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U N I V E R S I T Y   O F   Z A R A G O Z A

■ **Abstract**

In this working paper we model contracting for joint production between workers and shareholders when investment in knowledge is non-verifiable, and the resulting specific human capital embedded in the workers is non-tradable. The model provides sufficient conditions for workers becoming stakeholders of the firm, and conditions under which it is in the interest of shareholders to empower workers and/or increase their employability as a way to motivate workers' investment in knowledge. Problems of implementation of bilateral and trilateral governance mechanisms for the knowledge-intensive firm, which substitute for the hierarchical, shareholder-oriented mechanism of the physical capital-intensive firm, are highlighted.

■ **Resumen**

En este documento de trabajo se ofrece un modelo de relación contractual para la producción conjunta entre trabajadores y accionistas cuando no existe la posibilidad de comprobar la inversión en conocimiento que se ha realizado, y tampoco hay modo de rentabilizar el capital humano específico generado, que es ya una parte indivisible de los trabajadores. El modelo proporciona las condiciones necesarias para que los trabajadores se conviertan en grupos de interés de la empresa, además de las condiciones bajo las cuales les resulte favorable a los accionistas dar más poder a los trabajadores y/o aumentar su empleabilidad como una vía para motivarlos a que inviertan en conocimiento.

Se destacan los problemas que surgen con la puesta en práctica de sistemas bilaterales y trilaterales de gobierno corporativo para el modelo de empresa intensiva en conocimiento, que sustituyen a los sistemas jerárquicos de la empresa intensiva en capital físico y orientada exclusivamente a los accionistas.

■ **Key words**

Corporate governance, specific human capital, stakeholders, knowledge management.

■ **Palabras clave**

Gobierno corporativo, capital humano específico, grupos de interés, gestión del conocimiento.

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C O N T E N T S

1. Introduction

CRITICS of the dominant, shareholder oriented, model of corporate governance often justify the need for change because public corporations have gone too far, in terms of unethical conduct, in their profit maximizing behavior. Others justify the need for change from efficiency reasons: the shareholder oriented model of corporate governance was useful when the priority was the efficient accumulation of physical resources, but modern capitalism increasingly depends on knowledge and related resources and the governance of the modern firm has to be adapted to this new reality (Rajan and Zingales, 2000; Zingales, 2000) [1]. The complexities around generating, transferring and valuing knowledge based assets are well known (Arrow, 1962; Teece, 1986). Previous research also gives reasons why the organization (Kogut and Zander, 1996; Grant, 1996) and governance (Grandori, 2005; Osterloh and Frey, 2006) of knowledge based firms must be different from those of firms which use physical assets. However the details on the origin and nature of the complexities posed by knowledge based assets, compared with those of physical ones, have not been worked out; nor are there papers investigating the implications of workers' versus shareholders' finance of the investment in knowledge.

Our working paper describes and models a contracting situation between workers and shareholders who must take the following decisions: 1) who finances the investment in knowledge and physical assets for production? 2) how much should be invested in each asset depending on who finances it? 3) how are services from human capital embodied in workers and from physical assets combined to produce output that will be sold in an (imperfectly) competitive market? The received theory of the firm explains that efficient risk allocation (Wilson, 1968; Hart and Holmstrom, 1987) requires that shareholders finance long lasting risky investment because they can better diversify their wealth and returns than workers of the firm can do. Moreover, Williamson (1979, 1985), Klein, Crawford and Alchian (1978) propose

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1. There are also those who believe that no major change is needed in the current model of the capitalist firm and corporate governance, Holmstrom and Kaplan (2003).

single ownership of firm specific assets as a way to protect from hold up and make efficient investment decisions when contracts between independent buyer and supplier would have to be necessarily incomplete. If production requires services from physical capital and services from knowledge based human capital, it makes economic sense, in terms of efficient risk sharing, that shareholders finance both physical and knowledge based assets. The other two relevant possibilities are that workers finance all the assets and that shareholders finance the investment in physical capital and workers finance the investment in knowledge.

The vertical integration solution where shareholders finance all the assets faces a unique complication from the fact that shareholders cannot *own* the workers and therefore they are unable to prevent workers from leaving the firm taking with them the incorporated human capital, as they can as owners of material assets. The other single ownership solution where workers finance all the assets will face the limitations imposed by wealth constraints, risk aversion and imperfect financial markets. The third possibility, where workers finance investment in knowledge and shareholders finance the investment in non human capital, is complicated because the amount invested in knowledge can be non-verifiable information and because future transactions between well intentioned parties involving services from human capital resulting from such investment are problematic because knowledge is tacit and too costly to *codify* in a comprehensible way. Contracts between workers and shareholders will have to be necessarily incomplete so the risk of hold up can only be prevented by choosing to invest in knowledge that transforms into general human capital. Specificity in human capital may be determined by productive and/or competitive conditions so the collaboration between workers and shareholders involves specific assets and to be governed by incomplete contracts.

With the exception of workers' single ownership, incomplete contracts lead towards bargaining between the collaborating parties to decide how to allocate the existing resources in future transactions and collect the respective share of the quasi rents. The solution of the contracting problem will be affected by the respective bargaining power and outside opportunities if the collaboration breaks down. Future rents for today's investment decisions will depend on two key parameters, bargaining power and employability of human capital (non human capital is assumed to be general). Investment decisions and wealth creation will then depend on these two parameters and also on the financing decision.

We find that workers' single ownership is the trivial first best solution under unlimited wealth and perfect financial markets. When these condi-

tions do not apply, the two other two alternative solutions, namely that shareholders finance all the assets or that workers finance the initial investment in knowledge while shareholders finance the other assets, are both second best solutions. From a total wealth maximizing perspective workers' (shareholders') finance is preferred when workers' bargaining power is higher (lower) and when human capital is more general (specific). Next, the paper examines the conditions under which shareholders would be willing to give workers more bargaining power if they could, or the conditions for shareholders implementing practices that increase the employability of workers, as a way to increase the incentives to invest in knowledge when the workers finance this investment. The two shareholders' initiatives are shown to be partially effective for the purpose of increasing investment in knowledge and total welfare, but their relative effectiveness differs depending on other conditions. For example, employability is more effective than increasing bargaining power when the competitiveness of the firm in the product market is not affected, but not so much when one assumes, realistically, that employability of workers will reduce the competitive advantage of the firm.

The content of the working paper is related to the literature on the economics of human capital. Becker (1975) and Hashimoto (1981) consider the investment decision in firms' specific human capital, but they assume that investment is contractible and therefore solutions such that workers and shareholders share the cost of the investment are feasible to implement. Hall and Lazear (1984) look at how firm specific human capital affects workers' turnover but do not model the investment decision. Malcomson (1997) revises the literature on investment and hold up in labor markets; the literature assumes that the firm owns the services from the specific investment so if negotiation breaks down employers deploy such investment in outside investment alternatives. In this paper we assume that it is the workers who always appropriate the human capital services from knowledge investments, even when they do not finance them. More importantly, none of these papers explore the decision on who should finance the investment in knowledge, the workers or the shareholders, neither do they model the policy decisions on sharing quasi-rents and choosing the governance mechanism [2]. The Property Rights Theory of the Firm (see Hart, 1995,

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2. Other somehow related papers are Aoki (1990), Pagano and Volpin (2005) who model coalition formation between managers and workers to dispute shareholders rents but in a model of complete contracting and no distinction between general or specific human capital. Baker et al. (2002) model firms' boundary decisions applying relational contract theory combined with asset specificity and incomplete contracts. These papers do not examine the finance and policy decisions.

chapters 2, 3 and 4 for a review) has investigated the incentives to invest in non contractible firm specific human capital by both customers and suppliers in the context of vertical separation versus vertical integration decisions. The application of this framework to our contracting problem (where only suppliers make firm specific investment decisions) would anticipate the trivial first best optimal solution that workers should own *all* the assets of the firms. However this literature does not address either the policy and/or financing decisions. One limitation of our approach is that we cannot explore the incentive effects for workers that finance the investment in human capital of contractual solutions such as up-or-out (Waldman, 1990) or promoting the highly able workers to higher hierarchical positions (Prendergast, 1993) since the model does not contemplate different job positions.

The theoretical results of the paper provide some guidance on the public debate around good corporate governance and the possible reform of the dominant shareholders oriented model in favor of a stakeholders oriented one (Tirole, 2001; Blair and Stout, 2005). Our results identify productive conditions that support the economic rationale of governance models different from the shareholders oriented one and provide a general framework to investigate the welfare implications of governance choices. In this respect we explicitly examine the proposal of Blair and Stout (2005) on converting corporate boards into boards of trustees and the proposal by Osterloh and Frey (2006) to nominate representatives of knowledge workers as board members.

The rest of the working paper is organized as follows. Section 2 presents an overview of the economic thinking on contracting for labor services in the firm. Section 3 contains the formal model and the main theoretical results. Section 4 studies the interest of shareholders in increasing the bargaining power of workers, when the latter finance the investment in human capital, and in altering the specificity of human capital. Section 5 examines different proposals on corporate governance systems, in the light of the theoretical results of the paper. The conclusions summarize the main findings and refer to some extensions of the model.

2. Contracting Problems and the Theory of the Firm

CONTRACTING between providers of labor services and providers of capital services lies at the core of production of goods and services. Capital services are most often supplied from long lived invested assets owned by the firm, while labor services are provided by hired skilled workers. Under the legal form of the *corporation* shareholders, or managers on whom they delegate, decide on the use of the assets of the firm and on the conditions under which workers will have access to them. Shareholders decide initially on how much to invest in the firm and in what kind of assets such investment should be placed. Services from invested assets will be deployed over time along the economic life of the asset, so shareholders, at the time of the investment decision will take into account present and future transactions affecting capital services.

There are two cases where the time delay between the moment when the investment is made and when the assets will be used are not relevant for the investment decision. One is the situation when all future circumstances around the foreseeable transactions can be easily anticipated at the time of the invested and costlessly contemplated in a legally enforceable complete contract. The other occurs when assets are general so their economic value is similar in the use that initially motivates the investment than in any alternative one. In other circumstances that, either contracts have to be necessarily incomplete, or assets are specific to the use that originates them, the investment decision can be affected by decisions made by the other transacting parties and, from that, the investor will not be indifferent on who owns other complementary assets used in production. In fact, Transaction Cost Theory (Williamson, 1979, 1985; Klein, Crawford and Alchian, 1978; Teece, 1986) predicts single ownership of closely complementary assets to prevent ex post opportunism, which is possible because the contract is incomplete, and avoid hold up, because exit from the relationship implies a low outside value for the asset.

Later on the Theory of Property Rights (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995; Rajan and Zingales, 1998) raises the con-

cern about the implications of single ownership of non-human capital assets, for the incentives to invest in firm specific human capital. Hart (1995, chapter 3) documents the costs of vertical integration (single ownership) decisions in terms of lower incentives to ex ante invest in human capital by workers who are deprived of control over complementary non human capital. The theory predicts that if firm specific human capital is present in only one side of the transaction (for example in the buying or in the selling firm) then workers who invest in such capital should be the single owners of all complementary non human assets. However when firm specific human capital is present in both sides of the transaction (buyer and seller), since slavery is excluded and people who are endowed with such capital are not transferable, then the decision on how to allocate ownership rights of non human capital must be analyzed case by case.

Implicitly, the theory assumes absence of financial constraints and risk neutrality of those who put their personal wealth into productive investments. Under limited wealth and risky returns from investments, shared ownership (and shared economic risks) among many investors has well-known advantages over single ownership of human and non-human capital, even under well-functioning financial markets. To have financial investors (shareholders) as residual claimants financing tangible and intangible assets, while risk-averse workers receive a fixed salary, is viewed as an efficient way to allocate economic risks (Wilson, 1968; Hart and Holmstrom, 1987). Therefore, even in cases where firm specific human capital occurs in only one side of the transaction, the single finance and ownership of all, human and non-human, assets by workers must weight the negative welfare effects of no risk diversification by workers.

In this paper we consider that there are many economically relevant situations where the solution of workers financing investment in firm specific capital and hiring or owing non human capital, is not feasible; shareholders who finance the investments are needed for accumulation of productive capital. Secondly, the human capital is non tradable (non-slavery assumption) and therefore shareholders cannot own the human capital resulting from investment in knowledge so the use of human capital is always determined by the will of the workers. Finally, when investment is in knowledge related assets the contracting complexities, pointed out by Arrow (1962) and many others, prevent using complete contracts to protect the interests of workers and shareholders when they finance and decide on the amount of the respective investments.

Incomplete contracts will include a governance system, which sets how decisions will be made under circumstances not contemplated in the

contract. There are three main alternatives, hierarchical, bilateral and trilateral governance, proposed in the literature (Kreps, 1996). *Hierarchical* governance means that residual decision rights are all allocated to one of the contracting parties, for example, the entrepreneur in the traditional capitalist firm[3]. In *bilateral* governance, decision rights are shared among transacting parties (for example German co-determination). In *trilateral* governance, residual decision rights are allocated to a third party external to the transaction. The shareholders oriented governance system for today's corporations belongs to the class of hierarchical governance where shareholders hold the decision rights on any thing not pre-contracted.

The model presented in section 2 contemplates contracting between workers and shareholders under the assumption of hierarchical governance where shareholders (or managers appointed by them) will decide on the use in production of services drawn from an existing stock of physical and human capital. However decision rights are limited because, even when they finance the investment in knowledge, shareholders cannot prevent workers from leaving the firm. Second, the problem contemplates an exogenously given bargaining power of workers that affects the allocation of ex post cash flows. Section four will make the bargaining parameter endogenous, while section five explores the implications from implementing the other two governance forms.

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3. Simon (1951) is the first to formalize the employment relation as an incomplete contract, in which the employee sells his services to the employer who will observe the contingencies of the job as they appear, and will determine the appropriate task assignment for each worker. The efficiency of the relationship is determined by a trade-off between the flexibility of adjustment to contingencies as they arise, and the disutility of the worker arising from the uncertainty at the start of the relationship concerning the more or less attractive job to perform.

3. Contracting with Specific Human Capital

3.1. Description of the contracting problem

We describe a production and exchange situation summarized in table 3.1. Production involves physical capital, K, and human capital, H, and two agents identified as workers and shareholders. Workers are embedded in the human capital and, since they cannot be bought or sold, ownership of human capital is non-tradable. Physical capital can be traded. Investment in knowledge that will become human capital is non-verifiable; thus, explicit and legally enforceable contracts in this variable are not feasible. The assets have a long productive life and the complete contract at the start of the relationship would require foresight of future contingencies in a way that is unrealistic. Therefore, contracts will—necessarily—be incomplete.

TABLE 3.1: **Timing of contracting and investment decisions**

Time 0	Time 1	Time 2	Time 3
Parties decide who finances the investment in knowledge and in physical capital	Decisions on the amount invested in physical capital and knowledge	Parties agree on the terms of the transaction (resource allocation and rent sharing between workers and shareholders)	Market competition allocates wealth created between consumers and producers.

At time 0 a decision is made on who will finance the investment, workers or shareholders. There are several alternatives: workers finance both assets, human and physical; shareholders finance all assets; workers finance human capital while shareholders finance physical capital. At time 1, actual decisions on the amount invested are made. At time 2, the parties bargain on the conditions of exchange, subject to the capital and labor services available

from previous decisions [4]. Bargaining will proceed on the assumption that, in the event of no agreement, each party can leave the collaboration and collect the value of the respective assets in outside alternatives. This situation is equivalent to that where external labor markets are competitive and in order to retain workers firms have to pay at least as much as the best outside offer.

In the basic formulation of the model we assume that physical assets are of general use while human capital can have different degrees of specificity. If an asset is *general* it means that the asset holder can cash outside the current transaction the amount invested at $t = 0$. For physical assets, being general means that if amount invested is K then the outside value of the asset is also K. If human capital has *specificity* $1 - \lambda$, between 0 and 1, it means that the human capital services resulting from an investment in knowledge equal to H have a current outside value of λH. The outside value of human capital resulting from investments in knowledge increases with λ so this parameter gives a measure of *employability* of existing human capital. When parameter $\lambda = 0$, the outside value of the asset is also 0 (null employability) while if $\lambda = 1$ then existing human capital has full employability.

Decisions at time 0 and 1 will take into account what will happen in the future, times 2 and 3, when parties determine the terms of trade. To do so, transacting parties will evaluate the net benefits of the alternatives they face. We define by $U = F(K, H)$ the output of the transaction if physical and human capital are combined in the production process. $F( )$ is an increasing and concave production function, and the two assets are complementary, $F''_{K, H} > 0$. U expresses the utility from consumption, valued in euros, of willingness to pay for the product. The amount actually paid for the product, its price, will be determined by competitive conditions in $t = 3$.

To solve the contracting problem, we proceed by backward induction. Thus, we first solve for competition in the product market, $t = 3$.

3.2. Competition and price

At time 3 there are two firms competing in the market so potential buyers have two alternatives to choose from. We identify the alternative to our reference firm as firm *b*. The amounts of physical and human capital have been pre-

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4. Efficient and effective production requires that workers have the right human capital, capabilities for the job they are assigned, and that they provide the effort required to apply these capabilities. We focus on the first problem, of human capital accumulation, and ignore the additional problem of motivating effort.

viously determined to values K^* and H^*, respectively. Consumers' willingness to pay for each product are $U^* = F(K^*, H^*)$ and U_b respectively. On the other hand, marginal opportunity costs of production are C^* and C_b. The difference between value and opportunity costs determines the wealth created by the firm. It is assumed that the reference firm creates more wealth than firm b:

$$W = F(K^*, H^*) - C^* > W_b = U_b - C_b.$$

This assumption may be justified in that the reference firm employs firm's specific human capital. Specificity limits imitation and replication by rival firms and helps to sustain the competitive advantage. In general it makes economic sense to assume that wealth created by competing firms is an increasing function of the employability parameter λ, $W_b(\lambda)$ increasing with λ, so that full employability implies that the two firms create the same amount of wealth and the competitive advantage is lost, $W_b(1) = W$. To simplify the notation we write W_b or $W_b(\lambda)$ indistinctly.

Buyers will choose the product that gives them a higher consumer surplus (value minus the price they pay). Price is the competition variable firms have to attract buyers. Let P be the price charged by our reference firm and P_b that of firm b. In the equilibrium solution, buyers are indifferent to the offers of the two firms, and no firm has an incentive to change the price (profit-maximizing Bertrand equilibrium). In the equilibrium solution,

$$F(K^*, H^*) - P^* = U_b - P_b^* = U_b - C_b.$$

That is, firm b sets a price equal to its opportunity cost and the reference firm sets a price that makes consumers indifferent to the two alternatives.

The revenues collected by the reference firm are equal to,

$$P^* = F(K^*, H^*) - (U_b - C_b) = F(K^*, H^*) - W_b.$$

Where $W_b = U_b - C_b$ is the wealth created by firm "b". Therefore, the economic rent of the firm is $R^* = P^* - C^* = F(K^*, H^*) - C^* - W_b = W^* - W_b$, while consumers obtain a surplus of $CS^* = F(K^*, H^*) - P^* = W_b$. The total wealth created is $R^* + CS^* = W^*$. The equilibrium solution is summarized in the following proposition [5].

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5. This is a Bertrand competitive solution of the value-based cooperative game, formulated by Branderberger and Stuart (1996). The solution is the same as that given in the original paper,

Proposition 1. In the (Bertrand) competitive equilibrium solution, the reference firm earns a rent equal to the wealth created, over and above the wealth of the competing firm, $R^* = W^* - W_b$; consumers earn a surplus equal to the wealth created by the second most competitive firm in the market, $CS^* = W_b$; all other firms earn a rent equal to zero.

3.3. Resource allocation and bargaining between shareholders and workers at time 2

At time 2, shareholders and workers are endowed with physical and human capital resulting from investment decisions in time $t = 1$. They have to decide how to allocate these resources, taking into account the revenues provided by the competitive process and the opportunity costs of the assets. As just shown, for given values of physical and human capital K^* and H^*, revenues of the reference firm are given by $P^* = F(K^*, H^*) - W_b$. On the other hand, at $t = 2$ the opportunity cost of production is equal to $C = K^* + \lambda H^*$, since the outside value of human capital is determined by its degree of employability.

The allocation of physical and human capital at $t = 2$ takes place in a bargaining environment that leads to the *Nash bargaining solution*. This solution implies that the amount of resources used in production will maximize revenue minus opportunity costs (quasi-rents) and that resulting quasi-rents will be shared by the bargaining parties according to their respective bargaining power. That is, the values of K and H used in production are those that solve the problem,

$$Max\ P^* - C = F(K, H) - W_b - C = F(K, H) - K - \lambda H - W_b$$
$$K \leq K^*,\ H \leq H^*.$$

The optimal solution is $K = K^*$ and $H = H^*$ [6]. Then, each party receives a pay-off equal to the pay-off in the outside option, plus a share of the

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but is obtained from a straightforward competition model that departs from cooperative game theory approaches to the problem. The model implicitly assumes that separate collaboration between customer and shareholder, and customer and worker, will generate output of value equal to zero.

6. Recall that W_b is a constant and that λ is a parameter between zero and one. Under first best decision on K and H at time 1, the values of K^* and H^* would be determined by the first order conditions $F_K' = 1$ and $F_H' = 1$. On the other hand, the first order conditions of the problem in time 2, ignoring the resource availability constraints, are $F_K' = 1$ and $F_H' = \lambda$. Since λ is less or equal to one, the constraint will always be binding and therefore the optimal solutions are K^* and H^*.

optimal quasi-rent that varies with their bargaining power. If collaboration breaks down in $t = 2$, workers will get away with human capital of value λH^*, independently of whether or not they finance the investment, since shareholders cannot claim property rights over the workers. Once the investment is made, λH^* is also the opportunity cost of the human capital in the current allocation. Shareholders claim ownership of physical assets and the outside value of the investment is K^* (since we assume physical assets are general). Therefore, the Nash equilibrium pay-offs are given by,

$$GB \ (K^*, H^*) = K^* + (1 - \alpha) \ (F \ (K^*, H^*) - K^* - \lambda H^* - W_b).$$
$$GS \ (K^*, H^*) = \lambda H^* + \alpha \ (F \ (K^*, H^*) - K^* - \lambda H^* - W_b).$$

For shareholders and workers respectively.

3.4. Investment decisions at $t = 1$

The investment decision at $t = 1$ will maximize net pay-off, the gross determined at $t = 2$ minus the cost of the investment. The later will in turn depend on who finances the investment.

a) **Workers are the single owners of all the assets, both physical and human capital**. Single ownership avoids bargaining and the owner, workers in this case, collects all revenues, P^*. Therefore, assuming an interest rate of zero, discount factor of one, the net income of workers at $t = 1$ will be,

$$R^* = F \ (K^*, H^*) - W_b - K^* - H^*.$$

The optimal, rent-maximizing values of physical and human capital will satisfy the respective first order conditions of marginal productivity, F'_H, F'_K, equal to marginal cost of production (in this case 1 for the two resources by assumption). This is also the total welfare maximizing solution, confirming that single ownership of physical and human capital, if feasible, assures socially efficient investment decisions in physical capital and knowledge. Professional partnerships and workers cooperatives, where labor *hires* capital would be examples of legal forms of firms where partners and workers, respectively, are single owners of all assets of the firm. The relevance of exploring other financing and ownership alternatives comes from the possibility that workers financial constraints make necessary the involvement of external shareholders to finance the investment (we ignore

here other collective action problems that may create inefficiencies in these types of firms as discussed in Jensen and Meckling (1979) and Hansmann (1996).

b) **Shareholders finance both investments.** Shareholders will own the physical assets and will decide how and where to use them, but they cannot properly own the human capital. In making the decision at time 1, shareholders take this restriction into account that will affect the solution to the bargaining problem at time 2. Remember that the contract between workers and shareholder at $t = 1$ is incomplete, which means that the terms of the exchange will be under dispute in the future.

From the bargaining solution at $t = 2$ obtained above, the net profit at $t = 1$ of shareholders that finance both physical and human, capital is given by,

$$B (K^*, H^*) = GB (K^*, H^*) - K^* - H^* = (1 - \alpha) \ (F (K^*, H^*) - K^* - \lambda H^* - W_b) - H^*.$$

Shareholders will choose values of K^* and H^* that satisfy the first order conditions,

$$F'_K = 1. \tag{3.1}$$
$$F'_H = (1 + (1 - \alpha) \ \lambda) \ / \ (1 - \alpha). \tag{3.2}$$

Proposition 2. Shareholders' finance of both physical and knowledge capital imply under- investment in the two forms of capital and lower total welfare, compared with first best results, except in the particular cases of $\alpha = \lambda = 0$.

Equation (3.1) indicates that shareholders invest, in physical assets, an amount for which marginal productivity is equal to marginal cost of 1; this is a first best optimal condition. The result of under-investment in human capital, relative to the first best value, comes from (3.2) and the fact that the effective marginal cost of human capital for the shareholder is $\lambda \ + (1/(1 - \alpha))$, greater than 1 for general values of λ and α, and from F'_H being a decreasing function in H. When physical and human capital are complements in the production function, the marginal productivity of physical capital increases with the amount of human capital invested and therefore under-investment in human capital implies under-investment in physical capital too.

The right hand side of (3.2) will be equal to 1, that is it will be equal to the marginal production cost of H, only if $\alpha = \lambda = 0$: that is, when sharehold-

ers hold all bargaining power and human capital is fully specific. Zero bargaining power of workers is not sufficient to protect the value of the investment, since shareholders cannot claim property of the investment in knowledge underlying workers' human capital, nor can they prevent workers from leaving the firm to collect the outside value of such capital. Only when this outside value is also equal to zero will the effective marginal cost of H be equal to 1 for the shareholder, and the first best solution will be achieved.

c) **Workers finance the investment in human capital and shareholders invest in physical capital**. It is straightforward to see that the decision on physical investment is the same as in *b)* so we shall focus on the human capital decision.

The workers' pay-off at time 2 is the same as when shareholders finance the investment, $GS\ (K^*,\ H^*) = \lambda H^* + \alpha\ (F\ (K^*,\ H^*) - K^* - \lambda H^* - W_b)$. Their net pay-off at time 1, when the investment decision is made, takes into account that workers finance the investment in human capital, that is,

$$S\ (K^*,\ H^*) = \lambda H^* + \alpha\ (F\ (K^*,\ H^*) - K^* - \lambda H^* - W_b) - H^*.$$

The first order condition with respect to H^* is given by,

$$F'_H = (1 - (1 - \alpha)\lambda)/\alpha. \tag{3.3}$$

Proposition 3. The solution where workers finance investment in knowledge and shareholders finance investment in physical capital implies under-investment in the two forms of capital and lower welfare, compared with first best results, except for values of the parameters, $\alpha = 1$ or $\lambda = 1$.

The under-investment result comes from the effective marginal cost of H being greater than 1 for values of α or λ lower than 1. It is easily seen that the effective marginal cost of human capital is equal to 1 when either $\alpha = 1$ or $\lambda = 1$. Even though (3.1) continues to hold, under-investment in K is explained by complementarities with H. When workers finance the human capital and decide how much to invest in knowledge, the first best investment decision requires only one of the two conditions to be satisfied: either workers have all the bargaining power and collect all the extraordinary profits from the transaction, or human capital is fully general and its outside value assures at least a competitive return for the investment. Again, in the latter case, to invest in general human capital implies that, at time 2, the resource allocation decisions

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are made under similar conditions as at time 1, since the opportunity cost of human capital is now H before and after the investment is made.

3.5. The financing decision

The criterion to determine who will finance the investment in knowledge at $t = 0$ is total welfare maximization. That is, the investment will be financed by the party whose decision implies the creation of higher total wealth.

Proposition 4. Wealth created is maximized if workers finance the investment in knowledge when $\alpha \geq \alpha^c = (1 - \lambda)/(2 - \lambda)$ and shareholders finance the investment otherwise.

To prove this result, notice that from concavity of $F(\ )$ on $H,$ total wealth increases with higher values of H^* as long as $H^* < H^{**}$ (first best). Equation (3.1) gives the marginal productivity equal to marginal cost condition for physical capital, the same for all finance-investment alternatives. The left hand side of equations (3.2) and (3.3) gives the marginal productivity of human capital under shareholders finance, and under workers finance. Since marginal productivity has the same functional form in the two cases, we concentrate on the comparison in effective marginal costs of human capital: To maximize wealth created is equivalent to choosing the finance-investment alternative that gives the minimum effective marginal costs. Therefore, from (3.2) and (3.3) the effective marginal cost of human capital is lower under worker finance than under shareholder finance if

$$(1 - (1 - \alpha)\,\lambda)/\alpha \leq (1 + (1 - \alpha)\,\lambda)/(1 - \alpha). \tag{3.4}$$

Arranging the terms of the inequality, we find that (3.4) is equivalent to $\alpha \geq (1 - \lambda)/(2 - \lambda)$. The rest of the proposition follows immediately.

For a given value of the employability parameter λ wealth created is higher if workers (shareholders) finance the investment in knowledge when their bargaining power α $(1 - \alpha)$ is relatively high. For a given bargaining power wealth created is higher if workers (shareholders) finance investment in knowledge when employability is relatively high (low). Graphic 3.1 shows the combinations of the two parameters that determine the optimal financing decision. Since the minimum value of λ is 0, i.e., human capital fully specific, the maximum value of the bargaining parameter α for which it is desirable that shareholders finance human capital is ½; for values of bargaining power of workers higher than ½, wealth maximization will always re-

GRAPHIC 3.1: **Combinations of parameter that determine the second best optimal investment decisions on knowledge from the condition $\alpha \geq (1 - \lambda)/(2 - \lambda)$**
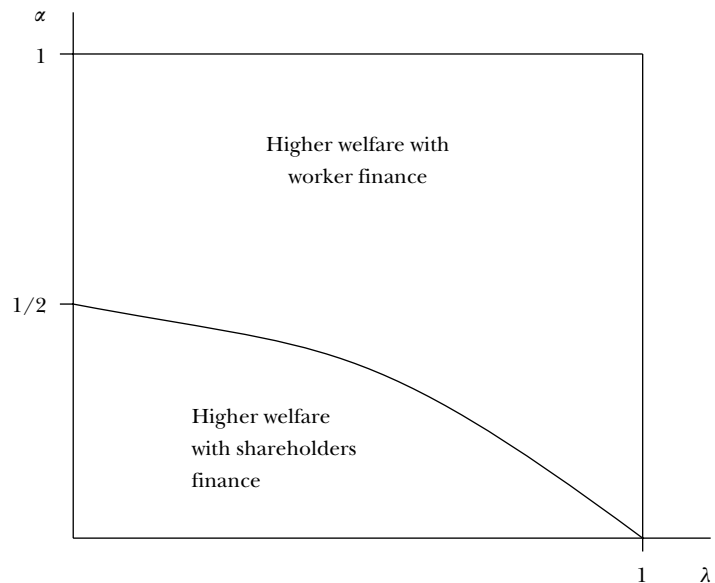
commend that workers finance the investment in knowledge. When shareholders finance all investments it is never second best optimal that workers have more power than shareholders, which makes economic sense since otherwise it would mean that those who pay for all the assets are in a weaker position than those that do not pay anything. On the other hand in situations where workers are the most powerful party in the transaction then it makes economic sense that they pay for the investment in knowledge.

It can be shown that when condition (3.4) is satisfied and workers finance the investment in knowledge their net pay-off is higher than the pay-off (profits) of shareholders if they had financed the investment. When condition (3.4) is reversed and shareholders finance the investment their profits are higher than the pay-off of workers if they had financed the investment. Therefore, a decentralized rule saying that the party who finances the investment in knowledge is the one who obtains higher net pay-off from the decision will implement the second best welfare condition given by equation (3.4) [7].

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7. To make sure that the decentralized solution works it must be true that when welfare maximization recommends that workers (shareholders) finance the investment in knowledge, shareholders (workers) earn higher profits under workers (shareholders) finance than the profits earned if they would finance the investment. We restrict the analysis of the paper to situations where these conditions hold, to keep its length within reasonable limits. The decentralized decision rule would be incentive compatible if parties could engage in side payments at $t = 0$.

4. Organizational and Strategic Choices

4.1. Shareholders' incentives to share power with workers

Workers' bargaining power can be given by factors external to the contracting parties; for example, the existence of organized trade unions, legal impositions on workers' representation in the governance bodies of firms, as happens with German co-determination laws, etc. Or it can be agreed by the parties as a way to improve wealth created. In this section, we explore the enlightened self-interest of shareholders to empower workers with higher bargaining power.

Proposition 5. When shareholder finance the investment in knowledge, the profit maximizing value of the empowerment parameter is zero. If workers finance the investment, shareholders prefer nil empowerment of workers if human capital is general, and positive empowerment if human capital is specific.

Proof. It is clear from (3.2) that, when they finance the investment, shareholders will never want to increase workers' bargaining power. But when workers finance the investment, shareholders weight the positive effect of empowerment on the incentive to invest, with the negative effect on the profit they get from the bargaining solution. Formally, the shareholders' problem is as follows.

$$
\underset{\alpha}{Max}\, B\,(K,\,H) = GB\,(K,\,H) - K = (1 - \alpha)\,(F\,(K,\,H) - K - \lambda H - W_b)
$$

$$
Subject\ to\ \underset{K}{Max}\, B\,(K,\,H) = (1 - \alpha)\,(F\,(K,\,H) - K - \lambda H - W_b)
$$

$$
\underset{H}{Max}\, S\,(K,\,H) = \lambda H + \alpha\,(F\,(K,\,H) - K - \lambda H - W_b) - H
$$

(P1)

Let $K^*(\alpha, \lambda)$, $H^*(\alpha, \lambda)$ be the values of K and H that solve the first order conditions on K and H. Substituting in the objective function, the first order interior conditions with respect to α are,

$$(1-\alpha)\ (F'_H - \lambda)\ H'_\alpha = F(K^*, H^*) - K^* - \lambda H^* - W_b.$$

From the first order conditions of optimal K and H it happens that $F'_K = 1$ (equation (3.1)) and $F'_H = \lambda + (1 - \lambda)/\alpha$ (equation (3.3)). Performing comparative static analysis in the first order conditions gives $H'_\alpha = ((1 - \lambda)/\alpha^2)(- F''_K/(F''_H F''_K - (F''_{KH})^2))$, where $F''_H F''_K - (F''_{KH})^2 > 0$ from the condition that the pay-off function is strictly concave (interior solution). Substituting in the previous equation, the value of α, preferred by the shareholders, satisfies the condition,

$$(1 - \alpha)(1 - \lambda)^2/\alpha^3 = - ((F''_H F''_K - (F''_{KH})^2)/F''_K)$$
$$(F(K, H^*) - K^* - \lambda H^* - W_b). \qquad (4.5)$$

The right-hand side is positive (remember that $F(\ )$ is concave and $(F''_H F''_K - (F''_{KH})^2) > 0$) for positive values of H^* so the left-hand side has also to be positive. A necessary condition for H^* positive when $\lambda < 1$ (equation (3)) is $\alpha > 0$. Therefore, shareholders will choose a positive value of the bargaining power parameter, but lower than 1 because for $\alpha = 1$ the left-hand side of (4.5) would be equal to zero. For $\lambda = 1$, the left-hand side of (4.5) is zero and the corner solution in this case is $\alpha = 0$. If human resources are fully general, it is in the interest of the shareholder to minimize the bargaining power of workers.

We have implicitly assumed that the socially optimal condition determining that workers finance the investment is satisfied, $\alpha \geq (1 - \lambda)/(2 - \lambda)$. To verify this condition in general is quite complex, and we check if shareholders choose a value of α within the set of socially optimal values with an example that assumes a Cobb-Douglas production function, $U = 27K^{1/3}H^{1/3}$.

Solving for the optimal values of K and H, and substituting in the objective function, the shareholders' pay off is equal to (assuming $W_B = 0$ with no loss of generality),

$$B(\alpha, \lambda) = \alpha(1-\alpha)(2(1-\lambda) + \alpha\lambda)/(1 - \lambda + \alpha\lambda)^2. \qquad (4.6)$$

When $\lambda = 1$, $B(\alpha, \lambda) = 1 - \alpha$ and the profit maximizing solution is $\alpha^* = 0$. On the other hand, when $\lambda = 0$, $B(\alpha, \lambda) = 2\alpha(1 - \alpha)$ and the profit maximizing value of the bargaining parameter is $\alpha^* = 1/2$. These solutions

GRAPHIC 4.1: **Optimal empowerment $\alpha^*(\lambda)$, continuous line, and critical value of workers' bargaining power so that it is socially efficient for workers to finance the investment in human capital, $\alpha_c = (1 - \lambda)/(2 - \lambda)$, dotted line**
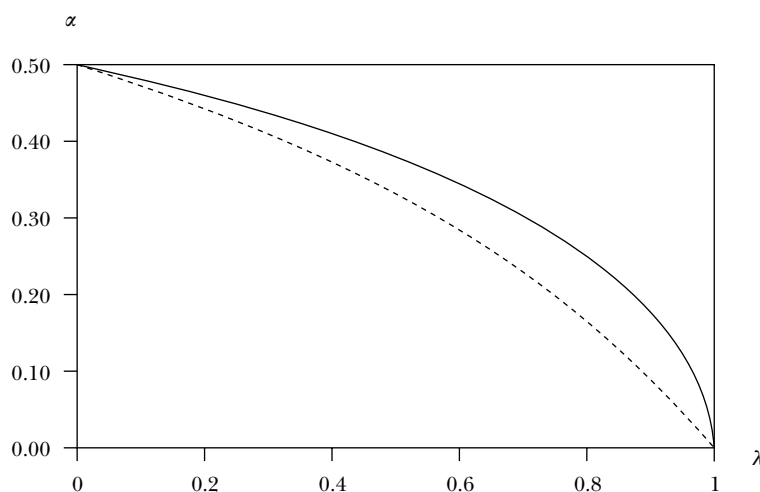
are consistent with the general results obtained above. The first order conditions of the profit maximizing problem give a cubic function of α, the decision variable, with two imaginary and one real solutions. From the latter, we can numerically solve for the optimal value of α as a function of λ. Graphic 4.1 represents the numerical solution. We also plot the value of the bargaining parameter associated with the condition of indifference between workers or shareholders finance, $\alpha_c = (1 - \lambda)/(2 - \lambda)$.

The observation of the figure reveals that the empowerment of workers that maximizes shareholders' profits satisfies the (second best) welfare maximizing condition $\alpha^* > \alpha_c$. Secondly, the level of empowerment preferred by shareholders, when workers finance the investment in knowledge, is decreasing with λ, the extent to which human capital is general: when workers finance the investment preferred by shareholders, profit maximizing, empowerment of workers increases with human capital specificity. Therefore, conditions exist under which shareholders choose a profit maximizing empowerment of workers above the minimum one required to satisfy the second best condition that workers should finance the investment in human capital [8].

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8. Shareholders may face a limit on the empowerment of workers when empowerment correlates with profits and risk sharing and workers are risk-averse. Risk aversion may make workers

4.2. Shareholders' interest in workers' employability

Shareholders also have preferences for the values of λ, the parameter that determines the employability of human capital. The preferred value of λ for the shareholders will be that which solves a problem analogous to (P1), but now the decision variable is λ instead of α. If shareholders finance the investment in knowledge, it is clear from (3.2) that their preferred choice of profit maximization is to minimize employability and choose a value of the parameter equal to zero. However, under workers' finance, shareholders may have an interest in increasing workers employability up to a certain point, since their profits increase as workers' investment in human capital increases. We skip the details and formulate the proposition that summarizes the main findings, which will be corroborated with the illustrative example. For the moment we assume that W_b is independent on λ.

Proposition 6. When shareholders finance the investment in knowledge, their preferred level of workers' employability is $\lambda = 0$ (human capital fully specific). When workers finance the investment, shareholders prefer positive but less than full employability, except for the particular case when they hold all bargaining power, $\alpha = 0$, where they will choose $\lambda = 1$.

Given the production function of the previous illustration solving (4.6) for the optimal λ given α we obtain,

$$\lambda^* = (2 - 3\alpha)/(2 - 3\alpha + \alpha^2).$$

First, notice that for all α, $\lambda^* = (2 - 3\alpha)/(2 - 3\alpha + \alpha^2) > (1 - 2\alpha)/(1 - \alpha) = \lambda_m$, where λ_m is the minimum value of the employability parameter for which it is second best for workers' finance. Therefore, for any value of the bargaining power α, the shareholder always chooses a value of the employability parameter above that which results from the condition that workers should finance the investment in human capital.

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refuse the empowerment offered by shareholders with the intention of providing incentives for their investment and financing the human capital. Workers may prefer to contract, up-front, a fixed salary w in exchange for their collaboration. Given that compensation w cannot be contingent on the value of human capital H by assumption, when workers have to finance the investment in human capital they will rationally choose a value of $H = 0$. To understand this solution, notice that the workers pay-off is $w + \lambda H\text{-}H$, which is maximized at $H = 0$ when $\lambda < 1$. Any investment in human capital must be provided by the shareholders at marginal cost $1 + \lambda$. Shareholders will see whether such investment is competitive, or not, given the situation of other firms in the market.

When $\alpha = 0$, $\lambda^* = 1$; $\lambda^* > 0$ when $\alpha < 2/3$ and $\lambda^* = 0$ when $\alpha \geq 2/3$. Shareholders choose positive values of the employability parameter, up to relatively high values of the bargaining power of workers. When $\alpha = 1/2$ then $\lambda^* = 2/3$ and $\alpha = 0.38$ implies $\lambda^* = 0.856$. These choices are not symmetric with those resulting from choice of α given λ obtained before: $\alpha^* = 1/2$ when $\lambda = 0$ and $\alpha^* = 0.38$ when $\lambda = 1/2$.

It can be shown that, for this illustration, the shareholders pay-off is higher for the choices of optimal λ given α than vice-versa. For example, for $\alpha^* = 0.38$ and $\lambda = 1/2$ the pay-off is 0.589, while for $\alpha = 0.38$ and $\lambda^* = 0.856$ the pay off is 0.657. In this illustration, shareholders will prefer to choose the employability parameter for a given bargaining power, rather than choosing the bargaining power for a given employability. We do not know, however, if this is a general result that can be extended to all functional forms or not [9].

When we turn to the general case of $W_b(\lambda)$ increasing with λ the conclusions are likely to change. As employability increase so it does the wealth created by competing firms and for this reason the competitive advantage of the reference firm is reduced. Shareholders (and workers) will be concerned about this competitive effect of employability in making decisions that affect such employability. The shareholders' trade-off in the choice of the employability parameter is straightforward from the solution to (P1) when W_b is substituted by $W_b(\lambda)$. The first order conditions will include the term $(1 - \alpha) W'_b(\lambda)_\lambda$; this means that higher employability of human capital implies a transfer of wealth created to customers since now competing firms are able to offer products that are closer substitutes to those of the reference firm (its competitive advantage is reduced for the benefit of customers). The benefits of employability in terms of higher incentives for workers investing in knowledge must be weighted against the loss of quasi-rents if higher employability also implies lower competitive advantage.

4.3. Shareholders' commitment by choice of the legal form of the firm

Blair and Stout (1999, 2005) explicitly claim that in production set ups where physical capital provided by the shareholders and resources provided by other contracting parties are complementary (team production) it may be

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9. In the particular case that shareholders can choose empowerment and employability, the profit maximizing solution when workers finance the investment in human capital is no empowerment, $\alpha = 0$ and full employability, $\lambda = 1$.

in the interest of shareholders to commit the physical capital (lock it into the firm) in order to stimulate the (specific) investment of the other interested parties. Blair (2004) argues that, in the Anglo-Saxon legal environment, to choose the public corporation as a legal form of the firm indicates that shareholders voluntarily commit to restrict the discretional disposal of the assets of the firm to their private benefit. Those shareholders who do not want to make the commitment, and prefer having more discretion in disposing of the assets that legally belong to the firm, will choose other legal forms, different from the public corporation. Asher, Mahoney and Mahoney (2005) and Grandori (2005) draw important managerial implications from these proposals. However no formal prove of this conjecture is provided.

The model assumes that physical capital is general and its outside value is always equal to production cost of the capital. To commit the capital to the firm can be interpreted in terms of shareholders voluntarily lower ex ante the outside value of the firm, that is to make physical capital firm specific. Blair suggests to do so by choosing a particular legal form for the firm. Consider the case where workers finance the investment in knowledge and shareholders finance the physical capital. Let μ between 0 and 1 represent the specificity parameter of the physical assets resulting from legal constraints at their disposal, decided by the shareholders. If $\mu = 1$ this will imply that shareholders can dispose of all the assets of the firm if collaboration breaks down. If the break down occurs and $\mu = 0$, then all the assets would be left in the firm. It can be assumed that, in this case, the assets remaining will be shared among the rest of the interested parties.

The effective cost for the shareholders of one unit of the assets they finance, in time 1, changes from $(1 - \alpha)$ in the initial model with no commitment, to $((1 - \alpha) + (1 - \mu) = 2 - \mu - \alpha)$ with commitment; the case we initially solved is a special case of the new one with $\mu = 1$. To commit the physical capital results in an increase in the cost of the input equal to $(1 - \mu)$. Simple algebra shows that to choose a value of $\mu < 1$ implies lower profit maximizing investment in physical capital by shareholders, and lower investment in knowledge by the workers, than that obtained with no commitment. The total wealth created also decreases, compared to that obtained under conditions of no commitment. Any private or social benefit of shareholders' commitment, as proposed by Blair and Stout, described, will have to do with other consequences.

For example, commitment is a tool that shareholders may use to increase the likelihood that the workers' participation constraint will be satisfied in case of uncertainty in the output. For illustrative purposes, assume that there is an externally-determined probability p that the collaboration

will continue in time 2, and a probability of $1 - p$ of termination. This uncertainty lowers the workers expected rent from the human capital investment, which now is equal to $S^1(K, H) = \lambda H + p\alpha (F(K, H) - K - \lambda H) - H$, when $\mu = 1$. It could happen that the expected value of compensation $SN^1(K, H)$ is either negative or implies a negative certainty equivalent when workers are risk-averse, in such a way that workers would refuse to collaborate. If shareholders would commit an amount μK of the investment in the benefit of the workers when collaboration terminates, then workers' expected rent will be [10] $S^1(K, H) + (1 - \mu) K$. When $\mu < 1$ the expected pay-off increases, as does the incentive of workers to collaborate. The legal form of the firm converts the physical capital to collateral of human capital investments.

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10. If external risk of termination can be separated from termination forced by the workers in the bargaining process, then expected workers compensation under commitment would be $SN^1(K,H) + p(1-\mu) K$, assuming that shareholders give μK to workers only if termination occurs due to external causes. Shareholders would receive $B^1 = (1-p(1-\mu)) K + p(1-\alpha)(F(K,H) - K - \lambda H) - K$. The increment in effective cost of investment for shareholders will be $(1-p)(1-\mu)$, and investment will increase, as will welfare and profits.

5. Choice of the Governance Form

THIS section will explore the welfare implications of the choice of the governance form in the contracting problem presented in the previous sections. The exposition will compare existing or proposed governance forms that match with hierarchical, bilateral and trilateral governance models.

Hierarchical governance implies that residual decision rights to close incomplete contracts will be allocated to one of the parties participating in the transaction; in our case either to workers or to shareholders. It is straightforward from the previous exposition that if those who finance the investment hold strong ownership rights (so that the party that finance the investment can prevent others from making decisions on the asset) *and* strong cash flow rights (full appropriation of ex post cash flows) then the allocation of decision rights to workers or shareholders makes no difference in inducing first best welfare maximizing investment decisions on firm specific assets. On the other hand, if shareholders have weak ownership rights (they can not prevent workers to leave the firm and take with them the human capital acquired from investment in knowledge financed by shareholders) and weak cash flow rights (so workers have bargaining power and capture a fraction of the firm's quasi rents) then shareholder' finance of the investment in knowledge will induce sub optimal investment decisions in knowledge and in related complementary assets. Workers hierarchical governance, such as that implemented through the cooperative or partnership legal form of the firm, will produce efficient knowledge specific investment decisions when workers have no financial constraints and have full cash flow rights (for example by renting the capital services from the market). If knowledge transforms into general human capital, then workers financing the investment in knowledge always gives first best investment decisions.

However, in situations where workers are financially constrained, there are concerns on optimal risk allocation and when renting markets for capital service are imperfect (so investors have to have control rights over the use of the physical assets to prevent expropriation) financial investors will have to continue being active holders of decision rights in the knowledge

intensive corporation. In this scenario shareholders will have incentives to share cash flow rights with workers when these workers finance the investment in knowledge (and shareholders the investment in other tradable assets) and resulting human capital is firm specific. But shareholders may have enlightened self-interests in going beyond sharing cash flow rights and give workers participation rights, for example by nominating workers' representatives in the board of directors.

The reason is that, ex post, it is in the interest of the shareholders to make decisions that reduce the employability of workers: Once the investment in human capital is made a marginal reduction in the value of λ implies an ex post gain (loss) for shareholders (workers) of $(1-\alpha)$ H^*. If workers anticipate that shareholders will make ex post decisions that will reduce the outside value of their investment in knowledge then they may refuse ex ante to finance such investment. Shareholders must credibly commit to leave unchanged the employability of workers from that which is anticipated when making the ex ante investment decisions. If such commitment is infeasible shareholders may give workers ex post decision power in key strategic and organizational decisions with consequences for the outside value of human capital. Nominating workers representatives in the board of directors would be one way to empower workers and prevent ex post opportunistic behavior by shareholders (Osterloh and Frey, 2006).

The hierarchical shareholders oriented governance form of today's capitalist firm may then naturally evolve into a *bilateral governance* form where workers and shareholders share ownership and cash flow rights, in proportions dictated by the interests of shareholders who manage the transition from their privileged initial position in established firms. Since the governance form affects wealth creation, for a given production technology, and wealth creation is a source of competitive advantage, stronger product market competition may force shareholders to speed up the transition to avoid unrecoverable losses in competitive positions.

Balanced bilateral governance is in fact legally enforced by the German co-determination system and is close to the consensus approach to decision making that has characterized the Japanese firm for many years. In our model this means that firms in these countries have to make decisions within an institutional framework that limits shareholders ownership rights (workers have half of the seats in the board of directors) and possibly also cash flow rights (in Japan workers have compensation tied to the evolution of profits of the firm, while in Germany collective bargaining is centralized to the industry and country level so workers' salaries are not tied too much to the profits of the employing firm). When bilateral governance implies

high values of α, the model shows that profit maximizing shareholders will have lower incentives to invest in knowledge unless the resulting human capital is fully specific (for α equal to ½ shareholders finance of the investment in knowledge is efficient only when the outside value of human capital is zero). In Japan and Germany investment to produce firm specific human capital has been financed by firms (with funds that otherwise would have been paid as dividends) and government subsidized. So not surprisingly external labour markets have been traditionally quite inactive in Japan and in German, with life employment for workers specially those employed in large firms.

A closer look to the model also tells us about the importance of coherent institutional choices to preserve the overall competitiveness o a particular economy. The model shows that different combinations of two key parameters, workers bargaining power and degree of human capital specificity, can give similar results in terms of wealth creation, when properly combined. For example, shareholders finance of the investment in knowledge with balanced bargaining power ($\alpha = 1/2$) and highly specific human capital ($\lambda = 0$), gives, second best, investment decisions similar to that of workers' finance with low empowerment ($\alpha = 1/4$) and relatively low human capital specificity ($\lambda = 2/3$). The first combination of parameters is that one would expect to dominate in Germany and Japan, while the second is probably close to the dominant institutional environment for US firms.

The third governance model proposed for the modern firms is that where the board of directors is converted into a board of trustees (Blair, 2004; Blair and Stout, 1999, 2005). The board now is composed of outsiders, with no direct or indirect interest in the firm, who receive the mandate to make decisions that maximize total wealth created. The proposal would then fall into the class of *trilateral governance* solutions. Shareholders and workers would now accept that all decision rights are held by the trustees so there is no room for bargaining in Stage Two; all parties will accept the decisions made by the board of trustees including its proposal about the allocation of quasi rents. If the system works as expected at Stage Three the trustees will induce managers to make competitive pricing decisions similar to those that are part of the equilibrium solution above. At Stage Two the decision will continue to be the same as above: the trustees will allocate the services from given human and physical capital to maximize the ex-post wealth appropriated by the firm. What changes here is the way quasi rents are allocated between workers and shareholders. The trustees will choose an allocation that induces efficient investment decisions in Stage One, taking into account which party finances such investment. For example, if workers

finance the investment in knowledge and shareholders the investment in physical capital then the board may assign shareholders and workers the pay-offs,

$$GB = K + b \ (F \ (K, \ H) - K - H - W_b).$$
$$GS = H + (1 - b) \ (F \ (K, \ H) - K - H - W_b).$$

Where b is a parameter between 0 and 1 which may be chosen under criteria of fairness in the distribution of surplus. At Stage One shareholders (workers) choose $K \ (H)$ that maximizes $B = GB - K = b \ (F \ (K, \ H) - K - H)$ $(S = (1 - b) \ ((F \ (K, \ H) - K - H))$, which implies choosing the first best values of K^{**} and H^{**} (those for which marginal productivity equal marginal cost of 1). So the trilateral governance system can give the first best result if it behaves as expected.

The first issue raised by the implementation of the trilateral governance is how to make sure that trustees will have the proper incentives to make welfare-maximizing decisions, especially taking into account the difficulties for finding an incentive system that drives board decisions towards this objective (Tirole, 2001). This will be even more complicate when the board of trustees has to introduce fairness as well as efficiency considerations in making decisions. For example the problem above shows that customers are also part of the list of stakeholders of the firm because they obtain a positive share of total wealth created. The model assumes that customers protect their interests through the opportunities to choose offered by product market competition. But consider a case with no competition so $W_b = 0$. Should the board of trustees make proposals on wealth allocation that imply a positive surplus for the consumers, or should care only about workers and shareholders?

Second, the proposal does not specify who will appoint the trustees. One possibility is that the shareholders who decide to go public, and list the firm on the stock market, nominate the first board of trustees and, after that, the board itself makes all future nominations. But now, the question is how to make sure that the owner/shareholder who decides to go public will choose the board with the criteria of maximum wealth, rather than the criteria to maximize the share price. Codes of good governance recommend that boards of listed firms should have a majority of independent directors to protect the interests of minority shareholders. The substitution of current boards of directors by boards of trustees will require replacing independent directors by trustees, and replacing the mandate of share value maximization with that of total welfare maximization. To find trustees motivated to act for the benefit of all stakeholders is not expected to be easier than

finding independent directors ready to protect the interests of all shareholders.

In addition to changes in formal governance structures, firms can rely on implicit contracts to protect the stakes of interested parties and foster ex-ante investments. At times 0 or 1 of the model, workers and shareholders can agree on certain conditions under which to conduct future transactions, although they are not legally protected by an explicit contract. Implicit contracts create conditions for sharing rents and protecting ex-ante investments, but also create incentives for wealth transfer, which must be accounted for. For example, new shareholders who join the firm through a public offer, or through a merger, may not feel obligated by the implicit contracts of previous shareholders (Shleifer and Summers, 1988). For this to be a feasible solution, trust between workers and shareholders may require additional restrictions such as blocking the exit of current shareholders. In situations where the investment is observable but not verifiable, implicit contracts can be used to agree on the amount of investment shared by workers and shareholders, in line with solutions to the hold-up problem proposed by Becker (1975).

6. Conclusion and Extensions

THE evolution form the industrial to the knowledge-based society has risen the logical concern for the question of whether existing governance systems of firms, which are rooted in the physical capital intensive industrial firm, are effective for governing the knowledge intensive one. All this at the time when markets expand in size and geography, industries vertically disintegrate and product market competition increases. This paper presents a focused contracting problem between workers and shareholders intended to highlight the issues under debate and clarify the possible consequences of proposed governance reforms. The results suggest that we may observe an increasing trend towards workers oriented hierarchical governance systems in line with higher involvement of workers in financing the investment in knowledge intensive assets, specially in activities with low physical capital intensity or when there is an active rental market for capital services. Removing workers' financial constraints and improving the markets where workers can transfer the risks of concentrating their wealth in human (and some times also physical) capital in the same firm, will be welfare improving institutional developments in the knowledge intensive economy, since they will foster workers' controlled efficient hierarchical governance forms.

When financial constraints and risk allocation concerns will require the presence of shareholders financing investments and sharing the risks, the issue of who should finance the investments will continue to be a relevant question as long as shareholders ownership rights over the human capital resulting from investment in knowledge continue to be weak and market employability of workers increases. If workers contribute to finance a large portion of the investment in knowledge, while shareholders finance the rest together with physical capital, then the expected trend is towards a more balanced governance system with workers and shareholders sharing ownership and cash flow rights for better protecting the rents from their respective investments and this way to increase the incentives to undertaken them. Shareholders have enlightened self interests in collaborating in the transition from the hierarchical shareholder oriented governed firm, towards the bilat-

erally governed one. More uncertain appears the diffusion of trilateral governance forms such as those where boards of directors become boards of (altruistic) trustees.

The model presented also predicts that in the old firm described by Rajan and Zingales shareholders had incentives to invest in specific human capital as needed, but in the new firm such incentives may disappear. It could happen that technological developments that increased the outside value of human capital broke up a status quo of low λ (high firm specific capital) and moderate α (workers sharing part of the quasi rents of the old firm). In the new scenario of higher employability of workers the position of the shareholders will be worsened because workers will increase the pay off, for a given value of α. It is likely that, to restore the equilibrium, shareholders will pressure managers to lower the bargaining power of workers or to move production to places with weaker trade unions. These responses of corporations to higher outside value of invested human capital may have turn out to give the desired result since in recent years the share of salaries in total GDP of developed countries has decreased or remained unchanged.

Off course other business strategies are possible. One way the new firm has to protect the rents of shareholders and workers in developed countries, is to produce highly innovative and highly differentiated products, that more than compensate the increase in W_b by competing firms that outsource production to countries with cheaper labor but similar product quality. The high-value moderate-cost strategy will require high investment in firm specific knowledge and related intangible assets (information technology, flexible organization). However to create internal conditions in the firm that make λ sufficiently low so that shareholders have incentives to finance the investment in knowledge, may be a difficult task, even at the low values of bargaining power of workers that we observe today. Workers may have to be involved in financing the investment in knowledge or, alternatively, public authorities may be forced to heavily subsidize it. These managerial implications of our results should be of interest for research on conditions that affect wealth creation and wealth appropriation and in turn the competitive advantage of firms (Barney, 1986, 2005; Lippman and Rumelt, 2003; MacDonald and Ryall, 2004). So far these papers have ignored the implications of wealth sharing for the ex ante investment decision in strategic resources.

The diversity of contracting situations that may occur depending upon the actual values of the parameters of the model, make very difficult to propose regulatory changes in corporate governance to improve welfare relative to the second best results documented in the paper. Better legal

protection of property rights for those who finance the investments continue to be an issue specially when shareholders finance the investment. When this protection is infeasible public subsidies and public finance of investment in knowledge may be worthwhile to consider, although this topic has been left out of the analysis of the paper.

The paper can be extended in several directions. One of them is making explicit the uncertainty of output and rents and allowing for risk averse workers. The workers' participation constraint, and possibly the investment behavior for those who accept to participate, are expected to change. The exposition above has hinted towards possible responses of workers when they have to assume risks, but the formal analysis would provide more rigorous results. Another extension is to allow for knowledge and non knowledge workers and examine the choice of governance mechanisms in such circumstances. Finally, a more realistic model of contracting would combine investment decisions with workers unobservable effort decisions in future production activities, so efficient contracting will have to address hold up and moral hazard problems at the same time.

References

Aoki, M. (1990): "Towards an Economic Theory of the Japanese Firm", *Journal of Economic Literature*, 28, 1-27.

Arrow, K. (1962): "Economic Welfare and the Allocation of Resources to Invention", in Richard R. Nelson (ed.), *The Rate and Direction of Inventive Activities*, Princeton University Press, Princeton.

Asher, C., J. M. Mahoney and J. T. Mahoney (2005): "Towards a Property Rights Foundation for a Stakeholder Theory of the Firm", *Journal of Management and Governance*, 9, 5-32.

Baker, G., R. Gibbons and K. Murphy (2002): "Relational Contracts and the Theory of the Firm", *Quarterly Journal of Economics*, 117, 39-83.

Barney, J. B. (1986): "Strategic Factor Markets: Expectations, Luck, and Business Strategy", *Management Science*, 32, 1231-1241.

— (2005): "Should Strategic Management Research Engage in Public Policy Debates?", *Academy of Management Journal*, 48, 945-948.

Becker, G. (1975): *Human Capital. A Theoretical and Empirical Analysis with Special Reference to Education*, New York, Columbia University Press.

Blair, M. (2004): "Reforming Corporate Governance: What History Can Teach Us", *Berkeley Business Law Journal*, 1, 1-44.

— and L. Stout (1999): "A Team Production Theory of Corporate Law", *Virginia Law Review*, 65, 247-328.

— and L. Stout (2005): "Specific Investment: Explaining Anomalies in Corporate Law", *UCLA School of Law, Research Paper Series*, 05-27.

Branderberger, A. and H. Stuart, Jr. (1996): "Value-Based Business Strategy", *Journal of Economics and Management Strategy*, 5, 5-24.

Grandori, A. (2005): "Neither Stakeholder Nor Shareholder 'Theories': How Property Right and Contract Theory Can Help in Getting out of the Dilemma", *Journal of Management and Governance*, 9 (1), 41-46.

Grant, R. (1996): "Towards a Knowledge Based Theory of the Firm", *Strategic Management Journal*, 17, 109-122.

Grossman, S. and O. Hart (1986): "The Costs and Benefits of Ownership: A Theory of Lateral and Vertical Integration", *Journal of Political Economy*, 94, 691-719.

Hall, R. and E. Lazear (1984): "The Excess Sensitivity of Layoffs and Quits to Demand", *Journal of Labor Economics*, 2, 233-257.

Hansmann, H. (1996): *The Ownership of Enterprise*, Cambridge, Harvard University Press.

HART, O. (1995): *Firms, Contracts and Financial Structure,* Oxford, Clarendon Press.

— and B. HOLMSTROM (1987): "The Theory of Contracts", in T. Bewley, *Advances in Economic Theory: Fifth World Congress,* Cambridge, Cambridge University Press, 71-155.

— and J. MOORE (1990): "Property Rights and the Theory of the Firm", *Journal of Political Economy,* 98, 1119-1158.

HASHIMOTO, M. (1981): "Firm-Specific Capital as a Shared Investment", *American Economic Review,* 71, 475-482.

HOLMSTROM, B. and S. KAPLAN (2003): "The State of US Corporate Governance: What's Wright and what's Wrong?", NBER WP 9613, April.

JENSEN, M. and W. MECKLING (1979): "Rights and the Production Function: An Application to Labor-Managed Firms and Codetermination", *Journal of Business,* 52, 469-506.

KLEIN, B., R. CRAWFORD and A. ALCHIAN (1978): "Vertical Integration, Appropriable Rents and the Competitive Contracting Process", *Journal of Law and Economics,* 21, 297-326.

KOGUT, B. and U. ZANDER (1996): "What Firms Do? Coordination, Identity and Learning", *Organization Science,* 7 (5), 502-518.

KREPS, D. (1996): "Markets and Hierarchies and (Mathematical) Economic Theory", *Industrial and Corporate Change,* 5, 561-591.

LIPPMAN, S. A. and R. P. RUMELT (2003): "A Bargaining Perspective on Resource Advantage", *Strategic Management Journal,* 24, 1069-1086.

MACDONALD, G. and M. D. RYALL (2004): "How Do Value Creation and Competition Determine Whether a Firm Appropriates Value?, *Management Science,* 50, 1319-1333.

MALCOMSON, J. M. (1997): "Contracts, Hold-Up and Labor Markets", *Journal of Economic Literature,* 35, 1916-1957.

OSTERLOH, M. and B. FREY (2006): "Shareholders Should Welcome Knowledge Workers as Directors", Working Paper 283, Institute for Empirical Research in Economics, University of Zurich.

PAGANO, M. and P. VOLPIN (2005): "Mergers, Workers and Corporate Control", *Journal of Finance,* 60, 841-868.

PRENDERGAST, C. (1993): "The Role of Promotions in Inducing Specific Human Capital Acquisitions", *Quarterly Journal of Economics,* 108, 523-534.

RAJAN, R. and L. ZINGALES (1998): "Power in the Theory of the Firm", *Quarterly Journal of Economics,* 113, 387-432.

— and L. ZINGALES (2000): "The Governance of the New Enterprise", in X. Vives (dir.), *Corporate Governance: Theoretical and Empirical Perspectives,* Cambridge, Cambridge University Press.

SHLEIFER, A. and L. SUMMERS (1988): "Breach of Trust in Hostile Takeovers", in A. Auerbach (dir.), *Corporate Takeovers, Causes and Consequences,* Chicago, Chicago University of Chicago Press.

SIMON, H.(1951): "A Formal Theory of Employment Relationship", *Econometrica,* 19, 293-305.

TEECE, D. (1986): "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy", *Research Policy,* 15, 285-305.

TIROLE, J. (2001): "Corporate Governance", *Econometrica,* 69, 1-35.

Waldman, M. (1990): "Up-Or-Out Contracts: A Signaling Perspective", *Journal of Labor Economics,* 8, 230-250.

Williamson, O. (1979): "Transaction Cost Economics: The Governance of Contractual Relations", *Journal of Law Economics and Organization,* 233-271.

— (1985): *The Economic Institutions of Capitalism,* New York, Free Press.

Wilson, R. (1968): "The Theory of Syndicates", *Econometrica,* 36, 119-132.

Zingales, L. (2000): "In Search of New Foundations", *Journal of Finance,* 55, 1623-1653.

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