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OWNERSHIP AND MANAGERIAL COMPETITION: EMPLOYEE, CUSTOMER, OR OUTSIDE OWNERSHIP*

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Abstract

This paper centres around the question of ownership of firms and managerial competition and how these affect managers and employees' incentives to invest in human capital. We argue that employees' incentives in human capital investment are affected by both ownership and competition since both ownership structure and competition provide bargaining chips to employees. Ownership provides protections which may improve or dull employees' incentives for human capital investment. When there is fierce market competition and no lock-in the allocation of ownership does not play a role (as one might expect), provided that human and physical assets are sufficiently complementary. If asset complementarity is low, ownership matters even in the absence of lock-in. In general, the most efficient ownership arrangement is that which maximizes managerial competition inside the firm.

Keywords: Ownership; competition; incomplete contracts; human capital.
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Ownership and Managerial Competition: Employee, Customer, or Outside Ownership

INTRODUCTION

There is a wide consensus nowadays that most economic activities are best undertaken in a market environment with private property. It is generally accepted that only the protection of private property rights and competition by rival firms provide adequate incentives to perform.

This general belief has led to a worldwide wave of privatizations. The striking success of some of the early privatization programs has also reinforced economists' beliefs in the overall virtues of the market system and private property.

Most proponents of privatization believe that "the market" and "private property" go hand in hand, but if for some reason production does not take place in privately owned firms it is still preferable to organize the allocation of goods and factors of production around some market system. Such a market system would work better than a centrally planned system but not as well as a market system organized around privately owned firms. This is, in a nutshell the consensus view of today.

However, it is not obvious a priori what form of property arrangements are best for the well functioning of markets. From a theoretical perspective it is not even clear that ownership matters at all when there is sufficient competition. As Holmstrom (1998) puts it, "the boundary [of the firm] question is interesting primarily because we cannot claim to fully understand either the internal organization of firms or the operation of markets by studying the two in isolation."

Another important consideration is that private ownership can take many different forms. A firm may be owned by dispersed outside shareholders, or by a single outside owner. It may be owned by employees, as in partnerships and producer cooperatives. Or it may be owned by a customer cooperative or joint venture. This diversity of arrangements suggests that the question is not just whether private ownership is essential but also what type of private or public ownership complements competition best: outside ownership or inside ownership by employees and/or customers?

While we are accustomed to thinking of firms as owned by investors (we call them

outsiders in this paper),[1] employee-owned firms, or customer-owned firms are not uncommon in market economies.[2] How we should appraise this development is a challenge.

This paper provides a theoretical analysis of the interaction between managerial market competition and ownership of firms. It is concerned with the question of how the efficiency of any of these ownership allocations depends on the extent of competition in managerial labor markets and, vice-versa, how particular ownership allocations facilitate competition. The paper takes the incomplete contracting perspective of Grossman, Hart, and Moore to build a model of firms based on property rights and residual control (see Grossman and Hart (1986), Hart and Moore (1990), and Hart (1995)).

Because of contractual incompleteness a manager's payoff is determined, at least in part, through ex-post bargaining. In other words, the employment contract cannot tie down exactly how the manager's future compensation evolves with circumstances and actions. We make the extreme simplifying assumption that all compensation is determined through ex-post negotiations and that, as a result, managers may be forced to give up part of the surplus they create through their ex-ante human capital investments. As in Grossman and Hart (1986), ownership of physical productive assets, tools, machinery, etc. may provide managers with some protection against ex-post exploitation.

In addition, the better managers may obtain protection from competition. That is, they can obtain better terms ex post by seeking multiple competing offers. Our main concern in this paper is to understand which form of ownership allocation

[1] The labels 'insiders' and 'outsiders' are innocent and play no particular role in our analysis. Moreover, since we assume away capital investment decisions in our model it seems natural to refer to investors as outsiders.

[2] In one of the most comprehensive studies of existing ownership arrangements to date, Hansmann points out that while investor ownership is generally predominant in Western Europe, North America, and Japan, a significant fraction of firms is employee owned in specific sectors, such as the service professions, and that this fraction is expanding in other sectors such as transportation. Similarly, customer ownership is concentrated in some intermediary goods sectors as well as service sectors (Hansmann, 1996). Moreover, in Russia and Central Eastern Europe, the vast majority of privatization has involved ownership transfers to employees of the formerly state-owned company.

maximizes the incentives for human capital investment in the presence of managerial competition.

While this question has been touched on to some extent in Hart and Moore (1990), it is not the main focus of their article. A more closely related paper is Rajan and Zingales (1998), who ask what is the optimal amount of ex-ante "access" (or competition) among managers under outside ownership. Their paper varies the extent of competition for a fixed allocation of ownership, while ours compares different ownership allocations for a given level of managerial competition[3]. Another set of related papers, comparing inside versus outside ownership, is Hart and Moore (1998) and Glaeser and Shleifer (1999).[4] These papers consider non-profit cooperatives (owned by customers or employees) and compare them to for-profit firms owned by outsiders. In contrast, our paper considers for-profit cooperatives and compares them to other forms of ownership for different levels of managerial competition.

All these papers (including ours) abstract from financial considerations by implicitly assuming that all parties have sufficient wealth (or access to perfect capital markets) to purchase any ownership title they may require. These strong simplifying assumptions have the virtue of isolating the role of ownership as an incentive for (or protection of) ex-ante human capital investments, but do bias results against outside ownership, as Hansmann has noted[5]. We are aware all along that abstracting from

[3] In addition, their paper (which follows Hart and Moore (1998) in this respect) considers a bargaining solution which implicitly assumes a limited form of competition. We shall consider a different bargaining solution, based on the outside option principle (see Binmore, Rubinstein and Wolinsky (1986)), which allows for extreme forms of competition such as Bertrand competition.

[4] Another recent paper by Banerjee, Mookherjee, Munshi, and Ray (1999) proposes a theory of inefficient decision-making in agricultural cooperatives and tests the theory on data of sugar cooperatives in Maharashtra.

[5] When assets are not in place and capital must be raised to fund physical investments then the capitalists must be given protections along with employees and customers. Hansmann (1996) develops a theory of ownership of firms based on the idea that the firm should be owned by whoever needs the greates protection, i.e. to reduce the costs of ownership in his words. This is how he attempts to explain the predominance of outside ownership (by capitalists) in the U.S. and other economies. Among the costs of ownership, he suggests, the most important are the costs of collective decision-making in the presence of divergent interests among the owners. What we found of interest in our model is that we could go some way towards explaining the patterns highlighted in Hansmann's book without introducing explicit decision-making costs between owners with divergent interests. We can

capital constraints is not a realistic assumption. But, the point of our analysis is to reveal effects that might not be as apparent in a more realistic model with capital constraints. In this respect we follow the recent economics literature on the subject which has also assumed away capital constraints in a first step. We intend to pursue this project further in the direction of introducing capital constraints in our future research.

We consider in turn three situations with increasing degrees of competition. In the first, there is a single firm composed of only one employee and therefore no managerial competition. In the second, there are two employees inside the firm competing to serve customers; this is a situation where employees compete in the firm's internal labor market. In the third situation, we consider two firms with two employees each, where competition takes place both internally and externally.

We find that any form of ownership allocation may be optimal depending on the nature of competition. When there is no competition at all, employee and customer ownership provide the same incentives for human capital investment. As one might expect they dominate outside ownership whenever the firm's physical capital is complementary with the employee's human capital. Perhaps, more surprisingly outside ownership may dominate when the firm's assets are not complementary. Indeed, when human and physical assets are not complementary, the employee may choose to overinvest so as to improve her bargaining position (or outside option) under employee/customer ownership, and outside ownership dominates because it dulls these incentives.

When there is only internal competition (due to lock-in effects) the dominant form of ownership is either an employee cooperative or a partnership. The reason is that under this ownership arrangement no quasi-rents get dissipated to outside owners be they customers or other third parties. However, employee ownership does not induce maximal internal competition because the "winner" is forced to share her marginal surplus with the "loser", so to speak. If there is ex-ante heterogeneity among employees and one of the two appears to be the more able one, then a "partnership", where

explain those costs purely in terms of ex-post hold-up problems. The point is that even if decision making costs can be minimized through some institutional fix (e.g. arbitrators) important cost of ownership by multiple parties with divergent interests may remain.

only the able employee is the partner (owner) dominates the employee cooperative, where all employees have the same control rights.

There is one special case, however, where employee ownership (whichever form it takes) is dominated. That is when there is only one relevant customer for the firm's services and that customer owns the firm. We shall think of this case as vertical integration. Under such an ownership arrangement internal competition is fiercer than under employee ownership and, consequently, provides better incentives for human capital investment. In fact, in our model it provides first-best incentives because under competition à la Bertrand (the most extreme form of competition) the "winner" appropriates the full marginal return from investment.

Note that under ownership by multiple customers (e.g. by a customer cooperative) internal competition as an incentive scheme is again weakened because some of the quasi-rents are dissipated to infra-marginal customers who belong to the cooperative.[6] Another way of interpreting this result is to observe that under multiple customer ownership inefficiencies arise due to "common agency" problems (see Bernheim and Whinston (1986)).

Finally, under internal and external competition the rankings of ownership allocations remain essentially unchanged except in the extreme case where employees' human capital is entirely general. In that case an irrelevance result obtains when the firm's assets are complementary with employees' human capital.

Surprisingly, when there is little complementarity between assets ownership matters again. As in the case with no competition employees tend to overinvest in human capital when asset complementarity is low and their incentives to invest must be dulled. This is achieved with ownership allocations which reduce the winner's ability to appropriate the entire marginal surplus. Thus, vertical integration (followed by an employee cooperative and outside ownership) are optimal here because they minimize the employee's ability to extract a greater share of surplus by boosting her outside options through human capital investments.

The remainder of the paper is organized as follows. Section 2 outlines the model.

[6] The essence of multi-customer ownership captured in our model is the heterogeneity of the customer-owners, i.e. the divergent interests of customer-owners, not just their number.

Section 3 considers ownership of firms in the absence of any competition. Section 4 allows for competition among employees inside the firm. This is a situation where the employees' ex-ante investment is sufficiently firm specific that they are effectively locked-in. Section 5 allows for competition within and across firms. Section 6 briefly considers the horizontal integration decision. Finally, section 7 offers some preliminary concluding remarks.

THE MODEL

We consider a model with at most two firms, n customers, m employees and l outside owners. The core transaction we focus on is a service to be provided by employees to customers. In each firm only one employee is needed to serve a single customer. For most of the paper we shall suppose that there are more employees available than customers that need to be served. With more than one employee available per customer there is competition for the provision of the service between employees.

To keep things simple we assume that all agents are risk-neutral and are primarily interested in maximizing income. The main question we shall be concerned with is who should control the use of the asset or own the firm: employees, customers or outside owners? As in Grossman and Hart (1986) we shall suppose that only owners have residual rights of control over the asset or the firm. Before transacting employees can invest in human capital. This investment enhances the value of the transaction and is non-contractible.

There are many possible real world examples that may correspond to this stripped down set-up: law firms, consulting firms, investment funds, professional schools, R&D ventures, medical firms, etc. In all these examples employees must undertake several years of training and undergo periodic retraining to be able to provide even basic services.[7] Also, by the time they are transacting their training costs are sunk and

[7] Although a large fraction of training takes place before employees are hired, there is substantial on the job training or human capital investments on the job (e.g., medical doctors, lawyers, academics, engineers). Moreover, in the section that discusses competition between firms we will address the issue how human capital investment match with specific firm assets: employees can be more or less productive depending on whether they are well matched or not then there may be hold up problems

generally contracts with customers are only written after training has been completed. For all these examples one observes a variety of different ownership arrangements. Some firms are owned by employees, others by customers or outside owners (see Hansmann (1996) for an overview of the different ownership allocations observed in practice).

Formally, our model describes a multi-stage game between firm owners, employees and customers. In the first stage, employees simultaneously make costly (unverifiable) human capital investments of k_i at a cost of $c_i(k_i)$ $(i = 1, .., n)$. We shall assume without much loss of generality that $c_i(k_i) = k_i$. When this investment is completed, employees, firm owners and customers may contract over service transactions in a second stage of our game. The total expected value of a service to a customer i is given by $\beta_i v(k)$ if it takes place outside the firm.[8] We assume that β_i is a random variable taking two values, $\beta_i \in \{0, 1\}$. The joint distribution over β_i's is such that the number of customers with $\beta_i = 1$ never exceeds the number of employees available. When the transaction takes place inside the firm the expected value of the service is given by $\beta_i V(k)$. We assume throughout this paper that :

$$V(k) > v(k) \text{ and } V'(k) > 0; v'(k) > 0; V''(k) \leq 0; v''(k) \leq 0$$

A transaction in a firm creates more value either because the firm provides access to facilities which otherwise are not available or because the firm extends it's reputation to the transaction. As in Grossman and Hart (1986), we shall assume that *ex post* contracting takes place under symmetric information and is efficient.

Thus, the timing of moves is as follows: (i) at date 0, firm ownership is determined; (ii) at date 1, employees make human capital investments which generate uncertain values; (iii) at date 2, the uncertainty is resolved and the parties bargain over the price of the service; (iv) at date 3, the service is provided.

Obviously, a key question is how bargaining works in our model. A natural and often used bargaining solution for multilateral bargaining problems is the Shapley value[9]. However, we believe that the Shapley value does not adequately reflect the

even if there is no lock-in at all.

[8] A service can take place outside of a firm, for example, a lawyer can serve a customer without using the law firm; a scientist can provide consulting without supports from the firm; etc.

[9] This is the bargaining solution adopted in Grossman and Hart (1986), Hart and Moore (1990)

outcome of competition among employees. We shall instead consider an alternative bargaining solution based on the so called "outside option principle" (see Binmore, Rubinstein and Wolinsky, 1986).[10]

To see why the Shapley value is not an entirely satisfactory solution consider the situation where two identical employees compete for a single customer with ex-post value v. In such a situation competition à la Bertrand between the employees would lead to a surplus division where the customer gets the whole net surplus v. But the Shapley value in this case is $\frac{2}{3}v$ for the customer and $\frac{1}{6}v$ for each of the employees. Our bargaining solution (based on the outside option principle), is the one that replicates the Bertrand outcome.

Given that we consider bargaining situations involving up to $m + n + l$ parties (employees, customers and outside owners) we cannot unfortunately use an "off the shelf" bargaining-with-outside-options solution, since such a solution is simply not available in the bargaining literature. We are therefore led to specify a very simple extensive form bargaining game which captures the logic of the outside option principle and applies to this general setting.

In all these games the weakest party (with no outside option) is assumed to make a take-it-or leave-it offer to the other parties. The other parties can accept or reject. If one of them rejects either the game ends or bargaining proceeds to another stage, where another party is selected to make a take-it-or-leave-it offer. We shall allow for at most two stages in all the bargaining games we consider. To focus on our main points, we leave the details of the bargaining games in the appendix.

Although the rules of these bargaining games may appear somewhat arbitrary, they capture the outside option principle. It is possible to allow for richer (finite) bargaining games with alternating offers and counter-offers which give unique bargaining solutions identical to the one above (see e.g. Bolton and Whinston (1993)). These bargaining games may appear to be more satisfactory and general but they are no less ad hoc than the one considered here.

Given that the general game with two firms, m employees, n customers and l

and Rajan and Zingales (1996) to mention just a few papers where this solution is adopted.

[10] A number of papers have considered multilateral bargaining solutions based on the outside option principle. See in particular Bolton and Whinston (1993), and de Meza and Lockwood (1996).

owners is somewhat complex we shall proceed by examining three special cases in turn of increasing complexity: i) **no competition**; ii) **internal competition** between employees within a single firm; iii) **external and internal competition** across two firms with two employees each.

OPTIMAL OWNERSHIP ALLOCATION WITH NO COMPETITION

In this section we consider a situation with no competition between employees. The optimal ownership allocations obtained in this case will serve as useful benchmarks to understand the relation between competition and ownership analyzed in the next sections. Thus, we shall consider here a single firm with only one employee, and possibly one outside owner. A hold-up problem arises here only if there is a single customer with $\beta_i = 1$ ex-post. Accordingly, we shall also assume that either $n = 1$ or, if $n \geq 2$, that the joint probability distribution over β_i's is such that only one customer desires the service ex-post. The main question we shall be concerned with is who should own the asset, the employee, customers, or an outside owner.[11]

Before we address this question we consider what happens when the employee and the single customer who values the service decide to transact on their own without using the asset or the premises of the firm. In this case the total ex-post surplus from the transaction, $v(k)$, is split equally between the employee and the customer and the employee chooses k in stage 1 to maximize

$$\frac{v(k)}{2} - k, \tag{1}$$

and ends up underinvesting in human capital. Indeed, from a first-best perspective he should set k to maximize

$$v(k) - k.$$

Now, suppose that the employee uses the firm's asset to serve the customer. He is then able to generate a total ex-post surplus of $V(k) > v(k)$.

For convenience, we shall assume throughout this paper that $V(k) = f(v(k))$,

[11] Here, in order to isolate comptition in labor markets and to eliminate competition in the product market we assume that there is only one customer. This assumption will be relaxed later in the paper.

with $f' \geq 0$ and $f'' \leq 0$. Here, f' is the marginal contribution of the firm's asset to the marginal value of production. It can be taken to be a measure of to the complementarity between the firm's asset and the employee's investment in human capital. That is, when $f' > 1$ the firm's asset has a positive marginal contribution to the marginal value of production (i.e. $V'(k) - v'(k) = (f' - 1)\, v'(k) > 0$) or is complementary to the employee's investment in human capital; and when $f' \leq 1$, i.e. $V'(k) < v'(k)$, an employee's investments in his human capital increase his outside productivity more than they increase his productivity within the firm. That is, investments in human capital for purposes of non-firm production. Thus, the firms's asset appears negative in its marginal contribution to the marginal value of production, or it is not complementary to the human capital. Indeed there are many instances where employees invest considerable human capital to improve their own position within a firm without significant effect on their marginal productivity.

The first-best solution here is for the employee to maximize $V(k) - k$, and to choose k^* such that:

$$V'(k^*) = f'v'(k^*) = 1.$$

Obviously, the employee's first-best incentives to invest in human capital are then increased if and only if $f' > 1$ around $\widehat{k}$, where $\widehat{k}$ solves $v'(\widehat{k}) = 1$.

What happens now in a second-best situation where human capital investment k is not contractible? We first look at the case where the firm is owned by a third party.

Outside Ownership

Ex-post it is always efficient to undertake production on the firm's premises, since then more value is created. Thus, under outside ownership the owner, employee and customer bargain over $V(k)$. In the bargaining game specified above it is straightforward to see that the bargaining solution is as follows:

- the outside owner gets $V - v$
- the customer and employee each get $\frac{v}{2}$.

In stage 1 the employee therefore chooses k to maximize

$$\frac{v(k)}{2} - k \tag{2}$$

Hence, relative to the case where production is undertaken without the use of the firm's asset, the employee's marginal incentives to invest are unchanged[12].

Surprisingly, although there is no marginal contribution of the firm's asset to the employee's investment incentives here outside ownership may nevertheless be preferable to other ownership structures. To see this, consider next the outcome under either employee or customer ownership.

Employee and customer ownership

When either the employee or a single customer own the asset the ex-post bargaining solution is simply $\frac{V}{2}$ for both employee and customer. We suppose that if a firm is owned by $n \geq 2$ customers (as in a consumer co-op), there is only one of them valuing the service. Then even the customers who do not value the service can extract some surplus as owners of the asset. Assuming that access to the asset requires the unanimous consent of all customers the bargaining solution then is such that all customers get $\frac{V-v}{n}$ each as owners and the customer with $\beta_i = 1$ also gets $\frac{v}{2}$ as a customer, while the employee only gets $\frac{v}{2}$.

Thus, under employee or single customer ownership ($n = 1$) the employee's marginal incentives to invest are given by:

[12]Note that if we adopt the Shapley Value as the bargaining solution instead we obtain that the outside owner gets $\frac{V-v}{3}$ and the employee and customer obtain each $\frac{V-v}{3} + \frac{v}{2}$. With this solution it is less obvious how the employee's icentives to invest differ from the case of contracting outside the firm. His incentives to invest are now increased if and only if,

$$\frac{V'(k^n) - v'(k^n)}{3} + \frac{v'(k^n)}{2} \geq \frac{v'(k^n)}{2},$$

where, k^n is the second-best optimal investment when production takes place outside the firm. Or,

$$V'(k^n) - v'(k^n) = \left(f' - 1\right) \cdot v'(k^n) \geq 0$$

That is, the employee's incentives to invest are increased if and only if $f'(k^n) > 1$ and the firm's asset is complementary with the employee's human capital.

$$\frac{V'(k)}{2} \tag{3}$$

Otherwise, the employee's marginal incentives are as before.

Thus, under all ownership allocations the employee underinvests if and only if $f' > \frac{1}{2}$.

The optimal ownership allocation

Comparing the efficiency of outside ownership and employee/customer ownership, we can see that the employee in a firm under outside ownership invests more than an employee in a firm under employee/customer ownership if and only if $f' < 1$.

Comparing the employee's incentives for investment in human capital under the three regimes we can thus conclude that *employee ownership is optimal* from an ex-ante perspective if $f' > 1$. In other words, employee ownership is optimal whenever the complementarity between the firm's assets and the employee's human capital is high. When $f' < 1$, outside-ownership dominates in general, except when $f' \ll \frac{1}{2}$, in this case it is not clear whether under-investment under employee ownership or over-investment under outside ownership is more efficient.

To summarize, our analysis so far yields the following result:

Proposition 1 *When there is no competition,*

1. *the employee always underinvests under employee-ownership; underinvests under outside-ownership if $f' > \frac{1}{2}$; overinvests if $f' < \frac{1}{2}$;*

2. *employee ownership dominates outside-ownership whenever the firm's asset makes a positive marginal contribution to the marginal value of production, that is, $f' > 1$;*

3. *when $\frac{1}{2} < f' < 1$ outside-ownership dominates employee ownership;*

4. *when the employee over-invests under outside-ownership ($f' < \frac{1}{2}$), either outside or employee ownership may be optimal depending on the trade-off between overinvestment and underinvestment ; and*

5. *customer ownership is equivalent to employee ownership when there is only one customer. With more than one customer-owner, customer ownership is equivalent to outside ownership.*

proof: obvious.

What happens with multiple customer ownership is that even customers who do not consume and therefore do not add any value demand a piece of the surplus as owners. That is, an owner-customer is an agent with two hats on. When they are not consuming they behave more like pure owners. Thus, in a customer-cooperative where consumption patterns differ wildly across customers some customers will see their interests mostly as outside owners and others mostly as customers. Our model captures this natural conflict between customers in an extreme way.

Some of the above results are related to observations made recently by Rajan and Zingales (1996) and de Meza and Lockwood (1996). Just as in de Meza and Lockwood (1996) removing ownership of the asset from the employee may induce him to invest more by providing him with better marginal incentives to invest. The effect works through the bargaining position of the employee, as in their model.

An important difference with their analysis is that here the removal of ownership may be inefficient even though it increases investment incentives when, as a result, the employee has incentives to overinvest. The mechanism behind the result of Rajan and Zingales (1996) is different from ours. In their model ex-ante investment may reduce the value of the asset. By removing ownership of the asset the negative effect on investment incentives of the reduction in ex-post asset value is limited, so that investment incentives may be increased[13].

[13] With the Shapley Value as a bargaining solution there may also be over-investment in human capital under outside ownership. The employee then over-invests in human capital if and only if,

$$\frac{V'(k^*) - v'(k^*)}{3} + \frac{v'(k^*)}{2} = \frac{1}{6}[2f' + 1]v'(k^*) > f'v'(k^*)$$

or,

$$f' < \frac{1}{4}.$$

As with our solution, overinvestment may occur because investment in human capital strengthens the employee's bargaining position more than it adds to the total value of production in the firm.

COMPETITION IN INTERNAL LABOR MARKETS

In this section we allow for internal competition by considering a single firm with two employees, a single customer with $\beta_i = 1$, and one outside owner. This would be a situation corresponding to perfect lock-in, where employees' human-capital is perfectly firm specific.

We denote by v^i and V^i the value of production respectively outside and in the firm with a single employee $i = 1, 2$, and by V the value of production when both employees participate in production in the firm. Also, we denote by k_i the investment in human capital of employee $i = 1, 2$.

We distinguish between four possible ownership structures : i) outside ownership; ii) employee cooperative; iii) employee partnership and iv) customer cooperative.

For reasons of tractability we shall restrict attention to the following functional forms for v^1 and v^2:

$$\left\{ \begin{array}{l} v^1(k_1) = \lambda \log(1 + k_1) \text{ and } v^2(k_2) = \underline{v} \text{ with probability } \alpha_1 \\ v^1(k_1) = \underline{v} \text{ and } v^2(k_2) = \lambda \log(1 + k_2) \text{ with probability } \alpha_2 \end{array} \right\}$$

with $\lambda > 1$, $\alpha_i \in (0, 1)$ and $\alpha_1 + \alpha_2 = 1$. Here, the difference $|\alpha_1 - \alpha_2|$ is a measure of heterogeneity between the two employees. As before we set $V^1 = f(v^1(k_1))$ and $V^2 = f(v^2(k_2))$, where, f is the same increasing function as in section 3. Finally we also assume that $V(k_1, k_2) = \max\{V^1(k_1), V^2(k_2)\}$.

This formalization captures the idea that although employees may be similar ex ante their ex-post realized human capital value will always be different. Moreover, with only one customer only the better employee is necessary for production. This assumption implies that ex-post competition between employees takes an extreme form: ex post only one employee is valuable[14].

With probability α_1 employee 1 is the "good" employee and contributes a total value of $V^1 = f(\lambda \log(1 + k))$, and employee 2 is the "bad" employee with a total value of $V^2 = f(\underline{v}) = \underline{V}$. Vice-versa, with probability α_2, $V^1 = f(\underline{v}) = \underline{V}$ and $V^2 = f(\lambda \log(1 + k))$. To simplify our analysis, we take λ to be large enough that

[14] In addition, an implicit assumption in these functional forms is that human capital investment only adds value for the employee who is best ex post. This assumption is inessential when there is only one customer.

$\lambda \log(1+k) > \underline{v}$ for all relevant choices of k. Also, for convenience we shall use the notation $\bar{V}$ for the higher value of the two employees and $\underline{V}$ for the lower value.

Outside Ownership

Under outside ownership negotiations now involve the two employees, the owner and the client. As before, the employees can in principle offer their services without using the firm's asset. The total surplus of this exchange would be lower but the owner would then be cut out of the deal. This possibility provides the employees with an outside option in their negotiations with the owner. Similarly, the owner, one of the employees and the customer can freeze out the other employee. The only party that cannot be excluded is the customer.

As outlined in section II multilateral bargaining here is captured in a simple two-stage game, where the owner makes a take-it-or-leave-it offer to the two employees and the customer in the first stage, and if the offer is rejected, the two employees make take-it-or-leave-it offers simultaneously to the customer in the second stage.

Without loss of generality, suppose that employee E_1 is ex-post more capable than employee E_2. Using backward induction and starting from the second stage both employees compete for the customer à la Bertrand and offer $\underline{v}$ in equilibrium. Therefore, equilibrium payoffs in that stage are such that E_1 gets $\overline{v} - \underline{v}$, the customer gets $\underline{v}$, and E_2 gets zero. These equilibrium payoffs are their outside options in the first round of bargaining with the owner. Therefore the outside owner will make an offer of $\overline{v} - \underline{v}$ to E_1 and $\underline{v}$ to the customer and keeps the residual $\bar{V} - \bar{v}$. To summarize, the outcome of multilateral bargaining under outside ownership is highlighted in the lemma below.

Lemma 1 *Under outside ownership, the bargaining solution is given by:*

Agent:	***employee*** $\mathbf{E}_1$	***employee*** $\mathbf{E}_2$	***outside owner*** O	***customer*** $(\beta_i = 1)$
Payoff:	$\overline{v} - \underline{v}$	0	$\overline{V} - \overline{v}$	$\underline{v}$.

Given that E_1 and E_2 each has respectively an α_1 and α_2 chance of being the better employee ex post, their ex-ante expected gross payoffs are $\alpha_i(\overline{v} - \underline{v})$ for $i = 1, 2$ under outside ownership. Thus, employee E_i $(i = 1, 2)$ chooses his initial investment

in human capital k_i given a level k_j chosen by employee E_j to maximize:

$$\max_{k_i \geq 0} \{\alpha_i(\lambda \log(1 + k_i) - \underline{v}) - k_i\} \tag{4}$$

We thus obtain employees' equilibrium investment choices under outside ownership.

Lemma 2 *Ex-ante equilibrium investment levels under outside ownership are*[15]*:*

$$k_i^O = \alpha_i \lambda - 1, \; i = 1, 2.$$

Since we are considering a model where ex-post values of individual investments are stochastic we obtain a very simple solution for the optimal choice of investments for the two employees. In particular, we need not consider mixed strategy equilibria in the investment stage, as in de Meza and Lockwood (1997) and Rajan and Zingales (1997).

Customer Ownership

When the firm is owned by n customers (with only one $\beta_i = 1$ customer) multilateral bargaining works as under outside ownership. The simplest situation is when there is a single customer-owner ($n = 1$). Proceeding by backward induction and assuming again that E_1 has a higher ex-post value the equilibrium payoffs in this case are highlighted in the lemma below.

Lemma 3 *The bargaining solution under ownership by a single customer is*

Agent:	***employee*** $\mathbf{E}_1$	***employee*** $\mathbf{E}_2$	***customer*** C
Payoff:	$\overline{V} - \underline{V}$	0	$\underline{V}$

When more than one customer owns the firm the bargaining solution is closer to outside ownership and is highlighted in the lemma below.

Lemma 4 *Under ownership by a customer cooperative, the bargaining solution is given by:*

Agent:	***employee*** $\mathbf{E}_1$	***employee*** $\mathbf{E}_2$	***customers*** $(\beta_i = 0)$	***customer*** $(\beta_i = 1)$
Payoff:	$\overline{v} - \underline{v}$	0	$\frac{\overline{V} - \overline{v}}{n}$	$\frac{\overline{V} - \overline{v}}{n} + \underline{v}$

[15] We assume that λ is always large enough that the optimal investment level is always positive.

Given that each employee E_i has an α_i chance of being the better employee ex post, employee E_i's ex-ante expected gross payoff is : $\alpha_i \left(\overline{V} - \underline{V}\right)$ under ownership by a single customer and $\alpha_i \left(\overline{v} - \underline{v}\right)$ under a customer cooperative. Therefore each employee chooses the same investment level under a customer cooperative as under outside ownership. But under ownership by a single customer employees maximize

$$\max_{k_i \geq 0} \{\alpha_i (f(\lambda \log(1 + k_i)) - f(\underline{v})) - k_i\} \tag{5}$$

Therefore equilibrium investments under customer ownership are as summarized in the following lemma.

Lemma 5 *Equilibrium investment levels under a customer cooperative (with $n \geq 2$) are the same as under outside ownership. But under ownership by a single customer they are:*

$$k_i^C = \alpha_i \lambda f' - 1$$

It is easy to see here that the investment incentives of each employee under ownership by a single customer coincide with the socially optimal investment incentives. Indeed, if the social objective is to maximize total expected value, then the planner's ex-ante investment problem is:

$$\max_{k_1 \geq 0, k_2 \geq 0} \{[\alpha_1 f(\lambda \log(1 + k_1)) - k_1] + [\alpha_2 f(\lambda \log(1 + k_2)) - k_2]\}$$

and we have[16],

Lemma 6 *The First-best choice of investment levels is:*

$$k_i^* = \alpha_i \lambda f' - 1.$$

As this subsection highlights customer ownership has dramatically different effects depending on whether it is a form of vertical integration, as under ownership by a single customer, or a form of common agency, as under a customer cooperative.

If one interprets the single customer as a representative for several homogenous customers and our cooperative with multiple customers as a customer cooperative

[16] Note that we must have $f' > \frac{1}{\alpha\lambda}$ and $\alpha = \min\{\alpha_1, \alpha_2\}$, here to guarantee that the first best investment is non-negative. Again, this requires λ to be large enough.

where members are heterogeneous then our result leads to the conclusion that when members are homogeneous the cooperative is more efficient and when they are heterogeneous it is less efficient. We can thus obtain a similar conclusion as Hart and Moore (1998) but in a different model.

Employee Ownership

We shall consider two forms of employee ownership. An employee cooperative, where all employees have equal ownership and control rights, and an (employee) partnership, where only the partner(s) have control rights and not other employees.

Employee Cooperative

When the firm is owned jointly by employees, decisions on the use of the firm's assets must be agreed on by both employees, so that the ownership payoff is divided equally between the two employees[17]. Therefore, the bad employee gets $\frac{1}{2}\left(\bar{V}-\bar{v}\right)$, and the good employee gets $\frac{1}{2}\left(\bar{V}-\bar{v}\right)+(\bar{v}-\underline{v})=\frac{1}{2}\left(\bar{V}+\bar{v}\right)-\underline{v}$ in equilibrium, where (as before) $(\bar{v}-\underline{v})$ is the outside option of the good employee. Thus, the bargaining solution under an employee cooperative (when E_1 has the higher ex-post value) is as described in the lemma below. Note that an important effect of joint employee ownership is to dull competition among employees.

Lemma 7 *The bargaining solution under ownership by an employee cooperative is:*

Agent:	***employee*** $\mathbf{E}_1$	***employee*** $\mathbf{E}_2$	***customer*** $(\beta_i = 1)$
Payoff:	$\frac{1}{2}\left(\bar{V}+\bar{v}\right)-\underline{v}$	$\frac{1}{2}(\overline{V}-\bar{v})$	$\bar{v}$

Each employee E_i has an α_i chance of being a good employee. If the employee is bad ex post he will simply get a share of the surplus as a co-owner, but his human capital investment has no value. Therefore, each employee's ex-ante program is:

$$\max_{k_i \geq 0} \left\{ \alpha_i \left[\frac{1}{2} \left(f\left(\lambda \log(1+k_i)\right) + \lambda \log(1+k_i) \right) - \underline{v} \right] - k_i \right\} \tag{6}$$

Hence, we obtain,

[17] An alternative formulation which yields the same results is that one employee is picked at random to decide on the use of the firm's asset.

Lemma 8 *Under an employee cooperative equilibrium investment levels are:*

$$k_i^{EC} = \frac{\alpha_i \lambda}{2}(f' + 1) - 1$$

Partnership

Under a partnership, decision rights concerning the use of the firm's assets are allocated to only one employee, the partner[18]. That is, unanimity among all employees is no longer required to take a decision. This regime allows for a stronger form of competition to take place. When the partner is better than the junior employee he improves his bargaining position through his outside option. But when he is worse, he simply acts like an outside owner. We suppose again, without loss of generality, that E_1 is the good employee. When he is the owner (that is, when the owner is the good employee ex post) then the bargaining solution is given by:

Agent:	**partner** $\mathbf{E}_1$	**employee** $\mathbf{E}_2$	**customer** ($\beta_i = 1$)
Payoff:	$\overline{V} - \underline{v}$	0	$\underline{v}$

Indeed, in that case the problem reduces to a simple bilateral bargaining game with an outside option for the customer (which is to get the service from the bad employee outside the firm's premises). If, however, the owner is the bad employee ex post (that is here, if employee E_2 is the owner) then the bargaining solution is similar to that under outside ownership (with employee E_2 acting like an outside owner) and is given by:

Agent:	**employee** $\mathbf{E}_1$	**partner** $\mathbf{E}_2$	**customer** ($\beta_i = 1$)
Payoff:	$\overline{v} - \underline{V}$	$\overline{V} - \overline{v}$	$\underline{V}$

Therefore, if employee E_1 is the owner his ex-ante expected gross payoff is given by:

$$\alpha_1(\overline{V}(k_1) - \underline{v}(k_2)) + \alpha_2(\overline{V}(k_2) - \overline{v}(k_2)).$$

And employee E_2 's ex-ante expected payoff is $\alpha_2(\overline{v}(k_2) - \underline{V}(k_1))$.

[18] Although this simple case looks artificial with two employees it should be clear that it corresponds to a more general situation where only the most able employees are promoted to the rank of partner and are thus given control rights.

Hence, the partner and the non-partner employee choose their human capital investments to solve respectively:

$$\max_{k_1 \geq 0}\{\alpha_1 \left(f(\lambda \log(1+k_1) - \underline{v}) + \alpha_2 \left(f(\lambda \log(1+k_2)) - \lambda \log(1+k_2)\right) - k_1\} \tag{7}$$

and,

$$\max_{k_2 \geq 0}\{\alpha_2(\lambda \log(1+k_2) - \underline{v}) - k_2\} \tag{8}$$

We thus obtain the following hybrid solution for the equilibrium investment levels under a partnership (here E_1-ownership):

Lemma 9 *The equilibrium investment levels under an E_1-partnership are:*

$$k_1^{E_1} = \alpha_1 \lambda f' - 1, \text{ for the owner employee } E_1; \text{ and}$$
$$k_2^{E_1} = \alpha_2 \lambda - 1, \text{ for the non-owner employee } E_2.$$

Remark 1 *Note that the incentives for the non-owner employee are the same as under outside ownership and that the partner-employee has socially optimal incentives to invest when $f' > 1$ (a similar result as that in the case of no competition).*

Comparing Ownership Allocations

Comparing equilibrium investment levels under different ownership structures we obtain the following ranking of ownership structures under pure internal competition between employees.

Proposition 2 *:When there is internal competition between employees (and outside options bind) then:*

1. *ownership by a single customer (vertical integration) achieves the first best;*
2. *When $f' > 1$ all other ownership structures give rise to underinvestment;*
3. *When $f' < 1$ all other ownership structures give rise to overinvestment;*
4. *If $\alpha_i = \alpha_j$ (employees are ex-ante homogeneous), where $i = 1, 2$, ownership structures are ranked as follows: the employee cooperative is the second-best*

ownership allocation, followed by an (employee) partnership , which in turn dominates outside ownership and a customer cooperative,

5. *If $\alpha_i \gg \alpha_j$ (employees are ex-ante heterogeneous), and E_i is the owner, then the partnership is the second-best ownership allocation; it dominates the employee cooperative, which in turn dominates outside ownership and the customer cooperative.*

proof: obvious.

The reason why ownership by a single customer achieves the first best is because the employee gets all the marginal return from investment when bargaining with the single customer-owner. However, under other ownership structures either there are possibilities for the employee to provide the service outside the firm or the marginal return has to be shared with others. In both cases the incentives of the employee are distorted.

It is worth highlighting the comparison between the employee cooperative and the partnership. When both employees are sufficiently similar ex-ante, i.e. $\alpha_i \approx \alpha_j$, then providing the same incentives to both employees (under an employee cooperative) is more efficient. It is straightforward to verify that since the production function is strictly concave the joint-employee ownership structure, which has a lower variance of investment levels across employees, dominates the partnership, which induces approximately the same per capita level of investments. However, when employees are sufficiently different ex-ante, i.e. $\alpha_i \gg \alpha_j$, allocating ownership to the better employee will provide more incentives for the better employee so that the expected value under the partnership is higher.

In related literature, Hansmann (1996), Hart and Moore (1998) and Kremer (1999) discuss collective decision problems (e.g., median voter problems) among heterogeneous owners. This paper models the strategic bargaining problem among heterogeneous owners. The problem which we modelled is complementary to the voting problem. Indeed, the outside options available to the various subgroups of owners should affect the alternatives among which the owners will vote.

A major difference with the case of no competition is that now outside ownership is always the worst ownership allocation (together with the customer cooperative). It either gives rise to the worst underinvestment or to the worst overinvestment.

An important implication of our theory is that the optimal ownership structure may depend on the differential ability of employees. Only when employees are homogeneous then allocating ownership to all employees is an efficient solution. When employees differ substantially in ability one tends to observe partnerships as a preferred mode of organization. For example, in the service professions, such as law, accounting, investment banking, consulting, advertising, architecture, engineering, and medicine (Hansmann, 1996, pp.66-69) partnerships are a very common form of organization. Here, partners are the employees who have performed well in the past. In the case of law firms, the partners in a law firm are the more qualified and experienced lawyers with higher skills and productivity, and less qualified lawyers are kept as permanent associates (Hansmann, 1996, p.91, 94 and n.9). The question from the above observation is why only one type or class of employees has ownership, rather than several or all? Our theory says that one possible reason for this is the potential for expropriation through ex post bargaining among groups of employee-owners.

Our model may shed new light on existing customer coops where owners are a group of regular customers, which are akin to our single customer-owner model (with $\beta_i = 1$) in the sense that all owners are regular customers in these examples, so that few of them are more owners than customers. In other words, all these examples are situations where the common agency problem among customer-owners is reduced. Having said this, this analogy is only suggestive and our model would require a significant extension to capture more accurately these multi-customer organizations.

Related and conversely, if we interpret state ownership as a form of nation-wide customer ownership, where common agency problems are likely to be more severe, then our analysis suggests that such a form of public ownership is likely to be inefficient.

EXTERNAL COMPETITION

In the previous section we considered only competition between employees within a single firm. Even if there are several firms this is the only possible form of competition

if employees' investments in human capital are entirely firm-specific, or if employees are entirely locked-in their firm for other reasons. In practice there is always some form of lock-in of employees. However, despite the likely presence of some lock-in it is not generally appropriate to assume that lock-in is total.

Therefore, in this section we allow for both competition within and between firms. We shall consider a labor market where employees' human capital is ideally matched to a specific firm. In such a situation internal and external competition are complementary.

External Competition with Matching

We first look at a case where human capital is partially firm-specific in the sense that one firm can use an employee's human capital better than the other, but this employee's human capital is also useful to the other firm. That is, there is a matching problem between firms and employees while employees are competing with each other.

We consider the simplest possible matching model with only two firms, A and B, two employees in each firm denoted by E_{A1}, E_{A2} and E_{B1}, E_{B2}, and two customers denoted C_A and C_B.

Again, we assume that $V(k_1, k_2) = \max\{V^1(k_1), V^2(k_2)\}$. That is, the best employee determines the value of the firm's product. We set up the model to allow for matching between employees and firms as follows. Customers and firms are now differentiated and each firm can serve only the corresponding customer, so that there is no competition between firms in the product market. Moreover, employees' human capital is now assumed to be better suited ex post in one firm than the other. That is, for any of the four employees we have $V_A(k_{ij}) \neq V_B(k_{ij})$. However, we continue to assume that all employees are identical ex ante and that their investments have a random value. We also retain the same stochastic structure as before with each employee having a $\frac{1}{2}$ probability of being a good employee. That is, by investing k_i in human capital employee i gets an ex-post value of

$$v(k_i) = \begin{cases} \underline{v}, & \text{with probability } \frac{1}{2} \\ \lambda \log(1 + k_i), & \text{with probability } \frac{1}{2}. \end{cases}$$

The new feature is that the realized ex-post value, when the employee is good, has

a higher value when the employee is well matched than when he is not. We model this by assuming that

$$\lambda = \begin{cases} \overline{\lambda}, & \text{when the good employee is well matched} \\ \underline{\lambda}, & \text{when she is mismatched} \end{cases}$$

with $\overline{\lambda} > \underline{\lambda}$. Moreover, we denote $V^h = f(\bar{\lambda}\log(1+k))$ and $V^l = f(\underline{\lambda}\log(1+k))$. Matching thus introduces the need for external along with internal competition.

In terms of bargaining outcomes the main effect of this new feature is to improve the good employees' outside options relative to what they would be in the absence of external competition.

As the social planner's program is,

$$\max_k \{\frac{1}{2} f\left(\bar{\lambda}\log\left(1+k\right)\right) - k\}$$

the first best investment k^* is given by:

$$k^* = \frac{\bar{\lambda}}{2} f'\left(\bar{\lambda}\log\left(1+k^*\right)\right) - 1.$$

Customer and Outside Ownership

Proceeding as before we consider in turn the three different ownership allocations. Since the good employee's full value, V^h, can only be realized with one of the firms, his outside option is squeezed down to V^l. It is straightforward to show that customer and outside ownership give rise to the same bargaining solution for good employees as described below (recall that our convention is to identify the good employee as E_{i1} with $i = A, B$).

Agent:	**employee** $\mathbf{E}_{i1}$	**employee** $\mathbf{E}_{i2}$
Payoff:	V^l	0

Thus, an employee's investment level is chosen to solve

$$\max_k \{\frac{1}{2}\left(f(\underline{\lambda}\log(1+k))\right) - k\}$$

and the optimal investment level k^O (k^C) is the solution of the following first order condition:

$$k^O = \frac{\underline{\lambda}}{2} f'(\underline{\lambda}\log(1+k^O)) - 1.$$

Comparing with the first best result, we observe that under outside ownership and customer ownership, employees will underinvest.

Employee Ownership

In contrast to outside (or customer) ownership, under an employee cooperative, every member of the cooperative gains an ownership share $\frac{1}{2}\{\frac{1}{2}[V^h(k_j) - V^l(k_j)] + \frac{1}{2}[V^h(k_i) - V^l(k_i)]\}$ and a good employee $\mathbf{E}_{i1}$ will also get his outside option V^l while keeping his ownership share of the firm which he jointly owns (in the case that his human capital matches with the other firm, he will be hired by the other firm with a payoff of V^l). Thus, the bargaining solution for employee j becomes

Agent:	**employee** $\mathbf{E}_{i1}$	**employee** $\mathbf{E}_{i2}$
Payoff:	$\begin{cases} \frac{1}{2}\{\frac{1}{2}[V^h(k_j) - V^l(k_j)] + \\ \frac{1}{2}[V^h(k_i) - V^l(k_i)]\} + V^l(k_j) \end{cases}$	$\begin{cases} \frac{1}{2}\{\frac{1}{2}[V^h(k_j) - V^l(k_j)] + \\ \frac{1}{2}[V^h(k_i) - V^l(k_i)]\} \end{cases}$

And an employee's program is

$$\max_{k_j}\{\frac{1}{2}\left(\frac{1}{4}\left(f\left(\bar{\lambda}\log(1+k_j)\right) - f\left(\underline{\lambda}\log(1+k_j)\right)\right) + f(\underline{\lambda}\log(1+k_j))\right) - k_j\}$$

So that the optimal investment level, k^{EC} is the solution of the following first order condition,

$$k^{EC} = \frac{1}{8}\left(\bar{\lambda}f'\left(\bar{\lambda}\log(1+k^{EC})\right) + 3\underline{\lambda}f'\left(\underline{\lambda}\log(1+k^{EC})\right)\right) - 1.$$

Comparing k^{EC} and k^O it is straightforward to see that outside ownership is less efficient than employee ownership.

Under a partnership, if the partner of the firm ends up being the good employee, then the bargaining solution is,

Agent:	**partner** $\mathbf{E}_{i1}$	**employee** $\mathbf{E}_{i2}$
Payoff:	$\begin{cases} V^h(k_i), \text{ if matched with own firm} \\ V^l(k_i) + [V^h(k_j) - V^l(k_j)], \text{ otherwise} \end{cases}$	$\begin{cases} 0, \text{ if matched with own firm} \\ 0, \text{ otherwise} \end{cases}$

When, instead, the partner is a bad employee then we have,

Agent:	**employee** $\mathbf{E}_{i1}$	**partner** $\mathbf{E}_{i2}$
Payoff:	$V^l(k_i)$	$V^h(k_j) - V^l(k_j)$

Denoting the probability that the partner ends up being good by α, and the probability that the partner ends up well matched with his own firm by θ, we obtain the following two optimization problems for the partner and employee respectively,

$$\max_{k_i}\{\alpha\left(\theta f\left(\bar{\lambda}\log(1+k_i)\right)+(1-\theta)\,f\left(\underline{\lambda}\log(1+k_i)\right)\right)-k_i\},\text{ for the partner}$$
$$\max_{k_i}\{(1-\alpha)\,f\left(\underline{\lambda}\log(1+k_i)\right)-k_i\},\text{ for the employee}$$

So that the optimal investment levels are,

$$\begin{cases} k^p=\alpha\left(\theta\bar{\lambda}f'\left(\bar{\lambda}\log(1+k^p)\right)+(1-\theta)\,\underline{\lambda}f'\left(\underline{\lambda}\log(1+k^p)\right)\right)-1,\text{ for the partner, and} \\ k^{np}=(1-\alpha)\,\underline{\lambda}f'\left(\underline{\lambda}\log(1+k^{np})\right)-1,\quad\text{for the employee (non-partner).}\end{cases}$$

When we take $\alpha\gg\frac{1}{2}$ and $\theta>\frac{1}{2}$ then, as before, we can show that a partnership where the employee with the higher α is the partner can dominate an employee cooperative. The reason is the same: in that case the unproductive employee-owner extracts too much surplus from the productive employee-owner and thus undermines his investment incentives.

The analysis of internal and external competition in this subsection thus leads to a similar ranking of ownership allocations as before. It is straightforward to verify that the following proposition holds:

Proposition 3 *When there is a matching problem between firms and employees,*

1. *all the ownership structures give underinvestment and the larger the difference $\overline{\lambda}-\underline{\lambda}$, the higher the underinvestment;*

2. *outside ownership and customer ownership are dominated by an employee cooperative;*

3. *if employees are heterogeneous and an ex-ante easier to be fitted employee is the partner then partnership is better than employee cooperative; and vice versa.*

proof: obvious.

Remark 2 *The difference $\overline{\lambda}-\underline{\lambda}$ measures the degree of firm specificity of an employee's human capital. The higher the degree of firm specificity, the larger the difference between employee ownership and other ownership structures.*

Under outside ownership and customer ownership, only good employees have value. Moreover, good employees are subject to some degree of hold-up: their payoffs are reduced to their outside option value which is lower than what they produced. This makes these ownership structures suboptimal in providing incentives to employees. However, under employee ownership, ownership provides some protection against ex-post hold-ups. In the case of an employee cooperative, all the employee-owners share the surplus that the best employee produced, thus it improves incentives. However, when the number of employee-owners is large, which we do not model explicitly, the advantage of employee-ownership will decline and eventually disappear. In the case of a partnership, the partner enjoys the surplus that the best employee produces. If the partner is a bad employee, the good employee's payoff is the same as under other ownership allocations. If the partner is a good employee, all the surplus produced by him will be appropriated (in the case that his human capital is not matched with his own firm, he will extract surplus from the employee he hires and he will be paid/hired by the firm which matches his human capital). Thus, if ex-ante better employees are partners, they will invest more efficiently.

This discussion thus makes clear that the results obtained in the case of pure internal competition are robust to the introduction of external competition. As the next subsection makes clear, the ranking of ownership allocations obtained under pure internal competition is only significantly affected when investment in human capital is completely non-specific.

External Competition with General Human Capital

When there is fierce market competition and no lock-in of employees, should ownership matter for efficiency? To address this question we now consider another polar case where there is no firm specific human capital (or no lock-in of employees) at all, and employees accumulate general human capital. This is a case where effectively all competition is external.

As before we assume that each firm can serve only one customer, so that there is no competition between firms in the product market. Customers are identical and firms have identical assets. That is, for any of the four employees we have $V_A(k_{ij}) = V_B(k_{ij})$

and $V(k_i, k_l) = \max\{V(k_i), V(k_l)\}$.

Moreover, as before, all employees are identical ex ante and the stochastic structure is such that at equal investment levels k_i each employee has a $\frac{1}{4}$ probability of being a good employee,

$$v(k_i) = \begin{cases} \underline{v}, & \text{with probability } \frac{3}{4} \\ \lambda \log(1 + k_i), & \text{with probability } \frac{1}{4}. \end{cases}$$

Since there is only one good employee ex post, there will be competition between firms to attract that employee[19]. Each firm now attempts to attract the better employee so as to offer a better product to its customer.

As one would expect, the main effect of competition between firms for the best employee is to strengthen the bargaining position of the best employee and consequently to widen the pay differential between good and bad employees.

Outside ownership

Consider first the situation where each firm is owned by an outside owner. As before, we can solve for the bargaining solution by backward induction:

Suppose that E_{A1} is the good employee ex post, and that both firms end up in stage two of the bargaining game. Then employee E_{A1} gets $\bar{v} - \underline{v}$, each customer C (with $\beta_i = 1$) gets $\underline{v}$, and the other employees get 0. Each firm can hold the customer and bad employee(s) down to their outside options given that there is no competition between firms for customers and bad employees. But Bertrand competition for the good employee may result in a higher payoff for employee E_{A1}. Indeed, when $f' \geq 1$ employee E_{A1} gets $\bar{V} - \underline{V}$ and the other parties obtain respectively, 0 for employees E_{ij}, $\underline{v}$ for each customer, and $\underline{V} - \underline{v}$ for each owner. To summarize, when $f' \geq 1$ the bargaining solution under outside ownership is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**outside owner** O_i	**customer** C (with $\beta_i = 1$)
Payoff:	$\overline{V} - \underline{V}$	0	$\underline{V} - \underline{v}$	$\underline{v}$

[19] The reason why we have only one out of four employees with a high productivity is that we want both firms (each with one customer having $\beta_i = 1$) to compete for the high quality employee. If there were more than one high quality employee there would be effectively no external competition.

When $f' < 1$, on the other hand, $\overline{V} - \underline{V} < \overline{v} - \underline{v}$, so that the bargaining solution is determined entirely by the outside options in stage 2 and is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**outside owner** O_i	**customer** C (with $\beta_i = 1$)
Payoff:	$\overline{v} - \underline{v}$	0	$\overline{V} - \overline{v}$	$\underline{v}$

Therefore, when $f' \geq 1$ employees choose their investment in human capital k_i to maximize:

$$\max_{k_i \geq 0} \{\frac{1}{4}[f(\lambda \log(1 + k_i)) - f(\underline{v})] - k_i\} \tag{9}$$

and when $f' < 1$ they choose k_i to maximize:

$$\max_{k_i \geq 0} \{\frac{1}{4}[\lambda \log(1 + k_i) - \underline{v}] - k_i\} \tag{10}$$

We thus obtain the following solution for the investment choices under outside ownership.

Lemma 10 *Equilibrium investment levels under outside ownership are given by:*

$$k_{ij}^{O} = \begin{cases} \frac{\lambda}{4} f' - 1, \text{ if } f' \geq 1 \\ \frac{\lambda}{4} - 1, \text{ otherwise} \end{cases}.$$

It is interesting to see competition between firms at work here. When $f' \geq 1$ perfect competition gives employees the correct marginal incentives to invest ex ante. But when $f' < 1$, employees over-invest.

Customer Ownership

Again solving by backward induction one obtains the bargaining solution under customer ownership: Bertrand competition between employees in the second stage of the bargaining game results in the following equilibrium payoffs: employee E_{A1} gets $\overline{V} - \underline{V}$, each customer C (with $\beta_i = 1$) gets $\underline{V}$, and the other employees get 0. It is easy to see that equilibrium payoffs are the same whether there is one or two customers with $\beta_i = 1$ in stage 2. With these payoffs serving as outside options for customers and employees in stage one, the bargaining solution under ownership by a

single customer (with $\beta_i = 1$) is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**customer** C (with $\beta_i = 1$)
Payoff:	$\overline{V} - \underline{V}$	0	$\underline{V}$

Under this ownership structure competition between employees inside a firm is maximized, and since both firms are identical, competition across firms does not add any additional competitive pressure. Thus, each employee here chooses his initial investment in human capital k_i to maximize:

$$\max_{k_i \geq 0} \{ \frac{1}{4} [f(\lambda \log(1 + k_i)) - f(\log(1 + k_j))] - k_i \} \tag{11}$$

When more than one customer owns the firm (as under a customer cooperative) the bargaining solution when $f' \geq 1$ is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**customers** ($\beta_i = 0$)	**customer** ($\beta_i = 1$)
Payoff:	$\overline{V} - \underline{V}$	0	$\frac{\underline{V} - \underline{v}}{n}$	$\frac{\underline{V} - \underline{v}}{n} + \underline{v}$

And when $f' < 1$, the bargaining solution is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**customers** ($\beta_i = 0$)	**customer** ($\beta_i = 1$)
Payoff:	$\overline{v} - \underline{v}$	0	$\frac{\overline{V} - \overline{v}}{n}$	$\frac{\overline{V} - \overline{v}}{n} + \underline{v}$

Not surprisingly, the bargaining solution is similar to that under outside ownership. So that equilibrium investment levels are as stated in the following lemma.

Lemma 11 *Under ownership by a customer cooperative, employees' investment levels are the same as under outside ownership. Under vertical integration (ownership by a single customer), the equilibrium investment levels are given by:*

$$k_{ij}^C = \frac{\lambda}{4} f' - 1.$$

Note that in the later case the solution is the same regardless of the value of f'. As before, the socially efficient outcome is achieved under this ownership structure.

Employee Ownership

Finally, consider the situation where each firm is jointly owned by two employees. As before, we assume that employees divide equally the surplus they can get as

owners. Once the firms' offers are determined the game proceeds as under outside ownership. Solving this game backwards we observe that Bertrand competition between employees results in equilibrium payoffs in the second stage of the bargaining game where employee E_{A1} gets $\bar{v} - \underline{v}$, each customer C (with $\beta_i = 1$) gets $\underline{v}$, and the other employees get 0. In the first stage of the game, when $f' \geq 1$, Bertrand competition for the good employee results in a wage for employee $E_{A1}$of $\bar{V} - \underline{V}$ and a wage of 0 for the other employees. Each customer gets $\underline{v}$ and the four employee-owners each get $\frac{1}{2}(\underline{V} - \underline{v})$.

Thus when $f' \geq 1$ the bargaining solution under employee cooperative is given by:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**customers** C $(\beta_i = 1)$
Payoff:	$\overline{V} - \frac{1}{2}(\underline{V} + \underline{v})$	$\frac{1}{2}(\underline{V} - \underline{v})$	$\underline{v}$

When $f' < 1$, so that $\overline{V} - \underline{V} < \overline{v} - \underline{v}$, on the other hand, the bargaining solution is:

Agent:	**employee** $\mathbf{E}_{A1}$	**employee** $\mathbf{E}_{ij}$	**customers** C $(\beta_i = 1)$
Payoff:	$\frac{1}{2}(\overline{v} + \overline{V}) - \underline{v}$	$\frac{1}{2}(\overline{V} - \overline{v})$	$\underline{v}$

These payoffs then translate into the following ex-ante investment choices for the employees. When $f' \geq 1$ they choose their investment in human capital k_i to maximize:

$$\max_{k_i \geq 0} \{\frac{1}{4} f\left(\lambda \log(1 + k_i)\right) - k_i\} \tag{12}$$

and when $f' < 1$ they choose k_i to maximize:

$$\max_{k_i \geq 0} \{\frac{1}{8}\left(\lambda \log(1 + k_i) + f(\lambda \log(1 + k_i))\right) - k_i\} \tag{13}$$

We therefore obtain the following solution for the investment choices under an employee cooperative.

Lemma 12 *Equilibrium investment levels under an employee cooperative are given by*

$$k_{ij}^E = \begin{cases} \frac{\lambda}{4} f' - 1, \text{ if } f' \geq 1 \\ \frac{\lambda}{4}(\frac{f'}{2} + \frac{1}{2}) - 1, \text{ otherwise} \end{cases}.$$

Thus, as under outside ownership, when $f' \geq 1$ perfect competition gives employees the correct marginal incentives to invest ex ante; when $f' < 1$, employees over-invest. However, under employee ownership there is less overinvestment than under outside ownership.[20]

Comparing Ownership Allocations

The analysis in this section highlights the positive effects of external competition on incentives under all three ownership allocations. When competition in labor markets is unrestrained then the first-best is achieved under all three ownership structures whenever $f' \geq 1$. If, however, $f' < 1$, then external competition has no effect on investment incentives and the ranking of ownership structures remains entirely determined by how it affects internal competition: single customer ownership is best and achieves the socially efficient outcome; it is followed by the employee cooperative, which in turn dominates outside ownership. We summarize the discussion in this section in the following proposition:

Proposition 4 *When there is no lock-in, employees invest in general human capital, and employees are homogeneous,*

1. *if $f' \geq 1$, Ownership is irrelevant: all ownership structures give first best investment incentives; however,*

2. *if $f' < 1$, ownership matters and the ranking of ownership allocations is such that: vertical integration is the most efficient, followed by the employee cooperative which dominates outside ownership and customer cooperatives; the later two ownership structures are equally efficient.*

proof: obvious from the above discussion.

The irrelevance result is consistent with the basic economic intuition that when there is fierce market competition ownership is not important. However, the second part of the proposition is somewhat surprising. Even when there is no hold-up

[20] When employees are homogeneous, the partnership mode is dominated by the employee cooperative mode. When employees are heteregeneous, on the other hand, the partnership may dominate the cooperative mode, but it does not change the ranking with other ownership structures. For the sake of presentation we omit the discussion of partnerships in this section.

problem, if the complementarity between firm assets and employees' human capital is low ownership still matters. The reason is that when there is low complementarity there can easily be overinvestment and, paradoxically, the ownership structure which leads to the least competition and the most ex-post opportunism by firm owners is the best.

MARKET STRUCTURE (HORIZONTAL INTEGRATION)

In this section we briefly consider the effects of horizontal integration under the three different ownership structures. Two basic lessons emerge from this analysis. First, integration always reduces welfare by distorting investment incentives, although it may raise the owners' payoff. Second, the effects of integration on incentives vary with the ownership allocation. Integration is worst under outside ownership, followed by employee cooperative ownership. It has no effect under customer ownership. Although these are not entirely surprising results, they could have important implications for antitrust policy.

We model integration of the two firms as in section 4 with the difference that instead of having two employees in the firm we have four. We also assume that employees are ex ante homogeneous and that there is only one good employee ex post. The bargaining solution in the integrated firm under outside ownership and customer cooperative is then as before, so that employees invest $k_I^O = \frac{\lambda}{4} - 1$ under outside ownership. Similarly, under ownership by a single customer the bargaining solution is similar and employees invest $k_I^C = \frac{\lambda f'}{4} - 1$. Finally, under an employee cooperative the bargaining solution is changed only to the extent that now four employees share the surplus ownership provides instead of just two. Thus, under an employee cooperative, employees invest $k_I^E = \frac{\lambda}{4}(\frac{f'}{4} + \frac{3}{4}) - 1$.

Comparing these investment levels to those obtained under non-integration in the previous section we can immediately conclude that when there is no lock-in of employees in firms then horizontal integration is always counterproductive from an efficiency perspective. It has no effect on investment incentives under a customer cooperative, but it strictly decreases investment incentives under either an outside or employee cooperative. The worst impact of integration is under outside ownership when $f' \geq 1$.

Note, however, that if there is perfect lock-in integration could be an efficient institutional response to overcome this constraint. That is, by integrating the two firms could increase the extent of internal competition and thereby improve incentives.

CONCLUDING REMARKS

Our paper provides a uniform framework within which both competition within and across firms, and interactions between internal/external competition and ownership can be considered. To our knowledge this is the first attempt to consider both forms of competition within a single framework together with the interactions between ownership and internal/external competition. Most of the existing literature on competition either deals with internal competition or external competition only.

Hansmann (1996) makes the observation that collective decision making in cooperatives can be inefficient when members are heterogeneous. Hart and Moore (1998) and Kremer (1999) formalized the idea with a voting model. Our results are consistent with theirs for different but related reasons. We show that when members are heterogeneous employee cooperatives are not efficient because bad employees hold up the good ones, which dulls incentives to invest ex ante. However, we show that if ex ante it is possible to identify who is likely to be better, a partnership mode may be efficient. With respect to customer cooperatives, we show that if customers are homogeneous (so that all customers desire the product of the firm) customer cooperatives are efficient. However, when members are heterogeneous customer cooperatives are not efficient since some members then act more like outside owners than customers and thus make the firm more like outsider owned firm.

Comparing our work with the literature on cooperatives (for recent surveys, see Bonin, Jones, and Putterman, 1993 or Dow and Putterman, 1996) we mainly note the following points. Jensen and Meckling (1979) and Dow (1993) argue that cooperatives have more difficulties in raising capital. As we mentioned in the introduction, our model does not consider capital constraints. This is an important omission which we plan to address in future work. Alchian and Demsetz (1972) and Holmstrom (1982) are concerned with moral hazard in teams and argue that employee cooperatives have more serious free-rider problems and lack adequate monitoring of individual

performance. They argue that outside-ownership may be superior because the owner as the ultimate residual claimant is highly motivated to monitor team member performance. In our model, we assume that human capital is observable ex post but ex ante is not contractible. Thus, we avoid the monitoring issue altogether. In related work, Bai and Xu (1998) considers monitoring by assuming that only the owner has the right to audit. They show that the free-rider problem does not render employee ownership ineffective as a means to motivate employees. In their model, when a worker's reservation wage is low and the monitoring cost or output uncertainty is high, workers' efforts are higher and the monitoring intensity is lower in an employee-owned firm than they are in a capitalist firm.

Bargaining with outside options game

Our bargaining game has two stages and the basic bargaining rule is designed to capture in a simple way the main logic behind the outside option principle: by letting the weakest party (who has no outside option) make a take-it-or-leave-it offer we obtain a bargaining solution where outside options bind since the proposer can hold the other parties down to at most their outside options.

In the **first stage** of our game firm owners make take-it-or-leave-it offers to employees and customers. Thus, the owners of the firm can only hold employees and customers down to the outside option they can obtain in the second stage by striking a deal without the firm owners. When a firm is owned by several owners we shall assume that they act as a team when determining an offer and that they share equally the gains from ownership[21]. If the offer is accepted by all the relevant parties the contract is signed. If at least one customer or employee rejects the owner's offer, the game moves to the second stage.

In the **second stage** only employees and customers bargain over service provision outside the firm. One of these two parties makes a take-it-or-leave-it offer, which the others can accept or reject. If it is accepted the contract is implemented. If it is rejected there is no trade and the game ends. The parties making take-it-or-leave-it offers in the second stage are taken to be the weakest ones on the long side of the market (who therefore have no outside options protection). By assumption employees are the weakest party, thus at this stage they make offers to compete for the customer's business, and each employee can only hold the customer down to her outside option, which is the best alternative offer the customer has received. If there is no well defined long side (that is, the number of employees equals the number of

[21]It is beyond the scope of this paper to address the question of conflicting objectives among multiple owners and to consider alternative collective decision making rules besides unanimity. Here owners write a comprehensive multilateral contract and maximize the joint surplus from ownership. This may appear to be a rather unrealistic description of how multiple firm owners reach decisions. In practice decisions are generally reached through majority voting and not through negotiations, when the number of shareholders is large. Our model can be adapted to allow for majority voting among owners without altering fundamentally the analysis and results. However, this would require specifying a somewhat more complex game.

customers) then the party making the take-it-or-leave-it offer is determined with the toss of a coin. The details of the game vary of course with the number of firms and players involved:

1. With a single firm, one employee, one customer and firm-owner the game works as follows: in the first stage, the firm-owner makes a take-it-or-leave-it offer to the employee and customer. If one of them rejects, the game moves to the second stage where the employee makes a take-it-or-leave-it offer to the customer with probability one half and vice-versa the customer makes a take-it-or-leave-it offer to the employee with probability one half.

2. With a single firm, two employees, one customer and firm-owner the above game is modified only in the second stage where now the employees being on the long side of the market make simultaneous offers to the single customer.

3. With two firms, each with two employees, a single customer and firm-owner, the game is again modified as follows. In the first stage, the two firm owners make take-it-or-leave-it offers simultaneously to all employees and customers. If one of the relevant parties rejects, then the game moves to the second stage, where employees now make competing offers to customers.

While other bargaining scenarios exist these will not be relevant as will become clear below.

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