Institutional Inertia

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Abstract

Can an inefficient institution survive despite the feasibility of constitutional change? In a world of incomplete contracts, technology choice may be utilized as a mechanism to influence future collective choice thus leading to productive inefficiency. However the feasibility of constitutional change together with the availability of transfers may in principle help to restore efficiency. This paper analyzes the efficiency of institutions in the context of corporate governance. In a world of certainty, outside ownership shows a systematic bias towards polarized technologies, whereas employee ownership is relatively more biased towards egalitarian technologies. Surprisingly, constitutional change will *never* take place due to the existence of vested interests. This holds irrespective of the bargaining power of the winning coalition, thus leading to institutional inertia. Under uncertainty, a cooperative is more likely to underperform an outside-owned firm; more dramatically, it may favor a Pareto dominated reform. Yet constitutional change may now take place as an insurance policy against the potential loss of vested interests. This result draws on the '*political risk aversion*' exhibited by risk neutral employees.

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1 Introduction

The aim of this paper is twofold. First, to explain how vested interests may arise among a firm's stakeholders; second, to show how the existence of such vested interests may prevent not only the choice of an efficient project, but also the adoption of an efficient institution.

To illustrate the type of inefficiencies that will be discussed in the paper, consider the following example. A group of 15 explorers sets off to extract the mineral resources from some island. To this end, they will need access to equipment. There are two alternative ownership structures. Either they could organize themselves as an independent expedition; i.e. they could own the equipment as a cooperative, with decisions taken by majority vote. Or they could become a royal mission, whereby the king would own the equipment and take all decisions.

There are two decisions to be taken. First, which kind of mineral to extract: they can either settle on an island with diamonds or on an island with gold. Second, how the spoils should be divided. Crucially these decisions are to be taken in sequence: they have to choose the island, and then they have to split the surplus. Also, neither decision can be contracted upon in advance.[1]

In the spirit of subgame perfection, suppose that the expedition has already landed on, say, the diamond island, and that the question is now how to share the profit. On this island, only 7 out of the 15 explorers are productive (let us say that the other 8 suffer from claustrophobia and cannot go underground). Each of the productive explorers has a productivity of 12. The unproductive have zero productivity. The productivity of each explorer is privately known before they set foot on the island, but becomes public information after they disembark.

If the mission is run as an independent expedition, the unproductive explorers will have a majority of the votes and so they will be able to expropriate productive explorers by denying them access to the equipment. To put a limit on expropriation, we suppose that the productive explorers have an outside option whereby they can get a payoff of 7 (that is, they have a productivity of 12 with access to the equipment, and 7 without). The winning proposal in the vote will thus be to leave 7 of the 12 in the hands of the 7 productive explorers, and divide the rest, 35, equally among the 8 unproductive.[2] That is, the unproductive will get a payoff of $4\frac{3}{8}$.

Had the king been in command of the expedition, he would simply expropriate all the explorers as much as possible, reducing their payoff down to their outside options (7

[1]The idea that decisions cannot be contracted upon in advance and that the owner of the equipment has the right to decide how it is used, first appeared in Grossman and Hart (1986).

[2]We suppose equal treatment within a group of explorers of the same productivity type. Various auxiliary assumptions could be made to rationalize this.

and zero for the productive and the unproductive types respectively). This would yield the king a payoff of 35.

Now let us suppose the expedition landed on a gold island. There are productive and unproductive explorers in this island too. But now the productive types are in the majority. Specifically, 8 of them have a productivity of 10, whereas the remaining 7 have a productivity of zero (we might suppose that they suffer from vertigo and cannot hike into the mountains searching for gold). In other words, there are more productive people on a gold island than on a diamond island, but their individual productivities are lower. For ease of comparison, let us continue to suppose that the productive explorers have an outside option of 7.

In an independent expedition, as the productive types are in the majority, there will be no expropriation on the gold island. The payoff accruing to each explorer will equal his own productivity, that is 10 or zero. Under royal authority, however, the king would expropriate the productive explorers, just as he did in the diamond island. Each of the 8 would have their payoff pushed down from 10 to their outside option 7. The king's payoff will be 24.

Having established the various' parties payoffs on each of the two islands, we can now move back to the first decision: which island to choose. Under royal authority, the king will obviously choose the diamond island, as the payoff, 35, exceeds the payoff of 24 from the gold island.

In the case of an independent mission, the choice of island is more intricate because there are four categories of explorers with competing interests: those who are productive on both islands, those who are productive on only one island, and those who are unproductive on both islands. Note that at this stage the question of who is in which category is private information, which precludes Coasian bargaining. Instead, the decision over which island to choose is made by a straight vote. Consider the payoff of an explorer who is productive on the gold island. His payoff, 10, is greater than the payoff he would get on the diamond island irrespective of whether he is productive there or not (7 or $4\frac{3}{8}$ respectively). Therefore, he will vote for the gold island. But there are 8 such explorers, so they will win the vote.[3]

Given that the decision over which island to choose varies across ownership structures, we might ask which organization performs better. The wealth of the diamond island is $7 \cdot 12 = 84$. The wealth of the gold island is $8 \cdot 10 = 80$. So efficiency calls for diamond extraction. The fact that the independent mission votes for the gold island whereas the royal mission chooses the diamond island means that, in this example, outside ownership performs better than common ownership.

[3]Interestingly, the decisive factor in determining the outcome of this vote is the fraction of productive explorers on each island, not the exact numbers of explorers in each of the four categories.

Of course, before the vote on choice of island is taken, the independent expedition should recognize that it would perform better under royal governance. This suggests that they should negotiate with the king for a transfer of ownership. Take the 'best' case where the explorers have all the bargaining power. They would demand a transfer price of 35, the king's maximum payoff. This amount would be divided equally among the 15 of them. Will they vote to sell to the king? No! The winning coalition formed by the 8 explorers who are productive on the gold island will block it. Under the status quo – independent mission –, they each get 10, as a result of the vote to extract gold. Under royal governance, the king would choose the diamond island and their overall payoff would be the sum of their outside option (either 7 or zero) plus their dividend ($\frac{35}{15}$) from the transfer – in total less than 10. Here we have an illustration of what we call *institutional inertia*: the failure of an inefficient organizational form to evolve into an efficient organization.

So, certainly, outside ownership is more efficient than common ownership in the above example. But this is by no means always the case. Consider a minor change to the example. Keep all the numbers the same except for the gold island where a productive type now has a productivity of 11 instead of 10. The gold island is then the efficient island as $8 \cdot 11 = 88$ is greater than $7 \cdot 12 = 84$. Applying the previous logic, it is straightforward to confirm that an independent expedition will still choose the gold island whereas the king will select the diamond island. In this modified example then, common ownership is more efficient than outside ownership.

Thus both forms of ownership structure can be efficient, depending on the circumstances. But can we say anything general about the biases away from efficiency? It turns out that we can. One thing to notice from the previous examples is that the independent expedition seems to have a tendency to vote for islands where there are more productive explorers albeit each has a smaller productivity. We might term such islands as 'egalitarian'. By contrast, the king seems to be inclined to choose islands where the productive explorers have higher productivity even though there are fewer of them. We might term these islands as 'polarized'. In the paper we prove the following general result about the *relative* bias of the two ownership structures.

A cooperative is more biased towards egalitarian projects than is an outside-owned firm. That is, if an outside-owned firm chooses an inefficient egalitarian project then so too does a cooperative. Correspondingly, an outside-owned firm is more biased towards polarized projects than is a cooperative. That is, if a cooperative chooses an inefficient polarized project then so too does an outside-owned firm.

It is important to note that this is a general result. It does not depend on the fact that one island has a majority of productive types and the other has a majority of unproductive types (as in the above examples). It might be the case that both islands have a majority of unproductive types – so that there is always redistribution.

Let us remind ourselves about the informational assumptions we have made so far. At the time when the island is chosen, explorers privately know their productivity on both islands. It is only by the time of the second decision, concerning redistribution, that this private information has become public. Of course there are many other possible informational assumptions that we might make. For instance, it could be that some of the explorers do not have a clear idea about their productivity on the islands. Consider the following example. Suppose that, at the time of the first decision, there are only two (not four) categories of explorers. The first category privately know their productivity: they know that they will be productive on both islands. Let us say that their productivity is always 12, and that there are 7 explorers in this category. The second category of explorer, who are in the majority, are uncertain about their productivity. They know that they will be unproductive on the diamond island, but that there is some chance they may be productive on the gold island. Exactly one of the 8 of them – at this point they do not know which – will turn out to be productive and have a productivity of 12 too (the rest will be unproductive). Notice that, given these numbers, in technological terms the gold island Pareto dominates the diamond island. Whereas on the diamond island there are only 7 productive explorers, on the gold island not only are these 7 explorers productive but also one additional explorer is productive. In all cases individual productivity is 12, and the reservation payoffs of the productive explorers is 7.

It is clear that the king will choose the gold island. Prima face, one would think that the independent mission would too. Surprisingly, this is not the case. Consider the payoff of an explorer who is unproductive on the diamond island. His payoff from this island, $4\frac{3}{8}$, is greater than his payoff from the gold island which, under the assumption of risk neutrality, equals his expected productivity $\frac{7}{8} \cdot 0 + \frac{1}{8} \cdot 12 = \frac{3}{2}$. Therefore, he will vote in favor of the diamond island. As there are 8 such explorers, they will win the vote, and the expedition will make a Pareto dominated choice. This voting outcome results from what we call *political risk aversion*: the failure of a cooperative to be efficient when the power of the current winning majority is jeopardized. And this result holds despite the explorers' underlying risk neutrality.

Given this extreme form of inefficiency, it might be supposed that the independent expedition will choose to change their constitution and sell to the king. But even this turns out not to be true! The king would pay them his expected payoff $8\,(12-7) = 40$. Since at the time on the decision of whether or not to sell there are only two categories of explorers, the majority group will have their way. Under the current constitution they get a payoff of $4\frac{3}{8}$, given that the diamond island is chosen. If they sell to the king, the king will choose the gold island and, their overall payoff will be the sum of their expected outside option, $\frac{7}{8} \cdot 0 + \frac{1}{8} \cdot 7 = \frac{7}{8}$, plus their dividend, $\frac{40}{15}$, from the transfer – in total $3\frac{13}{24}$, which is less than $4\frac{3}{8}$. Again this is an illustration of institutional inertia, of an extreme form: a failure to choose a new ownership structure that would yield, in technological terms, a Pareto improvement.

Individual uncertainty is not all bad news, however. It can reduce the scope for institutional inertia. For the case of no individual uncertainty, we prove a rather surprising result: if a cooperative chooses an inefficient technology (whereas an outside owner would not), the cooperative will *never* sell to the outsider. Yet this is not the case when there is individual uncertainty. The transfer price, accrued by the members of the cooperative as an upfront payment, may act as an insurance policy which compensates for the loss of political power.

The paper is organized as follows. The basic model is presented in Section 2 where the relative efficiency of employee and outside ownership is analyzed. Section 3 allows for the possibility of constitutional change. Section 4 introduces individual uncertainty. Section 5 analyzes the predictions of the model in the light of the empirical evidence. Section 6 presents a discussion of the hypotheses of the model and suggests some governance provisions to increase efficiency. It also includes a revision of the related literature. The concluding remarks are presented in Section 7.

2 Basic model

We consider a firm with I heterogeneous employees, where I is an odd number. At date 0 the firm is defined by the assets required to implement a productive technology. Two potential projects are revealed by nature: project i and project j.

The firm decides at date 1 which project to undertake. The cost of either project is normalized to zero. Once the technology has been implemented, the firm determines at date 2 how to distribute aggregate surplus among the firm's participants.

Contracts are incomplete. In particular, owners cannot commit at date 0 to a date 1 technology. Also, they cannot commit at date 1 to a date 2 sharing rule. It is this dynamic interaction between production and redistribution that can lead to inefficient decisions.

We consider two ownership structures: cooperative and outside ownership. In a one-member-one-vote cooperative, each employee is assigned one control right; decisions are taken by majority voting. As employees are heterogeneous, conflicts in decision-making are likely to arise. By contrast, in an outside-owned firm, investors are assumed to be homogeneous because they take decisions to maximize profits; as a result, their interests are aligned and the allocation of control rights among them is thus irrelevant. We discuss these two structures in turn.

2.1 The Cooperative

Consider a one-member-one-vote cooperative where both decisions, namely the technology at date 1 and the redistribution at date 2, are decided by majority voting. The characterization of employees is as follows. Under project i, employees can either be low

productivity types, with productivity normalized to zero, or high productivity types with productivity $x_i > 0$. Under project j, low types still accrue zero productivity whereas high types accrue productivity $x_j > 0$. We do not impose any ordering of employees across projects in terms of their individual productivity; that is, a low type under project i might be a high type under project j and viceversa. Thus at the voting stage at date 1, there are four types of employees, $\{ll, lh, hl, hh\}$, where (ll) denotes the group of employees whose productivity is low under both project i and project j, (lh) denotes the group of employees who are low types under project i but high types under project j, and so on. The fraction of these four types of employees is denoted by g_{ll}, g_{lh}, g_{hl} and g_{hh} respectively. We assume that there is a strictly positive fraction of all types; i.e. $g_{ll}, g_{lh}, g_{hl}, g_{hh} > 0$. The productivity of employees across projects is summarized in the following table:

Employee's type	Productivity (project i)	Productivity (project j)	Fraction
ll	0	0	g_{ll}
lh	0	x_j	g_{lh}
hl	x_i	0	g_{hl}
hh	x_i	x_j	g_{hh}

Note however that at date 2, once the technology has been undertaken, there are only two types of employees, namely low and high productivity types. Denote by f_i and f_j the fraction of high types under projects i and j respectively. The relation between the fractions of employees at date 1 and at date 2 is as follows:

$$g_{hl} + g_{hh} = f_i, \text{ and } g_{lh} + g_{hh} = f_j.$$

Notice that there are many combinations of g_{ll}, g_{lh}, g_{hl} and g_{hh}, which yield the same f_i and f_j.

Different types of employees will exhibit different preferences at each voting stage. At date 1, it is unlikely for one single type of employee to be in the majority; rather, different types of employees will form coalitions in order to win the vote. At date 2 by contrast, there will always be a majority formed by either low types or high types.

We assume the existence of a spot market at date 2 offering a reservation wage to employees. We assume that as low types are unproductive inside the firm, their outside wage is zero. By contrast, once the technology has been implemented, high types develop skills that are only partially firm specific. We assume that their outside wage is contingent on technology choice, i.e. w_i and w_j; we also assume that for each project, the outside wage is strictly higher than zero, but strictly lower than high types' inside productivity, that is, $0 < w_i < x_i$ and $0 < w_j < x_j$. The effect of the outside market is to put a limit on expropriation at date 2. Low types cannot be expropriated. High types cannot be pushed below their outside wage.[4]

[4]There is an alternative way to motivate the assumption of partial expropriation. Assume that high

In the analysis that follows, we characterize the technology choice and the redistributive schedule which is chosen in equilibrium. Each employee votes to maximize his expected payoff. As it is a two-stage voting game, we solve backwards.

2.1.1 Redistribution (date 2 vote)

Suppose that project i was chosen at date 1. At date 2, we assume that voting is "anonymous", in the sense that employees of the **same** type must be treated equally: coalitions cannot gang up on individual(s). Nonetheless, when low types are in the majority ($f_i < \frac{1}{2}$), they can expropriate high types. We assume, however, that their payoff remains lower than high types' payoff, even after expropriation. That is:

$$w_i > \frac{f_i (x_i - w_i)}{1 - f_i}.$$

Here, the LHS denotes high types' payoff following expropriation (i.e. their outside wage). The RHS denotes the expropriation receipts accrued by each low type; the numerator shows the individual expropriation suffered by high types, multiplied by the fraction of high types; the denominator shows the fraction of low types in the firm. The same applies when instead project j is chosen. These inequalities can be written more simply as:

(A1) $w_i > f_i x_i$ and $w_j > f_j x_j$

2.1.2 Technology choice (date 1 vote)

As there is no ordering of employees, we cannot apply the median voter theorem at date 1. Notice, however, that a stable voting outcome always exists as the technology set has been restricted to two projects.[5] To determine the equilibrium outcome, we should instead look at the formation of coalitions at this voting stage. Under majority voting, the winning coalition will be formed by at least $\frac{I+1}{2}$ employees. It turns out that coalition formation depends on which group is in a majority at date 2. We can thus distinguish three cases:

(Case H): High types' power: $f_i > \frac{1}{2}, f_j > \frac{1}{2}$

(Case L): Low types' power: $f_i < \frac{1}{2}, f_j < \frac{1}{2}$

types need to exert effort in order to be productive. If effort is costly and non-verifiable, the anticipation of expropriation will lead to underinvestment in effort. In equilibrium, expropriation, if positive, will be limited so as to induce high types not to shirk. This moral-hazard approach has been explored in Valderrama (2000).

[5] A general environment with J projects and I employee types is analyzed in Valderrama (2000).

(Case S): Split balance of power: $\begin{array}{c} \text{either} \\ \text{or} \end{array}$ $\begin{array}{l} \text{(a) } f_j < \frac{1}{2} < f_i, \\ \text{(b) } f_i < \frac{1}{2} < f_j \end{array}$

Notice that in case H, type (hh) is on the winning side in the date 2 vote, whichever project was chosen at date 1. That is, if project i was chosen, he would be productive and, since productive types are in a majority, they would vote against redistribution. The same applies if project j was instead chosen at date 1. Likewise, in case L, type (ll) is decisive in the date 2 vote, whichever project was chosen at date 1. Finally, look at case S. Under S(a), an employee of type (hl) is always on the winning side in the date 2 vote; if project i was chosen, he would be productive and, since productive types are in a majority ($f_i > \frac{1}{2}$), they would vote against redistribution; whereas if project j was chosen, he would be a low type and, since low types are in a majority ($f_j < \frac{1}{2}$), they would vote in favor of redistribution. Similarly, in case S(b), type (lh) is always decisive in the date 2 vote.

It turns out that, apart from an exceptional case, an employee who is always on the winning side at date 2, will always be able to form a winning coalition at date 1 too. Let us now examine in detail the argument whereby this is true.

Look first at case H, where type (hh) always wins the date 2 vote and there is no redistribution at date 2. Because there is no redistribution, type (hl) always prefers project i and type (lh) always prefers project j. This implies that if (hh) prefers project i, he will join (hl) to form a winning coalition at date 1 since $g_{hh} + g_{hl} = f_i > \frac{1}{2}$. On the other hand, if (hh) prefers project j, he will form a coalition with (lh) employees. This coalition will also win as $g_{hh} + g_{lh} = f_j > \frac{1}{2}$. In short, (hh) wins the vote at date 1, whichever his preferences between project i and j.

Consider now case L, where type (ll) is always on the winning side at date 2 and there is always redistribution. At date 1, if (ll) prefers project i, this means that $\frac{f_i}{1-f_i}(x_i - w_i) > \frac{f_j}{1-f_j}(x_j - w_j)$. By A1, (hl) will also prefer project i since he anticipates a payoff of w_i under project i which is strictly higher than $\frac{f_j}{1-f_j}(x_j - w_j)$ under project j. If (ll) prefers project j instead, then type (lh) will also prefer project j, using the same argument. Hence there are two potential winning coalitions at date 1. Either $\{ll, hl\}$ wins, because $g_{ll} + g_{hl} = 1 - f_j > \frac{1}{2}$, or $\{ll, lh\}$ wins since $g_{ll} + g_{lh} = 1 - f_i > \frac{1}{2}$. As a result, type (ll) wins the date 1 vote, irrespective of his preferences across projects i and j.

Finally, look at case S. As we have seen, in case S(a), type (hl) always wins the date 2 vote; moreover, there is redistribution under project j but not under project i. Look now at coalition formation at date 1. Type (ll) always votes for project j; although his individual productivity is zero under both projects, he gains through ex-post redistribution under project j. The voting preference of a type (hl) is in principle ambiguous. If redistribution receipts under project j are high enough to outweigh his loss in individual productivity with respect to project i, he will join (ll) type at date

1. They will form a winning coalition since $g_{hl} + g_{ll} = 1 - f_j > \frac{1}{2}$. Yet again, we find that the winner of date 2 vote, also wins date 1 vote. Alternatively, (hl) may prefer project i over project j and, the reason can be twofold; either because the value of x_i is relatively high, or because the value of redistribution under project j is small . In this case, coalition formation will depend on (hh)'s preferences. If (hh) prefers project i, i.e. $x_i > w_j$, the date 1 winning coalition will be formed by $\{hl, hh\}$, since $g_{hl} + g_{hh} = f_i > \frac{1}{2}$; thus (hl) will also win the date 1 vote. By contrast, if (hh) prefers instead project j, i.e. $w_j > x_i$, (hl) may not be able to form a majority group in favor of project i. This is the exceptional case in which a type who always wins the vote at date 2 may fail to win the vote at date 1.[6] As we want to rule out this exceptional case, we make the following weak assumption:

(A2) Whenever $f_j < \frac{1}{2} < f_i$ and $x_i \geq \frac{f_j}{1-f_j}(x_j - w_j)$, it must be the case that $x_i \geq w_j$.

–and similarly, with the subscripts i and j reversed in the symmetric case S(b).

Notice that, we only need this assumption when type (hl) favors project i. A2 guarantees that (hl) always wins the date 1 vote, irrespective of his preferences. Thus we have proved:

Lemma 1 *Under A1 and A2, an employee who always wins the vote at date 2, also wins the vote at date 1.*

Under A1 and A2, an employee who always wins the vote at date 2, also wins the vote at date 1.

As A2 is an intricate assumption, we can instead propose two sufficient conditions which are simpler to interpret and still ensure Lemma 1. The first condition is to assume that the high types' outside wage is never greater than their inside productivity, irrespective of the project, that is $w_j \leq x_i$ (and $w_i \leq x_j$). This implies that, an employee who is always a high type, weakly prefers the project which guarantees no redistribution at date 2.

Alternatively, we could restrict the outside wage to be the same across projects, namely $w_i = w_j = w$. By A1, a high type always prefers the project that leads to no

[6] As an illustration, consider two projects i and j, characterized as follows. Under project i, $f_i = 0.7$, $x_i = 6$ and $w_i = 4$. Alternatively, under project j, $f_j = 0.4$, $x_j = 10$ and $w_j = 8$. Moreover, assume that $g_{hl} < 0.5$. This technology set satisfies case S(a) since $f_j < \frac{1}{2} < f_i$.

Type (hl) prefers to be a high type under project i rather than a low type under project j as $6 > \frac{0.4}{0.6}(10 - 8) = 1.33$. But notice that type (hh) prefers project j as $8 > 6$. Likewise, type (ll) prefers project j in order to enjoy positive redistribution, in particular $1.33 > 0$. Finally, type (lh) will clearly vote for project j as $8 > 0$.

Given that type (hl) is in the minority, the winning coalition will be formed by $\{ll, lh, hh\}$ in favor of project j at date 1, despite the fact that (hl) is always decisive at date 2.

redistribution at date 2; hence, type (hh) will always be willing to join type (hl) in favor of project i.

The above analysis has shown that, assuming A1 and A2, for a given f_i and f_j, the pivotal employee is decisive irrespective of the particular combination of g_{ll}, g_{lh}, g_{hl} and g_{hh}, i.e. regardless of the ex-ante distribution of employees across the four types. This has the interesting implication that equilibrium outcomes will only depend on the ex-post distribution of types, f_i and f_j.

Now that we know how coalitions form at date 1, we can ask whether employee ownership is an efficient institution. We shall see that the outcome of the date 1 vote can be inefficient. The reason is that employees who are better off under the efficient technology, cannot commit at date 1 to compensate employees who are worse off under the efficient project. An employee can be worse off under the efficient technology not only when his individual productivity is lower, but also when he anticipates to be in a minority at the redistribution stage.[7]

As a benchmark, consider the first-best case, where it is feasible to commit to a date 2 redistribution. In this case, it is efficient to choose the project maximizing aggregate production. Without loss of generality, we suppose that:

Technology i is **efficient**, that is: $f_i x_i > f_j x_j$

Notice that a project is characterized not only by its level of efficiency, but also by the fraction and productivity of its high type employees. These two variables pin down the nature as well as the extent of redistribution at date 2; therefore, they will also prove to be crucial to determine the voting outcome at date 1. Given project i characterized by $\{f_i, x_i\}$, project j can necessarily be classified as one of the following.

First, project j may be a *dominated* technology, when it delivers fewer high types and they have lower productivity than under project i, that is, $f_j < f_i$ but $x_j < x_i$. Alternatively, project j might be characterized as a *polarized* technology, when it generates fewer high types but who each has greater productivity in comparison with project i, that is, $f_j < f_i$ but $x_j > x_i$. Finally, project j might be described as an *egalitarian* technology,

[7] One may wonder why there is no Coasian bargaining at date 1. We have in mind a world in which an employee's type is private information at this stage. For a large I, free riding would preclude transfers at date 1 and hence inefficient outcomes might arise in equilibrium; see Mailath and Postlewaite (1990). However, we are assuming that, once the technology has been implemented, an employee's productivity becomes public knowledge (witness the fact that the outside market can then distinguish between low and high types). So the date 2 vote takes place under symmetric information. We recognize that the tools provided by mechansim design could help to disclose private information at date 1; although its power would be limited by employees' participation constraint (i.e. their outside wage) and, by the fact it is only possible to screen on what high types' productivity turns out to be under the technology chosen on the equilibrium path but not off the equilibrium path. We intend to explore this avenue in future work.

when it delivers a bigger fraction of high types, but who each has a lower productivity in comparison with project i, namely $f_j > f_i$ and $x_j < x_i$. As the last two cases are more interesting than the first, we restrict project j to be either polarized or egalitarian.

(A3) Project j is either a polarized or an egalitarian technology. That is,

$$\begin{array}{cc} \text{either} & f_j < f_i \text{ and } x_j > x_i, \\ \text{or} & f_j > f_i \text{ and } x_j < x_i. \end{array}$$

In addition, given that the paper seeks to explore the effect of redistribution on technology choice, we ignore case H under which there is never redistribution.

(A4) At least one of the projects generates a majority of low types.
That is, either case L or S holds.

Now we turn to the main question of this section. Is it possible for a cooperative to select an inefficient project in equilibrium? The answer is positive. Consider the example presented in the introduction, satisfying assumptions A1-A4. An independent expedition of 15 explorers has to decide whether to settle on an island with diamonds or on an island with gold. In the diamond island 7 out of the 15 explorers are productive with individual productivity of 12 and outside option of 7. Positive redistribution yields a payoff of 7 and $4\frac{3}{8}$ for a productive and unproductive explorer respectively. In the gold island, 8 explorers are productive with individual productivity of 10. An explorer's payoff equals his individual productivity. The decisive coalition in technology choice is formed by the 8 productive explorers who are productive in the gold island. They favor gold extraction despite the efficiency of diamond extraction. Note that the inefficient project is egalitarian as it generates more productive explorers ($8 > 7$) albeit each has lower productivity ($10 < 12$). But is this a necessary condition for a cooperative to be inefficient? In other words, can a cooperative also vote for an inefficient polarized project? The following example provides the answer.

2.1.3 Example: Voting for an inefficient polarized technology

Consider a slight variation of the example presented in the introduction. The diamond island is still characterized by 7 productive employees with productivity of 12 and outside option of 7. But now in the gold island 5 explorers are productive with productivity of 16. Their outside option is again 7. Crucially now, unproductive types are in the majority in the gold island. They will thus expropriate productive types via redistribution. The winning proposal in the vote will be to give out 7 to the productive types and divide the rest $5\,(16-7) = 45$ among the 10 unproductive, each accruing $4\frac{1}{2}$.

As the wealth of the diamond island, $7 \cdot 12 = 84$ is greater than the wealth of the gold island, $5 \cdot 16 = 80$, efficiency calls for diamond extraction. But the cooperative will turn out to be inefficient. In fact, consider the payoff of an explorer who is unproductive

in the diamond island. His payoff $4\frac{1}{8}$ is lower than the payoff he would get on the gold island irrespective of whether he is productive or not (7 or $4\frac{1}{2}$). Therefore, he will vote for the gold island. As there are 8 such explorers, they will win the vote. Note that the gold island is polarized as there are fewer productive explorers ($5 < 7$) but with greater productivity ($16 > 12$).

The above example illustrates that there is not a clear direction of inefficiencies towards polarized or egalitarian technologies. Also, a cooperative might be an inefficient institution even when redistribution is anticipated under the efficient technology. More specifically we shall see that only in case L may a cooperative choose an inefficient polarized technology. In case S by contrast, a cooperative will always be efficient provided the inefficient technology is polarized.

Yet we can provide a general result concerning the relative bias of a cooperative in relation to an outside-owned firm. Before presenting the argument, let us first analyze technology choice under outside ownership.

2.2 Outside Ownership

Consider the behavior of an outside-owned firm. Investors are homogeneous and seek to maximize profits. In this model, profits are defined by the expropriation of employees' productivity. There are two types of participants in the firm. Outside investors, who are endowed with residual control rights and employees who receive a compensation to stay in the firm.

Notice that at date 2, outsiders can differentiate between low and high types. They will thus expropriate high types, obtaining a payoff of $If_i(x_i - w_i)$, under project i. Similarly for project j. Both low and high types will receive their outside options, namely 0 for low types and w_i, w_j for high types under project i and j respectively.

Will an outside-owned firm always choose the efficient project i? Notice that, project i will be chosen if and only if $f_i(x_i - w_i) > f_j(x_j - w_j)$. The fact that investors' payoff increases with project's efficiency may induce outsiders to choose project i as $f_i x_i > f_j x_j$. However, provided $f_i w_i > f_j w_j$, the expropriation effect under project j may dominate the efficiency effect under project i, leading to inefficient technology choice. As an extreme example, consider the case in which high types' inside productivity is almost equal to their outside option under the efficient project (i.e. $w_i \backsimeq x_i$). Outsiders will hence weakly prefer project j, no matter how inefficient this may be. Moreover, the inefficient project j can be selected, irrespective of whether it is polarized or egalitarian relative to project i. However, an egalitarian project can only be selected as long as the high types' outside option under the inefficient project is strictly lower than under the efficient project. To see why, suppose that outside ownership is inefficient, that is, $f_i x_i - f_j x_j < f_i w_i - f_j w_j$. As the LHS of the inequality is positive, this means that $f_i w_i$ must still exceed $f_j w_j$. If project j is egalitarian ($f_j > f_i$), it must be the case that w_j is strictly less than w_i. Yet this constraint does not apply when project j is polarized.

This observation may suggest a stronger bias towards polarized projects than towards egalitarian projects. But is the direction of distortion related to the firm's ownership structure? We turn to this question next.

2.3 Cooperatives versus Outside Ownership

The above analysis shows that institutional efficiency depends on the set of technologies revealed at date 1. A firm can be inefficient irrespective of its constitution; however, the factors leading to inefficiency differ across ownership structures. Whereas in a cooperative, the relative power between low and high types ex-post is crucial to determine efficiency, under outside-ownership the key variable is the firm's specificity of skills. Despite this observation, we can still compare the relative distortions in technology choice between employee and outside ownership. The answer is contained in the following Proposition.

Proposition 1 *Assume A1-A4. A cooperative is more biased towards egalitarian technologies than is an outside-owned firm; that is, if an outside-owned firm chooses an inefficient egalitarian technology then so too does a cooperative.*

Correspondingly, an outside-owned firm is more biased towards polarized technologies than is a cooperative; that is, if a cooperative chooses an inefficient polarized technology then so too does an outside-owned firm.

Proof.

Consider the first claim of the proposition. In case S, the characterization of project j as egalitarian implies that $f_i < \frac{1}{2} < f_j$. Assume that an outside-owned firm is inefficient: $f_i(x_i - w_i) < f_j(x_j - w_j)$. But notice that $f_j(x_j - w_j) < f_j(1 - f_j)x_j$, since, by A1, $w_j > f_j x_j$. Also, $f_j(1 - f_j) < (1 - f_j) < (1 - f_i)$. Therefore $f_i(x_i - w_i) < (1 - f_i)x_j$, so that $x_j > \dfrac{f_i(x_i - w_i)}{(1 - f_i)}$. This means that in a cooperative, type (lh) will vote in favor of project j. Remember that, given $f_i < \frac{1}{2} < f_j$, by Lemma 1 type (lh) is pivotal in technology choice. As a result, project j will also be selected by the cooperative.

In case L, project j is egalitarian if $f_i < f_j < \frac{1}{2}$. Note that in case L, by Lemma 1, the pivotal type at date 1 is (ll). Therefore our claim is that, if an outside owner chooses project j, i.e. if $f_i(x_i - w_i) < f_j(x_j - w_j)$, then it follows that $\frac{f_i}{1-f_i}(x_i - w_i) < \frac{f_j}{1-f_j}(x_j - w_j)$. But this claim follows immediately from the fact that $f_i < f_j$.

Let us now turn to the second claim of the proposition. In case S, project j is polarized if $f_j < \frac{1}{2} < f_i$. By Lemma 1, a cooperative will choose project j if the pivotal type (hl) favors it. His expected payoff is x_i and $\frac{f_j}{1-f_j}(x_j - w_j)$ under projects i and j respectively. But notice that, using A1, $\frac{f_j}{1-f_j}(x_j - w_j) < f_j x_j$. And, since j is inefficient, $f_j x_j < f_i x_i$,

which in turn is strictly less than x_i. This means that (hl) will always vote for project i. In other words, a cooperative will never choose a polarized project. By contrast, this is not always true under outside ownership. In particular, an outside owner will choose a polarized project as long as the value of w_i is large enough: $f_j(x_j - w_j) > f_i(x_i - w_i)$ if and only if $w_i > \frac{f_j w_j + (f_i x_i - f_j x_j)}{f_i}$. (Notice that this last inequality may hold even if $w_i < w_j$, given that $f_j < f_i$.)

In case L, project j is polarized if $f_j < f_i < \frac{1}{2}$. By Lemma 1, a cooperative will choose project j if the pivotal type (ll) prefers it. That is, if $\frac{f_i}{1-f_i}(x_i - w_i) < \frac{f_j}{1-f_j}(x_j - w_j)$. But given $f_j < f_i$, this inequality implies that $f_i(x_i - w_i) < f_j(x_j - w_j)$. Hence the outside owner will also choose the polarized project j.

Q.E.D.

In proving this proposition, we have also shown that, provided employees' power changes across projects (so that we are in case S), and as long as the inefficient project j is polarized, a cooperative is always efficient. This is because an employee always prefers to be a high type under the efficient project rather than a low type under the inefficient project; hence type (hl) favors project i. As (hl) is pivotal, he will always form a winning majority in favor of project i. By contrast, an outside owner will instead be inefficient, whenever his expected expropriation receipts are higher under the inefficient project.[8]

The intuition that underlies Proposition 1 is the following. Suppose that an outside-owned firm chooses an inefficient egalitarian technology. Then it must be the case that the inefficient technology allows higher expropriation than it does the efficient technology. Now consider a cooperative. In case L, type (ll) is pivotal at date 1. He shares similar preferences with outsiders as, by Lemma 1, he is in power under both technologies and will thus expropriate high types through redistribution. The only difference in preferences being that, for a given level of expropriation, type (ll) favors technologies generating fewer low types as these would allow higher per-capita expropriation. But this is precisely the characterization of an inefficient egalitarian technology. The inefficient behavior exhibited by outside owners is thus emphasized in a cooperative. In case S, the fact that the inefficient technology is egalitarian means that (lh) is pivotal in technology choice. The inefficient technology now looks more attractive to the pivotal type than it did in case L, because it allows him to become a high type, while still being in the majority at date 2. As we know from A1 that, for a given technology, an employee prefers to be a high type rather than a low type, (lh)'s preferences for the inefficient technology will be stronger vis-a-vis type (ll).

[8]This logic might suggest that an employee may also prefer to be a high type under project j, rather than a low type under project i. If this were the case, whenever the inefficient project j was egalitarian, a cooperative would always be inefficient since the pivotal type is then (lh). Yet, this is not always true. If project i is efficient enough – specifically, if $x_i > w_i + \frac{1-f_i}{f_i} x_j$– then the redistribution effect will dominate the individual productivity effect and a cooperative will be efficient.

Concerning the strong bias towards polarized technologies under outside ownership, note that in case L, if type (ll) favors a polarized technology, –generating more low types– it follows that total expropriation is necessarily higher under the inefficient technology. Therefore, an outside-owned firm would also be inefficient. Finally, the fact that a cooperative is never biased towards polarized technologies in case S completes our result.[9]

3 Constitutional Change

So far we have assumed that the firm's constitution is in place from date 0, before the choice of technology at date 1. As we have seen in Proposition 1, the initial constitution may be inefficient. Moreover, the fact that $\{f_i, x_i\}$ and $\{f_j, x_j\}$ are public knowledge means that everyone can anticipate an inefficient technology choice. In this section, we allow the firm to change its initial constitution as a commitment device to increase efficiency. The question is, will the firm's current owners hand over control rights to prospective efficient owners?

As a case in point, consider a cooperative. We know from Proposition 1 that a cooperative may select an inefficient egalitarian project j, even though an outside owner may not. If this is the case, will employees prefer instead to sell off the firm to efficient outsiders?

The context that we have in mind is one of competition among potential outside owners. Therefore the cooperative will extract all the surplus from a sale. A one-member-one-vote cooperative will divide returns equally among its members.[10] Also, the decision on constitutional change will be driven by a simple majority vote at date 0.[11] It turns out that, with a mild strengthening of A2, we can show that an employee

[9] At this point, it is important to emphasize that Lemma 1 underpins Proposition 1. To illustrate why, let us look back at the example presented in footnote 5, where A2 did not hold. In particular, type (hl), although decisive at date 2, failed to win the date 1 vote.

Given that $f_i x_i = 4.2 > 4 = f_j x_j$, project i is efficient. Also, as $x_j > x_i$ and $f_j < \frac{1}{2} < f_i$, project j is polarized. Recall that the date 1 winning coalition was formed by $\{ll, lh, hh\}$, in favor of project j.

On the other hand, notice that an outside-owned firm will choose the efficient project since $f_i(x_i - w_i) = 1.4 > 0.8 = f_j(x_j - w_j)$. Although the extent of expropriation is the same across technologies, project i delivers a higher number of high types. Thus, here is an example where Lemma 1 fails and the cooperative is more biased towards polarized projects than an outside owner.

[10] One may wonder why dividends are distributed uniformly among employees. In principle, we could envisage a contingent rule whereby dividends were tied to employees's type. But this information is private at the date of the constitutional vote. Following constitutional change, employees relinquish their control rights and hence have no incentive to renegotiate. The problem then boils down to the question of why Coasian bargaining fails at date 0 in a world of private information -as explained in foonote 7-. Under the veil of uncertainty, at the time of the initial constitution, a uniform dividend rule seems to be a focal decision rule.

[11] We might think of a more stringent voting rule, i.e. qualified majority. A more inclusive rule would be more conducive to constitutional inertia (as private information rules renders bargaining unfeasible). Our results would then be reinforced.

who is pivotal at dates 1 and 2, will also win the vote at date 0. Replace A2 with the following assumption.

(A2)' Whenever $f_i < \frac{1}{2} < f_j$ and $x_j \geq \frac{f_i}{1-f_i}(x_i - w_i)$, it must be the case that

$$x_j > (1 - f_i) w_i + f_i x_i.$$

–and viceversa, interchanging the subscripts i and j.

A2' resembles A2 except for the RHS of the final inequality, which is now $(1 - f_i) w_i + f_i x_i$ rather than simply w_i. Notice that the value of this convex combination is closer to w_i than to x_i as $f_i < \frac{1}{2}$.

Surprisingly, an inefficient cooperative will never vote to sell off the firm to outsiders. That is, there is institutional inertia.

Proposition 2 *Assume A1, A2', A3 and A4. A cooperative that is currently voting for an inefficient technology will never sell to an outside owner in order to restore efficiency.*

Proof

We know from Proposition 1 that if the cooperative is voting for an inefficient technology and the outside owner is not, then the inefficient technology must be egalitarian, i.e., $f_i < f_j$. When casting his vote at date 0, each employee computes his expected payoff under both employee and outside ownership. Remember that an outside owner is efficient but cannot commit not to expropriate high types ex-post. This implies that the profit of investors under outside ownership is determined by $I f_i (x_i - w_i)$. As the cooperative extracts all surplus from outside owners and divides the returns uniformly among its members, each employee receives $f_i (x_i - w_i)$ as a lump sum at date 0, in addition to his salary, under outside ownership. The equilibrium outcome at date 0 depends on the preferences exhibited by the winning coalition.

Under S, project j is egalitarian when $f_i < \frac{1}{2} < f_j$. Provided type (lh) can always form a winning coalition at date 0, the outcome on constitutional change will be robust to any ex-ante distribution of types $\{g_{ll}, g_{lh}, g_{hl}, g_{hh}\}$. The fact that the cooperative is inefficient and that (lh) is decisive in technology choice implies that $x_j \geq \frac{f_i}{1-f_i}(x_i - w_i) > f_i (x_i - w_i)$, where the last term captures the payoff accruing to (lh) upon sale. Thus, type (lh) favors employee ownership. Type (ll) by contrast will vote in favor of constitutional change. Whereas his individual productivity is always zero, the anticipates no redistribution under employee ownership but yet he receives a dividend under outside ownership. Finally, type (hh)'s anticipated payoff following constitutional change is $w_i + f_i (x_i - w_i)$. Given that the cooperative is inefficient, by A2', this payoff is weakly lower than his expected payoff under employee ownership, namely x_j. The winning coalition will thus be formed by $\{lh, hh\}$ in favor of the initial constitution.

Under L, project j is egalitarian when $f_i < f_j < \frac{1}{2}$. Note that if type (ll) prefers employee ownership so too does type (lh). Whereas under outside ownership the payoff of both types is the same – in particular they are both unproductive when the efficient technology is implemented–, under employee ownership the payoff of (lh) is strictly greater than (ll)'s payoff – as the cooperative implements the inefficient project and by A1 $w_j > f_j x_j$ –. Likewise if type (ll) prefers instead outside ownership, so too does type (hl). The argument mirrors the previous logic. In effect, under employee ownership the payoff of both types is the same, but under employee ownership the payoff of (hl) is greater. Therefore, type (ll) can always form a winning majority in favor of his preferred constitution; that is, (ll) is decisive at the date 0 vote. Crucially, as he is also decisive in technology choice, the cooperative can only be inefficient if and only if $\frac{f_j}{1-f_j}(x_j - w_j) > \frac{f_i}{1-f_i}(x_i - w_i)$. But $\frac{f_i}{1-f_i}(x_i - w_i) > f_i(x_i - w_i)$, where the RHS captures (ll)'s payoff under outside ownership. Therefore, the winning coalition will vote in favor of employee ownership.

Q.E.D.

The above result shows that an inefficient cooperative fails to sell off to outsiders even when it holds all bargaining power at the selling stage and hence a take-it-or-leave-it offer would allow all employees to internalize aggregate surplus. The reason why this compensation is not sufficient to guarantee constitutional change draws on the magnitude of the vested interests enjoyed by the pivotal type at the selling stage. These vested interests arise from his decisive role in both technology choice and redistribution. The argument works as follows. A cooperative can only become an inefficient institution when the type who is decisive at date 1 favors the inefficient technology. But he is also decisive at date 2. Therefore he neglects the efficient technology despite his power to set redistribution ex-post. Yet if the firm is sold off to outsiders, not only will the efficient technology be implemented but also he will lose power to expropriate the minority. He will however be compensated through the selling price following a one-vote-one-dividend rule. But this rule treats all employees equally. This implies that his privileged political position under employee ownership is jeopardized under outside ownership. Hence his payoff from the inefficient technology is strictly greater than his payoff from the efficient technology irrespective of the ownership structure of the firm. But the inefficient technology will only be implemented under employee ownership. This explains institutional inertia. In short, the initial constitution is favored by the decisive type as a shield to perpetuate his *'political power'*.

4 Extension: The Uncertainty Case

So far we have assumed that at the time of technology choice at date 1, each employee privately knows what his productivity type will be under both projects. This assumption, coupled with the fact that the fractions of high productivity (f_i and f_j) are public

knowledge, allows each employee to anticipate whether he will belong to the majority group at date 2 or not: there is *'political certainty'*. In this section we change the informational assumptions of the model to account for uncertainty. The question that we address is whether uncertainty may influence technology choice even though we continue to maintain the assumption of risk neutrality.

The framework that we have in mind is the following. At date 1 there are two feasible projects, the status quo, project j, and a new technology, project i. Under the status quo, a fraction f_j of the employees are productive with productivity x_j, and the others are unproductive with productivity zero. Whereas each employee privately knows his productivity under the status quo, he is uncertain about his productivity under the new technology. In particular, a low type under the status quo can become productive under the new technology accruing productivity x_i with probability p. Likewise, a high type under the status quo is also a high type under the new technology accruing productivity x_i with probability q. The values of x_i, x_j, f_j, p and q are all public knowledge. The fraction of high types under the new technology equals:

$$f_i = (1 - f_j)\, p + f_j q$$

As we want to explore the interplay between efficiency and uncertainty we continue to assume that technology i, the project about which there is individual uncertainty, is more efficient than project j: $f_i x_i > f_j x_j$. After the project is implemented at date 1, the productivity of each employee is publicly revealed at date 2. So that redistribution at date 2 takes place under symmetric information.

There are two main differences with respect to the case of certainty. First, there are only two types of employees at date 1, $\{l, h\}$ say, defined by their productivity type under the status quo. This renders the analysis of voting straightforward: technology choice will be simply determined by the larger group. Second, there is '*political uncertainty*': a member of the majority group at date 1 may turn out to be in the minority group at date 2. Note that this can only happen if the new technology is implemented. We might expect that under risk neutrality, such uncertainty will not affect technology choice at date 1. That is, if we considered two worlds characterized by the same set of technologies (i.e. the same x_i, x_j, f_j), with the only difference lying in the information structure of the new project, the choice of technology would remain unaltered. Surprisingly, this intuition is mistaken. We will compare how the cooperative functions with and without individual uncertainty. As the most interesting analysis arises under split balance of power, we shall focus on this case. Replace A4 with the following assumption.

(A4') Case S holds: either $f_j < \frac{1}{2} < f_i$ or $f_i < \frac{1}{2} < f_j$.

The following proposition shows that political uncertainty increases the likelihood of inefficient technology choice. We might say that a cooperative is '*politically risk averse*'.

Proposition 3

Assume that A1, A2, A3 and A4' hold. If the efficient technology i was chosen under political certainty it may no longer be chosen when it generates political uncertainty. However, if the inefficient technology j was chosen under political certainty, it will continue to be chosen under political uncertainty.

Uncertainty has no effect on technology choice as long as the winning coalition under certainty is formed by the same productivity types that comprise the majority group under uncertainty. This is because the expected payoff of an employee belonging to the majority under uncertainty is a convex combination of the payoffs accruing to each type belonging to the winning coalition under certainty. Risk neutrality ensures that the preferences of both groups are then aligned. Therefore, to analyze the influence of uncertainty in technology choice we should look at the composition of the majority group under uncertainty vis-a-vis the composition of the winning coalition under certainty. By A4', there are only two cases to consider.

Suppose first that $f_i < \frac{1}{2} < f_j$. Under uncertainty, the majority group is formed by high types under the status quo. Under certainty, the pivotal type is (lh) by Lemma 1. He may favor either the status quo project or the new technology. If he prefers project i, by A1, (hh) also prefers project i. If he prefers instead project j, by A2, (hh) will favor project j too. Hence the winning coalition at date 1 is always formed by high types under the status quo, irrespective of technology choice. Therefore, the composition of the majority group at date 1 is not affected by the existence of uncertainty. From the above discussion follows that the voting behavior of the cooperative will not be altered by political uncertainty.

Suppose instead that $f_j < \frac{1}{2} < f_i$. Recall that, in the course of proving Proposition 1, we showed that a cooperative is always efficient under certainty. As the pivotal type is (hl), he favors project i. By A2, (hh) also prefers project i. The winning coalition at date 1 is thus formed by high types under the new technology. Under uncertainty however, the majority group is formed by low types under the status quo. Hence, the composition of the majority group under uncertainty varies with respect to the certainty case. To show that the cooperative is politically risk averse we should then prove that low types may favor the inefficient project under uncertainty. Their voting behavior is the outcome of the following trade-off. On the one hand, a low productivity type likes the new technology. If he succeeds and becomes a high type, this is good news for two reasons: his individual productivity is higher; and, he is in the majority group at date 2. But he also likes the status quo project. If he failed and remained as a low type under the new technology, he would lose his power to set redistribution. If the probability of becoming a high type is low enough, the subsidy effect accrued under the status quo through redistribution will dominate the productivity effect under the new technology. Specifically, this is true whenever $p < \frac{f_j(x_j - w_j)}{(1-f_j)x_i}$. To see why, note that the payoff accruing

to a low type from the status quo project, $\frac{f_j}{1-f_j}(x_j - w_j)$, is higher than his expected payoff from the new technology, px_i.

As decisions are taken by majority voting, the fact that uncertainty can generate inefficiencies only when $f_j < \frac{1}{2} < f_i$, means that the uncertainty faced by high types is irrelevant for efficiency. In effect, when the cooperative is efficient under certainty, an employee who is a high type under the status quo yet a low type under the efficient project, favors the new technology. Under uncertainty, there is a positive probability that such an employee becomes a high type under the efficient technology. Therefore his efficient behavior is reinforced by the existence of uncertainty. Also, note that uncertainty is binding only when the dispersion between low and high types' payoff increases under the new technology. In effect, whereas the status quo ensures the existence of redistribution, the new technology leads to no redistribution.

Interestingly, there are two channels through which uncertainty feeds into an employee's payoff. First, through his productivity type. Second, through his power to set redistribution at date 2. Yet uncertainty can only create inefficiencies through the political channel. To see why, consider an alternative characterization of the new technology whereby all employees may either succeed and become high types with probability p, or may fail and remain low types with probability $(1-p)$. Hence there is aggregate uncertainty. Suppose that the majority is formed by low types. Although their productivity under the new technology is uncertain, they are certain to be in the majority group at date 2 irrespective of technology choice. It is straightforward to see that the cooperative will always choose the efficient project regardless of whether there is uncertainty or not.

Corollary 1 *Assume that technology i generates risk under uncertainty.*
An efficient cooperative is inefficient when the subsidy accrued by low types under the status quo is high enough. In particular when:

$$\frac{f_j}{1-f_j}(x_j - w_j) > px_i$$

It is worth realizing that the efficiency of a cooperative does not depend on the uncertainty faced by high types. As high types cannot expropriate low types, the subsidy generated under the status quo in the form of redistribution, can only become a source of vested interests for low types.

Interestingly, the uncertainty generated under the new technology is only binding when there is an increase in the dispersion between low and high types' payoffs with respect to the status quo. In effect, under the new technology, the date 2 majority group is formed by high types who favor no redistribution. Under the status quo however, the date 2 majority group is formed by low types who set positive redistribution. Low types are shown to be biased towards technologies ensuring a higher probability of being

decisive at date 2. This is because the marginal utility of holding power decreases in an employee's productivity type.[12] This asymmetry draws on the assumption that only low types can expropriate high types. Therefore, employees exhibit '*political risk aversion*' with respect to their productivity type.

4.1 Aggregate Uncertainty

The existence of uncertainty under the new technology impinges upon both an employee's productivity type as well as on his political stance at date 2. Yet it is important to highlight that uncertainty is only detrimental for efficiency as long as it is political, that is provided it threatens the current power of the date 1 majority group under the status quo. This contrasts with the certainty case where Lemma 1 guarantees that an employee's power to set redistribution is independent of technology choice. To isolate the effect of political uncertainty, consider an alternative framework where Lemma 1 still holds, that is, where an employee who is decisive at date 1 is also decisive at date 2. In this new setting, uncertainty will only lie on an employee' productivity. In particular, assume that project j generates a majority of low types, i.e. $f_j < \frac{1}{2}$. This implies that the date 1 majority group is formed by low types under the status quo. Consider an efficient technology i defined as follows. With probability p it succeeds so that all low types become high types. With probability $(1-p)$, it fails so that all low types remain being low types. At date 1, the realized efficiency of technology i is uncertain; that is, there is aggregate uncertainty. Also, the redistribution policy at date 2 is unknown. But crucially, an employee who is a low type under the status quo is always decisive in redistribution no matter which technology is adopted and irrespective of whether the new technology succeeds or fails. Note that the expected payoff of a low type from the new technology is a convex combination between x_i (if project i succeeds) and $\frac{f_j}{1-f_j}(x_j - w_j)$ (if project i fails). As this is strictly bigger than his payoff from the status quo technology, i.e. $\frac{f_j}{1-f_j}(x_j - w_j)$ for any value of p, he will always vote for the new technology.

4.2 Dominated Cooperatives

We have shown that an efficient cooperative may become inefficient under uncertainty. In what follows, we explore whether a cooperative might be relatively more inefficient than an outside-owned firm.

[12] In effect, suppose that the new technology i is implemented. Denote by $E[U(\cdot)]$ the expected utility of an employee who has a probability p of being a high type in the majority and a probability of $(1-p)$ of being a low type in the majority. Therefore $E[U(\cdot)] = (1-p)\frac{f_i}{1-f_i}(x_i - w_i) + px_i$. Likewise denote by $U[E(\cdot)]$ the utility of an employee with expected productivity of px who is always in the majority. Then, $U[E(\cdot)] = px_i + \frac{f_i}{1-f_i}(x_i - w_i)$. It is straigthforward to see that $E[U(\cdot)] < U[E(\cdot)]$. This inequality draws on the asymmetric behavior between low and high types at date 2.

Notice that uncertainty is never binding under outside ownership. Given that outsiders' payoff increases with high types' expropriation and that, employees' type is revealed at date 2, outsiders can still expropriate high types under the new technology. Hence all outcomes from section 2 will go through under uncertainty.

Under employee ownership uncertainty is only binding when $f_j < \frac{1}{2} < f_i$, that is when the status quo project is polarized. This implies that Proposition 1 applies when the status quo is egalitarian. Therefore, a cooperative is still more biased towards egalitarian projects than an outside-owned firm. Hence outside ownership will dominate employee ownership, provided the cooperative is also relatively more biased towards polarized projects. The following proposition contains the condition under which this is true.

Corollary 2. *Assume that technology i generates risk and A1-A5 hold. Outside ownership dominates employee ownership as long as:*

$$x_i > \frac{g_{hl} + g_{hh}}{g_{hh}} w_i$$

Proof:

Assume that project j is polarized, namely $f_j < \frac{1}{2} < f_i$ and $x_j > x_i$.
Also remember that $f_i = (1 - f_j) p + f_j q$.
A cooperative is more biased towards polarized projects than an outside-owned firm whenever the following equation holds:

$$f_j (x_j - w_j) > f_i (x_i - w_i) \Rightarrow \frac{f_j}{1 - f_j} (x_j - w_j) > p x_i$$

Rearranging:

$$f_i (x_i - w_i) > p x_i (1 - f_j)$$

Notice that the LHS of the inequality captures the profit of outsiders under project i, whereas the RHS represents the expected payoff of the majority group i.e. low types, under the new project corrected by the factor $(1 - f_j)$ that captures their relative preference towards the status quo project with respect to outside owners.
Substituting the value of f_i into the above equation:

$$[(1 - f_j) p + f_j q] (x_i - w_i) > p x_i (1 - f_j)$$

Remember that $(1 - f_j) p = g_{hl}$ and that $f_j q = g_{hh}$. The result follows directly.
Q.E.D.

The comparison between employee and outside ownership hinges on their relative bias away from efficiency. On the one hand, efficient technology is more attractive to an outside owner rather than to the decisive type in a cooperative. Outsiders, by expropriating all high types ex-post, internalize not only the productivity of g_{hl} employees, but

also of g_{hh} employees. On the other hand, an outside owner may favor efficient technology relatively less than a cooperative, as high types' expropriation is bounded above by their outside option w_i. If the former effect dominates the latter, a cooperative will be more likely to be inefficient than an outside-owned firm. It is worth noticing that as p and q are public information at date 1, g_{hl} and g_{hh} are also public knowledge. Employees can anticipate at this stage that employee ownership is dominated by outside ownership. Will the cooperative now change the initial constitution in order to increase efficiency?

4.3 Constitutional Change

Proposition 3 has shown that uncertainty can emphasize the extent of a cooperative's inefficient behavior. The assumption that p and q are known at date 1 means that everyone can anticipate inefficient technology choice. Will employees sell over the firm to efficient outsiders? In section 3 we saw that such transfer of ownership was always blocked by the winning coalition. Yet when inefficient behavior is driven by political risk the feasibility of constitutional change may restore efficiency.

Assume that A5 holds and uncertainty is binding. This implies that $f_j < \frac{1}{2} < f_i$. The vote on constitutional change takes place at date 0. Remarkably, the decisive type at date 0 is also decisive at date 1. In particular, the majority is formed by the employees who are low types under the status quo. Consider the voting behavior of a low type. Under the initial constitution, his productivity will always be zero as project j is adopted. Given that he is in the majority at date 2, his expected payoff is $\frac{f_j}{1-f_j}(x_j - w_j)$. Under outside ownership, he can become a high type with probability p. He will receive his outside option contingent on his type, plus a compensation over future expropriation receipts distributed as an upfront dividend. His expected payoff is thus determined by $pw_i + f_i(x_i - w_i)$. Note that if the bad state realizes under the new technology, he would be better off under outside ownership as he will still receive a positive dividend. However if the good state realizes he would be better off under employee ownership as $x_i > w_i + f_i(x_i - w_i)$. A low type will hence be willing to sell provided his probability of becoming a high type is low enough. A necessary condition is that $pw_i + f_i(x_i - w_i) > px_i$, that is $p < f_i$. Substituting the value of $f_i = (1 - f_j)p + f_j q$, this is equivalent to $p < q$. This condition is satisfied as long as there is positive correlation of types across projects. The following proposition states the conditions under which constitutional change will restore efficiency.

Proposition 4

Assume that A1-A5 hold and that there is positive correlation across types, that is, $p < q$. A cooperative will sell off the firm to outsiders provided the new technology is sufficiently efficient. That is, when:

$$f_i x_i > \frac{f_j}{1 - f_j}(x_j - w_j) + (f_i - p)\, w_i$$

The LHS of the inequality denotes project i's efficiency, which is partially internalized through date 0 dividends; the first term in the RHS denotes the status quo subsidy and the second term captures the constraint imposed by high types' outside wage which limits the date 0 dividend, although it also rises the payoff of a successful low type.

Proposition 4 says that if the efficiency of project i is high enough, the cooperative will favor project i indirectly under outside ownership even if it favors project j under employee ownership. Given that the same group is in power at date 0 and date 1, what is the intuition for this voting behavior? Outside ownership guarantees a compensation accruing to all low types irrespective of whether they become high types or not under the new technology. This compensation outweighs their expected expropriation in the event of success provided this is a low probability event. But it is precisely in this case when the adoption of the new technology under employee ownership is regarded as a risky option as the probability of accruing a zero payoff is too high. Hence the status quo would be favored under the initial constitution. In other words, constitutional change acts as an '*insurance policy*' enjoyed by low types when their probability of success is low enough. It turns out that a low type is indifferent between adopting a new technology under the initial constitution generating probability of success p and voting for constitutional change leading to the adoption of a new technology with probability of success $\left[f_i - (f_i - p)\frac{x_i}{w_i}\right]$. Therefore when $p < q$, a low type is willing to give up probability of success $(f_i - p)\frac{x_i - w_i}{w_i} > 0$ to ensure compensation. This probability could be interpreted as the *price of insurance* provided by constitutional change.

This section has shown that although political risk may turn a cooperative into an inefficient institution, the feasibility of constitutional change may however restore efficiency. But this is not necessarily the case. Remember the last example presented in the introduction as illustrative of two striking remarks. First, uncertainty lead a cooperative to reject a Pareto dominant technology, under which **all** employees were weakly more productive with probability 1. Second, the cooperative failed to sell off the firm to efficient outsiders.

5 Empirical Evidence

The purpose of this section is to analyze the theoretical predictions of our model in the light of the evidence provided by the empirical literature. Most of the relevant empirical research falls within two main types of analysis: either a comparison between the aggregated behavior of employee and outside owned firms across industries; or an assessment of firm dynamics as the character of the industry evolves over time. These two lines of study provide a natural ground to test our results. But in order to fine tune our testable hypotheses we first introduce a simplifying example that explores the possibility of an *efficient* cooperative selling off to outsiders in order to change the distribution of

payoffs. This example will also allow us to predict ownership structure across industries as a function of employees' mobility and technological innovation.

5.1 Example: Labor Mobility and Capital Structure

Consider the following example of the model outlined in Section 4. At date 1, the cooperative chooses between two feasible technologies, the status quo project j and a new technology i. Whereas each employee knows ex-ante his productivity under the status quo, his productivity under the new technology is only revealed ex-post. Project j is characterized by the fraction of high types f_j, their inside productivity x_j, and their outside option w_j. The new technology is characterized by the fraction of low types that will become high types p, the fraction of high types that will remain high types q, and the inside and outside productivity of high types denoted by x_i and w_i respectively. In the present example we simplify this setting by assuming $q = 1$, $x_i = x_j$ and $w_i = w_j = w$.

This simplification allows a natural characterization of an industry according to the firm specificity of employees' productivity measured by $(x - w)$. Also it simplifies the set of new technologies as they can be defined by the parameter p.

There are two main implications to be drawn from this example. First, the productivity of each employee is weakly higher under a new technology. In other words, project i Pareto dominates the status quo. Second, by A4, low types are in the majority under the status quo. Therefore, they will be decisive in the vote on technology choice under employee ownership as well as in the vote on constitutional change. Applying the results from Section 4 we also know that uncertainty is detrimental for efficiency. The question to be addressed is whether a cooperative is more or less likely to be efficient the higher the mobility of its employees. To answer this question we first consider a given industry and analyze the performance of the cooperative in relation to the efficiency of the new technology. Then we restrict all technologies to be equally likely and study the likelihood of efficient behavior across industries.

A priori, a technology characterized by a higher value of p is more attractive to low types and the reason is twofold: a high p increases the expected productivity of a low type. Also it rises the efficiency of the cooperative that can be in principle internalized via redistribution. Yet the anticipation of a change in the balance of power following the adoption of a new technology generates a *non-monotonic* relation between the efficient behavior of the cooperative and the efficiency of the new technology. More specifically, a cooperative is Pareto inefficient for intermediate values of efficiency. That is, when $\underline{p} \leq p < \overline{p}$.[13] For low values of p, the balance of power between low and high types under the new technology remains unchanged. All employees will then favor the efficient option. For higher values of p, the balance of power between low and high types under

[13]Where $\underline{p} = \frac{1-2f_j}{(1-f_j)}$ *and* $\overline{p} = \frac{f_j}{1-f_j}\frac{x-w}{x}$.

the new technology is reversed. Yet as the probability of a low type becoming high increases, the efficiency effect dominates the political effect and the new technology will be implemented by the cooperative even under unanimity rule.

Now, how does the behavior of the cooperative relates to the characterization of the industry? Note that $\underline{p}$ is a critical value that determines the swing in the redistribution policy in the cooperative and is thus independent of lock-in effects. On the other hand, $\overline{p}$ is an upper bound that trades off the increase in low types' expected productivity against their expected loss in subsidy from current redistribution. We can conclude that if all new technologies are equally likely, the efficient behavior of a cooperative increases with the mobility of its employees. This is precisely the empirical observation presented in (d).

In order to address the fact stated in (e) we will proceed as follows. First, we will consider a particular industry characterized by a measure of lock-in effects given by $(x - w)$. We will then determine the set of technologies for which the cooperative will behave efficiently. And likewise, the set of technologies for which the cooperative will select an inefficient technology. For each of these two cases, we will determine whether constitutional change will take place. Finally, assuming that all technologies are equally likely we will look at the reversion of ownership from efficient cooperatives to investors across industries.

In an industry defined by $(x - w)$, consider a new technology characterized by p, where p satisfies $\underline{p} \leq p < \overline{p}$. Employee ownership is inefficient. Yet low types may vote to sell off the firm to outsiders provided their expected payoff under outside ownership is higher than under cooperative form. This will be the case as long as $\widehat{p} \leq p$[14] The value of $\widehat{p}$ denotes the ratio between the difference in redistribution accrued by the pivotal type under the status quo (where receipts are divided only among low types) with respect to the per capita dividend obtained upon sale, together with the increased benefit of a pivotal type under project i as he may not only become a high type but also receive greater dividends from higher efficiency.

Next we determine the set of technologies that will drive a change in the initial constitution of the firm even if employee ownership is efficient. There are two cases to analyze:

First, consider a new technology i, such that $p < \underline{p}$. Remember that the cooperative is efficient and that there is positive redistribution under project i. It can be easily

[14] A low type will vote in favor of constitutional change as long as $pw + f_i(x - w) > \dfrac{f_j}{1 - f_j}(x - w)$. Substituting for the value of f_i and rearranging, it is easy to see that this is equivalent to $p > \widehat{p} = \dfrac{\dfrac{(f_j)^2}{1 - f_j}(x - w)}{f_j w + (1 - f_j)\, x}$.

shown that a majority of employees will vote for employee ownership.[15]

Second, assume a new technology i such that $p > \overline{p}$. Now the cooperative will choose project i at date 1 but there will be no redistribution at date 2. By comparing the payoffs of low types under employee and outside ownership it can be shown that low types will always sell off to outsiders.[16]

Finally, we analyze the interaction between ownership and skills' firm specificity. Consider the definition of $\underline{p}$, $\overline{p}$ and $\widehat{p}$ as a function of w, where $0 < w < x$. The value of $\underline{p}$ is constant for all values of w. Yet $\overline{p}$ is a decreasing linear function of w. More intricate turns out to be the function $\widehat{p}$. However we can still calculate the sign of the partial derivatives with respect to w, namely $\dfrac{\delta \widehat{p}}{\delta w} < 0$, and $\dfrac{\delta^2 \widehat{p}}{\delta w} > 0$.[17]

Interestingly, and showing a *reversed causality* with respect to most of the literature on the theory of the firm, the specificity of high types' skills which is assumed to be determined by industrial factors, plays a crucial role on a firm's efficiency through its effect on technology choice.

We can extract three main empirical predictions. First, conditional on an efficient cooperative reverting ownership to outsiders, it is more likely that lock-in effects are lower. Second, inefficient cooperatives that perpetuate their ownership structure are more likely to be observed in industries characterized by higher lock-in effects. Constitutional change is less likely to restore efficiency for lower values of w, for which the date 2 decisive role of the date 1 pivotal type is more valuable. Finally, employee ownership is more likely bo be observed in industries characterized by greater lock-in effects. To our knowledge, this last prediction has not been explored in the empirical literature.

[15] In effect, low types will vote in favor of outside ownership as long as

$$pw + f_i(x - w) > pw + (1 - p)\frac{f_i}{1 - f_i}(x - w)$$

Replacing the value of f_i in terms of p, this inequality would only hold if $p > p + f_j(1 - p)$. As $p < 1$, this is a contradiction and hence, cooperative form will remain.

[16] Current low types under the status quo will only sell off the firm to outsiders provided

$$pw + f_i(x - w) > px$$

Again, replacing the value of f_i and rearranging, this inequality is equivalent to $p < p + f_j(1 - p)$, which is always true.

[17] In particular: $\dfrac{\delta \widehat{p}}{\delta w} = \dfrac{-\dfrac{(f_j)^2}{1 - f_j}x}{[f_j w + (1 - f_j)x]^2} < 0$, and $\dfrac{\delta^2 \widehat{p}}{\delta w} = \dfrac{2\dfrac{(f_j)^2}{1 - f_j}x}{[f_j w + (1 - f_j)x]^3} > 0$.

5.2 How does the model fit the facts?

Although there exists an extensive empirical literature on cooperatives, most of the comparative results are ambiguous or fail to generate robust evidence on the tested hypotheses. Yet we can still find some empirical regularities that hold in most of the case studies analyzed in the literature as summarized by Bonin, Jones and Putterman (1993) and Hansmann (1996).

(a) Cooperatives present lower wage dispersion and higher productivity compression than outside-owned firms.

There is persistent evidence showing that the wage structure in cooperatives is less dispersed than the differences in productivity across employees. Also, employee-owned firms present less differential wage structures than similar investor-owned firms. For instance, in plywood cooperatives, nearly all employees adhere to a scheme under which all members receive the same rate of pay regardless of their task and seniority. Most law firms share the partnership's earnings equally among partners regardless of their individual productivity even if this is easily measurable. In France, 25 per cent of the surplus is distributed to workers as a bonus payment in all cooperatives. A case in point is the well known Mondragon cooperatives where 30 per cent of an employee's salary is transferred to a collective account.

Further, employee-owners tend to do similar work; rarely they have substantially different types of skill and productivity. In US plywood cooperatives semi-skilled employees commonly rotate over time through various jobs. In other words, not only pay but also productivity is more equalized among employees in cooperatives rather than in outside-owned firms. Even if these decisions engender inflexible technology choice and lack of diversification.

Our model accounts for this fact in Proposition 1. Following a particular technology, a cooperative will favor redistribution as long as low productivity types are in the majority. Redistribution under employee ownership narrows the gap in payoffs between employees by comparison with outside-owned firms. Moreover, proposition 1 shows that cooperatives are relatively more biased towards technologies generating more high types with lower individual productivity than investor-owned firms. This result predicts that the productivity among employees is bound to be less dispersed in employee controlled firms, as argued in the empirical literature.

(b) Cooperatives are more inefficient in the presence of uncertainty.

Employee ownership seems to be more common in industries where there is more available information on employees' individual productivity, such as the case of service professions. If we believe that a cooperative is more likely to survive the higher its efficiency, it follows that cooperatives are more efficient in the presence of more precise information on productivity.

Also, in volatile sectors like plywood cooperatives, although membership is marketable, there is evidence of underinvestment in comparison with plywood investor-owned firms, even when financial markets are available. Moreover, these cooperatives have significantly higher capacity utilization.

Finally, Holmstrom (1999) argues that employee dominated firms seem to be less successful in shifting resources to new technologies than shareholders dominated firms in economic environments characterized by higher volatility.

By combining Propositions 3 and 5, our model takes account of this fact by predicting than uncertainty, while increasing the likelihood of inefficient performance in cooperatives, does not affect the behavior of outside-owned firms.

(c) Cooperatives are more likely to change their ownership structure in volatile industries.

When the character of the industry has changed, there is evidence of an increased reversion of ownership from employees to outside investors. The best known examples of constitutional change of cooperatives are documented in the advertising industry and in the investment banking sector. In effect, advertising firms began converting from partnership to investor ownership in the early 1960's. Similarly, investment banking started to abandon the partnership form in the 1970's. Although one obvious reason is the need to attract more capital, this reversion process seems to be correlated with the increase in the complexity of new technologies and greater internal departmentalization, which renders expected productivity under feasible technologies more uncertain.

This empirical observation is accounted form by Propositions 2 and 4 of our model, which predict that a cooperative is more likely to sell off to outsiders in the face of individual uncertainty over employees' productivity.

Finally, there are two empirical regularities concerning both the efficiency of a cooperative and the dynamics of its ownership structure in relation with the mobility of its employees. Such cooperatives typically belong to industries characterized by technological uncertainty.

(d) Under uncertainty, cooperatives are more likely to be inefficient when employees are subject to higher lock-in effects.

In large industrial firms, where employees become more specialized, firms are rarely employee-owned. Conversely, employees are unusually mobile in employee-owned firms that belong to the transportation sector, plywood industries and small service professionals. This anecdotal evidence seems to square with the predictions of our model pointing out at the persistence of cooperatives in industries characterized by higher lock-in effects where the date 2 decisive role of date 1 pivotal type becomes more valuable.

(e) Under uncertainty, efficient cooperatives selling off to outside investors are more likely to belong to industries with lower lock-in effects.

This is the case in the most prominent example of cooperatives in the U.S. which belong to the plywood industry as well as in some service professions like advertising agencies. Yet efficient cooperatives belonging to less mobile industries such are large law firms have followed an up-or-out system whereby an employee must leave the firm if she has not been made a partner in a specific time horizon. This rule implies that all except more junior lawyers are owners, hence preventing the tendency to substitute employee owners with hired labor prevailing in other industries. This evidence is confirmed by our model that proves that conditional on an efficient cooperative reverting ownership to outsiders, it is more likely that lock-in effects are lower.

6 Discussion and Related Literature

The above analysis has been placed in an economic environment characterized by the uncertainty of technology choice. But how can we justify the existence of uncertainty in a firm? And, could uncertainty also distort investment decisions in an outside-owned firm with heterogenous investors? In what follows, we first motivate the introduction of uncertainty into the model. Next we propose some policies that may circumvent this inefficiency. Also we suggest some testable implications that may lead to future empirical work.

6.1 Motivation of Uncertainty

We could think of an increase in the size of the firm or the complexity of its operations as two main factors leading to uncertainty regarding the effect that the project undertaken by the firm will have on an employee's final payoff. We can illustrate this argument with the following examples. First consider an increase in the *size*[18] of the cooperative. We can view size as the replication of productivity across the population of employees. As now there are several employees belonging to the same categories, there may be some reorganization ex-post by which some of these employees will be transferred to job assignments dealing with the new project whereas some other employees will remain performing the same task. This would introduce individual uncertainty at the project voting stage regarding the final productivity of each employee. Alternatively, consider a cooperative in which redistribution is determined by a majority of winning coalitions. An increase in the size of the firm would raise the number of potential coalitions that may form at the redistribution stage, thereby introducing an element of uncertainty in the employees' final payoff. Next, consider an increase in the *complexity* of the operations

[18] A different effect of size on efficiency is given by Farrell and Scotchmer (1988) where cooperatives are characterized by partnerships with equal-sharing rules. Cooperatives will be smaller than their optimal size so as not to redistribute to lower productivity employees. However as the number of employees belonging to the same category increases the inefficiency generated by suboptimal size vanishes as cooperatives can achieve more homogeneous populations of employees.

undertaken by the firm. Following the adoption of a new project, a certain number of employees (movers) will increase their individual productivity. But these employees may be uncertain ex-ante about their own ability to increase their productivity after implementation. If all movers are equally productive under the status quo project, they will share the same beliefs about their own capabilities under the new technology; hence the probability of success for each mover will be the same. Ex-post however, a reduced number of movers will increase their productivity (say, the employees suffering lower individual costs to switching to the new project), whereas the remaining movers will continue being low productivity employees.

In addition, this paper can throw some light on the source of potential inefficiencies arising from the existence of heterogenous investors in an outside-owned firm. Heterogeneity among shareholders may be introduced when a firm issues '*targeted stock*'. This means that the payoff of each shareholder is tied to the earnings of a particular project. This may in turn create conflicts of interest among investors over the firm's productive decisions. Suppose that, following the implementation of a project, cash-flows could be transferred across different lines of businesses. This would entail ex-ante uncertainty regarding the final benefit accrued by each shareholder. As a result, shareholders may be reluctant to undertake a dominant project when it facilitates the diversion of income to other activities of the firm (due for instance to unobservable or unverifiable earnings). As a consequence, technologically dominated outcomes might also arise. This may help to explain the scarce existence of this type of stock among investor-owned firms (Hansmann, 1996).

6.2 Governance Provisions

Regarding potential mechanisms that may circumvent these inefficiencies, the first question we could ask is whether the uncertainty at the voting stage could be eliminated by designing an adequate insurance scheme after the new project has been revealed but before the vote on technology choice takes place. Employees whose current payoff may be jeopardized by the adoption of a new technology would be willing to pay a premium upfront that guarantees the payment of a subsidy in the event of a bad realization. However, this scheme boils down to a system of transfers by which high types compensate the resulting low types. Yet, the limitation imposed by lack of credibility and asymmetric information will render this scheme unfeasible.

We can devise two main governance provisions to solve the inefficiency that arises due to the failure of the cooperative in selecting a dominant technology. One solution is to constrain the domain of projects subject to decision making so as to decrease heterogeneity across employees and thus diminish the degree of conflict. Alternatively, the redistributive policy could be restricted in the constitution of the cooperative. Therefore, employees would not try to manipulate the investment decision so as to favor their preferred redistribution scheme. This seems to confirm empirical evidence. Barzel and

Sass (1990) show that projects whose total net value is positive but opinions are likely to be divided, will be excluded from the domain of voting by the developers of condominiums. Likewise Benham and Keefer (1991) state that the constitution of Mondragon cooperatives limits direct voting on controversial issues such as maximum dispersion in wages.

Another possibility is to change the allocation of control rights across employees. Since a superior technology is forgone whenever low productivity employees fear a low redistribution policy following investment, the allocation of more voting rights to high types would mitigate this underinvestment problem. If high types were identified with more senior employees who have accumulated more firm-specific skills to the firm over time, thus increasing their productivity, this ownership structure could then contribute to explain partnerships.

Finally, even under the assumption of a one-member-one-vote cooperative, the voting rule that governs ownership reversion proves to be relevant for efficiency. If we consider a general cooperative in which the productivity of employees varies within a continuous interval, employees with lower productivity will be more entrenched to power. This would implies that more inclusive voting rules would increase the likelihood of survival of inefficient constitutions. Davis (2001) argues that the one-member-one-vote governance rule in cooperatives contributes to the survival of the institution in cooperative form. Here we argue that it is not only the assignment of votes but also the voting rule that is crucial for the survival of cooperatives.

Employee-owned enterprises should be mostly encouraged in sectors characterized by homogenous employees and stable technological environments. In contrast, in volatile technological industries outside ownership should be actively promoted. The design of an appropriate standard statutory form and a complementary income tax schedule for corporate benefits are two potential instruments that may favor the development of the desired ownership structure.

6.3 Related Literature

Our analysis on the political determination of institutional reform relates to various streams of literature. Our approach is consistent with the modern theory of the political economy of corporate control. For instance, Perotti and von Thadden (2006) show how corporate governance in a democracy is determined by the preferences of the median voter according to his financial wealth relative to his human capital. Below a critical threshold, he will favor a banking governance structure whereby the implementation of safer projects is more likely to protect labor rents at the expense of financial returns. Conversely, if the median voter is wealthy enough, he will support equity dominance so as to encourage the adoption of risky projects that will allow him to capture the upward potential of financial returns. In addition to focus on the political determinants of corporate governance, our paper also explores the dynamics of corporate ownership as the endowments of human capital evolve with technological change. Separately, the traditional literature on corporate ownership has mainly focused on incentive problems faced by employees from their restricted access to capital markets.[19] According to this theory, capital intensive firms should be dominated by outside investors which does not seem to square with the stylized facts.[20] Instead we take the view of Barzel and Sass (1990) and Bonin, Jones and Putterman (1993) who show that conflicts in internal decision making may induce majorities to capture wealth from minorities thus rendering collective governance inefficient. Here we explain how the decisive role of the pivotal voter in setting redistribution ex-post may lead to an extreme form of inefficiency whereby reversal of ownership is blocked by the winning coalition.

Our paper also relates to the literature on incomplete contracts insofar as asset ownership confers control rights in implementing corporate strategy. However, in contrast with our approach, the incomplete contract literature has mainly emphasized the relative distortions on individual investment emerging under alternative ownership structures. Kremer (1999) and Bolton and Xu (2001) focus on the trade-off between private underinvestment under cooperatives (free riding) versus the dwindling incentives to invest in firm-specific skills under outside ownership (hold-up problem). Likewise, Roberts and Van den Steen (2001) emphasize distortions in individual investment as the main determinant in the composition of corporate control boards. More in line with our paper, Hart and Moore (1998) highlight the role of ownership in the ex-post efficiency of the firm. Whereas conflicts in decision making among heterogenous individuals may lead to distortions in investment under cooperative form, inefficiencies under outside ownership are likely to emerge with investors targeting the marginal consumer instead of the mean

[19]Borrowing may be unfeasible or excessively costly due to the high interest rate required as a way to compensate for the potential opportunistic behavior on the part of the employees with full control rights over the decisions of the firm.

[20]For instance, investment banking (with high capital requirements) has been dominated until very recently by employee ownership, whereas restaurants are typically investor owned (Hansmann, 1996).

consumer. However, they do not allow for endogenous transfers which in the context of our model become the source of vested interests lying at the heart of inefficient collective choice. Separately, Alboeck and Schultz (1997), Barzel and Sass (1990) and Aghion and Bolton (2003) deal with the optimal allocation of votes and/or the voting rule which is conducive to minimizing the costs of decision making. In contrast with these papers, we model inefficiencies as being driven by dynamic voting and show their persistence, despite the feasibility of constitutional change.

This paper is in line with the dynamic voting literature whereby the anticipation of future voting decisions leads the current median voter to neglect the implementation of an efficient policy. Besley and Coate (1998) and Roberts (1999) show how the median voter's decision, although suboptimal conditional on his current period's preferences, may be optimal once the constraints generated by the democratic process and the transition rule for future states are factored in. While the first paper is applied to the inefficiencies arising in a representative democracy where the efficient investment project may change the future preferences of the policy maker in a way that hurts the current majority, the second paper addresses the dynamics of clubs where today's decision on club size pins down the identity of the future median voter whose preferences may be at odds with the interests of the current median voter.

Our analysis is closely related to the literature on institutions and growth. Acemoglou and Johnson (2005) unbundle the significance of property rights protection against expropriation in facilitating higher income per capita beyond the effects spurred by the strengthening of private contracting. The potential for expropriation is proxied by the exogenous constraints imposed on the executive. Our paper however endogenizes the scope for expropriation arising from the distribution of political power between the elite and the remaining employees. Also we allow for the possibility of power reversal that may arise in equilibrium as long as the benefits from innovation compensate for the loss of political power. This insight is in line with the hypothesis put forward by Rajan and Zingales (2003) on the role of incumbent interests in retarding financial development. Although incumbent financiers may try to prevent entry in the financial sector, a sudden openness to trade flows and cross-border capital flows may tilt the domestic balance of power by bringing new entrepreneurs and foreign investors, thus inciting the elite to press for financial development in the wake of enhanced competition. Whereas this paper defines vested interests as the monopoly rents extracted by industrial and financial incumbents, we endogenize vested interests as arising from the exercise of political power which in turn is contingent on technology choice. In line with their prediction of a causality link between openness to trade/capital and financial innovation, our paper also predicts that employees' mobility may induce incumbents to relinquish control rights -as the expropriation effect dwindles-, thus strengthening the role for outside financiers. The extension of our model to technological uncertainty is related to the literature on reform, e.g. Fernandez and Rodrik (1991), and Krusell and Rios-Rull (1996). Although

these papers analyze how majority voting may lead citizens to disregard an efficient reform in order to keep the benefits generated by the status quo, they do not consider Pareto dominant projects nor do they allow ex-post transfers to compensate losers from reform[21]. That is why in our model, in contrast with theirs, we can show the existence of a status quo bias within a static setting.

Our paper can also be regarded as an illustration of the efficiency distortions explored in new field of comparative economics. Djankov, Glaeser, La Porta, Lopez-de-Silanes and Shleifer (2003) highlight the conflict between controlling disorder under democracy and restraining expropriation under dictatorship as the key issue drawing institutional design. Also it ponders whether the best political system for economic reform is necessarily democracy when a radical change is required.[22] Drawing a parallel between democracy and employee ownership on the one hand, and dictatorship and outside ownership on the other hand, their predictions fall in line with our results. Acemoglu (2003) argues that in a world of limited commitment a ruler may favor distortionary taxation as a means to contain private investment. Underinvestment may reduce the scope for expropriation thus giving incentives to citizens to engage in the superior market production (taxable) instead of in the inferior non-market technology (non-taxable). In our paper we also allow for the identity of the ruler to change as an endogenous corporate strategy.

[21]There are two crucial differences between Fernandez and Rodrik (1991) and our paper. In their analysis, inefficiencies only arise because citizens should pay a cost up front, in order to enjoy the benefits of reform. Otherwise, a reform would always be undertaken. Moreover, they do not allow for ex-post transfers among citizens to align interests towards reform. By contrast, in our model, there is no cost to be paid under a new technology. And it is precisely the existence of ex-post transfers among employees, via redistribution, which causes big inefficiencies to arise. In other words, it is this interaction between uncertainty and redistribution through dynamic voting, that creates Pareto dominated outcomes.

[22]This paper argues that whereas an activity among participants with similar resources and with little technological change can achieve order with little dictatorship, an activity involving players with massive inequalities of power is vulnerable to more disorder for a given level of policy, thus confirming our predictions.

7 Concluding Remarks

This paper explores the efficiency of alternative institutions, i.e. employee ownership and investor ownership with regard to economic reform, drawing a special emphasis on the politics of institutional choice as a key factor underlying inefficient behavior. More specifically, the analysis is performed within a framework of incomplete contracts, where decisions are undertaken by the firm's owners. Once a technology is implemented, the firm's owners also decide how to distribute aggregate surplus. Employees are heterogeneous and collective decision making is governed by majority voting.

The main contributions of this paper are threefold. First, it shows a systematic bias in the efficiency of alternative institutions contingent on the environment faced by the firm. This environment is defined in terms of two variables: the feasible set of technologies and, the degree of specificity of employees' human capital. In particular, outside-owned firms are shown to be relatively more biased towards polarized reforms than cooperatives. By contrast, cooperatives prove to be relatively more biased towards egalitarian reforms than outside-owned firms.[23] Provided the current institution turns out to be inefficient, a cooperative may in principle decide to transfer ownership to an efficient outsider. Yet the feasibility of constitutional change will not serve to restore efficiency. And this proves to be true irrespective of the extent of inefficient behavior. This outcome impinges upon the vested interests enjoyed by the winning coalition at the selling stage driven by their decisive power to set both technology and redistribution under the current constitution. And this result goes through for any bargaining power of employees vis-a-vis outsiders. This result may help to explain '*institutional inertia*'.

Second, this paper shows that in a volatile environment, uncertainty of reform may constitute a new source of inefficiency in cooperatives. Despite the assumption of employees' risk neutrality, low type employees exhibit *'political risk aversion'*. This means that they may favor a dominated technology whenever their decisive role in future voting outcomes might be jeopardized under a dominant technology. However, constitutional change may now take place provided inefficiencies are sufficiently large. Selling off the firm to outsiders can thus be regarded as a '*political insurance policy*' that compensates employees for their potential loss in power under the new technology.

Also, the likelihood of constitutional change increases with the mobility of employees across firms. The reason being that the extent of vested interests generated by political power becomes insignificant as the scope for employees' expropriation decreases. This prediction seems to corroborate the empirical anecdote provided by the current literature on the ownership of the firm and leads to the third result of the paper. The degree of specificity of employees' human capital influences the ownership structure of the firm, through its effect on constitutional change.

[23]This may reinforce the wage compression effect caused by redistribution in cooperatives which is acknowledged by the empirical literature.

There are at least two directions in which further research can be directed. First, the initial constitution of the firm and the voting rule under employee ownership could be endogenized. A possible way to proceed in this direction would be through the introduction of a probabilistic distribution characterizing the arrival of new technologies. Second, the model can be applied into the new field of comparative economics. Such an application would enable to assess the relative efficiency of alternative political institutions as well as to endogenize individuals' bargaining power from the adoption of reform.

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