounts compared to the benchmark. As a result, the ranking of consumer welfare obtained in the main text is also valid when firms set prices instead of quantities.

Proposition D2.1. *Joint agreements that fail to increase CSR efforts always harm consumers compared to the non-cooperative benchmark, more so if firms are allowed to coordinate their output. Formally:* $CS(q_B^*) > CS(q_B^{csr}) > CS(q_B^f)$.

Proof. In competitive regime r, consumer surplus (12) can be written as $CS(q^r) = \frac{n}{2}(\gamma(n-1)+1)(q^r)^2$ as both quantities and CSR levels are symmetric. Therefore, the ranking of consumer surpluses is equivalent to that of quantities. The ranking follows from

$$q_B^* - q_B^{csr} = A\frac{2t\gamma(n-1)(\beta_2-1)^2\beta_3}{(t(\beta_1-1)\beta_3^2 + 2(\gamma-1)(\beta_2-1))(t(\gamma(2n-3)+2)(\beta_1-1)\beta_3^2 - 2(\beta_2-1)(\gamma(n(\gamma(n-5)+3)+5\gamma-6)+2))} > 0,$$

and

$$q_B^{csr} - q_B^f = A\frac{t\gamma(n-1)(t(\beta_1-1)\beta_3 - \gamma(n-2)-1)}{(t(\beta_1-1)\beta_3^2 + 2(\gamma-1)(\beta_2-1))(2t(\beta_1-1)-1)} > 0.$$

∎

Compared to the non-cooperative benchmark, a price agreement increases conditional prices in Stage 2 and increases CSR levels in Stage 1. Which of these two forces dominates is *a priori* unclear, and Proposition 8 shows that a production agreement in a duopoly can increase consumer welfare if firms set quantities in Stage 2, investing is very cheap, and goods are sufficiently similar. This result does not generalize to price competition in Stage 2, where a price agreement will always decrease consumer welfare compared to the benchmark.

Proposition D2.2. *Price agreements harm consumers compared to the non-cooperative benchmark. Formally:* $CS(q_B^*) > CS(q_B^p)$.

Proof. The ranking follows from

$$q_B^* - q_B^p = A\frac{t\gamma(n-1)(2t(\gamma-1)(\gamma(2n-3)+2)(\beta_1-1)\beta_3 + (\beta_2-1)(n(\gamma(2n-9)+6)+7\gamma-10))}{(4t(\gamma-1)(\beta_1-1)+\beta_3)(t(\gamma(2n-3)+2)(\beta_1-1)\beta_3^2 - 2(\beta_2-1)(\gamma(n(\gamma(n-5)+3)+5\gamma-6)+2))} > 0.$$

∎

The reason why a price agreement in which firms jointly select conditional prices can never benefit consumers is primarily that the non-cooperative benchmark produces more consumer surplus when firms select prices in Stage 2 than when firms select quantities in Stage 2. Since prices are strategic complements and quantities are strategic substitutes, price setting generates a more competitive benchmark outcome with more output than quantity setting.

E Partial agreements with fringe competition

In this appendix, we show that the results from our baseline model extend to partial agreements that consist of m out of the n firms, with the remaining $n - m$ firms forming a competitive fringe ($m < n$). No profitable agreement exists that simultaneously increases consumer welfare and CSR compared to the benchmark.

Without loss of generality, let $i = 1, ..., m$ be the firms participating in the agreement, so $i = m+1, ..., n$ are the firms remaining in competition. We refer to members of the agreement as insiders and firms in the competitive fringe as outsiders. Firms play the two-stage game described in the main text, serving demand (2) at marginal production costs c and CSR investment costs $\frac{tv_i^2}{2}$. Let v_P^r denote the CSR level of a member of a partial agreement in competitive regime $r \in \{csr, p, f\}$. CSR levels of insiders and firms in the non-cooperative benchmark compare as follows – denoting insiders' outcomes by subscript P.[34]

Result E1. *Firms in a partial CSR agreement of a partial full agreement decrease CSR efforts, compared to the competitive benchmark. Only firms in a partial production agreement increase CSR efforts. Formally: $v_P^p > v^* > \{v_P^f, v_P^{csr}\}$.*

Result E1 states that a partial production agreement is the only partial agreement that increases CSR levels compared to the non-cooperative benchmark.[35] The first-order condition for firm i, who is an insider in a partial CSR agreement, is

$$\sum_{i \neq j}^{n} \frac{\partial \pi_i}{\partial q_j} \frac{\partial q_j^*}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} + \sum_{i \neq j}^{m} \left(\sum_{i \neq j \neq k}^{n} \frac{\partial \pi_j}{\partial q_k} \frac{\partial q_k^*}{\partial v_i} + \frac{\partial \pi_j}{\partial q_i} \frac{\partial q_i^*}{\partial v_i} \right) = 0. \tag{51}$$

Comparing (51) to (7) shows that each insider in a partial CSR agreement only considers the negative externality of its CSR level on $m - 1$, instead of $n - 1$, other firms' profit. As m goes to zero, the non-cooperative outcome is approached. As m goes to n, CSR levels converge to those of a market-wide CSR agreement. Therefore, CSR levels are always lower in a partial CSR agreement than in the non-cooperative benchmark, and the extent to which they differ is increasing in the size of the agreement: $v^* > v_P^{csr} > v^{csr}$.

---

[34]CSR levels for the general m-of-n setup are very lengthy and therefore omitted here. Comparing outcomes across different competitive regimes for all n and m is computationally infeasible. In this section we therefore report results for $3 \leq n \leq 10$ and all $2 \leq m \leq n - 1$. Note that these are not simulations: for each n-m combination, results hold for all parameter values of A, γ, and t. As the expressions of quantities and CSR levels are too elaborate to present, we label our comparisons "Results" instead of "Propositions", and omit the proofs. CSR levels that solve the general game and Mathematica syntax for all the results in this section are available upon request. See Treuren and Schinkel (2018) for a more elaborate discussion of partial agreements, including quantities and CSR levels of outsiders and results for $n > 10$. Allowing for $n > 10$, as in Treuren and Schinkel (2018), does not affect the results presented in this appendix.

[35]The curly brackets in Result E1 indicate that the ordering of v_P^f and v_P^{csr} can vary. See Treuren and Schinkel (2018) for a detailed discussion.

Denote the Nash-equilibrium conditional quantities set by insiders in a partial production agreement or a partial full agreement by $q^{in}(\mathbf{v})$, and the conditional quantities set by outsiders by $q^{out}(\mathbf{v})$.[36] The first-order condition for a firm i, who is an insider in a partial production agreement, is

$$\sum_{i \neq j}^{m} \frac{\partial \pi_i}{\partial q_j} \frac{\partial q_j^{in}}{\partial v_i} + \sum_{k=m+1}^{n} \frac{\partial \pi_i}{\partial q_k} \frac{\partial q_k^{out}}{\partial v_i} + \frac{\partial \pi_i}{\partial v_i} + \frac{\partial \pi_i}{\partial q_i} \frac{\partial q_i^{in}}{\partial v_i} = 0. \tag{52}$$

Comparing equation (52) to equation (8) shows that the only difference between the first-order conditions of a partial and market-wide production agreement is that the conditional quantities in a partial production agreement differ from those in a market-wide production agreement. Because $|\frac{\partial q_i^{in}}{\partial v_i}|$, $|\frac{\partial q_j^{in}}{\partial v_i}|$, $|\frac{\partial q_j^{out}}{\partial v_i}|$ are lowest when m is small, incentives to invest for insiders in a partial production agreement increase with the size of the agreement. When $m = n$, $q^{in}(\mathbf{v}) = q^c(\mathbf{v})$, and equation (52) reduces to equation (8). For all n and m, insiders increase their CSR levels compared to the non-cooperative benchmark because $\frac{\partial \pi_i}{\partial q_i} > 0$: $v^p > v_P^p > v^*$.

The first-order condition for firm i, who is an insider in a partial full agreement, is

$$\frac{\partial \pi_i}{\partial v_i} + \sum_{j=1}^{m} \sum_{k=m+1}^{n} \frac{\partial \pi_j}{\partial q_k} \frac{\partial q_k^{out}}{\partial v_i} = 0. \tag{53}$$

Comparing (53) to (9) shows that an insider in a partial full agreement has an additional incentive to invest in CSR compared to a market-wide full agreement. For each insider i and outsider j we have $\frac{\partial \pi_i}{\partial q_j} < 0$ and $\frac{\partial q_j^{out}}{\partial v_i} < 0$, which shows that investing in CSR increases profit for all insiders by reducing the quantity of outsiders. This effect is larger the smaller is m. As m increases from 0 to n incentives to invest in CSR decrease as the first-order condition for an insider converges from the non-cooperative first-order condition (6) to the market-wide full agreement first-order condition (9): $v^* > v_P^{fc} > v^p$.[37]

Consumer surplus is a function of the quantities of all insiders and outsiders in a partial agreement, as shown by equation (12). As we are interested in the behavior of insiders, and as in consumer surplus is a function of quantities only, we focus on the quantities of insiders as a measure of the agreement's contribution to consumer surplus. Denote by q_P^r the quantity of an insider in competitive regime $r \in \{csr, p, f\}$. Comparing quantities across the benchmark, a CSR agreement, and a full agreement, we obtain the following result.

Result E2.1. *Insiders in partial agreements that fail to increase CSR efforts always reduce output compared to firms in the non-cooperative benchmark, more so if insiders are allowed*

---

[36] $q_i = q^{in}(\mathbf{v})$ and $q_i = q^{out}(\mathbf{v})$ solve $max_{q_i} \sum_{k=1}^{m} \pi_k(\mathbf{q}, v_k)$ for $i = 1, \ldots, m$, and $max_{q_i} \pi_i(\mathbf{q}, v_i)$ for $i = m+1, \ldots, n$.

[37] If $|\sum_{i \neq j}^{n} \frac{\partial \pi_i}{\partial q_j} \frac{\partial q_j^*}{\partial v_i}| + \sum_{i \neq j}^{m} \sum_{i \neq j \neq l}^{n} |\frac{\partial \pi_j}{\partial q_l} \frac{\partial q_l^*}{\partial v_i}| - \sum_{i \neq j}^{m} |\frac{\partial \pi_j}{\partial q_i} \frac{\partial q_i^*}{\partial v_i}| > |\sum_{j=1}^{m} \sum_{k=m+1}^{n} \frac{\partial \pi_j}{\partial q_k} \frac{\partial q_k^{out}}{\partial v_i}|$ then $v_P^{csr} > v_P^f$. This happens when consumers view products as close substitutes (γ is close to 1).

to coordinate their output. Formally: $q^* > q_P^{csr} > q_P^f$.

Result E2.1 states that allowing insiders to coordinate their CSR levels decreases the quantity they produce compared to the non-cooperative benchmark, regardless of the size of the competitive fringe. A CSR agreement produces the non-cooperative quantity conditional on CSR levels in Stage 2. By Result E1 and the discussion following it, we know that a partial CSR agreement decreases CSR levels compared to the non-cooperative benchmark, and that CSR levels are reduced by more the more firms take part in the agreement. It follows that $q^* > q_P^{csr} > q^{csr}$.

Insiders in a partial full agreement reduce quantities both by reducing conditional quantities in Stage 2, and by reducing CSR levels in Stage 1. The first-order condition of an insider in Stage 2 of a partial full agreement or a partial production agreement is

$$\frac{\partial \pi_i}{\partial q_i} + \sum_{i \neq j}^m \frac{\partial \pi_j}{\partial q_i} = 0, \tag{54}$$

which shows that an insider's incentive to reduce its conditional quantity compared to the non-cooperative benchmark is increasing in agreement size m, as $\frac{\partial \pi_j}{\partial q_i} < 0$. For insiders in a partial full agreement, by Result E1 we know that the incentive to decrease CSR levels compared to the non-cooperative benchmark also increases in m. It follows that $q^* > q_P^f > q^f$.[38] Quantities of partial production agreement insiders and firms in the non-cooperative benchmark compare as follows.

Result E2.2. *Insiders in a partial production agreement reduce output compared to the non-cooperative benchmark, except when the agreement consists of two firms with no more than three outsiders and incentives to invest in CSR are high. Firms will not voluntarily form partial production agreements that benefit consumers, as when output is expanded firms are always worse off than in the benchmark. Formally: $q^* > q_P^p$ unless $m = 2$, $n \in \{3, 4, 5\}$, and $t < T_P(\gamma, n)$, in which case $\pi^* > \pi_P^{pc}$.[39]*

Recall that a production agreement increases CSR levels, but reduces conditional quantities, compared to the non-cooperative benchmark. In a market-wide production agreement, the reduction of conditional quantities is increasing in n, as the benchmark quantity is increasing in n. In a partial production agreement, the reduction of conditional quantities is still

---

[38] Let $\Delta v_P^{csr} = v_P^{csr} - v^*$, $\Delta v_P^f = v_P^f - v^*$, and $\Delta q^{in} = q^{in}(v^*) - q^*(v^*)$. As $|\frac{\partial q^{in}}{\partial v} \Delta v_P^f + \Delta q^{in}| > |\frac{\partial q^*}{\partial v} \Delta v_P^{csr}|$, we have $q_P^{csr} > q_P^f$.

[39] $T_P(\gamma, 3) = \frac{4+5\gamma-2\gamma^2-\gamma^3}{4(2+2\gamma-3\gamma^2-2\gamma^3+\gamma^4)} + \frac{1}{4}\sqrt{\frac{-2\gamma^2-15\gamma^3-16\gamma^4+2\gamma^5-6\gamma^6+\gamma^7}{(\gamma-2)(\gamma^2-1)^2(\gamma^2-2\gamma-2)^2}}$, $T_P(\gamma, 4) = \frac{-32-64\gamma+16\gamma^2+30\gamma^3-7\gamma^4-3\gamma^5}{4(4+4\gamma-5\gamma^2+\gamma^3)(-4-4\gamma+5\gamma^2+3\gamma^3)} + \frac{1}{4}\sqrt{\frac{256\gamma^2+1536\gamma^3+2112\gamma^4-416\gamma^5-444\gamma^6+588\gamma^7+61\gamma^8-102\gamma^9+9\gamma^{10}}{(4+4\gamma-5\gamma^2+\gamma^3)^2(-4-4\gamma+5\gamma^2+3\gamma^3)^2}}$, and $T_P(\gamma, 5) = \frac{-8-26\gamma-9\gamma^2+16\gamma^3+\gamma^4-4\gamma^5}{4(4+6\gamma-6\gamma^2+\gamma^3)(-1-2\gamma+\gamma^2+2\gamma^3)} + \frac{1}{4}\sqrt{\frac{36\gamma+252\gamma^3+505\gamma^4+132\gamma^5-234\gamma^6+136\gamma^7+129\gamma^8-72\gamma^9+16\gamma^{10}}{(4+6\gamma-6\gamma^2+\gamma^3)^2(-1-2\gamma+\gamma^2+2\gamma^3)^2}}$.

increasing in n, but equation (54) shows that the reduction of conditional quantities is also increasing in m, such that the reduction of conditional quantities is smallest if both m and n are small. In that case, insiders can increase quantities compared to the non-cooperative benchmark if investing is very cheap and products are very similar. Just as in the market-wide agreement case, these parameters result in the firms engaging in a CSR arms race that leaves firms worse off compared to the non-cooperative benchmark.[40]

F   Alternative consumer preferences

In this appendix, we show that our consumer welfare results are robust to altering the preference structure to allow for a direct effect of CSR on consumer welfare. When firms jointly select CSR levels, our consumer welfare results are valid as long as consumer welfare depends positively on both output and CSR levels. This is because both a CSR agreement and a full agreement decrease output and CSR efforts compared to the non-cooperative benchmark. A production agreement always increases CSR levels compared to the non-cooperative benchmark and decreases conditional quantities. Therefore, the net effect of these two opposing forces on consumer surplus depends on the demand structure and underlying preferences that are assumed.

In our baseline quasi-linear quadratic utility model, CSR levels only indirectly influence consumer welfare through the effect of CSR levels on quantities. To shed light on the robustness of our consumer welfare comparison between output market coordination and the non-cooperative benchmark, we revisit this comparison for the demand model in Salop (1979). In this model, consumer welfare is directly and positively influenced by CSR levels.

Assume that all firms, and a unit mass of consumers, are equidistantly located on a circle with circumference $L > 0$. Firms play a two-stage game. In Stage 1, firm i sets CSR level v_i at cost $\frac{tv_i^2}{2}$. In Stage 2, each firm i selects price p_i. The consumer located at x buys one unit of the good from the firm i that maximizes her indirect utility given in equation (15).[41]

The location of the consumer indifferent between consuming firm i's product, or the product of its neighboring firm j, is

$$\hat{x}_{ij} = \frac{(v_i - v_j) - (p_i - p_j)}{2\tau} + \frac{L}{6}. \tag{55}$$

The profit of each firm i then depends on the prices and CSR levels of its two neighbors j and k

$$\pi_i = (p_i - c)(\hat{x}_{ij} + \hat{x}_{ik}) - \frac{tv_i^2}{2}. \tag{56}$$

---

[40]It is noteworthy that for $n > 3$ total quantity will always decrease as outsiders actually reduce quantity in Nash-equilibrium compared to the non-cooperative benchmark. See Treuren and Schinkel (2018) for details.

[41]The standard assumption that each consumer buys one unit implies that α_S must be sufficiently large such that utility (15) is positive for all consumers.

We analyze the case of three firms for tractability reasons. In Stage 2 of the non-cooperative benchmark each firm i selects p_i to maximize profit (56), resulting in conditional price $p_i^*(v_i, v_j, v_k)$. In Stage 1 of the non-cooperative benchmark each firm i selects v_i to maximize $\pi_i(p_i^*(v_i, v_j, v_k), p_j^*(v_i, v_j, v_k), p_k^*(v_i, v_j, v_k), v_i, v_j, v_k)$. Denote the resulting price and CSR level as p_S^* and v_S^*, respectively. Focus on a partial price agreement where two firms, without loss of generality firm 1 and firm 2, form a price agreement, and firm 3 does not participate in the agreement. In Stage 2 of a price agreement, firms 1 and 2 select p_1 and p_2 to maximize $\pi_1 + \pi_2$, while firm 3 selects p_3 to maximize π_3, resulting in conditional prices $p_1^c(v_1, v_2, v_3)$, $p_2^c(v_1, v_2, v_3)$, and $p_3^{**}(v_1, v_2, v_3)$. In Stage 1 of a price agreement, each firm i selects v_i to maximize $\pi_i(p_1^c(v_1, v_2, v_3), p_2^c(v_1, v_2, v_3), p_3^{**}(v_1, v_2, v_3), v_1, v_2, v_3)$.

Denote the resulting price and CSR level of the two firms in the agreement as p_S^p and v_S^p, respectively. CSR levels of insiders and firms in the non-cooperative benchmark compare as follows (denoted by subscript S).

Proposition F1. *Allowing coordination in the output market, but not in CSR investments, increases CSR of insiders compared to the non-cooperative benchmark. Formally: $v_S^p > v_S^*$.*

Proof. The Nash-equilibrium conditional price of firm i in the non-cooperative benchmark is

$$p_i^* = c + \frac{5L\tau + 6v_i - 3\sum_{i \neq j}^n v_j}{15}, \tag{57}$$

The conditional price of firm 1 in a price agreement is

$$p_1^c = c + \frac{(20L\tau + 15v_1 - 3v_2 - 12v_3)}{36}, \tag{58}$$

and the conditional price of firm 2 by symmetry results when subscripts 1 and 2 are exchanged in equation (58). The conditional price of firm 3, not participating in the agreement, is

$$p_3^{**} = c + \frac{(8L\tau + 6v_3 - 3\sum_{i \neq 3}^n v_i)}{18}. \tag{59}$$

The Nash-equilibrium CSR level in the non-cooperative benchmark is

$$v_S^* = \frac{4L}{15t}. \tag{60}$$

The CSR level of the price agreement insider is

$$v_S^p = \frac{2L(5t\tau - 2)}{3t(9t\tau - 4)}. \tag{61}$$

In all proofs in this appendix, we consider parameter values such that an interior solution is guaranteed and the second-order conditions are satisfied: α large enough so that all consumers buy, and $t\tau > \frac{1}{2}$. The ranking follows from

$$v_S^p - v_S^* = \frac{2L(7t\tau - 2)}{15t(9t\tau - 4)} > 0. \blacksquare$$

Proposition F1 is in line with the baseline model: price agreement insiders always increase CSR levels compared to the non-cooperative benchmark. By increasing conditional prices in the Stage 2, firms in a price agreement increase the incentive to invest as servicing an additional consumer is more profitable. Prices of insiders and firms in the non-cooperative benchmark compare as follows.

The following Lemma compares the net effect on utility of price and CSR in a price agreement and the non-cooperative benchmark, and builds towards a consumer welfare comparison.

Lemma F1. $v_S^* - p_S^* > v_S^p - p_S^p$ unless $\tau < \frac{1}{15}(6 + \sqrt{6})$ and $t < \frac{1}{5}\sqrt{\frac{2}{3\tau^2} + \frac{2}{5\tau}}$.

Proof. We start by establishing that $p_S^p > p_S^*$. Substituting v_S^* into equation (57) gives

$$p_S^* = k + \frac{L\tau}{3}. \tag{62}$$

Substituting v_S^p and the CSR level of firm 3 in a price agreement into equation (58) gives

$$p_S^p = k + \frac{L\tau(5t\tau - 2)}{9t\tau - 4}. \tag{63}$$

The ranking follows from

$$p_S^p - p_S^* = \frac{2L\tau(3t\tau - 1)}{3(9t\tau - 4)} > 0.$$

Constructing $(v_S^* - p_S^*) - (v_S^p - p_S^p)$ from equations (60) to (63) gives

$$(v_S^* - p_S^*) - (v_S^p - p_S^p) = \frac{2L(3t\tau(5t\tau - 4) + 2)}{15t(9t\tau - 4)},$$

which is greater than 0 unless $\tau < \frac{1}{15}(6 + \sqrt{6})$ and $t < \frac{1}{5}\sqrt{\frac{2}{3\tau^2} + \frac{2}{5\tau}}$. ∎

Lemma F1 states that the net utility due to CSR levels and prices offered by an insider in a price agreement is less than the net utility offered by a firm in the non-cooperative benchmark, unless products are very similar in the horizontal sense (τ is small) and investing is cheap (t is small). As in the baseline model, business stealing incentives are very large in this case, so that firms in a price agreement invest heavily in CSR. Lemma F1 investigates the situation for consumers who purchase from either firm 1 or 2 in both competitive regimes. Therefore, the next proposition compares total consumer surplus across the two competitive regimes.

Proposition F2. *A price agreements reduces consumer welfare compared to the non-cooperative benchmark, except when incentives to invest in CSR are high. Formally:* $CS_S^* > CS_S^p$, *unless* $\tau < \frac{8}{15}$ *and* $t < \frac{8}{15\tau}$.

Proof. Ignoring travel costs, each consumer in the non-cooperative benchmark has utility $\alpha - v_S^* - p_S^*$, while in a production agreement consumers of firm 1 or 2 have utility $\alpha + v_S^p - p_S^p$, and consumers of firm 3 have utility $\alpha + v_S^{**} - p_S^{**}$. In the non-cooperative benchmark, the indifferent consumers are located halfway between adjacent firms leading to the lowest possible total travel cost: $\frac{\tau L^2}{12}$. With a production agreement, the indifferent consumers between firm 3 and a firm in the agreement are located $\frac{L(3t\tau-1)}{3(9t\tau-4)}$ from the firms 1 and 2, while the indifferent consumer between firms 1 and 2 is located halfway between them, leading to total travel cost: $\frac{L^2\tau(3t\tau(87t\tau-80)+56)}{36(4-9t\tau)^2}$. Summing the difference in utility net of travel costs for all consumers across the two regimes, and adding the difference in total travel cost, gives the difference in consumer surplus

$$CS_S^p - CS_S^* = L^2 \frac{(8 - 15t\tau)(t\tau(87t\tau - 64) + 12)}{90r(4 - 9t\tau)^2},$$

which is positive if $\tau < \frac{8}{15}$ and $t < \frac{8}{15\tau}$, and negative otherwise. ∎

Proposition F2 shows that a price agreement leads to a reduction in consumer welfare in the vast majority of all cases. The results presented in Lemma F1 and Proposition F2 are in line with our results in the baseline model. Although a price agreement will always increase CSR levels compared to the non-cooperative benchmark, consumer welfare typically decreases, unless goods are very similar and investing is very cheap.

49