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THE COOPERATIVE FIRM AS MONITORED CREDIT

BRENT HUETH AND PHILIPPE MARCOUL

Abstract. We develop a financial-contracting theory of the cooperative firm where production requires three generic tasks: working, managing, and monitoring. Workers provide an intermediate input (or labor directly); managers convert the workers' input into a final output; and directors monitor managers. We model the cooperative firm by letting the workers act also as directors. We show how bundling the labor and monitoring tasks can expand the scope for equilibrium market activity, even when doing so results in a strictly positive deadweight loss. Our theory provides new insight with respect to a substantial theoretical and empirical literature on the "life cycle" of worker-managed firms, and with respect to a complementary body of anecdotal evidence on the causes of worker buyouts and cooperative "degeneration." Our theory is also consistent with differences between the board compensation policies of cooperative firms, where members typically receive little more than travel and per-diem reimbursements, and of investor-owned firms, where members receive substantial pay often based in part on firm financial performance.

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Introduction

Considerable research effort has been directed at understanding the relative merits of cooperative versus investor ownership.[1] Disagreement remains, however, regarding the core set of motivations giving rise to the dominance of investor ownership in modern economies (Dow and Putterman, 2000).[2] There is arguably a better understanding of the relative disadvantages of cooperative ownership than of its advantages. This is not surprising given that cooperative capital is supplied primarily by *members,* who by definition cannot be solely investors, and who in most cases must be geographically proximate to the firm in order to transact either as input suppliers, workers, or consumers. This feature sharply restricts the pool of potential sources of capital available to cooperative firms, and represents a clear source of disadvantage relative to firms with no restrictions on outside investment. Also, preference heterogeneity among cooperative members, and a lack of liquidity in membership markets, together generate internal decision making frictions that are less severe in a publicly traded firm (Dow, 2001; Hansmann, 2000; Holmström, 1999).

Despite these disadvantages, cooperative firms seem often to be viable in economic environments that cannot support activity financed purely by outsiders. Hetherington (1991, pg. 247) sums up his cross-sectoral investigation of cooperative activity by concluding that, "Proprietary firms tend to be more aggressive, innovative, and flexible competitors, while mutuals, particularly cooperatives, continue to serve markets at rates of return at which proprietary firms would withdraw from business." This observation suggests that cooperative firms can extend the range of feasible market activity into relatively low-return environments, and in this sense apparently have an operational *advantage* over other organizational forms. Differences in work incentives provide one natural place to look for the source of this advantage. For example, as Dow and Putterman (2000, pp. 324-325) point

[1] For the purpose of this paper, the labels "investor" and "cooperative" are used to differentiate firms that are owned by outside investors, versus those that are owned by some other class of "members." These members, in addition to providing the firm's capital, transact with the firm either as input suppliers, workers, or consumers. The distinction is not without ambiguity. As Hansmann (2000, pp. 13-15) points out, an investor-owned firm is nothing more than a "capital cooperative" where members transact with the firm by providing capital in return for a share of firm profits. Conversely, cooperative members are clearly investors: they fund the firm's activities by foregoing profit allocations ("patronage refunds"), by allowing the firm to tax member transactions ("per-unit retains"), and also by investing cash directly in the firm (Frederick, 2005, pp. 69-81). The distinction is important for this paper only insofar as there is a difference in the nature of the business relationship a firm has with its members. Pure investors provide cash in return for a share of profits; cooperative members do the same, but also transact with the firm for goods and services.

[2] The relevant literature is vast, and we do not attempt a comprehensive review here. The interested reader can consult Bonin et al. (1993) and Dow (2003) for surveys regarding the labor-managed firm. Parallel developments in the literature on agricultural cooperatives (which, early on, preceded many of the developments in the labor-managed-firm literature) are nicely discussed in Sexton (1984). Consumer cooperatives have also been the subject of considerable theoretical and empirical research. See, for example, Enke (1945) , Sexton and Sexton (1987), and Hart and Moore (1998) for general theoretical contributions, and Banerjee et al. (2004) and Smith (1984) for relatively recent applications specific to the credit sector.

out in the context of the worker cooperative, "mutual monitoring, reductions in supervisory expenses, and strong work incentives, are widely accepted stylized characteristics of worker-owned firms." Certainly, if a cooperative firm can provide incentives to its workers that cannot be replicated in an investor-owned firm, then the cooperative firm can be sustainable in otherwise unsustainable environments.

The critical question is of course why cooperatively-owned firms can provide these incentives, while investor-owned firms cannot? What prevents an investor-owned firm from using exactly the same contract with its members that a cooperative firm uses? In attempting to answer this question, we focus on the dual role of members as input suppliers or workers on the one hand, and as monitors of management in their role as directors on the other.[3] The monitoring task is a direct byproduct of member financing and control, which we take as the defining feature of a cooperative firm. Motivational costs or "agency rents" vary across cooperative and investor-owned firms in this context because members are naturally motivated monitors. Heuristically, the value to members of transacting with the firm as workers or input suppliers increases with firm performance (because then the firm can afford to pay higher wages) so members have a "built-in" incentive to monitor management.

Although agency rents may be lower in a cooperative firm, there are countervailing costs associated with financing and directorship by workers. In addition to the liquidity and preference-heterogeneity costs noted above, workers and input suppliers are often poorly trained to take on directorship responsibilities. We model these varied costs of member control in reduced form by supposing simply that monitoring by cooperative members is more costly than monitoring by specialists. This assumption effectively introduces a deadweight cost for the cooperative firm, relative to a firm operated by outside investors. Combining the incentive benefit and deadweight cost aspects of member ownership results in a "hard times" theory of the cooperative firm: incentive benefits expand the set of feasible financial contracts, but only by shrinking total economic surplus relative to investor ownership. As a result, this expansion is only desirable when a firm financed by outsiders is not feasible. Such an infeasibility occurs when there is insufficient total surplus generated by the firm

[3]Our focus in this paper is therefore on the producer cooperative. Dow and Putterman (2000, pg. 321) make a distinction among "labor-managed firms and firms controlled by input suppliers (e.g., agricultural cooperatives), by customers (consumer cooperatives), or by others (for instance, non-profit organizations)." Bonin et al. (1993, pg. 1291) similarly focus on "producer cooperatives," but define this focus in such a way as to rule out study of "consumer and marketing cooperatives, collective farms, partnerships and other forms of not-for-profit organizations." While we agree that consumer cooperatives, partnerships, and non-profit organizations are fundamentally different from labor-managed firms, making a strong distinction relative to firms controlled input suppliers (i.e., marketing cooperatives) seems artificial. Any input that is supplied to such a firm is a transformation of labor effort, and the relevant set of incentive and organizational design issues differ only by degree (e.g., in relation to the separability of each individual workers' contribution to total output, and possibly with respect to the financial resources of workers). Moreover, as we will later argue, worker and marketing cooperatives (or what for us are "producers cooperatives") exhibit similar empirical patterns in terms of a "life cycle."

to motivate all the relevant parties. We show how a cooperative firm can operate in such an environment, so long as the deadweight cost associated with cooperation is sufficiently small. An analogous logic is used in the corporate finance literature to explain the role of banks, venture capitalist, and private equity funds as a source of monitored, and relatively high-cost, funds (Tirole, 2006, chapters 8 and 9).

In what follows, we briefly summarize related work within the empirical and theoretical literatures on cooperative behavior. We then present our model of the cooperative firm and demonstrate how bundling the working and monitoring tasks can extend market viability. The subsequent section considers a number of extensions to the basic model, and the final section concludes with a summary and discussion of directions for future research.

Related Literature

Worker buyouts of financially distressed investor-owned firms are a common source of formation for labor-managed firms (Dow, 2003, pg. 213). Similarly, Hetherington (1991, pp. 182-186) notes that many existing agricultural marketing cooperatives formed in response to exit by private handlers. Conversely, evidence suggests that cooperative firms are apt to "degenerate" through a gradual substitution of non-member labor for member labor, or to sell out ("demutialize") to investors when the firm is performing well. Collectively, these observations support the view that cooperatives have a characteristic "life cycle" involving formation in low-return economic environments, but eventual demise when returns are high (Ben-Ner, 1988). To understand these observations, two related sets of questions have to be answered. First, why would workers ever choose to invest in a failing private enterprise? And second, when successful, why is it difficult to sustain the cooperative organizational structure?

In attempting to answer just the first question, Ben-Ner and Jun (1996) argue that employee buyouts act as a screening mechanism with respect to the private information of firm managers. Management will never accept a low price for the firm when future prospects are good, but may be willing to pay relatively higher wages. Similarly, when future prospects are poor, management will never pay high wages, but may be willing to accept a relatively low sale price. In effect, workers can get a "good deal" in bad return states that result in part from their ability to bargain simultaneously over wages and a possible buyout. This argument has considerable intuitive appeal, but ignores changes in the financial and organizational makeup of the firm pre- and post-buyout. That is, while it may be true that a buyout offer by workers provides means of eliciting information from firm managers, it remains to be explained why employees (or input suppliers) should control the firm post buyout? Why not finance the purchase with the assistance of external investors, perhaps using the firm's assets as collateral, and grant control to investors? There is nothing about

the way workers organize their activities in this story that speaks to the special structural characteristics of the cooperative firm.

In an agricultural context, Hansmann (2000, p. 124) argues that farmers may choose to invest equity in a marginally valuable processing facility if the alternative is one or a small number of oligopsony buyers. That is, the return on investment in such a facility is made up of firm-level profits plus any benefit associated with inducing competitive pricing by other buyers. However, in many of the examples where farmers have taken over the activities of an investor-owned firm, it has been the threat of *no* buyer that has motivated farmers, rather than the threat of a small number of oligopsony buyers. A considerable body of literature suggests that cooperatives indeed have played an important pro-competitive role in agricultural markets (e.g., Refsell, 1914; Sexton, 1990; Fulton and Giannakas, 2001). However, cooperatives also seem to *extend* markets into economic environments that cannot support the activity of a firm funded by outsiders. These two effects are qualitatively distinct. The results we present below are the first we are aware of that provide a formal rationale for the "market extending" feature of cooperative activity. This effect has been discussed at length in the descriptive literature on cooperation in reference to the role that cooperatives play in meeting "unmet" services (e.g., Fulton and Ketilson, 1992). Cooperative lending institutions have similarly been cited as a means of providing credit to populations that are excluded from private credit markets (Guinnane, 2001).

Miyazaki (1988) develops a model to explain the full cooperative life cycle, and in doing so addresses both the "hard-times" formation and degeneration questions. Briefly, cooperative and noncooperative firms are distinguished in his model by the types of contracts that each firm can write with its employees. A cooperative firm can offer long-term contracts with income-smoothing benefits, while a noncooperative firm pays a competitive spot wage contingent on the realization of uncertainty. The cooperative contract extends the range of feasible economic activity by providing insurance to its members that is not available on the outside. However, cooperative members receive remuneration that depends on firm profits so that in high-return states, cooperative members are expensive relative to wage labor. This effect generates an incentive to substitute wage labor for member labor in high return states, and in the limit to degeneration with a single cooperative member. The model by Ben-Ner (1984) is similar in spirit, but where the the cooperative firm is defined behaviorally as an organization that maximizes profit per worker, and where cooperative members are assumed to have higher labor productivity than labor hired from the outside.

More recently, Rey and Tirole (2006) explicitly model membership dynamics. Following Hansmann's thesis regarding governance costs in democratic firms, the authors focus on members' inter-generational frictions related to capital investment. They derive conditions under which cooperatives can credibly compete with investor-owned corporations, showing

that cooperatives with a membership access fee (i.e. "discriminatory cooperatives") are usually better equipped to face such competition. Interestingly for our purpose, they conclude that the "non discriminatory cooperative is a highly fragile institution" that is "vulnerable to attacks by discriminatory cooperatives or by for-profits." Our theory reconciles this conclusion with the stubborn fact of existence for such cooperatives: These more traditional cooperatives exist possibly because "their natural economic habitat" is not attractive to the more common investor-owned firm.

Focusing on a different set of issues, Levin and Tadelis (2005) use the profit-per-worker objective function to explain why partnerships, rather than business corporations, emerge primarily in sectors where human capital plays a paramount role in production, and where product quality is difficult to observe. In this context, maximizing profit per worker results in an equilibrium hiring policy that selects relatively high-quality workers. The authors show that this effective commitment to quality is beneficial when information asymmetries between the firm and consumers are relatively severe. Like Levin and Tadelis (2005), we are interested in explaining why a single organizational form is predominantly observed in a particular class of economic environments. Our analysis differs, however, by focusing on information asymmetries that are internal to the firm, and by explicitly modeling a key *observable* structural difference between cooperative and noncooperative firms.

A "cooperative firm" is defined in U.S. tax law as an organization "operating on a cooperative basis and allocating amounts to patrons on the basis of the business done with said patrons" (Frederick, 2005, pg. 41). The expression "operating on a cooperative basis" is not defined anywhere in federal tax code, but is loosly described in various state incorporation statutes as an organization that is financed and democratically controlled by members (i.e., workers or consumers), where earnings are allocated according to "use" rather than financial stake, and where returns on outside investment are limited (Baarda, 1986, pg. 4). Perhaps it is reasonable to model these attributes in reduced form by assuming that employment contracts, or firm objectives, differ across cooperative and noncooperative firms. However, neither approach addresses the core organizational distinction regarding the bundling of financing, control, and "use." Jensen and Meckling (1979) make this point forcefully in their critique of the labor-managed firm literature, arguing that "What renders most of these efforts [to model and compare the labor-managed firm with a for-profit firm] unproductive is the almost universal tendency in the modeling to ignore precisely those institutional factors which are most crucial for the comparison."

In this paper, we focus on the dual role of workers as laborers and monitors of management as one clearly identifiable institutional factor that distinguishes cooperative from

noncooperative firms.[4] The monitoring role that is assumed by the board of directors in a public stock corporation is performed by workers (or their elected representatives) in a producer or worker cooperative. Presumably, it is efficient to take on this role in part because as members they finance the firm. Whatever the reason (we consider situations where investment and control are decoupled, and where they go together for reasons exogenous to our model), worker monitoring has an advantage relative to monitoring by outsiders. Given an employment contract that is tied in some way to firm value, worker monitors have an incentive to monitor management without direct compensation for doing so. That such an effect exists seems plausible based on empirical observations regarding differential pay for outside and worker directors. Although there are no systematic studies of this differential, Reynolds (2004) documents retainers for a sample of U.S. agricultural supply and marketing cooperatives that range between 100 and 200 dollars—and *no* performance-based pay. In sharp contrast, directors at noncooperative firms are payed substantial salaries *plus* often some form of performance-based reward. In addition to pay differences, ample case-study and descriptive evidence suggests that workers (and agricultural producers) are thoroughly engaged in managerial monitoring within their firms—much more so than the directors of a typical public-stock corporation. Greenberg (1986, p. 51) writes, "Any shareholder is free to go to the general manager or the treasurer in the business office and ask to see whatever documents or data he desires, a right that is often practised." He further notes that the average attendance rate at general meetings (held at least twice a year) exceeded 90 percent. The theory that follows accounts for the cooperative life cycle, and is consistent with these observed differences in pay structure and monitoring intensity for cooperative and noncooperative directors.

At a purely formal level, our results relate to recent work on multitasking and scope economies in the provision of incentives. Our treatment of the cooperative firm focuses on the bundling of two "tasks" in the job assignment of a single individual that in an investor-owned firm are unbundled, or specialized, across two or more individuals. Workers or input suppliers in a cooperative firm literally have two jobs: they provide labor or material inputs and they supervise management. What kinds of technological or market environments support bundling of this kind? Itoh (1994) was among the first authors to consider this question. In an extension of the multitasking model developed by Holmström and Milgrom (1991), Itoh (1994) shows how it can be efficient to combine tasks to save on risk bearing costs. Laux (2001) shows how, in a limited-liability contracting environment, total wage costs can be reduced by assigning multiple independent projects to a single agent, rather

[4]The formal restriction on returns payed to outside equity represents another fundamental distinction. The cost of such a restriction is clear, but what is the benefit? One possibility is that restricting returns payed to outsiders in the future may encourage further investment by insiders in the present. In this view, cooperative statutes might be viewed as a socially beneficial commitment device that increases member participation.

than to multiple agents. By paying the agent only when *all* projects succeed, the principal can effectively relax the agent's limited liability constraint by punishing the agent for a given project by taking away payment on another. Similarly, Sinclair-Desgagné (1999) shows how a principal can implement higher-powered incentive schemes in a multi-task setting by relying on sequential audits of the agent's performance. More recently, Schmitz (2005) demonstrates that two sequential projects should be carried out by the same agent only when project surplus is not high enough to justify always paying for high effort on the second project. Our work differs from the Itoh (1994) in that we study a contracting environment where agents are risk neutral, but have limited wealth. The results in Laux (2001) and Schmitz (2005) have a similar flavor to ours in that they both identify situations where there are incentive scope economies in bundling tasks. Our framework differs formally in that we study contracting over a single "project," rather than multiple independent projects. More importantly, we make the link between a key structural feature of a "cooperative" firm and the potential for incentive economies.

Theory

The theory we develop extends the corporate finance model of Holmström and Tirole (1997) who treat the firm as a "project" to be undertaken and financed by a limited-wealth entrepreneur, a lender, and, potentially, a third agent who monitors the entrepreneur. The model is simple, but rich in predictions regarding the nature of contracting among the various parties involved in financing, organizing, and controlling the firm's operations.

Technology, Information, and Payoffs. A firm undertakes a project that can either succeed or fail. When the firm's project succeeds, it generates revenue R, and otherwise generates no revenue. Production requires two tasks that we label "working" and "managing." Each task is independently carried out by at most one individual. The project costs I dollars to implement, but neither the worker nor the manager has any liquid wealth to pay this cost: the firm can only operate by borrowing. The opportunity cost of funds for "passive" investors is normalized to zero, and all parties are assumed risk neutral. The worker and the manager must each earn an expected return of at least zero to participate in the project.

We assume that effort levels applied to the working and managing tasks are each binary and can be "high" or "low." High effort improves the likelihood of project success. Absent effort by at least one party, the project fails for sure. For simplicity, we assume that each individual's marginal contribution to the probability of success is independent of the other's. If worker effort is high, but manager effort is low, the project succeeds with probability $q > 0$. Alternatively, if manager effort is high, but worker effort is low, the project succeeds with probability $r > 0$. When effort is high on both tasks, the probability of success is

$p \equiv q + r < 1$. In an extension we consider a slightly more general technology and show that doing so changes little in our analysis.

The worker incurs a private noncontractible cost $c > 0$ when effort for the relevant task is high. The manager's effort cost is measured by forgone private noncontractible benefits $B > 0$ that can be earned by not exerting effort, or "shirking." We assume that effort must be high on both tasks for the project to potentially generate positive expected surplus:

Assumption 1 (No Low Effort)**.**

$$\max\{rR, qR - c + B\} - I < 0.$$

This assumption rules out the feasibility of operating at a low level of effort on either task.

A "monitor" can be hired to limit the scope for managerial shirking. Doing so reduces B by $\Delta B > 0$ to $b \equiv B - \Delta B \geq 0$. Tirole (2006, p. 357) motivates this modeling approach by suggesting that the manager be viewed as having some latitude for project choice after all parties have contractually committed to participating in the firm. In particular, if the manager can choose between two projects that are identical in every respect except that one generates relatively large noncontractible private benefits for the manager, then the monitor's job is to distinguish these two projects, and to rule out the one with high managerial benefits. Knowing that this will occur in equilibrium, investors and the worker alter their expectations accordingly with respect to the incentive payment needed to induce high effort by the manager. Monitoring effectively represents a third production task within the firm. Although the monitor's action does not directly affect the firm's probability of success, it does potentially make implementing high management effort less costly. If the firm would not be feasible without such monitoring, then the monitor's effort is potentially an *essential* production input.

We distinguish between "private," or third-party, and worker monitoring. The firm can hire a private monitor who incurs an unobservable cost m_p to reduce the manager's benefit from shirking. The private monitor must earn a net return of at least zero to participate. Alternatively, the worker can perform the same monitoring task—that is, form a "cooperative"—at unobservable cost $m_c > m_p$. The additional cost $\Delta m \equiv m_c - m_p$ that the cooperative organization bears can represent differences in training between workers and specialized monitors, convexity in effort cost as workers now perform two tasks, or a reduced form for other governance frictions associated with the cooperative form. Despite the organizational deadweight cost Δm, the cooperative structure has an advantage in the sense that any success-contingent incentive provided for effort on the working task indirectly provides an incentive to exert effort on the monitoring task.[5]

[5]Relative to private monitoring, monitoring by the worker does not alter the firm's production technology (represented by the parameters q and r). For example, if in addition to policing management, a "monitor"

For expositional ease, we refer to a firm that does not use worker monitoring as a "private firm." We begin by characterizing the scope for economic activity by an unmonitored private firm. We initially assume that even in the private firm, the worker is the residual claimant on firm value, and further that the private monitor does not have any wealth to contribute to the project. Although it is perhaps natural to bundle investment with residual claimancy (suggesting we assign residual claimancy to passive investors), there is no reason in our model to do so. Effectively, we initially assume perfect competition in the market for loanable funds, and that the worker, rather than the manager or the monitor, sets contract terms within the firm. We then show that private monitoring extends the range of feasible economic activity, and further that the magnitude of this extension is not dependent on the assignment of residual claimancy in the model.[6] We develop an analogous treatment of the cooperative firm and make a comparison across the two organizational structures. We will show that monitoring by the worker, despite the extra cost Δm, can expand the range of feasible economic activity relative to a privately monitored firm.

Private Firm. Absent monitoring, and contingent on project success, the worker receives R and makes payments to the manager and to passive investors. Under Assumption 1, the project is only feasible if both the worker and the manager are induced to exert high effort. Conditional on high effort by the worker, and denoting the manager's success-contingent payment by x, the manager is willing to exert high effort if her expected payment from doing so, px, is at least as large as her payment from shirking, $qx + B$. Passive investors are willing to contribute capital to launch the project so long as their expected payment, conditional on high effort by the worker and manager, is at least as large as the project cost, I. Because the worker is residual claimant on firm value, she will always choose to minimize transfers to the manager and passive investors. The worker has no liquid wealth and cannot

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also provides advice, one might hypothesize that a cooperative board is less well informed about the relevant set of business opportunities for the firm, but better at policing the manager (e.g., because board members have regular interaction with the manager as input suppliers or workers). These effects could be represented in our model as a decrease in p and an increase in q. If p decreases, then under worker monitoring, the firm succeeds less often when both parties exert high effort. However, an increase in q lowers the cost of providing incentives to the manager, because the realization of project success or failure becomes more informative about the manager's action (for the simple technology in this paper, these assumptions imply a reduction in r, so that providing incentives to the worker becomes *more* costly). We allow for these effects in an extension.

[6] One is tempted to label the privately monitored firm, particularly when the monitor invests (which we allow for in an extension), as an "investor-owned" firm. However, there are no dynamics in our model, and so no sense in which "control" with respect to an uncertain future plays a role. Monitoring in our model effectively proscribes specific and known current period actions that would otherwise be available to management. In this sense, our model is missing an important element of what defines ownership (control rights over unforseen contingencies). A more complete modeling of the cooperative firm would therefore include the bundling of three things: working, monitoring, and control. However, formal modeling of interactions between explicit performance incentives and indirect incentives arising from the assignment of control rights is still an unsettled area of research. We leave this extension for future research.

pay out anything when the project fails. Consequently, the worker offers the manager and passive investors contracts that pay out B/r and I/p in the case of project success, and zero otherwise. Neither party is willing to enter such a contract unless they believe that there is enough leftover surplus to motivate high effort by the worker. Under high work effort, the worker earns $p(R - I/p - B/r) - c$, and under low work effort, $r(R - I/p - B/r)$.

Comparing these expressions and rearranging, we have the following lemma

Lemma 1. (Feasibility Requirement with No Monitoring). *An unmonitored firm is feasible if and only if*

$$R \geq R_u \equiv \frac{I}{p} + \frac{B}{r} + \frac{c}{q}.$$

The firm is feasible when market returns R are large enough to cover the opportunity cost of funds, and at the same time provide sufficient motivation to elicit high effort from the worker and the manager. There is an inefficiency in choosing to carry out the project because the worker and the manager do not bear the full cost of failure once the investment funds are sunk. Each party must instead be provided "information rents" (expected surplus above their reservation values of zero), and this limits the scope for attracting passive investors. In particular, projects where $(I + c)/p < R < R_u$ generate positive expected surplus, but are not financially viable. This is a well-known form of "credit rationing" that distorts the project implementation decision.

To see how monitoring can extend the range of project feasibility, suppose that the relevant parties pay a private monitor a success-contingent amount y to monitor the manager. If the monitor incurs the unobservable effort cost m_p, she observes the relevant set of projects available to the manager and can rule out the one with private benefits B. Provided the monitor can be provided adequate incentive to actually carry out this task, the worker can therefore induce managerial effort with a contract that pays out b/r in the case of project success and zero otherwise. Monitoring generates an expected wage saving of $\Delta B/r$. The worker, however, must ensure that the monitor's payment y is sufficient to induce monitoring effort. If the manager and the worker both exert high effort, expected surplus for the monitor is $py - m_p$. Absent monitoring effort, the manager will always choose to shirk and earn $qb/r + B > pb/r$. As a result, if the monitor chooses to shirk on her task, she earns qy. From the worker's perspective as residual claimant on firm value, the minimum payment needed to ensure incentive compatibility for the monitor is therefore m_p/r. Anticipating Corollary 1 below, the benefit from monitoring reduces to a simple comparison between ΔB and m_p: monitoring is potentially useful only when its cost is smaller than the wage savings it generates. Because the firm is only feasible when both the manager and the worker have sufficient incentive to exert high effort, and using an analogous logic to that used above for Lemma 1, we have

Lemma 2. (Feasibility Requirement with Private Monitor) *A privately monitored firm is feasible if and only if*

$$R \geq R_m \equiv \frac{I}{p} + \frac{b + m_p}{r} + \frac{c}{q}.$$

Monitoring reduces B to b, but at the cost of having to pay a monitor at least m_p/r. Direct comparison of the expressions in Lemma 1 and Lemma 2 yields

Corollary 1. (Market Extension with Private Monitor) *Private monitoring extends the feasible range of market activity if and only if* $m_p < \Delta B$.

This result is of course not new and is presented only to establish a baseline for point of comparison.[7] Information rents earned by the manager and the worker create a wedge between the private and social calculus of choosing to undertake the project. This wedge sometimes results in projects being turned down that would generate positive expected surplus in a full information economy. Monitoring can attenuate this inefficiency if doing so is not too costly relative to the reduction in information rents that monitoring generates. From the perspective of social welfare, however, monitoring should take place only when it's necessary—monitoring is pure deadweight loss if the project is otherwise feasible.[8]

Before beginning analysis of the cooperative firm, we first verify that the threshold R_m does not depend on our assumption regarding worker residual claimancy. To see this, first consider residual claimancy by the monitor. The worker and manager must each be paid, respectively, at least c/q and b/r to ensure high effort, conditional on the monitor also having adequate incentive to exert high effort. The monitor's expected payoff under high effort by all parties is $p(R - I/p - c/q - b/r) - m_p$, where again the passive investor is paid her reservation value I/p. The monitor prefers high effort when this expected payoff is at least as large as $q(R - I/p - c/q - b/r)$, which is what she could earn by offering the contracts I/p, c/q, and b/r to investors, the worker, and the manager, but then choosing to shirk on the monitoring task. Comparing expected payoff in each case, high effort is therefore preferred when $R \geq R_m$. The firm is *ex ante* feasible only when all parties are contractually promised sufficient incentive to choose high effort. The firm is therefore feasible under exactly the same set of conditions that determine feasibility for a monitored firm that operates under residual claimancy by the worker. It is straightforward and exactly analogous to verify that the same holds true for residual claimancy by either the manager or passive investors.

[7] For an excellent discussion and synthesis of the extensive corporate finance literature on monitoring and financial intermediation, see Tirole (2006, chapters 8 and 9).

[8] Nevertheless, for $m_p < \Delta B$, it is a cost that will always be born in a firm with worker residual claimancy. In this case, monitoring effectively transfers agency rent from the manager to the worker at an expected cost, pm_p/r, that is always lower than the expected transfer, $p\Delta B/r$. In an extension, we allow for investment and asset pledging by the relevant parties and show how managerial residual claimancy can be used to overcome this tendency toward excessive monitoring in a firm with worker residual claimancy.

Reassignment of residual claimancy influences the distribution of surplus among the relevant parties, but does not improve decision making with respect to project implementation.[9]

Cooperative Firm. In a cooperative firm, the worker performs the monitoring activity. We continue to assume that passive investors fully finance the firm, and that the worker is full residual claimant on firm value. If all parties are provided adequate incentive to choose high effort, investors must again be offered at least I/p when the project succeeds. Similarly, the manager must be offered at least b/r. In both cases, because the worker is residual claimant it is optimal for her to pay no more than the minimum necessary.

The worker now has two tasks and can potentially choose to shirk on either or both of them. When work and monitoring effort are both high, expected surplus for the worker is $p(R - I/p - b/r) - m_c - c$. If the worker continues to offer I/p and b/r to the investor and manager, but chooses to shirk on just the working task, expected worker surplus is $r(R-I/p-b/r)-m_c$. Analogously, if the worker shirks on just the monitoring task, expected worker surplus is $q(R - I/p - B/r) - c$, while if she shirks on both tasks expected surplus is zero. To induce investor participation and managerial effort, R must be large enough to ensure that the worker does not have an incentive to choose one of these deviation strategies. Because only one deviation strategy can bind in equilibrium, we have

Lemma 3. (Feasibility Requirement with Worker Monitor) *A cooperative firm is feasible if and only if*

$$R \geq R_c \equiv \frac{I}{p} + \frac{b}{r} + \max\left\{\frac{c}{q}, \frac{m_c}{r}, \frac{m_c + c}{p}\right\}.$$

If the first term is the largest of the terms in brackets, then provision of incentives for work effort more than compensates for monitoring effort. In effect, the worker does not need to be paid to monitor; she "voluntarily" incurs the monitoring cost m_c based on her private interest in seeing the project succeed. Although there is in some sense a saving from not having to explicitly cover the monitoring cost m_c, this scenario only arises when the payment needed to motivate work effort, c/q, is sufficiently high. Similarly, when m_c/r is the largest term in brackets, then incentives for monitoring effort more than compensate for work effort. When $(m_c + c)/p$ is the largest term, then the worker has the strongest incentive to shirk on both tasks. However, because shirking on both tasks results in certain project failure, the worker earns no information rents. Absent the informational rents paid to the manager, there would be no credit rationing in this case.

[9]Residual claimancy *does* potentially have efficiency consequences with respect to action choices. In particular, when Assumption 1 is relaxed so that projects are feasible when effort on one of the tasks is low, residual claimancy by an agent who takes an action will generally result in "better" action decisions than residual claimancy by passive investors (who do not take an action beyond agreeing to invest). Endogenizing the assignment of residual claimancy is beyond the scope of our analysis, but seems like a potentially fruitful direction for future research.

Combining Lemma 1 and Lemma 3, we have

Proposition 1. (Market Extension with Worker Monitor) *Relative to a firm with no monitoring, worker monitoring extends the feasible range of market activity when* $m_c \leq \Delta B$ *or* $c/q > \max\{m_c/r, (m_c+c)/p\}$*, and when* $m_c > \Delta B$ *if*

- $m_c/r > \max\{c/q, (m_c+c)/p\}$ *and* $m_c < \Delta B + rc/q$*; or*
- $(m_c+c)/p > \max\{c/q, m_c/r\}$ *and* $m_c < p\Delta B/r + rc/q$.

Proof. See Appendix. □

If $m_c < \Delta B$, then worker monitoring expands feasibility for exactly the same reason private monitoring does: it reduces managerial information rents, thus increasing the success-contingent surplus that can be pledged to the investor, without compromising profitability for the worker. However, even when $m_c > \Delta B$, worker monitoring can *still* expand the feasible range of market activity. Intuitively, this is because worker monitoring additionally saves on information rents paid to the monitor. More formally, assume the worker monitors. Then to ensure that the worker has an incentive to exert high work effort, the worker's success-contingent payment, after paying the passive investors and manager, must be at least c/q. However, if $c/q > \max\{m_c/r, (m_c+c)/p\}$, then this quantity also guarantees that the worker is better off exerting high monitoring effort, regardless of the relationship between m_c and B. Similarly, when $m_c/r > \max\{c/q, (m_c+c)/p\}$, then the success contingent payment that is required to induce high monitoring effort also induces high work effort—though m_c cannot be too large in this case; otherwise total agency rents paid in the worker monitored firm, $(m_c+b)/r$, are greater than rents paid in an unmonitored firm, $B/r + c/q$. Analogous logic can be used to explain what happens when incentives are strongest to shirk on both tasks.

Summarizing, when $R < R_u$ and $m_c \leq \Delta B$, worker monitoring reduces total information rents and transfers some of what the manager would earn absent monitoring to the worker. When $m_c > \Delta B$, the worker effectively takes on higher-powered incentives but accepts a lower net expected return—$[p(R - I/p - b/r) - m_c - c]$ versus $[p(R - I/p - B/r) - c]$ —to enable project feasibility.

The model in this section is a simple formalization of the cooperative firm, but one that accords well with the differences noted earlier regarding compensation policies for the directors of private and cooperative firms. One explanation for the near complete lack of performance-based pay of directors in cooperative organizations is that member directors do not need separate motivation to provide managerial oversight: they are indirectly motivated by a belief that without such oversight they might face a reduction in pay, or worse, lose their jobs. The next proposition, which is the main result of our analysis, demonstrates that

this effect can extend the market by more than private monitoring. In particular, Lemmas 2 and 3 yield:

Proposition 2. (Worker versus Private Monitoring) *Relative to a firm with private monitoring, worker monitoring extends the feasible range of market activity if*

- $c/q > \max\{m_c/r, (m_c+c)/p\}$*; or if*
- $m_c/r > \max\{c/q, (m_c+c)/p\}$ *and* $m_c < m_p + rc/q$*; or if*
- $(m_c+c)/p > \max\{c/q, m_c/r\}$ *and* $m_c < pm_p/r + rc/q$.

Proof. See Appendix. □

Proposition 2 reiterates the requirement that for worker monitoring to extend the market, m_c must not be too large—but this time in relation to the cost of private monitoring. The result emphasizes the source of advantage for the cooperative firm in terms that directly relate to its observable formal structure, namely the bundling of work and managerial control. As we pointed out in the introduction, there is substantial evidence suggesting that the cooperative firm exists largely in low-return economic environments. Proposition 2 provides one compelling reason why this may be so. This proposition also facilitates determining the equilibrium organizational structure as a function of the strength of the market, R. We do this in the next section.

Equilibrium Organization. Subject to financial feasibility, the worker chooses the organizational structure that maximizes her *ex ante* expected payoff. The worker earns an expected payoff $U \equiv p(R - I/p - B/r) - c$ when there is no monitoring, $U + \frac{p}{r}(\Delta B - m_p)$ when she hires a private monitor, and $U + \frac{p}{r}\Delta B - m_c$ when she forms a cooperative. The following proposition summarizes the worker's optimal organizational choice.

Proposition 3. (Equilibrium Organization) *Assume* $m_c < m_p + rc/q$*. Then for all* $R < R_c$*, no organization is feasible. Otherwise, we have the following two mutually exclusive regimes:*

(i) *if* $m_p > \Delta B$ *or* $m_c < pm_p/r$*, then the worker never hires a private monitor and*
- *if* $m_c \leq p\Delta B/r$*, then the worker monitors in the equilibrium organization for all* $R \geq R_c$*;*
- *if instead* $m_c > p\Delta B/r$*, the worker monitors in the equilibrium organization for* $R_c \leq R < R_u$*, while for* $R \geq R_u$ *there is no monitoring.*

(ii) *if* $m_p \leq \Delta B$ *and* $m_c \geq pm_p/r$*, then for* $R_c \leq R < R_m$ *the worker monitors in the equilibrium organization, while for* $R \geq R_m$ *the worker hires a private monitor.*

Proof. See Appendix. □

When $m_c < m_p + rc/q$, then $R_c < R_m$: worker monitoring extends the market further beyond any extension provided by private monitoring. The relationship between m_c and

pm_p/r determines when worker monitoring is preferred to private monitoring, conditional on financial feasibility for both forms of organization. When $m_c \leq pm_p/r$, information rents paid by the worker to a private monitor are greater than the cost of worker monitoring. The relationship between m_p and ΔB determines when private monitoring expands the range of economic activity, relative to no monitoring.

In the first regime, either private monitoring cannot extend the market ($m_p > \Delta B$), or the worker can always increase profit by replacing the private monitor and forming a cooperative ($m_c < pm_p/r$). In this case, private monitoring can never emerge in equilibrium. Moreover, if monitoring effectively transfers agency rent from the manager to the worker ($m_c \leq p\Delta B/r$), then the worker monitors even when doing so is not necessary for firm financial viability ($R \geq R_u$). Otherwise, if $m_c > p\Delta B/r$, then the worker monitors only when $R_c \leq R < R_u$.

In the second regime, private monitoring can extend the market ($m_p \leq \Delta B$), and is not dominated by worker monitoring ($m_c > pm_p/r$). In this case, the worker only monitors for R below R_m, and delegates monitoring to a third party for $R > R_m$. There is monitoring even when it is not necessary for firm survival because doing so transfers surplus from the manager to the worker ($m_p \leq \Delta B$ implies $(m_p + b)/r \leq B/r$).

This proposition clearly demonstrates the market extending role of worker monitoring. Interpreting R as a measure of "market strength," the cooperative firm (worker monitoring) either is the only form of equilibrium monitoring and market extension (regime i), or extends the market further beyond the extension provided by private monitoring (regime ii). In regime ii, the "cooperative" is born out of necessity, but "degenerates" when market conditions are strong. A firm that begins its life under worker monitoring because that is the only way to secure finance, is apt to hire out the monitoring activity if market conditions improve sufficiently. This logic is consistent with the cooperative life cycle hypothesis, and more generally with observations regarding the role of cooperatives meeting "unmet needs," but tending to convert or demutualize when the firm achieves strong profit performance.

Worker monitoring generates a welfare gain relative to an environment without worker monitoring if market conditions are weak, but results in excess monitoring when market conditions are strong. For $R > R_u$ the firm is feasible without monitoring, and thus capable of generating expected surplus $pR - I - c$, but the manager is always monitored except possibly when $m_c > p\Delta B/r$. More formally,

Corollary 2. (Excessive Monitoring) *If $m_c < p\Delta B/r$, then equilibrium monitoring is excessive for $R > R_u$.*

This is a sufficient condition for excessive monitoring. Monitoring can still be excessive even when $m_c \geq p\Delta B/r$ provided that regime 2 in Proposition 3 is the relevant one. This

result is not a consequence of worker monitoring per se, but rather of worker residual claimancy. When the worker is residual claimant, and provided $m_c < p\Delta B/r$, monitoring effectively transfers rent (at a cost) from the manager to the worker. In a worker-monitored firm, managers earn fewer rents than in a privately-monitored firm. Thus, even when doing so is not necessary for financial viability, monitoring is used to redistribute surplus in the organization. Besanko and Kanatas (1993) study a model with equilibrium *under* monitoring. Corollary 2 demonstrates that this results from the assumed managerial residual claimancy in their model. When the manager, rather than the worker, sets wage and financial policy for the firm, she of course prefers less monitoring.

Although we are not aware of an empirical study that explicitly studies whether monitoring is "excessive" or not, anecdotal and case-study evidence exists suggesting higher rates of managerial turnover (a potential indicator of dysfunctional board behavior) in cooperative organizations. In a historical study of governance and incentive design in 19th century Danish creamery cooperatives, Hviid (2006, pp. 51-52) documents relatively high rates of managerial turnover relative to private creameries. Bellas (1972, 53-54) documents a similar phenomena in the plywood worker cooperatives of the U.S. Pacific Northwest. He notes that, "Several managers maintain their permanent residence hundreds of miles from their job and then rent accommodations near the mill. A story is told of one manager who brought only one personal item, his hat, to the office; he kept it on the corner of his desk, signifying that he was ready to leave when he wasn't wanted."

Extensions

We have so far assumed that the worker is residual claimant, even in a firm that is privately monitored. Moreover, we have not allowed any party other than the passive investors to contribute wealth to the project. In this section, we relax these assumptions and demonstrate that the core qualitative results presented so far remain unchanged. We also show that the qualitative properties of Propositions 1 and 2 continue to hold under a more flexible specification of the production technology relating worker and manager actions to the probability of success. Finally, we briefly comment on the potential beneficial role of ownership illiquidity in cooperative firms, and consider the possibility of collusion between the monitor and manager.

Intermediary Competition and Asset Pledging by Workers. Here we add two extensions to the model, relative to the previous section. First, we suppose that a private monitor, in addition to the passive investors, can contribute capital to the project. Second, we allow the worker in a cooperative firm to pledge assets that, after some loss in value, can be transferred to passive investors in the event of project failure. It is not uncommon

for cooperative members to pledge substantial private assets to sustain cooperative operation.[10] It is much less common to observe such contributions by workers in a private firm. Although we do not model the reason for this asymmetry,[11] we *do* consider how such a difference would affect the equilibrium occurrence of cooperative activity.

The purpose of these extensions is to add further predictive content to our model. In particular, we demonstrate that intermediary competition tends to reduce the scope for equilibrium cooperative activity. When the market for intermediated capital is competitive, the monitor does not earn any information rents. This effectively reduces R_m, expanding the feasible range of market activity for a private firm, and therefore reducing the scope for cooperative activity. Similarly, we show how asset pledging by the worker in a cooperative firm—to the extent that such pledging can only take place in a cooperative firm—expands the feasible range of economic activity for worker monitoring. Thus, markets in which workers have valuable (and relatively transferable) assets to pledge can more easily support cooperative activity.

To give these predictions more precise meaning, first consider the organization of a private firm, and suppose that the monitor can contribute an amount I_m to the project. If she does, then passive investors contribute the remainder, $I - I_m$. Without monitoring, and without asset pledging by the worker, a private firm is feasible for all $R \geq R_u$. For $R < R_u$, the worker (who we continue to assume is residual claimant, even in a private firm) can tap a competitive market for monitored finance. As before, monitoring effort costs m_p and is unobservable. Thus, the private monitor must be paid at least m_p/r to ensure that monitoring actually occurs in equilibrium. However, because the market for monitored finance is competitive, the worker can request a capital contribution I_m such that the monitor's expected payoff $pm_p/r - m_p - I_m = qm_p/r - I_m$ is exactly zero. The monitor's investment is therefore qm_p/r, and passive investors contribute $I - qm_p/r$. To ensure that passive investors participate, they must receive at least $(I - qm_p/r)/p$ in the case of project success.

Contingent on success, the worker receives the project return, R, less payment to the private monitor, m_p/r, less the net payment to passive investors, $(I - qm_p/r)/p$. Direct calculation yields an expected surplus to the worker of $p(R - I/p - b/r) - m_p - c$ when contributing high effort on the work task. Under low work effort as a deviation strategy, the worker earns $r(R - I/p - b/r) - (m_p - qm_p/p)$. Computing the minimum R needed to induce high work effort, and comparing this value with R_m, yields

[10] For an example of such pledging, see **?** who conduct a case-study analysis of the formation of a farmers' marketing cooperative, and its eventual conversion into a for-profit organization.

[11] Modeling the perverse incentives that arise for the manager and passive investor to collude represents one possible means of endogenizing this asymmetry.

Proposition 4. (Market Extension with Intermediary Competition) *Competition in the market for intermediated finance expands the scope for equilibrium market activity by a privately monitored firm with the project feasible if and only*

$$R \geq R'_m \equiv R_m - \frac{qm_p}{rp}.$$

Now suppose that in a cooperative firm, the worker does not have cash to contribute, but can pledge assets worth F to the worker. We assume the assets are not perfectly redeployable so that they are only worth $f \leq F$ to the passive investors. Passive investors receive and amount z when the project succeeds, and the assets worth f when the project fails.[12] They are therefore willing to contribute funds when $z \geq (I - (1-p)f)/p$. Assume the worker monitors the manager, pays the manager the minimum amount necessary to ensure high managerial effort, and likewise pays the minimum amount necessary to ensure participation by the passive investors. Then the worker's expected return is $p(R - I/p - b/r) - m_c - c + \overline{F}$, where $\overline{F} \equiv pF + (1-p)f$ is the expected value of the worker's asset, given that it is pledged toward project success. Given these contractual commitments, the worker can shirk on the work task and receive and expected return $r(p - I/p - b/r) - m_c + r(F + (1-p)f/p)$. Alternatively, the worker can shirk on the monitoring task and receive expected return, $q(p - I/p - b/r) - c + q(F + (1-p)f/p)$. Shirking on both tasks yields zero. Comparing payoffs under high effort and each deviation strategy for the worker, we have

Proposition 5. (Market Extension with Asset Pledging by Worker) *Asset pledging by the worker expands the scope for equilibrium market activity by a cooperative firm with the project feasible if and only if*

$$R \geq R'_c \equiv R_c - \frac{\overline{F}}{p}.$$

Taken together, these two propositions suggest that, all else equal, there is greater scope for equilibrium cooperative activity when there is a high degree of imperfect competition in financial markets, and when workers have high value, and highly redeployable, assets.

Technology. Here we demonstrate that the principal qualitative result in Propositions 1 and 2 continue to hold under a more flexible technology that relates actions of the worker and manager to the probability of success. More generally, let $\Delta p_m < p$ and $\Delta p_w < p$ represent the reduction in the probability of success when just the manager or worker shirks. Similarly, let Δp where $\Delta p_m + \Delta p_w \leq \Delta p < p$, represent the reduction in probability of success when both parties shirk. Previously we assumed that $\Delta p = p = \Delta p_m + \Delta p_w$. Relaxing this assumption, we can evaluate the impact of a strong complementarity between

[12] More generally, we can let the passive investors seize some fraction of f (or interpreted differently, to seize f with some positive probability strictly less than one) in the case of failure. This generalization does not change the qualitative nature of our results.

the efforts of the manager and worker (Δp large relative to $\Delta p_m + \Delta p_w$). We can also consider comparative statics with regard to changes in the effort productivity of a single agent, say Δp_m, without changing the effort productivity of the other agent.

It is simple to show that with this new technology, a privately monitored firm is feasible if and only if

$$R \geq \hat{R}_m \equiv \frac{I}{p} + \frac{c}{\Delta p_w} + \frac{b + m_p}{\Delta p_m},$$

while a worker monitored firm is feasible if and only if

$$R \geq \hat{R}_c \equiv \frac{I}{p} + \frac{b}{\Delta p_m} + \max\left\{\frac{c}{\Delta p_w}, \frac{m_c}{\Delta p_m}, \frac{c + m_c}{\Delta p}\right\}.$$

Given these observations, the extensions of Proposition 1 and 2 are immediate. A strong complementarity between the work and managerial tasks imply that the worker has relatively weak incentives to shirk simultaneously on both tasks. From the expressions above, where Δp enters only in the second inequality, this favors the cooperative structure by potentially relaxing a binding incentive constraint. In particular, if $(c + m_c)/\Delta p > \max\{c/\Delta p_w, m_c/\Delta p_m\}$, then an increase in Δp expands the range of market environments where a cooperative can operate.

As noted earlier, it is perhaps reasonable to expect worker-monitors to have better information about managerial performance than private monitors.[13] We can model this by supposing there are different values for the term Δp_m across the two organizational structures. If Δp_m is relatively large for a cooperative firm, then cooperative members are better able to control managerial agency, and this to some extent offsets the organizational deadweight loss Δm.

Managerial Residual Claimancy. Here we consider a private firm where the manager is residual claimant, and compare this with a cooperative firm where there is no asset pledging by the worker. We can think of the manager as a wealth-constrained entrepreneur seeking finance for a discrete project that requires the input of a "worker," in addition to external financing (some of which potentially comes tied with costly monitoring).

First consider the manager seeking financing only from passive investors. In doing so, she must offer a claim on firm value of at least c/q to the worker to ensure high work effort, and must promise the investors at least I/p. As noted previously, Lemma 1 continues to hold under managerial residual claimancy. The project is feasible if and only if $R \geq R_u$. Similarly, it is straightforward to show that the manager can extend the feasible range of market activity to R_m by hiring a private monitor (and to R'_m by asking the monitor to

[13] Alternatively, we can think of worker-monitors as having access to given information at lower cost. This is not inconsistent with $m_c > m_p$ if a large part of m_c are collective decision making costs associated with democratic governance. Although we have not modeled these costs explicitly, they can be conveniently represented in reduced form as a contribution to m_c.

contribute sufficient investment funds to the project). Thus, in terms of the range of feasible activity for a private firm, firms that operate under residual claimancy for the manager are indistinguishable from those that operate under residual claimancy for the worker.

There is, however, an important behavioral difference between the two kinds of firms. As Corollary 2 makes clear, a cooperative firm tends to over monitor when R is high. This is because monitoring redistributes surplus from the manager to the worker. In contrast, when the manager is residual claimant on firm value, there is no gain from monitoring beyond extending the range of operation for the firm. This is a source of efficiency associated with managerial control. Thus, in addition to the pure deadweight cost arising from the difference in monitoring costs, Δm, we have an endogenous or behavioral source of disadvantage for the cooperative firm that occurs specifically when market conditions are strong. The following proposition summarizes the impact of this disadvantage in terms of the equilibrium organizational structure as a function of R:

Proposition 6. (Managerial Residual Claimancy for Private Firm) *Assume: i)* $\frac{p}{r}\Delta B - c < m_c < m_p + rc/q$*; ii) only passive investors have wealth to contribute to the project; iii) a cooperative firm operates under worker residual claimancy; and iv) a privately monitored firm operates under managerial residual claimancy. Then for all* $R < R_c$*, no organization is feasible. Otherwise, as* R *increases,*

- *if* $R_c \leq R < R_m$*, a cooperative firm is the equilibrium organization;*
- *if* $R_m \leq R < R_u$*, a privately monitored firm is the equilibrium organization;*
- *if* $R_u \leq R < R_* \equiv (I + m_c + c)/p + b/r + c/q$*, there is no monitoring in equilibrium and the firm operates under managerial residual claimancy;*
- *if* $R \geq R_*$ *then the equilibrium organization is indeterminate. The worker prefers worker residual claimancy, and the manager prefers managerial residual claimancy. A firm that operates under managerial residual claimancy earns more expected surplus than a firm that operates under worker residual claimancy when* $m_c + pb/r > rc/q$*.*

Proof. See Appendix. □

For $R < R_m$ only the cooperative firm is feasible. For R between R_m and R_u, the worker earns greater information rent as a worker in a privately monitored firm than she would as residual claimant on return from a worker-monitored firm. However, for R sufficiently high, cooperative expected returns (assuming there's no competition for market share, or that the private firm exits the market) exceed what can be earned as an employee. In this case, the worker can threaten entry and potentially extract some surplus from the private firm, or potentially enter into competition. Analysis of the outcome of such competition is beyond the scope of this paper, but Proposition 6 points to a potentially interesting interaction. In

a setting where managerial information rents are relatively small in comparison to rents that must be paid to workers, the cooperative firm may be competitive even when it monitors excessively. Moreover, as we will see below, there is good reason to believe that worker monitors are less prone to colluding with management.

Financial Illiquidity and Commitment. Consider the possibility of a "liquidity shock" in a privately monitored firm: before project success or failure is realized, but after the private monitor has exerted effort, a new investment opportunity arises requiring the monitor's services and a cash investment. The private monitor wishes to "cash out" of the existing project, using this cash for investment in the alternative project. Liquidity of this sort weakens incentives for monitoring, potentially even generating opportunities for strategic exit, by allowing the monitor to disinvest prior to the realization of performance. On the other hand, liquidity reduces the equilibrium cost of acquiring monitored capital by allowing the monitor to deploy her funds in their highest value use. Aghion et al. (2004, pp. 346-347) study this tradeoff and show that it is optimal to prohibit exit when the monitor's payoff in the outside opportunity is sufficiently low. They show, however, that the possibility of interim renegotiation will generally undermine any attempt to do so. The authors suggest that this result provides some basis of support for regulatory interventions that make exit costly. The cooperative firm structure is potentially another institutional response to the demand for commitment. It is reasonable to expect worker-monitors to have fewer outside opportunities than private monitors. Additionally, defining ownership in terms of "use," rather than investment stake, limits creation of liquidity in markets for ownership: users are heterogeneous, and users must be geographically proximate to the firm, neither of which is an attribute of capital.[14] Although often viewed as a handicap, the lack of exit opportunities for cooperative members can serve to mollify passive lenders who are concerned with ensuring dedicated managerial oversight.

Collusion. We have ruled out the possibility of collusion between the monitor and the manager. Although this assumption is a reasonable starting point and simplifies the analysis, there is potentially an incentive for the manager to suggest that the monitor be lax in return for a side payment. We briefly consider this possibility and show that in general opportunities for collusion between the manager and monitor are more limited when the worker is the monitor. For a recent analysis of collusion, but in the context of venture capital contracting for start-up finance, see Dessi (2005).

[14]Cook and Chaddad (2004) describe efforts by some agricultural marketing cooperatives (so-called "new-generation" cooperatives) to create liquidity by requiring an equity investment in proportion to use, and establishing a market for these "use rights." Results have been mixed. In no case has there been much active trading in use rights, and a number of prominent new-generation marketing cooperatives have been converted to some form of investor-owned firm (Holland and King, 2004).

The manager has no wealth and so cannot propose an up-front payment, but she may be able to transfer some portion of B to the monitor.[15] The question we then ask is: are there opportunities to collude, and are those opportunities more or less constrained in a cooperative firm? We will show that collusion is always feasible in a private firm, while it is always *infeasible* in a cooperative firm so long as Δm, ΔB, and q are all sufficiently small. Thus, although the cooperative firm tends to monitor too much, worker monitors are less apt to collude with management against the interests of passive investors.

First consider the potential for collusion in a privately monitored firm.[16] In equilibrium, and absent collusion, the manager earns expected surplus of pb/r, and the monitor earns $pm_p/r - m_p$. By deviating and not exerting high effort, the manager can earn $qb/r + B$. The manager can propose a collusive agreement either before or after the monitor has incurred the cost m_p. For simplicity we consider only an *ex ante* agreement. The manager approaches the monitor *ex ante* and proposes an *ex post* share of the managerial private benefits B. Not surprisingly, a transfer can always be chosen such that both parties gain. To verify this, it is sufficient to show that there exists a transfer τ such that $qb/r + B - \tau \geq pb/r$, and $qm_p/r + \tau \geq pm_p/r - m_p$. The first inequality says that the manager is better off shirking and paying the transfer than foregoing the project with private benefits. Similarly, the second inequality guarantees that the monitor gains by accepting the transfer and not monitoring. This pair of inequalities can be rewritten as $0 \leq \tau \leq \Delta B$ so that such a τ can always be found.

Now consider the possibility of collusion between the worker-monitor in a cooperative firm and the manager. Absent collusion, the manager again earns pb/r, and the worker-monitor earns $p(R - I/p - b/r) - m_c - c$. Using reasoning analogous to that used above, an *ex ante* collusive agreement is potentially feasible if $\tau \leq \Delta B$, and $q(R - I/p - b/r) - c + \tau \geq p(R - I/p - b/r) - m_c - c$, or when

$$\tau \geq \underline{\tau} \equiv r(R - \frac{I}{p} - \frac{b}{r}) - m_c.$$

Thus, if $\underline{\tau} > \Delta B$, then a collusive agreement is potentially sustainable in a private firm when it is not in a cooperative firm. However, this condition depends on R being sufficiently large. The following proposition, which is easily verified by substituting R_m into the expression for $\underline{\tau}$, demonstrates that R need not be too large, so long as Δm, ΔB, and q are sufficiently small:

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[15] By assumption the manager does not have any wealth and so cannot make an *ex ante* payment. Neither can she make an *ex post* payment in the case of project failure, unless it comes from B. Allowing for some exogenous cost of transferring these "private noncontractible managerial benefits" to the monitor complicates the analysis without adding any additional insight.

[16] We assume throughout this section that a private firm operates under residual claimancy by the worker; assuming otherwise does not qualitatively change the analysis.

Proposition 7. (Collusion) *Suppose $\Delta B < rc/q - \Delta m$. Then whenever a privately monitored firm is financially viable with $R \geq R_m$, a cooperative firm is immune to collusion between the manager and worker-monitor.*

The amount $rc/q - \Delta m$ is the reduction in expected surplus for the worker-monitor associated with managerial shirking, evaluated at R_m. ΔB is the maximum amount that can be transferred from the manager to the worker to induce collusion. For ΔB sufficiently small, collusion is not possible in the cooperative firm. To avoid collusion in a private firm, the worker and monitor each need to be given a relatively large claim on *ex post* surplus. This reduces the amount available to pay passive lenders, and potentially further limits project feasibility. Thus, the possibility of collusion in a privately-monitored potentially increases the scope for equilibrium market activity by a cooperative firm.

Conclusion

We study an organizational environment where firm production requires three generic tasks: working, managing, and, when returns are sufficiently low, potentially some form of managerial monitoring. This environment provides a convenient way to distinguish between "cooperative" firms and other forms of ownership. In a cooperative firm, the working and monitoring tasks are carried out by a single individual (or class of individuals), whereas in a "private firm" the monitoring task is performed by a specialist. Our model endogenizes choice over this pair of organizational structures, and characterizes the nature of economic environments that support one or the other structure as an equilibrium outcome.

Assuming that worker monitoring is costly relative to monitoring by a specialist, we show that worker monitoring arises as an equilibrium outcome only when market conditions are relatively weak. When market conditions are strong, workers prefer employment in a privately monitored firm, though for market conditions sufficiently strong, they can credibly threaten entry and potentially extract some market surplus that would otherwise accrue to private investors. The fundamental mechanism at play in our model is the incentive complementarity that arises from bundling two work tasks in a single individual (or class of individuals). This, combined with the existence of agency rents, implies that worker monitoring, though it ultimately shrinks total economic surplus relative to private monitoring, can increase the share of surplus which is promised to external investors. By doing so, the cooperative firm opens up opportunities for equilibrium economic activity that would otherwise not exist.

A cooperative firm tends to monitor too much. This, together with the relatively costly nature of worker monitoring, tend to support privately monitored organizations as an equilibrium outcome when market conditions are relatively strong. There is, however, a countervailing effect to the extent that the potential for collusion between monitors and managers

affects equilibrium financial contracts. A cooperative organization is less susceptible to collusion.

Our results are broadly consistent with stylized evidence regarding the nature and incidence of cooperative activity. In particular, it is often noted that cooperative firms tend to operate in relatively low-return settings that are unable to attract private capital. Similarly, cooperative firms often "degenerate" when market conditions are strong. Our model effectively provides a "hard-times" explanation for these phenomena: a cooperative arises out of necessity as the only feasible means of attracting finance when returns are low, but degenerates or converts when returns are high because doing so is Pareto efficient.

Additionally, our model can account for the stark difference in pay practices of board members across cooperative and private firms. Cooperative board members typically receive per diem and travel expenses, while the members of private boards often receive substantial performance-based pay. It is quite intuitive to imagine that these differences are at least partially attributable to the differential incentive that workers and shareholders have to monitor the firms they own. Shareholders in private firms tend on average to own a small fraction of total firm equity, and moreover do not have any commercial relationship beyond their investment that provides motivation for managerial oversight. Workers (or input suppliers) on the other hand, are motivated both by a relatively high ownership stake, and by the prospect of reduced future wages if the firm performs poorly.

There are a number of potential directions for future research. First, we have not considered competition between a private and cooperative firm. We noted that when market returns are sufficiently high workers may be able to threaten entry, but we did not explicitly model the relevant interaction. If entry results in the two firms splitting the market somehow, there may be environments that support simultaneous existence of cooperative and private enterprise. Worker monitors are less prone to collude with management. Moreover, to the extent that the worker's actions are important relative to the actions of management, there may be a benefit from residual claimancy by workers. Both effects counteract the costly nature of worker monitoring and create an opportunity for competitive interaction between the two types of firms.

Second, we have not modeled "control," which when allocated to workers represents another important structural difference between private and cooperative firms. Cooperative incorporation statutes proscribe majority control by non-members and explicitly limit the return that can be paid on outside equity. Presumably, restrictions such as these are intended to encourage member investment that otherwise would not be forthcoming. Thus, a formal model of interaction between finance, managerial oversight, and control is needed to more fully describe the cooperative firm.

Lastly, our model provides some direction for empirical work on cooperative governance. Most of the extant empirical research on cooperatives largely ignores or sidesteps firm governance by assuming that what distinguishes the cooperative firm, relative to other forms of business organization, is its "objective function." This assumption effectively puts all form of interaction between members, the firm's board, the firm's manager and employees, and external financiers, in a "black box" that, while useful for some purposes, closes off the possibility of studying governance directly. This is unfortunate because differences in governance arguably are central to what distinguishes the cooperative business model. Some questions that emerge from our analysis include: Controlling for firm size and other markets characteristics, do cooperative firms pay less than private firms for director services? Do cooperative boards monitor excessively (and how can this be measured)? How do contracts between third-party lenders (such as banks) and cooperative firms differ relative to similar contracts with private firms? Do cooperative firms compensate their manager's differently than similar private firms? Answers to these and other exciting questions await future research.

Appendix

Proposition 1:

Proof. Worker monitoring extends the feasible range of market activity, relative to no monitoring, when

$$R_u - R_c = \frac{\Delta B}{r} + \frac{c}{q} - \max\left\{\frac{c}{q}, \frac{m_c}{r}, \frac{m_c + c}{p}\right\} > 0.$$

The proposition identifies various conditions that are sufficient for this inequality to hold. There are three cases to consider depending on which term is the largest of c/q, m_c/r, and $(m_c + c)/p$. First, suppose that $c/q > \max\{m_c/r, (m_c + c)/p\}$. Then $R_u - R_c = \Delta B/r > 0$. Second, suppose $m_c/r > \max\{c/q, (m_c + c)/p\}$. Then

$$R_u - R_c = \frac{\Delta B}{r} + \frac{c}{q} - \frac{m_c}{r},$$

which is greater than zero so long as $m_c < \Delta B + rc/q$. Third, suppose $(m_c + c)/p > \max\{c/q, m_c/r\}$. Then

$$R_u - R_c = \frac{\Delta B}{r} + \frac{c}{q} - \frac{m_c + c}{p},$$

which is greater than zero so long as $m_c < p\Delta B/r + rc/q$. Lastly, if $m_c \leq \Delta B$, then because $rc/q > 0$ and $p/r > 1$, we have $R_u - R_c > 0$ in all three cases. □

Proposition 2:

Proof. The proof proceeds analogously to the previous one, except that we wish to determine sufficient conditions such that

$$R_m - R_c = \frac{m_p}{r} + \frac{c}{q} - \max\left\{\frac{c}{q}, \frac{m_c}{r}, \frac{m_c + c}{p}\right\} > 0.$$

First, suppose that $c/q > \max\{m_c/r, (m_c + c)/p\}$. Then $R_m - R_c = m_p/r > 0$. Second, suppose $m_c/r > \max\{c/q, (m_c + c)/p\}$. Then

$$R_m - R_c = \frac{m_p - m_c}{r} + \frac{c}{q},$$

which is greater than zero so long as $m_c < m + rc/q$. Third, suppose $(m_c + c)/p > \max\{c/q, m_c/r\}$. Then

$$R_m - R_c = \frac{m_p}{r} + \frac{c}{q} - \frac{m_c + c}{p},$$

which is greater than zero so long as $m_c \leq pm_p/r + rc/q$. □

Proposition 3:

Proof. When $m_c < m_p + rc/q$, then by Lemmas 1-3, $R_c < \min\{R_u, R_m\}$ and no organization is feasible for $R < R_c$.

Let $U_p \equiv U + \frac{p}{r}(\Delta B - m_p)$ and $U_c \equiv U + \frac{p}{r}\Delta B - m_c$ represent the worker's expected payoff under private and cooperative monitoring. First suppose that $m_p > \Delta B$, or that $m_c < pm_p/r$. Then either private monitoring is dominated by no monitoring because $U_p < U$, or by cooperative monitoring because $U_p < U_c$. Moreover, under these conditions, cooperative monitoring dominates no monitoring for all R if $m_c \leq p\Delta B/r$ because then $U_c \geq U$. If instead, $m_c > p\Delta B/r$, then $U_c < U$ so that the worker monitors only when doing so is necessary for financial feasibility, or when $R_c \leq R < R_u$.

Next, suppose $m_p \leq \Delta B$ and $m_c \geq pm_p/r$. Then the worker (weakly) prefers private monitoring to no monitoring and to cooperative monitoring because $U_p \geq U$ and $U_p \geq U_c$. However, for $R_c \leq R < R_m$, only cooperative monitoring is financial feasible. □

Proposition 6:

Proof. There are five regions to consider.

(i) $R < R_c$: When $m_c < m_p + rc/q$, then by Lemmas 1-3, $R_c < \min\{R_u, R_m\}$; no organization is feasible in this region.

(ii) $R_c \leq R < R_m$: By Lemmas 2 and 3, a privately monitored firm is not feasible for $R < R_m$, and a worker-monitored firm is feasible only for $R \geq R_c$; therefore, the worker-monitored firm is the only feasible organization in this region.

(iii) $R_m \leq R < R_u$: The manager can contract for services from a private monitor, and from the worker, and earn an expected payoff given by

$$p(R - \frac{I}{p} - \frac{m_p}{r} - \frac{c}{q}) > 0, \tag{1}$$

while the worker earns pc/q. Alternatively, the worker can propose a contract to the manager and monitor the manager herself, or hire a private monitor. In this case, the manager earns pb/r, while the worker earns

$$p(R - \frac{I}{p} - \frac{b}{r}) - m_c - c \tag{2}$$

under worker monitoring, and

$$p(R - \frac{I}{p} - \frac{m_p}{r} - \frac{b}{r}) - c \tag{3}$$

under private monitoring. We wish to show that both the manager and the worker prefer managerial residual claimancy with private monitoring. Comparing expressions (2) and (3), worker monitoring always dominates private monitoring for the

worker provided $m_c < pm_p/r$. Using the second inequality in part i) of the proposition, and noting that $p/r > 1$, this is always the case. The manager prefers managerial residual claimancy combined with private monitoring whenever the expression in (1) is greater than pb/r. This is true for all $R > R_m$, and is therefore always the case for the region under consideration. Similarly, the worker prefers to be employed by the manager when pc/q exceeds the expression in (2). Direct comparison yields

$$R < \frac{I + m_c + c}{p} + \frac{b}{r} + \frac{c}{q} = R_*.$$

We need to verify that $R_* > R_u$, which holds whenever $m_c > p\Delta B/r - c$. The condition stated in the first inequality of part i) from the proposition ensures this inequality is always satisfied.

(iv) $R_u \leq R < R_*$: We have just verified that the worker prefers to be employed by the manager (when this form of organization is feasible) for $R < R_*$. We wish to show that the manger prefers not to monitor in this region. With monitoring, the manager's expected payoff is given by the expression in (1). From Lemma 1, the firm is feasible without monitoring, and managerial profits increase by the amount pm_p/r.

(v) $R > R_*$: R_* is defined to be the value of R such that, for all larger values, the worker prefers to control the firm, than work for the manager. The expected payoff for the worker in this case is given by $p(R-I/p-b/r)-c-m_c$, which is less than the expression for the manager's expected payoff without monitoring, $p(R-I/p-c/q)$, when $m_c + pb/r > rc/q$.

□

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