COOPERTIVES VS OUTSIDE OWNERSHIP*

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Abstract

We are concerned with the design of a constitution for a firm -- an ex ante contract which assigns residual rights of control (and possibly residual income rights) without reference to the issue to be decided. We focus attention on two polar constitutions: nonprofit cooperatives and outside ownership. In the former, ownership is shared among a group of consumers on a one member, one vote basis. In the latter, all control rights and rights to residual income are allocated to an outsider. Ex post, agents are assumed to have asymmetric information, which rules out recontracting.

We have two main results. First, in the case of perfect competition, an outside owner achieves the first-best; a cooperative typically does not, because the rent from any cost advantage relative to the market is used to shield members from competitive pressure, and the median voter's preferences may not reflect average preferences. Second, in the case where the members of a cooperative have common preference orderings they unanimously vote for the first-best; an outsider owner typically makes inefficient decisions, tailored to the marginal rather than to the average consumer.

Keywords: Cooperatives, firms, ownership, property rights.

JEL classification nos.: D23, D71, D72, D82, L22, L31, P12, P13.

1. Introduction

It is often thought that the only efficient ownership structure in a market economy is one in which firms are owned by their investors. To be persuaded that this perspective is descriptively narrow, one need look no further than the introduction to Henry Hansmann's impressive book, The Ownership of Enterprise (1996). Hansmann paints a picture of rich diversity in ownership structure, on a broad canvas ranging from agriculture, timber, insurance, banking and the professions, to the arts, sport, religion, health, housing, education, public utilities and government itself. He points out that capitalism -- where firms are owned by the providers of capital -- is not the logical consequence of free markets and free enterprise. Even in the bastion of capitalism, the United States, capitalist firms (as so defined) are not as common as many economists might believe. In particular, there are conspicuous sectors of the US economy in which firms are owned by workers, consumers, or by some other group of "patrons" (Hansmann's generic term for people who have dealings with the firm).[1]

Ownership structures are not static. We are currently witnessing some major changes, which suggest that the costs and benefits of cooperatives may be finely balanced. For example, investment banks, advertising firms,

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[1]To quote Hansmann: in the US, employee-owned firms are widespread in the professions, such as law, accounting, investment banking and medicine; farmer-owned producer cooperatives dominate the markets for basic agricultural commodities; consumer-owned utilities supply electric power to ten percent of the population; occupant-owned condominiums are rapidly displacing investor-owned rental housing; mutual companies owned by their policyholders sell half of all life insurance and a quarter of all property and liability insurance; museums and arts organizations are overwhelmingly nonprofit; and nonprofit firms account for most nongovernmental hospitals, colleges, schools, and daycare centres, as well as a large share of nursing homes, health maintenance organizations and health insurance companies. In other developed market economies, the role of non-investor-owned firms is just as great.

medical practices, building societies and trading exchanges have changed, or are making the change, from members' cooperatives into regular profit-maximising firms. Going in the opposite direction, a debate is under way in the UK as to whether certain of the newly-privatized utilities ought to be converted from their current investor-owned status into cooperatives owned by local consumers.[2]

In this paper we develop a framework for analysing alternative ownership structures, and in particular we assess the relative merits of cooperatives, where a group of insiders own the firm, and investor-owned firms, where the firm is owned by an outsider.

Our framework is based on the "property-rights" theory of the firm (see Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995)). This theory takes the view that, first, a firm is defined by its non-human assets; and, second, in the absence of comprehensive contracts, decisions need to be taken over how these assets are used. The theory argues that the authority to make such decisions ultimately rests with the owner(s) of the firm.[3] More precisely, the owners have residual rights of control -- that is, the right to make all decisions except those that have been specified contractually.[4]

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[2]See, for example, Morse (1997).

[3]In an ideal world, in which the indefinite future can be anticipated and planned for, all decisions could be specified in an initial, enforceable contract written by the interested parties when the firm is first set up. The question as to who has authority is then irrelevant since there is nothing left to decide. In reality, transactions costs prevent the writing of comprehensive contracts, and so actual contracts are incomplete. Under these conditions, the allocation of authority matters, since those in authority make decisions with respect to which the initial contract is silent.

[4]Of course, the owners of a firm usually possess another right: the right to receive a pro-rata share of the firm's profit or residual income. There are good reasons why residual control and residual income rights are typically

The advantage of a control-based view of ownership is that it enables us to model a cooperative rather naturally. We suppose that in a cooperative decisions are taken on a one-member, one-vote basis. Different cooperatives have different patrons as members. We consider a consumer cooperative; specifically, we study a situation where a firm supplies consumers with a particular quality of a good at a particular price, and the question is, what should the quality and price be? The reason for analyzing consumer cooperatives is that they are relatively simple. However, we believe that the main ideas of the paper will extend to other kinds of cooperative.

Our model focuses on ex post inefficiencies, arising from asymmetries of information.[5] We consider a firm that has assets in place, with the capacity to supply up to I individuals, each of whom consumes at most one unit of a good. Ex ante the I individuals are identical, but ex post they privately learn their willingness to pay for the firm's output. In Section 2 of the paper, the type of output is fixed, and the only decision is what price to charge. If the firm is owned by an outsider (who possesses all the residual income rights as well as all the residual control rights), there is a textbook inefficiency: the owner, who faces a distribution of consumers with different willingnesses to pay and has some monopoly power, extracts maximum surplus by charging a price above cost. As a result, some individuals are excluded who would consume in the first-best. That is, there is inefficient exclusion. Moreover, if the outside owner also chooses the type of output to supply -- the subject of Section 3 -- then she will gear

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bundled together: if someone had control rights but did not receive any of the profit then he (or she) would not necessarily have an incentive to maximize the firm's value. However, the property rights theory views the question of who earns the profit as secondary to the question of who controls the firm's assets. Indeed, many cooperatives are nonprofit organizations.

[5]That is, unlike in much of the literature on incomplete contracts and control (including our own earlier work), we are not focussing on ex ante inefficiencies arising from specific investment and hold-up.

this choice to the willingness to pay of the marginal consumer, rather than the average consumer (as in Spence (1975)). Hence, there will be a distortion in quality as well.

In contrast, a cooperative chooses price and quality by a vote. For much of the paper we focus on a nonprofit cooperative, whose members' charter (the ex ante contract) rules out the payment of dividends. Thus a nonprofit cooperative charges a price that just covers cost. Suppose the cooperative has I members, "insiders". If all of them choose to consume, then, given a particular choice of quality, average cost pricing means they pay $p = \frac{F}{I}$, where F is the total production cost. (We normalize marginal cost to zero, up to capacity I.) However, at this price some members may choose not to consume (they may quit), in which case there will be spare capacity.

We suppose that the cooperative can use any of its spare capacity to sell to outsiders -- who have a reservation price p* -- and can price discriminate against them by charging them p* (the outside owner can also charge outsiders p*). The additional revenue brought in from outsiders can be used to lower the price to insiders, p, below $\frac{F}{I}$. Of course, this may deter more insiders from quitting, so we are looking for a fixed point for p.[6]

Overall, there is inefficient inclusion: certain insiders choose to consume because their willingness to pay is more than p, albeit less than p*. In the first-best, these insiders would be displaced by outsiders. The source of the inefficiency is the cost advantage enjoyed by the cooperative. The gap Ip* - F can be thought of as "rent", which the cooperative uses to subsidize (inefficient) consumption by its members.[7]

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[6]We assume that p* is greater than $\frac{F}{I}$. If p* were less than $\frac{F}{I}$ then outsiders could not be brought in at p* (otherwise the insiders would quit and consume as if they were outsiders), which means that the price to insiders, p, would have to rise above $\frac{F}{I}$ in order to cover cost.

[7]If F > Ip* then there is no inefficient inclusion, but there may be inefficient exclusion; see footnote 6.

Suppose now that the cooperative chooses quality as well as price. For simplicity, we consider only two levels of quality -- corresponding, say, to whether or not an investment is undertaken. The median member's wishes will be decisive in a vote, rather than the average member's, and this typically leads to inefficiency. For example, suppose that, whatever the investment decision, a majority of members have a small payoff (net of cost), but they are slightly better off if the investment does not go ahead. And suppose that the minority consist of members who stand to gain a great deal if the investment does go ahead. In such circumstances, the efficient decision is clearly to invest, but this will be blocked by the majority.[8] Moreover, any attempt by the minority to bribe the majority into changing their minds is thwarted by free-riding on the part of the individual members of the minority: the asymmetry of information (combined with large numbers) means that no individual can be forced to contribute to the bribe.

Thus, a cooperative and outside ownership are both inefficient, but in different ways. The central question we address is: which of the two ownership structures -- cooperative or outside ownership -- is less inefficient. One can think of the firm as having been set up initially by a developer, who is choosing between selling to a cooperative of I consumers and selling to an outsider. Given that ex ante, prior to learning their type, all I consumers are identical (and risk neutral), the developer has an incentive to choose the ownership structure that maximizes total expected net surplus, since this way he maximizes his own profit.[9]

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[8] As in Buchanan and Tullock (1962).

[9] An important question to ask is whether there are ownership structures other than cooperative or outside ownership which do even better than these two forms. Related to this, can "mechanisms" remove some of the inefficiencies of ownership? We discuss these issues further in Section 5. The crucial point to grasp is that the machinery of classical mechanism design, which makes use of game forms that map from abstract message spaces into outcomes, cannot be used (at least directly) in our context, because outcomes cannot be described in advance. That is, the only feasible mechanisms are "issue-free" contracts, or <u>constitutions</u>, of which ownership is a leading example.

Although it is hard to rank cooperative and outside ownership in general, we can make progress in two special cases. The first relates to perfect competition. Suppose that the output the firm produces if it doesn't invest, and the alternative output it produces if it does invest, can both be purchased on competitive markets. Moreover, assume that there are no transaction or transportation costs, i.e., insiders can costlessly trade on the external market. In these circumstances, an outside owner faces a perfectly elastic demand curve for each type of output. In consequence, she makes an efficient investment decision. (Also an outside owner does not exclude anyone.) Notice that our definition of perfect competition says nothing about costs. A cooperative may enjoy rent, which enables a majority to vote through an inefficient investment decision at the expense of a minority. (The cooperative may also exhibit over-inclusion of insiders.) In other words, a cooperative may be inefficient even under perfect competition. The reason is that rent shields the cooperative from outside competition, and renders the minority vulnerable to exploitation: members of the minority have no credible outside options, because rent subsidizes the price and makes quitting unattractive.[10]

In short, competition is good for outside ownership, relative to cooperatives.

Our second result concerns the case of common ranking. Suppose all the insiders rank the two output choices in the same way, net of costs. Then, provided that there is no inefficient inclusion, the cooperative achieves first-best, since the members unanimously vote for it. Notice that such homogeneity of opinion is not the same as saying that all the insiders have

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[10]We should add a caveat. In most of the paper we do not allow cooperative members to sell their places to outsiders. If membership sales are allowed, then in a perfectly competitive environment, a cooperative (like an outside owner) achieves first-best. However, there are costs to allowing membership sales, as well as benefits, and, as we illustrate in Section 4, in general it may be better for a cooperative to ban them.

the same net valuations (i.e., relative to quitting), since they may have different outside opportunities. Net valuations are what matter to an outside owner who wishes to extract surplus. For screening purposes, an outside owner typically makes inefficient investment decisions, even when all the insiders have a common ranking of the two output choices.

In sum, our second principal result states that homogeneity of opinion across the membership is good for cooperatives, relative to outside ownership. An implication of this is that cooperatives work well if their activities are narrowly defined, in which case presumably members' interests are aligned. Cooperatives are poor at dealing with significant change, when members' interests are likely to diverge.

To corroborate our second result, note that a major theme of Hansmann's book, supported by an array of case-studies, is that homegeneity is crucial to the smooth running of cooperatives.

We have chosen to place emphasis on nonprofit cooperatives because they lie at one end of a spectrum, which has outside ownership at the opposite end. Members of a nonprofit cooperative are only concerned with their consumption benefit, whereas an outside owner is solely interested in profit. Alternative forms of cooperative lie in between these two extremes. In particular, a for-profit cooperative pays a dividend to all members, irrespective of their individual consumption choice; here, the members put equal weight on profit and consumption benefit. This is no more than an intermediate case: there are essentially no new effects. As we proceed with our analysis, we will periodically discuss the difference that the payment of dividends makes; and we consider the matter more fully in Section 4.

The paper is organized as follows. Section 2 deals with the simple pricing model. Our main model, of investment choice, is presented in Section 3, which contains the two principal results. Section 4 asks whether cooperatives ought to allow membership sales, and whether they should pay dividends. In Section 5 we examine the feasibility of ex post renegotiation, and ask whether there exist better ex ante ownership structures, or other kinds of mechanism for making decisions. Section 6 briefly reviews the literature. Finally, Section 7 discusses lines of further research, and touches on a number of problems peculiar to cooperatives which our model does not capture.

2. A Simple Model: Pricing

Consider a collection of I risk neutral individuals, who are interested in consuming a good (or service); the good might also be an input required for a production process, i.e., the individuals might be producers rather than consumers. At date 0, the assets needed to produce the good are already in place: these assets define the firm.[11] It is only later, at date 1, that the assets are used to provide the good for the I individuals, and maybe for others too. The questions we will be interested in are: what type of good will be provided and how much will people have to pay for it?[12]

For the reasons discussed in the Introduction, we compare two types of ownership structure for the firm, to be chosen at date 0. One is a nonprofit cooperative, whereby the I individuals collectively own the assets, on a one-member, one vote basis; the members' charter rules out the payment of dividends at date 1. The other is outside ownership, whereby the assets are owned by an entrepreneur who does not consume the product, and who wishes to maximize profit (the entrepreneur possesses all the residual control and income rights).[13]

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[11] There may be investment at this date, but this is not modeled.

[12] The reader may find it helpful to have some examples in mind. The firm might be a tennis or golf facility and the good might be tennis or golf services enjoyed by players. Or the firm might be a stock exchange or a grain warehouse, and the good might be services provided to brokers or market makers, or to wheat farmers who wish to store their grain.

[13] We ignore any tax considerations that might, for example, tilt the choice towards a nonprofit cooperative.

We begin, here in Section 2, by considering the case where only one type of good can be provided at date 1. The question then is, what will the price of this good be, and who will consume it? Contracts are incomplete, in the sense that the price cannot be determined until date 1, whatever ownership structure is chosen at date 0.

We make a number of simplifying assumptions. First, we suppose that there is a fixed cost F of supplying the good, and we normalize the marginal cost of supply to be zero, up to a capacity constraint of I units.[14] Each unit is indivisible. Moreover, each individual consumes at most one unit, i.e., there is just enough capacity to supply all I individuals.

Second, we assume that each individual $i = 1,\ldots,I$ can consume the good provided by this firm and obtain a payoff u_i or can consume in the outside market and obtain a payoff w_i (all payoffs are monetary).[15] u_i and w_i are privately known by individual i. In what follows, all that matters are the net payoffs:

$$u_i - w_i = a_i, \text{ say.}$$

Although the I individuals are heterogeneous ex post (at date 1), we assume that they are identical ex ante (at date 0), in the sense that, for each i, (u_i, w_i) is drawn from the same probability distribution, which is common knowledge. Finally, we suppose that I is sufficiently large that the realized distribution of payoffs approximately equals the probability distribution from which they are drawn.

One interpretation of the above is that an identical good to the one

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[14] We take I as exogenous. See the remarks in Section 7.

[15] We assume that it is impossible for a consumer to buy the good and then resell it.

provided by this firm is available in an outside market at a competitive price π^*. Let t_i be the transaction (or transportation) cost that insider i must incur to trade in the outside market, and suppose that insider i has the option of not trading at all. Then $w_i = \max (u_i - \pi^* - t_i, 0)$, and $a_i = \min (\pi^* + t_i, u_i)$.

Just as these I "insiders" can consume "outside", we suppose that "outsiders" have an interest in consuming the good "inside". We represent this by a perfectly elastic demand curve by outsiders at a reservation price equal to p^*. One interpretation is that outsiders can trade in the outside market at price π^*, or can pay a transaction cost t to consume inside, i.e., $p^* = \pi^* - t$.

An important special case occurs when transaction costs are zero. Then $p^* = \pi^*$ and $a_i = \min (\pi^*, u_i)$, i.e., $a_i \leq p^*$ for all i. In fact, we take this last condition as the defining property of <u>perfect competition</u>:

$$a_i \leq p^* \quad \text{for } i = 1,\ldots,I.$$

Notice that this definition of perfect competition makes no reference to cost. For small enough F, the firm may enjoy a cost advantage relative to the market, in that it could supply I outsiders at price p^*, and earn a positive profit, or <u>rent</u>, $Ip^* - F$.[16]

It turns out that the model has different properties according to whether average cost is less or greater than the reservation price of outsiders, i.e., $\frac{F}{I} \leq p^*$ or $\frac{F}{I} > p^*$. We focus on the former case, since it is more interesting:

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[16]Note that our definition of perfect competition is consistent with the No Surplus Condition of Ostroy (1980); see also Makowski (1983).

Assumption A: $\frac{F}{I} \le p^*$.

We discuss the latter case in the Appendix.

To provide a benchmark, let us start with the first-best situation where everybody's payoff is public information and lump sum transfers are possible. Under these conditions, the outcome is chosen to maximize total monetary benefits. Suppose the fixed cost F is incurred. Then, if consumer i, an insider, consumes the good he obtains a net benefit of a_i, whereas, if an outsider replaces him, net benefit is p* (the outsider's reservation value). Clearly insider i should be replaced by an outsider if and only if $a_i < p^*$. Given this replacement rule, total net surplus is

$$\sum_i \max \{a_i, p^*\} - F. \tag{2.1}$$

Production will always take place in the first-best, since

$$\sum_i \max \{a_i, p^*\} - F \ge p^*I - F \ge 0.$$

(The second inequality follows from Assumption A.)

We turn next to the second-best world where payoffs are private information. It is easy to see that production will take place in the second-best under both ownership structures, nonprofit cooperative and outside ownership, since, by Assumption A, costs can be covered by setting $p = p^*$ (and selling possibly only to outsiders).

Outside ownership

Under outside ownership, the entrepreneur maximizes profit since, by assumption, she does not consume the good.[17] Since the entrepreneur does not know individual willingnesses to pay, she cannot price discriminate and therefore acts like a standard monopolist, charging a uniform price p, and excluding those whose net payoff from consumption, a_i, is less than p.[18]

Given Assumption A, an outside owner has two principal choices: she can set $p = p^*$ and sell to a mixture of insiders and outsiders, or she can set $p > p^*$ and sell only to insiders. The former strategy yields total revenue Ip^*. The latter strategy yields total revenue:

$$\max_p \; p \, \#\{i \mid a_i \geq p\}. \tag{2.2}$$

If the first strategy is optimal, the first-best is achieved since, given price p^*, only insiders for whom $a_i \geq p^*$ will consume, and the remaining places will be filled by outsiders, which is efficient. On the other hand, if $p > p^*$, the first-best is typically not achieved since some insiders (those for whom $a_i < p$) will be excluded and no outsiders will be included; i.e., there will be unused capacity.

Denote the outside owner's profit maximizing price by $\bar{p}$ (if there are multiple solutions, pick the smallest one).

<u>(Nonprofit) Cooperative</u>

The instruments available to a cooperative are essentially the same as those available to an outside owner. That is, like the outside owner, the

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[17]It actually makes little difference if the owner is herself a consumer, since the profit motive swamps any consumption benefit.

[18]Since consumption is zero or one, the entrepreneur cannot use non-linear pricing to discriminate.

cooperative cannot price discriminate since it does not know individual willingnesses to pay. Hence, all the cooperative can do at date 1 is to set a uniform price p for members (we call this a membership fee) and a (possibly different) price for non-members. Note that, if the cooperative could distribute profit, then it could set one price for members who do not consume, p_0, which could be negative (corresponding to a dividend) and another price for members who consume, p_1. However, in the case of a nonprofit cooperative, we can set $p_0 = 0$ (since if $p_0 > 0$, non-consuming members would quit), and treat $p_1 = p$ as the membership fee.[19]

Although we allow a cooperative to charge a different price for non-members, we suppose that this price must be at least as high as p, because otherwise members would quit and consume as non-members.[20] It is clear that the cooperative will always charge non-members their maximum willingness to pay, p*. Hence a necessary condition for a cooperative to admit outsiders is that the membership fee p is no more than p*. This turns out always to be the case, given the break-even constraint and Assumption A.

To understand how a cooperative works, note that if $a_i \geq \frac{F}{I}$ for all i, then the cooperative will break even by setting $p = \frac{F}{I}$. In this case, all insiders consume. Suppose therefore that $a_i < \frac{F}{I}$ for some i. In this case, some insiders will exit at the price $\frac{F}{I}$, which leaves room for outsiders, who

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[19]Note that non-consuming members cannot be forced to pay p_0, since p_0 is chosen at date 1; i.e., it is not specified in an initial (enforceable) contract.

[20]Let us say that members are identified by means of membership cards, issued at date 0. The card gives the right to consume at date 1 for a payment of p (we are calling p the "membership fee" payable at date 1). p cannot be higher than the price charged to outsiders at date 1 since members can always feign to be non-members by withholding their cards.

An outside owner could also charge a higher price to outsiders than to insiders; but this would not be profit maximizing.

can be charged $p^* \geq \frac{F}{I}$. The arrival of outsiders relaxes the cooperative's budget constraint, which means that the membership fee falls and some insiders may return. The cooperative outcome is a fixed point of this process.

One way to understand how the fixed point is determined is to consider the case where u and w are continuous random variables rather than discrete. Let H be the distribution function of $a = u - w$; that is, H(p) is the fraction of consumers with $a \leq p$. Then the membership fee $\hat{p}$ is the solution to:

$$(2.3) \qquad \hat{p}[1 - H(\hat{p})] + p^*H(\hat{p}) = \frac{F}{I},$$

since insiders with $a \geq \hat{p}$ pay $\hat{p}$, while the remaining places are filled by outsiders who pay p^*. It is easy to show that (2.3) has a solution $\hat{p} \leq \frac{F}{I}$,[21] and that this solution is unique (the left-hand side is increasing in $\hat{p}$). Moreover the solution $\hat{p}$ is <u>strictly</u> less than $\frac{F}{I}$ unless $\frac{F}{I} = p^*$ or $H(\frac{F}{I}) = 0$ (in the latter case, all of the insiders consume).

Note that there will typically be inefficiency in the cooperative if $\hat{p} < p^*$. The reason is that some insiders will remain in the cooperative given the low membership fee, when it would be more efficient to replace them with outsiders; this happens if $\hat{p} < a_i < p^*$. Of course, if $a_i \geq p^*$ for all i, then this does not happen; the cooperative achieves first-best.

How do we compare the performance of an outside owner and a cooperative? Note that outsiders never obtain any surplus from either ownership structure since they always pay their reservation price p^*. Since each consumer i is risk neutral and, ex ante, is equally likely to have the

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[21]Strictly speaking, if $\frac{F}{I} = p^*$ <u>and</u> $a = u - w$ never takes values above some $a_{max} < p^*$, then any $\hat{p}$ lying between a_{max} and p^* solves (2.3). In this case, $\hat{p}$ is irrelevant since none of the insiders consumes.

payoffs $(u_1,w_1),\ldots,(u_I,w_I)$, we can measure total surplus S by the sum of the payoffs of the I insiders, plus possibly the outside owner, under the two ownership structures. Let S^{oo}, S^c be total net surplus under an outside owner and a cooperative, respectively. Using the fact that outsiders are admitted if $p \le p^*$ but not otherwise, we have

$$(2.4)\quad S^{oo} = \begin{cases} \sum_{i|a_i \ge p^*} a_i + \sum_{i|a_i < p^*} p^* - F & \text{if } \bar{p} = p^* \\ \\ \sum_{i|a_i \ge \bar{p}} a_i - F & \text{if } \bar{p} > p^* \end{cases}$$

$$(2.5)\quad S^c = \sum_{i|a_i \ge \hat{p}} a_i + \sum_{i|a_i < \hat{p}} p^* - F$$

At date 0, the firm will be set up either as a cooperative or under outside ownership depending on whether S^c is greater or less than S^{oo}.

As our discussion so far indicates, an outside owner and a cooperative suffer from opposite problems of inefficiency: the outside owner typically excludes too many high-value users (if $\bar{p} > p^*$), while a cooperative typically includes too many low-value users (if $\hat{p} < p^*$). The comparison is summarized in Proposition 1.

Proposition 1. An outside owner may exlude all outsiders and some insiders (those with $a_i < \bar{p}$), i.e., there is generally some unused capacity. A cooperative has no unused capacity, but may include too many insiders (those for whom $\hat{p} < a_i < p^*$).

The following two examples in turn illustrate the inefficiencies described in Proposition 1.

Example 1

There are three types of inside consumer, with (approximately) J of each type, where the number of replicas, J, is large. It suffices to keep track of three representatives consumers, i = 1, 2 and 3, one of each type. $a_1 = 2$, $a_2 = 8$, $a_3 = 30$, $p^* = 7$, and (per replica) the cost is 15 (i.e. $F = 15J$).

In the first-best, the firm sells to consumers of type 2 and 3, and type 1 consumers are replaced by outsiders (since $a_1 < p^*$). Total net surplus equals $p^* + a_2 + a_3 - 15 = 30$. Under outside ownership, the entrepreneur sets $\bar{p} = 30$ and excludes type 1 and 2 consumers together with all outsiders; total net surplus equals $a_3 - 15 = 15$. Under a cooperative, $\hat{p} = 4$: consumers of type 2 and 3 need pay only 4 each, given that type 1 consumers quit and are replaced by outsiders who each pay $p^* = 7$ of the total cost F. Thus, in this example, a cooperative achieves first-best, and dominates outside ownership.

Note that if the cooperative were for-profit, rather than nonprofit, it would behave just like an outside owner. The point is that by charging type 3 consumers a price of 30, consumers of type 1 and 2 receive a dividend of 5 each, which is more than the consumer surplus they would enjoy from setting $\hat{p} = 4$. (And one can show that no other price can beat 30 in a vote; see Section 4.) In short, a nonprofit cooperative achieves first-best, whereas a for-profit cooperative and an outside owner do not.

Example 2

There are three types of inside consumer, with (approximately) J of each type, where the number of replicas, J, is large. It suffices to keep track of three representatives consumers, i = 1, 2 and 3, one of each type. $a_1 = 2$, $a_2 = 8$, $a_3 = 10$, $p^* = 9$, and (per replica) the cost is 15 (i.e. $F = 15J$).

In the first-best, the firm sells to type 3 consumers, and consumers of type 1 and 2 are replaced by outsiders (since a_1 and a_2 are less than p^*). Total net surplus equals $p^* + p^* + a_3 - 15 = 13$. Under outside ownership, the entrepreneur sets $\bar{p} = 9$ and sells to type 3 consumers and also to outsiders, thus achieving the first-best. Under a cooperative, $\hat{p} = 3$, and type 2's consume; total net surplus equals $p^* + a_2 + a_3 - 15 = 12$, which is not first-best. Hence in this example, outside ownership dominates a cooperative.

Note that this conclusion does not change if the cooperative is for-profit, rather than nonprofit. One can show that consumers of type 2 and 3 receive more consumer surplus from $\hat{p} = 3$ than they would receive in combined dividends and consumer surplus from any other price (again, see Section 4 for a formal analysis).

The inefficiency in a cooperative in Example 2 arises from the fact that the membership fee $\hat{p} = 3$ is so low that type 2 consumers stay in, rather than ceding their places to outsiders with a higher willingness to pay, $p^* = 9$. There is a simple way for the cooperative to overcome this inefficiency: type 2 consumers could sell their membership in the cooperative, i.e., the right to consume one unit of the good at a price $\hat{p} = 3$, to an outsider for $p^* - \hat{p} = 6$. (Since demand by outsiders is perfectly elastic, it is reasonable to suppose that insiders obtain all the surplus from this transaction.) Type 2 consumers are all made better off, since their utility rises from 5 to 6, and efficiency is restored.[22] We explore the possibility of membership-selling further in Section 4.

3. The Full Model: Investment and Pricing

So far we have analyzed how an outside owner and a cooperative differ over the decision of who should consume a given good (or service). In reality, however, many of the most contentious decisions facing a cooperative concern the question of what type of good should be provided; or, to put it another way, they concern whether a particular investment should be undertaken, which might improve or change quality.

In this section we compare how an outside owner and a cooperative make investment decisions. For simplicity we consider the case where there are two goods, or projects, A and B. Project A has a fixed cost F, zero marginal cost up to capacity I, and yields payoffs to the I insiders given by $u_1,\ldots,u_I$. Project B has a fixed cost G, zero marginal cost up to capacity I, and yields payoffs to the I insiders given by $v_1,\ldots,v_I$. One can imagine that G is substantially bigger than F -- e.g., because G includes the cost of additional investment -- but we will not insist on this. (If G = F, then the two projects can be thought of as representing horizontal differences in quality of the good.) We suppose that the I insiders have reservation payoffs given by $w_1,\ldots,w_I$. All three payoffs, u_i, v_i and w_i, are privately known by individual i, for i = 1,...,I. In what follows, all that matters are the net payoffs:

$$u_i - w_i = a_i, \text{ say, from good A,}$$

$$\text{and } v_i - w_i = b_i, \text{ say, from good B.}$$

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[22] Type 1 consumers also sell their membership; but they quit anyway.

As in Section 2, we suppose that the firm is set up at date 0 before the realization of the individual (u_i, v_i, w_i)'s; that the I individuals are ex ante identical in the sense that, for each i, (u_i, v_i, w_i) is drawn from the same probability distribution, which is common knowledge; and that I is sufficiently large that the realized distribution of payoffs approximately equals the probability distribution from which they are drawn.

Also as in Section 2, we suppose that there is a perfectly elastic demand curve by outsiders for what the firm produces: outsiders are willing to pay p* if project A is undertaken, and to pay q* if project B is undertaken.

We generalize the definition of perfect competition given in Section 2. We define perfect competition to mean

$$a_i \leq p^* \quad \text{and} \quad b_i \leq q^* \qquad \text{for all } i = 1, \ldots, I.$$[23]

We continue to assume that the reservation value of outsiders exceeds average cost; that is, in addition to Assumption A, we assume:

<u>Assumption B</u>: $\frac{G}{I} \leq q^*$.

We begin with the first-best. Using the same logic as in (2.1), we see that the criterion for project B to be preferred to project A is:

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[23]One interpretation of perfect competition is that there are competitive markets for goods A and B, with ruling prices p* and q* respectively; insiders and outsiders can trade on these markets without incurring transaction or transportation costs (but can only consume one of the goods).

$$(3.1) \qquad \sum_i \max\{b_i, q^*\} - G > \sum_i \max\{a_i, p^*\} - F.$$

Consider next an outside owner. Using the analysis of Section 2, we obtain the following formulae for the entrepreneur's profit under A or B:

$$\Pi_A = \max\left\{p^*I, \max_p p\ \#\{i \mid a_i \geq p\}\right\} - F,$$

$$\Pi_B = \max\left\{q^*I, \max_q q\ \#\{i \mid b_i \geq q\}\right\} - G.$$

The outside owner will choose B rather than A if and only if

$$(3.2) \qquad \Pi_B > \Pi_A.$$

Finally, consider a (nonprofit) cooperative. The cooperative will set a membership fee equal to $\hat{p}$ if project A is chosen (as determined in Section 2), and $\hat{q}$ if B is chosen ($\hat{q}$ is the equivalent to the solution to (2.3) -- replacing the distribution of a, H(a), by the distribution of b, and replacing F by G). The choice between B and A is determined by a simple vote by members of the cooperative. Consumer i's payoff equals $\max\{u_i - \hat{p}, w_i\}$ under project A and $\max\{v_i - \hat{q}, w_i\}$ under project B, and so consumer i votes for B if and only if

$$(3.3) \qquad \max\{b_i - \hat{q}, 0\} > \max\{a_i - \hat{p}, 0\}.$$

Project B will be selected if (3.3) holds for a majority of the I individuals. (The reader may wonder whether the outcome of the vote might be renegotiated. The answer is no, given asymmetric information and large numbers; see below.)

Although it is hard to rank outside ownership and a cooperative in general, we can throw some light on the nature of inefficiency in each organization by considering a case in which types are ranked:

Assumption R: (1) $\frac{F}{I} \le a_1 \le a_2 \le \ldots \le a_I$,

(2) $\frac{G}{I} \le b_1 \le b_2 \le \ldots \le b_I$,

(3) $b_1 - a_1 \le b_2 - a_2 \le \ldots \le b_I - a_I$.

R(1) and R(2) state that, irrespective of the choice of good, all I insiders value it above cost, and the high i's value it more -- they are the "big" consumers. And R(3) states that, in relative terms, the big consumers are keener on investing in project B than project A.[24] Note that Assumption R is only temporary, made to help clarify the nature of the distortions under different ownership structures; in Propositions 2 and 3 we will return to the general case.

The remaining important parameters are p* and q*. We will regard these as floating variables and allow them to lie anywhere from less than a_1 and b_1 at one extreme (but, by Assumptions A and B, not below $\frac{F}{I}$ and $\frac{G}{I}$), to above a_I and b_I at the other extreme.

Let us start with the case $p^* \le a_i$ and $q^* \le b_i$ for all i. Then the first-best rule (3.1) becomes

(3.4) $$\sum_i b_i - G > \sum_i a_i - F.$$

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[24]This says nothing about whether there is an absolute gain or loss: $b_I - a_I$ may be negative; or $b_1 - a_1$ may be positive.

The choice facing an outside owner is fairly straightforward. Suppose the outside owner picks project A. Then she will choose a "marginal" consumer a_J, say, and set $p = a_J$, so that inside consumers $i \geq J$ consume and everybody else is excluded. Her profit will be $(I - J + 1)a_J - F$. The outside owner makes a similar calculation for project B. To simplify matters, assume that the outside owner selects the same marginal consumer under the two projects. Then her profit under B will be $(I - J + 1)b_J - G$, and she will select B if and only if

$$(3.5) \qquad (I - J + 1)b_J - G > (I - J + 1)a_J - F.$$

We see that there are two distortions relative to first-best. First, the valuations of the intramarginal consumers, $i = J+1,\ldots,I$, are ignored. Given R(3), this distorts the outside owner's investment choice away from project B. Second, the valuations of the excluded consumers, $i = 1,\ldots,J-1$, are also ignored: the terms $(b_1 - a_1), \ldots, (b_{J-1} - a_{J-1})$ are excluded. If these terms are nonnegative -- i.e., if (ignoring cost) project B is better for everyone than project A -- then the outside owner's investment decision is further distorted away from project B.[25]

We turn next to the cooperative. Given R(1) and R(2), the cooperative's pricing decision is very simple: the break-even membership fee is $\frac{F}{I}$ for project A and $\frac{G}{I}$ for project B (all insiders consume). Consumer i votes for project B if and only if

$$(3.6) \qquad b_i - \frac{G}{I} > a_i - \frac{F}{I},$$

and the choice between B and A is made according to the wishes of the

[25]Both of these effects are familiar from the work of Spence (1975).

majority. If I is odd then it is easy to see that the preferences of the median voter will be decisive. In particular, a necessary and sufficient condition for the cooperative to vote for B is that (3.6) holds for the median member $i = \frac{1}{2}(I + 1) = M$, say.[26] Obviously the cooperative will achieve an efficient project choice if the median member has average valuations, i.e., if

$$a_M = \frac{1}{I}\sum_{i=1}^{I} a_i \quad \text{and} \quad b_M = \frac{1}{I}\sum_{i=1}^{I} b_i.$$

In fact a weaker condition for a cooperative to choose efficiently is that the median member ranks the projects in the same way as the average member; this is the case dealt with in Proposition 3 below. Note that there is no reason to think that in this case an outside owner will make the efficient choice.

If the median member does not have the average member's preferences, the cooperative will pick an inefficient outcome. For example, suppose there are just two types of individual with (approximately) K of the first type ($i = 1,\ldots,K$) and $I - K$ of the second type ($i = K+1,\ldots,I$). Assume that, net of costs, the small (low i) consumers gain very little from either project A or B, but less from B; whereas the big (high i) consumers gain significantly from both projects, but much more from B. Then if the small consumers are in the majority ($K > \frac{1}{2}I$), the cooperative will vote for project A, even though it is inefficient. In contrast, an outside owner will choose project B because she can charge the big consumers much more for B than for A (she excludes the small consumers).[27]

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[26] The reason is that if (3.6) holds for $i = M$ then it also holds for all $i > M$ (that is, a majority votes for B), whereas if (3.6) is violated for $i = M$ then it is also violated for all $i < M$ (that is, a majority votes for A).

[27] Let $a_i = \frac{F}{I} + \varepsilon$ for $i = 1,\ldots,K$; $a_i = a$ for $i = K+1,\ldots, I$; $b_i = \frac{G}{I} + \frac{1}{2}\varepsilon$ for $i = 1,\ldots, K$; $b_i = b$ for $i = K+1,\ldots, I$. Then if b is large enough, it is

At this point, the issue of renegotiation needs to be addressed. Following the vote in the cooperative, could the minority bribe the majority into agreeing to a different outcome? As we shall argue in Section 5, the answer is no. Any attempt to change the outcome of the vote, project A, is scuppered by the fact that each of the consumers $i = K+1,\ldots,I$ who stand to gain from switching to project B can pretend to be one of the losers, $i = 1,\ldots,K$. Remember, only the individual knows his own type: by dissembling, a big consumer can receive compensation from the others, rather than pay it. With large numbers (large I), and a degree of aggregate uncertainty (e.g., some uncertainty over the <u>exact</u> value of K), the free rider problem cannot be overcome.

In the above example, the inefficient majority gangs up on the efficient minority and thwarts a good investment opportunity. Another way to think about this is that the majority engages in rent-seeking activity: the majority votes for A rather than B because, even though total surplus is lower, it is distributed in a way that favors the majority. Of course, an outside owner also typically engages in rent-seeking activity. An outside owner chooses price and project type to maximize private surplus or private rent. However, in general this is not the same as social surplus or social rent.

We now relax the assumption that $p^* \le a_i$, $q^* \le b_i$ for all i. To simplify matters, suppose that p^* and q^* increase so that $p^* = a_N$, $q^* = b_N$ for some N. That is, there is <u>some</u> insider N whose preferences are exactly the same as the outside market. Then the first-best rule (3.1) becomes

(3.7) $$Nb_N + \sum_{i=N+1}^{I} b_i - G > Na_N + \sum_{i=N+1}^{I} a_i - F,$$

---

efficient to choose project B, and an outside owner will do this since she can charge $\bar{q} = b$ to the big consumers rather than $\bar{p} = a$. However, if $K > \frac{1}{2}I$, the cooperative will vote for A.

since insiders $i = 1, \ldots, N-1$ will be replaced by outsiders. Using R(3), the increase in p^* and q^* means that it is more likely that project B should be selected over project A.

Given a particular project choice, an outside owner will either price as before or will price so as to attract outsiders. Suppose project A is chosen. Then pricing to attract outsiders is the superior strategy if and only if $Ia_N > (I - J + 1)a_J$. Similarly, for project B. Several possibilities can occur. For example, it could be the case that $Ia_N > (I - J + 1)a_J$, but $Ib_N < (I - J + 1)b_J$. Under these conditions the increase in p^* and q^* reduces the likelihood that project B will be chosen by an outside owner. On the other hand, it could be the case that $Ia_N < (I - J + 1)a_J$, but $Ib_N > (I - J + 1)b_J$. Under these conditions, the increase in p^* and q^* increases the likelihood that project B will be chosen by an outside owner.

One thing we can be sure of is that, for large enough p^* and q^*, the outside owner will choose the first-best. In particular, if $p^* \geq a_i$ and $q^* \geq b_i$ for all i, then the outside owner faces a perfectly elastic demand curve at price q^* for project B and price p^* for project A. That is, the two sides of (3.7) represent social surplus as well as the outside owner's profit: the divergence between private and social benefit disappears when the market is perfectly competitive. (Also the outside owner does not exclude anybody, i.e., there is no excess capacity.)

Consider next how the increase in p^* and q^* changes the behavior of a cooperative. It is easy to see that <u>it does not change at all</u>. The cooperative continues to choose the membership fee $p = \frac{F}{I}$ if A is selected and $q = \frac{G}{I}$ if B is selected; moreover, the cooperative selects B if and only if (3.6) holds for a majority of the insiders. The point is that outside competition -- in the form of a high p^* or q^* -- has no effect on the cooperative's behavior, since, given R(1) and R(2), the membership fee is sufficiently low that all insiders consume.[28]

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[28]This conclusion is no longer valid if membership sales are permitted. See Section 4.

The fact that the cooperative is shielded from the outside market means that, if it was engaging in inefficient rent-seeking activities before, it will continue to do so now. That is, even under perfect competition ($a_i \le p^*$, $b_i \le q^*$ for all i), the majority may gang up on the minority and cause an inefficient project to be chosen. In contrast, an outside owner achieves the first-best under perfect competition.

It may help to summarize what we have found out with the help of Assumption R. In the absence of an effective outside market, a cooperative works well if the median member has the average member's preferences; in contrast, an outside owner may not make the right choice under these conditions (and may exclude some people). However, an outside owner becomes efficient as the outside market becomes competitive; whereas outside competition has no effect on a cooperative.

Let us now drop Assumption R. Propositions 2 and 3 extend our findings to the general case. Since Proposition 2 requires no further conditions, it can be stated without proof. Proposition 3 assumes that p^* and q^* are no more than a_i and b_i for all i, so as to rule out inefficient inclusion.

<u>Proposition 2</u>. Assume there is perfect competition: $a_i \le p^*$ and $b_i \le q^*$ for all $i = 1,\ldots,I$. Then an outside owner achieves the first-best, whereas a cooperative may not.

<u>Proposition 3</u>. Suppose $a_i \ge p^*$, $b_i \ge q^*$ for all i. Suppose I is an odd integer.[29] Finally, suppose that there exists some $i = M$, for whom, first,

$$b_M - \frac{G}{I} > a_M - \frac{F}{I} \quad \text{iff} \quad \sum_{i=1}^{I} b_i - G > \sum_{i=1}^{I} a_i - F;$$

[29]The proposition can be easily modified if I is even.

and, second, the set $\{1,\ldots,M-1,M+1,\ldots,I\}$ can be divided into exactly two halves, with $b_i - a_i \geq b_M - a_M$ for one half and $b_i - a_i \leq b_M - a_M$ for the other. Then the cooperative achieves the first-best, but an outside owner may not.

Proof. Since, $a_i \geq p^*$ and $b_i \geq q^*$ for all i, (3.1) reduces to (3.4). Now a cooperative sets membership fees $\hat{p} = \frac{F}{I}$, $\hat{q} = \frac{G}{I}$ (since $a_i \geq p^* \geq \frac{F}{I}$, $b_i \geq q^* \geq \frac{G}{I}$); and so, according to (3.3), consumer i votes for B if and only if $b_i - \frac{G}{I} > a_i - \frac{F}{I}$. Given the assumptions about consumer M, it follows that not only is M's vote pivotal, but also he votes for B over A iff (3.4) holds. That is, the cooperative makes the first-best choice of investment. Also, the cooperative serves all its members, which is efficient.

Q.E.D.

To us, the significance of Proposition 3 lies in the following corollary, which concerns common ranking.

Corollary Suppose $a_i \geq p^*$, $b_i \geq q^*$ for all i and there is a common ranking:

$$\text{either} \quad b_i - \frac{G}{I} \geq a_i - \frac{F}{I} \quad \text{for all } i,$$

$$\text{or} \quad b_i - \frac{G}{I} \leq a_i - \frac{F}{I} \quad \text{for all } i.$$

Then the cooperative achieves the first-best, but an outside owner may not.

To show that an outside owner may not achieve the first-best even under common ranking, consider the following example.

Example 3

There are three types of inside consumer, with (approximately) J of each type, where the number of replicas, J, is large. It suffices to keep track of three representative consumers, i = 1, 2 and 3, one of each type. Under Project A, $a_1 = 6$, $a_2 = a_3 = 18$, $p^* = 4$ and (per replica) the cost is 12. Under Project B, $b_1 = 10$, $b_2 = b_3 = 22$, $q^* = 8$ and (per replica) the cost is 21.

This example satisfies the conditions of the Corollary since $a_i \geq p^*$, $b_i \geq q^*$, and $b_i - \frac{G}{I} \geq a_i - \frac{F}{I}$ for all i. Moreover, it is easy to see that the cooperative unanimously votes for project B, since for an increase in per capita cost of $(G - F)/I = 3$ each consumer receives an additional gross payoff of 4 (none of the members -- in particular, none of the 1's -- wishes to quit).

However, an outside owner will choose project A. The reason is that the outside owner maximizes profit by excluding 1's (who have a much lower willingness to pay) and charging either $\bar{p} = 18$ or $\bar{q} = 22$. Project A then yields a per replica profit of 36 - 12 = 24, as opposed to 44 - 21 = 23 for project B. In other words, although the outside owner can increase the price each consumer pays by 4 if she chooses project B, total revenue increases by only 8 since type 1 consumers are excluded, and this does not cover the additional fixed cost of 9.

This inefficiency in Example 6 arises because, even though the consumers agree about the relative choice of projects, they are not identical. For instance, it may be that all insiders have the same payoffs from projects A and B, $u_i \equiv 18$ and $v_i \equiv 22$, but they have different outside opportunities: for type 1 consumers, $w_1 = 12$; whereas for type 2 consumers, $w_2 = 0$. As a result, the outside owner chooses an inefficient project in order to extract more surplus.

4. More General Cooperatives

In Sections 2 and 3 we studied a particular kind of cooperative -- one that does not pay out any profits to its members. In this section we relax this assumption. We also consider what happens if members can sell their places in the cooperative.

If the cooperative can pay out profit, then this creates an extra degree of freedom: as well as being able to charge a price p for members who consume the good the cooperative can also pay all members, whether they consume or not, a dividend $d \geq 0$.

To understand the implications of this, it is worth returning to the case in Section 2 where there is a single type of good. The budget constraint for a for-profit cooperative is

$$p \,\#\{i | a_i \geq p\} + \pi \,\#\{i | a_i < p\} = dI + F, \tag{4.1}$$

where $\pi = p^*$ if $p \leq p^*$ and $\pi = 0$ if $p > p^*$. That is, spare capacity can be sold to outsiders for p^* if $p \leq p^*$, but if $p > p^*$ outsiders will not be prepared to buy (they cannot be charged less than insiders and their maximum willingness to pay is p^*).

A cooperative member who consumes the good has net payoff $a_i - p + d$, while a cooperative member who does not consume has net payoff d. Thus there is a conflict between consumers and non-consumers. Consumers want to minimize $p - d$. Non-consumers want to maximize d; i.e., to set $p = \bar{p}$, just like an outside owner.

Let $p = \hat{\hat{p}}$ be the membership fee which minimizes $p - d$, subject to (4.1). It is clear that $\hat{\hat{p}} \leq p^*$. The reason is that if $p > p^*$, a small reduction in p leads to a reduction in d that is no bigger and so $p - d$ falls (recall that $\pi = 0$ when $p > p^*$). In fact, unless $a_i \geq p^*$ for all i, the inequality is strict: $\hat{\hat{p}} < p^*$.

It is also the case that $\hat{\hat{p}} \geq \hat{p}$, given that the membership fee $\hat{p}$ yields $d = 0$, and that any lower fee yields $d < 0$, which is infeasible. However, $p - d$ may not be monotonic in p, because a reduction in p causes $\#\{i|a_i < p\}$ to fall, i.e., more insiders consume, which may lead to a large fall in revenue from outsiders (who are being charged p*) and a consequent reduction in d. In other words, consumers may not want too low a membership fee because they rely on outsiders as a source of revenue in order to pay dividends. Thus it can be the case that $\hat{\hat{p}} > \hat{p}$.

It is easy to see that in equilibrium a for-profit cooperative will choose either $p = \hat{\hat{p}}$ or $p = \bar{p}$. In particular, take any $p \neq \hat{\hat{p}}$ or $\bar{p}$. And let d, $\hat{\hat{d}}$ and $\bar{d}$ be the dividends associated with prices p, $\hat{\hat{p}}$ and $\bar{p}$. On the one hand, all members who consume the good at price p prefer price $\hat{\hat{p}}$, since if they continue to consume at price $\hat{\hat{p}}$ their net payoff is $a_i - \hat{\hat{p}} + \hat{\hat{d}}$, which is larger than $a_i - p + d$ (and they can always choose not to consume the good at price $\hat{\hat{p}}$ if that makes them even better off). On the other hand, all members who do not consume the good at price p prefer price $\bar{p}$, since if they continue not to consume at price $\bar{p}$ their net payoff is $\bar{d}$, which is larger than d (and they can always choose to consume at price $\bar{p}$ if that makes them even better off). One of these groups will be in the majority (we ignore ties), and will ensure that price p will be outvoted by either $\hat{\hat{p}}$ or $\bar{p}$. Thus the choice comes down to a two-horse race between $\hat{\hat{p}}$ or $\bar{p}$, and the winner will be whichever wins a straight vote between them.

The conclusion is that a for-profit cooperative sometimes behaves like an outside owner by voting for the price $\bar{p}$, and sometimes votes for a price $\hat{\hat{p}}$ which lies between the price ($\hat{p}$) chosen by a nonprofit cooperative and the outsiders' willingness to pay (p*). Thus, in qualitative terms, a for-profit cooperative lies between an outside owner and a nonprofit cooperative.

It is also worth noting that, although it might seem that a for-profit cooperative should perform better than a nonprofit cooperative because it has an extra degree of freedom, this is not true in ex ante terms, as Example 1 demonstrated. The fact that for-profit cooperatives can be less efficient than nonprofit cooperatives provides some justification for focusing on nonprofit cooperatives in Sections 2 and 3.

We deal next with the issue of membership sales (we now return to the case of a nonprofit cooperative). As noted in Section 2, the right to consume a unit of the good at the cooperative equilibrium price $\hat{p}$ may be more valuable to an outsider than to an insider, and so one could imagine a market developing for this right. In practice, cooperatives do sometimes allow membership sales, although restrictions are often put on them. For example, the other cooperative members may have to approve the identity of the new member or may have the right of first refusal.[30] Such restrictions, of course, dampen the effectiveness of the market and mean that many cooperatives in reality lie somewhere between the case of no membership sales considered in Sections 2 and 3 and the case of a perfect membership market that we now consider.

To understand the effect of membership sales, start with the case of Section 2, where there is only one type of good. It is easy to see that the break-even membership fee for a nonprofit cooperative is $\hat{p} = \frac{F}{I}$. Insiders for whom $a_i < p^*$ will sell their places for $p^* - \hat{p}$ and receive a net payoff of $p^* - \frac{F}{I}$ rather than $a_i - \frac{F}{I}$. Insiders for whom $a_i > p^*$ will remain in the cooperative and will receive a net payoff of $a_i - \frac{F}{I}$. Note that excessive inclusion no longer occurs (no insider with $\hat{p} < a_i < p^*$ consumes). In other words, when the nature of the good is given, a cooperative which allows membership sales is <u>always</u> at least as efficient as an outside owner (who may have unused capacity).

When there is an investment choice, the comparison between a cooperative that allows membership sales and an outside owner is no longer straightforward and much of the analysis of Section 3 applies. In

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[30] There are no consumption externalities in our model. If the members of a cooperative care who else is a member, then a ban on membership sales may be necessary to block an undesirable person from becoming a member.

particular, our discussion for the case $a_i \geq p^*$ and $b_i \geq q^*$ for all i is unchanged, since the issue of membership sales does not arise. However, Proposition 2 must be modified. In fact, when there is perfect competition, a cooperative with membership sales achieves the <u>first-best</u> (as, of course, does an outside owner). The reason is that since $a_i \leq p^*$ and $b_i \leq q^*$ for all i under perfect competition, the members of a cooperative can do no better than to sell their places and consume outside, which means that total net surplus is given by profit ($p^*I - F$ if good A is produced and $q^*I - G$ if good B is produced); i.e., the cooperative unanimously votes for the profit-maximizing outcome just as an outside owner does. That is, we have shown:

<u>Proposition 2'</u>. Assume there is perfect competition: $a_i \leq p^*$ and $b_i \leq q^*$ for all $i = 1,\ldots,I$. Then if membership sales are allowed, a cooperative, like an outside owner, achieves first-best.

Since membership sales remove certain sorts of inefficiency it might be thought that it would always pay a cooperative to allow them when it sets up. However, this is <u>not</u> true. The next example shows that, from an ex ante point of view, membership sales may reduce surplus.

<u>Example 4</u>

There are three types of inside consumer, with (approximately) J of each type, where the number of replicas, J, is large. It suffices to keep track of three representative consumers, i = 1, 2 and 3, one of each type. Under Project A, $a_1 = a_2 = 1$, $a_3 = 12$, $p^* = 8$ and (per replica) the cost is 18. Under Project B, $b_1 = b_2 = 7$, $b_3 = 18$, $q^* = 6$ and (per replica) the cost is 18.

In this example, a cooperative that does not allow membership sales votes for the more efficient project B: total net surplus = $b_1 + b_2 + b_3 - 18 = 14$, as opposed to $2p^* + a_3 - 18 = 10$ for project A. The reason is that $\hat{p} =$

2 (consumer 3 need pay only 2, given that 1 and 2 quit and are replaced by outsiders who each pay $p^* = 8$ of the total cost), whereas $\hat{q} = 6$. 1 and 2 prefer B to A (their net payoffs are 1 as opposed to 0), as does 3 (his net payoff is 12 as opposed to 10). However, if membership sales are allowed, then $\hat{p} = 6$, $\hat{q} = 6$, and A is chosen, since 1 and 2 now prefer A to B (they sell their places for $p^* - \hat{p} = 2$ under A).[31]

Example 4 shows that, even in the absence of consumption externalities, membership sales may be bad. Interestingly, the example satisfies all the assumptions of the Corollary, except for $a_i \geq p^*$ for all i; in particular, it satisfies the common ranking condition. The problem is that, although insiders favor project B over project A, outsiders have the opposite preferences. And when insiders can sell to outsiders, outsiders' preferences dominate, which leads to an inefficient outcome. The example provides some justification for the analysis of Sections 2 and 3 where membership sales were ruled out.

5. A Broader Perspective

It is time to place our analysis in a broader perspective. In this section we discuss the feasibility of ex post renegotiation, and whether there exist better ex ante ownership structures.

The paper is concerned with the design of ex ante contracts which maximize expected surplus. This is equivalent to minimizing the expected degree of ex post inefficiency, since we are assuming that all the insiders are identical ex ante, and risk neutral. The source of ex post inefficiency is the fact that insiders have private information about their individual preferences. Without this friction, the Coase Theorem tells us that there would be no inefficiency, and the form of the ex ante contract would be irrelevant.

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[31] An outside owner also chooses A: he sets $\bar{p} = p^* = 8$ and gets a profit of 6 compared with a profit of 3 under B ($\bar{q} = 7$).

To make the discussion concrete, consider again the example discussed in Section 3 where the majority gangs up on the minority and blocks a good investment. Recall that the decision is whether to switch from project A to project B. We assume that, whichever project is chosen, the I insiders all have a higher willingness to pay than outsiders.[32] Certain insiders, the minority, would prefer to switch to project B, and stand to gain a great deal from doing so. The rest, the majority, prefer project A.

We argued in Section 3 that in a (nonprofit) cooperative the majority outvotes the minority, and project A is chosen. By contrast, an outside owner targets the minority interests, and efficiently invests in project B. Note, however, that the outside owner also doesn't achieve first-best, since she inefficiently prices out the majority.

This last inefficiency is well-known and understood: an outside owner charges too high a price and thus excludes some customers (in this case, the majority). But it may help to clarify why the Coase Theorem "fails" in the case of the cooperative. One might think that the minority could somehow arrange to bribe the majority into switching from project A to B. That is, following the vote, someone might propose a scheme whereby those cooperative members (the minority) who stand to gain from switching to project B contribute a given amount of money into a kitty which then gets distributed as compensation to the members who lose (the majority). The difficulty is that it is not known who is in the minority and who is in the majority, and so individuals cannot be targeted directly. One way round this difficulty is to arrange that project B is chosen and the kitty is distributed if and only if a critical number of contributions are made; otherwise, the status quo, project A, prevails and the contributions are refunded. Now if the <u>exact</u> size of the minority is common knowledge then such a scheme does indeed achieve the desired goal of implementing project B, since each of the

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[32] Hence, conditional on a particular project having been chosen, the efficient allocation is not to replace any insiders by outsiders. The only issue is which project to choose.

minority members knows that he is pivotal: he realises that unless he contributes to the kitty, project B won't go ahead. But it is clear that a scheme like this operates on a knife-edge. In particular, Mailath and Postlewaite (1990) and Rob (1989) prove that only a small amount of aggregate uncertainty causes schemes like this to fail, as do all other incentive compatible mechanisms.[33] Indeed, as the number of agents increases, there is less and less likelihood of dislodging the status quo.

Here we are using the term "status quo" to refer to the outcome of the formal contract. In the case of a cooperative, it is the outcome of the vote. Beyond this point, each signatory to the contract -- each member of the cooperative -- effectively has veto power: renegotiation requires everyone's agreement. If there is a large number of people involved, with asymmetric information, then the requirement of unanimity is almost always too great a hurdle to surmount. In the case of a cooperative, the outcome of the vote is therefore final, and cannot be renegotiated.[34]

Likewise, under outside ownership, given that customers' individual preferences are privately known, there is no scope for recontracting.

Formally, to adopt the terminology of Holmstrom and Myerson (1983), the two ownership structures select different allocations along the interim incentive efficient frontier. ("Interim" refers to the fact that agents have learnt their own types, but not each others'. "Incentive efficient" refers to the fact that there is no way to make everyone better off without violating incentive compatibility.) As we have seen in the example, different interim constrained efficient allocations entail different degrees

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[33]See also Levine and Pesendorfer (1995) and Segal (1997).

[34]Note, incidentally, that changing the voting procedure from simple majority voting to, say, supermajority voting typically will not help -- not least because there may be no easy way to specify in advance which is the default outcome that will occur if the specified majority is not attained (i.e., it may not be clear whether project A or project B is the default).

of ex post inefficiency. Provided we assume that the gain to the minority from switching to project B is great enough, the degree of inefficiency under outside ownership is less than in a cooperative.

This begs the question: are there better ownership structures? That is, in Holmstrom and Myerson's language, are there ex ante contracts which implement allocations which also lie along the interim incentive efficient frontier, but are nearer to the ex post efficient point?

In the above example, one obvious candidate is the contract which specifies, first, that project B will be chosen over project A, and, second, that the price charged to insiders will be set at average cost, $\frac{G}{I}$. This contract attempts to implement first-best directly, and so, if successful, would dominate both a cooperative and outside ownership. However, such a contract is hard to write. Our assumption is that there is considerable uncertainty between the date at which the contract is written and the date at which decisions need to be taken -- not just uncertainty about the insiders' valuations (which we asume are privately learnt), or about costs, or about outside demand, but, more fundamentally, uncertainty about the nature of the good to be traded. Thus, statements like "project B will be chosen over project A" cannot be written in advance, because it is impossible to envisage what projects A and B will be. Similarly, it makes no sense to write into a contract "the price charged to insiders will be set at $\frac{G}{I}$". The price of what? If the good cannot be described in advance then there is no point in specifying its price.

More generally, the machinery of classical mechanism design, which makes use of game forms that map from abstract message spaces into outcomes, cannot be used (at least directly), because outcomes cannot be described in advance.

With this in mind, we take the set of feasible contracts to be ones where authority to take decisions is allocated without any reference to the issue at hand. That is, we restrict attention to "issue-free" contracts. One might refer to such a contract as a <u>constitution</u>. An ownership structure, which allocates residual control rights, is thus a constitution.[35]

Note that the ownership structures that we have considered do not merely allocate residual control rights. In addition, they allocate the rights to residual income, or profit. Provided that profit is well-defined, the allocation of residual income can also be specified in an ex ante contract without reference to the issue to be decided ex post. Thus, in our analysis, there are two ingredients to a constitution: the allocation of control rights, or votes; and the allocation of income rights, or shares. Under outside ownership, all the votes and shares are held by the outsider. In a cooperative (as we have defined it), votes are allocated equally across the membership; and in a nonprofit cooperative, the allocation of shares is irrelevant.[36]

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[35]We don't abandon Bayesian analysis, however. We assume that the agents are able to perceive the consequences, in terms of payoff, of different constitutions. In other words, we draw a distinction between, on the one hand, agents being able to make an ex ante assessment of payoffs, and, on the other hand, being able to write an ex ante description of the actions (price, choice of project, ...) that yield those payoffs

Maskin and Tirole (1997) have recently shown that, in a context of symmetric information, and where renegotiation can be contractually prevented, the fact that actions cannot be described in advance does not necessarily constrain the set of implementable outcomes. That is, when agents can assess their payoffs ex ante, and know each others' types ex post, and can commit not to renegotiate, they can use sophisticated message games to finesse their inability to describe actions in advance. (If the parties cannot commit not to renegotiate, then the inclusion of outside parties in the contract can achieve the same ends, provided collusion can be avoided. Maskin and Tirole also have results for the case where there is renegotiation and outside parties cannot be brought in.) Whether these Maskin-Tirole mechanisms are as effective in the context of asymmetric information is an open question.

[36]We should note that we have implicitly built into the constitution of our

Of course, outside ownership and cooperatives represent only two ways of allocating residual control rights and residual income rights. However, we believe they have particular claim to attention. To see why, suppose some individual insider is allocated a disproportionately large fraction of the shares. Then the profit motive swamps any consumption benefit and this large shareholder has the same preferences as an outside owner. And, since the same is true of any large shareholder, there is no gain from having more than one. If the large shareholder has more than half the votes, this would be tantamount to giving him all the votes, which effectively makes the cooperative equivalent to outside ownership On the other hand, the large shareholder could have less than half the votes, the other votes being allocated thinly across other insiders. Such an arrangement would lie somewhere between outside ownership and a cooperative.

If there is no large shareholder then, since all insiders are assumed to be identical ex ante, there would appear to be no reason not to allocate the shares equally across the membership, and to give each member a vote, as in a cooperative.[37]

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cooperative an equal treatment rule. That is to say, no member is allowed to be discriminated against on grounds other than behavior, e.g., gender, race, or social background. For example, in the simple pricing model of Section 2, the price, p, was the same for all members. We might instead have considered a cooperative without an equal treatment rule, which would open the door to personalized discrimination: a majority could oblige some individual (or some minority) to pay a higher price. There are arguments why discrimination of this sort may be undesirable. One is that individuals are risk averse, and, since it is unclear who will end up being picked on to pay the higher price, discrimination only serves to introduce unwanted uncertainty over members' final payoffs.

[37] More generally, if there were several ex ante categories of insider, then members of different categories could be allocated different bundles of shares and votes. For more on this, see Section 7.

6. The Literature

The theoretical literature on cooperatives is considerable; for a recent survey, see Bonin, Jones and Putterman (1993). Much of the literature stems from the paper by Ward (1959), who argued that worker cooperatives maximize revenue per head, rather than profit, and that this leads to distortions. For example, since new hires dilute revenue per head, worker cooperatives restrict labor demand, relative to profit-maximising firms. It is generally recognized that such distortions are the result of (usually implicit) constraints on contracting: e.g., if new hires were charged an entry fee then distortions to labor demand would disappear.

There is a large empirical literature, which is also surveyed in Bonin, Jones and Putterman (1993). A notable contribution that postdates this survey is the work by Craig and Pencavel (1992, 1995) on the performance of plywood cooperatives in the U.S. Pacific Northwest.

Rather than attempt to review either the theoretical or the empirical literatures in depth, let us briefly discuss some recent contributions (mostly unpublished) that relate to the present paper.

Banerjee, Mookherjee, Munshi and Ray (1997) develop and test a model of Indian sugar farming cooperatives. They argue that the wealthier farmers enjoy disproportionate power, which they use to expropriate profit, and depress the sugar price paid to poorer farmers. This prediction (and other predictions concerning capacity levels and participation rates of different classes of farmer) are confirmed by data from nearly one hundred sugar cooperatives in the state of Maharashtra over the period 1971-93.

By contrast, our model does not have profit-stealing, and we might predict that the larger farmers would raise the sugar price in order to disproportionately benefit themselves (see Hart and Moore, 1996). For present purposes, the finding of Banerjee, Mookherjee, Munshi and Ray that we most want to highlight is the inverse relationship between efficiency and heterogeneity: they demonstrate that as the dispersion in wealth among sugar farmers grows, so do the distortions. This squares with our analysis: as differences across consumers grow, so the inefficiencies arising from asymmetric information also grow.

Another paper which focuses on heterogeneity within cooperatives is the study by Emmons and Mueller (1997) of cooperative banking in Germany. They develop and test a model in which some members are (net) depositors and others are (net) borrowers. These two groups clearly have conflicting views over the interest rate charged to borrowers. Emmons and Mueller show that since 1945 the balance of power has shifted from the borrowers to the depositors, with the result that cooperative banks now no longer provide credit at less than the market rate of interest, which means that they have been better able to compete successfully with other banking groups.

Kremer (1997) also concerns heterogeneity. In his model of a worker cooperative, workers with different abilities vote over (linear) wage schedules: in effect, they vote over how revenue is distributed. (This approach dates back to Roberts (1977).) Workers with lower (higher) ability vote for a flatter (steeper) schedule. If the median ability is less than the average, then the schedule will be flatter than 45°, wages will be compressed, and incentives will be dulled. This is consistent with Craig and Pencavel's finding that wage differentials are compressed in worker cooperatives, relative to firms with outside owners.

Barzel and Sass (1990) and Albaek and Schultz (1997) are two interesting papers that ask when is it optimal to have different classes of membership in a cooperative. That is, might different ex ante types be given different voting rights, bundled with different obligations? In our model, all members are identical ex ante, and so there is no point grouping them into different classes. We will return to the question of equal versus unequal treatment, and to these two papers, at the end of Section 7.

In our own earlier work on property rights and the nature of the firm, Hart and Moore (1990), we showed that a cooperative ownership structure can be optimal. (See also Bolton and Xu (1997) for a recent analysis of cooperatives and other ownership structures along similar lines.) The idea is that, in a world of incomplete contracts and relationship-specific investments, the ownership of assets confers power, which reduces the extent to which agents are subject to hold-up. Ownership (and power) is a scarce commodity, however, and in certain circumstances, it is best to distribute ownership evenly by means of common ownership, i.e., through a cooperative. The present paper is not to do with specific investment, hold-up and reducing ex ante inefficiency; rather it concerns ex post inefficiency (arising from asymmetric information), and the choice of ownership structure to minimize that inefficiency.

Finally, we should add that some of the ideas in the present paper originated in Hart and Moore (1996), which concerned the governance of trading exchanges.[38] There are a number of important differences. Our 1996 paper focuses on the pricing of a good, where a cooperative can use surplus from other profitable activities (which are not modeled) to subsidise losses from pricing the good at less than cost. Also, there was no outside demand for the good. By contrast, the present paper is primarily concerned with investment, or choice of output. Crucially, there is an outside market. The only surplus the firm enjoys is a (possible) cost advantage relative to the market.

7. Concluding Remarks

It may help to summarise our findings from the analysis in Sections 2 - 4. We are concerned with the design of a constitution -- an ex ante contract which assigns residual rights of control (and possibly residual income rights) without reference to the issue to be decided. We focus attention on two polar constitutions: nonprofit cooperatives and outside

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[38] Chapters 2 and 3 of Lee (forthcoming) provide an in-depth analysis of the governance of exchanges. Greising and Morse (1991) describe the infighting between larger institutional members and smaller individual members at Chicago's two main exchanges, the Board of Trade and the Mercantile Exchange -- conflicts which continue to this day.

ownership. In the former, ownership is shared among a group of consumers on a one member, one vote basis (since the cooperative is nonprofit, the allocation of residual income is irrelevant). In the latter, all control rights and rights to residual income are allocated to an outsider. We obtain two main results. In the case of perfect competition, an outside owner achieves the first-best; a cooperative typically does not, because the rent from any cost advantage relative to the market is used to shield members from competitive pressure, and the median voter's preferences may not reflect average preferences. And in the case where the members of a cooperative have common preference orderings they unanimously vote for the first-best; an outsider owner typically makes inefficient decisions, tailored to the marginal rather than to the average consumer.[39]

There are many interesting ways in which our analysis can be extended. First, we have modelled consumption as a 0/1 choice: "big" consumers are those who get high benefit from consuming a single item of the good. If demand is multi-valued then new effects arise. The membership fee can be disentangled from the price charged to members (in effect, the cooperative

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[39] It is worth noting a connection between our paper and the literature on unanimity in stock market economies (see Makowski (1983) and the references therein). That literature considers how a firm with heterogeneous shareholders chooses a production plan when markets are incomplete. This is akin to how a firm with heterogeneous owners makes a quality choice. In the stock market literature, the firm's ownership structure is taken as given; that is, the issue of the ex ante optimal choice of ownership structure is not considered. Also, sidepayments between owners are typically ruled out even though there is no (explicit) asymmetric information. Finally, an equal treatment rule is imposed, i.e., insiders must purchase consumption (shares) at the same price as outsiders. This last assumption explains an important difference between our results and the earlier literature. The stock market literature finds that, under perfect competition, all ownership structures are equally good, since they all lead to value- (or profit-) maximizing behavior. In contrast, we find that under perfect competition a cooperative may engage in rent-seeking activities and fail to maximize profit (value).

votes over two-part tariffs), which means that there is scope for additional conflict between big and small consumers, even if the cooperative is nonprofit. The big consumers -- those who consume most -- have an incentive to vote for a lower price (offset by a higher membership fee), since they benefit disproportionately.[40]

Second, our model has just one good being provided (although in Section 3 there was a choice over the type of good). When two or more goods can be supplied simultaneously, the issue of cross-subsidization arises. Even in a nonprofit cooperative, there is a degree of freedom -- and hence conflict -- over the prices that should be charged for each good. Preliminary research suggests that this may be a rich vein for future investigation.

Third, the initial choice of I needs to be modeled. This is related to the question of who should be in the cooperative (if there is to be one). To give a good answer, it will probably be necessary to delve into quite hard issues to do with the dynamics of membership.

Fourth, because we have assumed that agents are identical ex ante, we have made the natural assumption that in our cooperative there is only one type of member. In a more general setting, however, there may be good reasons for trying to introduce different classes of membership. Different classes of membership might bundle different levels of service with different voting rights and different membership fees.

For example, Barzel and Sass (1990) discuss how voting rights and membership obligations are allocated in condominia. Tenants' voting rights and obligations can be assessed in a number of different ways: they can be made to depend on floor area, or on the number of people in the household. Among other things, Barzel and Sass find that in practice these assessments

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[40] Section VI of Hart and Moore (1996) contains a pricing model along these lines. We analysed a <u>for-profit</u> cooperative voting over <u>uniform</u>-pricing policies; but since there was no exclusion this is equivalent to a nonprofit cooperative voting over two-part tariffs.

are made so as keep costs and benefits in proportion to each other -- thus minimizing conflicts of interest between different classes of tenant. In a similar vein, Albaek and Schultz (1997) analyse the optimal distribution of votes and cost-shares in a farming cooperative.

There may be costs associated with having different classes of membership in a cooperative. Clear, fixed arrangements such as one member, one vote may have the drawback of leading to inefficient outcomes in the voting; but they have the merit of not being open to abuse. A policy of equal treatment makes it less likely that one class of member will gang up on another -- for example, by raising the price charged to (the membership fee of) the other class.[41]

To conclude, we should caution that we may have painted too rosy a picture of cooperatives. There are certain problems specific to cooperatives, which, for clarity, we side-stepped in our formal analysis: voting, agency, and raising capital. Let us briefly consider these.

Voting

The reader will have noticed that in the paper we kept the menu of choices available to a cooperative down to a minimum. (In Section 2 there was no choice whatsoever: the cooperative was nonprofit, and there was only one price that balanced the budget. In Section 3, the choice was between project A and project B, with concomitant prices $\hat{p}$ and $\hat{q}$ which are unique.) This was deliberate. We wanted to avoid all complications to do with voting and collective decision-making, and to concentrate on the nature of the inefficencies that arise because of asymmetric information. In other words, we wanted, at least at the level of formal analysis, to keep the playing field level between cooperatives and outside ownership.

In practice, the playing field is not level. There are non-trivial

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[41] See also footnote 36.

costs associated with reaching decisions in a group with divergent interests. This means that outside ownership -- where power is concentrated in the hands of a single person, or in the hands of people with a common objective to maximize profit -- has distinct merit, over and above the particular instances we have highlighted in the paper.

The practical problems of democratic decision-making should not come as a surprise. At the theoretical level, the circumstances in which a median-voter theorem applies are quite restrictive. And, even when such a theorem does apply, it is not always easy to define a noncooperative game form which implements the median voter's preferred outcome.

Agency

One respect in which a cooperative suffers relative to, say, a public corporation, is that for a cooperative there is typically no effective market for corporate control. Large cooperatives, like other firms, are run on a day-to-day basis by managers; that is, there is a separation between ownership and (effective) control. An individual member of the cooperative cannot buy up the votes of his colleagues, because unbundling votes from membership is not permitted. Nor is a member permitted to acquire power by buying up lots of membership places for his own use. Hence it is difficult for an individual to exert pressure on management, except through the democratic process, which we know suffers from severe free-rider problems. In the cooperative, then, managers may be more entrenched than they would be in a public corporation.

There is another aspect to the agency problem faced by a large cooperative. What instructions, or incentive scheme, should the cooperative give to the manager? An outside owner has a relatively simple task: she instructs her manager to maximize profit. (Of course, this does not guarantee that the manager will maximize profit.) Profit-maximization has the merit of being, at least in principle, a clear-cut objective. A cooperative has a more complex objective: say to maximize the payoff of the median voter. But what, in day-to-day terms, does this mean?

Raising capital

A cooperative can raise money in a number of ways. Clearly, it can use retained earnings, or raise the price (membership fee). It can also issue debt or non-voting equity. Of course, all these methods can also be used by an outside owner.

What a cooperative cannot do is to sell standard voting equity ("standard" in the sense that the equity is not bundled with other rights -- e.g. the right to consume). Here, an outside owner is at an advantage, because she can issue voting equity. In this sense, the cost of capital to a cooperative will be higher than for an outside owner.

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Appendix

In this Appendix we consider how the analysis changes if average cost exceeds the reservation price of outsiders. For simplicity we restrict attention to the case where only one type of good can be produced (as in Section 2).

Assumption A′: $\frac{F}{I} > p^*$.

In the first-best, production will occur if and only if

$$\text{(A.1)} \qquad \sum_i \max \{a_i,\ p^*\} \ \geq \ F.$$

The main difference from the case studied in the text is that it may not always be efficient to produce.

Consider now the second-best. Given Assumption A′, an outside owner will never want to set p so low as to attract outsiders, since she will make a loss. Hence the entrepreneur will solve:

$$\max_p \ p \ \#\{i | a_i \geq p\}.$$

Let $\bar{p}$ be the smallest solution to the above problem. Then, under outside ownership, production of the good will occur if and only if

$$\text{(A.2)} \qquad \bar{p} \ \#\{i | a_i \geq \bar{p}\} \ \geq \ F.$$

Moreover, conditional on production occuring, an efficient allocation of consumption is realized if and only if $a_i \geq \bar{p}$ for all i; i.e., if and only if there is no exclusion, since otherwise the firm's capacity is under-utilized.

Consider next a cooperative. Given Assumption A′, a cooperative will also not admit outsiders. The reason is that the cooperative cannot charge insiders more than outsiders and $p \leq p^* < \frac{F}{I}$ implies that the cooperative makes a loss. Hence, the cooperative will simply choose a membership fee $p > p^*$ for insiders.

Let

$$\mathbb{P} = \left\{ p \mid p \, \#\{i \mid a_i \geq p\} \geq F \right\}$$

be the set of feasible, break-even membership fees if the cooperative produces. ($\mathbb{P}$ may be empty.) Then the choice among elements in $\mathbb{P}$ is simple: every cooperative member prefers a lower value of p to a higher one if he consumes the good and is indifferent if he does not. Thus, the cooperative will (unanimously) select a membership fee given by

$$\text{(A.3)} \qquad \hat{p} = \min_{p \in \mathbb{P}} p.$$

Note that at $\hat{p}$, the break-even constraint will hold with equality: $\hat{p} \, \#\{i \mid a_i \geq \hat{p}\} = F$.

On the other hand, if $\mathbb{P}$ is empty, the cooperative will set a zero membership fee and will not produce.

Note that (A.2) holds if and only if $\mathbb{P}$ is non-empty; i.e., an outside owner produces if and only if the cooperative produces.

It is easy to compute total net surplus under the two organizational forms:

$$S^{oo} = \begin{cases} \sum_{i | a_i \geq \bar{p}} a_i - F & \text{if (A.2) holds} \\ 0 & \text{otherwise} \end{cases}$$

$$S^{c} = \begin{cases} \sum_{i | a_i \geq \hat{p}} a_i - F & \text{if } \mathbb{P} \text{ is nonempty} \\ 0 & \text{otherwise} \end{cases}$$

The comparison between outside ownership and a cooperative is straightforward. Neither admits outsiders, but a cooperative chooses a lower price and hence includes more insiders, which is socially more efficient.

<u>Proposition 4.</u> Given Assumption A':

(1) Both under outside ownership and in a cooperative there is underproduction relative to the first-best; i.e., (A.2) implies (A.1) and $\mathbb{P} \neq \phi$ also implies (A.1), but not conversely.

(2) Production occurs under the cooperative if and only if it occurs under outside ownership.

(3) $S^c \geq S^{oo}$; that is, the cooperative is at least as efficient as an outside owner. In particular, the cooperative excludes fewer insiders (if it produces).

Proof. (2) is clear since an outside owner can make nonnegative profit if and only if the cooperative can break even.

To understand (1), suppose that the cooperative operates; i.e.,

$$\hat{p}\ \#\{i \mid a_i \geq \hat{p}\} = F.$$

Then

$$\sum_{i \mid a_i \geq \hat{p}} a_i \geq \hat{p}\ \#\{i \mid a_i \geq \hat{p}\} = F,$$

and hence

$$\sum_i \max\ \{a_i,\ p^*\} \geq \sum_{i \mid a_i \geq \hat{p}} a_i \geq F,$$

which implies that operation is efficient in the first-best.

(3) follows from the fact that a cooperative sets a lower price for the good (i.e., membership fee) than an outside owner: $\hat{p} \leq \bar{p}$.

Q.E.D.