

LONG-TERM VS. SHORT-TERM SUBCONTRACTING: A TRANSACTION COST ANALYSIS

Susana López-Bayón ^a
Manuel González-Díaz
Faculty of Economic Sciences
University of Oviedo, Spain

Abstract

This paper examines factors explaining the duration of inter-firm subcontracting agreements from the transaction-cost perspective. Specifically, we present an extensive empirical analysis in which additional transactional attributes are considered along with the conventional condition of specificity. To this end, we use a sample of 74 arrangements established in the Spanish electronic industry. According to classical studies, results show that the probability of signing a long-term contract is positively related to the subcontracted activity specificity. On the contrary, such probability is negatively related to the uncertainty regarding the future demand and to the degree of formalization of the contract, due to the fact that both factors increase the risk of contractual inflexibility of long-term agreements. However, neither technological uncertainty nor multiple subcontracting have significant effects on contractual duration.

Key words: subcontracting, contractual duration, transaction costs analysis, contract design, electronic industry.

JEL classification: L14, L22, L23.

^a Corresponding author. *Address:* Facultad de CC. Económicas. Avda. del Cristo S/N. 33071 Oviedo (SPAIN)
Fax: +34 985 10 37 08; *E-mail address:* sbayon@econo.uniovi.es

1 Introduction

This work aims to analyze the factors determining the *duration of contracts* that govern *subcontracting* relationships. For this purpose, we understand by subcontracting “the agreement by which a firm —contractor, buyer or principal— entrusts another — subcontractor, vendor or auxiliary— the procedure of performing for it, and according to certain pre-established indications, a part of its production or services —the final economic responsibility falling on the contractor—” (European Community Commission, Memorandum, 1989).

According to this definition, subcontracting relationships have been basically analyzed as an alternative to vertical integration —or as an instance of vertical disintegration—. Nonetheless, it is fitting to point out that the success of subcontracting does not only depend on the relative advantages offered by outsourcing compared to vertical integration, revealed in the classic “make-or-buy” trade-off —a topic conventionally studied in Transaction Cost Economics (Williamson, 1985, 1996; Shelanski y Klein, 1995). Once the firms decide to contract out a certain activity, the success of this decision is also influenced by the type of contractual structure the firms establish to organise their exchange relationship.

In this sense, our study seeks to contribute to the empirical literature that examines the economic rationale of the different alternatives of contract design and the way in which these influence the efficiency of inter-firm relationships. Particularly, it helps to narrow the gaps existing in empirical evidence about the form taken by subcontracting arrangements —due to the difficulty in obtaining qualitative data on private agreements—, focusing on a particular aspect of these: the duration of contracts.

This analysis is based on the contributions of the transaction cost theory (TC). According to this theory, contract duration is interpreted as a safeguard or guarantee mechanism, aimed to solving the problems generated by the specific nature of investments.

Nevertheless, we also examine additional transaction attributes —such as uncertainty, formalization and number of vendors— and their relationship with contract length. These attributes are not often considered along with specificity in empirical studies, so we seek to offer a more holistic (wider) analysis on factors determining contractual duration from the TC perspective.

The main hypotheses emerging from the literature have been tested on a sample of 74 contracts, established by contractor firms in the Spanish electronic industry that were in force in 1997. This sector was chosen as a field of study due to its twofold interest. Firstly, subcontracting has acquired an increasing economic importance in recent years in diverse sectors of activity, including the European and so the Spanish electronic industry (European Commission, 1997). Secondly, the empirical works analysing contract duration from the perspective of transaction costs focus, mostly, on North American energy industries or raw materials, whereas works on the manufacturing sectors are more scarce (Lyons, 1996)¹.

The remainder of the paper is organised as follows. Section Two formulates the general hypotheses on factors determining the duration of inter-firm contracts. Section Three describes the data and methodology used to test these hypotheses and includes a discussion of the results obtained. Finally, Section Four presents the main conclusions of the study.

2 Factors determining contract duration

The duration of a contract refers to the period of time (or number of discrete transactions) during which the parties agree *ex ante* to commit themselves to the terms and conditions specified in the agreement (Joskow, 1987, p. 169). This duration allows us to distinguish between “short-term” —with durations not over 1 or 2 years—, and “long-term”

¹ It can be noted that the main empirical works in this field are those of Joskow (1985, 1987, 1988 and 1990), Goldberg (1976), Goldberg and Erickson (1987), Crocker and Masten (1988, 1991), Mulherin (1986) and Pirrong (1993).

contracts —normally, between 3 and 5 years— or “indefinite duration” —in which, as there exists an intention to continue in the exchange, the expiration date is not stipulated—. However, the terms “short” and “long” depend on the type of exchange considered², even though in electronics subcontracting the above rule can be applied.

In this respect, it is also fitting to make an initial distinction between the *contract duration* in the strict sense and the *actual duration* of the agreement: The last one refers to the number of periods during which the trade between parties is governed according to the terms and conditions established by the contract. This period of time does not necessarily have to coincide with the period of validity arranged *ex ante* —formal duration of the contract—. Thus, for example, buyers and vendors can renegotiate extensions or renewals of the contractual arrangement frequently and voluntarily, even automatically, thus increasing its effective length. Similarly, the actual duration may be shorter than the stipulated duration if the contract is prematurely interrupted, whether by unilateral sanctions or pacts (Joskow 1987). It should be pointed out that, rather than the actual duration, this work analyses which factors determine the length stipulated *a priori*.

2.1 The impact of asset specificity on contract duration

The transaction cost theory establishes that the duration of inter-firm contracts is determined by the vulnerability of firms in the face of opportunistic behaviors that can arise when negotiating, repeatedly, the renewal or content of short-term contracts. In this sense, this theory considers that such vulnerability not only increases with the lack of competition *ex ante* in the sellers (or contractors) market, but also with making investments in transaction-specific assets. The reason is that, once these investments have been sunk, they generate a situation of monopoly or bilateral dependence, which, in turn, increases the risk of *hold-up*

² Thus, for example, in the subcontracting of IT services, the contracts usually establish durations ranging between 5 and 10 years, in such a way that a duration of 3 to 5 years is considered as “medium” and even “short-

during the contract execution stage³. That is to say, given that idiosyncratic assets have a lower value in any other use, the agent making the specific investment may be obliged to accept originally unfavourable conditions, losing part of her investment (Williamson, 1979, 1985; Klein, *et al.*1978). In this situation, the replacement of a discrete number of repeated transactions by a longer-term contract, that specifies *in advance* the terms and conditions for a series of future exchanges, provides the appropriate vehicle for avoiding problems of adaptation or breach *ex post* (Williamson, 1985; Joskow, 1985; Hart and Holmström, 1987).

A more exhaustive interpretation of this problem enables us to state that a long-term contract that has no penalty clause (explicit or implicit) for the breach of its terms, can really be considered as a short-term contract (Tirole, 1990, p. 54). Nevertheless, we must consider the legal sanctions that can be imposed if the agreements are prematurely interrupted without a justified cause. In this sense, the action of the courts will make the presence of such clauses unnecessary; although their explicit introduction in the contract may make legal action less ambiguous and less costly (Lyons, 1996).

In fact, the stipulated duration of the contract is expected to increase with the lifetime of the specific investments undertaken in the transaction. Furthermore, the only possibility of there occurring a hold-up of quasi-rents in the future renewals of the agreement, deteriorates the *ex ante* incentive to invest in assets that, being able to generate a greater value, are idiosyncratic to the transaction (Tirole, 1986; Hart and Moore, 1988; Rogerson, 1990). That is to say, the agents anticipate that the quasi-rents generated by their investment can be expropriated by the other party, which leads them to invest in alternative technologies that are

term” (Halvey and Murphy, 1996)

³ Specific assets have a value in the actual exchange relationship that is greater than they would have in any other alternative use. This difference in value, or *quasi-rent*, can be expropriated, generating a particular situation of opportunism known as *hold up*.

more flexible but less efficient⁴. From this perspective, the establishment of a long-term contract would act as a guarantee capable of increasing the potential gains to be derived from the transaction. The following hypothesis can therefore be proposed:

H1: In the presence of significant investments in specific assets, the probability of signing a long-term contract will increase. If it is not necessary to make specific investments in order to carry out the exchange, this probability will be lower.

2.2 The impact of number of vendors and partial subcontracting on contract duration

Resorting to a long-term contract is not the unique way available to dissuade partners from opportunism. In general, the ease with which the parties in an exchange can sanction breaches by changing the vendor/buyer acts as an implicit market safeguard capable of discouraging future opportunism. In this sense, even when the investments in specific assets have created a post-contractual situation of *small numbers*, the contractor can try to maintain the market discipline, or its bargaining power, through different practices. In the case of subcontracting, these practices can consist in contracting out an activity with various vendors instead of one vendor —multiple subcontracting—, or in internally maintaining part of the production subcontracted —partial subcontracting—.

In particular, multiple subcontracting avoids the principal depending on a single supplier, decreasing the costs of terminating a specific relation and finding a subcontractor with whom to restore the supply. Thus, the threats of retaliations if breaches are detected become more credible (Lyons, 1994). Similarly, multiple subcontracting enables the information asymmetries between contractor and subcontractor to be decreased. As the number of vendors increases, so does the intensity of their rivalry when bidding for new

⁴ The positive relation between exchange-specific investments and the value created is recognized, among others, by Asanuma (1989), Dyer (1997, 1998) and Parkhe (1993).

contracts or for a larger volume of business, which facilitates disclosing trustworthy information about their quality or production costs (Asanuma, 1989; Seshadri *et al.*, 1991; García-Cestona, 1995).

From this perspective, multiple subcontracting and the drafting of detailed long-term contracts can be considered alternative mechanisms for ensuring that future contractual adaptations will be overcome honestly and efficiently. That is to say, the contractors can also opt for establishing short-term contracts with the largest possible number of firms, in order to avoid post-contractual opportunism. In fact, subcontracting with multiple sellers is normally associated to a form of adversarial or “arms length” buyer-supplier relation compared to the so-called “partnership sourcing”. The latter is characterized by the search for co-operation and complementary specialization between the firms, promoted by the establishment of stable long-term relations with a *lower* number of vendors (Asanuma, 1989, Dyer and Ouchi, 1993). These reasonings enable us to put forward the following hypothesis:

H2: When an activity is subcontracted to multiple vendors, there will be a greater probability that the contract is short-term.

In the same way, if the firm performs partial subcontracting it will probably be in a greater position of power over the vendor, than it would if this activity was subcontracted in its entirety. This is due, not only to the fact that partial subcontracting favors the decrease of possible information asymmetries between the two firms —the contractor has “first-hand” information about the technical aspects of the outsourced activity—; but also to the fact that it can decrease the costs resulting from the suspension of the agreement. Therefore, we also posit a negative link between partial subcontracting and the duration of contract.

H3: When contractor maintains part of the production internally, there will be a greater probability that the contract is short-term.

2.3 Uncertainty, contract complexity and the risk of contractual inflexibility

Long-term contracts are not always efficient in avoiding the risks and costs caused by specific investments. This insufficiency arises when it is very difficult to accurately define the obligations of each party throughout the lifetime of the relationship. In this situation, gaps or problems of *contractual rigidity* may arise that will continue providing an opportunity for performing opportunistic behaviors (Klein, 1988; Crocker and Masten, 1991; Al Najjar, 1995). In particular, the efficient actions to be adopted in the face of an unforeseen event can prove different to those written *a priori* in the clauses of the long-term contract, generating a problem of “contractually-induced opportunism” (Klein, 1996). This problem arises when a party is obliged to strictly obey the “written content” of the contract and, with this, make costly concessions —far removed from the initial interest pursued in the exchange—.

Given the limited rationality of individuals, this risk of inflexibility will increase as the uncertainty surrounding the transaction rises. Therefore, in a setting of uncertainty it can prove more economical to accept the risks of short-term contracting, than the risk of inflexibility linked to longer-term contracts. This reasoning leads us to formulate the following hypothesis:

H4: The uncertainty surrounding the subcontracted activity, regarding both technology and future demand, decreases the probability of establishing long-term contracts.

However, the problem of rigidity generated by a long-term contract is influenced by its degree of complexity or formalization —i.e. the number of specific clauses written in to deal with different contingencies—. In fact, it is the establishment of a highly detailed long-term contract the factor that can increase, *ex post*, the doubts as to which clause to apply in an unforeseen contingency. Thus, the simultaneous restoring of contractual flexibility and the guarantee of fulfillment could also be achieved by introducing ambiguity in the terms of the exchange (Al-Najjar, 1995). It would be a question of defining a long-term “relational

contract”, where only the general terms and objectives of the relationship are specified, as well as the mechanisms for decision-making and dispute resolution (Milgrom and Roberts, 1992).

This kind of “rigidity problem” has been well documented in the studies concerning the illustrative Fisher Body and General Motors subcontracting agreement (Klein, 1988; 1996). The link between contract duration and contractual complexity has also been empirically tested by other authors —e.g. Mulherin (1986), Joskow (1988a) and Crocker and Masten (1991)—, who demonstrate that pricing or quantity clauses are heavily dependent on the duration of the contract. Even though it could be derived from this literature that long-term contracts can give adequate incentives, provided they contain adequate clauses (Joskow, 1985, 1987; Wiggins, 1991), we expect that when the uncertainty surrounding the transaction grows —e.g. as the contingencies in the contract go up— it becomes more expensive as well as more risky to write, monitor and enforce an elaborated *long-term* agreement (see *Figure 1*).

[Insert *Figure 1*: Contractual costs in long-term agreements]

All of this leads us to consider an interactive effect between the uncertainty and formalization on contractual inflexibility, with a negative impact on contractual duration:

H5: The negative relation between the duration of contracts and uncertainty will be increased in the case of highly formalized contracts.

[Insert *Table 1*: Summary of main hypotheses]

3 Empirical testing

In order to test the previous hypotheses, we collected detailed primary data on the subcontracting agreements established in the Spanish electronics industry. The hypotheses

were tested on a representative sample of contractor firms, made up of 74 companies. Therefore, our analysis only considers the information provided by the demand side; that is to say, it does not consider the data that the subcontractors could provide. Although this could constitute a bias in the information obtained, previous studies confirm that buyers and vendors share consistent perceptions of the attributes of the exchanges (Heide and John, 1990; Anderson and Narus, 1990).

The methodology used for data collection was the mail survey. In particular, the information was obtained from a subcontracting agreement for a product (goods or service) that was usually subcontracted, relevant in the firms' production system and that was in force in 1997. In all cases, individuals requested to filling in the questionnaire were managers directly responsible for the management of the contracts chosen by the firms.

The main sources used to obtain the list of firms in the objective population were the directories drawn up by the *Asociación Nacional de Industrias Electrónicas y de Telecomunicaciones* (ANIEL). Firms with fewer than ten employees (5.7% of those registered) were excluded. The justification lies in the fact that these smaller entities are usually specialised in highly specific products with lower added value, being more likely to act as subcontractors rather than contractors, a requirement stipulated in order to fill in the questionnaire (European Commission, 1997). In total, the population considered came up to 248 firms, from which 74 valid questionnaires were obtained, which represents a sample error of 9.5% at a level of confidence of 95%. Finally, we tested for a potential response bias by comparing the respondents and non-respondents on three key organization features: total sales, number of employees and sub-sector of activity. The results of the t-tests performed showed no difference at the significant level of 0.05; thus the results from our research can be generalized to the whole population.

3.1 Data and methodology

The constructs were operationalized with a mix of original and adapted scales derived from the conceptual definition of the constructs and the relevant literature. Measurement scales were also tested through several interviews with Spanish managers in charge of outsourcing contracts.

3.1.1 *Dependent variable and analysis method*

In order to measure the *duration* of the subcontracting agreement—the period during which both parties expressly commit themselves to obey the conditions stipulated in the arrangement—the respondents were directly requested to indicate the formal duration—in months and/or years—of the contract they maintained with the chosen subcontractor. Other authors, like Joskow (1987), operationalize contractual duration as the “actual” length of the agreement: periods of time between the date the contract expires and the date this was formalized or performed for the first time. Nevertheless, this measure poses various problems. Firstly, it requires both parties to have terminated the contract. In addition, this measure it is not always reliable, due to the fact that, just as indicated, the actual duration of a contract does not necessarily have to coincide with the stipulated duration.

The information obtained enabled us the construction of the dummy variable DURADIC, that takes a value of “1” if it is a long-term and/or indefinite contract and a value of “0” should a short or medium-term contract be signed—not over two years—. Considering only these two alternatives, instead of defining a continuous variable, entails simplifying the options existing in the determination of our dependent variable. The particular characteristics of the sample, however, justify this choice. Out of the valid responses obtained for this *item*, 56.7% correspond to indefinite or long-term contracts. The remaining 43.3% are short-term contracts (one year or under) and medium-term contracts (six cases with a duration between 1 and 2 years).

Taking the dummy variable DURADIC, as the dependent variable we went on to estimate a model where the probability of establishing a long-term and/or indefinite contract, $P_i = \text{Prob}(\text{DURADIC}=1)$, is explained by the independent variables defined according to the following epigraph.

Given the typical problems of the ordinary least squares (OLS) estimate in a model of dummy dependent variable⁵, the original model was transformed using a logistic function in the following form:

$$P_i = F(\alpha + \beta X_i) = \frac{1}{1 + e^{-(\alpha + \beta X_i)}}$$

which assumes that the model estimated by maximum likelihood is:

$$\log\left(\frac{P_i}{1 - P_i}\right) = \alpha + \beta X_i$$

where P_i is the dependent variable representing the probability that contractor i adopts an indefinite or long-term contract, X_i is the vector of independent variables of the model and β the vector of parameters to be estimated.

3.1.2 Independent variables

In accordance with the proposed hypotheses, as independent variables we have analyzed the specificity, the presence of multiple and partial subcontracting, uncertainty and the degree of complexity or formalization of the contract. *Table 2* shows a summary of the main descriptive statistics obtained for each of the predictors, as well as their correlations. The way in which such variables were measured through the questionnaire is discussed below.

Specificity measure. In order to measure this characteristic, the respondents were requested to indicate the degree to which the *subcontracted activity* was specific to their firm on a 5-point Likert scale, which enabled the construction of the SPECIFI variable. This item,

⁵ See, for example, Pindyck and Rubinfeld (1991 p. 249-260).

although it does not directly measure the amount of specific investments made by both parties participating in the exchange, can be interpreted as an integrating measure of the level of idiosyncratic assets undertaken in the subcontracting relationship, and with this, of the degree of bilateral dependence existing between the contractor and the subcontractor. It is fitting to point out that, in order to eliminate the possible biases in the interpretation of this term, the question incorporated in the questionnaire directly explains the concept of specificity to the respondents —i.e. the subcontracted activity is not redeployable to alternative uses or has no value for alternative buyers (Williamson, 1985)—.

Nevertheless, this form of measuring the presence and/or importance of specific investments is not free of disadvantages. In particular, the responses given to this type of qualitative question can depend on the subjectivity of the person responding to the questionnaire; that is to say, on the respondent's personal appraisal of the alternative uses of the firm's investments (Masten *et al.* 1991, p. 12). Despite this, the measures of specificity based on the responses of technicians or managers have been used in numerous empirical studies, which is mainly due to the difficulty in gaining access to direct quantitative information on this variable —e.g. Anderson and Schmittlein, 1984; Masten, *et al.* 1991; Lyons, 1994; Zaheer and Venkatraman, 1995—.

Multiple and partial subcontracting. To analyze the effect of the number of vendors on contract duration, the respondents were asked how many firms they subcontracted the activity to. Based on these data, we constructed the dummy variable MULTIPLE that takes a value of “1” if the firm has more than one seller and a value of “0” otherwise. Similarly, we operationalized partial subcontracting by means of another direct question which enables us the construction of the dummy variable PARTIAL, which was given the value of “1” when the firm maintains part of the production of the outsourced activity internally and “0” if not.

Uncertainty measure. Regarding this factor, various alternative measures have been considered, referring to the technological uncertainty surrounding the subcontracted activity, as well as the uncertainty concerning the future needs or demand of the subcontracted work.

Technological uncertainty has been analyzed in previous empirical studies from different perspectives, taking into account that this can be explained by the “dynamism” or “complexity” of the technology involved in the exchange. Thus, diverse works understand that this type of uncertainty is greater as the degree of novelty or technological change surrounding a transaction increases and/or the certainty with which such changes can be predicted decreases —e.g. Balakrishnan and Wernerfelt, 1986; Harrigan, 1986; Walker and Weber, 1984, 1987; Lyons, 1994; Zaheer and Venkatraman, 1995—. On the other hand, the studies that approximate this characteristic in terms of the degree of complexity of the technology have measured the latter by direct questions —e.g. Masten, *et al.*, 1991— or, indirectly, by the engineering effort required by the development of the exchanged product⁶.

Taking into account the above rules, we opted to assess the degree of technological uncertainty through the “dynamism”, as well as the “complexity” of the technology involved in the subcontracted work –measured by 5-point Likert scales–. The information obtained enabled the following variables to be set:

- DYNACTIV: measures the probability of the emergence of technical improvements in the design and/or functions of the subcontracted product.
- COMPLEX: measures the technical complexity of the subcontracted product compared to the rest of the products obtained internally by the contractor firm.

⁶ In particular, this measure is used by Masten (1984). Nevertheless, it must be pointed out that this measure based on the “engineering effort” has not only been used to evaluate the degree of technological complexity. It has also been used to estimate the specificity of *human capital* involved in a transaction (Monteverde and Teece, 1982) and, by Masten *et al.* (1991), to evaluate the degree of *similarity* between the internal operations of the firm and those contracted out.

- ENGINEER: measures the effort in engineering or R+D required by the subcontracted product compared to the rest of the products manufactured internally.

The estimation of the Cronbach α coefficient for the set of variables, confirms the internal consistency of the scales used (0.7792), which enables their combination in a single factor for approximating the technological uncertainty, UNCERTEC, the result of averaging the values of DYNACTIV, COMPLEX and ENGINEER.

Finally, the variable UNCERTAQ measures the uncertainty as to the demand. In particular, this variable measures, on a five-point scale, the degree to which the respondents expect significant fluctuations in the amount of future needs (annual, monthly consumption) of the subcontracted product.

Degree of contract complexity or formalization. In relation with the last hypothesis, we operationalized three clauses to develop a fine-grained measure of contractual complexity, in terms of the degree of specification of three basic dimensions of the results: clauses regarding prices, quantities and technical requirements. One item was devised for each type of clause. Using a methodology close to that of Ulset (1996, p.75-76), these items were part of the following questions: “In the contractual document, how clearly defined and clarified are the following points”: (A) Technical requirements concerning the subcontracted product; (B) Prices and installments; and (C) Quantities and deadlines. Each of these was answered in a 5-point Likert scale ranged from “everything clarified” to “nothing clarified”. The three items were summarized into a complexity index labeled FORMAL —the Cronbach α coefficient confirms the internal consistency of the three scales used (0.6838)—.

Control variables. Finally, we considered a set of control variables, referring to the sub-sector of the electronic industry where the contractor firms operate ($SECTOR_i$)⁷ and to the type of subcontracted activity ($IDENTIF$). The aim was to estimate the incidence of the characteristics typical of the field of activity and the nature of the subcontracted operation — apart from the previously defined independent variables— about the probability of establishing an indefinite or long-term agreement. $IDENTIF$ is a dummy variable that takes a value of “1” for subcontracting a manufacturing activity —whether the manufacture of components, finished products or equipment— and “0” for subcontracting a service other than manufacturing —such as, for example, design, programming or maintenance—.

[Insert *Table 2: Sample Statistics and Correlation Matrix*]

3.2 Results and Discussion

The above hypotheses were tested in the following stages. Firstly, a binomial logit model was estimated incorporating only the variables directly related to the hypotheses, without including the interactive effects between uncertainty and the formalization of contracts (Specification 1). Then, this model was again estimated including this interactive effect (Specification 2). Thirdly, in order to check the robustness of the results obtained, another estimate was made by only incorporating those variables whose effect was statistically significant (Specification 3). In the fourth stage, the control variables were incorporated (Specification 4). Such estimates are presented in *Table 4*. For each model, the value of the coefficients of the different variables, their standard error and an indication of their level of significance is shown.

⁷ The Electronics Industry is made up of the following sub-sectors: 1. manufacturers of *electronic components*; 2. *consumer electronics*; 3. *professional electronics*; and 4. *telematics*. Accordingly, we have created four dummy variables ($SECTOR1$, $SECTOR2$...) to represent each of them.

In general, all the models present satisfactory indicators of overall significance, with chi-squared values corresponding to levels of significance lower than 0.05. In addition, the percentages of correctly classified cases by the estimated functions are over 73% and 80% (Table 5).

Focusing on the hypotheses testing, it is observed that the variable SPECIFI, measuring the level of specific investments involved in the transaction presents a positive and statistically significant effect, which enables us to validate the reasoning of transaction costs compiled in the first hypothesis. That is to say, as relationship-specific investments become more important, the parties will find it more advantageous to rely on longer-term contracts that specify the terms and conditions of repeated transactions *ex ante*, rather than relying on repeated bargaining.

On the contrary, the MULTIPLE variable, although presenting the expected negative sign —would indicate a lower probability of drawing up a long-term contract when subcontracting with more than one vendor—, is not statistically significant. This therefore prevents us from validating the second hypothesis. Nevertheless, this lack of significance has to be considered with some reserves, due to the limitations existing in the measure of this characteristic. The restrictions imposed by the size of the sample have led us to use a dummy variable, instead of a continuous variable indicative of the number of subcontractors available. In this sense, the information provided by MULTIPLE can prove to be inadequate, concealing the possible effect of the number of vendors on the contract duration. In fact, this attribute has a negative statistical significant effect on DURADIC when we consider a new independent variable, VEND4, which adopt the following values: “1” if contractor firm has only one vendor; “2” if it has between two and four vendors; and “3” if it has more than 4 vendors (VEND4 coefficient: -0.824; Sig.: 0.031**; E.T.: 0.382; MODEL: χ^2 : 5.14, P<0.05).

Nonetheless, these categories are somewhat subjective to include the predictor VEND4 in the model.

In relation to Hypothesis 4, the variable UNCERTAQ presents the appropriate sign and is statistically significant, indicating that the greater the uncertainty, the lower the probability of establishing a long-term contract. This result backs up Hypothesis 4 and, with this, the aggravating effect of uncertainty regarding the risk of contractual inflexibility, in agreements with a lengthened period of validity. Nevertheless, it is fitting to argue an alternative justification for this result. The uncertainty concerning future demand proved to be significantly greater in those cases in which the firms mainly performed an “overflow subcontracting” (*Table 3*).

[Insert *Table 3*: Non-parametric test to compare UNCERTAQ means for two groups...]

This form of subcontracting usually has a temporal nature, although not necessarily sporadic; that is to say, its origin lies in temporary saturations of the contractor’s production capacity. For this reason, a permanent economic relationship is not likely to develop between the contractor and his subcontractors (Imrie, 1986). Thus, the result obtained may be, precisely, due to the connection between UNCERTAQ and this variety of subcontracting. On the other hand, the effects of technological uncertainty, UNCERTEC, are not statistically different from zero.

It is fitting to point out that, the interactive effect of uncertainty —whether regarding demand (UNCERTAQ) or technology (UNCERTEC)— with the degree of contract elaboration (FORMAL) is not significant. That is to say, the risk of contract inflexibility experienced in contexts of uncertainty does not seem to be aggravated when the contracts are more detailed. However, the extent of contractual formalization considered in isolation does present a negative direct effect, statistically different from zero. An explanation for this result

is that, independently of the existing level of uncertainty, the degree of explicit specification of the contractual terms increases the risk of contract inflexibility in long-term agreements, and so these tend to have a more informal or tacit nature and vice versa.

Finally, in relation to the control variables, the results reveal that, compared to the contracts used in the outsourcing of a service, the contracts established for industrial subcontracting —whether the manufacture of a component, a finished product or equipment— have a higher probability of being long-term agreements.

[Insert Table 4: Binomial logit model. Determinants of contract duration. β^{SIG} . (standard errors)]

[Insert Table 5: Classification Table]

4 Conclusions

This work analyses those factors determining the duration of subcontracting agreements. To this end, several hypotheses, derived from contractual theory, have been tested using evidence from the Spanish electronics industry, on a database consisting of 74 contracts. From the empirical test, various conclusions can be drawn.

The results show, first, that when the specificity of subcontracted activity increases — and so the level of specific investments involved— firms tend to rely on long-term contracts instead of short-term ones. The underlying argument behind this evidence, based on transaction cost analysis, is that a long-term contract is better at solving the quasi-rents expropriation problem. Moreover, this operates as a guarantee capable of encouraging subcontractors to make more idiosyncratic, and thus efficient, investments.

Second, the number of vendors does not show any statistically significant effect on contractual duration. We conjecture that this is due to the fact that we just look at the trade-off

between having one or more subcontractors. Further research, employing more precise measures regarding the number of vendors, is required to analyze this effect in depth.

Third, it is demonstrated that duration decreases as the magnitude of demand uncertainty increases. However, the effect of technological uncertainty on subcontracted activity is not significant. A possible explanation is that firms tend to employ short-term agreements to resolve temporary shortages of capacity, but not necessarily to solve potential rigidity problems of long-term contracts caused when demand or technology is unstable. In fact, rather than relying on repeated bargaining over short-term agreements, problems caused by inflexible long-term contracts seem to be better solved by means of less formalized arrangements —i.e. relational contracts—. Actually, results also reveal that formalization has a significant negative effect on contract duration.

In sum, our study suggests that it may be appropriate to sign less elaborated contracts if these are long-term. Proved that the more complex the contract, the more expensive is to write, to monitor and to enforce it, the restoration of contractual flexibility in long-term agreements could be achieved by resorting to implicit or self-enforcing safeguards —such as reputation or trust—, instead of writing more elaborated clauses so as to deal with the future contingencies. Despite our results concerning multiple and partial subcontracting do not support at all this argument, we hope this paper will open avenues for further empirical research on this topic.

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6 Figures and Tables

Figure 1: Contractual costs in long-term agreements



Table 1: Summary of main hypotheses

Hypotheses	Incidence on contractual duration
H1 Specificity (Hold-up problems)	Positive (+)
H2 Multiple subcontracting (Number of vendors)	Negative (-)
H3 Partial subcontracting	Negative (-)
H4 Uncertainty (Contract inflexibility)	Negative (-)
H5 Interaction between the degree of contract formalization and uncertainty	Negative (-)

Table 2: Sample Statistics and Correlation Matrix

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	1										
II	-0.259*	1									
III	-0.062	0.146	1								
IV	0.202	0.033	0.024	1							
V	0.211	0.099	0.344**	0.227	1						
VI	0.010	-0.031	0.230	0.040	0.281*	1					
VII	0.099	-0.052	-0.164	-0.110	-0.243*	0.032	1				
VIII	-0.202	0.140	0.082	-0.150	-0.147	0.038	-0.094	1			
XI	0.064	-0.038	-0.038	0.302**	0.186	-0.008	-0.317**	-0.410**	1		
X	-0.054	0.101	0.172	-0.217	0.039	0.001	-0.130	-0.168	-0.569**	1	
XI	0.427**	-0.142	-0.289*	0.184	0.033	-0.055	0.190	0.059	0.107	-0.252*	1
\bar{X}	3.30	0.68	0.27	2.81	3.00	2.54	0.06	0.16	0.58	0.19	0.67
S	1.38	0.47	0.44	1.01	0.89	1.05	0.19	0.37	0.49	0.39	0.47
I: SPECIFI		II: MULTIPLE		III: PARTIAL		IV: UNCERTEC		V: UNCERTAQ		VI: FORMAX	
VII: SEC1		VIII: SEC2		IX: SEC3		X: SEC4		XI: IDENTI			
* Significant at 0.05 (bilateral).		** Significant at 0.01 (bilateral).									
\bar{X} : Mean		S: Standard Deviation									

Table 3: Non-parametric test to compare UNCERTAQ means for two groups
(Grouping variable: Overflow Subcontracting)

	Group		Mean
Subcontracting to resolve temporary shortages of capacity	1. No		2,70
	2. Yes / In some extent		3,28
Mann-Whitney U	Wilcoxon W	Z	Asympt. Sig. (2-tailed)
435	996,5	-0,639	0,008

Table 4: Binomial logit model. Determinants of contract duration. β^{SIG} . (standard errors)

	Specification (1)	Specification (2)	Specification (3)	Specification (4)
Independent variables				
CONSTANT	-0.628 (1.376)	2.032 (1.925)	0.841 (1.201)	0.781 (1.369)
SPECIF_P	0.811*** (0.266)	0.942*** (0.314)	0.899*** (0.267)	0.777** (0.288)
MULTIPLE	-0.503 (0.673)	-0.622 (0.784)	-- --	-- --
PARTIAL	0.785 (0.688)	0.893 (0.832)	-- --	-- --
UNCERTEC	0.470 (0.311)	0.396 (0.384)	-- --	-- --
UNCERTAQ	-0.963** (0.424)	-0.885* (0.494)	-0.488 (0.375)	-0.487 (0.414)
FORMAL	-- --	-1.243** (0.482)	-0.753** (0.300)	-0.745** (0.314)
FORMAL*UNCERTEC	-- --	0.527 (0.452)	-- --	-- --
FORMAL*UNCERTAQ	-- --	0.605 (0.464)	-- --	-- --
Control variables				
SECTOR1	-- --	-- --	-- --	-1.685 (1.345)
SECTOR2	-- --	-- --	-- --	-0.294 (1.208)
SECTOR3	-- --	-- --	-- --	-0.691 (0.795)
IDENTIF	-- --	-- --	-- --	1.329* (0.804)
N	67	67	67	67
χ^2	19.485 (p= 0.002)	33.251 (p= 0.000)	22.851 (p= 0.000)	27.361 (p= 0.000)
Pseudo R²	0.252	0.391	0.289	0.339
Correctly classified	73.1%	76.1%	74.6%	80.6%
Significance levels.	* p < 0,1	** p < 0,05	*** p < 0,005	

Table 5: Classification table

	Specification (1)		Specification (2)		Specification (3)		Specification (4)	
	Predicted		Predicted		Predicted		Predicted	
Actual	Y=0	Y=1	Y=0	Y=1	Y=0	Y=1	Y=0	Y=1
Y=0	18	11	21	8	19	10	22	7
Y=1	7	31	8	30	7	31	6	32
% Cases predicted correctly	73.1%		76.1%		74.6%		80.6%	