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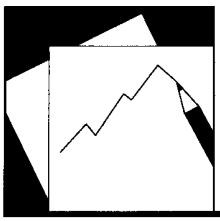

IMF Working Paper

Political Risk Aversion

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Political Risk Aversion

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Abstract

This paper studies the effect of individual uncertainty on collective decision-making to implement innovation. We show how individual uncertainty creates a bias for the status quo even under irreversible voting decisions, in contrast with Fernandez and Rodrik (1991). Blocking innovation is rooted in the aversion to the potential loss of political clout in future voting decisions. Thus, risk neutral individuals exhibit what we call political risk aversion. Yet individual uncertainty is not all bad news as it may open the door to institutional reform. We endogenize institutional reform and show a non-monotonic relationship between institutional efficiency and the size of innovation.

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I. Introduction

Technological innovation lies at the heart of discussions on how to increase growth and secure employment in a globalized economy.[2] Our concern in this paper is why firm owners may forego the implementation of a new, more efficient technology. To address this question, we consider a firm with heterogeneous employees where decisions are taken by majority rule. We take the view that technology defines not only employees' individual productivity but also their preference for redistribution. To examine the interaction between technology choice and redistribution we consider the following set up. A firm takes two decisions in turn: which technology to implement and how to divide aggregate surplus. There are two feasible technologies: a status quo technology and a new technology. Under the status quo technology, each employee privately knows his individual productivity. Under the new technology, he only knows his productivity distribution. In other words, innovation introduces individual uncertainty. We address two questions. First, does uncertainty affect technology choice under risk neutrality? Second, does uncertainty encourage institutional reform as a mechanism to foster innovation?

Our first result shows that uncertainty inhibits technological progress. The reason is that the pivotal voter under the status quo fears to lose its political clout under innovation. As a result, the new technology is voted down. We show that uncertainty introduces a systematic bias towards the status quo technology even if employees' individual productivity is weakly higher under the new technology and compensating transfers are allowed. We extend our model to aggregate uncertainty and show that this is not detrimental to efficiency. Only individual uncertainty hinders innovation by changing the future balance of power in the organization. This result echoes suggestions made by economic historians that political uncertainty is an important factor explaining technological stagnation. For example Mokyr (1990) argues that uncertainty about who would be in the majority group post-innovation precluded the systematic adoption of more efficient technologies in China from the 14th century to the end of the 19th century.[3] Our second result shows that uncertainty is not all bad news. It may encourage institutional reform and thus favor innovation ex-post. The pivotal voter may prefer to relinquish its political leverage under the current organizational form in exchange for an up-front compensation. The fact that employees may favor a lower ex-ante compensation following institutional change rather than a possibly higher ex-post payoff under the initial constitution is an instance of what we call *political risk aversion*. This result may help shed some light in explaining why technological innovation and institutional reform often come together.[4] Returning to the example of China, the Ninth Five-Year Plan[5] designed by China's State Development Planning Commission that placed

[2] A prominent example is provided by the renewed Lisbon strategy conceived by European Member States as the European response to globalization. The strategy report for 2008-2010 places innovation as a priority area through the establishment of the European Institute for Innovation and Technology expected to become operational in 2009. Under the new cohesion programmes, more than €85bn will be made available for investment in knowledge and innovation (Commission to the Spring European Council, 2006).

[3] Mokyr (1990) portrays the failure of China to sustain the technological supremacy it had reached in the centuries prior to 1400 as one of the greatest enigmas in the history of technology. China was a world technological leader under the Sung dynasty in 960-1179. The Chinese leadership ended when the state lost interest in promoting technological change under the Ming and Qing dynasties which reigned between 1368 and 1912. During the Sung dynasty technology adoption was regarded as preserving social and political control. After 1400 the Chinese government regarded technological innovation as a threat to the balance of power in society and thus as conducive to social unrest. As a result, the government ceased to foster innovation.

[4] An example is provided by Kim and Park (2004) who argue in favor of Korean corporate reform as a mechanism to move towards an innovation-driven economy.

[5] According to the figures on China's technological development in the Ninth Five-Year Plan period (1996-2000), a

technological innovation at the fore of the country's economic development was accompanied by a major privatization program of state owned enterprises over 1996-2000.[6]

The basic model is laid out in Section 2. The analysis is cast in an incomplete contracts framework under which asset ownership confers control rights to implement future decisions in the firm.[7] We assume that the initial governance structure allocates control rights to employees.[8] A well known result from the incomplete contracts literature is that an institution may turn out to be inefficient in the presence of private information. However there is no general result pointing at a systematic bias away from efficiency. At a more macro level, Fernandez and Rodrik (1991, henceforth FR), argue in an influential paper that a status quo bias against reform arises in the presence of individual uncertainty. However, this bias arises only if voters get to vote twice and can reverse with a second vote inefficient reforms adopted with a first vote once the uncertainty is resolved. Otherwise, when reforms are irreversible, the bias can go either way. By contrast with their result, we show the existence of a status quo bias even in the presence of irreversible technology choice. This result is in line with Ciccone (2004) who revisits FR's analysis and proposes an alternative model of irreversible reforms showing that if an efficient reform is not implemented under certainty, it will not be implemented under uncertainty either. We go a step further and show that an efficient technology that was implemented under certainty may no longer be implemented under uncertainty thus pointing at a systematic bias away from efficiency. The intuition for our result is the following. On the one hand, the existing majority under the status quo enjoys a subsidy from its power to set future redistribution. Driven by its fear to lose its political clout, the existing majority blocks innovation. On the other hand, employees benefiting from productivity gains under the new technology fail to form a winning coalition in favor of innovation. As individual uncertainty prevents them from learning ex-ante their individual productivity, they are unable to anticipate their political leverage ex-post. As a result, the new technology is voted down.[9]

In Section 3, we turn to institutional change. Prior to endogenizing firm ownership, we examine technology choice under outside ownership. Then we examine whether employees may sell off the firm to outside investors once the new technology becomes available but before any decision regarding implementation is made. The question we address is whether ownership evolves efficiently as a mechanism to enact innovation. The answer is positive provided the size of innovation is sufficiently large. The ability of institutional reform to enhance innovation draws on the existence of individual uncertainty. This result contrasts with Valderrama (2008) where institutional inertia is the only equilibrium under technological certainty.[10] However, if the gains from innovation are not too high, institutional reform will be stalled and the status quo will

total of 193 billion yuan was invested in the "Spark Plan" aiming to improve the technological level in rural areas, 23 billion yuan was injected in technical innovation for the industrial sector and state-owned enterprises, and 102 billion yuan in infrastructure in high-tech development districts following the example of Sillicon Valley (China Internet Information Center: http://www.china.org.cn).

[6] China alone accounted for 87.5 US$ billion of privatization proceeds in 2000-2006.

[7] The idea that decisions cannot be contracted upon in advance and that the owner of the firm's assets has the right to decide how they are used first appeared in Grossman and Hart (1986).

[8] Throughout the paper we shall use both terms cooperative and partnership interchangeably.

[9] By contrast to FR, we allow ex-post transfers among winners and losers following reform. In our model, it is the endogeneity of the redistributive decision rather than the sunk cost needed to adopt the reform as in FR, that generates inefficient technology choice.

[10] Institutional inertia refers to the failure of an inefficient organizational form to evolve into an efficient organization. This is due to the power of vested interests generated under the status. Vested interests are perpetuated under the existence of asymmetric information on the distribution of productivity gains amongst firm owners.

prevail. In such context, we characterize the technological environment under which outside-owned firms systematically outperform employee-owned firms.

In Section 4, we examine the relationship between institutional efficiency and the size of technological improvement, noting that employees may sell off the firm to outsiders not only to enforce efficient technology choice but also to affect the future allocation of surplus. To address this issue we parameterize the technology space according to the size of technological improvement and the degree of skills' firm specificity. We show that institutional reform serves as a mechanism to restore efficient technology choice for intermediate values of technological improvement. We also find that employee-owned firms are more likely to sell off to outside investors in the face of lower industry-specific human capital. Labor mobility, by reducing the size of vested interests enjoyed by the majority group, encourages institutional change for a larger set of new technologies.[11] While the question of how firm ownership affects technology adoption has been studied at length in the property rights literature, the reverse causality, i.e. how technology influences ownership, has received far less attention.[12] Section 5 provides some empirical support to our predictions and discusses the foundations of individual technological uncertainty. Section 6 reviews the related literature and Section 7 concludes.

II. Basic Model

A. Economic Environment

Our analysis incorporates individual-specific uncertainty from technological innovation into the model developed in Valderrama (2008). Consider a firm defined by the assets required to implement technology o (the "old" technology), a set of I heterogeneous employees, where I is an odd number, and a constitution governing future decision making. At date 0 technology n (the "new" technology), becomes available. The cost to switch to this new technology is normalized to zero. The firm decides at date 1 which technology to implement. Once the technology has been implemented, the firm determines at date 2 how to distribute aggregate surplus among the firm's owners and employees. 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. In the text, we shall refer interchangeably to technology and project, as well as to sharing rule and redistribution schedule.

The characterization of employees is as follows. Under project o, employees can either be low productivity types, with productivity normalized to zero, or high productivity types with productivity $x_o > 0$. Under project n, low types still accrue zero productivity whereas high types accrue productivity $x_n > 0$. We do not impose any ordering of employees across projects in terms of their individual productivity; that is, a low type under project n might be a high type under project o and vice versa. Whereas each employee privately knows his productivity under the status quo, he is uncertain about his productivity under the new technology. A low type under the status quo can become productive under the new technology with probability p. Likewise, a

[11] A case in point is provided by Goldman Sachs' initial public offering in 1999, when after more than 100 years under cooperative form, partners decided to sell off part of the company to outside investors.

[12] To abstract away from the financing constraints of innovation we assume that the new technology can be adopted at no cost.

high type under the status quo is also a high type under the new technology with probability q. Denote by f_o and f_n the fraction of high types under projects o and n respectively. The values of x_o, x_n, f_o, p and q are all public knowledge. After the project is implemented at date 1, the productivity of each employee is publicly revealed at date 2. Hence redistribution at date 2 takes place under symmetric information. The fraction of high types under the new technology equals:

$$f_n = (1 - f_o)\, p + f_o q \tag{1}$$

We assume the existence of a spot market at date 2 offering a reservation wage to employees. As low types are unproductive inside the firm, we assume that their outside wage is zero. By contrast, once the technology has been implemented, high types develop skills that are only partially firm specific. Because their inside productivity is contingent on technology, we allow their outside wage to depend on technology choice as well, thus we use the notation w_o and w_n. We assume that for each project, the outside wage is strictly higher than zero, but strictly lower than high types' inside productivity, that is, $0 < w_o < x_o$ and $0 < w_n < x_n$. As low types' productivity is zero, their human capital can not be expropriated. High types cannot be pushed below their outside wage.[13] The outside market puts a limit on expropriation according to the following assumption:

(A1) $w_o > f_o x_o$ *and* $x_o \geq w_n$

–*and similarly, with the subscripts* n *and* o *reversed in the symmetric case.*

Note that a sufficient condition for the last part of A1 is to restrict the outside wage to be the same across projects, namely $w_o = w_n = w$.

Next, we characterize the set of technologies$\{o, n\}$. Notice that a technology is characterized not only by its measure of efficiency but also by the fraction and productivity of its high type employees. As these two variables pin down the nature the extent of redistribution at date 2, they are crucial for technology choice at date 1. Since we want to explore the interplay between efficiency and uncertainty we assume that technology n, the project about which there is productive uncertainty, is efficient, that is: $f_n x_n > f_o x_o$.

Concerning the distribution of individual productivity, project o is defined as a *dominated* technology when it delivers fewer high types and when they have lower productivity than under project n, that is, $f_o < f_n$ and $x_o < x_n$. Alternatively, project o is characterized as a *polarized* technology, when it generates fewer high types but each of which has greater productivity in comparison with project n, that is, $f_o < f_n$ but $x_o > x_n$. Finally, project o is described as an *egalitarian* technology, when it delivers a bigger fraction of high types, but each of which has a lower productivity in comparison with project n, namely $f_o > f_n$ and $x_o < x_n$.

We consider two alternative organizational forms: employee ownership (partnership) and outside ownership. In a one-member-one-vote partnership, each employee is assigned one control right;

[13] There is an alternative way to motivate the assumption of partial expropriation. Assume that high types need to exert effort in order to be productive. If effort is costly and non-verifiable, the anticipation of expropriation will lead to low effort. In equilibrium, expropriation, if positive, will be limited so as to induce high types not to shirk.

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. In what follows we first examine technology choice in a partnership. We then endogenize the ownership structure by allowing the partnership members to implement institutional reform.

B. Technology Choice

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

Suppose that project o 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 ($f_o < \frac{1}{2}$), they can expropriate high types and accrue the payoff $\dfrac{f_o\,(x_o - w_o)}{1 - f_o}$, where the numerator shows the individual expropriation suffered by high types multiplied by the fraction of high types, and the denominator shows the fraction of low types in the firm. By (A1) however, a low type's payoff remains lower than a high type's payoff w_o, even after expropriation. The equilibrium redistributive scheme crucially depends on which group of employees is in the majority at date 2. Given that the paper explores how redistribution affects technology choice, we restrict attention to the set of technologies that generate a split balance of power:

(A2) Split balance of power: either $f_o < \frac{1}{2} < f_n$, *or* $f_n < \frac{1}{2} < f_o$.

The voting game at date 1 appears more complex since there are four different types of employees ex-ante $\{ll, lh, hl, hh\}$, where (ll) denotes the group of employees whose productivity is low under both project o and project n, (lh) denotes the group of employees who are low types under project o but high types under project n, and so on. Note however that, uncertainty on future individual productivity under project n, yields *de facto* only two types of employees, say $\{l, h\}$, defined by their productivity type under the status quo. This renders the analysis of voting straightforward: technology choice is simply determined by the larger group at date 1.

As a benchmark, consider the case of technology choice under certainty. Suppose that at date 1 each employee privately knows what his productivity type is under both the old and the new technology. This would render both technologies symmetrical and, more importantly, would enable each employee to anticipate whether he would belong to the majority or minority group at date 2. Contrast this case with that under which employees only know the distribution probability of their productivity under the new technology. Crucially, the vote on technology takes place under the veil of political uncertainty: when an employee casts his vote at date 1 he does not know whether he will be in the majority at date 2. The following proposition shows that uncertainty increases the likelihood of inefficient technology choice by the partnership. As

employees are risk neutral but uncertainty turns out to be detrimental to efficiency, we call the partnership *politically risk averse.*

Proposition 1

Assume that A1 and A2 hold. If the efficient technology is chosen under certainty it may no longer be chosen when it generates individual uncertainty. However, if the inefficient technology is chosen under certainty, it is also chosen under individual 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 need to look at the composition of the majority group under uncertainty vis-a-vis the composition of the winning coalition under certainty. By A2, there are only two cases to consider.

Suppose first that $f_n < \frac{1}{2} < f_o$. Under uncertainty, employees can be ordered according to their productivity under the status quo. Therefore, the majority group wins the vote. But under certainty, we cannot order employees across technologies and therefore the median vote theorem does not apply at date 1. To determine the equilibrium outcome we need to look instead at the formation of coalitions. It turns out that the preferences of type (hl) are pivotal to win the vote. He may favor either the status quo project or the new technology. If he prefers project n, by the first part of A1, (hh) also prefers project n. If he prefers instead project o, by the second part of A1, (hh) favors project o too. Hence the winning coalition at date 1 is always formed by high types under the status quo, irrespective of the existence of uncertainty. From the above discussion it follows that the voting behavior of the partnership is not altered by political uncertainty.

Suppose instead that $f_o < \frac{1}{2} < f_n$. It is straightforward to show that a partnership is always efficient under certainty. Look at the voting preferences of type (lh). Given that project n is efficient and applying A1, (lh) always favors project n. It turns out that (hh) also prefers project n by A1. The winning coalition 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 partnership is politically risk averse we need to 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 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 dominates the productivity effect under the new technology.

Corollary 1 *An efficient partnership under certainty becomes inefficient under uncertainty when*

the subsidy accrued by low types under the status quo is high enough. This happens if:

$$\frac{f_o}{1-f_o}(x_o - w_o) > px_n$$

Since individual uncertainty may generate inefficiencies only when low types are in majority, i.e. $f_o < \frac{1}{2} < f_n$, implies that the uncertainty faced by high types q is irrelevant for efficiency. In effect, the fact that a partnership is efficient under certainty implies that a high type under the status quo always favors the new technology even if he becomes a low type under the efficient project . Given that under uncertainty, there is a positive probability that he remains a high type under the efficient technology, his efficient voting behavior is reinforced by the existence of uncertainty.

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.[14] 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.

C. Aggregate Uncertainty

The existence of uncertainty under the new technology affects an employee's productivity type at date 1 as well as his political stance at date 2. Yet it is important to highlight that uncertainty is only detrimental to efficiency as long as it is of a political nature, that is provided it threatens the power of the date 1 majority group under the status quo. To isolate the effect of political uncertainty, consider an alternative framework where an employee who is decisive at date 1 is also decisive at date 2. In this environment, uncertainty only lies in an employee' productivity. In particular, assume that project o generates a majority of low types, i.e. $f_o < \frac{1}{2}$. This implies that the date 1 majority group is formed by low types under the status quo. Now consider an efficient technology n 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 low types. At date 1, the realized efficiency of technology n 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 at the redistribution stage 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_n (if project n is chosen) and $\frac{f_o}{1-f_o}(x_o - w_o)$ (if project o is chosen). As this is strictly bigger than his payoff from

[14] In effect, suppose that the new technology n 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 $E[U(\cdot)] = (1-p)\frac{f_n}{1-f_n}(x_n - w_n) + px_n$. Likewise denote by $U[E(\cdot)]$ the utility of an employee with expected productivity of px who is always in the majority. Then, $U[E(\cdot)] = px_n + \frac{f_n}{1-f_n}(x_n - w_n)$. 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.

the status quo technology, i.e. $\frac{f_o}{1-f_o}(x_o - w_o)$ for any value of p, he always votes for the new technology. This shows that uncertainty is not detrimental to innovation.

III. Institutional Reform

Proposition 1 has shown that technological uncertainty increases the likelihood of a partnership's inefficient technology choice. The fact that the defining parameters of the new technology are common knowledge implies that employees can anticipate their inefficient behavior before the vote on technology takes place. To circumvent their collective action problem employees may consider changing the firm's initial constitution by selling off the firm to efficient investors once the technology set has been revealed but before they vote on technology. As Williamson remarks (2005, p.2): "Contractual hazards are bad news. But there is also an upside: contractual hazards, like other costs, invite mitigation– which is where the real challenge and analytical import of potential breakdown resides. Upon looking ahead and recognizing that possible breakdowns are in prospect, cost-effective private ordering mechanisms that have the purpose and effect of mitigating contractual hazards will be devised, thereby to better assure that mutual gains from trade are realized." The question that arises is whether such hazard-mitigating mechanisms may take the form of a change in the firm's ownership structure. Provided the answer is positive, the change of ownership, i.e. institutional reform, would act as a commitment device to enact an efficient innovation. We now turn to analyzing this question after characterizing the conditions under which outside ownership is efficient.

A. Outside Ownership

Consider the behavior of an outside-owned firm. Investors are homogeneous and seek to maximize profits, where profits are defined by the expropriation of employees' productivity. There are two types of stakeholders 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 $If_o(x_o - w_o)$ and $If_n(x_n - w_n)$ under project o and n respectively. Both low and high types will receive their outside options, namely 0 for low types and w_o, w_n for high types under project o and n respectively.

Does an outside-owned firm always choose the efficient project n? Notice that, project n is chosen if and only if $f_n(x_n - w_n) > f_o(x_o - w_o)$. The fact that investors' payoff increases with project efficiency may induce outsiders to choose project n as $f_n x_n > f_o x_o$. However, provided $f_n w_n > f_o w_o$, the expropriation effect under project o may dominate the efficiency effect under project n, leading to inefficient technology choice. As an extreme example, consider the case in which high types' productivity is almost equal to their outside option under the efficient project (i.e. $w_n \backsimeq x_n$). Outside investors will weakly prefer project o, no matter how inefficient this may be.

Notice that uncertainty does not have any bearing on technological choice. Given that outsiders' payoff increases with high types' expropriation and that each employee's type is revealed at date 2, outsiders can still expropriate high types under the new technology. In what follows we analyze

whether an inefficient partnership may sell off to investors that would implement the efficient technology.

B. Endogenizing Ownership

The context that we have in mind is one of competition among potential outside owners. Therefore the partnership would be able to extract all the surplus from a sale. A one-member-one-vote partnership divides returns equally among its members.[15] Also, the decision on institutional change is driven by a simple majority vote at date 0.[16].

Suppose that the partnership is inefficient under the initial ownership form and that uncertainty is binding. By Proposition 1 this implies that $f_o < \frac{1}{2} < f_n$. The vote on institutional change takes place at date 0 when low types under the status quo are in the winning majority. Consider the voting behavior of a low type. In a partnership, his productivity is zero as project o is implemented. Given that project o generates a majority of low types, he anticipates a payoff of $\frac{f_o}{1-f_o}(x_o - w_o)$. Under outside ownership, he can become a high type with probability p. He would receive his outside option contingent on his type, plus a compensation over future expropriation receipts distributed as an up-front dividend. Under risk neutrality his expected payoff is $pw_n + f_n(x_n - w_n)$. Note that if the bad state is realized under the new technology, he would be better off under outside ownership as he would still receive a positive dividend. However if the good state is realized he would be better off under employee ownership as $x_n > w_n + f_n(x_n - w_n)$. A low type is hence willing to sell provided his probability of becoming a high type is low enough. A necessary condition is that $pw_n + f_n(x_n - w_n) > px_n$, that is $p < f_n$. Substituting the value of $f_n = (1 - f_o)p + f_o q$, 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 institutional change will restore efficiency.

Proposition 2

Assume that A1 and A2 hold and that there is positive correlation across types, that is, $p < q$. A partnership sells off the firm to outsiders provided the new technology is sufficiently efficient. That is, when:

$$f_n x_n > \frac{f_o}{1 - f_o}(x_o - w_o) + (f_n - p)w_n$$

The LHS of the inequality is a measure of project n'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

[15] 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. Under the veil of uncertainty, at the time of the initial constitution, a uniform dividend rule seems to be a focal decision rule.

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

dividend although it also increases the payoff of a low type that becomes productive under the new technology.

Proposition 2 says that if the efficiency of project n is high enough, the partnership favors project n indirectly under outside ownership even if it favors project o 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 because the probability of accruing a zero payoff is too high. Hence the status quo would be favored under the initial institution. In other words, institutional reform acts as an *insurance policy* for low types when their probability of success is low enough. It turns out that a low type is indifferent between implementing an innovation that generates a probability of success p under the initial institution, and voting for institutional reform leading to the adoption of an innovation that generates probability of success $\left[f_n - (f_n - p)\,\frac{x_n}{w_n}\right]$. Given that that $p < q$, the winning majority is willing to give up probability of success $(f_n - p)\,\frac{x_n - w_n}{w_n} > 0$ to ensure an up-front compensating transfer following institutional reform. This probability could thus be regarded as the *price of insurance* provided by institutional reform.

C. Dominated Employee Ownership

Proposition 2 has shown that uncertainty is not all bad news for an employee-owned firm. Although it may turn an efficient partnership into an inefficient institution, institutional reform may restore efficiency. When reform does not take place in equilibrium, we can characterize the relative efficiency of employee-owned firms vis-a-vis outside-owned firms, a task to which we now turn. We have shown that a firm can be inefficient irrespective of its ownership structure and this is due to the linkages between technology choice and sharing rule. However, the factors leading to inefficiency differ across institutional forms. Whereas in a partnership, it is the political game between high and low types that pins down the sharing rule at date 2, under outside-ownership expropriation is fully determined by skill specificity. As uncertainty distorts the balance of power in a partnership while leaving expropriation proceeds unaffected under outside ownership, we show next that uncertainty may make partnerships more inefficient relative to outside-owned firms regardless of the technology set.

First we show that a partnership is more biased towards egalitarian projects. Then we provide a sufficient condition whereby a partnership is more biased towards polarized projects.

Lemma 1 *Under A1 and A2, a partnership is more biased towards egalitarian projects than an outside-owned firm.*

Proof:

The characterization of project o as egalitarian implies that $f_n < \frac{1}{2} < f_o$. Assume that an outside-owned firm is inefficient, i.e. $f_n\,(x_n - w_n) < f_o\,(x_o - w_o)$. Notice that $f_o\,(x_o - w_o) < f_o\,(1 - f_o)\,x_o$, since, by A1, $w_o > f_o x_o$. Also, $f_o\,(1 - f_o) < (1 - f_o) < (1 - f_n)$.

Therefore $f_n(x_n - w_n) < (1 - f_n)x_o$, so that $x_o > \dfrac{f_n(x_n - w_n)}{(1 - f_n)}$. This means that in a partnership, type (lh) votes in favor of project o. Remember that, given $f_n < \frac{1}{2} < f_o$, in proving Proposition 1 we showed that type (lh) is pivotal in technology choice. As a result, project o is also selected by the partnership. QED

Denote g_{ll}, g_{lh}, g_{hl} and g_{hh} the fraction of the four types of employees, $\{ll, lh, hl, hh\}$, respectively. The condition stated in the following corollary guarantees that a partnership is more biased toward inefficient projects than its outside-owned counterpart.

Corollary 2. *Assume that A1 and A2 hold. A partnership is dominated by outside ownership provided:*

$$x_n > \frac{g_{hl} + g_{hh}}{g_{hh}} w_n$$

Proof:

Assume that project o is polarized, namely $f_o < \frac{1}{2} < f_n$ and $x_o > x_n$. Remember that $f_n = (1 - f_o)p + f_o q$.

A partnership is more biased towards polarized projects than an outside-owned firm whenever the following equation holds:

$$f_o(x_o - w_o) > f_n(x_n - w_n)$$

Simplifying:

$$\frac{f_o}{1 - f_o}(x_o - w_o) > p x_n$$

Rearranging:

$$f_n(x_n - w_n) > p x_n (1 - f_o)$$

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

Substituting the value of f_n into the above equation:

$$[(1 - f_o)p + f_o q](x_n - w_n) > p x_n (1 - f_o)$$

Since $(1 - f_o)p = g_{hl}$ and $f_o q = g_{hh}$, the result follows directly. QED

The comparison between employee and outside ownership hinges on their relative bias away from efficiency. On the one hand, the efficient technology is more attractive to an outside owner than to the decisive type in a partnership. 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 partnership, as the expropriation of high types is bounded above by their outside option w_n. If the former effect dominates the latter, a partnership will be more likely to be inefficient than an outside-owned firm.

IV. Efficiency, Innovation, and Labor Mobility

When a contracting party makes a relationship-specific investment, it also restricts its labor mobility. Under incomplete contracts, this generates ex-post opportunism at the redistributive stage, thus weakening incentives to acquire firm-specific skills. By allocating control rights at the redistributive stage, the firm's institutional form has a major influence on the level of firm-specific investment (Grossman and Hart, 1986). Likewise at the country level, countries endowed with good institutions specialize in trade flows wherein relationship specific investments are most important (Nunn, 2007). At an industry level, there is empirical evidence consistent with the hypothesis that industry-specific skills are important to explain cross-industry variation in wages (Weinberg, 2001).[17] A key implication of the incomplete contracts literature is that institutions matter for firm-specific investment. In this paper we examine the reverse causality: does human capital firm-specificity determine which organizational form arises in equilibrium?

To answer this question consider the following simplified version of the model presented in Section 2. Keeping the same notation as before, we take $q = 1$, $x_n = x_o = x$ and $w_n = w_o = w$. This simplification allows a natural characterization of an industry according to the importance of industry-specific skills measured by $(x - w)$. Note that a high number is associated with high industry-specific skills and low interindustry mobility as the marginal productivity declines for workers who switch industries. Also in this example a new technology is simply parameterized by the probability p that a low type becomes a high type. To the extent that the productivity of each employee is weakly higher under the new technology, project n dominates the status quo. Relevant for the political equilibrium is also the fact that, given A2, low types under the status quo are in the majority to determine technology choice. Once the new technology has become available, they are also decisive in the vote on institutional change. We proceed in two steps. First, we analyze the performance of a partnership. In particular, we examine whether the likelihood of innovation increases with the size of technological improvement. Next we endogenize firm ownership. Using our analysis of Section 3, we identify a lower bound for the size of innovation such that a partnership will agree to sell off the firm to outside investors. This allows us to characterize institutional efficiency as a function of technological efficiency and labor mobility.

A. Partnership Efficiency

A priori, a technology characterized by a higher value of p is more attractive to low types and the reason is twofold. First, a high p increases the expected productivity of a low type. Second, it increases the efficiency of the partnership that in principle can be 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 efficiency of the cooperative and the efficiency of the new technology as measured by p.

Proposition 3

[17] Weinberg (2001) shows that the employment of new entrants to the labor market is more responsive to demand shifts than the employment of experienced workers pointing at the importance of barriers to inter industry mobility generated by industry-specific skills.

Assume that A1 and A2 hold. A partnership is inefficient for intermediate values of p. That is, if and only if:

$$\underline{p} \leq p < \overline{p}$$

where $\underline{p} = \frac{1-2f_o}{(1-f_o)}$ *and* $\overline{p} = \frac{f_o}{1-f_o}\frac{x-w}{x}$.[18]

For low values of p, the balance of power between low and high types under the new technology remains unchanged. Low types are in the majority at the redistributive stage regardless of whether the new technology has been adopted. As the ex-post payoff of each employee is weakly higher under the new technology, all employees favor the efficient option even under unanimity rule. For higher values of p however, the balance of power between low and high types under the new technology is reversed. As high types are now be in the majority following the adoption of the new technology, a compensating transfer to the low types that lose the subsidy of the status quo but do not benefit from productivity gains is not credible. As a result, the new technology is voted down and the firm becomes inefficient. Yet as p becomes sufficiently high, the efficiency gains under the new technology outweigh the redistributive benefits under the status quo and the new technology gets implemented.

Figure 1. Technological and Institutional Efficiency

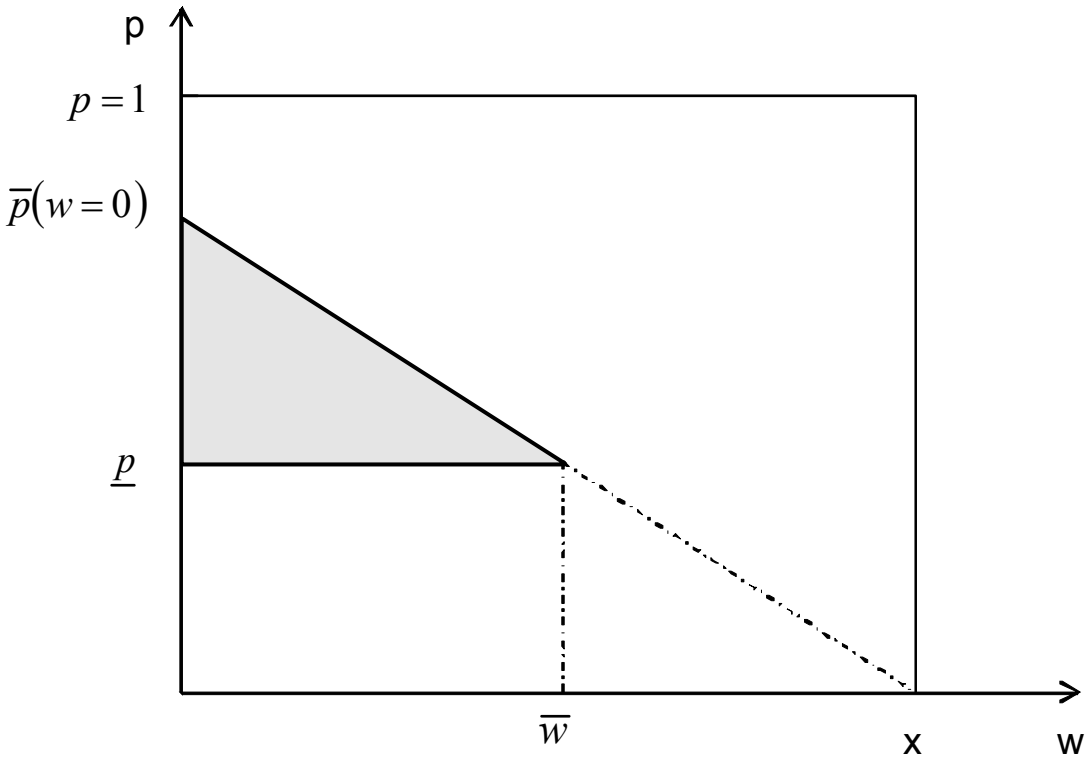

Figure 1

[18] Note that this inequality imposes a lower bound on the value of f_o, i.e. $\frac{x}{3x-w}$.

The shaded area in Figure 1 depicts the parameter space for which the partnership becomes inefficient. Note that for the partnership to be inefficient a necessary condition is that $\overline{p}(w=0) > \underline{p}$ and $w < \overline{w}$. This condition can be restated as $f_0 > \frac{1}{3}$ and $w < \frac{3f_0-1}{f_0}x$. That is, for the partnership to be inefficient, the subsidy accruing to the winning majority under the status quo should be high enough in terms of the number of productive types that it generates and the specificity of their skills.

B. Institutional Efficiency

The issue of interest is whether skill specificity may contribute to explain the ownership structure that may be observed ex-post. For that, consider a given industry characterized by a measure of lock-in effects $(x-w)$. To apply the results from Section 3, we first characterize the set of technologies for which the partnership agrees to sell off to outside investors to restore efficiency. To the extent that ownership conversion brings forward a compensating transfer for the expected expropriation of human capital, we also allow an efficient partnership to transfer ownership to outside investors to reallocate redistribution. For each of these two cases, we study whether institutional change takes place. This leads to the following result.

Proposition 4

Assume that A1 and A2 hold. The initial institution is employee ownership but institutional reform is feasible. Given inside productivity x, outside productivity w, and a new technology space parameterized by p, in *equilibrium:*

(i) Partnerships are efficient if $p \in \left[0, \underline{p}\right)$

(ii) Partnerships are inefficient if $p \in \left[\underline{p}, \widehat{p}\right)$

(iii) Partnerships go public if $p \in [\widehat{p}, 1)$

$$\textit{with } \widehat{p} = \frac{\frac{(f_o)^2}{1-f_o}(x-w)}{f_o w + (1-f_o)x}, \ \frac{\partial \widehat{p}}{\partial w} < 0, \textit{ and } \frac{\partial^2 \widehat{p}}{\partial w} > 0.$$

Proof:

In an industry characterized by $(x-w)$, consider a new technology with parameter p, where p satisfies $\underline{p} \leq p < \overline{p}$. From the above analysis, the partnership is inefficient. Yet, provided the technology is sufficiently efficient all employees will be better off in expected terms. A low type votes in favor of institutional change as long as $pw + f_n(x-w) > \frac{f_o}{1-f_o}(x-w)$. Substituting for the value of f_n and rearranging, it is easy to see that this is equivalent to

$$p > \frac{\frac{(f_o)^2}{1-f_o}(x-w)}{f_o w + (1-f_o)x} = \widehat{p}.$$

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

First, consider a new technology n, such that $p < \underline{p}$. Remember that the partnership is efficient and that there is positive redistribution under project n. It can be easily shown that a majority of employees vote for employee ownership. In effect, low types vote in favor of outside ownership as long as:

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

Replacing the value of f_n in terms of p, this inequality would only hold if $p > p + f_o(1 - p)$. As $p < 1$, this is a contradiction and hence the partnership form remains.

Second, assume a new technology n such that $p > \overline{p}$. Now the partnership will choose project n 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. Current low types under the status quo only sell off the firm to outsiders provided:

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

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

To show the last part of the proposition, note that $\dfrac{\partial \widehat{p}}{\partial w} = \dfrac{-\dfrac{(f_o)^2}{1 - f_o}x}{[f_o w + (1 - f_o)x]^2} < 0$, and

$$\frac{\partial^2 \widehat{p}}{\partial w} = \frac{2\dfrac{(f_o)^2}{1 - f_o}x}{[f_o w + (1 - f_o)x]^3} > 0$$

QED

In Figure 2 we look at the cross-industry variation in ownership patterns holding inside productivity x constant. Recall that $\underline{p}$, $\overline{p}$ and $\widehat{p}$ can be written as a function of w, where $0 < w < x$. As shown in Proposition 3, $\underline{p}$ is constant for all values of w, $\overline{p}$ is a decreasing linear function of w, and by Proposition 4, $\widehat{p}$ is a convex decreasing function of w.

Figure 2. Endogenous Ownership

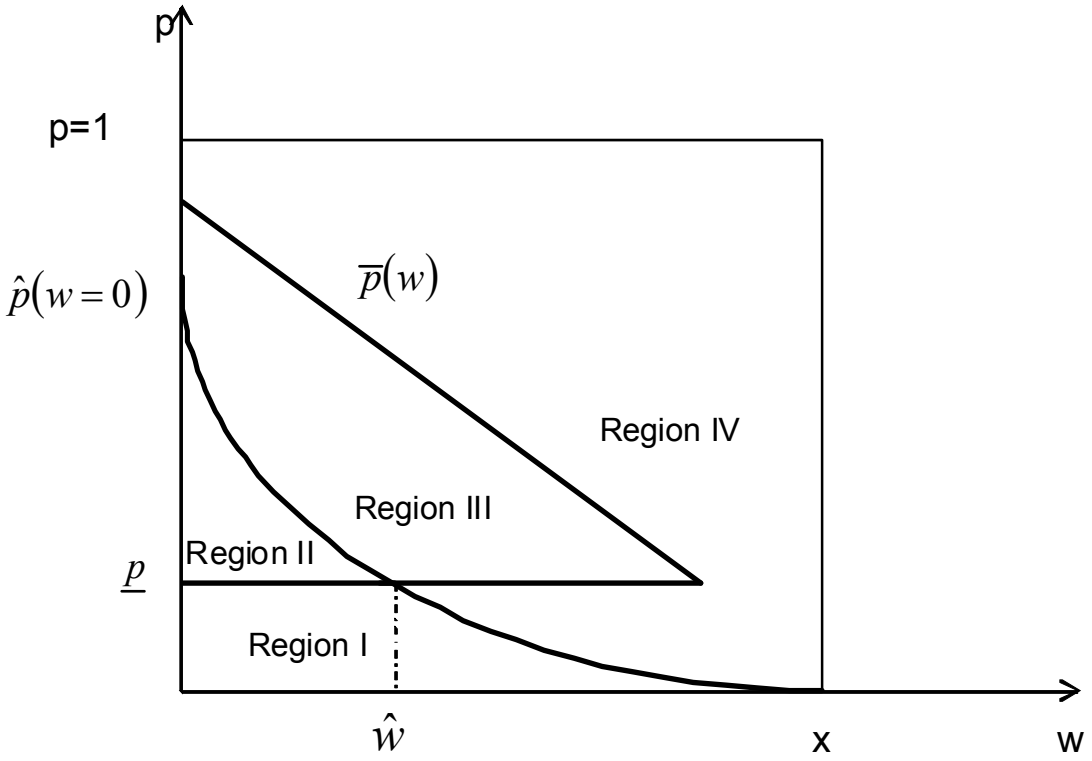

Figure 2

Figure 2 splits the parameter space (w, p) into four regions. Initial partnerships that turn out to be efficient continue to exist in Region I; inefficient partnerships survive in Region II; inefficient partnerships convert into efficient outside-owned firms in Region III; and, efficient partnerships sell off to efficient outsiders in Region IV. Note that institutional reform acts as a mechanism to establish efficient technology implementation in Region III.

For an inefficient partnership to survive, a necessary condition is that $\widehat{p}(w=0) > \underline{p}$ and $w < \widehat{w}$. This boils down to $f_0 > 0.38$ and $w < \frac{f_0^2-(1-f_0)(1-2f_0)}{f_0^2+f_0(1-2f_0)}x$. Putting together Propositions 3 and 4, we conclude that a firm is efficient irrespective of its ownership structure provided the fraction of high types under status quo technology ranges over $f_0 \in [0, 0.38]$.[19] Otherwise, for $f_0 \in \left(0.38, \frac{1}{2}\right)$, institutional efficiency depends on two factors: the degree of labor mobility and the size of technological improvement. This observation points at two testable implications. First, for a given technology set, partnerships are more likely to convert into outside-owned firms the higher the rate of labor mobility.[20] Second, for a given degree of labor mobility, outside ownership should be increasingly observed in industries endowed with more efficiency technologies. Recent

[19] Remember that for $f_0 < \frac{1}{3}$ a partnership is always efficient, and for $f_0 \in \left[\frac{1}{3}, 0.38\right]$ constitutional change takes place.

[20] This prediction contrasts with the general view in the economics of governance literature where hierarchy – approximated here by outside ownership– is regarded as the paradigm organizational form in the face of asset specificity (Williamson, 2005). Our result suggests that outside ownership may no longer be an equilibrium outcome once we allow for investors' opportunistic behavior.

empirical evidence in the professional services industry points at a rise in labor mobility associated with partnerships going increasingly public (Levin and Tadelis, 2005), lending some support to our first prediction. Our second prediction is in line with Morrison and Wilhelm (2008) who argue that the arrival of more efficient technologies has accelerated the decision of investment banking partnerships to go public.

V. Discussion

A. How does the model fit the facts?

In what follows we discuss the predictions of the model in the light of stylized facts on partnership performance under uncertainty.

(a) Partnerships are more inefficient under uncertainty.

Employee ownership seems to be more common in industries where there is more available information on employees' individual productivity, such as the professional services industry.[21] If we believe that a partnership is more likely to survive the higher its efficiency, it follows that partnerships are more efficient in the presence of more precise information on productivity. Also, in volatile sectors like plywood, although membership is marketable, there is evidence of underinvestment in employee-owned firms in comparison with investor-owned firms, even when financial markets are available.

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 high volatility. Our model is consistent with this observation by predicting than uncertainty, while increasing the likelihood of inefficient performance in partnerships (Proposition 1), does not affect the behavior of outside-owned firms.

(b) Partnerships are more likely to convert to outside ownership when industries become more volatile.

There is evidence of increased transfers of ownership from employees to outside investors when the volatility of the industry changes. Some of the best known examples of such transfers documented by Hansmann (1996) are found in the advertising and the investment banking industries. 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 evident reason is the need to attract more capital, this process tends to be associated with firm restructuring, which renders post-reorganizational individual productivity uncertain. Another prominent example is given by securities exchanges. Hart and Moore (1996) point to a number of instances where reforms have been hindered by the conflicts in decision making in an increasingly diverse membership of exchanges. They suggest that the transformation of exchanges, including the Stockholm Stock Exchange and the Chicago Mercantile Exchange, into

[21] Hansmann (1996) stresses the major role played by partnerships in service industries including medical cabinets, financial services providers, and legal and consulting organizations.

limited liability companies may serve as a mechanism to induce efficient technology choice. This empirical observation is accounted for in Propositions 2 which predicts that a partnership may agree to sell off to outside investors so as to encourage the adoption of innovative technologies.

(c) Partnerships selling off to outsiders are more likely to belong to industries with lower firm-specific human capital.

This is the case in the most prominent examples of partnerships in the U.S. which belong to the plywood industry and the advertising sector. By contrast, partnerships belonging to industries with lower labor mobility such are large law firms have followed an up-or-out system whereby an employee must leave the firm if he has not been made a partner within a specific time period. This rule implies that all except more junior lawyers are owners, thus preventing the substitution of employee owners by hired labor as observed in other industries. This evidence is consistent with Proposition 4 which shows that, for a given level of uncertainty, a partnership is more likely to transfer ownership to outsiders when firm-specific human capital is lower.

B. Foundations of Individual Uncertainty

Our analysis has been set in an economic environment where a new technology brings about uncertainty as to individual productivity. Can we justify the existence of such uncertainty in a firm?

Certainly an increase in the size of the firm or in the complexity of its operations are two main causes leading to uncertainty regarding the effect that the firm's project has on an employee's final payoff. Let us illustrate this argument with the following examples. First consider an increase in the *size*[22] of the partnership. We can view size as the replication of productivity across the population of employees. Since now there are more employees belonging to each category, employees may not know ex-ante whether they will be transferred to job assignments dealing with the new technology ex-post or instead will remain performing the same old task. In this case, even if each employee knew his individual productivity under the new technology he will be uncertain at the voting stage about his final productivity should the firm implement the new technology. Alternatively, consider a partnership in which redistribution is determined by a majority coalition. 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 undertaken by the firm, whereby employees cannot ascertain ex-ante their individual cost to switching to the new project. Following the adoption of a new project, a number of employees (movers) will have higher individual productivity. Suppose that all movers are equally productive under the status quo project and therefore they share the same beliefs about their own capabilities under the new

[22] A different effect of size on efficiency is given by Farrell and Scotchmer (1988) where cooperatives are characterized as partnerships with equal-sharing rules. Partnerships 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.

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, whereas the remaining movers will continue being low productivity employees, thus introducing individual uncertainty on their final payoff.

C. Heterogeneous Investors

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 specific project. In the context of our model, targeted stock may 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).

VI. Related Literature

Our paper is inscribed in the property rights tradition, following in particular the seminal work of Grossman and Hart (1986) and Hart and Moore (1990) whereby asset ownership gives the firm owners control rights to make productive decisions and share aggregate surplus. We use political economy arguments to explain resistance to technological innovation within the firm. The idea of inefficient policy persistence has been largely explored in the political economy literature.[23] Piketty (1999) highlights the ideological bias of the French electorate against the implementation of job subsidies to explain the persistence of costly income transfers as a means to achieve income equality. Coate and Morris (1999) present a lobbying model where agents make private investments following the current policy and thus increase their willingness to pay for the continuation of the status quo policy. In our model it is the anticipation of dynamic voting that leads the current winning coalition to neglect the implementation of innovation (in the spirit of Besley and Coate, 1998, Roberts, 1999, and Piketty, 2000).

Resistance to reform because of its potential impact on the redistribution of rents has been analyzed by Howitt and Wintrobe (1995), where voters fear losing the election after raising a policy issue, and Blanchard and Giavazzi (2003) where product market deregulation dwarfs workers' rents and labor market liberalization weakens their bargaining power. The intertemporal component of reform has been stressed by Dewatripont and Roland (1992), Laffont and Qian (1999) and Roland (2002). These papers examine the role of political institutions in transition countries and argue that a gradualist approach, emphasizing the need for an adequate sequencing of reforms, can create constituencies for further reform. Unlike our model they do not show how a

[23] For two excellent surveys, see for example Rodrik (1996), and Roland (2002).

gradualist approach, i.e. a corporate reform followed by technological innovation, may be observed in equilibrium keeping the constituency constant. The idea that Pareto dominated outcomes may arise due to conflicting political groups has been explored in models of stabilization delay. Alesina and Drazen (1991) and Martinelli and Escorza (2007) explain delay as the outcome of a war of attrition in which each group has an incentive to resist adoption in the hope that the others will capitulate first and therefore bear a higher burden of the reform program. That approach is essentially a strategic waiting game while our model explores the inefficiencies created by dynamic voting.

As mentioned in the introduction, the impact of individual specific uncertainty on the likelihood of adoption of reform has been examined in an influential paper by Fernandez and Rodrik (1991). There are two crucial differences between Fernandez and Rodrik (1991) and our paper. In their analysis, inefficiencies arise because citizens have to pay a cost up-front, in order to enjoy the benefits of reform. In the absence of such a cost, a reform would always be undertaken. Moreover, they do not allow for ex-post transfers among citizens, whereas such redistribution is the source of inefficiency in our model. Our paper is more closely related to Jain and Mukand (2003) who endogenize the redistributive decision and obtain a non-monotonicity result between the distribution of winners from economic reform and the probability of its adoption. Unlike their paper, we also endogenize the governance structure, that is, the rules of the game. This allows us to show under which conditions innovation is implemented following institutional change though it would have been blocked under the initial institutional arrangement.

Our paper is also related to the literature on the dynamics of firm's institutional form. In the context of professional and financial services organizations, Levin and Tadelis (2005) and Morrison and Wilhelm (2008) show how the recent organizational shifts from partnership to corporate form can be explained by the availability of a better monitoring technology of employees' productivity and by the arrival of technological innovations, respectively. In contrast with these papers, we focus on the political economy constraints surrounding technology adoption. Closer to our model is Rajan and Zingales (2001) who address the dynamics of organizational design as a mechanism to deal with the problem of expropriation. They show that firms operating in sectors with high expropriation risk are likely to sell off to employees in order to provide individual incentives to remain in the firm. Instead, we regard corporate reform as a device to encourage efficient collective decision-making. By contrast, some theoretical work as well as empirical studies (Albuquerque and Rebelo, 2000) point at industrial structure inertia following trade reform. We provide a mechanism under which institutional inertia may prevail in industries characterized by high firm specificity of skills because it preserves the vested interests accrued under the status quo.

Our analysis of the link between firm ownership and technology choice can be reinterpreted under the lenses of the institutions and growth literature. Aghion et al (2007) explore how the effect of democracy on economic growth depends on the distance to the technological frontier. According to these authors, the growth-enhancing benefit of democracy is greater the closer the economy is to the technological frontier because democracies tend to encourage market entry. In contrast to their assumption that democracy reduces the protection of vested interests, we show that a democratic governance rule may help perpetuate vested interests. Abiad and Modey (2005) examine empirically what are the main factors that may undermine vested interests opposed to further financial liberalization. They find that shocks and learning matter more than ideology of the incumbent government and the structure of the economy such as openness to trade. This

contrasts with Rajan and Zingales (2003) who show how a sudden opening to trade and capital flows may tilt the balance of power by bringing in foreign investors. Enhanced competition may incite the financial elite to press for financial development. Their prediction that financial innovation follows capital account liberalization, is analogous to our prediction of a positive correlation between employees' mobility and efficient technology choice. Finally, our paper can be regarded as an illustration of the efficiency distortions explored in the field of comparative economics. Djankov et al. (2003) highlight the conflict between controlling disorder under democracy and restraining expropriation under dictatorship as the key issue drawing institutional design. Also their paper ponders whether the best political system for economic reform is necessarily democracy when a radical change is required.[24] Drawing a parallel between democracy and employee ownership on the one hand, and dictatorship and outside ownership on the other hand, their predictions are the mirror image of our results.

VII. Concluding Remarks

This paper has shown that individual uncertainty can exacerbate the inefficient behavior of an employee-owned firm even under risk neutrality. Uncertainty amplifies distortions due to collective decision-making, whereby the winners from efficient technology choice fail to compensate the losers. We show that individual uncertainty generates a bias towards the inefficient status quo technology. This result holds even if the vote on technology choice is irreversible, in contrast with Fernandez and Rodrik (1991). In the extreme, a partnership may favor a dominated technology whereby all employees realize ex-post lower individual productivity. As this behavior is rooted on the aversion of the winning majority to the potential loss of future political leverage, employees exhibit a form of political risk aversion.

Notwithstanding this bad news associated with uncertainty, employees may agree to change the firm's governance structure provided inefficiencies are sufficiently large. That is, they may benefit from the efficient technology under outside ownership even though they would support the inefficient technology under employee ownership. Selling off the firm to outsiders acts as a mechanism to circumvent the efficiency losses associated to private information and limited commitment. Compensating transfers which are not credible ex-post under the initial institution, materialize ex-ante as an up-front selling price under institutional reform.

We endogenize firm ownership and show a non-monotonic relationship between institutional efficiency and the size of innovation. For low values of technological improvement, employee ownership is efficient. For high values of technological improvement, an employee-owned firm goes public and innovation is implemented. For intermediate values of technological improvement, employee ownership survives under a low technology path. We also prove a negative correlation between the likelihood of institutional reform and the firm-specificity of human capital. Institutional reform is more likely to succeed in industries or during eras characterized by higher labor mobility. This is because the extent of vested interests from future political leverage under the status quo policy declines. This prediction is supported by anecdotal evidence from the empirical corporate governance literature. We believe this model can be generalized to a political

[24] 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, in line with our predictions.

economy framework where the incumbent government's economic inaction in the face of uncertainty may trigger political change.

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