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The Cost Of Ownership In The Governance Of Interfirm Collaborations[*]

Abstract:

This paper investigates the selection of governance forms in interfirm collaborations taking into account the predictions from transaction costs and property rights theories. Transaction costs arguments are often used to justify the introduction of hierarchical controls in collaborations, but the ownership dimension of going from "contracts" to "hierarchies" has been ignored in the past and with it the so called "costs of ownership". The theoretical results, tested with a sample of collaborations in which participate Spanish firms, indicate that the cost of ownership may offset the benefits of hierarchical controls and therefore limit their diffusion. Evidence is also reported of possible complementarities between reputation effects and forms of ownership that go together with hierarchical controls (i.e. joint ventures), in contrast with the generally assumed substitutability between the two.

Key Words: interfirm collaboration, property rights, transaction cost, Spanish firms.

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1. INTRODUCTION

What determines the boundaries of the firm is an important question in the theory of economic organization, still under very lively intellectual debate (Holmstrom and Roberts, 1998). The conventional distinction between firms and markets, hierarchies and prices, as the mechanism which solve the coordination and incentive problems resulting from division of labor and exchange, not only is still under the process of academic clarification, but it is challenged by the proliferation of intermediate or hybrid mechanisms of governance (Williamson, 1985, 1991; Imai and Itami, 1984; Powell, 1990). When a firm needs a good or service to carry out its plans, it may buy it in the market, develop it itself, or joint efforts with other agents, firms, in what is often called interfirm cooperation. Now firms do not exchange in an anonymous market, neither they merger into a single entity, so the cooperative action is often viewed as an example of "hybrids" between the market and merger or acquisitions.

A closer look at interfirm collaborations[1] reveals that they differ in the governance structure chosen to regulate the collective actions: sometimes such structure relies more on market principles (contracts, prices); others it involves principles often found in the internal organization of firms (hierarchy, plans, orders). Therefore, the intellectual challenge is not only to explain why firms or why markets to organize and govern economic transactions, but why firms choose different governance forms for their collaborations. This paper is written with the purpose of contributing to answer the previous question by introducing in the theoretical analysis the propositions derived from the theory of property rights (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 1995) besides the widely used, so far, theory of transaction costs (Coase, 1937; Williamson, 1975; 1985, 1991). The propositions are tested using data about interfirm collaborations in which participate Spanish firms.

The research question of this paper is not new. For example, Pisano (1989), Pisano and others (1988), Osborn and Baugh (1990), Gulati (1995) investigate why firms choose equity exchanges (minority interests, joint ventures) to support collaborations. More recently, Oxley (1997) further distinguishes among bilateral and multilateral contract, within the collaborations which do not involve equity exchanges, while Gulati and Singh (1998) separate collaborations under minority equity interests and collaborations governed under the form of joint ventures. In all these papers, the basic underlying framework is borrowed from Transaction Cost: as any collective action, interfirm collaboration involves coordination and incentives needs. Contracts have limitations when

they come to solve these needs, specially if interdependencies are intense (Gulati and Singh, 1998), and payoff are difficult to enumerate ex-ante and verify ex-post creating appropriability hazards (Oxley, 1997). Therefore, in certain cases, it is more efficient (it has lower transaction costs) to substitute or complement contracts with some of the principles and rules proper of the hierarchy (administrative controls, formal coordination units, authority).

The property rights theory has pointed out the limitations of transaction costs to explain the boundaries of the firm with the argument that the costs of the firm (hierarchy), have not been properly expelled out (Hart, 1995). In other words, transaction cost economics has emphasized the costs of using the market to govern exchange, but it has not provided a rigorous explanation of the costs of the firm as a governance structure. To our knowledge, the literature on explaining the choice of governance forms for interfirm collaborations has ignored so far the property rights approach and, therefore, we believe, it has ignored some basic costs of introducing hierarchical principles in the governance of collaborations. We spell in more detail which are such costs in section two of the paper, but to motivate the exposition let us consider the case of joint ventures. One of the basic predictions of the property rights model is that joint ownership (each party has veto power on how to allocate the assets) is inefficient when either separate ownership (each party is the owner of some assets) or single ownership (all assets belong to one party) are also feasible. However, a joint venture with two parties, each holding 50 per cent of the shares, is a widely diffused form of joint ownership in interfirm collaborations. To reconcile the empirical evidence with the theoretical prediction is quite important, if we take into account the recognition given by the academic profession to the property rights approach[2], and the diffusion of balanced joint venture[3].

Section two of the paper presents the theoretical model and postulates the hypothesis to be tested. Besides extending transaction cost to properly account for the "costs of ownership", the paper combines results from the theory of implicit contracts and the consideration of "market power" interests to expand the factors that determine the choice of the governance form. Section three contents the description of the data, the variables, the methodologies used to test the hypothesis (ordered logit and multinomial logit models), and the empirical results. The paper closes with discussion of the results and conclusions.

2. THEORETICAL MODELS

2.1. Transaction cost and property rights

The basic proposition of transaction costs economics establishes that "transactions which differ in their attributes, are aligned with governance structures which differ in their costs and competencies in a discriminatory way" (Williamson, 1991, p. 277). The application of transaction cost theory to explain the governance form in inter-firms collaborations requires to properly identify the relevant attributes involved in the transaction, the alternative governance forms considered and the costs functions resulting from using a governance form in each transaction.

<u>The transaction</u>

In this paper, the unit of analysis (transaction) is what we label as "interfirm collaboration", defined as any non transitory relation among independent companies which involves exchange and/or sharing of resources and capabilities to obtain mutually beneficial outcomes. With this definition, we identify transactions where there are at least two firms and both remain legally independent entities (so the transaction does not take place within a single firm, as would be the case if it was the result of a merger, acquisition or internal development). Also we identify transactions where the relation among the participating firms goes beyond an anonymous spot exchange of goods or service at a market predetermined price (so even that the transaction takes place in the domain of the market it involves long term relations with identifiable parties). In some cases the collaboration involves exchange of an already existing good or service in a long-term non-spot basis. In others, collaborating firms share resources to carry out ex-novo activities either creating at the same time a new entity (firm) or without creating it.

The transaction attribute listed as determinants of the cost of governance, differ across the authors. Williamson (1985) selected three: the nature of the involved assets, general or specific; the available information, uncertainty and symmetry; the frequency under which the transaction takes place. Milgrom and Roberts (1992), on the other hand, indicate five potentially relevant attributes: the specificity of investments, frequency and duration between consecutive transactions; complexity and uncertainty about possible actions in the future; difficulty of measuring the performance along the transaction; interrelations among transaction and/or persons involved.

In the present paper we shall refer to the level of "transaction complexity", assumed to be an increasing function of interdependencies among transacting units, level of asset specificity, uncertainty about future contingencies and difficulties of measuring performance. As in others

research papers, the attributes considered as sources of complexity are not directly observable, and they will have to be approximate by variables that can be observed.

<u>The governance forms</u>

Imai and Itami (1984) made the important distinction between where transactions take place, in the market or within firms, and the principles used to govern them, organization principles or market principles. Interfirm collaboration takes place in the domain of the market, as the two or more firms involved remain independent, but sometimes they rely mostly on organization principals, such as hierarchy, administrative control, and formal coordination units. Most of the previous works on the governance of collaborations have made the distinction between governance forms that rely on contracts and forms that rely on hierarchical controls. From an empirical perspective, contracts are further divided in unilateral or bilateral exchange (Oxley, 1997). Within the hierarchy, differences in degree have been attributed to equity (minority) exchange, and to the creation of a new independent firm -joint venture- (Gulati and Singh, 1998).

Implicit in the notion of hierarchy there is the idea of authority and fiat (Williamson, 1991). The literature on interfirm collaboration has extensively described how joint ventures, for example, imply the introduction of hierarchical principals, compared with the case of contracts. However, the implications in terms of allocating ownership rights have been ignored. This is why we extend the choice of governance to consider the theory of property rights, introduced in Grossman and Hart (1986) and summarized in detail in Hart (1995).

Agents participating in exchange and/or production are often forced to rely on incomplete contracts. This is due to the fact that when the contract is written down it is impossible or extremely costly to anticipate all future contingencies, or such contingencies will be unverifiable by third parties (mainly the courts) when they actually occur. Therefore, incomplete contracts are ambiguous about what will happen in certain circumstances, so a mechanism has to be designed to resolve such ambiguity. Presumably, a new bargaining process will be initiated, but even in this situation it has to be anticipated what will happen in case of disagreement.

The property rights theory associates the actual resolution of the incomplete contracts with the allocation of "residual decision rights". To hold such rights over the non-human assets of the transaction means to have the rights to decide on any non-anticipated contingency. In this regard, to be the "owner" of an asset is to hold the residual decision rights on the asset. Ownership is an institution to allocate residual decision rights. In a world of complete contracts, where everything is predetermined ex-ante, ownership is irrelevant. But when contracts are incomplete and there are

specificities in the transaction, the allocation of decision rights (ownership) matters in terms of incentives to invest more or less in the specific assets, before the transaction takes place.

In the property rights framework, governance forms differ according to how residual decision rights are allocated. When assets in both sides of the transaction belong to one of the parties we refer to single ownership because the decision rights are concentrated in only one part. This is the situation created when two previously legally independent firms merger into a single one. If each of the two or more transacting parties has veto power on the use of the assets, the governance is known as joint ownership; a 50 – 50 equity joint venture between two firms will be a form of joint ownership. If the residual decision rights are allocated to a third party not directly involved in the transaction, as it would be the case in collaboration where some third party arbitration is contemplated in the contract to resolve disputes, the governance form is known as trilateral governance. Finally, ownership of the assets can be distributed among transacting parties; separated ownership.

A typology.

Borrowing from transaction costs economics and from the theory of property rights, the governance forms available for exchange and production can be described as follows; see Figure 1

Spot Classical Contracting corresponds to pure market exchange where prices are the main (and sufficient) information to adjust resource allocation decision in an efficient way. Buyers and sellers can substitute each other at no cost and therefore the identity of the transacting parties is irrelevant (anonymity). Finally, the "quid" and the "quo" of the exchange occur at the same time, so exchange only takes place when there is mutual compliance.

Long Term Classical Contract is a governance form closer to the pure market governance as it continues to rely on prices to guide adjustments and coordinate decisions. Contracts are fairly standardized and complete but the repeated and long-term perspective of the transaction makes relevant the identity of the parties. To substitute a partner has an important cost (at least you have the search costs, trying to find the best new partner). A time distance will generally exist between the "quid" and the "quo" of the transaction, and therefore the formal and explicit contract plays a more significant role in regulating the transaction.

Neoclassical Contracting is a governance form where contracts provide a framework under which production or exchange will take place, and some degree of incompleteness and ambiguity is acknowledged. The ownership of the assets is separated among the transacting parties, as in the previous two cases, but the contract may include safeguards for the transacting parties in the form
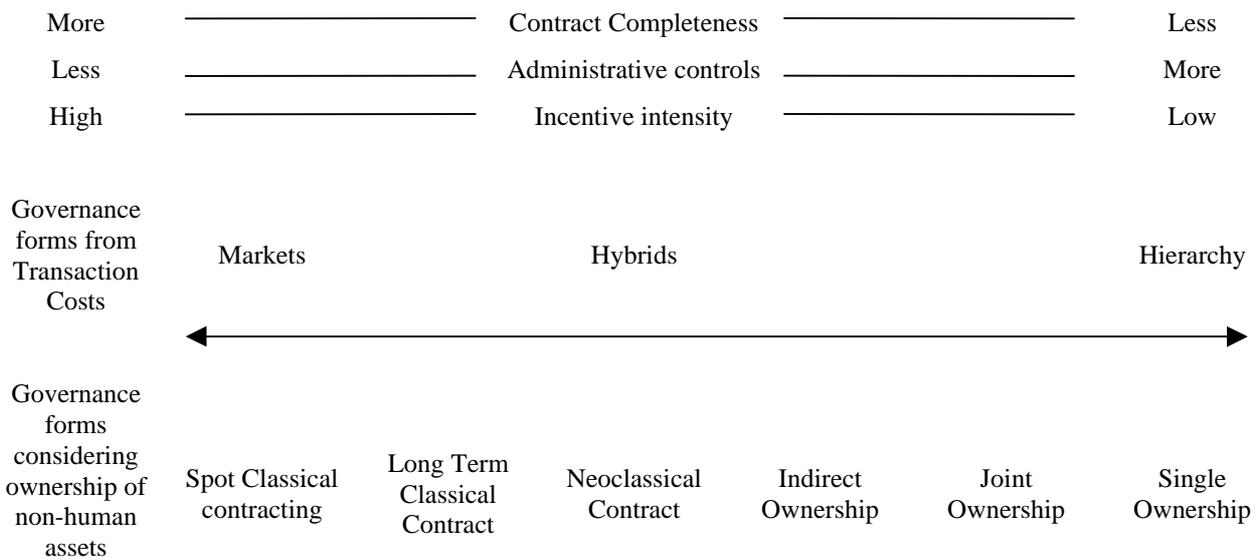
of information disclosure clauses, penalties for certain behavior, explicit dispute resolution mechanisms (arbitration), etc[4].

The term Indirect Ownership is used to refer to situations where the ownership of the assets in the collaboration (transaction) is the result of holding ownership rights over the assets of the collaborating firms themselves. The clearest example is minority equity interest through cross-shareholdings. Depending upon the size of the equity holdings and the statutory or contracted provisions, the holder of the minority interest will have more or less influence on the decision process affecting the control and management of the collaboration. For example, collaborating firms may also exchange seats in their respective boards of directors.

Joint Ownership, as indicated above, implies that the holder of the decision rights has individual veto power on the use of the assets involved in the collaboration. Such assets are clearly segregated and placed in a legally separated entity where they are administrated under this ownership condition. A joint venture with 50 – 50 equity holdings of the two parties is a clear example of joint ownership, although the veto condition can also be instrumented contractually, independently of equity holdings.

The fact that a new firm is created suggests that the joint venture substitute the market by the hierarchy. Notice, however, that the governance form differs from the pure hierarchy (hierarchical governance) because in the later assets in both sides of the transaction are owned by a single party; Single Ownership. The previous literature on inter-firm collaboration has emphasized the use of administrative and hierarchical control when collaboration is organized in the form of the joint venture, recalling that in fact a new firm is created. But the distinction between single and joint ownership has been ignored. Moreover, a joint venture where one party has more than 50 per cent of equity and, consequently, has effective control (assuming one share one vote), would have to be considered single ownership and a departure from a proper interfirm collaboration.

Figure 1. Typology of Governance Forms

More	——————— Contract Completeness ———————	Less
Less	——————— Administrative controls ———————	More
High	——————— Incentive intensity ———————	Low

Governance forms from Transaction Costs	Markets	Hybrids	Hierarchy

← ————————————————————————————————— →

Governance forms considering ownership of non-human assets	Spot Classical contracting	Long Term Classical Contract	Neoclassical Contract	Indirect Ownership	Joint Ownership	Single Ownership

Transaction costs and the choice of the governance form

Firms interested in certain resource or activity can rely on market exchange, internal development or collaboration with other firms to satisfy their needs. In this respect, inter-firm collaboration can be placed in the domain of market relations but with the use of strong organization principles as the relation goes beyond anonymous spot exchange at a predetermined price. From the perspective of the governance, collaborations are examples of hybrids, in the terminology of Williamson (1991), since they share elements of the two pure governance forms, markets and hierarchy.

The empirical and theoretical work on inter-firm collaboration has not focused so much on the choice of the hybrid from in front of the market and/or internal development alternatives, but rather on explaining the variations in the forms of governance observed in the broad field of collaborations, some closer to market exchange, some closer to vertical integration (hierarchy)[5].

Besides technical or productive efficiency, firms involved in collaborations look after organizational efficiency, determined by how the coordination and incentive problems of the collective action are effectively solved. In this respect, transaction costs may be viewed as the economic value of the resources employed in solving such coordination and incentive problems, plus the opportunity loss, i.e. the net wealth which could be achieved under the ideal conditions where coordination and incentive problems would be automatically solved (fiction world of perfect competitive markets), and the wealth obtained with the solution actually in place.

Each governance form implies alternative ways of solving the coordination and incentive problems, different amounts of explicit resources employed in such solution, and different residual or opportunity losses. The contribution of transaction costs economics has been to identify attributes of each transaction and dimensions of the different governance forms, such that a reduced cost function can be identified relating transaction costs and attributes of the transaction, for each possible governance forms. The application of transaction cost economics to interfirm collaboration has followed the same approach.

The transaction complexity in interfirm collaborations determines the coordination needs and the nature of the incentive problems. In general, more complex transactions imply also more transaction costs, but the evolution and nature of such costs will differ from one governance form to the other and therefore a most efficient form can be selected.

Long Term Classical contracting relies mostly in market mechanisms to govern transactions. This means that prices help to solve coordinating problems and that contracts are fairly complete. Moreover, "exit" (and substitution among sellers and buyers) is an effective protection against ex-post opportunism. All these conditions will be satisfied as the intensity of interdependencies is low, the resources involved are fairly general and ex-ante uncertainty about future contingencies is limited. In other words, we expect theses governance forms to dominate in the lower levels of transaction complexity.

In Neoclassical contracting, contracts are a frame of reference to which the parties appeals when there are conflicts of interest, but the actual relation contemplates mutual adaptation to small perturbation and some joint coordination efforts. The tolerances for adjustments as contingencies arise are, however, small and this implies that contracts are fairly complete or, in other words, uncertainty is in general relatively low. The ownership of the assets is kept separated among the transacting parties so individual incentives are preserved. This governance form can handle more resources specificities than classical contracting because uncertainty is low and formal explicit contracts fairly detailed can be written.

As uncertainty increases and contracts have to be necessarily more incomplete, under the presence of resources specificities which create bilateral relationships, contracts (and exit) can not longer protect efficiently against ex-post bargaining and opportunism (Oxley, 1997). Some "voice" mechanism is needed to induce the parties to participate in the transaction. Equity interests include voice rights and, at the same time, rights over residual income, so some alignment between individual and collective interests is also achieved. The indirect ownership of cross-shareholdings provides additional safeguards for the interests of the transacting parties and with them the

likelihood of more complex collaborations being completed increases. When besides uncertainty and resources specificities the collective action involves intense interdependencies and high coordination needs, equity interest should be complemented with operational and administrative devices which perform the coordinating function. It is assumed that the creation of a new firm, joint venture, will facilitate coordination, as it will have at its disposal the elements proper of hierarchical governance (Kogut, 1988; Osborn and Baughn, 1990; Gulati and Singh, 1998). Therefore, equity interests, including joint ventures, are likely to be more effective as governance forms when collaborations are highly complex in terms of uncertainty, resources specificities, interdependencies,… so incentive problems and coordination needs are highly severe. This leaves room for neoclassical contracting at intermediate levels of complexity.

The costs of ownership

The property rights literature has criticized transaction cost economics with the argument that it has properly described the benefits of ownership, but it has largely ignored the costs. References to cost of bureaucracy, weakening of individual incentives, hazards of internal politicking…, to explain the limits to the expansion of the hierarchy (firm) are ambiguous and difficult to make operative in empirical analysis. We believe that this criticism is also pertinent for the literature on inter-firm collaboration, where the advantages of hierarchical controls to solve coordination needs (Gulati and Singh, 1998) and to protect from appropriation hazards (Oxley, 1997), have been spelled out with detail, but the costs are practically ignored.

When it comes to explain the boundaries between firms and markets, the property rights approach takes ownership of non-human assets under common ownership. Decisions about asset ownership and firm boundaries are important because control over assets gives the owner bargaining power when unforeseen or uncovered circumstances force parties to negotiate how their relationship should be continued (so we are in a world of incomplete contracts and resources specificities that make the exit option unattractive).

Ownership of human capital is not transferable. The efficiency implications of ownership of non-human assets have been evaluated in terms of its effects on the ex-ante investment decisions in relation to specific human capital. In the Grossman-Hart-Moore world, the human capital of all transacting parties is complementary and the same complementarily occurs between human and non-human capital. When ownership of a non human assets is transferred from one party to the other, the marginal incentives to invest in human capital are affected in a different way: it increases for those receiving more assets and it decreases for those who transfer them. No general solution can be derived; sometimes is more efficient to keep ownership of non human assets separated in the

different transacting parties, others is efficient to concentrate them in one side of the transaction (the seller or the buyer). But what the theory finds is that neither joint ownership or third party ownership is efficient when other options are available (Hart, 1995, Chapter 3).

Further extensions of the basic model have modified these results:

i)   If specific investment before the transaction is incorporated into ownership transferable physical capital, then joint ownership may be more efficient than single ownership (Hart, 1995, p. 68).

ii)   Second, if human capital and non-human capital are substitutes rather than complements, then third part ownership may be efficient (Rajan and Zingales, 1998).

iii)   Third, reputation in a context of repeated transactions, may make joint ownership efficient in the basic model (Halonen, 1994; Baker et al., 1997). A firm does not want to loose its reputation due to the effects on the net value of the future benefits.

The conclusions above have several implications for the analysis of inter-firm collaborations, besides the general point of paying more attention to the costs of ownership. First, it is difficult to explain or justify the selection of ownership forms different from single ownership without considering explicitly this alternative. In other words, the choice to be explained should be among contracts and all forms of ownership. Second, a more detailed analysis of the relationship between human and non-human assets is clearly pertinent. Third, as 50 – 50 equity joint ventures is a common form of collaboration and the theory predicts that such form of joint ownership is inefficient, some work is needed to reconcile the evidence with this prediction.

Cost functions and hypotheses

Following Williamson (1991), the arguments from Transaction Costs outlined above will be condensed in reduced form cost functions, which will be helpful to formulate the hypotheses to be tested.

Let x be a continuos variable which measures the complexity of the transaction, and let L (x), N (x), and H (x) be the cost function which determine the transaction costs of governing transaction complexity x through Long Term Classical contracts, with Neoclassical contracts and with Hierarchical principles, respectively. From conventional transaction cost analysis, the following properties are assumed:
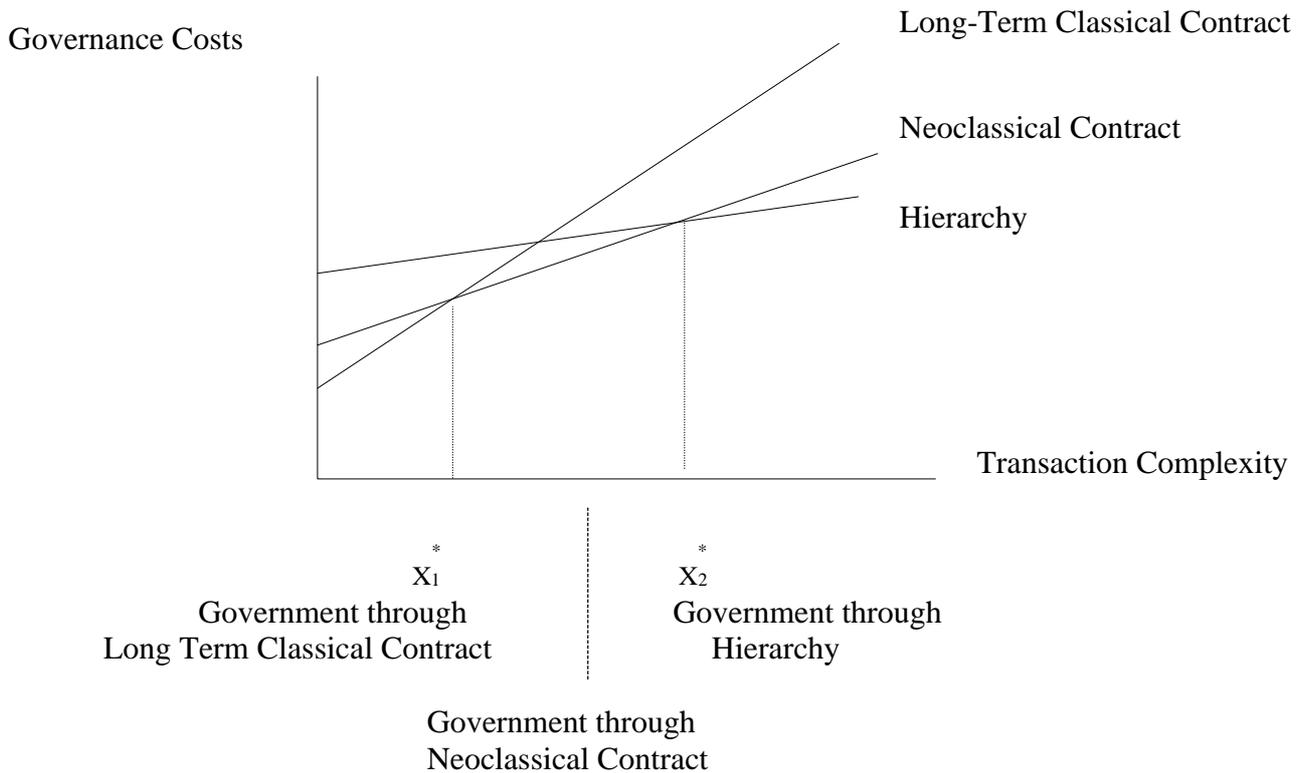
$$L(0) < N(0) < H(0) \qquad (1)$$

$$L'_x > N'_x > H'_x \qquad (2)$$

Condition (1) refers to the relation among transaction costs at low level of transaction complexity. The lower costs of Long Term Classical contract come from the "public good" nature of markets when it comes to provide information (prices) and individual incentives (invisible hand). Low complexity implies that the attributes of the transaction are such that prices are sufficient statistics to guide adjustment and coordination, and individual incentives are compatible with global efficiency. At the other extreme, when the substitution of contracts is associated with the introduction of administrative and hierarchical controls, as it is the case in the literature of inter-firm collaboration, such controls imply the use of resources to perform coordination, supervise activities and measure inputs or outputs (visible hand). Such resources have a cost, which is reflected in the higher value of H (0), compared with L (0). We assume that Neoclassical contracting has fixed set up costs in between Long Term Classic and Hierarchy. This form of contract does not rely on hierarchical principles to govern the transaction, so it saves costs with respect to Hierarchy. But the contract is less standardized, should cover more contingencies, and due to the difficulty to foresee all of them, more resources should be invested in writing and monitoring the contract.

Condition (2) establishes and ordering of the marginal transaction costs with respect to the complexity of the transaction[6]. The costs of using Classical contracts increase faster than the costs of Hierarchy as uncertainty and resource specificity, for example, create bilateral dependencies and risks of rent expropriation. The resources put up ex-ante to complement the market and the explicit contract, save now on incremental transaction costs. This case may be extended to the solution of coordination needs when interdependencies are high. Once again, Neoclassical contracts are attributed marginal transaction costs in between the costs of the other two forms.

Property (1) and (2) are translated into the graphical representation of Figure 2[7]. Up the level of complexity x_1^*, the most efficient governance form (lower total transaction cost) is Long Term Classical contracting; the higher marginal costs are compensated by their lower fixed costs. Beyond x_1^* and up to x_2^* Neoclassical contracting has the lowest transaction costs. Finally, for higher complexity levels (beyond x_2^*), Hierarchy would be preferred (lowest costs).

Figure 2. Relationship between Governance Costs and Transaction Complexity.

Source: Adapted from Williamson (1991).

Figure 2, together with the attributes of the Transaction which have been recognized as sources of complexity, allow us to formulate the following hypothesis:

> H1a: There exist two ordered complexity thresholds in inter-firm collaborations, which determine the respective choice of Long Term Classical contracting, Neoclassical contracting and Hierarchical arrangements.

> H1b: Complexity is positively associated with coordination needs, as interdependencies increase, and also with incentive problems, information asymmetries, resource specificity and measurement cost.

So far, no consideration is made of the costs of ownership, as the substitution of contracts by hierarchy has only considered the introduction of administrative and operational mechanisms for coordination and control. As it has been mentioned above, to go from "contracts" to "firms" implies to change the allocation of ownership rights on non-human assets and this has implications for efficiency.

Moreover, joint ownership is only efficient, compared with all ownership alternatives, under special conditions. So the property $H'_x < N'_x$ no longer holds in general: separated ownership of physical assets, which is the case in Neoclassical contracting, may be more efficient in terms of ex-ante incentives to invest in assets specific to the transaction, than joint ownership.

From the property rights perspective, then, hierarchy may be less attractive than contracts at high levels of complexity (uncertainty and resource specificities), especially when the specific assets are human capital not incorporated into physical capital in the process of the transaction.

> H2: When there are ex-ante investments in human capital embodied on the persons making the investment, inter-firm collaborations which imply joint ownership of the non human assets are less likely than those which keep ownership of assets separated among the collaborating parties.

Consequently, in the case of joint ventures, we may have to weight the potential benefits of introducing administrative systems, which help to solve coordination needs, with the direct costs of these systems AND with the indirect costs due to the choice of an inefficient governance form from the point of view of the allocation of ownership rights.

2.2. Collusion opportunities and implicit contracts as determinants of the firms boundaries

Collusion interests

Inter-firm collaborations may not only respond to efficiency considerations aimed to lower production and transaction costs, but to facilitate coordination among firms in the product market and alleviate competitive pressures.

If firms are rivals in the product market the costs and benefits of collaboration are more difficult to evaluate since now they may interfere with the competitive process. Veugelers and Kesteloot (1996) reach this conclusion for firms collaborating in R&D activities. Reynolds and Snapp (1986), on the other hand, show that firms in the same product market may reduce the intensity of competition and obtain profits closer to the monopoly solution by creating equity linkages among them (cross-shareholding and joint ventures). The search of more market power and the facilitate of collusive practices may then be additional reasons why firms collaborate.

H3: For a given level of transaction complexity, inter-firm collaborations with equity linkages are more likely when there are opportunities to attenuate product market competition among collaborating firms.

Implicit contracts

The economic analysis of inter-firm collaborations as a part of the broader question of explaining the boundaries of the firm (market, integration, hybrids) has considered so far the selection among explicit contracts (more or less complete) to regulate the transactions. However, collaborating parties may also rely on implicit contracts, i.e. contracts that are sustained by mutual promises of good faith, non-opportunistic behavior and priority of collective interest over individual ones.

Transacting parties are willing to participate in transactions governed by implicit contracts because there are savings in costs compared with the use of explicit contracts sustained by the courts and legal procedures, and because each one believes that the other parties will comply with the promises of not acting opportunistically. The reduction in costs is obvious if we take into account that contracts do not have to be written down and that no ex-post verification by third part will be implemented (since there is no formal contract, verification is excluded as a possibility).

The credibility of promises of "good behavior" will be sustained by the presence of social norms, Coleman (1990), Kandel and Lazear (1992), and by the egoistic interest of preserving a good reputation. If one party abuses of the trust of the other, who accepted to transact under the governance of an implicit contract, it may be broken a social norm which establishes what are considered the desirable patterns of behavior from the point of view of the collectivity. Social pressures in the form of sentiments of "guilt" and/or "shame" make promises credible as parties know that those making the promises will try to avoid such social sanctions.

Reputation helps to sustain implicit contracts, as persons build up believes about future behavior of the others based upon observed behavior in the past (Kreps, 1990). If one agent has abused of the trust of the others in the past, it is expected that no one will want to be involved in implicit contracts with such agent in the future. The potential short-term benefit of the abuse may be offset by the future losses, as the abuser will not be able to participate of the advantages of implicit contracts. In fact, some transactions may generate so high transaction costs if they rely on explicit contracts that they can only be viable if implicit contracts are feasible. Therefore, the access to such transactions will be restricted to those whose reputation induces in others believes of good faith in their behavior.

In the inter-firm collaboration literature, implicit contracts can be considered substitutes of explicit contract provisions in Neoclassical contracting, and/or substitutes of voice and other safeguard mechanisms against opportunistic behavior when Hierarchies substitute contracts. Therefore, for a given level of transaction complexity it is expected to observe less hierarchical governance structures in collaborations where implicit contracts are feasible than in those where they are not (Gulati, 1995; Gulati and Singh, 1998; Oxley, 1997).

> H4a: For a given level of transaction complexity, the likelihood of contractual safeguards and hierarchical controls in inter-firm collaboration is lower when collaborations are carried forward under conditions which favor social norms and reputation effects, as sustainable of implicit contracts.

Notice, however, that, as indicated above, the property rights theory finds complementarities between implicit contracts and some forms of hierarchical governance structures considered in inter-firm collaborations, such as joint ventures, as a case of joint ownership. Recall that the efficiency of joint ownership as a form of governance is recovered when reputation considerations are introduced into the analysis. The reason is that, with joint ownership, it is possible to lower the parties payoffs in the case of contract abuse and, consequently, increase the future losses which are compared with short-term benefits of defecting; Halonen (1994).

> H4b: The likelihood of joint ownership in inter-firm collaborations with person-embodied specific human capital increases under conditions that favor reputation effects.

3. EMPIRICAL ANALYSIS

The data used in this work come from a detailed study of the inter-firm collaborations announced in Spanish leading economic newspapers and magazines during the three-year period of 1990 till 1992. The condition for an announcement to be included in the database was that at least one of the participating firms had to be from Spain. When possible, the description of the collaboration and of the selected governance structure was completed with information coming from different sources. Finally, a total of 1148 evidences of collaborations were identified and completely described with the variables listed below.

Variables

Dependent Variable

The dependent variable is the governance form of the collaboration. The coding of this variable proceeds as follows:

i)   Long Term Classical Contract = 0, when the collaboration is an Exchange Agreement

ii)   Neoclassical Contract = 1, when the collaboration is an Alliance

iii)   Hierarchy = 2, when the collaboration involve a Cross-Shareholding or a Joint Venture.

An interfirm collaboration is identified as an <u>Exchange Agreement</u> when it involves the supply of a product, service or know-how from one firm to the other in a recurrent basis; when firms share a given facility for marketing, distribution or after sale services; technology licensing; subcontracting of manufacture or R&D.

For example, since 1995 Freixenet, the Spanish firm leader of the sparkling wine market, is collaborating with the German distributor Eckes. The relation is based on a distribution contract among both firms. The time period that was initially established were three years (at the end of this period both firms could maintain the relation if they were interested in). The contract clauses establish the supply of the product (specifying all their characteristics) and some aspects of the marketing program. For example, Eckes must sell a minimum of bottles. If they could not do it, Freixenet would be able to cancel the contract, compensating Eckes with an amount equivalent to one-year profits[8].

Collaboration is classified as an <u>Alliance</u> when firms set up a project that implies the production or development of a non-existing product or service. No new legally independent entity is created and the project may have a limited or open time horizon. For example, Telmex, a Mexican firm, and Telefónica developed a project with the purpose of finally creating a digital system operated through a submarine cable of optic fiber. No time limit was established in the contract.

The exchange of minority interest, <u>Cross-Shareholdings</u>, and the creation of new entities<u>, Joint ventures</u>, are the collaborations more easy to identify and properly separate from Alliances and Exchange Agreements. For example, Banco de Santander and Royal Bank of Scotland exchanged equity (the former bought 9.9 per cent of shares of the later and Bank of Scotland bought 4.9 per cent of Banco Santander) to do joint investments in Europe and exchange experience and technology. On the other hand, Acerinox, a Spanish company, and Armco, a US firm, jointly created the firm North American Stainless, an example of joint venture.

The codification of the variables does not explicitly recognize the different forms of ownership. However notice that Exchange Agreements and Alliances are cases of <u>Separate Ownership</u> as collaborating firms control the residual decisions right, if any, of the physical assets involved in the collaboration. Cross-shareholdings and Joint ventures, on the other hand, are treated initially as

forms of <u>Joint Ownership</u>. Ideally, it would be of interest to know in which cases the parties have individual veto power on the assets combined in the collaboration and/or the actual shares hold for each of them in the joint venture, but such information was not available. Notice, however, that Geringer and Herbert (1989) and Killing (1983) report empirical evidence on the fact that, in general, the creation of a joint venture incorporates the right of veto over strategic decisions by the partners. We rely on this evidence to assume that this veto power is present in most of the joint ventures of our sample, although this evidence has not been contrasted. To see the robustness of the results to this assumption some sensitivity analysis will be performed, for example, excluding cross-shareholdings as a form of joint ownership.

Explanatory variables

In this paper we consider that it is possible to assign a more or less degree of complexity to the observed transaction depending upon the uncertainty, the assets specificity, interdependencies, number of parties, measurement problems, etc. The assumption postulates that more complex transactions present higher values in these underlying attributes.

Most often, empirical data do not allow measuring directly the theoretically postulated attributes; therefore, we have to manage with the appropriate proxies. In our particular case, the attributes of the transaction actually observed are: the number of collaborating parties; whether there are multiple activities contemplated in the transaction or only a single one; whether the collaboration involves R&D activities or not; whether the collaboration had to do with the expansion in the same product-market where the firms are already active or, to the contrary, involves diversification into new ones. We now relate these observable variable attributes with the sources of complexity.

The number of independent parties involved in the transaction will affect the complexity of such transaction as the number of potential interactions, and therefore interdependencies among them, will increase with such number. So, the number of partners is considered to have positive influences on the coordination needs. The problems of measuring individual contributions to the collective action, which facilitate free riding behavior (Alchian and Demsetz, 1972), will also likely increase.

As the number of activities to be performed within the inter-firm collaboration increases, it is likely that the number of interdependencies will also increase. Collaborations with multiple activities (coded with 1) as compared with those with a single activity (0), have more coordination needs. Furthermore, the likely interrelations among them will make more difficult to spell out the

contributions and pay-off for each partner and, therefore, it will increase the risks of expropriation, compared with those when only one activity is performed. Therefore it is possible to associate this observed attribute with higher degrees of transaction complexity.

The two other attributes affecting the complexity of the transaction are the realization of technology and R&D related activities (1), compared with the absence of such activities (0), and whether the purpose of the collaboration is to diversify into new product-market (1), compared with expansion in the current ones (0).

The presence of R&D related activities in the collaboration suggest that the transaction involve production and transfer of knowledge, which is difficult to protect with contracts. In this situation, transaction complexity increases because (Arrow, 1969; Williamson, 1985):

i)   For fixing a price it is necessary to know the product, but once the knowledge is acquired there is no point in paying the price.

ii)   The knowledge may be non-codified and often ex-ante uncertain, so the outcomes of the transaction are difficult to enumerate and verify.

iii)   The generation of knowledge often involves sunk costs and therefore specific resources to the transaction.

Finally, it will be assumed that innovation through R&D activities is likely to have more person embodied human capital than other activities. Innovation is highly labor intensive and the costs incurred on it are widely recognized as sunk costs (Stiglitz, 1987).

Inter-firm collaborations which imply diversification into new products and markets will be associated with more transaction complexity than those which only expand current products-markets of the parties, because it is expected higher uncertainty in the former than in the later. Expansion will allow the transacting parties to draw from previous experiences at the time of enumerating possible contingencies to take place along the transaction. Diversification, on the other hand, implies newness and less potential for anticipating disrupting events and for evaluating their likelihood of occurrence.

The conditions that favor social pressure and reputation effects as sustainable of implicit contracts, are proxies by the variables nationality of the collaborating part and location of the activities to be carried out. Social norms are more likely in culturally homogeneous social communities. Moreover, geographical proximity will facilitate the observation of the behavior of the partners and check whether such behavior is consistent or not with the premises. Observation of the behavior, or at

least, of the consequences of it, is necessary to apply social sanctions such as shame, and to start the application of economic penalties by excluding the deviating part from future collaborations.

The partner nationality variable is divided in five categories: Spanish, European Union, United States, Japan and Other countries. Implicit contracts are expected to be more viable when partners are Spanish or European (cultural proximity). It may also be argued that higher socio-cultural distance among collaborating partners may difficult collaborations that involve strong interpersonal relations. So, instead of introducing more hierarchical controls, firms choose to rely on more standardized contracts such as licensing. So, socio-cultural distance may favor both, long-term contracts and hierarchies.

Collusion opportunities are proxied by a variable that refers to the nature of the relations among collaborating firms. A distinction is made between horizontal (1) and vertical (0) relation. In the first case, collaborating firms belong to the same stage of the industry's value chain and therefore are likely to compete in the same market. Vertical relations occur when firms belong to consecutive stages of the value chain. The search of market power, as a possible objective of some form of equity linkages among firms, can be expected under horizontal relations.

Information is also available on the economic sector where the collaboration takes place. Manufacturing, Construction and Service sectors are widely represented. It is acknowledge that patent protection differ across industries (Oxley, 1997; Gulati and Singh, 1998), so the legal system will protect in a different degree the interests of the parts depending upon the economic sector where the collaboration is developed. Furthermore, according to Harrigan (1985) rapidly changing technological development induces the formation of somewhat more informal forms of collaboration such as non-equity agreements. As industries become mature, more formal modes of collaboration such as joint ventures become the preferred ones. So, in choosing particular modes of collaboration, the level of technological sophistication of industries plays an important role (Hagedoorn and Narula, 1996, p. 280). Osborn and Baughn's (1990) survey suggest that technological stability of industrial sectors is a crucial factor in explaining different patterns of equity and non-equity partnerships. The estimation will control for sector effects including sector dummies as explanatory variables.

Finally, two time dummies, one for the year 1990 and other for the year 1991 (so the omitted year is 1992), are included as control variables to account for possible macroeconomic factors common to all collaborating firms in a given year. Table 1 summarizes the explanatory variables used in the analysis and provides basic descriptive statistics for each of them.

Overall, 26 per cent of the collaborations are Exchange Agreements, 32 per cent Alliances and 41 per cent involve equity interests (Cross-shareholdings and joint ventures). The dominant form of collaboration has the following attributes: it involves activities different from R&D, it is created with the purpose of market expansion, the partner is from outside from Spain, the collaboration takes place in a manufacturing sector and the firms involved have an horizontal relation.

Methodology

To test the hypotheses we shall use two methodologies: ordered logit and multinomial logit choice models.

Let x_i be the level of complexity of collaboration i where:

$$X_i = \beta y_i + \varepsilon_i \qquad (3)$$

The vector y_i includes all the variables (proxies) considered as sources of complexity (together with possible control terms); the vector β includes the weights attached to each source of complexity; and ε_i is the error term.

The theoretical model, synthesized in conditions (1) and (2), assumes that the unobservable variable x_i determines the choice of one of the ordered governance forms as it falls in one of the following discrete intervals:

i)   If $x_i < \mu_0$, Long Term Contract (=0) is selected

ii)   If $\mu_0 \leq x_i < \mu_1$, Neoclassical Contract (=1) is selected

iii)   If $\mu_1 \leq x_i$, Hierarchy (=2) is selected   (4)

The ordered logit statistical analysis estimates the vector of parameters β taking into account the observed characteristics of the collaboration y_i and the mapping in (4). It assumes that the underlying probability distribution of ε_i is normal.

Acceptance of hypothesis 1 requires that the thresholds levels μ_0 and μ_1, with $\mu_0 < \mu_1$, are confirmed by the statistical estimation and that the variables considered associated with complexity do in fact have a β coefficient positive and significant.

Our model derives the thresholds μ_0 and μ_1 assuming properties (1) and (2) of the underlying and unobservable cost functions. The multinomial logit choice model provides an statistical

methodology which is based upon the comparison of the utilities (negative costs), associated with each of the alternative governance forms, given a vector of transaction's characteristics. In probabilistic form, the model is expressed as follows:

$$P_{ij} = P(G = j / y_i) = e^{\alpha_j y_i} / \Sigma_k e^{\alpha_k y_i}$$

Where P_{ij} is the probability that collaboration i is governed by structure j, j = 0, 1, 2; α_j is a vector of coefficients which determine the impact of the explanatory variables on the probability that each of the governance forms will be selected. The variation of α_j across governance forms is consistent with the assumption that the cost functions (utilities) are different for each of them, see Figure 2.

To estimate the coefficient α_j the utility of one of the alternatives is used as normalization value. In our case, the alternative will be the Long Term Classical contracting. Therefore, the parameters of the other alternatives have to be interpreted in reference to the omitted one. A particular value of one estimated coefficient α_{lj}, indicates the extent to which the attribute l of the transaction contributes to the utility of governance alternative j, beyond the contribution that this attribute would have in determining the utility of the base option, Long Term Classical contracting.

The existence of the thresholds of complexity postulated in hypothesis 1 is the result of increasing fixed costs and decreasing marginal costs with respect to complexity as governance forms approximate the hierarchy. If the base option to compare with is the Long Term Classical contracting, then we should expect that the likelihood of choosing other governance forms different from the base option at lower levels of transaction complexity decreases as such governance forms are closer to the hierarchy. At the same time, the likelihood of choosing an alternative governance form compared with that of choosing the base option, as complexity increases should increase more intensively as more hierarchical is the alternative form. Therefore, we expect $\alpha_1 < \alpha_2$.

The multinomial logit choice model allows for another way to test H1a, and also will be the methodology used to test the other hypotheses as they are formulated in terms of comparisons of likelihood values.

4. RESULTS

The first estimation corresponds to the ordered logit model; Table 2. The statistical package LIMDEP 5 used for such estimation, fixes a threshold value of $\mu_0 = 0$, and therefore, in Table 2 only the estimated value of μ_1, the second threshold, is reported.

As established in the hypothesis H1a, the estimated value of μ_1 is positive and statistically significant at 1 per cent level. Therefore, the prediction that there will be complexity thresholds that will determine the switch from one governance form to the other in interfirm collaborations, can not be rejected from our data. When the complexity index is below zero, captured basically by the constant term given our definition of the variables, then the Long Term Classical contract is the governance form most likely to be selected; at intermediate levels of complexity, between 0 and 2.54 in the scale of complexity, the most likely governance form is Neoclassical contracting. Finally, beyond 2.54, the governance form with highest likelihood involves some form of hierarchical control.

Insert Table 2

Table 2 also confirms our hypothesis H1b in the sense that the complexity index increases with interdependencies, uncertainty, resources specificities and measurement problems, since we obtain positive coefficients for the proxy variables used to measure these attributes of the transaction, number of partners, number of activities performed, the presence of R&D activities and the purpose, expansion or diversification, of the collaboration. The highest estimated coefficients are for the variable "Multiple" and "Diversification", which means, for example, that those collaborations to perform multiple activities imply a relatively high level of complexity compared with those which only perform one activity, and consequently they also have higher likelihood of incorporating hierarchical controls. On the other hand, the coefficient of "Number of Partners" is not statistically significant, so the variable does not seem to significantly affect the level of complexity, according to our data[9].

The ordered logit model is estimated with the rest of the variables that the theory points out as potentially affecting the choice of the governance form, second column of Table 2. The inclusion of these variable is only for control purposes, as their effects will be tested with the multinomial logit model. Notice, however, that these variables have in some case statistically significant coefficients and a positive sign on it would indicate that, for a given level of complexity, higher values of the variable increase the likelihood of choosing a more hierarchical governance form. This happens, for example, when collaborating firms have an horizontal relation, and when the partner comes from another European country. On the other hand, the likelihood of hierarchical forms decreases relatively in Energy and General Services.

An alternative way of testing hypothesis 1 is by estimating the intercepts and slopes of the likelihood functions from the multinomial logit model. As indicated in the theory section, the relative slopes of these functions, with respect to the base case of comparison, Long Term Classical Contract in our formulation, capture the relatives slopes, in an inverse way, of the governance cost functions represented in Figure 2. On the other hand, the intercept captures the relative fixed cost. Also remarkable is that the multinomial logit allows for more flexibility in the estimation (it does not assume monotonicity on the effects of each variable on the probability of choice as the ordered logit does), and it is the methodology which will allow us to test the rest of the propositions.

Table 3 reports the results of the multinomial logit model. First, notice that overall, the results are consistent with the thresholds values detected by the ordered logit model: the estimated constant is negative and has higher absolute value as one moves towards governance with formal controls, -2.4 for Neoclassical Contracts and –4.22 for hierarchical (both significantly different from zero and 4.22 > 2.4, t value of 1.9). These values would be consistent with the relation of fixed costs presented in Figure 1, costs which are the relevant for determining the preference for Long Term Contracts at low levels of transaction complexity. So at low levels of complexity, Long Term Contracts are relatively more preferable than other governance forms and the difference in preference are higher when this governance form is compared with hierarchical controls than when it is compared with Neoclassical contracts.

Insert Table 3

With respect to the slopes, estimated α_{ij}, the theoretical predictions are confirmed at least for the variables "Multiple" and "Diversification". For them, the estimated α_{ij} are both positive and significant and furthermore $\alpha_{i2} > \alpha_{i1}$ as the theory predicts. In other words, as complexity increases when we move from one collaboration that has only one activity to another with multiple activities, the likelihood of choosing a non classical contracting form increases but it increases more rapidly in the case of governance forms with hierarchical controls than in the case of Neoclassical contracting (5.14 > 2.5, t value of 5.77). The same evidence is obtained when complexity is the result of the higher uncertainty attributed to diversification versus expansion, although the difference between the two estimated values of α_{ij} is now lower (4.34 > 2.16, t value of 1.38). Combining the relationship between intercepts and slopes, we can explain the thresholds of Figure 1 already identified by the ordered logit.

But Table 3 also points out that the variables number of partners and R&D deviate from the predictions of the transactions costs analysis. Number of partners has a positive and significant

coefficient, but it is the same for the two non-classical governance forms, 0.51 and 0.51 (t value of 0.01). Therefore, number of partners increases the attractiveness of forms different from classical contracting but does not differently for each of them. With respect to R&D, collaborations with technological activities have higher likelihood of being governed by Neoclassical contracts and lower likelihood of incorporating hierarchical controls. These result are not inconsistent with those of the ordered logit but just indicate that the effect of the variable in the likelihood function is not monotonic and can only be captured with more flexible models such as the multinomial logit.

More important, the negative coefficient of the R&D variable in the governance forms with hierarchical controls is difficult to justify from the argument of transaction costs. However, the result is consistent with the prediction from the property rights approach assuming that in technological activities there are person embodied specific human capital investments. The theory predicts that separated ownership of physical assets, as it is the case in any form of contracting, is more efficient than some form of "joint ownership" that is present with cross-shareholdings and joint ventures. Therefore, we find evidences in favor of hypothesis 2 formulated from the theory of the boundaries of the firm based in the property rights approach.

Another interest of our analysis is to investigate whether the choice of the governance forms may be affected by market power reasons besides efficiency ones. The estimated coefficient of the variable horizontal is positive and significant for the two non-Classical contracting forms, but is higher (1.31 > 0.63, t value 2.07) in the case of Neoclassical contracts. Therefore, hypothesis 3 is not confirmed by our data since to move from collaborations among vertically related firms to collaborations among horizontally related ones, does not increase more the likelihood of introducing equity interests in the collaborations than the likelihood of non introducing them, especially when we compare with Neoclassical contracting.

The conditions that affect the viability of implicit contracts also seem to influence the choice of the governance form. For a given level of transaction complexity, the preferred governance form in collaborations where both partners are Spanish is Neoclassical contract. This governance form is the most vulnerable one to ex-post opportunism as the contract only provides guidelines for the relation (compared wit the more binding Long Term Contract), and there no control rights from ownership or hierarchy. Firms seem to be more reluctant to choose Neoclassical contracts with partners from other countries, specially if they are from outside Europe, which would be consistent with our prediction that cultural, social and physical proximity are conditions which restrict opportunistic behavior because it is more likely to have social pressure from norms, and reputation is more valuable. Assuming that a partner from another European country has more "proximity" to

Spanish firms than from the rest of the world, the evidence that the likelihood of hierarchical controls is higher when there are European partners than otherwise, contradicts, however, hypothesis 4a. This may point out towards more complex relations between implicit contracts and hierarchical controls than their view as substitutes postulated from the transaction cost approach.

The two columns of the second model of Table 3 look precisely to the issue of possible complementarities between implicit contracts and joint ownership. The model estimated now includes the interactive variable Spanish-R&D to capture those collaborations where Spanish firms perform technological activities, i.e. collaborations where it is more likely to have favorable conditions for reputation effects and where there may be person embodied specific human capital.

The estimated coefficients for the rest of the variables of the model practically remain the same, and the coefficient of the new interactive variable is positive and significant in both, Neoclassical contract and Hierarchical forms. It appears that reputation effects and technological activities increase the likelihood of both non-Classical contracting forms, compared with the likelihood of Classical contracting, but notice that in the forms that imply joint ownership the estimated coefficient is higher. So evidence is found in favor of hypothesis 4b.

The results of Table 3 also confirm the sector and time effects already found in the ordered logit model. Neoclassical contracts are less likely among manufacturing firms, while Electricity firms tend to use less hierarchical forms. On the other hand, the use of Hierarchical forms appears to be declining over time. The explanation of these results would require further theoretical developments.

The estimations of Table 3 have been subject to robustness test. It may be argued that Cross-shareholdings do not imply a form of joint ownership and therefore should not be included together with Joint venture. Moreover, the hierarchical controls of the two forms are likely to be different. One way of testing the sensibility of the results to the treatment of shared ownership in Table 3 would be to separate Cross-shareholdings as an independent governance form, but this creates more estimation problems since in some of the variables, number of partners, for example, we do not have variability. Other possibility is to eliminate Cross-shareholdings from the sample; after all, Cross-shareholdings may be a control mechanism set up by collaborating firms which may shelter other forms of collaborations, alliances, joint ventures, exchanges. If we re-estimate the model without the Cross-shareholdings, the basic results of Table 3 remain unchanged. Finally, it would be argued that from the property rights perspective, we should compare all forms of separate ownership with all forms of share ownership. To carry out this comparison, a logit model was estimated coding the value of 0 to collaborations identified as exchanges and alliances, and the

value if 1 to the collaborations with Share Ownership. The estimated coefficient of Spanish – R&D continues to be positive and consistent with the results reported in the paper.

Due to the lack of information, to test the robustness of the results to the inclusion of firm's variables, such as size, R&D expenditures,..., has not been possible. However, as Oxley (1997) and Gulati and Singh (1998) find the inclusion of firms' characteristics in the models does not seem to alter the basic results.

5. DISCUSSION AND CONCLUSIONS

The proliferation of different governance forms in interfirm collaborations expands the interest in explaining the boundaries of the firm beyond the categories of markets, hierarchies, hybrids and networks. Several papers have been published, reviewed in previous sections of the paper, to explain why certain forms of governance may be preferred to the others, and the conclusions point towards the advantages of hierarchical controls, in terms of lower transaction costs, over explicit contracts when collaborations involve intense interdependencies and appropriability hazards, and when implicit or relational contracts are not feasible. The potential costs of the hierarchy have been generally ignored, probably because the transaction costs literature has not spelled them out properly beyond generic references to "bureaucratic costs". In fact, it would be difficult to find in the literature on interfirm collaborations arguments why we do not generally observe hierarchical controls (minority shareholdings for example) among firms involved in collaborations (alliances, exchanges...) so that selective hierarchical interventions are applied when needed. The stand-by controls should not harm the relations when not activated and would contribute to efficiency if activated as initially unforeseen circumstances make them desirable.

This paper has been written with the purpose to integrate the property rights theory about the boundaries of the firm, with explaining the choice of a governance form in interfirm collaborations. We believe that this theory clarifies the costs of introducing what have been called hierarchical controls, and that under the property rights approach they in fact imply different forms of ownership with respect to governance forms that rely only in contracts. Our underlying conjecture along the paper has been that the governance forms incorporating hierarchical controls, joint ventures and cross-shareholdings, are in fact forms of "joint ownership" (any party has veto power on the use of the non-human assets employed in the collaboration). Therefore, to introduce the so-called "hierarchical controls" is in fact to move from "separated ownership", when collaborations are governed by contracts, to "joint ownership". The property rights approach identifies the implications for dynamic efficiency (incentives for investments that increase value before the

transaction) of the choice of the ownership forms. In fact, the basic model predicts that joint ownership should not be selected when separated ownership and/or single ownership are also feasible alternatives. The challenge posed by the empirical evidence on collaboration to the property rights approach, comes from the fact that joint ownership forms are widely used.

The empirical analysis performed in this paper finds evidence that the costs of joint ownership may be superior to the benefits of hierarchical controls in collaborations which involve technical activities, R&D, and the conditions which make inefficient joint ownership of the non-human assets (person embodied specific human capital), may be present. So far, the empirical evidence (Pisano, 1989; Gulati, 1995; Oxley, 1997; Gulati and Singh, 1998) indicated that the likelihood of introducing hierarchical controls increased in collaborations having to do with technological activities, compared with non technological ones. More detailed and insightful information about the actual characteristics of the R&D collaborations could be needed to explain the different empirical evidence obtained from our sample, but it may just be that technological activities are sufficiently heterogeneous so that in some cases the benefits of hierarchical controls outperform the costs of joint ownership and in others the costs are higher than the benefits. This conclusion would also be consistent with the arguments of Holmstrom (1999) and Holmstrom and Roberts (1998) in the sense that the property rights approach is not sufficient to explain the boundaries of firms, and it has to be complemented with contributions from the theories of incentives design and efficient coordination.

Another important result of the paper, also new in the literature, is that we find evidence of complementarities between conditions which favor reputation effects and the use of hierarchical controls, although the reason would be that such reputation effects increase the benefits of joint ownership compared with separated or single ownership, relatively to the benefits when they are absent (the transaction takes place only once). So the general presumption that "trust", as an explanation of why agents rely on implicit contracts, substitute hierarchical controls, should be clarified. The fact that reputation effects may both reduce the need of hierarchical controls (in terms of incentives design and coordination efforts) and increase the relative benefits of joint ownership, introduces more ambiguity on the prediction about which governance form to choose, with equity interests or without them, in the presence of reputation effects.

The paper, we believe, makes also a methodological contribution to the literature on the selection of governance forms for collaborations, since it clarifies the relation between the results of the ordered logit model and of the multinomial logit model. This clarification seems important since Oxley (1997), for example, uses the ordered logit model but does not even report the estimated

threshold value of the variable which determines the choice of the governance form. However, such threshold is the cornerstone of the theory, as our Figure 2 makes clear. Moreover, our interpretation of the variable which determines the choice of governance in terms of complexity of the transaction as this complexity falls within certain limits, thresholds values, it is more consistent with the theory that the interpretation given in Oxley (1997, p. 401). Secondly, we establish a detailed link between the coefficients estimated in the multinomial logit model and the ordered logit results. Such link is possible because these coefficients can be related to the differences in fixed costs and in variable costs of governance, across governance forms, as a function of any variable that makes the transaction more or less complex in the terms established in the paper.

As it is generally the case in previous literature and hypothesized in the theory section, the paper also finds evidence that the cultural and social proximity of the partners, measured by their geographical origin, may influence the choice of the governance form. Proximity favors in general Neoclassical contracting, i.e. the intermediate form between Classical (Long-Term) contracts and hierarchical controls. Therefore, collaborating firms may perceive Classical contracts and the presence of equity interests as governance forms which provide more protection against ex-post opportunism than Neoclassical contracts, and they will be preferred when partners are more "distant" so implicit contracts are less feasible.

This result, together with others, for example, the fact that equity interests are more likely than Classical contracts but less likely than Neoclassical ones when firms are horizontally related, suggests the relevance of disaggregating contracts in two (or more) categories. Comparing a single category of contract with governance forms including equity interests, we would find that equity interests are more likely when collaboration is among horizontally related firms and, according to our hypothesis, conclude that there may be collusion interests behind interfirm collaborations. When Classical and Neoclassical contracts are distinguished, such conclusion does not emerge.

Our paper and the results obtained, although encouraging in terms of opening new avenues for empirical work on the boundaries of the firm, have limitations due mainly to the nature of the data. The information about the collaborations is quite limited both in terms of the actual features of the selected governance form and in terms of the attributes which are identified as sources of complexity in the transaction. We would have benefited from a more detailed description of the terms of the contracts to make sure that the coding of the dependent variable was the correct one. This difficulty is often recognized in the literature, Oxley (1997, p. 391), but nevertheless it is important to recall it and introduce some caution in the conclusions. Information was also limited on the type of technological activities and in particular whether they really involved person

embodied specific human capital. To have this detailed information, as well as the degree of complementarity between human and non-human assets involved in the collaboration, it will be critical to be able to progress in empirical analysis of the property rights predictions. We hope that the preliminary evidences presented in this paper will encourage future efforts to collect these data and verify the robustness of the results.

Table 1. Descriptive Statistics of the Variables.

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of partners (mean)	2.27	0.94	2	16

Cooperation range (%)
   1. Multiple activities
   0. One activity
	0.527	0.5	0	1

Kind of activity (%)
   1. R+D
   0. Other kind
	0.082	0.27	0	1

Nature (%)
   1. Horizontal
   0. Vertical
	0.609	0.49	0	1

Purpose (%)
   1. Diversification
   0. Other
	0.07	0.25	0	1

Nacionality (%)
   1. International
   0. National
	0.652	0.48	0	1

Sector (%)
   Manufacturing (dummy)
   General services (dummy)
   Energy (dummy)
   Construction (dummy)
   Finance services (dummy)
	
	 0.436
	 0.265
	 0.112
	 0.069
	 0.118
		
		 0.50
		 0.44
		 0.32
		 0.25
		 0.32
			
			 0
			 0
			 0
			 0
			 0
				
				 1
				 1
				 1
				 1
				 1

Partner's country
   Europe (dummy)
   USA (dummy)
   Japan (dummy)
   Other (dummy)
	
	 0.405
	 0.103
	 0.034
	 0.456
		
		 0.491
		 0.304
		 0.183
		 0.498
			
			 0
			 0
			 0
			 0
				
				 1
				 1
				 1
				 1

Total collaborations	1148			

Table 2. Ordered Logit Estimation of the Choice of Governance.

	Model 1	Model 2
Intercept.	-0.44775** (0.19514)	-0.76107** (0.38380)
N° partners	0.11299 (0.78897E-01)	0.86489E-01 (0.84830E-01)
Multiple	3.5044*** (0.16573)	3.5683*** (0.17632)
R+D	0.52309** (0.25124)	0.55994** (0.25094)
Diversification	2.1279*** (0.46526)	2.3986*** (0.47620)
Horizontal		0.41458*** (0.14597)
Spanish		0.27627E-01 (0.22904)
Europe		0.37750* (0.22256)
USA		-0.40945 (0.28502)
Japan		0.23452 (0.38883)
Manufacturing		-0.34588 (0.21862)
Construction		0.15029E-01 (0.24332)
Energy		-0.81374*** (0.26971)
Gnral. Services		-0.77157** (0.30925)
Data90		0.52688*** (0.15886)
Data91		0.36143** (0.16182)
MU(1)	2.5476*** (0.13570)	2.6503*** (0.13970)
Log. Likelihood	-885.6349	-852.6389
Chi square.	709.5562***	775.5482***
Percentage correct classification	64.8%	66.63%

Standard Error in parenthesis.
*Significance < 0.1; ** Significance < 0.05; ***Significance < 0.01.

Table 3: Multinomial Logit Estimation of the Choice of Governance.

	Alliance	Joint venture –Cross shareholdings	Alliance	Joint venture –Cross shareholdings
Intercept	-2.4017*** (0.63206)	-4.2256*** (0.73369)	-2.3870*** (0.63723)	-4.2234*** (0.73981)
Nº partners	0.51583*** (0.19420)	0.51923** (0.20334)	0.54326*** (0.19848)	0.54672*** (0.2075)
Multiple	2.5029*** (0.31307)	5.1406*** (0.33287)	2.4637*** (0.31237)	5.1166*** (0.33196)
R+D	1.0269*** (0.27512)	-1.3540* (0.70703)	0.28192 (0.32978)	-2.6932** (1.1236)
Diversification	2.1697** (1.0928)	4.3480*** (1.1347)	2.0183* (1.1106)	4.1415*** (1.1422)
Horizontal	1.312*** (0.21442)	0.63020** (0.24799)	1.4202*** (0.21995)	0.70958*** (0.25066)
Spanish	1.1482*** (0.36132)	0.60872 (0.41303)	0.87867** (0.36733)	0.37770 (0.41682)
Europe	0.64788* (0.34792)	1.0296*** (0.39552)	0.65997* (0.34714)	1.0509*** (0.39716)
USA	0.47468E-01 (0.42847)	0.17438 (0.50061)	0.85475E-01 (0.42740)	0.19522 (0.50204)
Japan	0.12250 (0.63599)	0.77240 (0.68677)	0.24290 (0.62801)	0.87603 (0.68857)
Manufacturing	-1.6333*** (0.32403)	-0.43285 (0.38995)	-1.6766*** (0.32684)	-0.47242 (0.39295)
Construction	-0.28044 (0.35296)	0.92721E-01 (0.42069)	-0.31080 (0.35632)	0.71995E-01 (0.42405)
Energy	-0.64690 (0.39997)	-1.4997*** (0.49656)	-0.55857 (0.40407)	-1.4160*** (0.50083)
Gnral. Services	1.1349 (0.82259)	0.55134 (0.87064)	1.1882 (0.82892)	0.60150 (0.87738)
Data90	0.42867* (0.23815)	0.96341*** (0.28187)	0.39667 (0.24174)	0.94437*** (0.28419)
Data91	0.38318 (0.23856)	0.60610** (0.28497)	0.35872 (0.24159)	0.58309** (0.28676)
R&D – Spanish			2.4489*** (0.67906)	3.5564** (1.4725)
Log. Likelihood	-753.9903		-745.4062	
Chi square	972.8455***		990.0137***	
Percentage correct classification	71.95%		71.95%	

Standard error in parenthesis.
*Significance < 0.1; ** Significance < 0.05; ***Significance < 0.01.

NOTES:

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[1] In this paper the word "collaboration" is preferred to "cooperation" because the later suggests the convergence of objectives among firms participating in the exchange or production and therefore the absence of conflicts of interests. The fact that firms collaborate does not imply that each one changes its proper objectives and interests and assume collective ones. The term "alliance" also widely used to refer to any form of collaboration, as in Gulati and Singh (1998, p. 781), is used in this paper to identify a subset of collaboration forms.

[2] See for example the issue of the Journal of Economics Studies, January (1999).

[3] There have been several papers discussing the advantages and disadvantages of balanced joint ventures versus non-balanced one's (see Kogut (1988) for a good classification). But no references have been made to the costs and benefits of ownership as considered in the property right approach.

[4] A detailed comparison between Classical and Neoclassical contracting is found in Mcneil (1974, 1978). See also Williamson (1991, p. 271-273; 1985, p. 70-72).

[5] To ignore two of the possible alternatives, spot contracting and merger or internal development, when explaining the choice of governance forms in collaboration, may in fact bias the results. In any case, the literature on the determinants of "vertical integration" is very large. Worth to mention because of its proximity to interfirm collaboration, is the study of vertical integration in the context of the theory of the multinational firm; Gatignon and Anderson (1988) is an excellent example of the work in this field.

[6] The expression L'_x means the derivative of the function $L(x)$ with respect to the variable x.

[7] Linearity of the variable costs functions is assumed for simplicity and without loss of generality.

[8] "Compensation due to clients" saves commerce agents. It is supposed that the agent creates some clients for the exporter and, for creating them, they must receive non-surrender compensation.

[9] The result is the same if number of partners is treated as a dummy variable with 0 for two partners and 1 for more than two.

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