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Abstract

To stimulate companies to take corporate social responsibility collectively, for example for climate change or fair trade, their agreements may be exempted from cartel law. To qualify under Article 101(3) TFEU, the public benefits must compensate consumers for higher prices of the private good. We study the balancing involved in assessing a public interest-cartel in a public goods model that allows for antitrust damage avoidance and crowding out of individual contributions. The required compensatory public good level decreases in each consumer's willingness to pay, which is contrary to the Samuelson condition. A cartel will provide minimal public benefits for maximal private overcharges. Still it is typically not sustainable, since those consumers who are damaged most by the cartel price increase, by self-selection also have the lowest appreciation for the public good and therefore are the hardest to compensate. The information necessary to tell the rare genuine public interest-defense from cartel greenwashing allows the government itself to provide first-best.

JEL-codes: H41, K21, L40

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1 Introduction

There is growing appreciation for companies collectively taking corporate social responsibility (CSR) for public interests such as environmental protection, public health, culture or fair trade.[1] Restraints

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[1]See the reception of the initiative *Business Roundtable, Statement on the Purpose of a Corporation*, 19 August, 2019; and the GCLC-FTAO Brussels Conference on *Sustainability and Competition Policy: Bridging two Worlds to Enable a Fairer Economy* held 24 October 2019.

of trade among competitors may take away negative externalities or ease commons problems, just by reducing output.[2] The more sophisticated idea is to allow the built up of market power, by collusion, merger or monopolization, for the firms involved to make a compensatory public good contribution.[3] In US antitrust, such wider public policy arguments on welfare merits have little traction.[4] However, European competition authorities are revising their competition rules to encompass 'sustainability factors' as part of the transition to a climate neutral economy.[5] Most concrete is a policy to exempt a horizontal agreement with anticompetitive effects from the cartel law under Article 101(3) of the Treaty on the Functioning of the European Union (TFEU), if it actively promotes a public interest on balance more than it harms consumers through price overcharges.[6]

The Dutch Authority for Consumers and Markets (ACM) pioneered the assessment of such a 'public interest-cartel' in *National Energy Agreement for Sustainable Growth* (2013). As part of the contract, electricity companies in the Netherlands jointly agreed to close down five coal-fired power plants, reducing capacity high in the merit order by roughly 10%, 5 years ahead of government planning. The ACM predicted electricity prices to increase, costing the Dutch about Euro 75 million per year, and valued the projected reductions in emissions, of CO_2 and also SO_2, nitrogen oxide and fine particles insufficient compensation at Euro 30 million. Crucially, the authority argued that the claimed CO_2 reductions in the Netherlands would be offset by higher emissions elsewhere, because the emission allowances would remain in the EU Emissions Trading System, and still affect the Dutch. The electricity companies involved refused to contribute by taking sufficiently many carbon rights off the market.[7] Other cases concerned coordinated investments in non-excludable and non-rivalrous improvements also, in public health, culture and the well-being of children and farm animals.[8]

The public interest-cartel policy may improve upon situations in which government coordination fails to overcome the classic under-provision of public goods that results from free-riding, in bureau-

[2] Adler (2004), for examples, argues that antitrust interventions in the California sardine fishery led to over-fishing and environmental damage. Crane (2005) suggests that United States Tobacco's monopolization attempts of the snuff tobacco market increased welfare through health improvements and health-care costs savings from lower tobacco consumption.

[3] See Kingston (2011).

[4] See Werden (2014). The landmark case is *National Society of Professional Engineers v. United States* 435 U.S. 679 (1978), in which the Supreme Court rejected the argument that competition would produce inferior engineering work endangering public safety as a justification for suppression of price competition in violation of Section 1 of the Sherman Act. It concluded that even if competition would conflict with professional standards, that would be a matter of regulation, and "... not a reason, cognizable under the Sherman Act, for doing away with competition."

[5] See Competition Policy International, *EU: MEPs demands fundamental overhaul of competition policy*, February 4, 2019; *Competition and Consumer Day*, 25-26 September 2019 in Helsinki, panel on "Sustainability and EU competition law"; and Council of the European Union, *External Dimension of European Competitiveness*, 19 November 2019, Brussels. The Netherlands Competition Authority (ACM) has been a forerunner with its 2014 *Vision Document on Competition & Sustainability*.

[6] Conceptually, the idea is akin to the efficiency-defense in horizontal mergers, which in essence requires merger-specific marginal cost reductions that off-set the unilateral effects of the merger, so that consumer prices do not increase. See Goppelsroeder *et al.* (2008).

[7] ACM, *Analysis of the planned agreement on closing down coal power plants from the 1980s as part of the Social and Economic Council of the Netherland's SER Energy Agreement*, 2013 (in English). The approval of the ACM, that was open to valuing the CO_2 reduction higher than the prevailing market price per tonne, hinged on this point.

[8] See Section 2 for detailed references.

cracy, lack of jurisdiction or political will. Industry often also knows best how to make their own production processes more sustainable: which air pollution control system to install, cradle-to-cradle designs or humane farm animal care to adopt. It has experience gauging the latent willingness of their customers to pay for more responsibly produced goods, such as green energy or fair trade products. Private companies can therefore be innovative and the more efficient producers of certain public interests.[9]

However, admitting coordination between competitors also raises some immediate concerns.[10] Horizontal agreements, also well-intended ones, are known to carry direct and indirect risks of collusion, including higher prices and lower quality of products and less variety. For instance, Duso *et al.* (2013) establishes empirically that networks between competitors participating in R&D joint ventures are conducive to collusion. Social objectives such as sustainability are sufficiently soft to invite overly rosy contribution claims that are hard to verify. While corporations may want to be seen taking social responsibility, the actual effects thereof need not exceed what suffices for self-promotion.[11] Collectively they may abuse the exemption to get away with objectionable collusion under the guise of green. Just the availability of a 'green cartel'-exemption then undermines deterrence.

Moreover, some well-known cartels in fact aimed to reduce sustainability. One of the first big international cartels, the 1920s *Phoebus* cartel of lightbulb producers, including General Electric, Osram and Philips, was formed to shorten the product lifespan below what was technically possible to profit from planned obsolescence.[12] In the European Trucks cartel, manufacturers coordinated, apart from prices, on delayed introductions of new lower-emissions technologies.[13] Suspicion of similar collusion by German auto manufacturers are under investigation.[14] Instead CSR is often promoted by more rather than less competition. Porter & Kramer (2006) prescribe CSR as a competitive advantage. Fernandez-Kranz & Santalo (2010) find that firms in more competitive U.S. industries invest more in CSR activities. Flammer (2015) reports an increase in CSR activities with increased competition following import tariff reductions.

In this paper, we ask whether the public interest-cartel policy is a viable means to combat public

[9]See Shleifer (1998). Coase (1974) famously claimed that lighthouses, which Paul Samuelson had made a textbook example of services that could only be provided by government, were in fact in late 19th century Britain efficiently built and operated by private individuals that were granted the right by the government to levy tolls on passing ships calling at British ports. Coase's lighthouse case has been criticized as a pure example of efficient private production of a public good because of the government backing. A cartel exemption would be like that. However, as Bertrand (2006) documents, the statutory authority at the time, Trinity House, also imposed strict quality requirements for the building, maintenance and operation of lighthouses, while excludability from port services enforced the levying of the tolls. Also, several privately owned lighthouses needed to be taken over by Trinity House when their service was neglected.

[10]We note that legally a horizontal agreement with anticompetitive effects in the meaning of Article 101(1) TFEU that is exempted under paragraph 3 is not a cartel. To be brief, we nevertheless refer to one in this paper to as a 'cartel', 'cartel agreement' or 'collusion'.

[11]See Laufer (2003), Delmas & Montes-Sancho (2010), or the response by Joseph Stiglitz to the *Business Roundtable* initiative referenced in footnote 1 in *The Guardian* of 29 August 2019.

[12]See Krajewski (2014).

[13]European Commission, *Case AT.39824 - Trucks*, 19 July 2016.

[14]European Commission, "Antitrust: Commission opens formal investigation into possible collusion between BMW, Daimler and the VW group on clean emission technology," September 18, 2018.

good underprovision. The policy can be thought of as government mandating an industry to impose a coordinated tax on the private consumption good(s) it produces, provided that the consumers of that private good are compensated with a sufficiently large public good contribution - such as a carbon off-set. A profit-maximizing cartel contributes the required minimum to the public good - which under EU case law is to keep the consumers of the private good cartellized indifferent on average - against the most profitable price increase. The higher the price mark-up, the more compensation is required. We consider whether enough revenue can be generated this way to provide the compensatory public good - which did not seem to be the case in the *National Energy Agreement*.

The policy is studied in a model of public goods provision with private contributions based on Bernheim (1986) and Bergstrom *et al.* (1986). Heterogeneous individuals optimally spend their endowment on a private good, a composite commodity representing the rest of the economy remaining in competition, and a public good. This setup is in line with the leading cases, that featured public goods to which individuals also can contribute themselves - for example by installing solar panels or choosing child labor free products. We simplify the analysis by ignoring possible ties between the private and the public good. While the industry contributions in some cases can be viewed also as product improvements - such as green electricity or fair trade chocolate - the main gains - lower emissions, proper wages - are enjoyable by all and separate from the private good consumption. The knowledge that the public interest standard has been raised - so that the planet, children and animals are better off - provides utility to all who care.[15] The competition authority is assumed to be able to monitor and enforce the compensation requirement perfectly.

We find that the required compensatory public good level decreases in consumers' willingness to pay for the public good, which is contrary to the Samuelson condition. Still a cartel can often not afford the required compensation for any price increase. Consumers substitute away from the cartellized good, which reduces their harm but also undermines fund-raising for the public good. In addition, individual contributions to the public good are crowded out by the cartel's - which apart from standard rational neutralization can reflect moral self-licensing.[16] Together these responses reduce feasibility. The policy paradox is that it targets exactly the wrong people to pay the most for the public good, namely those consumers who buy larger quantities of the private good because they appreciate the public good relatively little, which makes them the hardest individuals to compensate, so that a public interest-cartel can often not afford to. Welfare can be increased if the cartel is sufficiently more efficient at producing the public good. Yet the information necessary to tell the rare genuine public interest-defense from cartel greenwashing allows the government itself to provide first-best.

The remainder of this paper is organized as follows. Section 2 details the policy. Section 3 reviews related literature. Section 4 models the trade-off involved in compensating consumers for price increases in the private good industry by firm-provided public goods and study the extent to which it can

[15] Schinkel & Spiegel (2017) study cartel incentives to promote more sustainable products that are valued by consumers as product improvements. Section 8 offers a brief discussion of possible combinations of private-public good contributions.

[16] See Mazar & Zhong (2010) and Lin & Chang (2012).

contribute to welfare. Sustainability of the policy depends on the specifics of consumer preferences. For constant elasticity of substitution utility functions, Section 5 sets out the limiting conditions under which a public-interest cartel can be profitable. Section 6 considers the policy when the cartel is more efficient in producing the public good. In Section 7 alternative welfare measures are discussed. Section 8 discusses several extensions. Section 9 concludes. Derivations are provided in an appendix.

2 The Public Interest-Cartel Policy

The legal basis for the public interest-cartel policy is in paragraph 3 of Article 101 of the Treaty on the Functioning of the European Union (TFEU), of which most Member States have an equivalent in their national competition law provisions. It stipulates that the prohibition of all agreements between firms which have as their object or effect the prevention, restriction or distortion of competition within the internal market, may be declared inapplicable if such an agreement: "...contributes to improving the production or distribution of goods or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit." In essence, the policy stretches the efficiency gains here intended by the drafters of the Treaty to include the advance of wider public interest such as more sustainable production - offering a public interest-defense for cartel offenses. Whether wider benefits than reduced monetary costs of production are at all admissible here is subject of discussion among legal scholars.[17] The current European Commission's *Horizontal Guidelines* hardly discusses them, but are under revision also on this point.[18]

In the singular case *CECED* (1999), the European Commission allowed producers of washing machines to coordinate the discontinuation of their cheapest product lines, on the conclusion that it saved consumers sufficient electricity and water use in compensation. While the Commission noted environmental benefits also, in the form of avoided emissions of carbon dioxide, sulfur dioxide and nitrous oxide, which it valued at more than seven times the increased purchase costs of more energy-efficient washing machines, these were appreciated as a side-effect.[19]

A few Member States have since assessed anticompetitive agreements on possible public interest benefits. The French agency deemed the wider diffusion of cinematographic works a general interest that justified coordination among distributors in *Cinema Code* (2009) - although not diversity in literary publishing in *Digital books* in that same year.[20] The Dutch ACM developed a consistent approach to incorporating sustainability benefits in cartel decisions from 2011, when North Sea shrimp fishermen fined for collusion to reduce their catches received public and political support for their claim on appeal that the extra profits had allowed them to invest in new shrimp fishing technology that was

[17] See Loozen (2019).

[18] European Commission, "Guidelines on the Application of Article 81(3) of the Treaty, 2004/C 101/08," *Official Journal of the European Union*, 2004a.

[19] Commission Decision, Case IV.F.1/36.718, *CECED*, 24 January 1999.

[20] See Brook (2019), page 145.

less damaging to the seabed - to which neither the authority, nor the courts had been receptive.[21]

After the competition authority found the *National Energy Agreement* to fall short on reducing CO_2 emissions, it was formally instructed by the Netherlands Ministry of Economics Affairs to weigh the wider whether "... in agreements that restrict competition made in order to promote sustainability, a fair share of the improvements benefits 'users' in the long run."[22] Yet also in *Chicken of Tomorrow* (2015), the ACM did not grant an exemption. In the initiative, poultry farmers, broiler meat processors and Dutch supermarkets responded jointly to a public outcry against the poor living conditions under which chicken were held in factory farms, that apart from cruelty to animals also raised public health concerns for virus mutation and resistance to antibiotics, with an agreement to improve. The ACM concluded from questionnaires that although consumers were willing to pay 0.82 euro/kilo for more sustainable chicken meat on average, with a 1.46 euro/kilo price rise they would not benefit from the initiative on balance.[23]

These assessments fit within the EU legal framework. Article 101(3) TFEU specifies four cumulative conditions to qualify for a cartel exemption as: (i) the benefits must be objective and clearly visible; (ii) consumers must receive a fair share of them; (iii) the restrictions must not be indispensable to obtain the benefits; and (iv) competition in the market in question should not be fully eliminated.[24] Conditions (i) and (iii) are practical to confirm, and were satisfied in the lead cases. With regards to (iv), *CECED* (1999) clarified that remaining competition can be on other dimensions than price, such as brand image and technical performance, as well as by parties outside of the agreement. Yet also a partial cartel typically drives up prices.[25]

The key condition to study therefore is (ii): consumer compensation. The Commission's *Horizontal Guidelines* explain it to mean that the benefits of the agreement are passed on, so that: "the net effect of the agreement must *at least be neutral* from the point of view of those consumers directly or indirectly affected by the agreement."[26] Under reference to the ruling of the Court of First Instance in *Shaw* (2002), the *Guidelines* state it is about: "the overall impact on *consumers of the products within the relevant market* and not the impact on individual members of this group of consumers."[27] Therefore

[21] See Steenbergen *et al.* (2017).

[22] Policy rule *Competition and Sustainability*, nr. WJZ / 14052830, 6 May 2014 (our translation: the original is only available in Dutch), in response to which the ACM published its 2014 *Vision Document*.

[23] See ACM, *Analysis of the sustainability arrangements concerning the 'Chicken of Tomorrow'*, 2015 (in English).

[24] See also ACM, *Vision Document on Competition & Sustainability*, 2014. These conditions are similar to the requirements for mounting an efficiency-defense in merger control in European Commission, "Guidelines on the Assessment of Horizontal Mergers Under the Council Regulation on the Control of Concentrations," *Official Journal of the European Union*, 2004b, Chapter VII.

[25] See Schinkel and Treuren (2020).

[26] European Commission (2014a), recital 85.

[27] European Commission (2014a), recital 87. In *Shaw*, the Court finds that in assessing compensation (in that case of a group of vertically tied lessees): "it is not material that the benefits produced by the notified agreements do not entirely compensate the price differential suffered by a particular tied lessee if *the average lessee* does enjoy that compensation and it is therefore such as to produce an effect on the market generally." Case T-131/99, *Shaw*, 21 March 2002, recital 163. In *Asnef-Equifax*, the Court of Justice confirmed that not each and every individual consumer in the relevant market would minimally have to be made indifferent. Case C-238/05, *Asnef-Equifax*, 23 November 2006, recitals 68-70.

welfare weights are to be applied, which necessitates cardinal interpersonal utility comparisons.

3 Related Literature

The subject introduces classic public economics into modern industrial organization. Samuelson (1954) determines that the efficient level of public good provision is where sum of the marginal rates of substitution of all individuals is equal to the economy's marginal rate of transformation between the public good and any private good. Society's demand curve for a public good is the aggregation of all individuals' willingness to pay for each level of that public good against the numéraire. Lindahl (1958) suggests individuals be taxed personalized prices, so as to contribute their marginal willingness to pay at the optimal level of the public good, times that level. Hanemann (1991) identifies the maximum willingness to pay for changes in the availability of a public good as a compensating variation.

Without coordination, public goods will be under-provided and Olson (1965) designates the provision of public goods in larger economies a government task. In practice, it is complex to implement optimal public goods production, as it requires private information about preferences that people would have an incentive not to reveal. Optimal taxation theory seeks to design tax-subsidy schemes for financing public goods that achieve efficiency without specific knowledge about the individual preferences, including by targeting revealed consumption patterns.[28] Even though incentive-compatible implementation schemes do exist, government policy can only be second-best.[29]

Our analysis builds on a literature that studies government provision of the public good in economies with voluntary private contributions. Pareto improvements can be obtained through commodity taxation in such economies, and efficiency in public good provision via lump-sum taxation. However, if consumers anticipate that the government will use the tax revenue to finance purchases of the public good, they adjust their own public good spendings. Bergstrom *et al.* (1986) show that for income redistributions smaller than the initial individual voluntary contributions to the public good, crowding out of government spending on the public good by lump sum taxation is full. Bernheim (1986) establishes a similar neutrality result for 'distortionary' taxation on labor income as well, provided consumption bundles do not change. The latter is obtained by government also setting labor incomes and spending all revenues only on the one of two public goods to which all consumers are contributors.

Andreoni & Bergstrom (1996) points out that local neutrality crucially depends also on the structure of the game. If government commits to no change in taxes and balances the budget by adjusting its contribution to the public good, consumers can keep their private consumption constant, no matter what the other consumers do, and so offset the policy. In different setups, government can unambiguously increase total contributions.[30] In our model, the cartel price rise has real effects and its

[28] See Boadway & Keen (1993) on the use of observables, including revealed preferences and self-selection, to determine who to tax what for which type of public good.

[29] See Diamond & Mirrlees (1971), Stiglitz & Dasgupta (1971), Atkinson & Stern (1974) and Walker (1981).

[30] See Boadway *et al.* (1989).

compensatory public good contribution is typically not fully crowded out. Also we do not impose a balanced budget, as not all cartel profits need to be contributed to the public good. Our model furthermore has only one public good and includes a third, composite commodity, so that consumers can substitute away from the cartellized product and mitigate the damage brought about by the cartel price increase.

Closest to our application, the public goods model with private contributions has been used to study the extent to which corporate social responsibility may contribute to public interests. Bagnoli & Watts (2003) shows that firm contributions to a public good when consumers are socially responsible vary across market structures. Besley & Ghatak (2007) finds that corporate social responsibility does not improve upon private voluntary contributions. Kotchen (2006) studies 'green markets', in which bundled private and public goods are offered, and also finds that company contributions to more sustainable production are often neutralized by reduced consumer donations, unless the economy is sufficiently large - which we find also to help public interest-cartels.

Schinkel & Spiegel (2017) study the public interest-cartel policy in a product quality model and show that allowing coordination on product standards reduces the incentives to invest in more sustainable products, despite consumers wanting to pay for them. Only if firms are allowed to appropriate the surplus do they produce more sustainable. This implies that if valued public interests are to be promoted through private collusion, coordination on price or volume should be exempted, not on the standard itself. In that case, however, the cartel must be forced to compensate consumers, which in turn reduces its members' incentives to invest and hence affordability of the policy.

4 Balancing the Public Interest-Defense in Cartel Offenses

Consider an economy with n individuals $i = 1, ..., n$, who each spend their income between consuming a private good x that is produced by an industry that is considered for a public interest-cartel exemption, a composite commodity y that represents all other consumption of goods supplied on markets that remain unchanged, and possible private contributions $g_i \geq 0$ to a public good G. Individual i's preferences are represented by utility function $U_i(x_i, y_i, G)$, which is twice continuously differentiable and increasing in each argument, with marginal utilities of consumption being positive and decreasing in each argument, so that all individuals consume a positive amount of all goods.[31] We assume a minimal degree of substitutability between the three goods in the economy and consider uniform prices, normalized as $(p_x, 1, p_g)$, in which p_g is the cost of contributing a unit of public good. It can vary between individuals, the government and the industry.

The production of x and y is standard, in that the firms pursue profits and in competition produce efficiently with the lowest cost technology. We assume that firms do not benefit intrinsically from

[31] $U_i(x_i, y_i, G)$ is assumed to satisfy the standard conditions: $lim_{z\to 0^+} \frac{\partial U_i}{\partial z_i} = \infty$ and $lim_{z\to\infty} \frac{\partial U_i}{\partial z_i} = 0$ for all $z \in \{G, x, y\}$.

contributing to G, for example through brand awareness or lower production costs. Also, the quality of x does not change with the industry's efforts. That is, buyers appreciate the private good for its main product characteristics - doing their laundry, powering household appliances and feeding them - and value any improvements in the sustainability of their production separately. This is a reasonable assumption in the case of electricity, fair trade products and washing machines, where the main quality of product is not affected when the pollutive, extortive and low-end versions are no longer produced - while the disappearance of their negative side-effects is indeed a public good. The assumption is restrictive, however, in some cases, for example if the taste of better-life meat products is better.

Setting aside changes in externalities from simple direct volume effects from collusive price increases, including possibly higher externalities resulting from substitution to y , the public interest is measured entirely by the total public good level G. It consists of an existing provision of the public good $g_N \geq 0$ and the contribution (in any) $g_F \geq 0$ by the sector producing x. That is,

$$G = \sum_{i=1}^{n} g_i + g_N + g_F. \tag{1}$$

By abstracting from government contributions to G paid out of taxation on (all) commodities or incomes, we avoid burdening the notation unnecessarily. The analysis can be thought of as additional private public good provision, after the government has set g_N. If the public good is clean air, the g_i's can be investments by individuals in the installation of soot filters on cars, for example, while g_F would be an industry-wide shift to low emissions technology of production. Both also can be a carbon offset purchase, or a contribution to a school in the region from which cacao beans are sourced. In the case of animal welfare, individual contributions can be thought of as a consumer choice for free-range chicken, and bio-industry jointly adopting higher livestock farming standards - and so discontinue a public bad at a cost.

Individual i decides on how to optimally allocate his wealth endowment w_i over private consumption and contributing to the public good as follows:

$$max_{g_i, x_i y_i} U_i(x_i, y_i, G),$$

$$s.t. \, p_x x_i + y_i + p_g g_i \leq w_i.$$

Note that despite the preference structure, the optimal individual contribution to the public good may well be negative, in particular when there is already a high initial provision of the public good by nature or others. If the air was pure and pollution-free, it would be unlikely that people invested into making it even cleaner. Similarly, low wealth endowments or a low preference for the public good can prevent individuals from spending their own resources on it. However, substantial individual diminutions of the public good are not natural to our concerns. While, for example, individual consumers

may, in the knowledge that others invest in clean air, relax their own emissions, such compensations are not typically more than off-setting. Therefore, we impose that $g_i \geq 0$. If unconstrained negative public good contributions were possible, the policy would potentially be fully neutralized by crowding out.[32]

The socially optimal total level of public good G^S satisfies the Samuelson condition, which relative to the privately produced good x is that

$$\sum_{i=1}^{n} \frac{\partial U_i(.)}{\partial G} / \frac{\partial U_i(.)}{\partial x_i} = \frac{p_g}{p_x}. \tag{2}$$

The condition reflects the non-rivalry of G. Given the private goods allocation, more of the public good should be provided as long as the overall benefit to all consumers from it, measured by their aggregate willingness to pay, are at least as great as the cost of providing the public good. For anyone trying, government or companies, to establish G^S requires information on the preferences of all. In the following, we assume that government fails to supplement the classic under-provision of the public good in competitive equilibrium, so that the total public goods level falls short of meeting G^S. We study whether collusive provision can improve upon that situation.

4.1 Competitive Equilibrium

In the competitive benchmark equilibrium, a large number of identical firms produce the private good x at zero economic profits and $g_F = 0$. Let individual i 's optimal purchase bundle be (x_i^*, y_i^*, g_i^*), and so $G^* = \sum_{i=1}^{n} g_i^* + g_N$. Note that while individuals are price takers, they do react to each others' behavior through the public good. When $g_i^* > 0$, individual i is a contributor. Otherwise, he is a non-contributor with $g_i^* = 0$. Someone is more likely to be a contributor if his wealth is sufficiently high, public good contributions from other sources are low, if he values the public good more compared to the other goods, or if the prices of the other goods are high.[33]

Assuming that all the goods are normal goods and that there is a single-valued demand function for the public good, everybody taking the contributions of others as given, there exists a competitive Nash equilibrium with a unique quantity of the public good and unique sets of contributors and non-contributors.[34] The structure of the utility functions assures that if $g_N = 0$ and there is no provision by

[32] See Bernheim (1986).

[33] See Bergstrom *et al.* (1986).

[34] The equilibrium existence and uniqueness proof is analogous to that in Bergstrom *et al.* (1986), with the only additional aspect being the composite commodity y_i, which does not affect the proof materially. Apart from the inequality constraint for private contributions to the public good, each consumer's optimization problem is a standard demand problem with income $w_i + G_{-i}$. Denoting $f_i(w)$ individual i 's demand function for the public good and assuming it is single-valued, individual i 's contribution becomes $g_i = max\{f_i(w_i + G_{-i}) - G_i, 0\}$, by the inequality constraint. This is a continuous function from a compact and convex set on itself, so that existence of a Nash equilibrium follows from Brouwer's Fixed Point Theorem. The proof of uniqueness is more complex and follows Bergstrom *et al.* (1986) verbatim, with an additional sufficient assumption that the marginal propensity to consume the public good is

firms either, at least some consumers will purchase the public good. In fact, if $G = 0$, every consumer has an incentive to contribute. For sufficiently high positive initial levels of g_N, no individual privately contributes.

Individual i's indirect utility is

$$V_i^*(p_x, p_g, W, g_N) = U_i \left(\frac{w_i - y_i^*(.) - p_g g_i^*(.)}{p_x}, y_i^*(.), g_i^*(.) + G_{-i}^*(.) + g_N \right),$$

in which W is a vector of the wealths of all consumers, which are all relevant through the determination of G^*- whether any consumer contributes to the public good and how much critically depends on his wealth.[35] His contribution then co-determines the contribution from other consumers.

4.2 Collusive Provision of the Public Good

The public-interest justification for exempting a cartel amounts to allowing the industry a cartel price increase $p_x^c > p_x$, in exchange for the industry making a compensatory contribution to the status quo public good level, $g_F > 0$. Since the agreement would be legal once exempted, it is contractible with side-payments and we can ignore issues of cartel stability. Evaluation of the policy can thus be done by comparing two static Nash equilibria, which we assume to be unique: $(p_x, g_F = 0)$ versus $(p_x^c > p_x, g_F > 0)$. Obviously, many different models of industrial organization and (oligopolistic) market competition can characterize both the competitive benchmark and coordinated equilibria from fundamentals. Yet as long as the market power granted under the policy raises prices, our analysis applies.

We consider infinitesimal cartel price rises and ignore general equilibrium effects through prices and wealth redistributions, including any surplus cartel profits distributed over shareholding consumers. Partial equilibrium comparative statics with respect to the composite commodity and the cost of producing the public good can be interpreted as the market for the private good being small relative to the rest of the economy. For the relevant market of the private good, it is less innocuous. In particular would the decrease in the demand for the private good resulting from the cartel price increase in general equilibrium decrease p_x, so that it depends on the model specifications whether the net effect on the price of the private good will indeed be positive, and compensation be required. This demand effect is second-order, however, and counteracted by the crowding out effect. Cartel surplus profits are the measure of welfare changes, since consumers are kept indifferent by the policy.

The extent to which cartel provision of the public good can improve upon the under-provision in

a differentiable function of wealth satisfying $0 < f_i'(w) < 1$ for all $i = 1, .., n$. In the model in Section 4, existence and uniqueness of equilibrium is proven by construction directly, allowing also for a higher marginal propensity to consume the public good.

[35] G_{-i} is the amount of public good contributions by other consumers than individual i, excluding the nature's and firm provision. Note that we could equivalently include G_{-i} and w_i, instead of W, in the indirect utility function as the contributions of other consumers are taken as given by individual i.

competitive equilibrium and compensate the price increase depends on the interplay of several effects. In response to the cartel price increase of x, three things will happen. First, consumers will substitute away from the cartellized private good, either to the composite commodity or by making a larger public good donation, or both. These substitution effects mitigate their individual harm from the price increase directly. Larger contributions to the public good also benefit others, but substitution to the composite commodity lowers the required level of public good compensation. Second, the increase in p_x has negative real income effects, which reduce the consumption of x, y and g, which are all assumed to be normal goods.

Third, there may be crowding out effects with contributors, as increases in G_{-i} may induce lower own contributions, including to stop contributing at all. Non-contributors enjoy the increased level of public good provided, and in border cases can be induced by the increase in p_x to start purchasing the public good. Generally, however, the substitution effect towards the public good are at least partially offset by the income and crowding out effects. In addition, the industry's compensation contribution $g_F > 0$ will further crowd out private contributions to the public good. For example can improvements in the energy efficiency of appliances be partially offset by lax morals in their use, and with improved living conditions for chicken overall, some consumers may switch back from buying better life chicken to the generically improved industrial poultry. This increases the demand for the private and composite commodity in the collusive equilibrium.

Figure 1 illustrates the concept of 'compensating public good', which essentially is a compensating variation delivered in the form of a public good, in (x_i, G)-space. Individual i consumes at (x_i^0, G^0) in competitive equilibrium, contributing to the public good. The price rise from p_x to p_x^c turns the budget equation, making the individual worse of at (x_i^1, G^1). With the wealth transfer g_F, he is brought back to his original utility level at (x_i^2, G^2) under the collusive price. $G^2 - G^1$ being smaller than g_F reflects partial crowding out.

On balance, the net utility change for individual i from allowing a public-interest cartel is

$$\triangle U_i = V_i^*(p_x^c, p_g, W, g_N + g_F) - V_i^*(p_x, p_g, W, g_N), \tag{3}$$

which increases in g_F.

Interpreting the compensation requirement under Article 101(3) TFEU and the *Horizontal Guidelines* to mean that the consumers of the private good are to be compensated on average, and assuming a cardinal comparison possible by the weighted sum of individual utilities, using weight α_i for the utility of individual i - or its type - as a welfare function, the cartel is to ensure that the change in total social welfare is non-negative, i.e.

$$\triangle SW = \sum_{i=1}^{n} \alpha_i \triangle U_i \geq 0. \tag{4}$$

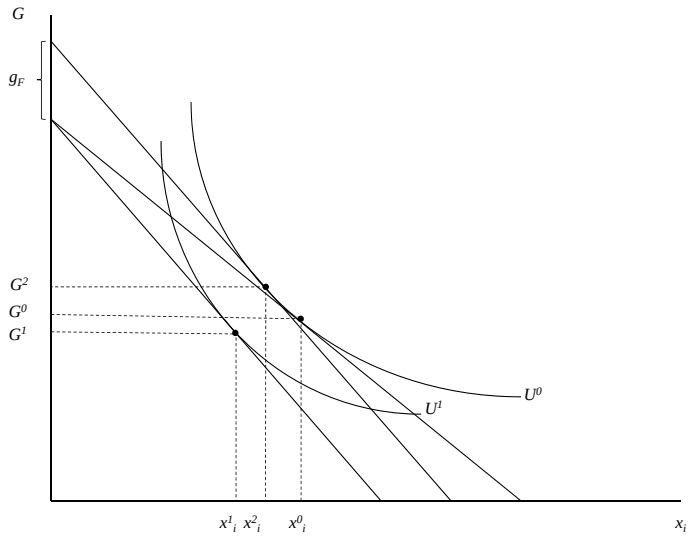

Figure 1: Compensating public good.

Obviously, different weights amount to interchangeable variations in social welfare, for which the competition rules may be interpreted to give competition authorities rather wide discretion.

In linear approximation, condition (4) is

$$-(p_x^c - p_x)\sum_{i=1}^{n}\alpha_i\frac{\partial U_i(x_i^*(.),y_i^*(.),G^*(.))}{\partial p_x} \leq g_F\sum_{i=1}^{n}\alpha_i\frac{\partial U_i(x_i^*(.),y_i^*(.),G^*(.))}{\partial g_F}, \tag{5}$$

since all consumers consume a positive amount of the cartellized good.[36]

Firms have no incentive to contribute more than minimally required and so seek to establish condition (4) − (5) with equality, if at all. Let the minimally required compensatory level of firm public good contribution be $\hat{g}_F$, i.e. the level of cartel contribution that makes consumers even on average. The competition authority should only accept the public interest-defense if the level of the public good actually provided by the cartel is at least $\hat{g}_F$. To make this kind of complex assessment requires a lot from the competition authority, including perfect information of preferences and perfect monitoring of firm behavior. Yet in those cases in which the cartel can compensate consumers and still profit, welfare can be created.

[36]Note that while the term $\frac{\partial U_i(x_i^*(.),y_i^*(.),G^*(.))}{\partial p_x}$ in (5) generally will be negative, it may be positive for individuals who care little for the private consumption good, yet benefit from other people's substitution effects toward the public good.

In the remainder of this section we study to what extent the policy can contribute to welfare, which turns out to depend crucially on whether or not there are private contributions to the public good. In Section 4.2.1 we analyze an economy with no private contributors to the public good. In Section 4.2.2 we consider economies in which at least one individual is a contributor. For analytical convenience, we assume that the set of contributors does not change under the policy.

4.2.1 Improvement to a No-Contributors Economy

If g_N is sufficiently high, no individual contributes to the public good in either of the periods and $g_i^*(.) = \frac{\partial g_i^*(.)}{\partial p_x} = \frac{\partial G_{-i}^*(.)}{\partial p_x} = 0$. The equilibrium purchases of each consumer depend only on own wealth and prices of the private good and the composite commodity. The indirect utility function becomes $V_i^*(p_x, p_g, w_i, g_N + g_F)$, since only nature and the firms provide the public good. The collusive increase in p_x causes individual i a marginal harm of

$$\frac{\partial U_i(x_i^*(.), y_i^*(.), G^*(.))}{\partial p_x} = -\frac{\partial U_i(x_i, y_i, G)}{\partial x_i} \frac{\left(\frac{\partial y_i^*(.)}{\partial p_x} p_x + w_i - y_i^*(.)\right)}{p_x^2} + \frac{\partial U_i(x_i, y_i, G)}{\partial y_i} \frac{\partial y_i^*(.)}{\partial p_x}. \tag{6}$$

The cartel damage is expressed in the first right-hand term, through the consumption of x, mitigated by consumption of y and further substitution towards the composite commodity in the second term. The utility losses will be distributed unevenly. Unsurprisingly, those who like the private good the most will suffer the highest utility decline. Also wealthy consumers are hurt more.

Compensation condition approximation (5) for a discrete price change for which all individuals remain non-contributors becomes

$$\begin{aligned}(p_x^c - p_x) \sum_{i=1}^{n} \alpha_i \left(\frac{\partial U_i(x_i, y_i, G)}{\partial x_i} \frac{\left(\frac{\partial y_i^*(.)}{\partial p_x} p_x + w_i - y_i^*(.)\right)}{p_x^2} - \frac{\partial U_i(x_i, y_i, G)}{\partial y_i} \frac{\partial y_i^*(.)}{\partial p_x} \right) \\ \leq g_F \sum_{i=1}^{n} \alpha_i \frac{\partial U_i(x_i, y_i, G)}{\partial G},\end{aligned} \tag{7}$$

which holding with equality implicitly defines $\hat{g}_F > 0$.

Note that while it may appear that in an economy with only non-contributors there is no willingness to pay for more public good than the status quo, this need not be so. There is under-provision in the competitive no-contributors equilibrium that may well be improved upon by coordination. If a sufficiently large proportion of individuals has a high enough willingness to pay for the public good, even though too low to privately contribute, consumers can be compensated on average. However, a private cartel is not well incentivized to provide a sufficient improvement in the public good, as the following result illustrates.

Proposition 1. *In a no-contributors economy, $\hat{g}_F$ decreases in $\frac{\partial U_i(.)}{\partial G}$ for all $i = 1, ..., n$.*

Proof. By assumption, marginal utility of the public good is decreasing for each individual. In a no private contributors economy, there are no substitution effects of the firms' provision of the public good. As a result, an increase in an individual marginal willingness to pay for G on the full range of U_i amounts to higher utility gain from each additional unit of g_F provided by the firms, thus lowering the compensating level of public good for individual i and the average compensation $\hat{g}_F$. ■

Rather than *increasing* the level of the public good when one or more consumers have a ceteris paribus higher marginal willingness to pay for it, as the Samuelson condition prescribes, a cartel will only need to invest *less* in compensating public good. The reason is that for the same price rise, consumers are compensated on average with a lower amount of public good if one or more of them value the public good more. This results from the cartel's incentive to only produce the bare minimum of compensation required for any price overcharge. While there may exist specific social welfare weights $(\alpha_1, ..., \alpha_n)$ such that $\hat{g}_F$ by compensation requirement (7) happens to implement the Samuelson condition (2) for a given price increase p_x^c, that would be a rare coincidence.

4.2.2 Crowding Out

In an economy with at least one contributing consumer i, its equilibrium utility brought about by a small increment in p_x becomes

$$\frac{\partial U_i(x_i^*(.), y_i^*(.), G^*(.))}{\partial p_x} = \frac{\partial U_i(x_i, y_i, G)}{\partial x_i} \frac{-1}{p_x^2} \left(\left(\frac{\partial y_i^*(.)}{\partial p_x} + p_g \frac{\partial g_i^*(.)}{\partial p_x} \right) p_x + w_i - y_i^*(.) - p_g g_i^*(.) \right) +$$

$$\frac{\partial U_i(x_i, y_i, G)}{\partial y_i} * \frac{\partial y_i^*(.)}{\partial p_x} + \frac{\partial U_i(x_i, y_i, G)}{\partial G} \left(\frac{\partial g_i^*(.)}{\partial p_x} + \frac{\partial G_{-i}^*(.)}{\partial p_x} \right). \tag{8}$$

Individual i 's marginal equilibrium utility gain from firm provision of the public good is

$$\frac{\partial U_i(x_i^*(.), y_i^*(.), G^*(.))}{\partial g_F} = \frac{\partial U_i(x_i, y_i, G)}{\partial G} \left(\frac{\partial g_i^*(.)}{\partial g_F} + \frac{\partial G_{-i}^*(.)}{\partial g_F} \right) +$$

$$+ \frac{\partial U_i(x_i, y_i, G)}{\partial x_i} \frac{1}{p_x} \left(- \frac{\partial y_i^*(.)}{\partial g_F} - p_g \frac{\partial g_i^*(.)}{\partial g_F} \right) + \frac{\partial U_i(x_i, y_i, G)}{\partial y_i} * \frac{\partial y_i^*(.)}{\partial g_F}, \tag{9}$$

where the set of arguments (.) are the terms exogenous to the individual, i.e. $(p_x, p_g, W, g_N + g_F)$. Substituting (8) and (9) into (5) holding with equality implicitly defines $\hat{g}_F > 0$.

Some individuals may gain utility when p_x increases, from increases in the public good contributions

by others as they substitute away from x. This is reflected in the term $\frac{\partial G^*_{-i}(.)}{\partial p_x}$ in (8), which is non-negative and effectively represents a mitigation of consumers' harm. Since the increase in $p^c_x > p_x$ and $\hat{g}_F > 0$ occur simultaneously, some individuals may benefit from both. However, there will always be contributing consumers in the economy harmed by the price increase as well. In addition, among contributors the term $\frac{\partial G^*_{-i}(.)}{\partial g_F}$ in (9) is non-positive, so that there is crowding out of their private contributions by the cartel provision. Some contributors may become non-contributors in response to the cartel's contribution. The crowding out is not complete, however, and the marginal benefit from the cartel's public good provision is always positive.

With at least one individual contributing privately to the public good, the policy need no longer always be contrary to the Samuelson condition. It may be that $\hat{g}_F$ increases in one or more individuals' marginal willingness to pay for the public good. Suppose for example that a contributor's willingness to pay for the public good goes up, which makes her contribute more, thus increasing G. This will generally lower the marginal utility of the public good to others, who will therefore substitute towards the private goods and thus may require more compensating public good for any cartel price increase. The policy can, however, never be socially optimal, as the following result reveals.

Proposition 2. *In an economy with at least one contributor, the public interest-cartel policy can never implement G^S.*

Proof. For contributor j, the first-order conditions require that

$$\frac{\partial U_j(.)}{\partial G} / \frac{\partial U_j(.)}{\partial x_j} = \frac{p_g}{p_x},$$

be satisfied with equality, since the contribution condition $g_j \geq 0$ is not binding. Since $\frac{\partial U_i(.)}{\partial G} / \frac{\partial U_i(.)}{\partial x_i} \neq 0$ for every $i = 1, ..., n$, the presence of only one contributor in the economy already implies that the Samuelson condition (2) is violated. ■

The public-interest defense cannot be socially optimal because of private substitution effects. Even though the overall level of public good in the economy is increasing in g_F, no matter how high g_F is, a contributor will always substitute away from the public good in a manner that prevents achieving the first-best. To contributors, the firms' provision is a mere wealth injection, which moves out the social optimum and makes it unattainable by collusion. The highest possible improvement of welfare in a contributor economy is attained by requiring the cartel to spend all of its cartel profits on the public good, yet there is no guarantee that this is sufficient to compensate consumers either. In fact, this would be the common case of government provision through a unit tax on product x.

4.3 Sustainability of a Compensating Cartel

While it may be possible to compensate consumers for a cartel price rise through public good provision, it will often be impossible to pay for the required compensation out of the cartel proceeds, in which case the policy cannot improve welfare. To see the problem, note that the individuals that are hardest to compensate with public good need not be the ones who suffered the most harm by the price increase. There may well be consumers that derive too little utility from G to be compensated effectively, even if they have not suffered much damage from the price increase at all. In this respect, public good compensation is very different from monetary compensation, which will never need to go beyond making the old bundle affordable again. On compensation via a public interest, there is no effective upper limit. The public interest compensation scheme thus proves to be potentially costly, quite possibly too costly to be financed from the cartel price overcharge on the private good.

In order for the compensation scheme to be incentive compatible for the cartel, each firm's costs of contributing to the public good cannot exceed the extra profits it yields by the higher price. Assuming that the colluding firms have efficient means of splitting the cost of producing $\hat{g}_F$, the industry's sustainability condition is

$$p_g \hat{g}_F \leq \Pi(p_x^c, p_y, W, g_N + \hat{g}_F) - \Pi(p_x, p_y, W, g_N), \tag{10}$$

where $\Pi(.)$ are the joint profits of firms engaged in the collusive agreement and paying for the public good.[37] The cartel prefers condition (10) to hold with the strictest possible inequality, but cartel profits may be constrained by residual competition.

For a public interest defense to be possible, conditions (4) and (10) need to be satisfied simultaneously. However, even if consumers are compensated on average, the policy impacts them with important differences. Each consumer's contribution to financing the public good is the overcharge he pays for his consumption of the private good, $(p_x^c - p_x)\, x_i^*$, proportional to his preference for the private good. A consumer who likes the private good a lot more than the public good ends up paying a lot for compensation he appreciates little. In a no-contributors economy, where two consumers i, j have $MRS_{x,y}^i > MRS_{x,y}^j$ and the same level of initial endowment, consumer i is charged more for his private good consumption. If additionally $MU_G^i < MU_G^j$, consumer i receives lower utility compensation via $\hat{g}_F$.[38] Since the required $\hat{g}_F$ compensates consumers on average, he suffers a net utility loss.[39]

In a contributor economy, consumers with high $MRS_{x,G}$ additionally self-select themselves. Relative preference for the private good over the public good manifests itself in a lot of private good

[37] Alternatively, we may ask if the cartel is able to pay for the required public good provision out of its price overcharge, that is whether $p_g \hat{g}_F \leq (p_x^c - p_x) \sum_{i=1}^{n} x_i^c$, in which x_i^c is the level of consumption of the private good under the cartel regime. This is condition (10) for the case of perfect competition at constant marginal costs, considered in Section 5.

[38] If $MU_G^i > MU_G^j$, the net utility comparison is ambiguous.

[39] In a more complex economy, his net utility outcome depends on $\hat{g}_F$ derived from the preferences of all consumers.

consumption and little private contribution to the public good. Those individuals who consume a large amount of the private good thus have a large exposure to damage from even a small cartel price increase. They value the public good relatively little and also have low mitigating substitution towards the rest of the economy. To the extent that they did contribute to the public good in the competitive equilibrium, they will respond with relatively large reductions, crowding out the compensation.

The latter effect is illustrated in the Dutch *National Energy Agreement* and the *Chicken of Tomorrow* cases. Consumers of cheap chicken meat produced under bad living conditions have already revealed not to care much for chicken welfare. Instead it is vegetarians who are most likely to have the highest willingness to pay for more animal friendly broiling. In the matter of the coal burning electricity plants, households that already purposely buy wind or solar power are particularly willing to pay for a reduction in CO_2 emissions, not gray electricity users. Compensating individuals with the lowest willingness to pay requires the most public good, which is expensive. Likewise, in the French *Cinema Code* consumers of mainstream movies are overcharged for the wide availability of art films for which they have no appreciation.

Note also that in no-contributors economies $\hat{g}_F$ generally increases in g_N. A higher level of the initial provision of the public good implies a lower marginal willingness to pay for the public goods for each individual, as consumers cannot substitute away from it. Utility loss from the cartel price increase, however, is unaffected by the level of g_N. As a result, each unit of g_F provided by the firms compensates consumers less than it would with less g_N in the economy, so that more compensation is required.

These policy characteristics together make that the industry may not be able to afford the required compensation: if the cartel attempted to increase revenues in order to pay for its compensation requirement with higher prices, an even larger compensating contribution would be required. Whether or not the public interest-cartel can nevertheless be sustainable, and thus potentially improve welfare, necessarily is highly case-specific. In the next section we analyze a common preference structure and show that while there exist economies in which the policy is sustainable, they are a small and special subset of all economies.

5 Sustainable Public Interest-Cartels

Suppose preferences can be represented by well-behaved constant elasticity of substitution utility functions, that is, let the preferences of individual i be represented by

$$U_i = a_i \frac{G^{1-\theta}}{1-\theta} + b_i \frac{x_i^{1-\theta}}{1-\theta} + c_i \frac{y_i^{1-\theta}}{1-\theta}, \tag{11}$$

in which (a_i, b_i, c_i) are positive parameters expressing relative preferences for the public good, the private good x_i and the composite commodity y_i , and $\theta = 1/\rho \in (0, 1)$, satisfying the general

conditions imposed in the previous section. All individuals are consumers in the relevant market. Consumer i is a contributor to be public good if and only if

$$w_i > \left(p_x (\frac{b_i p_g}{a_i p_x})^\rho + (\frac{c_i p_g}{a_i})^\rho \right) (G_{-i} + g_N), \tag{12}$$

and $g_i = 0$ otherwise. Note that a wealthy enough individual will contribute to the public good, and at lower wealth levels if a_i is high and g_N is low.

The optimal (Samuelson) level of public good for this economy is

$$G^S = \left(\frac{p_x^c}{p_g} \sum_{i=1}^{n} \frac{a_i}{b_i} \left(\frac{w_i}{p_x^c + (\frac{c_i p_x^c}{b_i})^\rho} \right)^\theta \right)^\rho, \tag{13}$$

which increases in each individuals' marginal willingness to pay for the public good a_i.

Firms produce good x at constant marginal costs c, so that $p_x = c$. Denoting market demand for good x at price p_x as $D_x(p_x)$, under the weighted average compensation requirement to produce $\hat{g}_F$, collusion is profitable for the industry only if

$$\Pi = (p_x^c - c) D_x(p_x^c, \hat{g}_F) - p_g \hat{g}_F (p_x^c, c) \geq 0, \tag{14}$$

where the demand at price p_x^c naturally depends also on $\hat{g}_F$ as it enters the consumer's optimization problem.

Figure 2 illustrates the problem of sustainability when there are two types of individuals.[40] On the horizontal axis increases the cartel price from the competitive level $p_x = c = 1$. The vertical axis displays public good contributions, as well as cartel profits. The circled lines show both types' private contributions to the public good in the absence of compensation, the triangulated lines when the cartel compensates. The upper two lines belong to type 2, who values both the public good slightly more than individual type 1 does, with a relatively decreased valuation of the private good. With no cartel compensation, both types classically substitute towards the public good with cartel price increase. Eventually, type 1 will become non-contributor.

The dashed line shows $\hat{g}_F$ for each cartel price increase. Allowing a cartel with a compensation requirement leads both types to reduce their own voluntary contributions in response, on the balance of a substitution effect from the private good to the public good and the composite commodity, and a negative income effect from the cartel price rise, plus a crowing out effect from the cartel provided public good contribution. While both types just remain net contributors for the cartel prices displayed, they each reduce their private contributions steeply as compared to a situation without cartel provision. Industry profit is given by the lower solid line: for price increases above$p_x^c = 1.98$, the cartel can't

[40]Parameter values are: $\alpha_1 = \alpha_2 = 1$; $(a_1, b_1, c_1) = (1, 1, 1)$; $(a_2, b_2, c_2) = (1.2, 1, 1)$; $\theta = \frac{1}{2}$; $(w_1, w_2) = (10, 10)$; $g_N = 1$; $(p_x = c, p_y, p_g) = (1, 1, 1)$.

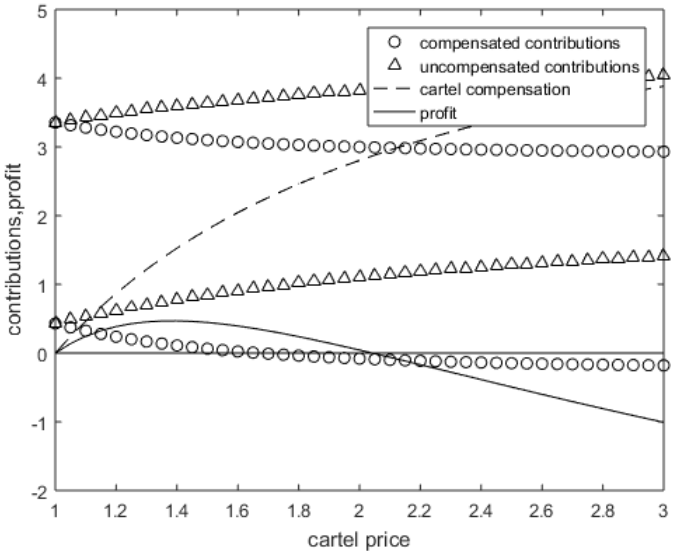

Figure 2: Sustainable public interest-cartels.

actually afford the compensating public good level required.

The example captures how the policy asks that consumers with a high consumption of the private good, whom are damaged a lot by the cartel price rise, pay most for the public good, for which they have a relatively low preference. The cartel provision crowds out private contributions in addition. In this specification, the cartel profit is positive for some price range and identifies, since Π is concave for constant elasticity of substitution-type demands, a unique viable optimal cartel strategy under the compensation requirement. Next we study the set of parameters for which a sustainable public interest-cartel is possible and its scope. Section 5.1 considers the case without private contributions to the public good. In Section 5.2 there are private contributions.

5.1 No-contributors Economy

Suppose condition (12) is not satisfied for any individual i, so that $g_i = 0$ for all i and only $G = g_N + g_F$ enters into every individual's utility. The compensating amount of public good $\hat{g}_F$ for this economy decreases in consumers' relative preference for the public good (a_i), in accordance with Proposition 1.[41] With both $D_x(p_x^c, \hat{g}_F)$ and $p_g \hat{g}_F$ fully characterized, using the fact that locally $p_g \hat{g}_F|_{p_x^c = p_x} = 0$, we find that $\frac{\partial \Pi}{\partial p_x^c}\Big|_{p_x^c = c} \geq 0$ for infinitesimal cartel price rises if and only if

[41] The expression for $\hat{g}_F$ is equation (19) in the appendix, which also serves as an illustration of Proposition 1.

$$\sum_{i=1}^{n} \alpha_i a_i \sum_{i=1}^{n} \frac{w_i}{c + (\frac{c_i c}{b_i})^{\rho}} \geq \frac{p_g g_N^{\theta}}{c} \sum_{i=1}^{n} \alpha_i b_i \left(\frac{w_i}{c + (\frac{c_i c}{b_i})^{\rho}} \right)^{1-\theta}. \tag{15}$$

If a large proportion of consumers has a strong preference for the public good, that is if a_i is large for sufficiently many (or heavily weighted) individuals, the left hand-side of (15) increases, making compensation more sustainable. The right hand-side increases analogously in b_i. Note also that the right hand-side of (15) increases in both p_g, as producing the public good is more expensive, and g_N, reflecting that the willingness to pay for additional public goods provision decreases in the existing public good level. In fact, if g_N is low enough, it will become possible to collude sustainably and compensate - yet it will also induce individuals to contribute privately for lower wealth levels. In addition, the closer θ is to 0, the less constraining (12) is, reflecting that utility becomes near linear in all goods.

Figure 3 shows the space for a sustainable public interest-cartel for a no-contributors economy with two types.[42] Type 1's preferences for the public and the private good are varied, relative to a fixed non-contributing type 2, at I2. The cartel marginally increases the price from $p_x = c$. The dashed line marks the preferences for which type 1 will remain a non-contributor too. The solid line depicts sustainability condition (15). Together, the two lines mark a bandwidth in which the ratio of a_1 to b_1 should stay for a public interest-cartel to be sustainable in this economy. That is, type 1's preference weights for the public and the private good should jointly increase and not diverge much. While possibilities for compensation requires a sufficiently high value of a_1, relative to b_1, a_1 should not become too high, or type 1 becomes a contributor. If, on the other hand, b_1 increases above the solid line, type 1 likes the private good so much, the cartel cannot profitably compensate him.

The specific shape and location of the space of $\frac{a_1}{b_1}$ values for which the policy is sustainable depends on all other parameters of the economy. The higher g_N, for example, the more both the sustainability and the type 1 contributor boundary move to the right, leaving more or less the same space for aligned preferences. The example is non-specific however: generally the relative preferences for the private and public good should stay within narrow bounds, or the cartel cannot make up with these consumers for its overcharge on the private good with an inexpensively small enough public good contribution.

As noted, the policy could be socially engineered in this economy to be first-best by choosing the individual welfare weights appropriately. For example, with preferences of both types in the sustainable cartel space, for a discrete price increase from one to two, the cartel is made to compensate to the socially optimal public good level if individual type 1 has a weight roughly two-and-a-half times that of type 2. The cartel contributes in that case almost three times the natural public goods level.[43]

[42] Parameter values are: $\alpha_1 = \alpha_2$; $c_1 = 1$; $(a_2, b_2, c_2) = (1, 1, 1)$; $\theta = \frac{1}{3}$; $(w_1, w_2) = (10, 10)$; $g_N = 10$; $(p_x, p_y, p_g) = (1, 1, 1)$.

[43] Type 1 is $(a_1, b_1) = (0.5, 1)$. For $p_x^c = 2$, the social welfare weights that implements the Samuelson condition are $(\alpha_1, \alpha_2) = (1, 0.395)$. Relative to $g_N = 10$, the cartel is required to contribute a further $\hat{g}_F \tilde{=} 27$.

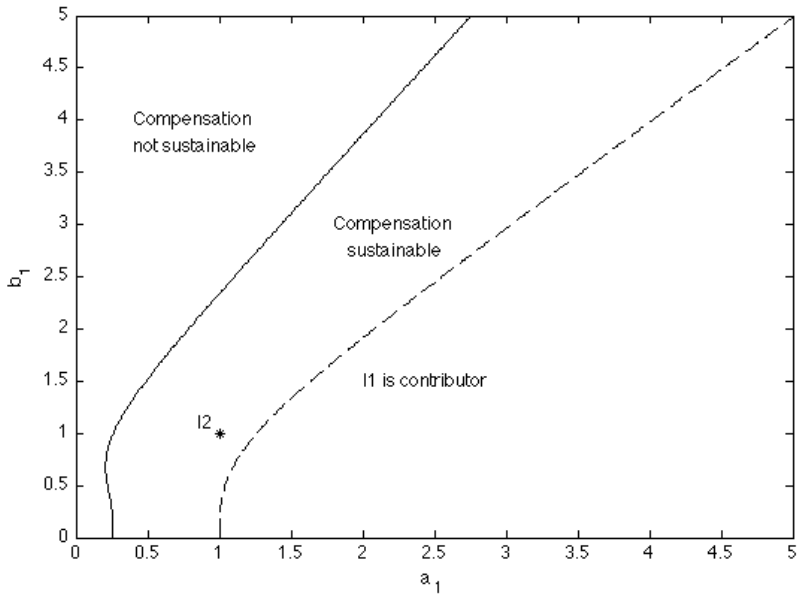

Figure 3: Sustainable public interest-cartels space in a no-contributors economy.

5.2 Contributor Economies

In an economy in which at least some individuals are private contributors to the public good, the crowding out effect comes into play. Suppose condition (12) is satisfied for all individuals, which is the case if they all have high enough wealth endowments. The level of public good in equilibrium then is proportional to the total value of the endowment in the economy, so that consistent with Bergstrom *et al.* (1986), lump-sum reallocation of wealth have no effect on the total level of public goods in equilibrium. However, the cartel overcharge changes consumption bundles through substitution and income effects, so that crowing out in a contributor economy is not full.

The compensating cartel contribution $\hat{g}_F$ is sustainable in an all-contributor economy for an infinitesimal cartel price rise if and only if

$$\sum_{i,j}^{i\neq j}\left(\alpha_j a_j\left(\frac{b_i}{a_i}\right)^{\rho}+\alpha_i a_i\left(\frac{b_j}{a_j}\right)^{\rho}\right)\geq p_g^{\rho-1}\sum_{i,j}^{i\neq j}\frac{\alpha_j a_j-\alpha_i a_i}{a_i^{\rho}a_j^{\rho}}\left((b_j c_i)^{\rho}-(b_i c_j)^{\rho}\right), \tag{16}$$

in which $\sum_{i,j}^{i\neq j}$ is the sum over all unique pairs of two different individuals (i,j) in the total n.[44] Since different levels of initial public good are essentially variations in wealth, condition (16) does not depend on g_N.

[44]The expression for $\hat{g}_F$ is equation (20) in the appendix, which also serves as an illustration of Proposition 1.

Sustainability depends critically on the relationships between preferences for the private, the public and the composite commodity. Note that it does not depend on prices, apart from p_g, the price of the public good, for which, since $\rho > 1$, it naturally holds that the more expensive it is to compensate consumers, the harder it is to do so from the cartel proceeds. Given welfare weights, since the left-hand side of (16) is positive and the right-hand side is a subtraction, it can be satisfied for a wide variety of parameter values. What matters is the 'distance' in preferences between pairs of individuals, in all three goods. Certainly, supposing all individuals receive the same weight (i.e. if $\alpha_i = \alpha_j$ for all (i, j)), if everybody values the public good equally (i.e. if $a_i = a_j$ for all (i, j)), it will always be possible to compensate all consumers in a contributor economy profitably. The same is true if all individuals value both the private good and the composite commodity equally (i.e. if $b_i = b_j$ and $c_i = c_j$ for all (i, j)). In both cases, the right-hand side of (16) is zero.

Around these limit identity cases is a range of different preference structures for which compensation is possible as well, as long as consumers are sufficiently homogeneous in their valuation of the three goods in society. If the values of a_i are far apart between pairs of individuals, the right-hand side of (16) will be larger and compensation not sustainable, unless the combined preferences for the private goods x and y are very close, so that the last part of the right hand-side of the condition goes to zero. The cross-multiplications of b_i and c_j reflect the fact that cartel damage is mitigated by substitution towards the composite commodity when p_x rises.

Figure 4 is an all-contributors economy with two types, induced by a lower level of g_N in otherwise the same example as above.[45] In the region in which both types contribute, between the dashed lines, the ratio $\frac{a_1}{b_1}$ stays relatively constant. Given that $\frac{a_2}{b_2} = 1$, if individuals are more different than quite alike in their preferences, it will not be possible to mount a sustainable public interest-defense. In the upper-left region, type 1 has insufficient liking of the public good to contribute, whereas in the lower-right region his contribution is so large that it crowds out type 2's. Compensation is sustainable within the region between the solid lines, by which (a_1, b_1) are bounded away from zero and cannot be too high. Compensation is in principle possible close to the vertical axis, as long as type 1 is sufficiently wealthy, where the cartel would make sufficient profit on his large consumption of the private good. To the lower-right, type 1 likes the public good enough to be easy to compensate. The upper-limit on sustainability bounds the parameter space in which compensation is sustainable in an all-contributors economy, relative to the importance of the rest of the economy.

The higher g_N, the wider the bandwidth within which consumers are (non)contributors, while the sustainability bound remains the same. The location of the sustainability upper-bound depends on the relative importance of the composite commodity in individual preferences: if the c_i's are sizable, compared to the private-public good trade-off, the parameter space is bounded as in Figure 4. Certain higher (a_1, b_1) combinations then cannot benefit from mitigating substitution to the composite

[45] Parameter values are: $\alpha_1 = \alpha_2$; $c_1 = 1$; $(a_2, b_2, c_2) = (1, 1, 1)$; $\theta = \frac{1}{3}$; $(w_1, w_2) = (10, 10)$; $g_N = 2$; $(p_x, p_y, p_g) = (1, 1, 1)$.

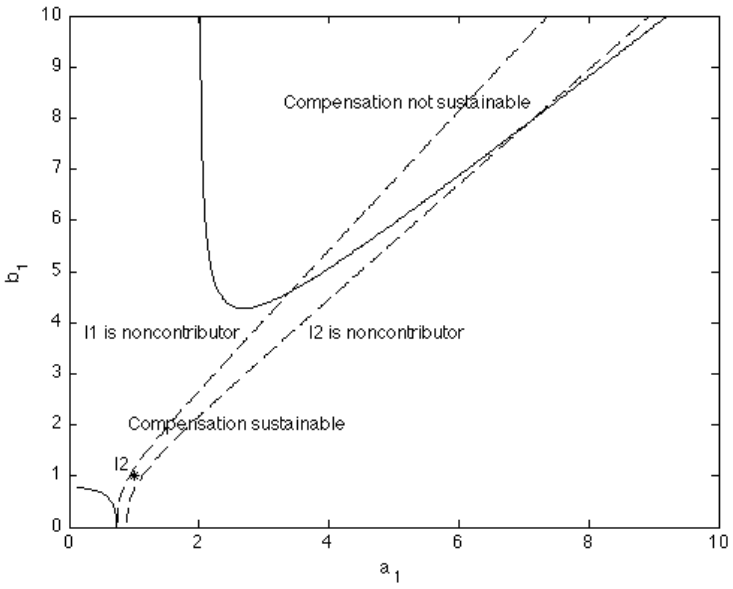

Figure 4: Sustainable public interest-cartel space in an all-contributors economy.

commodity enough. If the preference for the composite commodity is small to begin with, the sustainability condition need not restrict the absolute values of (a_1, b_1), as long as their ratio remains within bounds. Even though in an all-contributors economy compensations tend to be cheaper, still in most circumstances no sustainable compensation exists.

The scope for sustainable cartel prices and profits increases in the size of the population and their wealth. More individuals increases the free-riding problem and thus adds space for socially advantageous compensation, albeit making some of them more likely to become non-contributors. At the same time does it increase overall purchases of the private good and thus profits, while the required public good compensation is still the same. Larger consumer wealth endowments do the latter also, as would redistribution of the cartel profits, for example through consumer share-holdings in the colluding firms. Yet since by law the consumers of the private good are to be compensated, the policy paradox cannot be escaped.

For intermediate economies with contributors and non-contributors, conditions are even more complex, yet the main intuitions hold. Cartel provision of the public good can alleviate the problem of under-provision in competitive equilibrium and so bring an economy closer to efficient public good levels. This is the case even though consumers decrease their contributions in response to the policy. Mixed economies in fact combine the presence of a high willingness to pay for the public good in some portion of the population, with non-contributors that aggravate the problem of under-provision. In

addition, individual contributions to the public good in an economy in competition are further discouraged by free-riding when the number of individuals is larger. Together with the fact that the cartel provision benefits more people over which the cost of producing the public good can be spread, this widens the space for improvement by the policy. The finding remains that the existence of a critical mass of consumers who combine a low marginal utility for the public good with high purchases of the private good can easily make an effective public-interest cartel impossible.

6 The More-Efficient Cartel

A main justification for the public interest-cartel policy is that companies would often be better placed to produce the kinds of public goods intended, such as cleaner ways of producing, better living conditions for their live-stock, or fairer labor conditions in the low-cost countries from which they source their inputs. Arguably, companies themselves know best how to produce more in line with the public interests concerned. If allowed to collude in return for public good, they would be incentivized to produce the compensating contribution efficiently at the lowest possible costs, as a necessary condition for profit-maximization.

Production of the public good that is done more efficiently by the firms in cooperation than by individual consumers or the government amounts to a price $p_g^c < p_g$ per unit of g_F. It obviously relaxes the conditions for sustainability of the policy (15) and (16). This more-efficient cartel argument is a true justification for the policy, as the following result makes precise.

Proposition 3. *For any economy, there exists a* $0 \leq \hat{p}_g^c < p_g$ *, below which the public interest-cartel policy is sustainable.*

Proof. The result is obvious from setting $p_g^c = 0$ in conditions (15) and (16). The exact levels of $\hat{p}_g^c$ for a no-contributor and a contributors economy are characterized in the appendix.■

Essentially, if compensation is free for the cartel, providing the necessary compensation pays for each price overcharge. In addition, in contributor economies, expensive private contributions are crowded out by the more efficient cartel public goods provision, which frees up income that in part is spent on x, raising cartel revenues to help make the compensation affordable.

The minimally required efficiency gain to make the policy feasible can be very large, however. In figures 3 and 4, $p_g^c < p_g$ moves up the solid lines that bound the area of preferences for which compensation is profitable and thus can enhance welfare. Essentially, the cheaper public goods provision allows the cartel to also compensate consumers with a stronger preference for the private good, because it allows the cartel to contribute more to it, for the same price increase. The range of sustainable price increases and cartel profits thus increases in the difference $p_g - p_g^c$.

The information required for a competition authority to determine whether the industry in collusion is sufficiently more efficient at advancing the public interest enough to fully compensate consumers is prohibitively large. Note also that government should be able to do better, simply by setting and financing the level of public good itself, and contracting the more efficient firms to provide it. In fact, it can do this also with less than perfect information.

7 Alternative Welfare Measures

The construction of a welfare function to comply with the case law that consumers in the same relevant market are compensated is cardinal, as noted. As a result, the policy does not offer an unambiguous welfare standard to guide the competition authority's balancing exercise. In conditions (15) and (16), the choice of weights in the welfare function α_i directly affects the sustainability condition: it can be possible to weigh certain individuals in such a way that a cartel will not be able to compensate the consumers profitably - and vice versa.[46] Moreover, government requires a lot of information on consumer preferences to monitor whether sufficient average compensation is given, because even when it is, potentially a large number of consumers will be worse off under the policy and complain.

Alternative norms may allow for a more practical approach. Consumer surplus may seem an empirically viable measure, yet even as an approximation of welfare it is not well-defined, as demand for the public good does not integrate even for standard preferences. Also, while aggregate demand for the private goods is observable, that for the public good is not.

A Pareto criterion requiring all consumers to be compensated for the cartel price increase would certainly be more strict, as a single individual with little or no willingness to pay for the public good would veto the exemption and hold up any possibilities for a public interest-defense. At the same time, it may be easier to police for a competition authority from consumer complaints of insufficient compensation. Consider an all-contributors economy in which one individual h is the hardest to compensate. The linear approximation of minimal individual-specific level of public good required with general utility functions is

$$-(p_x^c - p_x)\frac{\partial U_h(x_h^*(.), y_h^*(.), G^*(.))}{\partial p_x} = \hat{g}_{F,h}\frac{\partial U_h(x_h^*(.), y_h^*(.), G^*(.))}{\partial g_F}. \tag{17}$$

In the case of constant elasticity of substitution utility functions, the cartel can afford the implied $\hat{g}_{F,h}$ if and only if

[46] The example of an unsustainable public interest-cartel in Figure 2, in which both types have equal weight, becomes sustainable if individual 2 receives a weight in the welfare function that is at least three times higher than the weight of individual 1.

$$a_h^\rho \geq p_g^{\rho-1}\left(b_h^\rho \frac{\sum_i^{i\neq h}\left[\left(\frac{c_i}{a_i}\right)^\rho\right]}{\sum_i^{i\neq h}\left[\left(\frac{b_i}{a_i}\right)^\rho\right]} - c_h^\rho\right), \tag{18}$$

in which $\sum_i^{i\neq h}$ is the sum over all individuals other than h. While this condition is considerably simpler than condition (16) and requires no welfare function, still information is needed about the preferences of all consumers to implement it, since all individuals interact through the public good contributions. Also consumer notifications would be ex-post and suffer too from free-riders, who have an incentive to file false complaints also against a genuine public interest-cartel in an attempt to dissolve it.

Asking for potential Pareto improvements, for which those who are better off could compensate those who are worse off, as proposed in the Kaldor-Hicks-criteria, is not obvious either. This criterion is less stringent than the Pareto criterion, but it still requires a full comparative statics analysis. Moreover, in economies with contributors any redistribution of wealth among contributors does not change individual utilities by the neutrality result in Bergstrom *et al.* (1986), and so Kaldor-Hicks compensation offers no solution. In the no-contributors economy, the information required to establish whether potential compensations exist remains staggering. It is not clear whether the relevant case law discussed in Section 2 would allow the potential Pareto criterion.

Finally, a more practical approach, which the Dutch competition authority ACM took in the *National Energy Agreement* and the *Chicken of Tomorrow* cases, may be to try to measure the maximum willingness to pay for the promised cartel public good contribution by consumers of the private good and compare it to the projected cartel price increase. In principle, if the average willingness to pay for the new equilibrium public goods level is larger than the price increase, the public interest-cartel would be allowed and otherwise not. For small increases in an all-contributors economy, the approach seems straightforward: for an increase in the public good provision the average willingness to pay is equal to the current price of the public good p_g.[47]

However, such a test is generally not strict enough, since the price increase of the private good will lead to substitution towards private contributions to the public good, which will lower the willingness to pay for further contributions by the cartel. In addition, once some compensation is given, consumer's willingness to pay for the public good will be lowered further. Therefore, even if the (average) willingness to pay for the public good would be found to be higher than the cartel price increase, i.e. $p_x^c - p_x$, it is still very well possible that consumers are damaged on average. Asking consumers to compare discretely different regimes in questionnaires may allow for including the cartel's coordination benefits as well as consumer demand substitutions, yet is potentially unreliable.

[47] For the no-contributors economy, we obtain the overall willingness to pay at a point $G = g_N$ as $p_g^{g_N} = \left(\frac{\sum_{i=1}^n w_i}{g_N \sum_{i=1}^n \left(p_x(\frac{b_i}{a_i p_x})^\rho + (\frac{c_i}{a_i})^\rho\right)}\right)^{\frac{1}{\rho}}$, which is not obvious to establish empirically.

8 Extensions

Several extensions of our basic model present themselves for further analysis. Including public interest benefits that result directly from a reduction in the consumption of private commodities that generate negative externalities, such as smoking or polluting production, due to prices increasing, adds effect to the policy. We do note that arguably those individuals who consume most of products that harm the public interest will generally care less for the public benefits, or they wouldn't generate the externalities. A cartel price overcharge in this context can be seen as a uniform Pigovian tax on those individuals that cause the negative externality by consumption.

In case consumers value the firms' collective efforts also as a quality improvement of the private good, as in Schinkel & Spiegel (2017), the efforts increase demand for the private good. Certain public interest also are complementary to private consumption, such as in cars and road safety, given companies an incentive to care for them. In such hybrid cases, despite partial crowding-out as in Kotchen (2006), the sustainability constraint for a public interest-cartel may be relaxed. However, firms then also have incentives to contribute already in competition. The additional advance from collusion may therefore be little. Where it requires that the cartel can appropriate the benefits from its investments, compensation needs to be strictly enforced and then typically is not viable either.[48]

The policy may be enhanced if a public interest-cartel would apply price discrimination instead of uniform pricing, which comes available as a business strategy with market power. Since government presumably cannot differentiate VAT between buyers (at least not of the same good), price discrimination would be an additional instrument unique to collusive provision. Firms would also often have the necessary information on their customers' preferences for it. In that case, the cartel would be able to charge consumers with a higher willingness to pay for the public good a higher price for the private good, and so implement personalized taxation that seems akin to Lindahl pricing.[49]

However, again a public interest-cartel has no direct incentive to implement this. The price discrimination would be to increase prices to consumers with a higher willingness to pay for the *private* good, and these are restricting prices - as are substitutions to the composite commodity. By the nature of public goods, a price discriminating cartel can still only offer one level of compensation for all consumers. Cartel profit-maximizing behavior thus amounts to looking for individuals that have the lowest ratio of utility lost to cartel revenue gained and charge them higher prices for the private good. These are not generally aligned with a higher willingness to pay for the public good.

The effect of price discrimination on the level of public good provided is also not obvious. Since the strategy can eliminate those individuals that drive up the necessary level compensatory public good under uniform pricing, it can decrease the level of public good ultimately provided in compensation.

[48] See also Schinkel (2020) and Treuren.

[49] Note that nonlinear pricing is less advantages to a cartel in contributors economies, since the fixed price component would be comparable to a lump sum tax, to which the neutrality result of Bergstrom *et al.* (1986) applies, while still demanding compensation.

Yet there are also economies in which a price discriminating cartel would end up producing more public good than under uniform pricing. For example when there are a sufficiently high number of individuals with high marginal utility from the public good and some (wealthy enough) individuals through whom the cartel can finance the public good provision by making them pay a lot for the private good at a relatively low utility loss. Of course, in either case consumers do not benefit as they would remain to be kept only indifferent. Yet the policy is sustainable and thus possibly welfare enhancing more often.

The policy is hampered by the legal requirement that buyers must be compensated. It is a strict test, in the sense that the industry agreement should at a minimum deliver enough benefits to those individuals who pay for them through the anticompetitive price effects. Yet advances in energy preservation, clean air and public health obviously bring high and wide-ranging gains to many more people than just those local and unappreciative consumers. Not counting these wider benefits can easily block great joint CSR initiatives, and instead initiate only the advance of local minor public interests. Advocates of the public interest-cartel policy have therefore plead the 'consumers' compensation criterion be relaxed, in that also benefits to non-buyers of the cartellized product be counted.[50] The 'current consumers-standard' seems based on concerns about welfare redistribution, rather than optimality.

Yet the requirement that consumers are compensated on average, rather than all, while preventing hold up from just a few no-willingness to pay types, also implies that there will always be losers from the policy among consumers with a low marginal valuation of the public good. Consumers with a low preference for the private good and a relatively high willingness to pay for the public good are effectively paying less, in terms of damage suffered by the price increase, than the consumers targeted to pay by the policy: those who buy substantial volumes of the private good. These welfare redistributions are implicit. In fact, it is generally much easier to offer the consumers harmed monetary compensation, that is, to award cartel damages - which is of course not what the policy is about, and further goes to show how it is misconstrued.

In response to the *National Energy Agreement* and *Chicken of Tomorrow* initiatives having been found too light by the Dutch competition authority, it was given a wider objective by the Ministry: "the benefits both to the current consumer in the future, as well to future consumers of the product or service concerned are taken into account: it is about a longer term than right here, right now, and others that do not themselves consume the product."[51] While seemingly sympathetic, this stretch holds a danger of justifying essentially any cartel by invoking other, or imagined future generations of consumers that appreciate the public interest in question so much that even when properly discounted virtually any local market concentration today is justified, however harmful to the current consumers. Such a wide interpretation could seriously undermine cartel enforcement.

However, it is possible to also bring the benefits to "future consumers" consistently under the criterion, by counting the well-being of next generations as valued by the current consumers of the

[50] Dolmans (2020).

[51] Modification of the Dutch policy rule referenced in footnote 23, in force since 5 October 2016, paragraph 3.3.

product in question. Out of recursive altruism for their offspring, individuals currently alive are willing to pay for leaving behind a better world.[52] This interpretation of the compensation criterion conserves consumer sovereignty as the basic principle. It also implies that the benefits need not be restricted to future consumers of "the product or service concerned": what matters is the cartel's contribution to the well-being of the progeny of its current customers - whose willingness to pay for it may, however, be limited by a similar negative self-selection effect as we identify for public goods.

9 Concluding Remarks

The provision of public goods in compensation for allowing the built up of market power, be it by (partial) collusion, merger or monopolization, proves cumbersome. The public interest-cartel policy suffers from some fundamental problems. Overcharging the private good has negative real income effects. In response to the price rise, consumers substitute away from the cartellized commodity, which mitigates their damage but also complicates raising the funding. The compensatory provision of the public good by the cartel in turn crowds out private contributions, which works to neutralize it. However well-intended their CSR initiatives may be, companies have all the incentives to raise prices by as much as they profitably can, while doing as little for the public interest as they can get away with and pocket the difference.

The contribution that a cartel will offer is less if people like the public good more, which goes against basic teachings of public economics. Still compensation is often not feasible for any price increase, since those with the largest antitrust harm, because of their relatively large consumption of the private good, also have relatively lower appreciation for the public good. In fact, to compensate people that have no or very little appreciation of the public good is prohibitively expensive, compared to regular monetary compensation. Only in economies in which most people are sufficiently 'balanced' in their preferences, in that they appreciate private and public goods quite alike, and/or the industry in coordination is very much more efficient at producing the public good, may a cartel be able to raise enough money to compensate their consumers on average.

In any case, the policy burdens a competition authority with the complex task of identifying genuine public interest-cartels. With imperfect enforcement, a green cartel claim is not informative: the policy is easily abused for cartel greenwashing, by which some cosmetic public good provision is tried for a free pass to collude. To identify whether the policy does apply, determine the required off-setting public good level, and monitor if it is in fact delivered, requires a prohibitively large amount of information. With it, government can always do better, for example by raising the minimally required funds for the optimal public goods level through taxation, even just VATs, tendering production of the public good from the most efficient companies, or setting proper standards. Where government lacks information

[52] See Galperti & Strulovici (2017). Jouvet *et al.* (2000) and Karp (2017) are applications of intergenerational altruism to environmental policies.

about preferences, it can still do better, while remaining in control, for example by majority voting, by tapping into superior corporate knowledge and capabilities to promote public interests most efficiently by involving industry in the drafting of government regulation, or by supporting private initiatives such as product labeling.

The more classic government provision and regulation of public goods, paid for by taxation, is known to be imperfect, as a result of jurisdictional or political barriers, effective lobbies and creative compliance. Yet, quite a bit of government failure seems to be tolerable before the private provision of public goods becomes superior to the public. Allowing a public interest-cartel seems hardly an effective workaround for a well meaning antitrust agency operating in a intergovernmental vacuum. In the cases so far seen, the more traditional government interventions were perfectly available. Energy inefficient household appliances and coal burning electricity plants can simply be phased out by law, as cruelty to farm animals can be made illegal by putting sufficiently high minimum standards in place for treating live stock, and books and movies can be subsidized. More than a conviction that competition agencies are best placed to balance different public interests, the introduction of the public interest-cartel seems to reflect a lack of political will to regulate, or, more concerning even, a politicking of antitrust. To fix a government failure to repair one market failure (the provision of public goods) by creating another market failure (market power), that requires near perfect government market oversight, seems second-best - at best.

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Appendix - Derivations of the Model in Sections 4 and 5

Consumer $i \in \{1, .., n\}$ has a wealth endowment w_i and a utility function

$$U_i = a_i \frac{G^{1-\theta}}{1-\theta} + b_i \frac{x_i^{1-\theta}}{1-\theta} + c_i \frac{y_i^{1-\theta}}{1-\theta}.$$

For consumer i, the budget constraint is (normalizing $p_y = 1$)

$$w_i + p_g G_{-i} - p_g G - p_x x_i - y_i = 0,$$

with $g_i \geq 0$. First-order conditions for consumer i with no bounds for g_i are

$$x_i = \left(\frac{b_i p_g}{a_i p_x}\right)^{\rho} G,$$

$$y_i = \left(\frac{c_i p_g}{a_i}\right)^{\rho} G,$$

$$g_i = \frac{w_i - \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho}\right)(G_{-i} + g_N)}{p_g + p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho}},$$

so that $g_i > 0$ iff condition (12) in the text holds.

The Samuelson Condition

$\sum_{i=1}^{n} MRS_i = MRT$ for an economy after the price increase, expressed relative to the private good x_i is

$$\sum_{i=1}^{n} \frac{a_i G^{-\theta}}{b_i x_i^{-\theta}} = \frac{p_g}{p_x^c}.$$

Substituting $x_i = \frac{w_i}{p_x^c + (\frac{c_i p_x^c}{b_i})^{\rho}}$ yields (13) in the text.

No-contributors Economy

If each consumer's voluntary contribution is negative both under competition and collusion, $g_1 = ... = g_n = 0$ in both states. The public good does not enter the utility maximization, so that demands are

$$x_i = \frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}},$$

$$y_i = \frac{w_i}{1 + (\frac{b_i}{c_i p_x})^{\rho} p_x}.$$

Equilibrium utility is

$$U_i^* = \frac{1}{1-\theta}\left(a_i G^{1-\theta} + b_i\left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x})^{\rho} p_x}\right)^{1-\theta}\right),$$

where $G = g_N$, as no consumer contributes to the public good. Equilibrium utility under collusion is the same, with the higher price p_x^c and $G = g_N + g_F$, including the industry's compensation. Giving consumer i a weight α_i in a welfare function, total welfare becomes

$$SW = \sum_{i=1}^{n} \alpha_i U_i^* = \sum_{i=1}^{n} \frac{\alpha_i}{1-\theta}\left(a_i G^{1-\theta} + b_i\left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x})^{\rho} p_x}\right)^{1-\theta}\right).$$

Equating welfare in the two equilibria $(p_x, G = g_N)$ and $(p_x^c, G = g_N + g_F)$,

$$\sum_{i=1}^{n} \frac{\alpha_i}{1-\theta}\left(a_i g_N^{1-\theta} + b_i\left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x})^{\rho} p_x}\right)^{1-\theta}\right) =$$

$$\sum_{i=1}^{n} \frac{\alpha_i}{1-\theta}\left(a_i (g_N + g_F)^{1-\theta} + b_i\left(\frac{w_i}{p_x^c + (\frac{c_i p_x^c}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x^c})^{\rho} p_x^c}\right)^{1-\theta}\right),$$

which is equivalent to

$$\sum_{i=1}^{n} \alpha_i a_i g_N^{1-\theta} + \sum_{i=1}^{n} \alpha_i\left(b_i\left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x})^{\rho} p_x}\right)^{1-\theta}\right) =$$

$$\sum_{i=1}^{n} \alpha_i a_i (g_N + g_F)^{1-\theta} + \sum_{i=1}^{n} \alpha_i\left(b_i\left(\frac{w_i}{p_x^c + (\frac{c_i p_x^c}{b_i})^{\rho}}\right)^{1-\theta} + c_1\left(\frac{w_i}{1 + (\frac{b_i}{c_i p_x^c})^{\rho} p_x^c}\right)^{1-\theta}\right).$$

This condition yields the minimally required compensation level to keep total welfare constant

$$\hat{g}_F = \left(g_N^{1-\theta} + \frac{Z(c) - Z(p_x^c)}{\sum_{i=1}^{n} \alpha_i a_i} \right)^{\frac{1}{1-\theta}} - g_N, \tag{19}$$

in which

$$Z(p) = \sum_{i=1}^{n} \alpha_i \left(b_i \left(\frac{w_i}{(p + (\frac{c_i p}{b_i})^{\rho})} \right)^{1-\theta} + c_i \left(\frac{w_i}{(1 + (\frac{b_i}{c_i p})^{\rho} p)} \right)^{1-\theta} \right),$$

for $p = c$ and $p = p_x^c$, respectively.

Total industry profits in perfect competition at $p_x = c$ are zero. After raising the price to p_x^c and paying compensation $\hat{g}_F$ industry profits become

$$\Pi = (p_x^c - p_x) D_x(p_x^c) - p_g \hat{g}_F(p_x^c, p_x).$$

In order to determine analytically whether $\hat{g}_F$ can be sustainably contributed by the cartel, it suffices to investigate for a marginal cartel overcharge the sign of $\frac{\partial \Pi}{\partial p_x^c}\Big|_{p_x^c = c}$, since if a positive deviation from the cost-price $p_x = c$ yields a positive profit, there naturally exists a price $p_x^c > p_x$ at which firms make profit and consumers are compensated, while if it does not, no sustainable compensation exists due to the concavity of the profit function. At point $p_x^c = p_x (= c)$

$$\frac{\partial \Pi}{\partial p_x^c}\Big|_{p_x^c = c} = \frac{\partial (p_x^c - p_x) D_x(p_x^c, \hat{g}_F)}{\partial p_x^c}\Big|_{p_x^c = p_x} - \frac{\partial p_g \hat{g}_F}{\partial p_x^c}\Big|_{p_x^c = p_x} = D_x(p_x, \hat{g}_F) - \frac{\partial p_g \hat{g}_F}{\partial p_x^c}\Big|_{p_x^c = p_x},$$

since

$$\frac{\partial (p_x^c - p_x) D_x(p_x^c, \hat{g}_F)}{\partial p_x^c}\Big|_{p_x^c = p_x} =$$

$$\left(\frac{\partial (p_x^c - p_x)}{\partial p_x^c}\Big|_{p_x^c = p_x} \right) D_x(p_x, \hat{g}_F) + (p_x - p_x) \left(\frac{\partial D_x(p_x^c, \hat{g}_F)}{\partial p_x^c}\Big|_{p_x^c = p_x} \right) = D_x(p_x, \hat{g}_F),$$

as the latter part is zero. Even though in actual cases price increases will be discrete rather than infinitesimal, this approach allows for identifying where there is possibility for a sustainable public interest-cartel at all.

Demand $D_x(p_x^c)$ has the form

$$D_x(p_x^c) = \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} \frac{w_i}{p_x^c + (\frac{c_i p_x^c}{b_i})^{\rho}}.$$

The derivative of the costs of compensation evaluated at point $p_x^c = p_x (= c)$, using the fact that $[Z(p_x) - Z(p_x^c)]|_{p_x^c = p_x} = 0$, becomes

$$\left.\frac{\partial p_g \hat{g}_F(p_x^c, p_x)}{\partial p_x^c}\right|_{p_x^c = p_x} = \frac{p_g g_N^{\theta}}{(1-\theta)\sum_{i=1}^{n} \alpha_i a_i} \left[- \left.\frac{\partial Z(p_x^c)}{\partial p_x^c}\right|_{p_x^c = p_x} \right],$$

where

$$- \left.\frac{\partial Z(p_x^c)}{\partial p_x^c}\right|_{p_x^c = p_x} = \frac{(1-\theta)}{p_x} \sum_{i=1}^{n} \alpha_i b_i \left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}} \right)^{1-\theta}.$$

We thus finally get

$$\left.\frac{\partial p_g \hat{g}_F(p_x^c, p_x)}{\partial p_x^c}\right|_{p_x^c = p_x} = \frac{p_g g_N^{\theta}}{p_x \sum_{i=1}^{n} \alpha_i a_i} \sum_{i=1}^{n} \alpha_i b_i \left(\frac{w_i}{p_x + (\frac{c_i p_x}{b_i})^{\rho}} \right)^{1-\theta},$$

so that the sustainability condition (positive $\left.\frac{\partial \Pi}{\partial p_x^c}\right|_{p_x^c = p_x}$) is as in equation (15) in the text.

Contributors Economies

Assuming the contributor condition is satisfied for every consumer in both states of the economy, $g_i = \frac{w_i - \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho}\right)(G_{-i} + g_N)}{p_g + p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho}}$ and thus

$$G = \sum_{i=1}^{n} g_i + g_N + g_F = \left(\frac{p_g(g_N + g_F) + \sum_{i=1}^{n} w_i}{p_g + \sum_{i=1}^{n} \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)} \right),$$

with $g_F = 0$ before the price increase and $p_x = p_x^c$ after. Using $x_i = \left(\frac{b_i p_g}{a_i p_x}\right)^{\rho} G$ and $y_i = \left(\frac{c_i p_g}{a_i}\right)^{\rho} G$, equilibrium utility is

$$U_i = \frac{G^{1-\theta}}{1-\theta} \left(a_i + b_i \left(\frac{b_i p_g}{a_i p_x} \right)^{\rho(1-\theta)} + c_i \left(\frac{c_i p_g}{a_i} \right)^{\rho(1-\theta)} \right).$$

Giving consumer i a weight α_i in a welfare function, total welfare becomes

$$SW = \sum_{i=1}^{n} \alpha_i U_i^* = \frac{G^{1-\theta}}{1-\theta} \sum_{i=1}^{n} \alpha_i \left(a_i + b_i \left(\frac{b_i p_g}{a_i p_x} \right)^{\rho(1-\theta)} + c_i \left(\frac{c_i p_g}{a_i} \right)^{\rho(1-\theta)} \right).$$

Welfare in the two equilibria equal,

$$\frac{(g_N + \sum_{i=1}^{n} g_i)^{1-\theta}}{1-\theta} \sum_{i=1}^{n} \alpha_i \left(a_i + b_i \left(\frac{b_i p_g}{a_i p_x} \right)^{\rho(1-\theta)} + c_i \left(\frac{c_i p_g}{a_i} \right)^{\rho(1-\theta)} \right) =$$

$$\frac{(g_N + g_F + \sum_{i=1}^{n} g_i)^{1-\theta}}{1-\theta} \sum_{i=1}^{n} \alpha_i \left(a_i + b_i \left(\frac{b_i p_g}{a_i p_x^c} \right)^{\rho(1-\theta)} + c_i \left(\frac{c_i p_g}{a_i} \right)^{\rho(1-\theta)} \right),$$

after expressing the equilibrium level of the public good yields the minimally required compensation

$$\hat{g}_F = \frac{\sum_{i=1}^{n} w_i + p_g g_N}{p_g} \times$$

$$\left\{ \left(\frac{p_g + \sum_{i=1}^{n} \left(p_x^c (\frac{b_i p_g}{a_i q_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)}{p_g + \sum_{i=1}^{n} \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)} \right) \left(\frac{\sum_{i=1}^{n} \alpha_i \left(a_i + b_i (\frac{b_i p_g}{a_i p_x})^{\rho(1-\theta)} + c_i (\frac{c_i p_g}{a_i})^{\rho(1-\theta)} \right)}{\sum_{i=1}^{n} \alpha_i \left(a_i + b_i (\frac{b_i p_g}{a_i p_x^c})^{\rho(1-\theta)} + c_i (\frac{c_i p_g}{a_i})^{\rho(1-\theta)} \right)} \right)^{\frac{1}{1-\theta}} - 1 \right\}. \tag{20}$$

Analogous to the no-contributors case, we have that $\left. \frac{(p_x^c - p_x) D_x(p_x^c)}{\partial p_x^c} \right|_{p_x^c = p_x} = D_x(p_x)$ where

$$D_x(p_x) = \sum_{i=1}^{n} x_i = G \sum_{i=1}^{n} \left(\frac{b_i p_g}{a_i p_x} \right)^{\rho} = \left(\frac{p_g g_N + \sum_{i=1}^{n} w_i}{p_g + \sum_{i=1}^{n} \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)} \right) \sum_{i=1}^{n} \left(\frac{b_i p_g}{a_i p_x} \right)^{\rho}.$$

The derivative of the costs of compensation evaluated at point $p_x^c = p_x (= c)$ is

$$\left. \frac{\partial p_g \hat{g}_F}{\partial p_x^c} \right|_{p_x^c = p_x} = \left(p_g g_N + \sum_{i=1}^{n} w_i \right) \times$$

$$\left(\frac{(1-\rho)p_x^{-\rho}\left(\sum_{i=1}^{n}(\frac{b_i p_g}{a_i})^{\rho}\right)}{p_g+\sum_{i=1}^{n}\left(p_x(\frac{b_i p_g}{a_i p_x})^{\rho}+(\frac{c_i p_g}{a_i})^{\rho}\right)} + \frac{\rho p_x^{-\rho}\left(\sum_{i=1}^{n}\alpha_i b_i(\frac{b_i p_g}{a_i})^{\rho-1}\right)}{\sum_{i=1}^{n}\alpha_i\left(a_i+p_x^{1-\rho}b_i(\frac{b_i p_g}{a_i})^{\rho-1}+c_i(\frac{c_i p_g}{a_i})^{\rho-1}\right)} \right).$$

Some algebra reveals that the sustainability condition $\frac{(p_x^c-p_x)D_x(p_x^c)}{\partial p_x^c}\Big|_{p_x^c=p_x} \geq \frac{\partial p_g \hat{g}_F}{\partial p_x^c}\Big|_{p_x^c=p_x}$ becomes condition (16) in the text.

Critically More-Efficient Cartel Production

In a no-contributors economy, the cartel is the only actor purchasing the public good. In case when the cartel pays $p_g^c < p_g$ for the production of public goods (i.e. is more efficient than the rest of the economy), the existence of sustainable compensation condition (15) becomes directly

$$\sum_{i=1}^{n}\alpha_i a_i \sum_{i=1}^{n}\frac{w_i}{c+(\frac{c_i c}{b_i})^{\rho}} \geq \frac{p_g^c g_N^{\theta}}{c}\sum_{i=1}^{n}\alpha_i b_i\left(\frac{w_i}{c+(\frac{c_i c}{b_i})^{\rho}}\right)^{1-\theta},$$

since only the cartel increases the initial public good provision by nature.

In a contributor economy, an equivalent for (16) when cartel produces the public good at price $p_g^c < p_g$ is

$$\left(\frac{\sum_{i=1}^{n}\left(\frac{b_i}{a_i}\right)^{\rho}}{1+p_g^{\rho-1}p_x^{1-\rho}\sum_{i=1}^{n}\left((\frac{b_i}{a_i})^{\rho}+(\frac{c_i}{a_i})^{\rho}\right)} \right) \geq \frac{p_g^c}{p_g}\times$$

$$\left(\frac{(1-\rho)\left(\sum_{i=1}^{n}(\frac{b_i}{a_i})^{\rho}\right)}{1+p_g^{\rho-1}p_x^{1-\rho}\sum_{i=1}^{n}\left((\frac{b_i}{a_i})^{\rho}+(\frac{c_i}{a_i})^{\rho}\right)} + \frac{\rho\left(\sum_{i=1}^{n}\alpha_i a_i(\frac{b_i}{a_i})^{\rho}\right)}{\sum_{i=1}^{n}\alpha_i a_i\left(1+p_x^{1-\rho}p_g^{\rho-1}(\frac{b_i}{a_i})^{\rho}+p_g^{\rho-1}(\frac{c_i}{a_i})^{\rho}\right)} \right).$$

Unlike (16), the existence of sustainable compensation is not independent form the price vector $(p_g, p_x, 1, p_g^c)$ since both the cartel and consumers contribute to the public good and the consumer contribution is influenced by both p_g and p_x.

As the left hand-side is positive in both conditions, in both a contributor and a no-contributor economy there will always exist an efficiency level of cartel production of the public good (modeled as $p_g^c < p_g$) that satisfies the sustainability condition. Setting $p_g^c = 0$ satisfies it automatically.

The Pareto Criterion

Assume consumer h is the most difficult to compensate individual in society. In the all-contributor economy, the required compensation for consumer h is

$$\hat{g}_{F,h} = \frac{\sum_{i=1}^{n} w_i + p_g g_N}{p_g} \times$$

$$\left[\frac{p_g + \sum_{i=1}^{n} \left(p_x^c (\frac{b_i p_g}{a_i p_x^c})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)}{p_g + \sum_{i=1}^{n} \left(p_x (\frac{b_i p_g}{a_i p_x})^{\rho} + (\frac{c_i p_g}{a_i})^{\rho} \right)} \left(\frac{a_h + b_h (\frac{b_h p_g}{a_h p_x})^{\rho(1-\theta)} + c_h (\frac{c_h p_g}{a_h})^{\rho(1-\theta)}}{a_h + b_h (\frac{b_h p_g}{a_h p_x^c})^{\rho(1-\theta)} + c_h (\frac{c_h p_g}{a_h})^{\rho(1-\theta)}} \right)^{\frac{1}{1-\theta}} - 1 \right].$$

By similar algebra as above, $\left. \frac{\partial \Pi}{\partial p_x^c} \right|_{p_x^c = p_x} \geq 0$ iff condition (18) in the text holds.