STRATEGIES OF GROWTH, INTERNALIZATION AND EFFICIENCY IN SPANISH CONSTRUCTION SECTOR: THE CASE OF THE SIX BIGGEST COMPANIES

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ABSTRACT

This study analyzes strategies of the six most important companies in the construction sector in Spain, which occupy competitive relevant positions at the global level. It investigates about what are its competitive advantages, business style, strategies of growth and internationalization. Special attention is given to the levels of technical efficiency in the period 1994-2015 in a first stage. The second investigates the relationship of the efficiency and its explanatory factors. The results suggest an important and dynamic growth by different routes; acquisition, merger, diversification and internationalization of these companies. There are differences in efficiency between the companies analyzed. Levels of (in) between-company efficiency as well as the pattern of the same is not the same over time. Relationship between the efficiency and the process of accumulation of resources of the companies, in terms of property, plant and equipment as well as its international expansion in relation to their share of sales in international markets over the total, has a positive relationship.

JEL: C6, L1, L7, M1.

INTRODUCTION

After the negative effects experienced by the economic crisis at the global level since 2008, with special incidence in countries such as Spain, where the construction sector is one of the driving forces of the economy, the prospects seem hopeful. The plan of investments in the construction sector for Europe will grow in 2016 and 2017 in a percentage 2.4 and 3.1 respectively (Eurostat 2015).

In the last two decades, the activity of the main Spanish construction companies has been very dynamic and protagonists of a deep and important process of strategic growth (inorganic through purchases or mergers and organic by means of the search for new markets/customers). This process of diversification and internationalization of its operations, probably based on the accumulation of resources and capabilities (techniques for engineering, design, services, financial and management) has allowed probably achieve levels of competitiveness relevant, taking advantage of business opportunities. According to Engineering news-record (ERN 2015) six Spanish companies (hereinafter 6SC) Acciona, Ferrovial Agroman (FERROVIAL), Obrascon Huarte Laín (OHL), Sacyr Construction (SACYR), Fomento de Construcciones y Contratas (FCC) and Actividades de Construcción y Servicios (ACS) are part of the top 250 companies worldwide. Five of them are among the 70 best, and in particular ACS occupies the first place in the rankings in recent years. This same company, controls the company Hochtief Aktiengesellschaft that occupies the second place. According to Bloomberg and Deloitte (2015) Spain is the second country by turnover (64.964 million euros) behind France (85.006 million euros). According to this ranking the 6SC are among the 28 first.

With these considerations, this work has as objective to analyze the strategies that have carried out the 6SGC to occupy competitive positions in the market today. In particular, it investigates about what are its competitive advantages, business style, strategies of growth and internationalization. Special attention is given to the levels of technical efficiency (hereinafter TE) of 6SG in the period 1994-2015 in a first stage. The second investigates the

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relationship of the TE and its explanatory factors, such as the company size, the percentage of sales in international markets and the effect of the crisis.

The work is organized in the following way. In the next section, we review the literature and present the methodology. In the third section, discusses the strategies followed by the companies analyzed. The fourth section shows the main results achieved. Finally, the fifth section contains the main conclusions.

REVIEW OF THE LITERATURE AND METHODOLOGY

The analysis of companies in the construction sector with special orientation toward the area of efficiency and its explanatory factors, has a certain international presence, as can be seen in the review of the literature that is in (De Jorge-Moreno et al. 2016). In Spain, the work carried out by (Bielsa and Duarte 2010; Kapelko et al. 2014; Kapelko and Oude Lansink 2015; De Jorge-Moreno et al 2016) are based on the analysis of the efficiency in the construction sector through samples of companies with greater or lesser sectoral representativeness. Except error there are no studies that use the case analysis as a methodology such as the one that is used in the present investigation, for the construction sector.

The literature referring to the study of the process of internationalization from exploratory approaches, is very extensive. The more traditional vision on how to set this process, is the one that refers to a sequence of learning cycles, necessarily in the long term, where initially the companies first learn to dominate your business at a national level, to subsequently address gradually the international markets under accumulate experience (Johanson and Vahlne, 1977). Authors such as (Dunning and Lundan 2008) raised the so-called advantages of ownership, arising from the accumulation of technical or management capabilities. Other authors mentioned as technological innovation, the approach toward certain market niches, the baggage in advance by the promoters and involvement in international networks are factors of success (Zahra and George, 2002; Sharma & Blomstermo, 2003).

The relationship between the activity of internationalization and the efficiency has been a topic that has received substantial attention by academics and professionals, generating abundant literature (Bernard and Jensen (1999); Aw et al., 2000; Delgado et al 2002; Baldwin and Gu, 2004; Girma et al 2004; Fryges and Wagner, 2008; Sun and Honh, 2011, Merino 2012 among others). In general, these studies try to give answers to the causal relationship between internationalization and efficiency, in whose results typically found a positive relationship between these concepts.

The methodology that is used in this study relates to the approximation multi-case. This approach is particularly suitable for the objective, of an exploratory nature, its development and understanding (Esterberg, 2002) and is particularly recommended when you search depth in the questions posed and the researcher has little or no control over the events (Eisenhardt, 1989; McKenzie et al., 1997; Yin, 2009). In summary form the steps taken have been the following; 1) the search for scientific work relating to construction companies in different databases (JCR, Scopus, etc.) 2) elaboration of a dossier by searching on secondary information on companies, from memories, reports, corporate information, press releases 3) in relation to information of a more quantitative, prepared a database for each company and each year by means of the database SABI (Sistema de Análisis de Balances Ibéricos). This database collects a sample of companies' representative of companies registered in the mercantile registry of all Spain.

The methodology that is used in this study, for the analysis of the TE is based on partial frontier of order-m proposed by (Cazals, Florens and Simar 2002), which have advantages on the methodologies for estimating efficiency such as the DEA[2] or FDH. For example, these traditional methodologies are sensitive to extreme values, noise in the data or the problems of the dimensionality (Cazals et al. 2002; Simar 2003 and Wheelock and Wilson 2009). In contrast, the estimators of order-m are robust to the problems mentioned.

The proposal would be the following is considered to be a vector of inputs $x_c=(x_{c1}, x_{c2}...x_{ci}...x_{cI})$ and an output $y_c= (y_{c1})$. Characterizing the whole elements of the vector of activity $\lambda=(\lambda_1, \lambda_2.,....., \lambda_c)$ and the coefficient of efficiency as α, the program approach with linear output orientation would be the following (for more detail see Tauchmann 2012);

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$$\max \ \alpha_c \ ,$$
$$(\alpha_c \ \lambda_1, \lambda_2, .. \ \lambda_c)$$

$$x_{c,i} - \sum_{s=1}^{c} \lambda_s \, x_{s,i} \geq 0, \qquad i = 1, \ldots \ldots, I \qquad \qquad [1]$$

$$\sum_{s=1}^{c} \lambda_s \, y_{s,j}, -\alpha_c \, y_{c,j} \geq 0, \qquad j = 1, \ldots \ldots, J$$

$$\sum_{s=1}^{c} \lambda_s = 1,$$
$$\lambda_s \, \epsilon \, (0,1), \quad s = 1 \ldots \ldots \ldots, S$$

For each year and company c within the program 1 is identified another year in the sample with superior performance (in a year, with $\lambda_s=1$), and it is also estimated that the increase of output required to reach the border not convex ($\alpha_c>1$), where ($1-\alpha_c$) is the proportional increase in the level of output. In this regard are compared against companies themselves, each year can be the reference of others: Authors as (Parker and Martin 1995; Boussofiane et al. 1997; or De Jorge-Moreno and Rojas 2016) among others use this framework of comparison. The two first analyzed the relationship between efficiency and privatization in nine major UK companies. While the third is studying the relationship between efficiency and internationalization in the case of the company Inditex.

Per the order-m proposal, consider a positive value fixed integer m. For a level of input ($x_{c,i}$) and output ($y_{c,j}$) the estimate defines the maximum expected value of m random variables ($y_{1,j}\ldots\ldots.,y_{m,j}$) that show a conditional distribution of output array and observing the status $y_{m,j}> y_{c,j}$.

Formally the algorithm order-m proposed is programd on four steps:
1) for a given level of $y_{c,j}$, produces a random sample of size *m*.
2) computes the program 1 and estimated $\bar{\alpha}_c$
3) Repeat step 1 and 2 B times and gets β coefficients of efficiency $\bar{\alpha}_c^b (b = 1,2, \ldots B)$. B you choose between 200-2000.
4) was used to compute the average value of B samples as
$$\alpha_c^m = \frac{\sum_{b=1}^{\beta} \bar{\alpha}_c^b}{\beta}$$
Once obtained the inefficiency $\bar{\alpha}_c$ each year in a second stage through the regression 2, explains its value from a vector $z = (z_l, z_l\ldots, z_L)$ of certain individual variables, the environment that without being directly related to the production of the company affect the process of management.

$$\bar{\alpha}_c = f(Z_i, \beta_i) + \varepsilon_i \qquad\qquad [2]$$

STRATEGIES OF THE COMPANIES ANALYZED
In this section, we analyze the strategies developed by the 6SC. To do this is to carry out the analysis in the following sub sections; 2.1 origin, growth and diversification of activities 2.2 Internationalization Process.

Origin, growth and diversification
The six companies that are analyzed in this work have their origins in the late nineteenth century and early twentieth century. As indicated (Torres 2009a) this timeframe could be related with the business opportunities that encouraged the creation of construction companies, linked to the policy of public works and the plans for industrialisation before and after the Spanish civil war. Its initial activity concentrates on the construction of communications infrastructures (roads, motorways, railways, metropolitan, ports and airports), transfers, irrigation and water purification plants, industrial facilities (for the cement industry, energy, steel, petrochemicals and shipbuilding), social facilities (health, educational and sports, etc.). Most of the companies had then its headquarters in Madrid (strategic point of the time, where were the headquarters of the bodies of State administration). In table 1, shows the processes of growth (acquisition, merger, and diversification) carried out in the formation of the 6SC until the present. Most of the founders of the companies that constitute these groups are

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engineers of roads or industrial José M. Aguirre (Agroman); José Entrecanales (Entrecanales and Ms. Tavora); Rafael del Pino (Ferrovial), José Junquera and Alfonso Sanchez (Dragados y Construcciones). The capital requirements to meet the projects are related to the presence of banks in the founding capital of some companies. For example, Banco Central as the principal shareholder of the company, Dragados. Banco Urquijo as a promoter of OCISA or Banca Más Sarda, present in shareholding FOCSA. On the other hand, it is remarkable the presence of family businesses without explicit connection with banking entities. For example, Entrecanales and Tavora (family Entrecanales), Ferrovial (family Del Pino), Construcciones y Contratas (family Koplowitz), Huarte (family Huarte).

Table 1. Chronology of company formation

Company	Year	Process	Company composition*	Observations
ACS	1983	Acq.	Construcciones PADROS (CP) (1968)	ACS starts
	1986	Acq.	OCISA (1942)	Important extensión
	1988	Acq.	SEMI (1919)	Diversification in S. Industriales
	1989	Acq.	Cobra (1948)	Enlargement S. Industriales (Latam)
	1992	Fusion	OCP Fusion de OCISA y CP	Among the 10 largest Spain
	1996	Acq.	Auxini (1945)	Auxini de propiedad estatal
	1997	Acq.	Guines Navarro (GN) (1930)	GN specializing in civil engineering projects
		Acq.	Vías (1928)	Specialized in railway development
	2003	Fusion	Dragados (1941)	ACS+Dragados between the 5 biggest one worldwide
		Acq.	Urbaser (1983)	Environment activities
		Acq.	Clece (1992)	MultiServices company
	2011	Acq.	participation in Hochtief (1873)	Leader in Germany, Major Expansion
		Acq.	participation in Turner (1902)	Turner filial de Hochtief Specialized in Non-Residential Building
		Acq.	participation in Cimic (1949)	Cimic filial de Hochtief Specialized mining concessions
FERROVIAL	1952	Creation	Railway origin	Founded by Rafael del Pino
	1958	Expan.	Important contract awarded by Renfe	Growth
	1960	Divers.	Projects of hydraulic works, roads, etc.	Diversification of activities in civil engineering projects
	1985	Acq.	Acquisition of Cadagua (1970)	Specialized in design, construction and exploitation of plants Treatment and purification
	1992	Acq.	Acquisition of Agroman (1926)	Expansion oUSA market
	2000	Acq.	Budimex (Polonia), Amey(RU), Cespa(España)	Rafael del Pino President
		Acq.	Operador Heathrow Airports Holdings	
	2013	Acq.	Enterprise	Specialized in Services in UK
	2014	Acq.	Airports of Aberdeen, Glasgow and Southampton	Airports ampliation
ACCIONA	1931	Fusion	Entrecanales y Tavora	Founders José Entrecanales and Manuel Tavora
	1970		Generational change	Fathers and sons
	1978	Fusion	Cubiertas y Mzov	Fusion Cia. Ferrocarriles de Medina del Campo to Zamora y de Orense a Vigo (Mzov)(1862) y Cubiertas y Tejados (CYT) (1916)
	1997	Fusion	Fusion of Cubierta and Mzov (1978) y Entrecanales y Tavora (1928-1970)	Acciona

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	Year	Type	Description	Notes
	1980		Railway expansion	Expo 1992, High speed first line construction
	1996	Creation	Necso	New Entrecanales, Covers, Services and Works
	2004		Transformation on three pillars of Growth; Infrastructure Energy and water	Unification of brands in Acciona
	2007	Divers.	Acciona together with Enel formalize control over Endesa	
	2010	Divers.	Renewable energy	73% of Ebitda are renewable, 16% infrastructure
FCC	1900	Creation	Fomento de obras construcciones y contratas (FOCSA)	
	1944	Creation	Construcciones y Reparaciones S.A (CYCSA)	Koplowitz family
	1992	Fusion	Construcciones y Contratas, S.A. fusión with Fomento de Obras y Construcciones, S.A. (Focsa)	Fomento de Construcciones y Contratas SA
	2001	Creation	Realia	Fusion of FCC and Caja Madrid real estate businesses
	2002	Creation	Flightcare	Diversification in the handling sector (Brussels Airport)
	2005	Acq.	ASA in Eastern Europe for waste management	Internacional expansion
	2007	Creation	Globalvía infrastructures by FCC and Bankia	Management of infrastructure concessions (2nd in PWF concessions)
OHL	1927	Creation	Huarte	Huarte and Malummbres family
	1963	Creation	Laing	A subsidiary of British group John Laing Construction
	1996	Acq.	Entry of Obrascón as an industrial partner (1911)	
	1998	Fusion	Huarte y Obrascon	
	1999	Fusion	Fusion Huarte, Obrascon y Laing	OHL starts
SACYR	1967	Creation	Cavosa	
	2001	Fusion	Cavosa obras y proyectos	
	2003	Fusion	SACYR-Vallermoso	Vallermoso (1921) y Cavosa
	2005	Acq.	Grupo SUFI y el 30% de ENA	Expansion/Growth
	2006	Acq.	20% de Repsol YPF	Diversification
		Fusion	Grupo Itinere	

Source: own elaboration through reports and reports of companies
* Parenthesized year of creation of the company, Adq = acquisition, Divers = diversification

The implementation of activities with important projects required the companies a constant increase of its capital resources and labor, the skilled labor (engineers, architects and other middle-level technicians), and its sources of financing, as well as a constant improvement of the construction techniques, organization and management. There was certainly a long and intense process of accumulation of experience, which allowed to attain to these companies a great knowledge of the business, essential for their subsequent outlet to the outside. This process was favored by several factors:

1) The existence of joint ventures, formula that allowed the collection in the implementation of a project to companies with different specialization and/or with complementary capabilities. Apart from other advantages such as the greater financial capacity to undertake the project or the sharing of the risk. The temporary unions favored diffusion of the construction techniques and the joint accumulation of experience, (ii) the presence of foreign firms in large infrastructure works, already in the

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1950s, with the consequent learning effect on the Spanish companies involved with those in temporary unions or acting as subcontractors of certain parts of the project and (iii) the collective action of the large construction companies with the creation of SEOPAN (subgroup of companies of Public Works on a national level). This organization, which was born at the end of 1957 to represent these companies before the Public Administration, assumed after other tasks, such as the study of the general problem of the sector and the advice to its partners

Lines of business or activities carried out in the period between 1995 and 2015 have been many and varied, as shown in table 2 and partially in Table1. The information contained in the reports and annual accounts is an additional difficulty of unification and aggregation of data, that do not use the same groupings in the different temporary jumps studied, by the own variation and change of activities in firms with the passage of time or because sometimes it is simply broken down to a greater or lesser degree that same information (not allowing to know in some cases, for example, what is construction of building infrastructures, or what is construction or concession-management of infrastructure, etc.).

Table 2. Diversification of 6SC business lines and activities in 1995-2005-2015

ACS		2015 (miles €)	(%)	2005 (miles €)	(%)	1995 (miles €)	(%)
	Construction	25319489	72,5%	5724798	47,3%	484151	61,1%
	Civil work					246403	
	Edification					237748	
	Industrial services	6500723	18,6%	4077352	33,7%		
	Services and licenses			2420299	20,0%		
	Communications and energy						
	Systems					306600	38,7%
	Environment	3138544	9,0%				
	Travellers transport						
	Corporation and others	-34094	-0,1%	-108563	-0,9%	1039	0,1%
	Total	34924662	100 %	12113886	100%	791791	100%
FERROVIAL							
	Construction	4287000	44,2%	3583017	49,4%	240032	39,0%
	Roads and motorway	513000	5,3%			168577	27,4%
	Airport	8000	0,1%				
	Infraestructures			614033	8,5%	48090	7,8%
	Hydraulic work					135662	22,0%
	Specific works					22664	3,7%
	Property developer			768140	10,6%		
	Licenses						
	Services	4897000	50,5%	2444462	33,7%		
	Rest and adjustments	-6	0,0%	-152642	-2,1%	0	0,0%
	Total	9701000	100 %	7254011	100%	615418	100%
OHL							
	Construction and Building	3248219	74,3%	2083629	85,3%	56793	41,1%
	Civil work					78110	56,5%
	Industrial	352092	8,1%				
	Services	199211	4,6%			3349	2,4%
	Environment			62784	2,6%		
	Infraestructures promotion						
	Management Property developer						
	Licenses	444877	10,2%	249665	10,2%		
	Developments	124467	2,8%	46582	1,9%		

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	Total	4368866	100 %	2442660	100%	138252	100%
FCC							
	Construction	1992936	30,8%	3346700	47,2%	1441521	58,8%
	Environment services	2855608	44,1%	2078000	29,3%	560967	22,9%
	Integrated management of water and urban environment	1033507	16,0%		0,0%	150289	6,1%
	Property developer					72824	3,0%
	Versia			721500	10,2%		
	Grucysa					72891	3,0%
	Energy						
	Cementos	580410	9,0%	978400	13,8%	239371	9,8%
	Corporation	48090	0,7%		0,0%		0,0%
	Eliminations	-34527	-0,5%	-34800	-0,5%	-86888	-3,5%
	Total	6476024	100 %	7089800	100%	2450975	100%
SACYR							
	Construction	1219770	41,4%				
	Sales buildings					186007	77,1%
	Land and solar sales					6184	2,6%
	Leases					37659	15,6%
	Provision of Services					11443	4,7%
	Licenses	324677	11,0%				
	Holding			333	0,0%		
	Services						
	Promoion						
	Heritage						
	Grupo Sacyr			1285163	30,8%		
	Grupo Itinere			360921	8,6%		
	Grupo Vallehermoso			1241078	29,7%		
	Grupo Valoriza	722530	24,5%	343299	8,2%		
	Industrial	289539	9,8%				
	Grupo Testa			205849	4,9%		
	Somague	392376	13,3%	740314	17,7%		
	Consolidation adjustments						
	Total	2948914	100%	4176957	100%	241294	100%

Source: own elaboration through reports and reports of companies

Table 2 shows, for each one of the construction companies the activities that they have developed over the years3 1995, 2005, and 2015, and on what can be commented as follows:

- ACS: centers in 2015 its activity of primary shape to the construction of infrastructure (although it does not have a specific breakdown) having risen to exceed 70 % of its total activity, from a period between 2000 and 2010 in that diversified into other activities your business (industrial services, concessions, communications and energy, etc.). The construction of infrastructure takes you to today to count with a portfolio of business to important future since the own construction (after winning public competitions in many cases) leads to the granting and managing of the further exploitation of those infrastructures for long time limits and to ensure, therefore, a certain level of future income.
- FERROVIAL: has its split activity in some way to equal parts which is construction of which are services, with a niche for the construction and management of infrastructures. With the passage of time has been increasing the weight of the services and reducing the maximum percentage of 82.5 % attained in 2000 in construction.

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- OHL: The weight of the building is the main nucleus of its activity, but today with the greatest importance to the construction of infrastructure (although you cannot differentiate the figure in some years of the general construction). In recent years, has been introduced activities linked to the environment, services and concessions, as well as industrial activities (representing 8,1 % in 2015).

- FCC: is the one that shows more clearly a current reduction of the weight of the construction in their total sales (30.8%), in contrast to the increase that has made in environmental services, services of water management and the urban environment that are over 60 %. Maintains the activity in cement, although in the years prior to the crisis reached a higher percentage in their sales.

- SACYR: presents problems to differentiate more clearly the different activities that develops as broken down in their consolidated accounts sales by the different groups of companies that are part of the global group. Even so, can be seen as has eased their business from an activity more purely dedicated to the development, construction and sale of residential areas (at the end of the years 90) toward a position of construction, mainly for infrastructure, management of concessions and industrial activities.

- ACCIONA: has been decreasing its percentage of sales in construction and infrastructures to present (from 93.1 % in 1995 to 81,1 % in 2000, 56,6% in 2005, 49.8 per cent in 2010 to 40.4 per cent in 2015). On the other hand, has been diversifying its activity by introducing activities linked to water services (in general, logistical and transport, urban and environmental) and energy (which takes on great relevance with a 33,9 % of its total sales, which increases continuously from the year 2005).

Internationalization Process

The process of internationalization of the 6SC starts in the second half of the 1960s. For example, company Dragados with hydroelectric projects from 1966 in Turkey, Argentina and Venezuela. In the seventies, the company Ferrovial with greater presence in the international markets from 1974 in the north of Africa, Persian Gulf and Latin America. The company Agroman with projects in the Dominican Republic and Portugal. With the aim of promoting international activities was created in 1976 the Association of Construction Companies in international activity (AECI) where they were members of the greater part of companies that have subsequently formed the current 6SC.

The two dimensions which are often considered to be in the process of internationalization are related with the degree of internationalisation of the value chain and the number of countries with an international presence. In this regard a high level of internationalization is associated to a high number of activities (logistics, procurement and production, etc.) of the value chain in the exterior. When the range of countries of destination is large with different input modes (export, franchise, direct investment) and the percentage of the activity of sales abroad over the total is relevant, then the multinational companies are considered.

Figures 1a and 1b show the evolution of the percentage of sales (left) and the number of countries (right) where the 6SC have an international presence. As can be seen in 2015, ACS, FERROVIAL and OHL have percentages of foreign sales to exceed 70 %, while that FCC, SACYR and ACCIONA are in the environment to 50%. In the graphic on the right by the number of countries, the company ACS stands out from the crowd with a relevant international expansion of 85 countries, while OHL, FCC and ACCIONA are in 38, 45 and 51 countries respectively. Finally, the companies with the lowest presence abroad FERROVIAL and SACYR with 24 and 27 countries respectively.

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Figures 1a and 1b evolution of the international presence of the companies analyzed
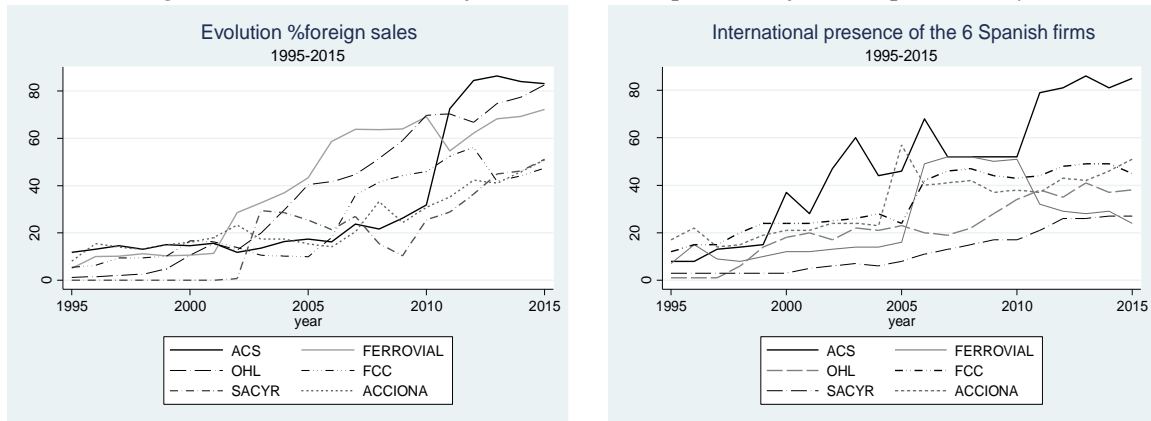
Source: author´s elaboration

Figures 2 and 3 shows the evolution of the international presence of the 6SC referred to the selected years 1995, 2005 and 2015. In Figure 2, the graphics in network show on the one hand, as the 6SC share the same countries in the circular structure when they are more than two firms in the same country, from one year to another increases the diameter and the density of the nodes. On the other hand, shows in the outer part of the circular structure the countries where only a presence by each company has independently. Finally Figure 3 shows through maps the presence of any of the 6SC at the global level.
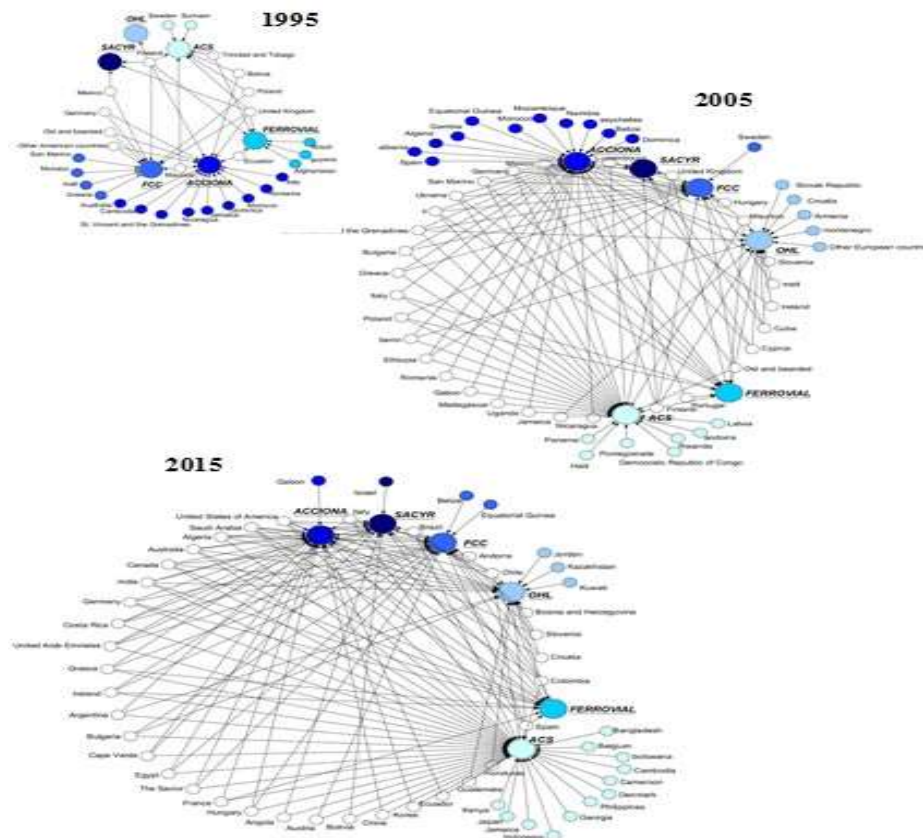

Figure 2. Network visualization of the international presence of companies
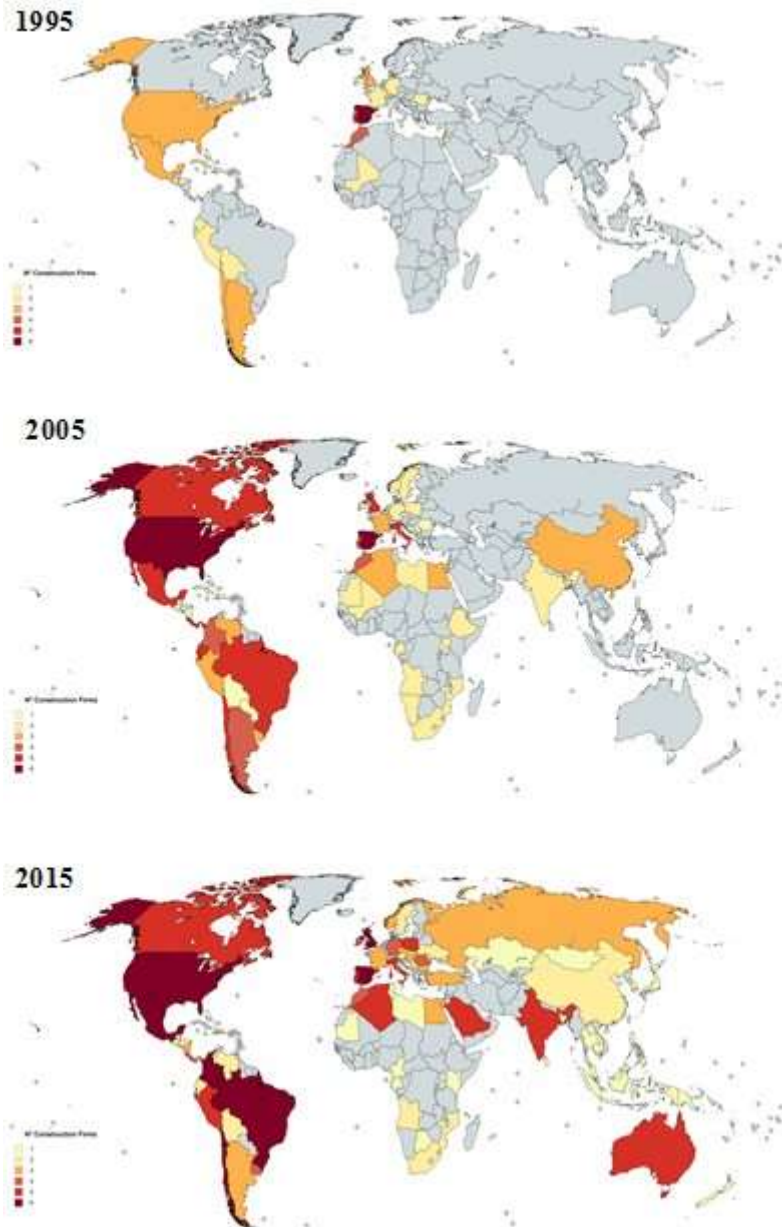*Source: author's elaboration*

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Figure 3. International geographical presence of companies

RESULTS

In this section shows the results derived from the two stages of analysis. In section 4.1 are shown the results relating to the analysis of the efficiency individualized for each company. In section 4.2 presents the results of the analysis of the explanatory factors of the efficiency.

Analysis of efficiency

Table 3 shows the indexes of efficiency obtained for the 6SC for the 22 years analyzed with output orientation. Given that the estimates of efficiency have been carried out with the STATA program 13.0, values greater than 1 indicate inefficiency and vice versa. Since the average values for the period considered, all companies show values of super-efficiency in relation to their levels for years. The company ACS, shows a lower value 0,9099 indicating a better behavior in the management of its resources in comparison with their levels for years. While companies

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FERROVIAL and ACCIONA show higher values 0,9546 and 0,9569 respectively. In relation to the values of the efficiency obtained annually, all companies are in the frontier in the initial years ($\bar{\alpha}\_c=1$), while from 1996 and 1997 their levels fluctuate with levels of super efficiency ($\bar{\alpha}\_c<1$) with different patterns. In the case of ACS, reaches its highest levels of efficiency from 2011, FERROVIAL and SACYR are located on the frontier in the years at the end of the period 2013 and 2014 respectively. ACCIONA shows levels of inefficiency $\bar{\alpha}\_c$ ($\bar{\alpha}\_c>1$) 1,0492 and 1,0076 in the years 2010 and 2014.

Table 3. Evolution of the efficiency order-m by company 1994-2015

| year	ACS	Ferrovial	OHL	FCC	SACYR	Acciona
1994	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
1995	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000
1996	0,9984	0,9978	0,9896	1,0000	1,0000	1,0000
1997	0,9753	1,0000	0,9663	0,9941	1,0000	0,9762
1998	0,9853	0,9836	0,9555	0,9889	0,9882	0,9630
1999	0,9853	0,9867	0,9243	0,9753	0,9958	0,9957
2000	0,9641	0,9444	0,9835	0,9676	0,9511	0,9814
2001	0,9605	0,9511	0,9710	0,9656	0,8929	0,9823
2002	0,9723	0,9511	0,9196	0,9823	0,9099	0,9743
2003	0,8249	0,9433	0,9539	0,9723	0,7243	0,9647
2004	0,8780	0,8909	0,9798	0,9761	0,8774	0,9552
2005	0,9267	0,9468	0,9716	0,9638	0,7982	0,9270
2006	0,9063	0,8196	0,8708	0,8468	0,8740	0,8740
2007	0,8406	0,8913	0,8847	0,8334	0,9031	0,8694
2008	0,9316	0,9220	0,9011	0,8747	0,8289	0,7271
2009	0,9554	0,9194	0,9300	0,8986	0,8306	0,9905
2010	0,9119	0,9199	0,8975	0,8954	0,8466	1,0492
2011	0,7993	0,9417	0,9148	0,8981	0,9805	0,9756
2012	0,8835	0,9925	0,8895	0,8151	0,9953	0,9840
2013	0,8641	1,0000	0,9061	0,9890	0,9992	0,9246
2014	0,7389	1,0000	0,9644	0,9667	1,0000	1,0076
2015	0,7161	1,0000	0,9632	0,9499	1,0000	0,9316
Mean	0.9099	0.9546	0.9426	0.9433	0.9270	0.9569
SD	0.0835	0.0477	0.0399	0.0584	0.0828	0.0663
Min.	0.7161	0.8196	0.8707	0.8151	0.7242	0.7270
Max.	1.0000	1.0000	1.0000	1.0000	1.0000	1.0492

Source: author´s elaboration

Figure 4 shows the distribution of the efficiency with violin-shaped graphics. In the inner part of the figures can be analyzed the distribution through the chart box-plot and externally shows the distribution kernel. The white point illustrates the median and the dark area the first and third quartile. Companies ACS, SACYR and ACCIONA show a wide dispersion of the values of efficiency. The latter shows the value of inefficiency before mentioned. The companies FCC, FERROVIAL and especially OHL show the least dispersion of values.

Figure 4. Graphics violin efficiency Orderm by company
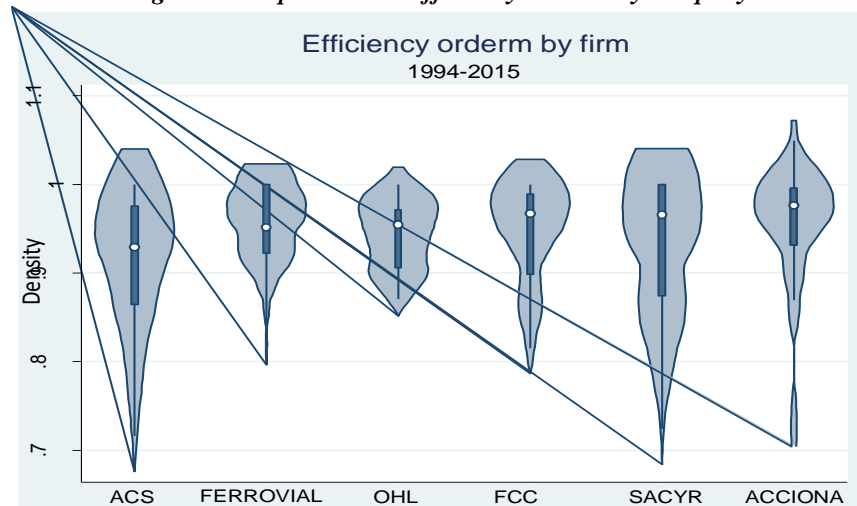
Source: author´s elaboration

Finally, Figure 5 shows the evolution of efficiency, comparing the Order-m and DEA methodologies. These graphs show the different evolution patterns of efficiency with both techniques and by company. In general, the behavior of both tendencies of efficiency follows an antagonistic process, indicating that when there are efficiency improvements with the traditional DEA methodology (dashed line), simultaneously they also improve efficiency levels with Order-m. As can be seen the company ACS follows a trend of improving efficiency compared to other companies, which are U-shaped.

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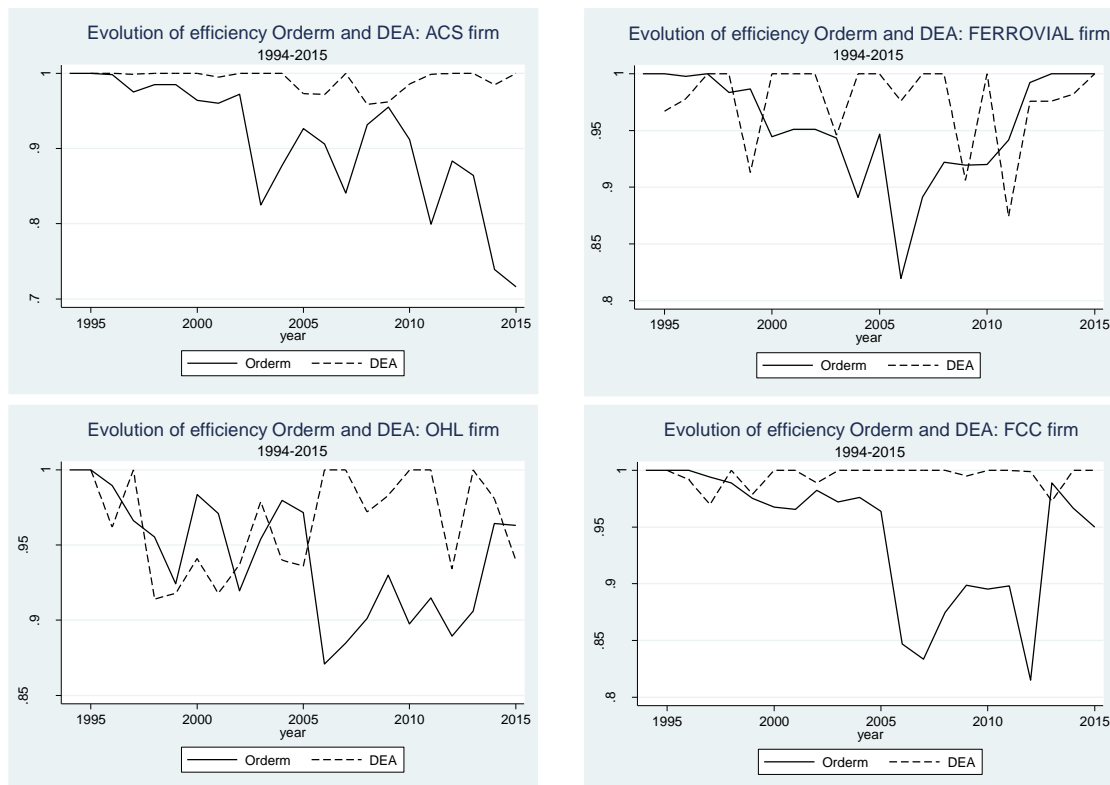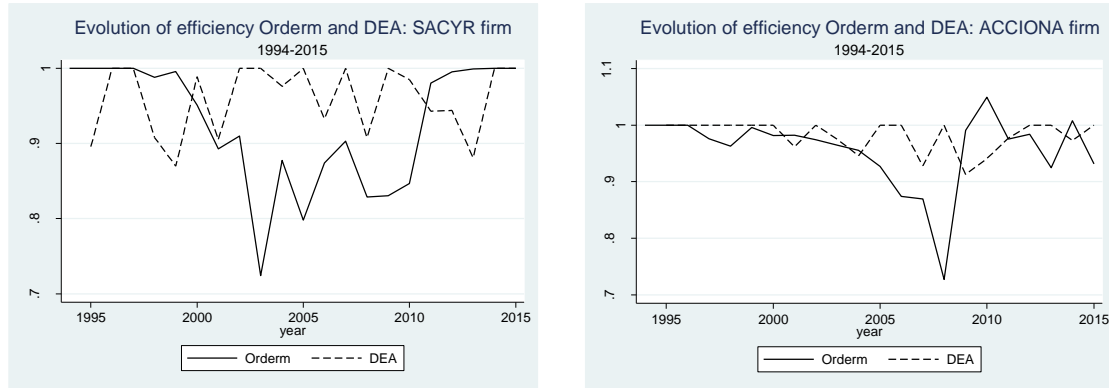
Source: author´s elaboration

Figure 5. Comparative chart of the efficiency Orderm and DEA per company

Explanatory factors of efficiency

In this section analyzes the factors that explain the efficiency. As such are considered the resources used by the companies analyzed, in terms of tangible assets, the level of international activity measured as the percentage of sales abroad on the total sales. There are also two variables dummies, one concerning the period of economic crisis and another for the control of the effect company. Per the equation 2, the regression model by ordinary least squares to determine the influence of the explanatory factors would be the following:

$$\bar{\alpha}_c = \beta_o + \beta_1 \, Ln \, FA + \beta_2 \, IS + \sum_1^6 \beta_3 D\_f + \beta_4 D\_C + \varepsilon_i \qquad [3]$$

Where the dependent variable is the index of efficiency order-*m* ($\bar{\alpha}_c$). FA is the fixes assets, IS is the volume of sales in international markets as a percentage of the total sales of the company. *D_C* is a dummy variable that captures the period of crisis. Finally, *D_f* is a dummy variable that identifies the company.

Table 4 presents the results estimated from the equation (3). The parameter β_1 of FA is negative and statistically significant. As the company accumulates greater volume of resources is more efficient. This result could be related with the economies of scale and scope. Equally the β_2 parameter of IS, is negative, therefore as companies reach higher levels of international activity are more efficient. The effect of the crisis has had a negative impact on the efficiency of firms, as reflected by the positive and statistically significant sign of parameter β_4

Table 4. Results of efficiency determinants

Variables	Coef. Est/S.E.
LnFA (β_1)	-0.0201***
	(0.00417)
IS(β_2)	-0.118**
	(0.0362)
FERROVIAL(β_{3_2})	0.0710***
	(0.0165)
OHL(β_{3_3})	0.0159
	(0.0170)
FCC (β_{3_4})	0.0379*
	(0.0166)
SACYR(β_{3_5})	-0.00337
	(0.0167)
ACCIONA(β_{3_6})	0.0476**
	(0.0166)
D_crisis(β_4)	0.0439**

	(0.0156)
Constant(β_o)	1.206***
	(0.0540)
N	132
R-sq	0.385
adj. R-sq	0.345

*p<0.05, **p<0.01, ***p<0.001
Omited variables: ACS company, D_crisis=0
Source: author´s elaboration

CONCLUSIONS

The six companies in the construction sector studied constitute an analysis of interesting case as a result of the competitive position they occupy at the international level in the construction sector and for its long history of business and corporate development. The in-depth study that provide the methodologies used could be removed as conclusions the following:

You can observe an important dynamic of growth by different routes; acquisition, merger, diversification and internationalization of these companies. This growth is observed in a wide temporal context and with a certain heterogeneity in the activities to which the analyzed companies are dedicated and their origin factors in the creation of the company, as the (in)dependence on family, the (in)dependency of banking institutions or the international expansion of activities.

There are differences in efficiency between the companies analyzed. The levels of (in) beteewn-company efficiency as well as the pattern of the same is not the same over time. The relationship between the efficiency and the process of accumulation of resources of the companies, in terms of property, plant and equipment as well as its international expansion in relation to their share of sales in international markets over the total, has a positive relationship. These results achieved by the companies analyzed have been influenced by the effects of the economic crisis.

The main limitation of the work relates to the implementation of the method of the case and therefore with its possible generalization. This is partially offset by analyzing six companies. However, despite having had access to certain information documentary of secondary character, it has not been possible to obtain information on the evolution and strategies followed by the competitors of the companies analyzed. Despite this, it is possible that this work provides a reference for the study of companies with long trajectory temporary and international competitive positioning. There is also the possibility of using the experience of the companies analyzed, in the teaching sphere. Future extensions of the work could be directed to perform work for other areas of activity, different methodologies or temporary criteria.

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Notes and annex.

1. As well as the suggestions of (Doz 1996; Yin 1994; and Eisendhart 1989).

2. In addition, the DEA analysis is incorporated. The (Banker et al. 1984) assumes variable returns to scale

$$\text{Max } \theta$$

$$\text{s.a.:}$$

(RVE). The program, which must be resolved for each year, is as follows:

$$\sum_{j=1}^{N} y_{sj}\lambda_j \geq y_{si}, \quad s = 1,...,S$$

$$\sum_{j=1}^{N} x_{mj}\lambda_j \leq \theta x_{mi}, \quad m = 1,...,M$$

$$\lambda_j \geq 0. \quad j = 1,...,N$$

[2]

Where the companies use an input vector $x = (x_1,...,x_j,...x_n) \in R_+^n$ to produce $y = (y_1,...,y_j,...y_n) \in R_+^n$ outputs

The value obtained for each year s oscillates between the values 0 and 1. The unit would correspond to an efficient year with which the border would be constructed. We assume output orientation given the goal of international growth and expansion that managers may have and variable returns to scale because of market imperfection or possible financial constraints (see Coelli et al., 2002).

3. The years 2000 and 2010 are omitted to save space.

Id	Year	ACS	FERROVIAL	OHL	FCC	SACYR	ACCIONA
1	1994	1	1	1	1	1	1
2	1995	1	0,967	1	1	0,896	1
3	1996	1	0,978	0,962	0,992	1	1
4	1997	0,999	1	1	0,97	1	1
5	1998	1	1	0,914	1	0,908	1
6	1999	1	0,913	0,918	0,979	0,87	1
7	2000	1	1	0,941	1	0,989	1
8	2001	0,995	1	0,918	1	0,905	0,962
9	2002	1	1	0,937	0,989	1	1
10	2003	1	0,946	0,979	1	1	0,975
11	2004	1	1	0,94	1	0,976	0,946
12	2005	0,973	1	0,936	1	1	1
13	2006	0,972	0,976	1	1	0,933	1
14	2007	1	1	1	1	1	0,928
15	2008	0,959	1	0,972	1	0,908	1
16	2009	0,962	0,906	0,983	0,995	1	0,913
17	2010	0,986	1	1	1	0,985	0,941
18	2011	0,999	0,874	1	1	0,943	0,977
19	2012	1	0,976	0,934	0,999	0,944	1
20	2013	1	0,976	1	0,973	0,881	1
21	2014	0,985	0,982	0,981	1	1	0,973
22	2015	1	1	0,94	1	1	1
	Mean	0,992	0,977	0,966	0,995	0,961	0,982
	SD	0,013	0,036	0,032	0,009	0,047	0,027