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CONFLICT BETWEEN COMMUNITIES, CITIZEN OWNERSHIP AND THE PRODUCTION OF PUBLIC GOODS*

Laura Abrardi♦, Luca Colombo♣, Pier Angelo Mori♠

Abstract

The paper investigates the conditions under which consumer ownership should be preferred to investor ownership in economies with externalities. On making their choices investor-owners take into account producer surplus only, while consumer-owners take into account both producer and consumer surplus, whereby consumer-owned firms' objectives are naturally aligned with those of society. Nonetheless, we find that pursuing consumers' objectives may be socially less beneficial than pursuing investors', when external effects of consumption are at work. For the dominance of investor ownership there is needed a conflict, in a sense that is made precise in the paper, between the community of consumers and external communities of citizens affected by the externality. This, however, is not by itself sufficient and there is also needed the existence of a common interest between investors and the external community of citizens.

Keywords

Consumer ownership, Property rights, Public goods, Externalities, Multi-stakeholder governance

JEL Codes

D23, D62, D70, H40

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1 Introduction

If having a self-interested baker make my loaf is good in a competitive setting, it may not be so when competition is absent or limited. Indeed, the lack of competition is likely to foster what Adam Smith calls conspiracy against the public—i.e. consumers—and reduce social welfare. When this is the case, there is room for alternative production organizations, notably those where consumers own the enterprises that cater to them and, in short, produce themselves what they consume. The literature points out several disadvantages of consumer ownership relative to investor ownership. Prominent among them are dispersed ownership and limited property-rights transferability, to which there are to be added greater collective decision-making costs, as consumers typically display greater diversity among themselves than investors. On other planes, instead, consumer ownership appears to be more advantageous.

Consider the simple case of homogeneous investors and customers. On making their choices investor-owners take into account producer surplus only, while consumer-owners take into account both producer and consumer surplus, which means that in the latter case the firm's objectives are naturally aligned with society's. Then, if there are neither internal efficiency nor heterogeneity issues and firms have market power, it seems beyond doubt that ownership allocation is not irrelevant and, in particular, that placing consumers in charge of pricing improves their own welfare and society's as well. The argument just seen leads to an apparently very strong, almost tautological conclusion, but it actually refers to a specific situation from which an important element is missing—external effects. If we allow for them, matters grow more complicated and it is no longer assured that pursuing consumer objectives is socially more beneficial than pursuing those of investors.

Besley and Gathak (2001) were the first to investigate the effects of firm ownership changes on the production of public goods from the property-rights perspective. Their basic question was: who among the concerned parties should own (the assets indispensable for the production of) a public good? In that literature the actions producing external effects have the nature of non-contractable specific investments and ownership is just a means for inducing a satisfactory level of them. Besley and Gathak's main insight is that ownership of a service with a public good nature should rest with the party that has the largest subjective valuation of the external effects generated by it. This insight has been probed by a number of subsequent contributions that ask the same basic question within modified versions of the original Besley and Gathak model, allowing for additional features such as location, or unequal bargaining powers (see, e.g., Halonen-Akatwijuka and Pafilis, 2014; Müller and Schmitz, 2016, 2017; Schmitz, 2013, 2014). Here we probe Besley and Gathak's insight too but in a different direction from previous contributions.

In this paper we espouse the property-rights idea of ownership as residual rights of control and we apply it to public goods production, as in Besley and Gathak, but our focus is not on specific investments in physical assets, along the lines first traced by Grossman and Hart (1986). We consider instead a public good that is produced not by individual specific investments but by individual consumptions of private goods. However, despite the differences, Besley and Gathak's case and ours have the same basic nature, in that both involve choices that are not contractable and not transferable with firm ownership. In the circumstances we consider here, the decision powers attached to ownership concern firm's pricing strategy, as in Hart and Moore (1996). We also focus on different determinants of ownership allocation. Since in our context there are no specific investments, ownership changes have no effects on stakeholders' bargaining powers but they bring with them different owner objectives. Stakeholders' preferences are naturally identified by the economic function they embody—consumers, investors—and firm policy varies, as ownership shifts from one group to another, irrespective of whether there is a specific investment to be made.

In the literature spawned by Besley and Gathak the relation between externalities and the specific investments producing them is purely technological and exogenously given. In our model, instead, the feasibility of externality-generating actions is mediated by the market and is endogenous. Here, then, are at play two main factors of ownership allocation: the market nature and the external-effect type. A further substantial difference with Besley and Gathak and the ensuing literature is that in this paper we ask the basic question above within a *multilateral* context, instead of a bilateral one. In existing models there are involved two individuals or groups of individuals, while here we consider *three* groups of stakeholders/potential owners: a community of citizens who consume a private good and are affected by externalities generated by their own consumption; citizens, belonging to an external community, who do not consume but are affected by the externalities; investors who do not consume and are not touched by external effects. Differently from previous contributions, we also consider several types of public goods, differentiated by the nature of the external effects they have on the different communities of citizens. More specifically, we allow for two categories of public goods—those which affect only the (internal) community of consumers who generate them by their consumption and those that affect other (external) communities. The latter proves the more problematic and is the cause in our context of the results that contradict Besley and Gathak's main insight.

To pave the way for our analysis, we first elaborate a few preliminary results for the case of a single community of citizens/consumers. In these circumstances the public good can be only of the common-pool type, and this is, as usual, accompanied by free riding. We analyze market equilibria with for-profit firms and find, rather unsurprisingly, that public goods provision is inefficient, independently of market conditions, and also that the welfare ranking between perfect competition and monopoly depends on the sign of external effects. However, under the present conditions transferring decision powers to the affected people—i.e. citizens—is enough to solve the efficiency issue, as consumer-owners are able to fully control free riding through pricing. A strong result in this regard is that consumer ownership supports the first best, and hence dominates investor ownership irrespective of the degree of market competition (the result is the companion to an analogous one for the case of no externalities). Then, for the class of within-community externalities we find confirmation of Besley and Gathak's claim that the ownership of the firm(s) from whose activity externalities ultimately stem is to be assigned to the most caring party. This result obtains essentially for in the given circumstances there is no conflict among consumers. This, however, is no longer the case when there are two citizen communities touched by the external effects but only one of them takes part in the decision process that ultimately generates them. It is well known that allocative inefficiency is a likely effect of citizens' heterogeneity and attendant conflicting interests, whenever collective choices affect allocation, typically through voting (see e.g. Shepsle and Weingast, 1984, for an application of the median voter model to the analysis of public goods provision). Heterogeneity is indeed a cause of efficiency losses when allocative choices rest with political institutions, but the phenomenon is not limited to them.

To abstract from efficiency losses due to collective decision-making through voting, we keep assuming as before that the internal community is homogeneous. In these circumstances conflict can arise between communities but not within them. A first result is that conflict can arise only in the presence of *negative* externalities, either unilateral—affecting only one community—or bilateral—affecting both. When there are conflicting interests between internal and external communities, ownership by internal citizens generally fails to achieve full efficiency for society as a whole and in such situations there is room for alternative ownership structures—in particular investor ownership—to prevail. Note, however, that, though heterogeneity and conflict between communities are necessary, they are by no means enough for the result. The reason is that for comparing inefficient ownership structures the relevant criterion is *relative*, not absolute efficiency. As a matter of fact, when conflict among consumers causes citizen ownership to be inefficient in absolute terms, it does not necessarily cause it to be relatively inefficient too and for this there is required something else besides conflict. The main insight we gain in this regard is that there must be consensus of a specific kind between one group of consumers and investors.

More precisely, conflict between communities causes departures from full efficiency that are larger, the larger the conflict is. This, however, is not sufficient for the dominance of investor ownership until conflict grows so large that there arises a preference for it by the external community too. Then, the critical factor is actually not conflict but *common interest*, specifically between the external community of citizens and the investors—that is, a sort of *de facto* alliance between the two groups. Viewed from a different angle, there is no way for ownership by investors to be dominant if they do not find an 'ally' in either citizen community. Note that the condition can be extended to political firms affected by internal conflict between a majority and a minority: investor ownership dominates when investors have a common interest with the minority. In conclusion, while with just two interest groups, as in Besley and Gathak, it is the stakeholders who value the good most to win ownership, with more than two interest groups stakeholders who do not value the good most may well be owners, provided that they belong to the dominant 'alliance', i.e. that which values the good most. Then, ultimately the key factor here is which alliance cares most about the good.

The result does not change if ownership is shared. We examine this issue, by concentrating ourselves on a specific case—a citizen enterprise that includes both communities as owners. Ownership enlargement has two main effects. On the one hand, it widens the audience of those who potentially affect the collective choice. In a word, under it a larger set of preferences is aggregated. On the other hand, it increases the number of people who are called to participate financially in production by the sharing of revenues and costs. We show that shared ownership, like single-community ownership, does not warrant the attainment of the first best and may well be dominated by a for-profit organization.

Our contribution has policy implications too. At the turn of the millennium a liberalisation wave hit public utilities and, as part of this process, energy markets were opened to the private enterprise, following the vertical and horizontal unbundling of former state-owned enterprises. At the same time new forms of citizen involvement have started to appear in the form of cooperatives, community interest companies and consumer trusts. Wind farm ownership in Denmark, for example, is largely community-based, with corporate owners accounting for only 12% of total onshore plants, compared with 25% for cooperatives and 63% for farmers (Pollitt, 2010). These are hybrid forms of ownership, based on the participation of local communities, that are of the same type as the participatory firms we study here. The paper allows a better assessment of their performance against alternative organizational modes, as a basis for policy design.

The paper is organized as follows. After laying out the model in Section 2, Section 3 offers an introduction to consumer ownership and studies its behavior in the absence of externalities, by elaborating a few benchmark results. The following sections extend the basic model by allowing for externalities of various types. Section 4 deals with externalities affecting only the community that generates them (within-community externalities). Section 5 further extends the analysis to externalities that, besides affecting the hosting community, also affect external communities. Section 6 extends the analysis to shared consumer ownership, and Section 7 concludes.

2 The Model

In our economy there are one private consumer good of given quality, which is consumed by n consumers, and a numeraire good ('money'). Besides consumers, there are other individuals who do not consume and are unaffected by the external effects generated by consumption. These individuals are investors, since they are interested in money and, if they take on the ownership of a firm, they do it for purely financial reasons.

Every consumer i consumes an amount x_i of the good, $i = 1, \cdots, n$. Consumption produces an externality $f(x), x \equiv \sum_i x_i$, which enters into utility functions. In our model all consumers have the same preferences, represented by a quasi-linear utility function $u(x_i, f(x)) + W_i$, where W_i is their net wealth and $u(x_i, f(x))$ is the utility from consumption x_i and externality $f(x)$. Both the utility and the externality production functions are assumed differentiable and the utility function is also assumed concave and increasing in x_i, $u_1 > 0$. Note that the externality is of the common-pool type and has the nature of a public good, whose effects are independent of market nature and ownership changes.[1] Net wealth includes any revenues from the participation in firms' profits as shareholders or members. In the paper we allow for two main types of firms—investor-owned and consumer-owned, the latter also called 'cooperative' for brevity. We also make two simplifying assumptions: consumers participate in a firm only if this is a cooperative and the initial net wealth is zero for all, so that W_i is zero too, unless consumers are members of a cooperative.

In equilibrium total consumption equals total output, irrespective of market nature. Then, we do not have to distinguish formally between the two quantities and can use the symbol x for both. Since for our purposes there is no need to specify how output is allocated among firms, we avoid distinguishing formally between individual firms' outputs. We denote by $C(x)$ the total cost the economy bears for producing x, when its production is efficiently distributed among a given number of incumbent firms, endowed with a given technology. We also assume the cost function is twice continuously differentiable and convex. Social welfare is measured by the sum of individual utilities. Note that the summation is performed over all individuals in the economy, consumers and investors alike.

3 The benchmark case: no externalities

The paper's general aim is to study how effective alternative production organizations—differentiated by market and firm ownership—are in dealing with different kinds of external effects.

[1]The main difference with the classic examples of the commons like pastures and fisheries is that these external effects cannot be eliminated through a reallocation of property rights, as an individual's 'consumption' of an externality is in no way transferable to others.

Propaedeutical to this study is the analysis of a benchmark economy where no external effects are present. For this purpose we focus in this section on a special case of the environment outlined in Section 2, in which private goods are produced without externalities, i.e. $f(x) = 0$ for all x. Given consumer homogeneity, there is no need to distinguish individual demands formally and we set $x_i = q$ for all consumers i. Accordingly, the individual utility function is specified as $u(q)$, $u' > 0, u'' < 0$, and the aggregate demand as $x = nq$.

The first-best individual consumption q is a solution to the optimization problem

$$\max_q [nu(q) - C(nq)]$$

and must meet the following first-order condition:

$$u'(q) = C'(nq). \tag{1}$$

Note that under the assumptions made above on utility and cost functions this condition is also sufficient for a solution to the above optimization problem. Markets for the private good may have different degrees of competition on the supply side but for this paper's purposes it is enough to analyze the polar cases of perfect competition and pure monopoly, which we do in the next subsections.

3.1 Market equilibrium with for-profit firms

In this subsection we gather, for the reader's convenience, a few standard results on market equilibria with for-profit firms that will become useful later. At price p each consumer chooses a q such that

$$\max_q [u(q) - pq] .$$

The inverse demand function is then defined by the following first order condition:

$$p = u'(q), \tag{2}$$

from which one gets the individual demand function $q = (u')^{-1}(p)$.

As is well known, under *perfect competition* the only rational firm objective is profit maximization, irrespective of the nature of the firm and its owners, in particular whether they consume the good produced or not. In other words, the objectives of firm owners are wholly irrelevant to firm behavior (see e.g. Spulber, 2009). Thanks to the assumed properties of cost functions, the perfectly competitive aggregate supply function is well defined, and is obtained as usual from the condition $p = C'(x)$. Market equilibrium is then identified by the equation

$$u'(q) = C'(nq).$$

Note that this coincides with (1), which means, as is well known, that equilibrium allocations coincide with social optima.

At the opposite end of the market spectrum stands pure *monopoly*. A monopolistic for-profit firm chooses the individual price so as to maximize its profit $[pnq - C(nq)]$, i.e.

$$\max_q \left[u'(q)nq - C\left(nq\right)\right].$$

Again, the optimization problem is concave by the assumptions previously made on utility and cost functions and the equilibrium quantity solves

$$n\left(qu''(q) + u'(q)\right) - nC'(nq) = 0,$$

which simplifies to

$$qu''(q) + u'(q) = C'(nq). \tag{3}$$

From the comparison between (3) and (1), we obtain that the individual consumption in case of a monopolistic for-profit firm is lower than that in the first best for $u''(q) < 0$.

3.2 Monopolistic cooperative

The paper's focus is on firm ownership and particularly on how different ownership structures perform comparatively. The firms we dealt with in the previous subsection were all investor-owned,[2] but there is also a further structure that can arise in our context—consumer ownership. We now turn to this. Differently from investor ownership, here the ground is much less trodden and, in the absence of relevant results from the literature, we need to elaborate our own model to deal with this case.

The first step is to specify the nature of the consumer-owned firm we are going to study. Consumer ownership occurs when a firm's owners are consumers of the goods it produces. The most widespread and best-known type of this kind is certainly the consumer cooperative, where consumer ownership is combined with a democratic governance. The latter is a universal characteristic of cooperatives at large and its meaning is essentially that ultimate control powers rest with its members, who exercise them on a "one head - one vote" basis. Here we focus on consumer-owned firms belonging to this class, that will be referred to in the following simply as "cooperatives".[3] In the real world, however, there is a large variety of types under this name and, to make the subject tractable, we have to delimit the field further. For our purposes we

[2] According to the concept of firm ownership now current in Economics, the owners of a firm are identified with the persons who share a bundle of two rights—the right to control and the right to appropriate residual earnings. An early economic contribution embracing this view is Grossman and Hart, 1986; see Hansmann, 1996, for an extensive discussion.

[3] In this paper by 'cooperative' we just mean a cooperative firm, though the term might take other meanings too. There is an obvious analogy between cooperative firms, government-owned enterprises and, more generally,

can simplify matters by assuming the coincidence of consumer-customers and owners, n in number (i.e. the cooperative is of the so-called 'fully mutual' type). Two further delimitations are needed to get a meaningful representation of consumer-owned firms.

Even a minimal model cannot avoid the issue of governance. Observed consumer cooperatives mostly display a hierarchical governance structure, where a management acts under the monitoring and directions by members. Actual models of governance vary considerably in the powers that each group has and the way they are used. Some cooperatives, like large corporations, are managerial, while others tend towards direct democracy. We cannot go into the details of this topic here. What we need here is a stylized model of a cooperative with a minimal governance structure capable to capture the effects of consumer (citizen) participation in the running of a business. For this purpose we make an assumption that is usual in the literature on participatory firms (see e.g. Putterman, 1980; Farrell, 1985; Putterman and DiGiorgio, 1985; Hart and Moore, 1996; Dow and Putterman, 2000; Renstrom and Yalcin, 2003; Kelsey and Milne, 2006, 2008): we disregard the managerial layer and assume that our cooperative is directly run by its members, who make all relevant firm choices themselves (as a matter of fact, with homogeneous consumers like those we have in our context the assumption is pretty uncontroversial, see Mori, 2017, for more details).

The second delimitation we make concerns the market structure. As our analysis is essentially about pricing, the cooperative must enjoy some market power, since, if it had none, a consumer cooperative would behave just like a profit-maximizing one (see Section 3.1). Then, to simplify as much as possible, we concentrate on the monopoly market, and we assume that, when cooperative-based organizations arise, there is only one cooperative—that we call 'monopolistic cooperative'—encompassing all consumers (as a matter of fact, if consumers are equal, the participation choice is necessarily the same for all).

Consumer ownership implies that consumers are the final recipients of the profits earned by the firm they patronize. Then, member benefit is the sum of individual net utility and profit share (note that W_i coincides in this case with the profit share and is generally not zero, differently from the standard case reviewed in the previous section). We assume the two-stage action timing usual for this kind of problems (see e.g. Farrell, 1985; Spulber, 2009): at the first stage members vote on price; at the second one each of them decides her own demand, taking the price set at the previous stage as given. At each stage every individual's welfare is jointly determined by her own choices and the others'. More precisely, given the price set at the first stage, individual consumption choices jointly affect individual income from profits via the profit-sharing mechanism. At the first stage consumers' ballots jointly determine the price

democratic political institutions, in that all of them are governed, directly or indirectly, by majority rule. Thanks to this fact, our model could easily be re-interpreted to apply to political firms and political institutions at large, with citizens taking the place of consumers. However, in the present paper we will not tread this road.

at which exchanges will take place at the later stage. We thus have two nested games—a voting game and a demand game—played by the same individuals in different roles, the former in the role of owners and the latter in that of consumers. Note that in the present context the voting game actually reduces to a maximization problem, whose solution, however, cannot be worked out without knowing the solutions of the demand game.

We proceed by backward induction and start characterizing member demands for the good at price p under the uniform sharing rule. Member i's demand at price p, given the others' demands $x_{-i} \equiv \sum_{j \neq i} x_j$, is a solution to

$$\max_{x_i} \left[u(x_i) - px_i + \frac{p(x_i + x_{-i}) - C(x_i + x_{-i})}{n} \right]. \tag{4}$$

Note that under the assumptions on utility and cost functions we have made (see Section 3) a solution to this problem is likely but not sure to exist. The same is actually true of all the optimization problems we will encounter in the sequel of our analysis. Since existence issues are immaterial to our aims, we just assume that this and all the subsequent optimization problems are concave and thus have a solution.

Given price p, member i's *Nash demand* at that price, $\hat{x}_i(p)$, is her best reply to $x_{-i}(p) \equiv \sum_{j \neq i} x_j(p)$ and is formally defined by the following inequalities:

$$u(\hat{x}_i(p)) - p\hat{x}_i(p) + \frac{p(\hat{x}_i(p) + \hat{x}_{-i}(p)) - C(\hat{x}_i(p) + \hat{x}_{-i}(p))}{n} \geq$$
$$u(x_i) - px_i + \frac{p(x_i + \hat{x}_{-i}(p)) - C(x_i + \hat{x}_{-i}(p))}{n}, \forall x_i, \forall i.$$

Note that the functions $\hat{x}_i(\cdot)$ depend on the number of members n too, but we avoid making it explicit in the notation since this is a constant parameter.

It is immediate to see that under the strict concavity of the optimization problem these Nash demands are unique and equal across members, if these are homogeneous, i.e. formally $\hat{x}_i(p) = \hat{q}(p), \forall i, \forall p$. Assume to the contrary that $\hat{x}_i(p) \neq \hat{x}_j(p)$ for some i, j. Then, owing to strict concavity, the first order condition

$$u'(\hat{x}_h(p)) - \frac{n-1}{n}p - \frac{C'(\hat{x}(p))}{n} = 0 \tag{5}$$

cannot hold for $h = i, j$ simultaneously, which contradicts the assumption that $\hat{x}_i(p)$ and $\hat{x}_j(p)$ are Nash demands at p. The strict monotonicity of $u(x_i), C(x)$ also rules out multiple Nash demand functions, $\hat{q}^a(p), \hat{q}^b(p), \ldots$ Since it is common knowledge that all consumers have the same preferences, everyone knows that, once the price is set, each member will express the same individual demand $\hat{q}(p) = \hat{x}(p)/n$, where $\hat{x}(p) = \sum_{i=1}^{n} \hat{x}_i(p)$ is the aggregate demand. Then, the indirect utility function can be written as

$$U(p) \equiv u(\hat{q}(p)) - p\hat{q}(p) + \frac{pn\hat{q}(p) - C(n\hat{q}(p))}{n}. \tag{6}$$

The individual voter's choice is a solution to the maximization problem $\max_p U(p)$ and all voters will cast the same ballot, owing to preference homogeneity. The preferred price by everybody is then that meeting the first-order condition

$$u'(\hat{q}(p))\hat{q}'(p) = \frac{C'(n\hat{q}(p))\hat{q}'(p)}{n}n, \tag{7}$$

which coincides with the first best equation (1). Lastly, by comparing (7) with (1), we obtain the result stated in the following proposition (for more details see Appendix A).

Proposition 1. In the absence of externalities the monopolistic cooperative supports the first best in equilibrium.

The proposition is akin to a number of similar results on monopolistic pricing in consumer-owned firms, the first of which is due to Farrell (1985), subsequently followed by Hart and Moore (1998) and several others. Differently from what we do here, these contributions do not account for free-riding effects induced by profit-sharing and fail to notice that in the cooperative set-up consumer-member demands generally differ from standard ones, as individual consumption choices affect the size of the profits distributed to consumers and generate a sharing effect. Even though in the special case under consideration such phenomena do not show up in equilibrium, this is not generally true and taking due account of the sharing effect is important not only for a full understanding of the mechanics of cooperatives' pricing policies in the present set-up, but also for the identification of equilibria in more general contexts (Section 4).

For our purposes, it is convenient to rewrite the first-order condition (5) as

$$u'(\hat{x}_h(p)) - p + \frac{1}{n}(p - C'(\hat{x}(p))) = 0. \tag{8}$$

A *sharing effect* is generated by the third addendum of (8), which distorts demand upward when it is positive and downward in the opposite case. By increasing her consumption by one unit, a consumer-owner earns the marginal net surplus $[u'(\hat{x}_h(p)) - p]$ plus an additional income from its participation in profits, which is equal to $\frac{1}{n}[p - C'(\hat{x}(p))]$. If the income variation is positive, demand is raised beyond the level that would obtain without profit-sharing, while it is pushed below for negative values.[4] There is, however, one price where no distortion occurs—the first-best price—and this is the unanimously preferred price. When members have homogeneous preferences, the demand game at any price assigns an equal individual welfare to all of them. In Nash equilibrium this is just the sum of the (individual) gross surplus at $\hat{q}(p)$ minus the price for this quantity plus the profit share, and each addendum is exactly $1/n$ of the corresponding aggregate one, i.e. the standard social surplus at $\hat{q}(p)$. Since there is no

[4]This point is ignored by Farrell (1985) and the literature on consumer-controlled firms spawned by it.

divergence between individual and social interests, the same price optimizes both and no free riding occurs in equilibrium, as is stated in Proposition 1.

An immediate implication of the proposition is the following corollary.

Corollary 1. The monopolistic cooperative equilibrium is equivalent in welfare terms to the perfectly competitive one.

In the circumstances under consideration cooperative equilibria are characterized by the absence of demand distortions (the sharing effect is null) and thus the monopolistic cooperative exactly replicates a perfectly competitive market with investor-owned firms on the supply side. The reason for this is the cooperative's different ownership structure and particularly the members' consumption motivations behind its behaviour, that fully annihilate the impact of monopoly power.

In conclusion, without externalities there is a definite ranking of the different market organizations, with the monopolistic cooperative equivalent to a perfectly competitive market and the standard for-profit monopoly dominated by both. This is the benchmark that we will use for comparisons in the next results. In the next section we study situations in which free riding is not limited to the cooperative and, owing to externalities, it arises also in markets where suppliers are for-profit firms.

4 Externalities

In the previous section we focused on the baseline case with no externalities. Now we address the general case outlined in Section 2 where externalities arise from the consumption of the private good. In particular, we assume that there is an externality jointly produced by consumption of the private good according to the production function $f(x)$, $f'(x) > 0$ for all $x, x \equiv \sum_i x_i$.[5] The externality may be positive ($u_2 \equiv \partial u/\partial f > 0$) or negative ($u_2 < 0$). We are interested here in the differences between alternative organizations in dealing with external effects and, as before, we distinguish between for-profit and cooperative organizations.

[5]The relationship between external effects and ownership patterns is studied in the corporate governance literature (e.g. Hansen and Lott, 1996; Harford, 1997; Prinz and van der Burg, 2013). Public goods provision is also center-stage in the political economy literature on democracy (e.g., Roemer, 1993; Lizzeri and Persico, 2001; Besley and Coate, 2003). In this literature, however, the focus is on the efficiency of alternative electoral systems, while we analyze the efficiency of different ownership patterns.

4.1 Demand for goods supplied by investor-owned firms

When the private good is provided by a for-profit firm, for any price p and x_{-i}, each consumer maximizes

$$u(x_i, f(x_i + x_{-i})) - px_i \tag{9}$$

under the usual consumer budget constraint. To keep the analysis simple, here we focus on interior solutions only, hence disregarding the impact of the budget constraint.[6]

Individual i's demand at price p is a maximizer of (9) with respect to x_i, given p and x_{-i}. The demand function $x_i(p, x_{-i})$ is then a solution to the following first order condition

$$p = u_1(x_i, f(x_i + x_{-i})) + u_2(x_i, f(x_i + x_{-i}))f'(x_i + x_{-i}), \tag{10}$$

where $u_1(x_i, f(x_i + x_{-i})) = \partial u/\partial x_i$ and $u_2(x_i, f(x_i + x_{-i})) = \partial u/\partial f$.

In Nash equilibrium with homogeneous preferences there hold $x_i = x_j = q$ and $x_{-i} = (n-1)q$ for all i, j, so that equation (10) becomes

$$p = \tilde{p}(q), \tag{11}$$

where $\tilde{p}(q) = u_1(q, f(nq)) + u_2(q, f(nq))f'(nq)$. Correspondingly, we use the symbol $\tilde{q}(p)$ to denote Nash demands without sharing effects, as opposed to the Nash demands with sharing effects of the cooperative case, $\hat{q}(p)$ (with a slight abuse of notation, we use the same symbol as without externalities).

Aggregate demand at p is then $x = nq = n\tilde{q}(p)$, that can be more conveniently written as $x/n = \tilde{q}(p)$, from which we obtain the inverse aggregate demand function

$$p = \tilde{p}\left(\frac{x}{n}\right). \tag{12}$$

To ensure the existence of an interior solution we assume a downward-sloping invertible demand function for the private good, i.e.

$$\frac{\partial \tilde{p}(q)}{\partial q} < 0. \tag{13}$$

The socially optimal individual quantity is

$$q^* = \operatorname{argmax}_q \left[nu(q, f(nq)) - C(nq)\right],$$

which satisfies

$$u_1 + nu_2 f' = C'. \tag{14}$$

The socially optimal aggregate quantity is then $x^* = nq^*$. Note that a positive (negative) externality increases (decreases) the level of output relative to the situation where no external effects are present.

[6] Allowing for corner solutions would complicate the analysis somewhat without producing substantially new insights.

4.2 Perfect competition

We assume that in the case of perfect competition, all firms are for-profits. Since the perfectly competitive equilibrium price is such that $p = C'(x)$, from (12) we get

$$\tilde{p}\left(\frac{x}{n}\right) = C'(x). \tag{15}$$

Hence the equilibrium aggregate quantity in perfect competition x^{PC} solves[7]

$$u_1 + u_2 f' = C'. \tag{16}$$

By comparing (16) and (14), we can immediately state the following proposition.

Proposition 2. In a perfectly competitive equilibrium with positive (negative) consumption externalities the aggregate consumption x^{PC} is lower (larger) than the first best level.

This result is standard. The cause of overconsumption lies in a *free-riding* effect induced by the joint production of negative externalities. On working out their demands, individuals take into account the impact of the externality on themselves but not on others, whereby they consume more of the private good than is socially desirable. Analogous considerations apply to the case of underconsumption in the case of positive externalities. Note that the distortion is larger the larger is the size of the market n: when the number of consumers is high, the aggregate effect of the externality is larger and the gap between the first best and the competitive outcome is widened.

4.3 Monopolistic for-profit firm

A monopolistic for-profit firm chooses the price so as to maximize its profit, i.e.

$$\max_p \left[pn\tilde{q}(p) - C(n\tilde{q}(p))\right].$$

The first order condition for the above expression is

$$n\tilde{q}(p) + np\tilde{q}'(p) = nC'(n\tilde{q}(p))\tilde{q}'(p),$$

or, more compactly,

$$\frac{\tilde{q}}{\tilde{q}'} + p = C'.$$

Since $p = u_1 + u_2 f'$, the previous equation becomes

$$\frac{\tilde{q}}{\tilde{q}'} + u_1 + u_2 f' = C', \tag{17}$$

[7]Note that under our assumptions, the problem at hands is concave.

whose solution is x^M. By (13) the term $\tilde{q}/\tilde{q}'$ is negative and therfore $x^M < x^{PC}$. The comparison of the equilibrium equations for monopoly (17) and perfect competition (16) with that defining the first best (14) immediately yields the following proposition.

Proposition 3. In the presence of *positive* externalities ($u_2 > 0$) there holds $x^* > x^{PC} > x^M$. Conversely, under *negative* externalities ($u_2 < 0$) there holds $x^* < x^{PC}$ and $x^M < x^{PC}$.

The proposition essentially states that, when there are externalities inducing free-riding behaviors, monopoly may dominate perfect competition but only in specific circumstances. To see why, first consider what occurs with positive externalities. In this case, the aggregate consumption is larger when the good is provided by perfectly competitive firms than by a monopolistic firm. Both perfect competition and for-profit monopoly exhibit underconsumption in equilibrium, as consumers ignore the positive effects of own consumption on the other consumers but the distortion is of different size in the two markets. In standard monopoly the adverse effect of underconsumption is strengthened by the exploitation of market power through high prices, which further reduces consumption and amplifies the loss due to the externality, so that perfect competition is always preferable to for-profit monopoly.

When externalities are negative, a different outcome is instead possible. In this case perfectly competitive equilibria always display overconsumption, as consumers disregard the negative impact of own consumption on fellow-consumers' welfare. As is immediate to see, equations (14) and (16) are equal except in the marginal utilities $u_2 f'$ and $nu_2 f'$, whose divergence causes a distortion that is increasing in the consumers' number. In monopoly there occurs the same distortion but there is also a countervailing effect induced by the monopolistic exploitation of market power, which abates consumption and attendant external effects, as can be easily seen from equation (17). Since the term $\tilde{q}/\tilde{q}'$ is negative, consumption is lower, all else equal, i.e. there occurs underconsumption, which implies $x^M < x^{PC}$. If the underconsumption effect generated by monopolistic pricing is not too large—i.e. demand $\tilde{q}^{-1}(q)$ is sufficiently elastic or n sufficiently large—it mitigates the overconsumption effect due to the externality without overriding it, and the final outcome is an x^M such that $x^* \leq x^M < x^{PC}$, i.e. monopoly dominates perfect competition in welfare terms (though it does generally not attain the first best). Conversely, when market power effects are large relative to free-riding ones ($\tilde{q}/\tilde{q}'$ is large and n small), underconsumption prevails over free riding and the outcome is $x^M < x^* < x^{PC}$. In this case perfect competition may be preferable from a welfare standpoint.

As a final remark, we note that, while perfectly competitive equilibria never support the first best, standard monopoly equilibria sometimes do (i.e. $x^* = x^M$). A necessary condition for this to occur is that equations (14) and (17) have the same solution, i.e. the following condition be met

$$(n-1)u_2 f' = \frac{\tilde{q}}{\tilde{q}'}. \tag{18}$$

Since $u_2 \geq 0$ is inconsistent with this equation (recall that $\tilde{q}' < 0$), it is evident that the first-best can be supported by a for-profit monopoly equilibrium only if externalities are *negative*.[8]

4.4 Monopolistic cooperative firm

In Sections 4.2 and 4.3 we analyzed perfectly competitive and monopoly markets along usual lines. The upshot was that the dominance of perfect competition over monopoly is no longer assured when there arise externalities generating free riding behaviors. Now we look at markets served by a monopolistic consumer cooperative and here we face an entirely novel picture. The main difference with the previous analysis is that in this context consumer-owners strategically interact between themselves not only via the consumption externality $f(x)$ but also via profit-sharing. In other words, if the supplier of the private good is a cooperative, there are two external effects originating from consumption decisions, instead of one, that intertwine together—the consumption externality effect and the sharing effect, already met in Section 3.2.

The game played by consumer-members has the same two-stage structure as before. At the first stage members vote for the price p; at the second one, each of them chooses her individual consumption given the price set in the previous round. We proceed backward, as usual, and look first at the individual optimal consumption choices at the second stage. Given a price p, the decision problem faced by the representative consumer is the following variant of (4)

$$\max_{x_i} \left[u\left(x_i, f(x_i + x_{-i})\right) - px_i + \frac{p(x_i + x_{-i}) - C(x_i + x_{-i})}{n} \right]. \tag{19}$$

In Nash equilibrium individual demands at this price, $\hat{q}(p)$ (equal for all consumer members), are solutions to the following equation

$$p = \frac{n}{n-1} \left[u_1(q, f(nq)) + u_2(q, f(nq))f'(nq) - \frac{C'(nq)}{n} \right], \tag{20}$$

which is obtained by replacing $(x_i + x_{-i})$ with $n\hat{q}(p)$ in the first-order condition of problem (19). By varying p, one obtains the demand function and, given this, the individual indirect utility function under the uniform profit sharing rule[9]

$$u\left(\hat{q}(p), f(n\hat{q}(p))\right) - p\hat{q}(p) + \frac{pn\hat{q}(p) - C(n\hat{q}(p))}{n}.$$

[8]There are actually cases where condition (18) is met. One such case is when utility and cost functions are respectively

$$u(x_i, f(x)) = x_i^{\alpha} - Ax,$$
$$C(x) = cx,$$

$A > 0$, $0 < \alpha < 1$. The case is fully analyzed in an annex to the paper that can be obtained from the authors upon request.

[9]Note that, to avoid encumbering the notation too much, we keep using the symbol $\hat{q}(p)$ for individual demands under profit-sharing in the presence of externalities as well.

The latter is the individual objective function at the voting stage (first stage of the cooperative's game) and the corresponding first order condition is

$$u_1\hat{q}' + u_2 f' n\hat{q}' = \frac{1}{n}C' n\hat{q}'$$

or, more simply,

$$u_1 + nu_2 f' = C', \tag{21}$$

from which the solution x^C is worked out. Note that the latter equation coincides with the first-best condition (14). Therefore, being the cooperative's members homogeneous, they will vote unanimously for the first-best price p^* and the amount of externality produced is optimal (for more details see Appendix A). All this is summarized in the following proposition.

Proposition 4. In the presence of an externality $f(x), f'(x) > 0$, the first best is always supported by the monopolistic cooperative.

In the previous subsections we saw that in the presence of an externality a perfectly competitive market never supports the first best in equilibrium, while a for-profit monopoly may occasionally do. Then, an immediate implication of Proposition 4 is the following corollary.

Corollary 2. In the presence of an externality $f(x)$ the monopolistic cooperative dominates all market organizations based on for-profit firms weakly and some of them strictly, depending on the circumstances.

In the no-externality case the cooperative-based market organization is equivalent from a social welfare standpoint to a perfectly competitive market and the for-profit monopoly is inferior to both (Section 3.2). In the externality case, instead, there is no overall equivalence of the cooperative with either alternative, though in some cases monopoly supports the same outcome (first-best) as the cooperative (recall that perfect competition instead never does). Then, we can say that the presence of an externality reinforces the case for the participatory enterprise.

This result underscores an important difference between a competitive market and a participatory production organization integrating consumers and producers. As is well known, the externality problem we are studying can be solved through a competitive market by placing a wedge between demand and supply, for example by means of an appropriately designed Pigouvian sales tax. This solution, though, has two important limitations: first, it requires the intervention of an external agent—government—and, secondly, it is subject to the pitfalls of asymmetric information. Pigouvian taxes indeed require government's full knowledge of critical information that is privately held by the agents (namely, preferences and cost functions), in the absence of which implementation is necessarily imperfect or impossible. By contrast, in the participatory solution the first best is attained without calling in external agents and, above all, without relying on too stringent informational requirements. It is just with regard to the informational plane that the participatory solution displays one of its most appealing strengths.

Proposition 4 is the main result of this section. It bears a resemblance to Proposition 1 and it is actually an extension of it to a context with externalities, but the underlying phenomena are rather different from those at work in the context of Section 3.2. The proposition states that, under an encompassing consumer cooperative (that is, in the absence of non-member customers) and homogeneous consumer preferences, the total free-riding effect is always null in equilibrium and the first best is attained, irrespective of whether the externality is positive or negative ($u_2 \gtrless 0$).

Individual Nash demand functions, as we have seen, are defined by (20), and it is immediate to verify that the intersection of the aggregate demand with sharing, $n\hat{q}(p)$, and that without, $n\tilde{q}(p)$, occurs, as before, at the competitive market-clearing price $p^{PC} = C'(nq(p^{PC}))$. It is important to note, however, that this is no longer the first best (see equation (14)). As we have already noted, consumer-owners here interact with each other through two channels, profit-sharing and the jointly-produced externality. Let us rewrite (20) as

$$u_1(\hat{q}(p), f(n\hat{q}(p)) + u_2(\hat{q}(p), f(n\hat{q}(p))f'(n\hat{q}(p)) - p + \frac{1}{n}\left(p - C'(n\hat{q}(p))\right) = 0.$$

This is analogous to equation (8). The last addendum on the left-hand side is the sharing effect. For prices higher (lower) than p^{PC} there occurs a negative (positive) effect on private consumption. On the other hand, when $u_2 > (<)\ 0$, the distortion originating from the externality causes an under-(over-)consumption effect. In equilibrium the two distortions must be of opposite sign and equal in absolute value, so as to yield a zero total free-riding effect (Proposition 4). In other words, for $u_2 > (<)\ 0$ we must have $p^* > (<)\ p^{PC}$. An interesting point to note is that the cooperative's advantage over for-profit organizations lies not in the absence of free riding phenomena in equilibrium—on the contrary, there are two non-null such effects at work—but in the choice of a price that generates a zero *total* free riding effect.[10] What is the logic behind such a choice?

Consider each stage's choices. They both affect the welfare of people other than the decision-makers through external effects, but in different ways. The price choice effects are channelled by the Nash demand functions. As a matter of fact, choosing a price means setting a welfare level for one and all at one touch. By contrast, an individual consumption choice affects others' welfare only partially through the externality, as the final outcome depends on the fellow-consumers' choices as well. In a word, the pricing choice has a *public-good* na-

[10]Note the difference with the case of no externalities, where the sharing effect is null in equilibrium (see Section 3.2). Note also that, thanks to this fact, in that context working out calculations with $x(p)$ in place of $\hat{x}(p)$, as Farrell (1985) and others do, would bring about the same outcome. Here, instead, if we ignored the sharing effect and its role in shaping equilibria, we would be led to the wrong outcome.

ture (as noted by Silvestre, 1994) that is instead missing from individual consumption choices ('public-good' decision vs. 'private-good' decision). This difference is crucial. In the voting game consumers compute the effects of price changes on their own welfare through the Nash demands arising in the second-stage game and, in so doing, they are also forced to take into account their choices's effects on their fellow-consumers' welfare, which are instead ignored at the second stage where free-riding phenomena may appear. Though not subject to free riding, price-setting may cause other kinds of distortions, namely redistribution among members. For redistribution phenomena to materialize, however, there is required some heterogeneity among the concerned individuals. Under the conditions of this section, the cooperative organization eliminates any form of heterogeneity and, since all lose or gain from price variations in the same measure, there is no way for one member group to induce surplus transfers from another and hence no redistribution effect is actually possible (redistribution requires differentiated effects, while external effects are symmetrical here). As a consequence, it is in the interest of every consumer-owner to choose the price that annihilates free riding effects at the second stage so as to maximize social surplus, just as a benevolent planner would do (note that here, as in the case without externality, individual welfare is just one n-th of the social welfare, i.e. each component is one n-th of the corresponding total: total gross surplus, total price, total profits). In other words, there is no conflict between individual and social interests and individual and social objectives are perfectly aligned.

Let us get back one moment to for-profit monopoly. Here the choice problem is the same as in the cooperative but the choice rests with a different group of individuals, investors. This introduces a fundamental heterogeneity between two groups of social surplus recipients, one—the decision-makers'—motivated by profit-seeking and the other by consumption motives. It is this heterogeneity that makes surplus redistribution possible in this case and explains the different behavior of the two firm types. Price hikes have the effect of tilting the distribution of social surplus from consumer surplus to profits but affect its total size as well. Then, as is well known, the monopolist's choice will generally entail an upward price distortion causing redistribution of the total surplus in favor of profits, which is instead impossible in the homogeneous cooperative. Note that under our conditions a for-profit monopoly firm can occasionally support the first best (Section 4.3), and hence is sometimes equivalent to a homogeneous consumer-owned cooperative, which cannot occur without externalities. The reason is again the free riding effect. By keeping prices high, and hence consumption low relative to perfect competition, the monopolist in fact reduces the negative impact of free riding on social welfare. In particular, when external losses inflicted by free riding are strong enough relative to individual benefits from private consumption, the monopolist's choice may casually fall on the first-best price, as we saw in Section 4.3. An unusual fact occurring in our context is that perfect competition may perform worse than monopoly. Perfectly competitive markets are effective at countering for-profit firms' attempts at redistribution in their favor through high prices but in the presence of (negative) externalities they are, as it were, *too* effective, since equilibrium prices do not allow for external effects and turn out too low. Competitive equilibria thus imply a positive amount of free riding and this is the basic reason why this market organization is always dominated by the cooperative and sometimes even by monopoly.

This result offers new insights into the effects of competition. The traditional view is that competition is generally beneficial except in a few circumscribed cases, the most important of which is undoubtedly increasing returns. As is well known, when returns to scale are increasing over the whole range of output levels that can be absorbed by the market—in a word, when there is natural monopoly—it is socially preferable not to have competition in the market. For traditional theory, then, the basic factor behind 'good' monopoly is essentially technological. Here we have a further point of view: monopoly—of the right kind, it must be added—may be good for non-technological reasons as well. Even in the absence of the classical natural monopoly conditions, the joint production of external effects by private consumption or production justifies the replacement of many competing investor-owned producers with one monopolistic producer under the control of the consumers of both the private good and the public good generated by consumption (production). An essential factor for this to be true is, we have seen, free riding over which consumer ownership has better control than other organizational forms.

Summing up, this section has shown that in the homogeneity case externalities can be fully taken care of by the community of users through cooperation among themselves, without the need for altruistic attitudes (i.e. even if they are purely egoistic users) or a benevolent planner. In this case there is no room for business organizations other than consumer-owned ones either. As a matter of fact, the previous analysis has made clear that these can be socially desirable in the face of external effects *only if* individual preferences are heterogeneous.[11] There are two ways by which heterogeneity may enter into the picture. One is when members are differentiated among themselves. In this case redistribution phenomena of the same nature as in the for-profit monopoly are possible within the cooperative too, though perhaps of different intensity (the different motivations of decision-makers—consumption vs. investment—will generally play a positive role by attenuating the impact of redistribution effects). The other is what we may call external heterogeneity. In this section's circumstances the homogeneous cooperative solves the efficiency issue fully but in others it does not, as externalities may generate specific forms of heterogeneity that involve people outside the cooperative. As we will see in

[11]This holds true provided that there are no differences in internal firm efficiency across different organizational modes, as we assume in this paper. Of course, it is possible that ownership allocation affects internal efficiency and that for-profit firms are internally more efficient than the competing organizations, as some contributions in the literature claim, but here we disregard this issue.

the next section, when this occurs, not only is the cooperative generally unable to support the first best but it may even perform worse in social welfare terms than for-profits.

5 Two communities

A community is a group of individuals who consume, directly or indirectly, the consumer good produced in the economy and an economy may comprise several such communities, differentiated by some attribute. In the previous sections all consumers were equal and hence there was only one community. Suppose now that we have two separate communities. The first is just the previous section's one and includes all individuals who consume the private good. The second community is a new one and consists of individuals who do not consume the good directly but are affected by the first community's consumption via an externality. In a word, the externality produced by private consumption now affects two communities instead of one.[12] To distinguish the two communities we will then refer to them as 'internal' and 'external' respectively, and to their members as 'internal/external consumers'.

Internal consumers' preferences are represented by the utility function $u(x_i, f(x))$ of the previous section, where, we recall, $f(x)$ is the public-good effect of individual consumption on themselves. We keep assuming as before that, when a cooperative is formed, all internal consumers, and they alone, are members, as no individual from the external community is entitled to become a member (this assumption will be relaxed later). External consumers are all equal and their preferences are represented by the utility function $v(g(x))$, where $g(x)$ denotes the external effect of the private good's consumption on the members of the external community. To simplify, we also assume without loss of generality that the two communities consist of the same number of individuals, n. Finally, we assume as before that there exists a group of investors, i.e. individuals who do not consume, either directly or indirectly (see Section 2).

In the previous section we allowed for both positive and negative externalities affecting the single community that was present there. We do the same for the external community too, by allowing for both types of externalities, i.e. $v'(g(x)) \gtrless 0$. Then, altogether there are four possible cases. The following table (Table 1) provides a few concrete examples for the most significant ones.

[12] The latter community's members can actually be viewed as consumers of a sort, as they indeed consume something—the public good generated by the externality—and can be said to consume the private good indirectly.

Table 1 – Examples of externalities affecting two communities

u_2	v'	
$u_2 < 0$	$v' < 0$	(Waste management, $u_2 < 0$) The internal community is the group of residents in a neighborhood where a total amount of garbage x is produced. The waste treatment process—e.g. by incineration—produces a negative externality $f(x)$ affecting both communities, $u_2 < 0, v' < 0$. Garbage rates paid by the residents may or may not allow for the external effects and are the key market variables here.
$u_2 > 0$	$v' > 0$	(Air quality improvement) A territory uses a given amount of energy, which can be produced either from a polluting source—e.g. coal—or a green one—e.g. solar (green energy). The internal community is comprised of those who use energy and the external one of those who do not use it. Variable x is the fraction of green energy over total and $f(x)$ is an index of air quality improvement. The key market variable is in this case the differential between the price of green and non-green energy.
$u_2 \geq 0$	$v' < 0$	(Water tapping, crossed external effects, $u_2 > 0$) The internal community is located upstream of a river from which it taps water for civilian use. The more water it taps, the less is available to the downstream community. The private consumption of water by the residents, x, generates a public good $f(x)$ that affects both communities, but in a different way. In the internal community a larger x contributes to a cleaner and healthier environment, thus producing a positive externality ($u_2 > 0$). The effect on the external community's environment is just the opposite—a less clean and less healthy environment ($v' < 0$). The internal community's water rates are the key market variables. (Water pollution, $u_2 = 0$) To consume or produce an amount x of some good, the internal community discharges an amount x of untreated wastewater into a river, with no impact on itself but a negative impact on an external community living downstream.

An important point to note is the difference between the external effects of the previous section and the present one's. The externalities occurring within the community that consumes the private good, $f(x)$, have basically the same nature as the commons, with which they share two features—they are the result of joint production and are reciprocal. When a second community, that does not consume the private good, comes into the picture, a further external effect arises, $g(x)$, which is instead not of the common-pool type. Both effects generate free riding but of a different nature and different organizations will not react to them with the same effectiveness. The difference is especially striking in cooperatives. While they are capable to fully annihilate free riding phenomena within communities (Section 4.4), they are not able to do so with externalities across them. The reason, as we will see in the next section, is essentially that this kind of externality introduces heterogeneity into society that was instead absent in the single-community case. As a consequence, with inter-community externalities it is no longer true that the largest social surplus is obtained by assigning the most caring party the ownership of the firm(s) from whose activity externalities ultimately stem, as in Besley and Gathak (2001). We show that under plausible conditions it may be in the interest of consumers and of society as a whole to grant ownership to investors rather than to themselves, when there are external effects on non-hosting communities. The two driving factors are the specific nature of inter-community externality, in particular whether there is consensus or conflict between the concerned communities, and the market nature, in particular whether the for-profit firm(s) with which we compare the consumer cooperative operate(s) in perfect competition or not.

5.1 Welfare analysis of market equilibria

In the new set-up we are considering, the external community's members are affected by an externality but do not participate in the decision-making process, which still involves the same individuals as before. Since the objective function of every individual—whether consumer or investor—is not changed by the presence of the external community (i.e., on taking decisions they disregard the term $v(g(x))$), equilibria do not change either, irrespective of market nature (cooperative, perfectly competitive, monopolistic). What changes here is the social optimum and, as a consequence, the ranking of the various organizational forms under consideration changes too. The socially optimal individual quantity is now defined as

$$q_E^* = \mathrm{argmax}_q \left[nu(q, f(nq)) + nv(g(nq)) - C(nq) \right],$$

and solves the following first order condition:

$$u_1 + nu_2 f' + nv' g' = C'. \tag{22}$$

To ensure the existence of an interior solution, we assume that the LHS of equation (22) is decreasing in q. The first best with two communities q_E^* generally differs from the first best with a single community, q^*, as equation (22) differs from (14) by the term $nv'g'$. Which is the larger then depends on the final impact of the external effects, in particular the sign of u_2. The most relevant implication of this fact is that Proposition 4 ceases to hold. In the two-community case the cooperative's equilibrium quantity is still the same x^* as in the one-community context. The difference is that the first best moves away from x^*, and thus the cooperative's equilibrium no longer supports it, differently from the single-community case (Proposition 4). This in turn modifies the ranking of the different organizational forms and in particular it causes the cooperative to fall behind for-profits in some cases. The chief task of the present section is to understand what is behind the divergence between the cooperative equilibrium and the social optimum.

We start our analysis by looking at how each of the three organizational modes performs relative to the first best.

Perfect competition. In perfect competition there are two distortions at work. The first one is of the common-pool type and is due to the fact that a for-profit's customers do not take into account the impact of their consumption x_i, through $f(x)$, on the other members of the internal community, as is clear from the comparison of (22) and (16) (compare, in particular, the term $nu_2 f'$ in the former with $u_2 f'$ in the latter). The effect is overconsumption with negative externalities ($u_2' < 0$) and underconsumption in the opposite case ($u_2' > 0$). The second distortion is the consequence of internal consumers disregarding the effects of their consumption x_i on the external community, which are formally captured by the term $nv'g'$ in (22)—a term that is instead absent from (16). This results in overconsumption in the case of a negative externality on the other community ($v' < 0$), and underconsumption in the reverse case ($v' > 0$). The two effects obviously reinforce one another when they have the same sign and in this case the comparison yields a definite ranking, as is summarized in the following proposition.

Proposition 5. If $u_2 > (<)\ 0, v' > (<)\ 0$, $x^{PC} < (>)\ x_E^*$ ($x_E^* \equiv nq_E^*$).

Note that these distortions are of the same sign as those arising with a single community (Proposition 2). When the external effects have opposite signs ($u_2 > (<)\ 0, v' < (>)\ 0$), the final effect is instead indefinite and both $x^{PC} < x_E^*$ and $x^{PC} \geq x_E^*$ are possible.
To sum up, in the presence of externalities across communities a perfectly competitive equilibrium may entail overconsumption or underconsumption according to circumstances, and may also support the first best, which is instead always precluded under standard conditions with within-community externalities only. The case of opposite external effects is where differences with the single-community context are biggest.

Monopolistic for-profit. By comparing (17) with the first-best equatiion (22) it is immediately clear that there are several possible causes of departure from optimality. First of all, the for-profit monopolist disregards the impact of the externality on internal consumers (the term $nu_2 f'$ in (22)), and this brings about an over-(under-)production effect when $u_2' < (>)\ 0$. A second cause of welfare losses is that the monopolist restrains output to maximize profits (formally, the culprit is the term $\tilde{q}/\tilde{q}' < 0$ in (17)). However, it does not take into account the externality imposed on the external community ($nv'g'$ in (22)) either, and this produces under-(over-)production when $v' > (<) \ 0$.

Monopolistic cooperative. The cooperative's production choices do not take into account the externality imposed on the external community, as is immediately clear from the comparison between (21) and (22). As a consequence, under the cooperative organization there always arises over-(under-)consumption when $v' < (>) \ 0$.

5.2 Common interests, conflict and ownership

We now turn to the comparison of the different organizations in terms of social welfare. It is intuitive that a critical variable affecting the ranking is the sign of external effects and the next two propositions, which follow directly from the comparison of (16), (17), (21) and (22), confirms the intuition. Together they provide a complete characterization of the relation between equilibrium outputs under the different organizations.

Proposition 6. If both external effects are positive, $u_2 \geq 0, v' > 0$, there is a definite ranking of equilibria under the three organizations, which sees the cooperative as the dominant one, i.e. $x_E^* > x^C \geq x^{PC} > x^M$.

The sign of the externalities plays a key role here. When both externalities within and across communities are positive, the cooperative comes closer to the first best than the for-profit monopoly and even perfect competition, though it fails to attain it. The reason is that the cooperative's members do not take into account the positive effect of own consumption on the external community. A perfectly competitive market is inferior to the cooperative-based one as, in addition to the previous effect, prices disregard the positive externality involving the internal community either. Standard for-profit monopoly is inferior to both, since it is subject to the failures arising with perfectly competitive firms and moreover it also suffers from the fact that output is further reduced in order to maximize profits via higher prices.

The picture gets more complicated when external effects are negative. A necessary condition for a for-profit firm to support the first best is then that at least one negative external effect is present, $u_2 < 0$ or/and $v' < 0$, as is immediately clear from the comparison of the first-best equation (22) with the equilibrium equation for monopoly (17). As a matter of fact, the two hold simultaneously only if

$$(n-1)u_2 f' + nv'g' = \frac{\tilde{q}}{\tilde{q}'},$$

whereby, being the right-hand term negative, either u_2 or v' must be negative too. This observation leads immediately to Proposition 7.

Proposition 7. If at least one of the external effects is negative, there exists no single organization that dominates all others in every case. However, there exist definite rankings between some of the three organizations, that vary according to the combination of externality signs:

a) if $u_2 < 0, v' < 0$, there hold $x_E^* < x^C < x^{PC}$ and $x^M < x^{PC}$;

b) if $u_2 < 0, v' > 0$, there hold $x^C < x^{PC}$, $x^M < x^{PC}$ and $x^C < x_E^*$;

c) if $u_2 \geq 0, v' < 0$, there hold $x^C \geq x^{PC} > x^M$and $x^C > x_E^*$.

Part a) of the proposition states something that may sound unusual: under its conditions any organization type can be dominant with the exception of perfect competition, whereby the organizational 'choice' is actually restricted to two market structures—for-profit monopoly and cooperative monopoly. The monopolistic cooperative's advantage in social welfare terms is that it is the only organization capable to internalize the common-pool externality within internal consumers. By contrast, in perfect competition firms have no power to manipulate prices and thus fail to avoid the negative impact on welfare of this external effect and of the external effects on the outside community. This is why a perfectly competitive market performs worse than the cooperative. But it may perform worse than the for-profit monopoly too, as in the latter case the firm is led to restrain output to keep high prices, which turns out to have a better impact on the external community. In other words, there is a trade-off between internal welfare losses due to monopolistic pricing and external welfare losses due the larger consumption of the private good and larger external effects on the external community in perfect competition. There is instead no definite ranking between for-profit monopoly and cooperative and either may be dominant in terms of social welfare according to the circumstances. The for-profit monopolist reduces its output, as suggested by the presence of the term $\tilde{q}/\tilde{q}'$, and dominates the cooperative if there holds $u_2 f' + \tilde{q}/\tilde{q}' < n u_2 f'$, which requires a sufficiently low n or a sufficiently high (in absolute value) $\tilde{q}/\tilde{q}'$. When the conditions of Proposition 7.b) hold, both the cooperative and the for-profit monopolist underproduce relative to perfect competition—in the former case because it takes into account the negative effects on the internal community (free riding) and in the latter because it restrains output to keep prices high. Again, the final outcome is uncertain but now perfect competition may be welfare improving, as it brings about a higher output that implies larger positive effects on the external community. No definite ranking emerges in case c) either. The cooperative overproduces relative to the first best, because it does not take into account the negative effects on the external community. The same occurs in perfect competition too but here output is lower, owing to for-profit firms' disregard of the positive externalities on the internal community and, moreover, the difference in total output may be large enough to achieve exactly the first best outcome (when $(n-1)u_2 f' + nv'g' = 0$).

Proposition 7 has an interesting implication: when negative external effects of any kind are at play, the cooperative organization may be dominated by for-profit firms of either type, in contrast to the case of positive externalities, where we know by Proposition 6 that such a result never occurs. This fact is in itself not surprising. If we look at a cooperative more closely, it is evident that its nature is that of a political entity, similar to a legislature. That externalities are not enough to warrant government intervention in the economy is a basic tenet of the public choice school and in support of it some contributions have for example shown formally that a political firm under the democratic rule may actually yield a larger production of public bads than the market (Shepsle and Weingast, 1984; Roemer, 1993). Our results are consistent with these findings but go further as they allow new insights into the reasons why this may occur.

We already know that, when externalities concern more communities, cooperative equilibria do not always coincide with the first best. What makes a departure from optimality possible in this case? To anticipate the answer, the point is that even within cooperatives there are possible redistribution phenomena of the same basic nature, though in a different guise, as those induced by a monopolist. Such phenomena arise when internal consumption affects outside communities through externalities, while they never occur when there is a single community of homogeneous consumers (see Section 4). In other words, replacing the for-profit motive with a consumption motive in firm owners' choices does reduce perverse redistribution effects—up to the point of fully annihilating them—in this case but outside it this is no longer guaranteed and the consumption motive may even enhance them, as we will see in a moment.

The groups of potential surplus recipients are now three instead of two, as, besides the investors—who neither consume nor are affected by externalities (uncaring party)—and the consumers of the internal community, we have an external community of individuals who do not consume the private good but are affected by the externality caused by its consumption. Let us first go back to Proposition 6. Under its conditions both types of for-profit organizations cause a dissipative surplus redistribution within the internal community, exactly in the same measure as in the previous section (the variables affecting internal welfare have not changed). By contrast, with the cooperative organization, the internal social welfare is larger (it is actually maximized, as it was in the single-community case, Proposition 4) and the external community also gets a larger surplus, for in the cooperative equilibrium consumption is larger than under both types of for-profits (though not optimally so) and the external effects are positive. As a consequence, the outside community is better than under any for-profit organization. Note that the preference ordering of the for-profit price and the cooperative price is the same for the two communities. In a word, between the two communities there is a *de facto* alliance in this case—a concept that will be made precise below.

The story told by Proposition 7 is different. When there are negative external effects, the cooperative no longer supports the first best and there is no longer a definite ranking of the different organizations. In particular for-profits may now be dominant. The first fact to be noted is that the behavior of the cooperative versus the external community is qualitatively the same as the for-profit monopolist's versus internal consumers. Let us focus on the case of bilateral negative effects (the following argument can be easily adapted to the mixed cases as well). When a cooperative switches from the first-best price p^* to its preferred one, p^C, the internal consumer's surplus increases, while both the total surplus and the external community's surplus decrease. In other words, there occurs a redistribution of social surplus from the external community to the internal one, just as a redistribution of surplus from consumers to investors occurs in standard monopoly via price hikes. Note that redistribution is possible with *negative* externalities but not with positive ones. Note also that the channel by which redistribution occurs is different, here being the non-pecuniary external effect $g(x)$ in place of the pecuniary external effects on expenditures and profits caused by price variations in the for-profit monopoly. Despite this and the fact that different groups of individuals are involved, there is no doubt that the two phenomena are qualitatively the same, though possibly of different size.

Let us now examine the factors behind the indefiniteness result of Proposition 7 about the welfare ranking of the three organizations. For illustrative purposes, we focus on the case where monopoly is the dominant market organization in the class of for-profit ones and we compare this and the cooperative solution (a similar argument can be made for the case of dominant perfect competition). While a for-profit monopolist induces social welfare losses by redistribution from internal consumers to investors, the cooperative organization brings about an increase in the internal community's welfare, larger consumption of the private good and a lower welfare of the external community relative to the for-profit equilibrium. When the external welfare loss is large enough to outweigh the internal welfare loss under the for-profit organization, the latter emerges as dominant. For society as a whole what matters is the relative weight of the redistribution effects in the two situations: when the effect within the internal community—i.e. the conflict of interests between internal consumers and investors—is stronger than the redistribution effects and the conflict across communities, standard for-profit monopoly turns out a better option from a social standpoint. In conclusion, it is the relative weight of the welfare produced internally vs. that produced outside that ultimately determines the ranking and only when the external welfare has a strong weight in total welfare it is possible for a for-profit monopoly to dominate the cooperative.

It is intuitive that, when the for-profit monopoly is dominant, there must be a sort of consensus between investors and the external community and, viceversa, a conflict between internal consumers on the one side and both investors and external individuals, on the other. We now want to make this intuition precise. In collective-choice problems heterogeneous individuals generally prefer different collective actions (in the limit, every individual's preferred action differs from all others'). Nonetheless, when confronted with any couple of feasible actions, the set of individuals is partitioned into two subsets, those who prefer one and those who prefer the other option, and both subsets can be non-empty. In other words, when preferences are heterogeneous, there is not agreement between all individuals over the whole choice set, but there is always agreement within some subset of individuals over any binary choice subset or, as we can say, there is a 'common interest' between these individuals over this choice subset. Formally, given a choice set C and a set of individuals affected by the collective choice, N, we say there is a *common interest* between individuals belonging to a subset $A \subset N$ over some subset B of the choice set if they have the same preferences over the latter.[13]

In the present context there are three groups of individuals—investors, internal consumers, external consumers—and two ownership structures—investor-ownership (for-profit monopoly) and (internal) consumer-ownership (cooperative)—that, in a normative sense, constitute a choice set. A noteworthy point is that the common interests linking the different groups turn out to be the key factor behind the social ordering of the organization structures. Let us have a look into this in the case of a socially dominant for-profit monopoly (M). Each organization structure implies a definite equilibrium price and definite quantities. Then, preferences on ownership structures are just equivalent to preferences on the equilibrium prices or quantities they entail and, if we keep to the utilitarian approach to social choice, the preferences of each group are represented by the sum of individual utilities within that group.

The social welfare function is then defined by

$$W(q) = n\left[u(q, f(nq)) - pq\right] + \pi(q) + nv(g(nq)).$$

If the individual consumption in the monopoly equilibrium is denoted by q^M (corresponding to the monopoly price $p^M = x^{-1}(nq^M)$), by definition of q^C there holds

$$\begin{aligned} &n\left[u(q^C, f(nq^C)) - p^C q^C\right] + \pi(q^C) \geq \\ &n\left[u(q^M, f(nq^M)) - p^M q^M\right] + \pi(q^M). \end{aligned} \tag{23}$$

Now suppose that the for-profit monopoly is socially preferred to the cooperative, i.e.

$$\begin{aligned} &n\left[u(q^M, f(nq^M)) - p^M q^M\right] + \pi(q^M) + nv(g(nq^M)) > \\ &n\left[u(q^C, f(nq^C)) - p^C q^C\right] + \pi(q^C) + nv(g(nq^C)), \end{aligned}$$

which, together with (23), implies

$$v(g(nq^C)) < v(g(nq^M)). \tag{24}$$

By definition, q^M is such that $\pi(q^C) \leq \pi(q^M)$ ($q^M = \operatorname{argmax}_q \pi(q)$). From this and (24) it follows that there is a common interest between investors and the external community about the (monopolistic) for-profit organization structure, as is summarized by the following

[13]More formally, if $x \succeq_i y, x, y \in B \subset C, i \in A \subset N$. Individuals in N are heterogeneous if $x \succ_i y$ and $x \preceq_j y$ for some $x, y \in C$ and $i, j \in N$.

Proposition 8. A necessary condition for a for-profit monopoly to dominate the cooperative from a social standpoint is that the external community and investors have a common interest over ownership structures.

A point to be stressed is that, while investors may have a common interest with the *external* community (and, when this occurs, it is full of consequence), they cannot have a common interest with the internal community of consumers, as the latter never prefers the for-profit monopoly to the cooperative owned by itself. To see why, consider the special case where the internal community prefers the monopoly price p^M—a case that is unlikely but not impossible. Even in this case, however, consumers will prefer to own the firm, as they can still charge the price p^M, being free in this choice, but their welfare will be larger, since they would also earn the profits that go to investors under the monopolistic organization. It is then clear that the cooperative will never do worse from the standpoint of the internal welfare than the for-profit monopoly. The only community of consumers that can find the monopoly organization preferable in certain circumstances is the external one.

Proposition 8 is helpful in further clarifying the reasons why the cooperative is always dominant under positive bilateral externalities. As a matter of fact, under such conditions both internal and external communities always prefer the cooperative price or, in other words, they have a common interest with regard to the organizational form and hence for-profit monopoly turns out socially inferior. By contrast, for monopoly to be dominant there is needed conflict between the two communities of consumers—that cannot occur unless there are negative externalities—and a common interest between investors and external consumers. Note that for such conflicts to arise the external effects on each community's welfare need not be of opposite sign, provided that at least one of them is negative. Indeed, even when both effects are negative it is possible that members of the two communities are in conflict with each other and that the external ones find it convenient to 'ally' with investors.

The crux of Proposition 8 is that for-profit monopoly dominates the cooperative thanks to the fact that the external community suffers a sufficiently strong welfare loss, more precisely that the conflict (redistribution) between the monopolist and the internal community is less strong than the conflict between the two communities of consumers. It is natural at this point to ask if handing over decision-making powers to the external community by establishing an "external" cooperative might be welfare-improving. The question opens up a new perspective that is certainly worth investigating but space constraints prevent us from doing it here. We close on this subject with one final observation. Intuitively, when it is the external community that suffers more from externalities, it may be better to grant ownership to it than to the internal community. Nonetheless, in this case too inter-community conflict remains the key factor in the weighing of cooperatives against for-profit organizations and, if this turns out especially severe, it is to be expected that for-profit monopoly can still dominate over consumer-owned firms, irrespective of their internal or external nature.

Remark 1. The previous analysis is centred on the comparison between a cooperative and standard monopoly. Such a comparison is meaningful if the latter dominates perfect competition, but the converse is possible too (precisely, under the conditions of Proposition 7.b) and 7.c). When this is the case, the relevant question is whether the cooperative is dominated by perfect competition, not monopoly. It is however straightforward to check that also for the perfectly-competitive market there holds a result analogous to Propositon 8 (in the previous argument just replace monopoly price and quantities, M, with the corresponding perfectly competitive ones, PC).

Remark 2. As we have seen, though consumers, internal and external, have the same basic nature—they are driven by a consumption motive—it may well happen that some groups of consumers have closer interests to investors than to other groups of consumers. This does not occur only in the present context but it is part of a wider phenomenon associated with heterogeneity. In our model externalities are a source of heterogeneity across groups of direct and indirect consumers (homogeneous within each group). However, even direct consumers can, and will normally have heterogeneous preferences. When this is the case, within a consumer cooperative there can arise member groups with conflicting interests, that act in the same way as the internal and external communities of our model, even without externalities of any kind. Such are, typically, the majority and the minority among a cooperative's members. In this situation, when for-profit monopoly dominates the cooperative (cf. Mori, 2018, for more details), the minority has a common interest with investors, just as in our model the external community does.[14]

6 Inclusion and multiple-community ownership

So far we have dealt with firms owned by a single homogeneous class of stakeholders—either investors or consumers. Joint firm ownership by multiple stakeholder types is another organizational mode that has been debated in economics for quite a long time and has recently become the subject of a specialized literature. The basic question this literature asks is if and when governance enlargement from one stakeholder group—typically investors—to multiple ones is socially beneficial. In this section we ask the same question with reference to consumer-owned organizations.

[14] Note that it is not economic function—consumer, investor—to identify who is best suited to be owner of the public-goods production but the degree of conflict and consensus between the different interest groups. Function is not a good indicator of 'distance' between different groups of individuals.

The specific type of multi-stakeholder firm we focus on is what we call the *inclusive cooperative*, whose members are the individuals belonging to the two communities (the two communities constitute different stakeholder groups, one of which is comprised of consumers of the private good and the other of non-consumers hit by the external effects of consumption). The above question then specifies here as follows: is the inclusive cooperative more efficient than the single-community one?[15] The answer is no, or at least not always. The baseline message of Section 5 was that assigning firm ownership to the most caring party is not necessarily the socially best option when the firm produces public goods and the dominance of consumer-ownership over for-profit firms—i.e. organizations controlled by uncaring parties—is no longer warranted, differently from the case of purely private goods. The point is that inclusion, though complicating the picture somewhat, does not fundamentally alter this conclusion, as we will now see.

In dealing with inclusion we face a new problem: the cooperative resulting from the enlargement to the external community is formed by heterogeneous members. We recall that cooperatives are governed by majority rule (see Section 3.2 above). In our model this means that, since preferences are homogeneous within each community, the equilibrium price will be just that preferred by the more numerous one. To avoid unnecessary complications, we limit ourselves to considering inclusive cooperatives that encompass *all* members of both communities. We also make a simplifying assumption about their numerosity. In the previous sections, both communities were assumed to have n members. We keep the same assumption with one small tweak: we postulate that either community has just one member more than the other—which causes the prevalence of either over the other—but we make calculations as if they all had n members, as the resulting error can be ignored without damage.[16] Another issue we face is the distribution of losses. In consumer cooperatives losses are covered either by capital reductions or by transfers from members to firm. Our simple model does not allow for capital (that is equal to zero), and hence the only way to cover losses is their sharing among members. It is very unlikely that losses incurred in the production of the private consumption good can ever be passed to non-consumers and thus the loss distribution rule ought to be appropriately restricted.[17] Again, allowing for this formally would complicate calculations somewhat and,

[15]This question is relevant not only to cooperatives but more generally to democratic political institutions at large. Is the enlargement of constituencies, or a more inclusive democracy, always beneficial? More specifically, is it good to call all citizens affected by a decision to participate in the democratic choice process? The problem is fundamentally the same as that studied here and can be analyzed in a similar way (see Footnote 3 above).

[16]As a matter of fact, the results presented below are essentially qualitative and the error, being decreasing in n, becomes negligible for a sufficiently large n.

[17]If the majority is made of consumers of the private good, they would have an incentive to charge low prices in order to make non-consumers pay for part of their consumption. On the other hand, given voluntary participation, non-consumers would exit, if terms got too unfavourable to them. A full-fledged model ought to account for both

given the aims of this section, we restrict the analysis to equilibria that entail positive profits.

Inclusion has more than one effect. On the one hand, it increases the number of those who participate in the decision-making process and potentially affect the collective choice, but, on the other, it also increases the number of people who are called to take part in the sharing of profits. It has long been known that majority rule generally yields inefficient social outcomes (see Sen, 1969, for a comprehensive review) and that a constituency change may be socially beneficial or harmful depending essentially on whether it widens or narrows the distance between the median and average voters. This holds in our context too. In particular, the shift from a single-community cooperative to an inclusive one is beneficial, if it has a favourable effect on the median voter's preferences.[18] All this is fairly well understood and there is little to add. Not so clear, instead, are the distributive effects of inclusion. In particular, we do not know if inclusion is capable to cause welfare changes on its own via profit-sharing, that is when there are no changes in the firm's internal politics. This is the specific point we want to focus on and, to make the analysis as simple as possible, we consider only inclusive cooperatives controlled by the internal community, so that comparisons within the cooperative field are made between firms that have the same controlling community and thus are free from political effects triggered by majority changes.

In an inclusive cooperative, members calculate their demands for the private good in much the same way as in single-community ones. Individual demand by member i at price p, given the others' demands x_{-i}, is a solution to the following maximization problem:

$$\max_{x_i} \left[u(x_i, f(x_i + x_{-i})) - px_i + \frac{px_i + px_{-i} - C(x_i + x_{-i})}{2n} \right]. \tag{25}$$

Note that this differs from the previous sections' formulation (see problem (19)) in that profits are now divided by $2n$ instead of by n, as a result of the increase in the number of members (profit-recipients). Nash demands are derived from (25) in the same way as in Section 4.3. Let $\hat{q}^{JC}(p)$ be the individual Nash demand at price p in the inclusive case. Then, if it is the internal community to have the majority, the equilibrium price is found by solving the problem[19]

phenomena.

[18]In the median-voter model a constituency enlargement produces effects only if it changes the median voter with another one having different preferences. Under our conditions this is possible only if the external community comes into control, i.e. it is the more numerous. Moreover, for the change to benefit (harm) society, the new pivotal voter's preferences must be closer to (farther from) the average voter's, or, in other words, the external community's interests must be closer to (farther from) those of society as a whole than the internal community's. Intuitively, this requires that the external community's welfare has a substantial weight in total social welfare.

[19]Conversely, when the inclusive cooperative is controlled by the external community, the equilibrium price is a solution to the problem

$$\max_{p} \left[v\left(g(n\hat{q}^{JC}(p)) \right) + \frac{np\hat{q}^{JC}(p) - C(n\hat{q}^{JC}(p))}{2n} \right].$$

$$\max_{p}\left[u\left(\hat{q}^{JC}(p), f(n\hat{q}^{JC}(p))\right) - p\hat{q}^{JC}(p) + \frac{np\hat{q}^{JC}(p) - C(n\hat{q}^{JC}(p))}{2n}\right], \tag{26}$$

whose first order condition is (for simplicity we skip the functions' arguments)

$$\hat{q}^{JC'}\left[u_1 + u_2 f' n - C'\right] - \frac{1}{2}\left[\hat{q}^{JC} + p\hat{q}^{JC'} - C'\hat{q}^{JC'}\right] = 0. \tag{27}$$

We denote the solution to this equation by p^{JC} and this is the price chosen by the inclusive cooperative (with internal majority).

Our main interest here is in demand changes triggered by inclusion. Note that, if the LHS of (27) is negative (positive) at p^C, there holds $p^C > (<)\ p^{JC}$ by the concavity of the optimization problem (26).[20] Unfortunately, it is not possible to infer from equilibrium prices how $\hat{q}(p^C)$ and $\hat{q}^{JC}(p^{JC})$ relate to one another, because switching from the single-community to the inclusive cooperative will cause shifts in demand functions that are not easy to predict,[21] as they depend on a number of factors interacting between themselves. It is not our aim here to go into a full analysis of the problem but, even without one, it is possible to establish a few interesting facts.

Fact 1. Inclusive cooperatives can support the first best.

As we verify in Appendix B by means of a numerical example, there are indeed cases where the inclusive cooperative supports the first best. By contrast, this never occurs with single-community ones, that always entail either over- or under-consumption (Section 5.1). Therefore, when the inclusive cooperative attains the first best, it produces less (more) than the corresponding single-community one, according to the case. What is the role of inclusion in all this?

Imagine that inclusion takes place at some point, starting from the single-community cooperative equilibrium. The immediate effect of such transformation is the redistribution of profits among a larger number of recipients, now comprising the external community's members as well,[22] after which internal consumers enjoy only half the profits they did before. This reduces the value of profits to members and in fact makes for an incentive to exchange profits with consumer surplus by adjusting price and demand. Adjustments can be in either direction, depending on a number of factors (that we will see in a moment) and in some cases it happens that total demand varies in the opposite direction to the distorsions arising with a single-community cooperative, thereby compensating for them and finally raising social welfare.

[20] Note that the sign at p^C of the first addendum on the LHS of (27) depends on the sign of u_2: it is positive (negative), if $u_2 > (<)\ 0$ (see Lemma C.3 in Appendix C).

[21] So that, for example, there may simultaneously hold $p^C > p^{JC}$ and $\hat{q}(p^C) > \hat{q}^{JC}(p^{JC})$.

[22] Recall that we are restricting ourselves to inclusive cooperatives in which the internal community command a majority (see above), which implies that there not a majority change on shifting from the single-community to the inclusive cooperative.

In the case of the first example at Appendix B there occurs exactly what we have just described. In order to gain some insights into the mechanics of the process, let us have a look at the details of the example. Preferences of the internal and external communities' members are represented respectively by $u(x_i, x) = \sqrt{x_i} + Ax$ and $v(x) = Bx$, where A, B are exogenous parameters whose signs determine the type of externality each community is exposed to. Moreover, it is assumed that the production technology is linear, i.e. the cost function is given by $C(x) = cx, c > 0$. In the example under consideration parameters A and B are negative, which means that both communities are affected by negative externalities ($u_2 < 0, v' < 0$). Then, with a single-community cooperative there arises over-consumption (Proposition 7-a). On shifting to the inclusive cooperative, the LHS of (27) gets positive at p^C (marginal profit lower than marginal consumer surplus at price p^C), which calls for a demand adjustment to restore balance. More precisely, there must be a change in demand such that the internal members' marginal benefit (the LHS of (27)) *decreases*, i.e. either the consumer surplus decreases or the marginal profit increases (or a combination of the two). Note that, if the marginal utility of the consumer good is decreasing as usual, the marginal consumer surplus can decrease in response to a reduction in demand only if the marginal utility of the externality is itself decreasing. In the specific case under consideration the marginal utility is constant and thus the reduction in marginal member benefit is entirely due to an increase in marginal profit, that is obtained here through a demand *decrease* ($\hat{q}^{JC}(p^{JC}) < \hat{q}(p^C)$), because the marginal profit function is decreasing. To obtain a demand variation, price must vary too. Under the present case's conditions, in particular $u_2 < 0$, there must occur a price *increase*, since under the demand function shifts leftward at p^C, $\hat{q}^{JC}(p^C) < \hat{q}(p^C)$ (see Lemma C.2 in Appendix C) .[23]

Of course, inclusion can be welfare-improving in other situations too, possibly through different combinations of price and demand adjustments. However, the basic logic is the same in every case and the intuitive account we have just made can be adapted to the other situations where an inclusive cooperative realizes welfare gains relative to the single-community one.

As is clear from the previous analysis, inclusion actually enlarges the class of cases where consumer ownership emerges as the dominant organizational mode. This is certainly an interesting fact but it should not be overstressed. As we have seen, membership enlargement causes the marginal profit to fall below the marginal consumer surplus and the imbalance is resolved by price/demand adjustments in either direction, according to the circumstances. In the case discussed above there occurs a demand adjustment that actually reduces the distance from the first best, but in other cases the single-community's distortions are widened, not reduced.

Fact 2. The inclusive cooperative does not always dominate the exclusive cooperative.

[23] It is to be stressed again that there is no simple rule linking the signs of demand and price variations, as they depend on three factors—marginal cost, the value of private consumption to the individuals holding the majority and its external effects—interacting between themselves in complex ways.

Again, we are not interested in a full-fledged analysis and for our purposes it is enough to ascertain that there exists at least one case where an inclusive cooperative is dominated by the corresponding exclusive one. This is done by the second example of Appendix B, which belongs to the class $u_2 < 0, v' > 0$. In that case the single-community cooperative suffers from under-consumption (Proposition 7-b) and the imbalance between marginal consumer surplus and marginal profit following the shift to the inclusive cooperative is solved by a *de*crease in demand, i.e. by moving farther from the first best.

Note that dominance results similar to Fact 1 and Fact 2 are already available in the literature. Especially relevant for the analogies to the present analysis are Besley and Gathak's (2001) results about joint ownership. Their perspective, however, is different and different are the phenomena their analysis focuses on. While they analyze joint ownership in terms of bargaining, here we are concerned with the democratic process and our analysis, though leading to similar conclusions, brings to light further factors—specifically the distribution effect—that their analysis instead overlooks.

We already know circumstances where a for-profit monopolist performs better than a single-community cooperative (see Section 5.2). Since inclusive cooperatives sometimes fall behind single-community ones (Fact 2), it comes as no surprise that standard monopoly can do better than both. In the third example of Appendix B there occurs just this and Fact 3 summarizes what we have said.

Fact 3. A for-profit monopoly can dominate both the single-community and the inclusive cooperative.

What have we learned from the previous discussion? Its focus was the effects of inclusion in democratic economic organizations ("cooperatives" for short). In classical analyses of the democratic process welfare losses arise because of voters' heterogeneity and welfare changes are the consequence of either changes in voters' preferences or majority changes. Here we have brought to light a further channel by which inclusion generates welfare changes—the distribution effect. Membership enlargements, as we have seen, entail a dilution of ownership with a consequent reduction in old members' profit share. If to a constituency there are added new members, perfectly identical to the old ones, no effect ensues. The distribution effect arises only if some heterogeneity is present among members and, moreover, can occur even in the absence of changes in voters' preferences or majority.

Of course, the crucial point is the sign of these changes: do reductions in individual profit shares cause members to consume more or less in equilibrium? The above analysis, though preliminary and incomplete, has shown clearly that the final effect on equilibrium demand and social welfare can be either, depending on precisely three factors: marginal cost, the value of private consumption to the individuals holding the majority, and its external effects. It may for example occur that inclusion is followed by a decrease in total demand (production), while the single-community firm suffers from over-consumption. In such a case a membership enlargement actually produces welfare increases and, as we have seen, sometimes even allows to attain the first best. This finding is in line with the narrative of a considerable part of the literature on multi-stakeholder governance, according to which including more than one—possibly every—stakeholder group into firms' decision-making process is beneficial for society. Unfortunately, this is not always true and there are values of the three factors above for which just the opposite occurs, as our analysis has shown. In conclusion, we must be cautious on the merits of inclusion, and not only for it may bring with it adverse majority changes: we have seen that, even without them, inclusion can actually produce welfare losses for purely distributive reasons.

The fact that inclusion is generally not capable of solving the doldrums of consumer ownership elicits a further observation. The main result of Section 5.2 was that consumer ownership is dominated by for-profit firms, even under monopoly conditions, whenever severe conflict arises within the field of consumers. In that analysis the comparison was between for-profits and single-community cooperatives. The reader might suspect that the result was due to the specific structure of consumer ownership that was considered there, and that it would vanish if the restriction were removed. We have instead shown in this section that it is possible with inclusive cooperatives as well. In light of this, a reasonable bet is that the phenomenon is not restricted to the specific forms of democratic governance we have examined but is intrinsic to it.

This remark has a further implication that is worth noting. Our model takes the consumer cooperative as reference but is actually not confined to the cooperative field. In this regard, there is a common basic feature, as we have already noted (Section 3.2 above), between consumer cooperatives and government-owned enterprises, as both are governed, directly or indirectly, by majority rule. In light of this, our model can be easily re-interpreted to apply to political firms as well, with citizens taking the place of consumers. A benevolent government-owner that aims at maximizing social welfare is obviously better than any alternative but this is not a realistic hypothesis, as privatization theory underscores. Since the 90s a large body of literature has explored the privatization of both public services and government enterprises and has indicated several reasons—many of them related to internal firm efficiency—that would justify it (see e.g. Megginson and Netter, 2001). Our analysis adds a new piece to the picture, by pointing out that political governance can foster forms of exploitation of some groups of consumers/citizens by others—i.e. rent-seeking in a specific guise. The risk of exploitation is relevant to all forms of democratic governance and is not avoided just by extending voting rights to all concerned parties, as this section's analysis has made clear. What we have found is that, when conflict among different citizen groups is severe, granting decision powers over production to the concerned people is not the best solution, since the market can reduce total rent-seeking by acting as an umpire, even under the most adverse conditions to the market solution, that is monopoly. We will not elaborate further on this point here but we note that we have here the core of a new argument in favour of privatization beyond the standard ones available in the literature.

7 Concluding remarks

Assessing the relative merits of consumers' ownership vs. investors' ownership is less obvious than it may seem at first glance. On the one hand, if market power is the only distortion affecting an economy, assigning ownership to consumers is the best option in terms of overall surplus. The reason is that the firm's objectives are in this way perfectly aligned with those of society, as in their choice consumer-owners take into account both producer and consumer surplus, whereas investor-owners consider producer surplus only. On the other hand, pursuing consumer objectives may be socially less beneficial than pursuing those of investors when consumption generates externalities.

This paper investigates the optimal allocation of ownership by a model that allows for three groups of stakeholders: a community of consumers that are affected by the externalities generated by their own consumption, a community of citizens that do not consume but are affected by the externalities, and a group of investors that do not consume and are not touched by external effects.

Assuming away Pigouvian taxes or subsidies of any type (no theory of the firm is indeed possible if ownership has no impact on efficiency), the presence of externalities and their interactions with market power, by introducing a wedge between individual and social interests, make the issue of firm ownership particularly interesting. We have found that a monopolistic cooperative encompassing all consumers in the economy always supports the first best, (weakly) dominating all market organizations based on for-profit firms and, in particular, perfect competition. In the presence of consumption externalities, the perfectly competitive outcome always entails overconsumption (under negative externalities) or underconsumption (with positive externalities) due to the free riding effect generated by joint production. Indeed, while individuals take into account the marginal impact of the externality on their own welfare, they disregard the effects on others and consume more or less than would be socially desirable. Under positive externalities, the situation gets worse in welfare terms if the market is a for-profit monopoly, since the adverse effect of underconsumption is strengthened by the impact of market power on prices. It gets better, instead, in the presence of negative externalities, as monopolistic pricing dampens the impact of free riding on welfare, although the first best can only be reached under the very special situation in which the two effects exactly compensate one another. While in general for-profit firms cannot achieve the first best, the latter is naturally attained by a monopolistic cooperative. In this case, under homogeneous preferences, it is in the interest of every consumer-owner to choose the price that eliminates free riding at the second stage and thus maximizes social surplus. Hence, there is no conflict between individual and social interests, and individual and social objectives are perfectly aligned.[24] This result is especially interesting in that it provides an additional reason for a monopoly to be socially beneficial, besides the usual technological one of increasing returns to scale, that is the joint production of external effects by private consumption (production) justifies the replacement of many competing investor-owned producers with one (consumer-owned) monopolistic producer.

Different conclusions hold when there is an external community consisting of individuals who do not participate in the cooperative and do not consume the good directly but are affected by the internal community's consumption via an externality. While a cooperative can fully annihilate free riding when confined to the hosting community, it is unable to do so with externalities hitting outside communities too. The consumption motives driving mutual organizations are not enough here to rule out rent-seeking by consumers and to guarantee that different groups of consumers have common interests. Under heterogeneous preferences, the ranking of different organizations in terms of social welfare depends crucially on the signs of external effects: monopolistic cooperatives no longer support the first best and, under negative externalities, they may be dominated both by monopolistic and perfectly competitive for-profit firms. Under positive externalities the interests of the two communities are aligned but under negative ones they are conflicting. In particular, under negative externalities in a monopolistic cooperative there occurs a redistribution of social surplus from the external community to the internal one—not unlike the redistribution of surplus from consumers to investors through monopoly prices. The crucial factor here is the weight of the two redistribution effects. While the for-profit monopoly produces welfare losses owing to the redistribution from consumers to investors, the cooperative increases the internal community's welfare (via larger consumption of the private good) and it decreases the welfare of the external community relative to the for-profit equilibrium. When the conflict of interests (i.e. the redistribution effect) between internal consumers and investors is less strong than the conflict across communities, the standard for-profit monopoly turns out being welfare improving. Ultimately, the dominance of the for-profit monopoly requires a common interest between investors and external consumers, which in turn requires conflict between the communities of consumers (occurring only with negative externalities).

[24] This is not the case with a for-profit monopoly, as price setting rests with a different group of individuals—investors. This introduces a fundamental heterogeneity between those who make decisions—motivated by profit-seeking—and the consumers. The monopolist's choice entails an upward price distortion causing redistribution of the total surplus in favor of profits, which is instead impossible in the homogeneous cooperative.

Yet different findings emerge when it comes to an inclusive cooperative that encompasses all individuals belonging to the two communities as members. Shifting from a single-community cooperative to an inclusive one has two major, potentially countervailing, effects. On the one hand, it increases the number of individuals who participate in the decision-making process (a political effect); on the other, it increases the number of people who take part in the sharing of profits (a distribution effect). The relative weights of the two effects determines whether the inclusive cooperative dominates the single-community cooperative.

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Appendices

A Some properties of single-community equilibria

No externality. In Figure A.1 curves $\hat{x}(p)$ and $x(p)$ represent the aggregate demand functions with and without sharing effect, respectively.

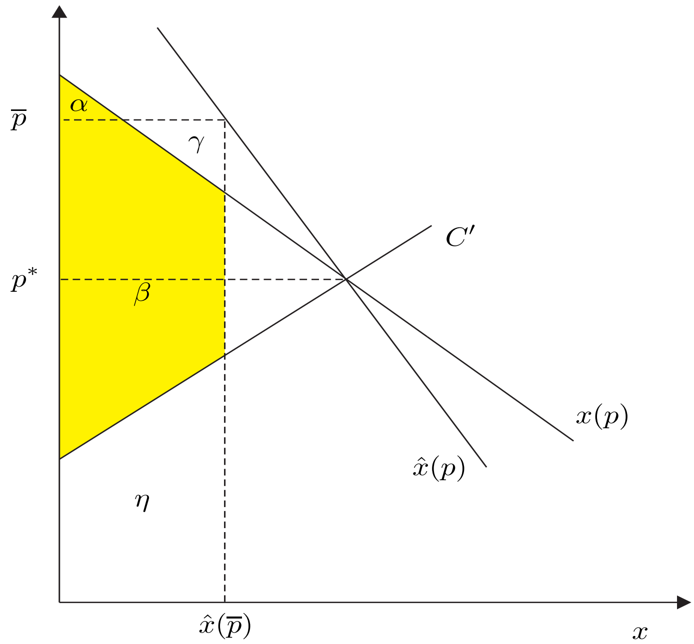

Figure A.1 – Cooperative equilibrium without externalities

Given any price $\bar{p}$ consumer-owners' total demand is $\hat{x}(\bar{p})$. The total gross surplus is equal to the area $(\alpha + \beta + \eta)$, the total price is equal to $(\beta + \gamma + \eta)$, the total profits are given by $(\beta + \gamma)$. Then, the social surplus at this price is the area of the shaded trapeze, $(\alpha + \beta)$, and the individual one is $(\alpha + \beta)/n$. It is immediately clear from Figure A.1 that the price preferred by every consumer-owner coincides with the first-best one, p^*.

Externalites. In this case it is convenient to represent the individual price choice by consumer-owners at the first (voting) stage in two steps: one first finds the welfare-maximizing quantity and then the equilibrium cooperative price is worked out through the Nash demand functions. The relevant maximization problem is

$$\max_x \left[u\left(\frac{x}{n}, f(x)\right) - p\frac{x}{n} + \frac{1}{n}\left(px - C(x)\right)\right],$$

which simplifies to

$$\max_x \left[u\left(\frac{x}{n}, f(x)\right) - \frac{C(x)}{n}\right].$$

Note that n times the maximand $nu(x/n, f(x)) - C(x)$ is just the total welfare. The solution to this problem is the first-best consumption x^*, and the corresponding cooperative price is p^*_{coop} such that $\hat{x}(p^*_{coop}) = x^*$.[25]

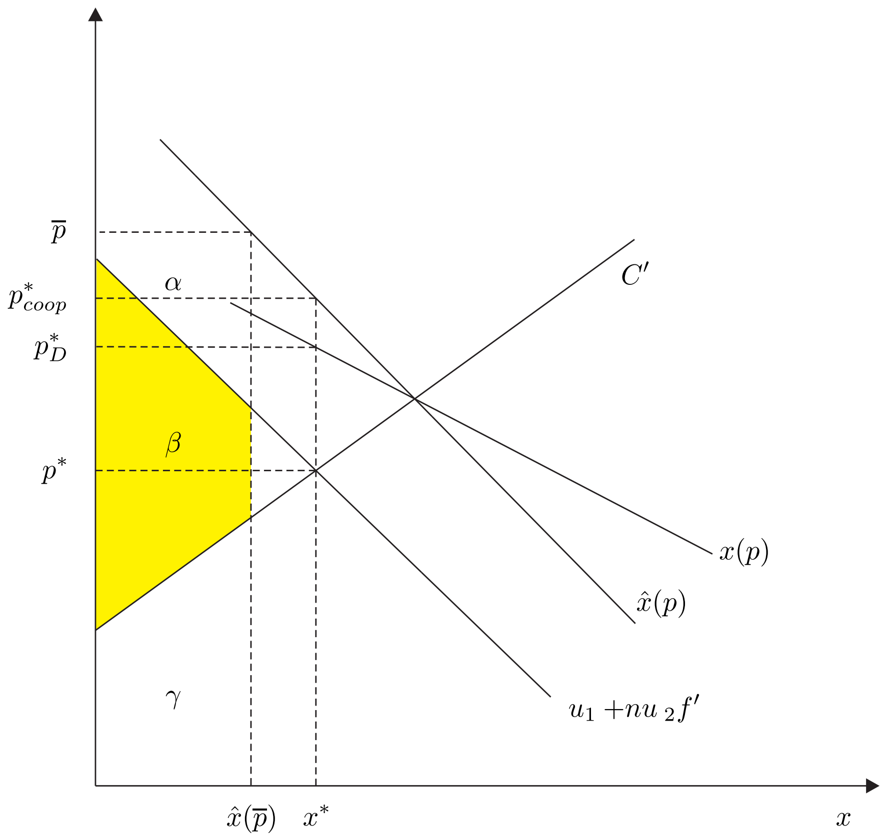

Figure A.2 – Cooperative equilibrium with externalities

Figure A.2 provides a graphical representation. The curve marked as $u_1 + nu_2 f'$ is defined by the equation

$$p = u_1(\frac{x}{n}, f(x)) + nu_2(\frac{x}{n}, f(x))f'(x).$$

In the context with externalities the equation of the standard total demand curve (no sharing effect) $x(p)$ can be derived as follows. Note that, to avoid overloading the notation, we use the same symbol as in the case without externalities. Individual i's demand at price p and the others' demands $x_{-i} < x_{-i} \equiv \sum_{j \neq i} x_j$, is a solution to the maximization problem (see optimization problem (19))

$$\max_{x_i} [u(x_i, f(x_i + x_{-i})) - px_i]$$

[25]Note that, by a slight abuse of notation, here we continue to use the same symbols for the standard total demand, $x(p)$, and the cooperative's total demand, $\hat{x}(p)$, as in the case of no externalities. See below for more.

and at a Nash equilibrium it must meet the following first-order condition

$$p = u_1\left(\frac{x(p)}{n}, f(x(p))\right) + u_2\left(\frac{x(p)}{n}, f(x(p))\right) f'(x(p)).$$

From this we immediately get $x(p) = n \overset{-1}{g}(p)$, with

$$g(x(p) \equiv u_1\left(\frac{x(p)}{n}, f(x(p))\right) + u_2\left(\frac{x(p)}{n}, f(x(p))\right) f'(x(p)).$$

In the same way it is possibile to obtain an explicit expression for $\hat{x}(p)$ in the context with externalities (note again that we keep using the same symbol $\hat{x}$ already used for the case without externalities). We skip the maximization problem and jump directly to the relevant first order condition, i.e.

$$p = \frac{n}{n-1}\left[u_1\left(\frac{\hat{x}(p)}{n}, f(\hat{x}(p))\right) + u_2\left(\frac{\hat{x}(p)}{n}, f(\hat{x}(p))\right) f'(\hat{x}(p)) - \frac{C'(\hat{x}(p))}{n}\right]. \tag{A.1}$$

From this we get $\hat{x}(p) = n \overset{-1}{h}(p)$, for

$$h(x(p) \equiv \frac{n}{n-1}\left[u_1\left(\frac{\hat{x}(p)}{n}, f(\hat{x}(p))\right) + u_2\left(\frac{\hat{x}(p)}{n}, f(\hat{x}(p))\right) f'(\hat{x}(p)) - \frac{C'(\hat{x}(p)}{n}\right].$$

Lastly, a couple of words on the position of the curves in the graph. Note that $x(p)$ is located at the right of the curve $u_1 + nu_2 f'$: this is because $u_2 < 0$, which implies that the ordinate at any x is lower on the latter curve than the former (see equation (A.1)). The position of $\hat{x}(p)$ in the graph is instead dictated by $x(p)$, as the two curves intersect at some point on C', namely at $p = C'(x(p))$, and hence the intersection with $\hat{x}(p)$ lies above the curve $u_1 + nu_2 f'$. It is straightforward to check that indeed the intersection of $\hat{x}(p)$ and $x(p)$ lies at $p = C'(x(p))$: by replacing $p = C'$ in equation (A.1), we get

$$u_1(x/n, f(x)) + u_2(x/n, f(x)f'(x) - \frac{C'(x)}{n} = \frac{n-1}{n}C'(x),$$

which is just the equation of $x(p)$ (no sharing effect).

Remark A.1. It is to be stressed that, differently from the case of no externalities, price p^* in Figure A.1 is not the first-best price. It is well known that in the face of externalities there is generally no competitive price supporting the first best allocation. However, as Pigou first showed, it is possible for a competitive market to support the first best if a wedge is driven between supply and demand prices by means of suitable taxes/subsidies. Price p^* is then the Pigouvian equilibrium supply price in a competitive market with externalities: p_D^* is the equilibrium demand price and t, $t = p_D^* - p^*$, is a sales tax which induces total consumption (output) x^*.

Remark A.2. (*Representation of the amount of social welfare produced by the cooperative*) Figure A.2 also allows to represent the amount of social welfare attained by producing and exchanging through the cooperative. Given a price $\bar{p}$ at which exchanges take place, consumer-owners' total gross surplus is equal to the area $(\alpha+\beta+\eta)$; the area $(\alpha+\beta+\gamma+\eta)$ represents the total price and $(\alpha+\beta)$ the total profits. Then, the social surplus at this price is the area of the shaded trapeze, β, and the individual one is $(\beta)/n$.

It is to be noted that the equilibrium cooperative price p^*_{coop} is larger than the competitive one (see Lemma A.1 below). As a consequence, in cooperative equilibrium with externalities, differently from the case of no externality, there occurs a positive sharing effect.

Lemma A.1.

$$p^*_{coop} = \frac{n}{n-1}\left[u_1\left(\frac{x^*}{n}, f(x^*)\right) + u_2\left(\frac{x^*}{n}, f(x^*)\right) f'(x^*) - \frac{C'(x^*)}{n}\right] > C'(x^*) \qquad \text{(A.2)}$$

Proof. By definition at x^* there holds

$$u_1\left(\frac{x^*}{n}, f(x^*)\right) + nu_2\left(\frac{x^*}{n}, f(x^*)\right) f'(x^*) = C'(x^*),$$

whence

$$u_1\left(\frac{x^*}{n}, f(x^*)\right) + u_2\left(\frac{x^*}{n}, f(x^*)\right) f'(x^*) > C'(x^*).$$

After multiplying by n we get

$$n\left[u_1\left(\frac{x^*}{n}, f(x^*)\right) + u_2\left(\frac{x^*}{n}, f(x^*)\right) f'(x^*) - C'(x^*)\right] > (n-1)C'(x^*),$$

which is just (A.2). $\square$

B Numerical Examples

We illustrate the properties discussed in Section 6 with reference to a simple economy identified by the following functional forms:

$$\begin{aligned} C(x) &= cx \\ u(x_i, x) &= \sqrt{x_i} + Ax \\ v(x) &= Bx \end{aligned} \tag{B.1}$$

where $x_i \geq 0$ and $c > 0$.

First best. The welfare-maximizing quantity q_E^* can be obtained by solving

$$\max_q \left[n\sqrt{q} + nAnq + nBnq - ncq \right],$$

whose first order condition is

$$\frac{1}{2\sqrt{q}} + An + Bn = c.$$

Hence, we immediately obtain

$$q_E^* = \frac{1}{4\left(c - nA - nB\right)^2}. \tag{B.2}$$

Exclusive cooperative. The individual demand function in the case of an exclusive cooperative of consumers is obtained by solving:

$$\max_{x_i} \left[\sqrt{x_i} + A(x_i + x_{-i}) - px_i + \frac{(p-c)(x_i + x_{-i})}{n} \right],$$

whose first order condition is

$$\frac{1}{2\sqrt{x_i}} + A - p + \frac{p-c}{n} = 0,$$

i.e. $\hat{q}(p) = \frac{n^2}{4[(n-1)p + c - An]^2}$, or

$$\hat{p}(q) = \frac{n}{n-1}\left(\frac{1}{2\sqrt{q}} + A - \frac{c}{n}\right).$$

The quantity q^C preferred by the exclusive cooperative is obtained by solving

$$\max_q \left[\sqrt{q} + Anq - \hat{p}(q)q + \frac{\hat{p}(q) - c}{n} nq \right] = \max_q \left[\sqrt{q} + Anq - cq \right].$$

The first order condition,

$$\frac{1}{2\sqrt{q}} + An = c,$$

allows to obtain

$$q^C = \frac{1}{4(c-An)^2}. \tag{B.3}$$

Inclusive cooperative of consumers. The individual demand function in the case of an inclusive cooperative with internal majority can be obtained by solving

$$\max_{x_i}\left[\sqrt{x_i} + A(x_i + x_{-i}) - px_i + \frac{(p-c)(x_i+x_{-i})}{2n}\right],$$

whose first order condition is

$$\frac{1}{2\sqrt{x_i}} + A - p + \frac{p-c}{2n} = 0.$$

By the symmetry of Nash demands in equilibrium, the previous condition can be expressed as

$$\hat{p}^{JC}(q) = \frac{n}{(2n-1)\sqrt{q}} + \frac{2An-c}{2n-1}.$$

The quantity chosen by the consumers of the joint cooperative solves the problem

$$\max_q\left[\sqrt{q} + Anq - \hat{p}^{JC}(q)q + \frac{\hat{p}^{JC}(q)-c}{2n}nq\right] =$$

$$= \max_q\left[\sqrt{q} + Anq - \left(\frac{n}{(2n-1)\sqrt{q}} + \frac{2An-c}{2n-1}\right)\frac{q}{2} - \frac{cq}{2}\right],$$

whose first order condition is

$$\frac{1}{2\sqrt{q}} + An - \frac{n}{2(2n-1)2\sqrt{q}} + \frac{2An-c}{2(2n-1)} = \frac{c}{2}.$$

By simple rearranging, we obtain:

$$\frac{3n-2}{4(cn-2An^2)} = \sqrt{q}.$$

Therefore, the equilibrium quantity and price in the case of an inclusive cooperative with consumers' majority are given by

$$\hat{q}^{JC} = \left(\frac{3n-2}{4(cn-2An^2)}\right)^2 \tag{B.4}$$

and

$$p^{JC} = \frac{n}{(2n-1)}\frac{4n(c-2An)}{3n-2} - \frac{c-2An}{2n-1} = \frac{c-2An}{2n-1}\left(\frac{4n^2}{3n-2} - 1\right), \tag{B.5}$$

respectively.

For profit monopolist. The demand function in the case of a for profit monopolist is obtained from

$$\max_{x_i} \left[\sqrt{x_i} + A(x_i + x_{-i}) - px_i\right],$$

whose first order condition is

$$\tilde{p}(q) = A + \frac{1}{\sqrt{q}}$$

We now find the profit-maximizing quantity by solving

$$\max_q \left[(\tilde{p}(q) - c)nq\right] = \max_q \left[\left(A + \frac{1}{\sqrt{q}} - c\right)nq\right],$$

whose first order condition is

$$\frac{1}{2\sqrt{q}} = c - A.$$

By rearranging, we obtain the equilibrium quantity in the case of a for profit monopolist:

$$q^M = \frac{1}{4(c-A)^2}. \tag{B.6}$$

Equilibrium quantities. For convenience, we summarize here the equilibrium quantities expressed in (B.2), (B.3), (B.4) and (B.6):

$$\begin{aligned} q_E^* &= \frac{1}{4\,(c - nA - nB)^2} \\ q^C &= \frac{1}{4(c - An)^2} \\ \hat{q}^{JC} &= \left(\frac{3n-2}{4(cn - 2An^2)}\right)^2 \\ q^M &= \frac{1}{4(c-A)^2}. \end{aligned}$$

When $n = 10, c = 1, A = -1$, $B = -0.4$, $W(q_E^*) = W(\hat{q}^{JC}) = 0.16 > W(q^C) = 0.14$, thus demonstrating Fact 1 in the main text. Note that the equilibrium prices are $p^{JC} = 14.6$, $p^C = 11$, i.e. profits are positive.
When $n = 10, c = 1, A = -1$ and $B = 0.1$, $W(q_E^*) = 0.25 > W(q^C) = 0.24 > W(\hat{q}^{JC}) = 0.22$, which proves Fact 2.
When $n = 10, c = 1, A = -1, B = 1$, $W(q_E^*) = 2.5 > W(q^M) = 1.8 > W(q^C) = 0.4 > W(\hat{q}^{JC}) = 0.3$, as expressed by Fact 3.

C Auxiliary results

Results in this Appendix are used in Section 6 of the main text.

Lemma C.1. $\hat{q}^{JC}(p) \leq (>)\ \hat{q}(p) \iff p \geq (<)\ C'(n\hat{q}(p))$.

Proof. We denote the member demand for the consumption good at price p by $\hat{q}^{JC}(p)$, if the cooperative is inclusive (JC), and by $\hat{q}(p)$, if it is single-community (C) (note that we previously used $\hat{q}(p)$ for both demands under the single-community and the inclusive cooperative, but now we need to distinguish them formally to make comparisons between them). Nash demands with the single-community cooperative are defined by equation (20), which we reproduce here for the reader's convenience:

$$p = \frac{n}{n-1}\left[u_1(q, f(nq)) + u_2(q, f(nq))f'(nq) - \frac{C'(nq)}{n}\right]. \tag{20}$$

By rearranging terms (and skipping the arguments for clarity) we rewrite it as follows

$$\frac{n-1}{n}p + \frac{C'}{n} = u_1 + u_2 f'. \tag{C.1}$$

The problem analogous to (19) for the inclusive cooperative is

$$\max_{x_i}\left[u\left(x_i, f(x_i + x_{-i})\right) - px_i + \frac{p(x_i + x_{-i}) - C(x_i + x_{-i})}{2n}\right] \tag{19 bis}$$

and the equation corresponding to (20) for this problem is

$$p = \frac{2n}{2n-1}\left[u_1(q, f(nq)) + u_2(q, f(nq))f'(nq) - \frac{C'(nq)}{2n}\right], \tag{20 bis}$$

which is convenient to rewrite (skipping the arguments) as

$$\frac{2n-1}{2n}p + \frac{C'}{2n} = u_1 + u_2 f'. \tag{C.2}$$

Let us now focus on the LHSs of (C.1) and (C.2). For any p, q such that $p \geq (<)\ C'(nq)$ there holds the following inequality

$$\frac{n-1}{n}p + \frac{C'(nq)}{n} \leq (>)\ \frac{2n-1}{2n}p + \frac{C'(nq)}{2n}.$$

Then, for any $p \geq (<)\ C'(n\hat{q}(p))$ we have

$$\frac{2n-1}{2n}p + \frac{C'(n\hat{q}(p))}{2n} \geq (<)\ \frac{n-1}{n}p + \frac{C'(n\hat{q}(p))}{n} =$$
$$u_1(\hat{q}(p), f(n\hat{q}(p))) + u_2(\hat{q}(p), f(n\hat{q}(p)))f'(n\hat{q}(p))$$

Note that the equality between the last two expressions is just equation (C.1) as specified for $\hat{q}(\cdot)$. By rearranging terms and skipping the arguments, we get that at $\hat{q}(p)$ there holds

$$0 \geq (<)\ u_1 + u_2 f' - \left(\frac{2n-1}{2n}p + \frac{C'}{2n}\right) \equiv \frac{dU^{JC}}{dp},$$

where U^{JC} is the maximand in problem (26). This inequality and the concavity of U^{JC} imply that $\hat{q}^{JC}(p) \leq (>)\ \hat{q}(p)$ if and only if $p \geq (>)\ C'(n\hat{q}(p))$. □

Lemma C.2. If $u_2 > (<)\ 0$, then $\hat{q}^{JC}(p^C) > (<)\ \hat{q}(p^C)$.

Proof. Recalling $x^C \equiv n\hat{q}(p^C)$, by analogy we define $x^{PC} \equiv nq^{PC}(p^{JC})$. By Proposition 3.1, if $u_2 > 0$, we have

$$x^{PC} < x^C \tag{C.3}$$

whence $p^{PC} = C'(x^{PC}) < C'(x^C)$. From (C.3) and the property $\hat{q}(p) \geq (<)\ q(p) \iff p \geq (<)\ C'(nq(p))$ (see Figure A.2 of Appendix A), we obtain $p^C < p^{PC}$. Moreover, by Lemma C.1, from this we get $p^C < C'(n\hat{q}(p^C)) \iff \hat{q}^{JC}(p^C) > \hat{q}(p^C)$. The reverse sign holds for $u_2 < 0$. □

Lemma C.3. If $u_2 > (<)\ 0$, the first addendum on the LHS of (27) is positive (negative) at p^C.

Proof. If we replace $\hat{q}(p^C)$ with $\hat{q}^{JC}(p^C)$ in

$$\left[u_1(\hat{q}(p^C), f(n\hat{q}(p^C))) + u_2(\hat{q}(p^C), f(n\hat{q}(p^C)))f'(n\hat{q}(p^C))\right] = 0$$

we get $\left[u_1(\hat{q}^{JC}(p^C), \ldots\right] < 0$, by Lemma C.2 and the concavity of U^{JC}, whereby—recalling that $\hat{q}' < 0$—the first addendum on the LHS of (27) is positive. □