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THE DEMAND FOR KNOWLEDGE INTENSIVE BUSINESS SERVICES IN A REGIONAL ECONOMY: OUTSOURCING DETERMINANTS FOR FIRMS IN ARAGON[^]

Fernando Rubiera Morollón
University of Oviedo (Department of Applied Economics), Spain
Eva Pardos
University of Zaragoza (Department of Applied Economics), Spain
Ana Gómez Loscos [*]
Fundación Economía Aragonesa, Zaragoza, Spain

ABSTRACT:

The use of advanced business services has become an essential element for competitiveness in modern economies in which traditional competitive advantages are being replaced by new ones based on higher quality, knowledge or the use of information and communication technologies (KIBS). Within this context, labelled by some authors as servindustrial societies, certain services (computing, communications, human resources, engineering, consulting or management) are generally outsourced so as to exploit the advantages derived from specialization and division of labour, as well as those of scope and agglomeration economies. However, some businesses, sectors or regions appear to present very different outsourcing patterns of advanced producer services. This could be connected to the strong trend towards geographical concentration of advanced services firms. Some studies have shown that firms in regions with an underrepresented advanced services sector (as opposed to those regions which concentrate demand as well as supply of these services) could face a vicious circle of low demand for advanced services due to their low quality; therefore, outsourcing patterns will probably differ between regions. This paper presents a study of the explanatory elements of business outsourcing decisions applied to a Spanish region with the aforementioned characteristics, employing discrete response models use to the information obtained in a survey elaborated by the authors. The variables that are found to be most relevant are the size and age of the firm, its technical complexity structure and its satisfaction with previous outsourcing experiences, among others.

Key words: Advanced business services, outsourcing, regional development.

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1. Introduction.

The traditional competitive advantages of businesses based on price, lower labour costs or the abundance of natural resources are being replaced by new advantages based on elements such as higher quality, knowledge or the correct use of information and communication technologies (ICTs). This has meant that certain tertiary activities, such as computer related services, management consultancy, labour recruitment and provision of personnel or technical services, have become key activities for stimulating and developing the active economy of a territory, and can be defined as *knowledge intensive business services* (KIBS).

These activities, however, are characterised by intense patterns of spatial concentration, presenting major territorial imbalances in their distribution. Different studies have found solid evidence indicating that these major differences in spatial distribution in the provision of advanced producer services affects the behavioural patterns of firms with respect to the consumption of these services. This consumption is found to be significantly lower in regions in which this sector is less developed. One such region among thee Spanish ones is Aragon, with an under-represented number of firms and employees in the advanced services sector, and a especially high concentration of general economic activity and of advanced services in particular in and around its capital city, Zaragoza[1].

In view of the relevance of the above statement, this paper presents an analysis of the outsourcing patterns of advanced business services that allows us to test whether different patterns really do exist in this respect on the basis of the location of firms within a region, and if they differ from the ones found at national/regional levels. We likewise identify the factors that affect the buy-*versus*-do decision with respect to a particular advanced service. After reviewing the economic literature on the subject, we present an empirical analysis that includes all the variables that are the most relevant *a priori*. The carrying out of this empirical analysis, in which discrete response models are employed, required the construction of our own database.

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[1] Business services made up only 5% of value added and 6% of employment in the region in 1999, not surprisingly given the extraordinary concentration of the sector in Madrid and Catalonia (50% of national employment in the sector). The trend towards asymmetric location is again extreme within the region, the city of Zaragoza, with around 60% of regional employment, concentrates more than 80% of the jobs in business services. See Pardos and Gómez-Loscos (2003a) and Pardos, Rubiera and Gómez Loscos (2004) for further details.

After briefly defining the concept of advanced services/KIBS and reviewing the effects of these activities on regional development (Section 2), we make a general presentation of the analysis carried out (Section 3). Section 4 begins with a description of the most relevant features of the survey elaborated by the authors, to then go on to present the main results obtained in the analysis, for which discrete response models were employed (a logit model to analyse the decision to use advanced business services and a multinomial ordered logistic model for the outsourcing determinants). A number of initial conclusions, summarised in the final section, are then drawn on the basis of this analysis.

2. Advanced business services and their influence on territorial development.

Rubalcaba (1997) defines *business services* or *producer services* as *those real tertiary (non financial) activities that fully influence the competitiveness of firms through their use as intermediate inputs in the value chain and by means of the gains in quality and innovation resulting from the interactive provision between provider, client and service.* This definition precisely delineates the set of activities that constitute this branch of the tertiary sector. There is, however, substantial heterogeneity within this sector, with very diverse activities coexisting. One of the internal classifications of the activities belonging to this branch, of the many that may be applied, distinguishes between *traditional* and *advanced* business services. The distinction between the former and the latter is fundamentally based on different technological intensities and different intensities of knowledge.

Thus, business services that require little technology and which do not need human resource intensive in knowledge are considered *traditional*. Services such as those of industrial cleaning, investigation and security activities, secretarial services and packaging activities are, among others, examples of activities that may be considered *traditional* business services. Likewise, business services that require high levels of technological intensity and human resource intensive in knowledge may be considered *advanced*. Activities such as technical services (architectural and engineering activities and related technical consultancy), computer and related services (hardware consultancy, software consultancy and supply or data processing) and even labour recruitment and provision of personnel services may be considered advanced business services activities. To give a clear answer to the question as to which activities would form part of advanced business services in cases that are difficult to classify, it is necessary to manage another additional criterion. *Advanced* business

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services may be considered as those which contribute to the adaptation of client firms to change, innovation or technological development, as well as the incorporation of advanced techniques in business management, production, market research or adaptations of internationalisation processes. Thus, the particular cases of accounting and fiscal consultancy services would not be considered advanced services, since their contribution to change or innovation in the firm that acquires them is not very relevant. It would hence be more correct to consider them as traditional services. Likewise, staff training services may be included in the advanced category, since their function is relevant for the adaptation of the firm to change.

In brief, advanced business services, as opposed to traditional ones, are personalised services an offer a relatively diversified range with high quality provision. They are characterised by their high tendency to concentrate and centralise, high level of qualifications of their workers and, generally speaking, high functional and geographical flexibility of their staff. They imply a major connection to information, new technologies, new management, production and sales techniques, and to new markets, they go beyond the local dimension. Usually it can be said that these services attain high productivity through their low intensity in labour factors, they are better described as capital intensive relative to traditional services (Asiaín 2002).

Having carried out the delimitation of advanced business services, it is now necessary to enumerate and internally order these activities. Bearing in mind that we are referring to a highly specific branch, it is relevant to look for internal classification criteria that go beyond those of mere assignment by industry activities. We therefore propose the classification contained in Table 1, in which a list of activities is presented alongside their correspondence with the *NACE Rev1 code*, grouped together in a practical way considering the industry sector. In order to use it for building our own database, an effort has been made between theoretic criteria and a manageable branch division, so that firms would find it easiest to answer the questionnaire.

In accordance with the above delimitation of advanced services and considering the activities that are included in this branch of the tertiary sector, their importance in economic growth, attraction and development of a particular territory is evident. At least four ways may be considered by means of which these activities influence the competitiveness of the regions in which they are developed.

Table 1: A possible classification of advanced business services (*)

COMPUTER SERVICES	
(72)	Hardware and Software consultancy and supply
	Data processing and data base activities
	Maintenance and other computer services
ADVANCED BUSINESS AND MANAGEMENT CONSULTANCY	
(74.11, 74.12, 74.13, 74.14 and 74.84)	Business organization
Accountancy, auditing and legal	Management control
consultancy not considered	Strategic planning
	Economic and financial consultancy
	Foreign trade consultancy
	Logistics consultancy
	Socio-economic studies
	Urban planning consultancy and locating plants
	Quality management
	Market surveys
HUMAN RESOURCES	
(74.5)	Personnel recruitment and training
Temp recruitment agencies not	Safety and occupational health
considered	
ENGINEERING AND INDUSTRIAL DESIGN	
(74.2, 74.4 and 74.84)	Architecture, engineering and another technical services
	Technical test and analysis
	Quality control
RESEARCH & DEVELOPMENT	
(73)	R&D consultancy
ADVERTISING	
(74.4)	Advertising, public relations and communications
Advertising leaflets	Trade fairs, conferences and exhibitions organization
not considered	Graphic design
ENVIRONMENTAL CONSULTANCY	
(74.7 and 74.84)	Energy saving and w aste treatment
Regular refuse collection not considered	Environmental impact assessment/correction

(*) In brackets and italics Correspondence NACE Rev 1 codes.

Source: Own.

Firstly, advanced services improve the competitiveness of the firms that contract them[2], since they allow these firms to reduce prices as a result of increased productivity, the conversion of fixed costs to variable costs by means of *outsourcing* and an increase in the division of labour. The *subcontracting* firm focuses on its own activity and the services firm on carrying out its particular activities, which are becoming more and more complex and which therefore require greater specialization. At the same time, the provision of these services facilitates an improvement in quality, a factor of growing relevance in the competition between firms in present-day economies (Lindahl 1994).

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[2] See Filer and Siegel (1999) as an example.

Secondly, advanced business services facilitate the transition to *servindustrial societies*[3], contribute to innovation in firms and help in the acquisition of the necessary knowledge and instruments for full implementation and mastery of the new information technologies[4], in which both Europe as well as Spain lag considerably behind the USA[5]. In the Spanish and European context, Aragon is not specialised in services, nor in business services. Although the sector has been the most dynamic in terms of value added and particularly in job creation for the last years, it still has a smaller weight in the regional economy than the Spanish average, and a considerable potential to grow and to become more integrated with the industrial sector[6].

Thirdly, advanced business services play an important *infraestructural* role (Begg 1993), since they generate a series of dynamic relations between firms that decisively affect the territory in which they act. Their presence is thus an element of attraction for new industrial investment (Alonso and Chamorro 2000), they facilitate the full incorporation of the new information and communications technologies[7], as well as access to and the overcoming of the challenges derived from what has been called the globalisation of economies[8]. In formerly industrialized regions, characterized by a lack of dynamism and greater difficulties in adapting to new productive structures, advanced business services may contribute in a special way to economic revitalization via the transmission of new production systems (new knowledge and know-how) and adaptation to the new technologies, steering these regions towards their required restructuring (Zurbano 1997). Lastly, these activities are fundamental for SMEs. Small and Medium-sized Enterprises are key players in present-day economies due to being more flexible and capable of adapting to change as a result of their reduced size. They have, moreover, a special capacity for job creation. However, it is precisely their size that makes it difficult for them to generate, on their own, complex or specific knowledge that will enable them to accede to the new information technologies, participate in internationalisation or continuously innovate. A dynamic producer services sector can

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[3] The type of society identified by Ruyssen (1987), who indicated that one cannot properly speak of *deindustrialisation* but rather of a *new economy*, of a *mixed society*, of a combination of goods and services.
[4] See Gallouj (2002), Muller and Zenker (2001), Antonelli (1998) and Gule and Quinn (1998), among others.
[5] See European Commision (1998).
[6] Aragon would be included in the group of Spanish regions with a smaller advanced services sector according to the specialization index, at a distance of more than 0.25 from the unit. See Note 1 and Pardos and Gómez-Loscos (2003a, b).
[7] As pointed to by Gallouj (2002) or Antonelli (1998), among others.
[8] See, for example, Aharoni and Nachum (2000).

overcome this problem and fuel the development and survival of this type of enterprise (Keeble, Bryston and Wood 1991).

Finally, the high direct or indirect job-creation capacity of these activities should not be overlooked (Wood 1986). Business services in general, and advanced ones in particular, are characterized by presenting strong processes of geographical concentration, the result of which is that certain regions benefit from attracting firms belonging to this sector that are capable of generating a high volume of employment and production. On the other hand, the gains in competitiveness and efficiency that these activities generate in the ways mentioned above together with their capacity to attract new investment will facilitate greater economic growth in the rest of the economy, thus creating new jobs.

3. Methodology of the present study on *outsourcing* patterns of advanced business services.

Having delineated the branch of advanced business services and analysed its importance for the economic growth and competitiveness of the territories in which these activities are developed, the aim of this section is to present a study on the patterns of outsourcing of these activities in our region of interest, Aragon in Spain. We try to identify the relevant elements in the decision to use a particular service, in the first place and, secondly, we analyse the determinants of the outsourcing behaviour of the firms.

After a comprehensive review of the literature on this subject, it may be considered that among the main elements that *a priori* appear to be the most relevant in the decision of firms to outsource may, the following may be highlighted:

• The size of the firm (variable *SIZE*). All the empirical literature on this topic seems to coincide on the existence of a relationship between the degree of *outsourcing* and the size of the firm. In the majority of studies, such relationship is found to have an inverted *U* shape. This is because small firms have lesser and simpler tertiary needs, which means that they subcontract out fewer producer services activities, both advanced as well as traditional. The larger the firm, however, the greater and more complex the tertiary needs it will have, with the subsequent need to resort to a greater use of subcontracting. When the size of the firm exceeds a certain limit, its capacity to be self-sufficient with respect to services is greater, which on occasions translates as lesser

external tertiary needs[9]. The variable *SIZE* may be constructed by taking either the turnover of the firm or its workforce, though for reasons of statistical availability in the empirical analysis, we shall opt for the use of the latter.

• The ownership structure (variable *FOREIGN OWN*). The type of firm we are dealing with from the viewpoint of ownership structure (branch, subsidiary, franchise or independent firm; public or private sector regional, national or foreign capital firm) will have a relevant influence on the way of managing the firm, through which it may possibly translate this influence to its *outsourcing* behaviour (O´Farrell *et al.* (1993) and O´Farrell *et al.* (1998)). Once again, there exists great difficulty of a practical nature due to the fact that the information relative to the ownership of firms is very difficult to obtain. However, variables may be constructed that include the share of each type of ownership with respect to the total registered capital of the firm.

• The fact of being part of a larger group of firms (variable *GROUP*) can be considered a related but differentiated influence on the decision to use advanced services, as well as on the degree of outsourcing. Quite often these national or multinational groups are more aware than individual firms of the need for advanced services to assure their competitiveness. At the same time, there can be found reasons to expect their use of outsourcing strategies (for example, through their links to large and competitive suppliers of those services) or, on the contrary, their resort to in-house or "in-group" supply related to the size obtained thanks to the group.

• The degree of technological complexity (variable *TECH*). A factor that *a priori* appears to be important in the intensity with which external consumption of advanced services is demanded is the level of technological complexity at which the firm has to operate[10]. Although this technological complexity is beginning to be generalised, there exist activity sectors that present a greater need to participate in the new ICTs, as well as to keep innovating constantly in these and other fields. It may be approximated by the capital stock per worker, measured by means of the total capital stock divided by the number of employees. This is what is proposed for the variable *TECH* employed in this research study.

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[9] See, Mañas (1992), O´Farrell, Hichens and Moffat (1993) or Hermosilla (1997), among others.
[10] See Moulaert and Daniels (1991), O´Farrell, Hichens and Moffat (1992), and Wood (1997), among others.

• The importance of human capital (variable *TRAINING*). Another factor that in principle appears to be important in the decision to *outsource* is the need that each firm has to boast highly qualified staff (Wood 1997). Therefore, the level of training required by the firm must be included in the analysis of the factors that influence its *outsourcing* behaviour. This is included by means of the variable *TRAINING*, constructed as the average number of staff that have a degree in the company, thus approximating the average level of training existing in the entity.

• Age of the firm (variable *AGE*). O´Farrell *et al.* (1993) and O´Farrell *et al.* (1998) find the variable years of permanence of the firm on the market to be significant in its degree of external consumption of business services.

• Destination of production (variable *EXPORT*). The studies by O´Farrell *et al.* (1993) and O´Farrell *et al.* (1998) also reveal the significance of the destination of production; i.e. whether this is mainly international or national, or whether, to the contrary, it is chiefly regional. Other authors have found evidence that the internationalisation processes of firms bring about an increase in the tertiary consumptions of these firms (Daniels 1993). A variable that includes the percentage of production directed to non-regional or strictly international markets may capture this factor.

• The location of the firm (variable *ZARAGOZA*). Several studies have found that the largest external consumption of services is carried out among firms that are located in, or very close to, large urban centres (Illeris 1996). As mentioned, all the studies on the spatial behaviour of these activities report a strong trend in this sector to concentrate around certain nucleus or development *nodes*[11]. When this occurs, the benefits of the economies of agglomeration are concentrated in very specific areas in which the majority of firms in the sector locate. The remaining territories will present much lower levels of development of the activities located there, as well as a lower quality and competitive capacity in these activities. Faced with this scenario, two kinds of reaction may be expected among the firms that are potential consumers of outsourced advanced services and are established in the territories in which these activities have been developed less. For Large and Medium-sized Enterprises, it is easy to identify which areas in each country boast the privilege of having developed an extensive fabric of

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[11] The literature on this topic is very extensive; however, we recommend the synthesis presented in Daniels and Moulaert (1991) and in Illeris (1996). For Spain, please see Martínez and Rubiera (1999).

advanced producer services firms. It will therefore be very common for these firms to adopt the behaviour of *fleeing* towards these areas in search of lower prices and greater quality in the offer of advanced services. The more complex and specific the demanded service and the worse its available offer within a region, the greater this flight will be. On the other hand, Small to Medium-sized Enterprises will normally opt for the other existing alternative, which consists in limiting their consumption of advanced services when faced with the high prices and reduced quality of the offer at a regional level. Some of these entities of a smaller size may venture to consume in other regions, but they will not normally be acquainted with the existing possibilities in the sector and will thus make little use of these services (Martínez and Rubiera 2001 and Martínez and Rubiera *et al* 2002). In Aragon, its capital, Zaragoza, is the only large urban centre, and therefore the location of firms in this city is an independent variable.

• It seems appropriate to include the satisfaction of the firm in the external tertiary consumptions they have previously carried out (variable *SATISFAC*) as an important factor in the subsequent decisions of contracting new services[12]. We use a dummy variable that takes the value 1 if the firm is satisfied with each business service branch, and 0 if it is not.

• Finally, there may be a series of factors that are common to an activity sector and have an influence on the decision to buy versus do a particular advanced service[13]. We therefore propose to use dummy variables for sectors. The choice of the level of sectorial disaggregation is fundamental, since it requires not disaggregating too much (which implies obtaining not very satisfactory results), nor aggregating excessively (which would suppose a loss of relevant information). The sectorial classification proposed in this paper, consists of just three sectors: industry, services and construction, which is highly conditioned by the available data.

The dependent variables in all this analysis are two. In the first analysis, it is the decision to use a particular service (variable *USE*), which may be formulated independently for each type of advanced service (in accordance with the classification presented in Table 1) or in an aggregate way for the entire advanced business services sector. In the same way, the

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[12] See, for example, Nowak and Washburn (1998) or Patterson and Spreng (1997).
[13] Hermosilla (1997), Mañas (1992) and Wood (1997).

decision to *outsource* a particular service (variable *EXT*$_i$) or not, is the dependent variable in the second part of the estimation. The following expression summarizes the initial general theoretical formulation of the proposed model for analysing demand patterns of advanced business services:

$$USE_I \quad or \quad EXT_I = a + (b_0 SIZE + b_1 SIZE^2) + cAGE + dTECH + eTRAINING + fEXPORT +$$
$$+ gSATISFAC + hGROUP + kPFOREIGOWN + lZARAGOZA + \left[\sum_1^3 r_{IJ} SECTOR_J\right] + u$$

4. Empirical analysis of the outsourcing patterns of advanced business services in the Aragonese economy.

4.1. The data: survey elaborated by the authors on the consumption of advanced business services by Aragonese firms.

The empirical application of the proposed model presented in the previous section is hindered by a considerable lack of adequate official sources of statistics, therefore, the authors chose to elaborate their own database, which was custom-designed so as to be able to carry out this study. The questionnaire included requests for information on the variables presented in Section 3.

The geographical scope of the survey was the regional total. The sectorial scope was that of the main sectors demanding advanced services (industry, services and construction). A sample survey was carried out on this population with a random design stratified by sectors and the size of the firm, within the limits of our framework. That is, we tried to use a low level of aggregation in combination with a satisfactory level of representativeness of the selected groups of firms, given the expected low response for a non-official survey. The size of the firm has been measured in terms of workforce, resulting in three groups: those with less than 10 employees, from 11 to 250 employees and more than 250 employees (as for the latter, we surveyed all the available firms in the database). The sample size obtained was 413 valid questionnaires, with a sample error of ±4,82% and a confidence level of 95% with p=q=0,5. The firms that replied appear to reflect quite faithfully the characteristics of the population in the variables that we may monitor from the original information. As regards the fieldwork for the survey, the questionnaire was sent by postal mail, carrying out a telephonic monitoring as

well, to obtain a greater response rate[14].

This complex survey includes a first part in which we try to characterise the firm through their activities, age, juridical nature, capital ownership, and other economic data referred to labour, turnover and expenses in business services. The second part focuses on the use of advanced business services, studying in depth levels of use, outsourcing, suppliers, satisfaction, effects of those services on economic variables, assessment of potential supply and, finally, intention of future use.

To select the level of disaggregation of the advanced business services we have tried to keep it comparable with other empirical studies (such as the *Annual Service Survey* of the National Statistical Institute, Rubalcaba *et al* (2000) or Martínez *et al* (2002)), without deepening further in Correspondence NACE codes, and to follow the theoretical base shown in Table 1. As a result, we differentiate seven kinds of KIBS: computer services, advanced business and management consultancy, human resources, engineering and industrial design, research and development, advertising and environmental consultancy.

4.2. Main results obtained in the empirical study applied to the Aragonese economy.

On the basis of the data obtained in the survey elaborated by the authors, it was possible to apply the empirical study formulated in Section 3 of this paper to the specific case of the Aragonese economy. Econometric estimation of the expression presented in Section 3 was carried out in the following way. Firstly, characterized models for binary response were employed seeing that the dependent variable takes the outcome 0 to reflect a decision to not do anything (not to use or not to *outsource* a particular advanced service) and the outcome 1 when the decision to do so is taken (for example, to *outsource* this advanced service). The logistic model (LOGIT) was applied as the most appropriate to estimate the determinants of the use of advanced services.

However, these models cannot be applied directly in the second part of our analysis given the fact that the majority of firms do not decide to *outsource* all of an advanced service or to *outsource* none of it, but rather take partial decisions (to *outsource* a particular percentage). This means establishing a limit above which a firm is considered to be adopting

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[14] Only 390 firms have included employment data and only 254 have specified their turnover. The database of the Aragonese Trade Chambers was used as the framework for designing our population. Though less complete and depurate than other databases, it offers a great number of firms belonging to every sector (we extracted 2.835 firms from a total of 45.000). The sample was big enough to obtain a satisfactory response rate. The survey was carried out by the firm Chi-Cuadrado.

an *outsourcing* strategy and below which we would not consider the firm to be adopting said strategy. In this case, the LOGIT model, as well as the alternatives, linear probability model (LPM) and the probabilistic model (PROBIT) present two notable problems. The first of these is the subjectivity that is introduced in the analysis due to having to determine a limit above which the outcome 1 is given to the variable and below which the outcome 0 is assigned. It is true that whenever a percentage of a discrete scale is reparameterized, we introduce a certain degree of subjectivity in the steps that are determined. However, the greater the scale, the lower the subjectivity will be, as it is able to gather more information. Therefore, with a scale with only two levels (0 and 1), the subjectivity introduced is very high. The second problem, closely related to the first, lies in the loss of information that is produced in a case like ours in which the majority of firms are situated at intermediate levels of outsourcing and very few are located at the extremes.

All this consequently led to the use of the Multinomial Ordered Logistic Model (MOLM). This approach introduces a much wider gradation, thus being the most adequate of all those employed, and will therefore be the one used to focus the present research. The variable EXT_i may, in this case, take five possible outcomes. The outcome 0 when nothing is subcontracted, although the service is used (and therefore internally produced). The outcome 1 when a small part of the service is subcontracted (up to 25 per cent). The outcome 2, in the case of an average external provision (between 25 and 75 per cent of the total). The outcome 3, when a large part of the consumed service is subcontracted (more than 75 per cent). And finally, the outcome 4, when the totality of the service is externally provided. This formulation is much more appropriate for our investigation. However, the problem of the Multinomial Ordered Logistic Model resides in the fact that it is much more complex to interpret than binary response models. Tables 2 and 3 present a synthesis of the analyses carried out.

Table 2: Estimation of the *use* patterns of advanced business services in Aragon LOGIT binomial model

(-) implies negative incidence, (+) implies positive incidence, */** and *** indicate the significance of the z-statistic at 1, 5 and 10 per cent, respectively.

Variables	Total advanced business services	Advanced business and management consultancy	Computer services	Research & Development	Engineering and industrial design	Environmental consultancy	Advertising	Human resources
SIZE [1]		(+) ***						(+) ***
SIZE^2								
AGE [2]	(+) *	(+) ***				(+) ***		(+) ***
TECH [3]	(+) **		(+) ***					
TRAINING								
EXPORT	(+) ***	(+) ***		(+) ***				
SATISFAC [4]	not available	(+) ***	(+) **	(+) ***	(+) **	(+) **	(+) *	(+) *
GROUP								
FOREIGN OWN								
ZARAGOZA [5]	(+) **	(+) ***			(+) ***			
SECTOR$_{INDUSTRY}$ [6]	(+) ***			(+) ***	(+) **	(+) ***		

Notes: (1) Size of the firm constructed by taking workforce (sumo f the total employees of the firm. (2) Years of permanence of the firm on the market. (3) Capital stock divided by the number of employees. (4) Dummy variable: being 1 if the firm is satisfied and 0 if not. The variable is for each service branch so data for the total are not available. (5) Dummy variable: being 1 when the firm is located in the city of Zaragoza and 0 otherwise. (6) Only the Industrial sector is shown because Construction and Service sectors are not significant in any case.

Source: Own.

Table 3: Estimation of the *outsourcing* patterns of advanced business services in Aragon MOLM (Multinomial Ordered Logistic Model)

(-) implies negative incidence, (+) implies positive incidence, */** and *** indicate the significance of the z-statistic at 1, 5 and 10 per cent, respectively.

Variables	Total advanced business services	Advanced business and management consultancy	Computer services	Research & Development	Engineering and industrial design	Environmental consultancy	Advertising	Human resources
$SIZE^{(1)}$				(-) ***			(-) ***	
$SIZE^2$							(+) ***	
$AGE^{(2)}$	(+) ***	(+) ***		(+) ***				
$TECH^{(3)}$			(-) ***	(-) **	(-) ***			
$TRAINING$	(-) ***	(+) ***	(-) ***				(-) ***	
$EXPORT$					(-) ***			
$SATISFAC^{(4)}$	not available				(+) ***			
$GROUP$	(-) *		(-) *			(-) *		(-) **
$FOREIGN\ OWN$	(-) ***							(-) ***
$ZARAGOZA^{(5)}$								
$SECTOR_{CONSTR}^{(5)}$	(+) ***				(+) ***			(+) ***

Notes: (1) Size of the firm constructed by taking workforce (sum of the total employees of the firm. (2) Years of permanence of the firm on the market. (3) Capital stock divided by the number of employees. (4) Dummy variable: being 1 if the firm is satisfied and 0 if not. The variable is for each service branch so data for the total are not available. (5) Dummy variable: being 1 when the firm is located in the city of Zaragoza and 0 otherwise. (6) Only the Construction sector is shown because Industrial and Service sectors are not significant in any case.

Source: Own.

We begin with the use/not use analysis (table 2). It can be seen that only *SATISFAC* is statistically significant in all the KIBS branches. This implies that the satisfaction obtained with the demanded services is an essential factor in the subsequent decisions of the firm. Therefore, a low quality in the business services firms of a specific area at present is likely to bring future low demands for advanced services in that area. There aren't any other variables which are statistically significant for all branches. However, some variables are significant in several cases. For instance, *AGE*, years of permanence of the firm in the market, is significant in advanced consultancy and management services, environmental consultancy and human resources, as well as in the total sector. In all these cases this variable has a positive influence in the decision of using the tertiary activities. *EXPORT* has a positive influence on the use of

advanced consultancy and management and research and development, and *ZARAGOZA* has the same effect on advanced consultancy and management, research and development and engineering. These two variables are significant in the aggregate analysis (total KIBS) as well. On the other hand, *TECH* is significant in only two cases, the aggregate analysis and the computer and ICT services branch, in both with a positive influence. Finally, we found that *SIZE* is statistically significant only for two branches: advanced consultancy and management services and human resources. In both cases its influence is positive, which means that the bigger is the company, the greater will be its needs for services in these two branches. A parabolic expression is not fount ($SIZE^2$ is not statistically significance). Therefore - in the two cases in which this variable is significant - there is not a lower use of services among the biggest companies. Curiously, we did not found more cases in which *SIZE* is significant. An analysis of the data shows that their average follows indeed a parabolic pattern in several branches, but this always happens with a strong dispersion.

The industry variable (*SECTOR*) which has three possible outcomes (industrial, construction and service sectors) is only significant for the industrial sector ($SECTOR_{INDUSTRY}$). We can see that industrial firms tend to use more of research and development, engineering and industrial design and environmental consultancy than the rest. The variable is significant too in the aggregate case.

Table 3 summarizes the results obtained applying a MOLM (Multinomial Ordered Logistic Model). The depended variable is now *EXT* instead of *USE*. As it was said before, *EXT* is a multinomial discrete variable which takes five possible outcomes to distinguish different levels of externalization between the firms which use a specific advanced service. The results are now weaker and with lower significance. The expected and estimated influence of the variables can now be positive or negative.

Among the variables with a statistically negative influence on outsourcing decisions we find *SIZE* in the branches of research and development (in the case of advertising *SIZE* is negative but $SIZE^2$ is positive, which implies a total positive effect, although negative for the smaller firms), *TECH* in computer and ICT services, research and development and engineering, *GROUP* in computer and ICT services, environmental consultancy, human resources and the total sector and *FOREINGOWN* only in the human resources branch and the aggregation of the branches (total sector). *TRAINING* could be in this first group of variables with a negative influence on externalization because there is a negative significant incidence

on computer and ICT services and the whole sector. But there is an exception with advanced consultancy and management in which it shows a positive and significance influence.

Taking these results as a whole, we can see that, when the firm is bigger or it has more technological resources or training personnel than the average, it uses more advanced services but it outsources less. This behaviour is probably due to the greater firm's capacity for self-provision of its tertiary needs.

On the other hand, *AGE* has a positive influence on advanced consultancy and management services, research and development and the total as well. The same happens to *SATISFAC,* although this time only with engineering services. The case of *SIZE* in advertising services shows a positive influence with a parabolic pattern, which means that in smaller companies the trend to outsource is weaker but when they attain a medium size or bigger a clear positive influence can be observed. Finally, the sector which is now significant is construction (*SECTOR$_{CONTRUCT}$*) with a positive effect in engineering and human resources and in the total.

Some variables show clearly that they are key to determine the use of KIBS in a firm but not enough to justify their external provision (*SATISFAC*, *ZARAGOZA*), while others have exactly opposite influences in terms of use and outsourcing (*SIZE*, *TECH*, *EXPORT*). The influence of *SECTOR* changes with the approach, in the first model industrial activities show a strong trend to use certain advanced services activities but in the second model construction companies tend to be outsource more than the rest. Only *AGE* shows a positive influence in both cases.

6. Conclusions.

This paper presents a study of the use and outsourcing patterns of advanced services by Aragonese firms, based on an *ad hoc* database built by the authors to overcome the lack of information at under-regional levels. To do so, two different models with a discrete dependent variable were estimated, chosen as the most appropriate for the characteristics of this research: the LOGIT model for the decision to use/not use KIBS, and the Multinomial Ordered Logistic Model (MOLM) for the degree of outsourcing of KIBS. The formulation of the equation to estimate included the elements that, following a review of the theoretical and empirical literature on the topic under study, were considered *a priori* to possibly exert more influence on the trend to *use* and/or *outsource* advanced services.

The results show that the decision to use a certain service seems to be independent of the decision to outsource it, since we have found that several variables have different effects in each case. Firstly, satisfaction with service quality is the most important variable for the use/not use decision, as it is the only one that remains significant in all cases. Secondly, as expected, location in a large urban centre seems to be relevant in the use decision, at least in certain specific branches, but it is not so in the decision of the outsourcing degree. In this outsourcing decision, variables like capital per worker or size of the firm, which had a direct relationship with the use of KIBS, show a negative influence. This allows us to conclude that bigger firms and those more technologically sophisticated are understandably more often users of KIBS, but at the same time they are able to provide these services in-house instead of buying them from other providers. In the same sense, we can interpret the negative influence of better human capital (training of personnel in our models) and belonging to a group of firms in the degree of outsourcing of KIBS. Only the years of permanence of the firm in the market or the belonging to the construction sector have a clear positive influence on this decision. Other variables that were expected to have a more significant influence do not appear to be key factors in the *demand* patterns of Aragonese firms. This is the case for size, or foreign participation in the ownership structure, while the outward orientation of the firm seems could be a reason to use advanced services but its influence is not confirmed as regards the outsourcing patterns.

To sum up, the analysis of demand patterns for KIBS at an under-regional level of disaggregation points to some differences in the variables that were expected to be relevant to the use and outsourcing decisions after other national and regional studies. This suggests the importance of taking into account potential bias when building databases at this level, and deepening into the interrelationships among the different variables that were used.

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