Does innovative effort matter for corporate performance in Spanish companies in a context of a financial crisis? A fuzzy-set QCA approach

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Abstract

The aim of this paper is to examine whether innovative effort is a key driver of the financial performance of a set of 3,860 Spanish companies in a context of a financial crisis. For this purpose, we use contrarian case analysis and configural analysis using fuzzy-set qualitative comparative analysis (fsQCA) to test the main tenets of complexity theory: (1) innovative effort, as a single antecedent condition, is not a sufficient or necessary factor of a high score in corporate performance; (2) a few possible configurations lead to high corporate performance (equifinality principle); (3) contrarian cases occur; and (4) causal configurations for high scores for corporate performance are not the mirror opposites of causal configurations for low scores for corporate performance (causal asymmetry principle). The findings suggest that innovative effort, as a single antecedent condition, is not a sufficient or necessary factor for a high score in corporate performance.

Keywords Innovation · Corporate performance · fsQCA · Contrarian case analysis · Configural analysis · Complexity theory

JEL Classification L25 · O31 · G39

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1 Introduction

The reality of the crisis shows that, in Spain[1], more than 150 companies go bankrupt daily because of their economic situations. In this sense, we wondered whether innovative efforts would be necessary to improve the performance of Spanish companies in a year of crisis.

Several studies analyze the relationship between innovation and profitability (Bogliacino and Pianta 2013; Atalay *et al*. 2013; Geroski *et al.* 1993; Heunks 1998). The Oslo Manual (OECD/Eurostat 2005) emphasizes the importance of this relationship. Many studies argue for the existence of a direct link between innovation and corporate performance. The argument for this positive relationship between the two variables is based on innovation creating products with higher added value that have a competitive advantage that limits competence. This relationship enables companies to earn enormous profits (Schumpeter 1934) because customers value the

[1] The Spanish economy is mainly composed of small and medium-size enterprises (SMEs), which represent an essential source of entrepreneurship and innovation. According Spanish General Directorate of the Industry and SMEs, on Octubrer 2017, SMEs represented 99.998% of the total companies registered in the Spanish Ministry of Employment and Social Security. Also, 54.14% were micro enterprises with no salaried workers.

exclusivity of the product incorporating this innovation (Lieberman and Montgomery 1988). This innovative effort is especially advantageous for small and medium enterprises (SMEs) because their smaller size and greater agility afford them greater flexibility to develop innovative products and processes and to generate new demand that allows them to grow (Rosenbuch *et al.* 2011). However, there is no consensus in the literature about the direct relationship between innovation efforts and business performance (Liao and Rice 2010; Santos *et al.* 2014; Subramanian and Nilakanta 1996).

The research provides a new perspective on the relationship between corporate performance and innovative effort dominant in the literature because we consider contrarian cases and apply contrarian case analysis and configural analysis using "fuzzy-set Qualitative Comparative Analysis" (fsQCA) to examine a set of propositions. The findings suggest that innovative effort, as a single antecedent condition, is not a sufficient or necessary factor for a high score in corporate performance. Additionally, almost one third of the analyzed Spanish companies are contrarian cases, and we provide three sufficient configurations that lead to high corporate performance.

The research may contribute to improving the making of financial decisions considering configurations of determinants of corporate performance and not only individual factors. In the study, three sufficient configurations are obtained, indicating that the companies that have high sales growth and liquidity and low indebtedness, or high innovative effort, sales growth and indebtedness, or high sales growth and low weight in their sectors are likely to achieve high scores in corporate performance. Therefore, innovative effort is neither necessary nor sufficient to predict a high score for corporate performance. In one of the three obtained models, innovative effort was combined with high sales growth and indebtedness to achieve a high score for corporate performance, and in the other two obtained models, it was irrelevant.

Following this introduction, Section 2 provides the literature review for the relationship between innovative effort and corporate performance. Section 3 includes the major testable tenets of complexity theory regarding the determinants of corporate performance. Section 4 describes the data and methodology used. Section 5 presents the findings of the research and discusses them. Section 6 reflects the conclusions and limitations of the research.

2 Literature review

Innovation can take different forms focusing on the existence of a new idea or behavior (Jiménez-Jiménez and Sanz-Valle 2011), and innovation not only affects the viability of a company but also serves as a driving force

for economic and social change (Santos *et al.* 2014). Thus, in recent decades, researchers have begun to assess the implementation of these new ideas in the development of new processes and products, causing innovation to emerge as a field of study itself (Santos *et al.* 2014) because it is one of the contributors to economic growth (Grupp 1998; Atalay *et al.* 2013).

At the corporate level, innovation refers to the willingness of companies to adopt new ideas that lead to the development of new products (Rubera and Kirca 2012). It is one of the main instruments for entering new markets, increasing market share and improving the competitiveness of companies (Youndt and Subramaniam 2005; Gunday *et al.* 2011). Thus, innovative effort is essential to the survival and success of companies (Bell 2005; Kim and Maubourgne 2005; Chen and Huang 2010; Ko *et al.* 2011). Therefore, companies, regardless of the sector in which they operate or their size, must perform innovation processes (Elci and Karatyli 2009) that allow them to survive and thrive in hypercompetitive environments and markets (Kim and Maubourgne 2005; Rosenbuch *et al.* 2011).

In this regard, several studies have shown that this innovative effort has a positive impact on the profitability of companies by improving their market positions, thus achieving a competitive advantage over the competence (Walker 2004). The existence of this positive relationship between innovative effort and corporate performance has been reflected in numerous studies analyzing different types of innovation (Damanpour *et al.* 1989; Pelham 1997; Han *et al.* 1998; Hult and Ketchen 2001; Li and Atuahene-Gima 2001; Baer and Frese 2003; Guo *et al.* 2005; Artz *et al.* 2010; Therrien *et al.* 2011; Hashi and Stojčić 2013). They have concluded that companies with innovative products can enjoy greater benefits by having less competence (Schumpeter 1934). However, this competitive advantage may only have a transitory effect on corporate performance if innovations are quickly diffused and imitated by competitors (Knight 1921; Hashi and Stojčić 2013). However, there has also been evidence in the literature that companies that persevere in their innovative efforts can achieve high returns over long periods of time (Lööf *et al.* 2001; Kemp *et al.* 2003; Sharma and Lacey 2004).

The existence of a direct link between innovation and profitability has been analyzed and confirmed in different countries. The most important work has been related to American companies. Studies by Griliches (1986) and Lichtenberg and Siegel (1991) analyzed the North American context and provided evidence of a direct link between innovative activities and the growth of business productivity. Similarly, Geroski (1993) and Wakelin (1998) found that innovative efforts had positive effects on profit margins and productivity for UK companies. Hashi and Stojčić (2013) found similar results for a group of European countries, and Goto and Suzuki (1998) found evidence for the Japanese manufacturing industry. For emerging countries, such as Turkey,

Gunday *et al.* (2011) showed how innovation had positive effects on business performance in manufacturing firms, whereas Atalay *et al.* (2013) analyzed the Turkish automotive industry and demonstrated the existence of a direct link between innovation in products and processes and corporate performance. Regarding Spain, Diaz-Diaz *et al.* (2008) analyzed a group of industrial firms and obtained evidence that innovation positively affects corporate performance.

The literature has not only focused on large companies as there are also studies at the microenterprise level (Nooteboom 1994; Sok *et al.* 2013; Okwiet and Grabara 2013; Raposo *et al.* 2014). Rosenbuch *et al.* (2011) suggest that smaller companies obtain greater benefits from their innovative effort because they are more flexible to adapt, thereby facilitating innovative activities.

However, despite all of these references, there is no consensus in the literature regarding the direct relationship between innovation efforts and business performance. Liao and Rice (2010) indicated that innovation activity is usually valued positively by companies, although it is subject to unknown risks and costs, whereas the profits are only potential. Therefore, the direct relationship between innovation and business performance may not be so clear, and it remains under discussion. Santos *et al.* (2014) found no relationship between business performance and innovation in Brazilian companies. Subramanian and Nilakanta (1996) found a relationship only between innovation and corporate performance when innovation was measured as a multidimensional variable. Liao and Rice (2010) found that the corporate performance of a set of Australian SMEs is influenced by innovation only when there are changes in market positioning and in the supply of the companies analyzed.

Considering the literature review, the study of the relationship between corporate performance and innovation efforts has been investigated; however, the number of studies in this area has remained limited (Atalay *et al.* 2013). Additionally, these studies analyzed only the net effects of innovative effort and did not consider contrarian cases; they were more concerned about goodness of fit than good prediction. In this sense, this paper attempts to provide a new approach to the relationship between innovative effort and corporate performance using fsQCA to test the main tenets of complexity theory (Ordanini *et al.* 2014; Wu *et al.* 2014; Ferguson *et al.* 2015; De Villiers *et al.* 2015) in Spanish companies.

3 Testable tenets for the main determinants of corporate performance

The literature raises the issue of the complexity in measuring how business performance (Pantea *et al.* 2014) Hashi and Stojčić (2013) report that the variables most commonly used to measure performance are productivity,

sales, revenues from exports and some financial measurements of economic profitability. Rosenbuch *et al.* (2011) indicate that researchers have yet to achieve a consensus regarding the components (i.e., conditions) of business performance. No single metric is adequate and different metrics are appropriate depending upon the circumstances occurring during the implementation of a firm-level strategy (Hagel *et al.* 2010). Venkatraman and Ramanujam (1986) divided the performance measurement in three directions: financial performance, operational performance and business performance, but the decision made by enterprises will be ultimately reflected in the financial performance (Tseng *et al.* 2013). There, the research considers financial performance as the standard of corporate performance and ROA as indicator of corporate performance because it has been very used in research. The achievement of a high score in corporate performance is a complex phenomenon in which the configurations of individual antecedent conditions are more important than the individual attributes of corporate performance.

With regard to the drivers of corporate performance, Pantea *et al.* (2014) describe the existence of two streams. The first indicates that specific factors of companies are the major drivers of business success. This view directly aligns with the theory of resources and capabilities (Barney 1991), according to which the success of a company depends on its resources. The second trend emphasizes the importance of external factors as the determinants of business success. In our posed configurational framework, we use the following antecedent outcomes, both specific and external to the company itself, to encompass the drivers from the previous two streams: antecedent outcomes related to factors specific to the company: the drivers associated with their own resources and capabilities, innovative efforts, sales net growth, indebtedness level and liquidity ratio; and antecedent outcomes related to factors external to the company: the share of the company in the sector in which it operates.

The complexity theory-based models in this study propose that corporate performance depends on alternative combinations of these five antecedent conditions. Thus, the posed propositions are the four major tenets of complexity theory in the context of corporate performance in Spanish companies, as follows. Proposition 1: Innovative effort, as a single antecedent condition, is not a sufficient or necessary factor for a high score in corporate performance. Proposition 2: A few possible configurations lead to high corporate performance (equifinality principle). Proposition 3: Contrarian cases occur; that is, high scores in innovative effort lead to low scores in corporate performance (positive contrarian cases), and low scores in innovative effort lead to high scores in corporate performance (negative contrarian cases). Proposition 4: Causal configurations to predict a

high score in corporate performance are not the mirror opposites of causal configurations to predict the negation of high scores in corporate performance (the causal asymmetry principle).

4 Data and methods

This section describes the data[2] and method used in the research.

4.1 Data

The study includes a set of 3,860 Spanish companies with data on patents in their balance sheets under the item, "patents, licenses, trademarks and similar" according to the Sistema de Análisis de Balances Ibéricos (SABI) database. For this purpose, we select 2008 because it was the first complete year of the current financial crisis, which began in 2007. The data are obtained from the SABI database, which includes the balance sheets of thousands of companies from Spain and Portugal.

To select this sample, first we choose all of the Spanish companies with data on patents in their balance sheets under the item "patents, licenses, trademarks and similar" (5,522 companies) according to the SABI database, and we removed the companies that presented extreme values of ROA (our dependent variable) to analyze the companies with ROAs between -43% and 47% (3,860 companies). Therefore we assure that we were considering companies with R&D activity and with a non-exceptional economic performance. Nevertheless, we were aware that the size of the company could play a role in the R&D expenditure. To address this issue, we do not use the variable "patents, licenses and trademarks" directly, but we build a ratio between that variable and the total assets of the company to relativize that value depending on the firm size.

The outcome condition is the measurement of corporate performance. The research considers financial performance as the standard of corporate performance and ROA as indicator of corporate performance because it has been very used in research and can foster a better view of the fundamentals of a business than ROE (Hagel *et al.* 2010) and because the effects of the antecedent conditions on the outcome condition are not immediate (McClelland 1998).

Here are key features of the data. To approximate innovative effort, the study uses data in the balance sheets under the item "patents, licenses, trademarks and similar" (hereinafter patents), which is included in the "intangible assets" section, the balance sheet section that contains data related to spending on innovation and development and other innovative activities of companies (Piscitello 2004). However, this attribute is an

[2] Dataset is available upon request from corresponding author at mcgonv@unileon.es.

absolute measurement of innovation effort and can be biased by the size of the company. To reduce this effect, we build a proxy of innovative effort, i.e., the ratio between the patents and total assets of the company. Indebtedness level is the relationship between the company's external resources and equity to measure its degree of leverage. The liquidity ratio is the ratio between assets and liabilities. Sales net growth is the percentage of annual variation in net sales over the previous period. The share of the company in the sector is the volume of the assets of the company over the total assets of the sector in which it operates.

4.2 Methods

To examine the posed propositions in our configurational framework in the context of corporate performance in Spain, we perform contrarian case analysis and configurational analysis using fsQCA because the dominant literature on multiple regression analysis (MRA) has focused only on estimating the presence or absence of the net effects of every independent variable on the dependent variable, and it is necessary go beyond this methodology to advance and test theories in different disciplines (Woodside 2013).

4.2.1 Complexity theory

Woodside (2014) emphasized three important points related to complexity theory. First, "'Scientist' tools are not neutral" (Gigerenzer 1991) because research methods and instruments shape the ways in which we think and test theories. Second, models should be centered on forecasting and not only on goodness of fit. Third, it is necessary to conduct more rigorous research to develop the full potential of complexity theory, especially in the social sciences. In this sense, Woodside (2014) offers the following tenets of the complexity theory. T1: A simple antecedent condition may be necessary, but a simple antecedent condition is rarely sufficient for predicting a high or low score in an outcome condition. T2: Recipe principle: A complex antecedent condition of two or more simple conditions is sufficient for a consistently high score in an outcome condition. T3: Equifinality principle: A model that is sufficient is not necessary for an outcome with a high score to occur (Ragin 2000). T4: Causal asymmetry principle: Recipes indicating a second outcome (e.g., rejection) are unique and not the mirror opposites of recipes with different outcomes (e.g., acceptance). T5: An individual feature (attribute or action) of a recipe can contribute positively or negatively to a specific outcome, depending on the presence or absence of other ingredients in the recipe. T6: For high outcome scores, a given recipe is relevant for some but not all cases; the coverage is less than 1.00 for any one recipe. Thus, a few exceptions occur for high antecedent scores for a given recipe that work well for predicting high outcome scores.

4.2.2 Contrarian case analysis.

Contrarian case analysis allows us to identify the number of cases that do not support the main effect, that is, a symmetric relationship between the outcome variable and the main antecedent. Contrarian case analysis can be very useful to data analysis because symmetric-focused studies rarely consider modeling the indicators for contrarian cases (Wu *et al.* 2014). Contrarian cases can be of two types: positive contrarian cases, which indicate that high scores for antecedent conditions lead to low scores for outcome conditions, and negative contrarian cases, in which low scores for antecedent conditions lead to high scores for outcome conditions. The two sets of contrarian cases run counter to the main large effect size positive relationship (Wu *et al.* 2014). To perform contrarian case analysis, we expressed both conditions (antecedent and outcome) in quantiles to examine better all of the cases in the sample; that is, a table of relative and absolute frequencies was created to reflect the association among the different quantiles of the antecedent condition and the outcome condition. Additionally, it is convenient to indicate statistical significance using measurements to determine the degree of association that exists between the outcome and the antecedent conditions, such as Cramer's phi and Cohen's w (Cohen 1988).

4.2.3 Configural analysis

Three principles underlie configuration theory (Ordanini *et al.* 2014). First, Outcomes of interest rarely result from a single antecedent condition. Second, antecedent conditions rarely operate in isolation from contexts effects. Third, the same antecedent condition can have different, even opposing, effects depending on the context (Greckhamer *et al.* 2008). The objective of configurational analysis is to find some equifinal configurations, that is, different combinations of antecedent conditions that result in the same outcome.

To perform the configural analysis, the study includes the use of fsQCA with the STATA fuzzy package (Longest and Vaisey 2008). FsQCA is a mixed qualitative-quantitative method that allows us to analyze the relationships between the outcome and its antecedent conditions because it provides all of the possible combinations of antecedent conditions to achieve an outcome that considers two states of these variables: presence and absence (Ragin 2000). The application of fsQCA provides all of the possible configurations of antecedent conditions of an outcome condition. Unlike correlation analysis and multiple regression analysis (MRA), which uses matrix algebra, fsQCA uses Boolean algebra, and it requires transforming original scaled values into fuzzy set values for both antecedents and outcome conditions. These fuzzy set values indicate the degree of membership of every case in each set, and they range from 0.00 (full non membership) to 1.00 (full membership) with intermediate memberships between 0.00 and 1.00 (Ragin 2000). After generating fuzzy set values for individual antecedent conditions, it is possible to calculate membership scores for every configuration

including more than one antecedent condition, and it is the minimum fuzzy score under each of the conditions (Wu *et al.* 2014). Additionally, it is necessary to set three breakpoint values to transform original scaled values into fuzzy set values: 0.05 (the original values cover 5% of the data values – full non-membership), 0.50 (the original values cover 50% of the data values – membership ambiguity) and 0.95 (the original values cover 95% of the data values – full membership).

The main analysis of fsQCA is the analysis of causal sufficiency to evaluate which configurations of antecedent conditions are sufficient to achieve an outcome. An antecedent condition X is sufficient for outcome Y if Y will always occur if X is present, but other conditions in addition to X might also produce Y. Empirically, this means that all cases in which X is present share the occurrence of Y. In fuzzy set terms, a sufficient relationship exists if X is a subset of outcome Y; that is, across all cases, the degree of membership in condition X is consistently less than or equal to the degree of membership in outcome Y (Legewie 2013). For this analysis, the study includes calculating the consistency index, which is the proportion of consistent cases or the degree to which a simple or complex antecedent condition drives an outcome condition. The consistency index (Equation 1) indicates that the membership score for the outcome is consistently higher than the membership score for the causal configuration. It is similar to the correlation coefficient in regression analysis.

$$Consistency\ Index\ (X_i \le Y_i) = \frac{\sum[\min(X_i, Y_i]}{\sum X_i}, \tag{1}$$

Where, for the case i:

X_i is the membership score in the X configuration; and

Y_i is the membership score in the outcome set.

Additionally, in this analysis of causal sufficiency, we calculate the coverage index (Equation 2), which assesses the relative importance of causal configuration to explain the outcome, and it serves to reduce the number of sufficient configurations by eliminating those with an insufficient number of best-fit cases in the sample. It is similar to the variance explained in regression analysis.

$$Coverage\ Index\ (X_i \le Y_i) = \frac{\sum[\min(X_i, Y_i]}{\sum Y_i}, \tag{2}$$

Where, for the case i:

X_i is the membership score in the X configuration; and

Y_i is the membership score in the outcome set.

The analysis of causal necessity[3] allows us to examine the antecedent conditions that may be necessary for the outcome to occur. This indicates that the membership score for the outcome is consistently less than the membership score for the causal configuration.

5 Findings and discussion

This section includes the findings and discussion for a symmetrical test or contrarian case analysis to determine the presence of contrarian cases that do not support the symmetric relationship between innovative effort and corporate performance and for an asymmetrical fsQCA data analysis to test the major tenets of complexity theory in symmetrical testing to determine the associations.

5.1 Findings for contrarian case analysis

First, we perform contrarian case analysis to detect the contrarian cases that do not support the main effect, that is, a symmetric relationship between corporate performance in Spanish companies (outcome variable) and the innovative effort (antecedent condition, the object of research). Table 1 reports a quintile analysis of innovative effort in Spanish companies and their performances, and it reflects the absolute and relative frequencies in all of the quintiles of both variables.

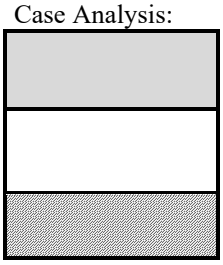
Table 1 Innovative effort and corporate performance in Spanish companies

Spanish companies		**Quintiles of ROA (2009)**					**Total count**
		Very low 1	**Low 2**	**Medium 3**	**High 4**	**Very high 5**	
Quintiles of Patents/Assets (2008)	**Very low 1**	168	185	143	139	137	772
		4.35	4.79	3.70	3.60	3.55	20.00
	Low 2	162	175	148	155	132	772
		4.20	4.53	3.83	4.02	3.42	20.00
	Medium 3	132	152	164	162	162	772
		3.42	3.94	4.25	4.20	4.20	20.00
	High 4	161	120	182	149	160	772
		4.17	3.11	4.72	3.86	4.15	20.00
	Very high 5	149	140	135	167	181	772
		3.86	3.63	3.50	4.33	4.69	20.00
	Total count	772	772	772	772	772	3,860
		20.01	20.00	20.00	20.00	20.00	100.00

Notes: The table shows the variables of outcomes (ROA 2009) and antecedents (Patents/Assets 2008) in quintiles and absolute and relative frequencies.

[3] An antecedent condition X is necessary for an outcome Y if the occurrence of Y is not possible without the presence of X, but X alone is not sufficient to produce Y. In such cases, all cases in which outcome Y occurs share the presence of the antecedent condition X. In fuzzy set terms, a necessary relationship exists if outcome Y is a subset of antecedent condition X; that is, in each case, the degree of membership in Y is less than or equal to the degree of membership in X (Legewie, 2013).

Case Analysis:



Cases occur of very few patents with very high ROA (positive contrarian cases = 570 companies or 14.77%).

Cases occur of very many patents with very low ROA (negative contrarian cases = 563 companies or 14.59%).

Cases supporting the main effect (1,347 companies or 34.90%).

Pearson's chi2 (16) = 45.7254 Pr = 0.000
Cramer's phi-prime = 0.0544 Cohen's w = 0.1088

5.2 Calibration of the original data

To apply the fsQCA, we transform the original scale of the values of the drivers of corporate performance into fuzzy set scales with values between 0 and 1 to reflect the idea of membership in the set of "good corporate performance", ranging from 1 indicating full membership in the set to 0 indicating nonmembership in the set, with intermediate values between them (Ragin, 2000). To generate these fuzzy score measurements, we use the standardized rank transformation (Longest and Vaisey, 2008) because the considered antecedent conditions are continuous variables. It consists of ordering the variable and then standardizing this ranking to range from 0 to 1. Equation (3) for this standardization is:

$$\frac{ranked\ var - min(ranked\ var)}{max(ranked\ var) - min(ranked\ var)} \quad (3)$$

5.3 Findings for configural analysis

We perform fsQCA to examine all possible configurations of the binary states (presence and absence) of the considered five drivers of corporate performance: innovative effort (P), sales net growth (S), indebtedness level (D), liquidity ratio (L) and share of the company in its sector (W), according to the previous review of the literature.

There are $2^5 = 32$ possible combinations, in which uppercase letters and lowercase letters indicate the presence and absence of the attributes in these configurations, respectively. According to this methodology, each company will have a degree of fuzzy membership greater than 0.5 in only one configuration (best-fit case), as indicated by Longest and Vaisey (2008).

5.3.1 Outcome models to predict high corporate performance

Three sufficient configurations are provided by the STATA fuzzy package (Longest and Vaisey 2008) and are shown in Table 2, where we can see the configurations of antecedent conditions that are sufficient for achieving

a high score for corporate performance, with its coverage measurements and consistency for the entire solution. These three sufficient configurations explain approximately 64% of the corporate performance in the considered sample of Spanish companies, and its combined consistence is approximately 79%; that is, the combined three causal configurations cover 78% of Spanish companies that show high corporate performance (outcome condition).

Table 2 Sufficient configurations to predict high corporate performance

Sufficient configurations	Raw coverage	Unique coverage	Solution consistency
1. S*d*L	0.444	0.045	0.834
2. P*S*D	0.425	0.047	0.835
3. S*w	0.524	0.052	0.821
Total Coverage = 0.638 Solution Consistency = 0.788			

Notes: S: sales net growth; D: indebtedness level; L: liquidity ratio; P: innovative effort; W: share of the company in its sector. Uppercase and lowercase letters indicate presence and absence of attributes, respectively.

The first configuration is characterized by a high score for sales growth and liquidity and low indebtedness. The second configuration also requires a high score for sales growth, as well as a high score of innovative effort and indebtedness. The third configuration also presents a high score for sales growth but a low share of the company in its sector.

5.3.2 Outcome models to predict the negation of corporate performance

Additionally, we apply fsQCA to provide outcome models to predict the negation of corporate performance, that is, to obtain the negation of a high degree of corporate performance (Table 3).

Table 3 Sufficient configurations to predict the negation of corporate performance

Sufficient configurations	Raw coverage	Unique coverage	Solution consistency
p*s*W	0.416	0.036	0.834
s*l*W	0.408	0.010	0.851
p*s*D	0.422	0.071	0.849
S*D*W	0.419	0.012	0.852
Total Coverage = 0.565 Solution Consistency = 0.805			

Notes: S: sales net growth; D: indebtedness level; L: liquidity ratio; P: innovative effort; W: share of the company in its sector. Uppercase and lowercase letters indicate presence and absence of attributes, respectively.

5.3.3 Predictive validity

To test the predictive validity of the outcome models, we divide the total sample of 3,860 Spanish companies into two subsamples with the same number of Spanish companies – a modeling subsample and a holdout subsample – as in Wu *et al.* (2014). Table 4 shows the outcome models to predict a high degree of corporate performance in the first subsample, and Table 5 presents the findings for testing the outcome models of subsample 1 for the data in the second subsample or the holdout subsample, and the results indicate acceptable coverage (0.439, 0.413 and 0.500 for the three models, respectively) and high consistency (0.835, 0.843 and 0.826 for the three models, respectively).

Table 4 Sufficient configurations to predict high scores for corporate performance for subsample 1

Sufficient configurations	Raw coverage	Unique coverage	Solution consistency
1. S*d*L	0.441	0.022	0.835
2. P*S*L	0.425	0.015	0.858
3. S*w	0.524	0.108	0.821
Total Coverage = 0.602 Solution Consistency = 0.802			

Notes: S: sales net growth; D: indebtedness level; L: liquidity ratio; P: innovative effort; W: share of the company in its sector. Uppercase and lowercase letters indicate presence and absence of attributes, respectively.

Table 5 Tests of models for subsample 1 using data from subsample 2

Sufficient configurations	Raw coverage	Unique coverage	Solution consistency
1. S*d*L	0.439	0.030	0.835
2. P*S*L	0.413	0.015	0.843
3. S*w	0.500	0.104	0.826
Total Coverage = 0.596 Solution Consistency = 0.805			

Notes: S: sales net growth; D: indebtedness level; L: liquidity ratio; P: innovative effort; W: share of the company in its sector. Uppercase and lowercase letters indicate presence and absence of attributes, respectively.

5.4 Discussion

With these findings, we examine the four posed propositions.

Proposition 1: Innovative effort, as a single antecedent condition, is not a sufficient or necessary factor for a high score in corporate performance.

These three obtained sufficient configurations (Table 2) support the following conclusions. Sales growth is an almost necessary, but not a sufficient, condition for achieving a high score for corporate performance. Its

absence generally inhibits a high degree of corporate performance, but its presence alone cannot produce a high degree of corporate performance because it would need to combine with other antecedent conditions. Innovative effort, liquidity and indebtedness are neither necessary nor sufficient to achieve a high score for corporate performance. Innovative effort and liquidity can be either present or irrelevant to achieving a high score for corporate performance. Indebtedness can be present or absent or irrelevant to achieving a high score for corporate performance.

Innovative effort is present in one of the three sufficient configurations, but it is irrelevant in two sufficient configurations, according to the findings of Table 2. This result reveals the weak link between innovative effort and corporate performance, and it allows us to confirm that the direct relationship between innovative effort and corporate performance, defended by some authors (Gunday *et al.* 2011; Heunks 1998; Lieberman and Montgomery 1988; Noteboom,1994; Schumpeter 1934), does not hold in all cases, and it is necessary to combine this innovative effort with other attributes of corporate performance to achieve a high degree of corporate performance, such as a high degree of sales net growth and indebtedness in one of the three sufficient configurations obtained. It can result in contradictory combinations of a high degree of innovative effort with a high degree of indebtedness, perhaps due to the cost of innovation projects that can increase the indebtedness of the company, above all in the initial phase of its implementation.

Additionally, innovative effort is indifferent in two of three sufficient configurations, and this result can be explained with the counterarguments to the direct relationship between innovative effort and corporate performance (Rosenbuch *et al.* 2011). First, innovative effort requires resources that can be limited in the case of SMEs (Acs and Audrestch 1988). Moreover, innovation is subject to risks and uncertainties (Liao and Rice 2010; Eisenhardt and Martin 2000). Additionally, Rosenbuch *et al.* (2011) stated that innovative activities in established companies face greater difficulties than in small businesses because the latter are more flexible (Christensen and Bower 1996; Hill and Rothaermel 2003). Amit and Schoemaker (1993) indicated that as companies mature, a tradeoff among between greater specialization of resources, greater experience and greater flexibility. As they mature, already established companies lose one of the competitive advantages that they possess in their inception, which is their great flexibility because they develop routines and structures that increase rigidity in decision-making (Van de Ven 1986).

Therefore, these findings support proposition 1, which establishes that innovative effort, as a single antecedent condition, is neither sufficient or necessary for a high score in corporate performance. This conclusion is explainable by the findings of previous studies suggesting that the effect of innovative effort on

corporate performance is weaker in some companies, such as SMEs or mature companies. Additionally, these findings support that individual antecedent outcomes, depending on how they are combined with other attributes, can foster or inhibit the outcome condition (Ordanini *et al.* 2014).

Proposition 2: A few of possible configurations lead to high corporate performance (equifinality principle). FsQCA provides three, not one, equifinal configurations that lead to high corporate performance (Table 2). These combinations reflect the different factors that companies consider to make financial decisions and increase their performance. According to these three combinations, we can distinguish three different types of companies: the first, which we could call "healthy companies," appreciate high sales growth and liquidity and low indebtedness to achieve high performance; the second, which we could call "innovative and risky companies", consider high innovative efforts, sales growth and indebtedness to obtain high performance; and the third, which we could call "productive and small companies", consider high sales growth and low shares in their sectors to obtain high performance. Only the second group of Spanish companies considers innovative effort, combined with sales growth and indebtedness, to make financial decisions for increasing their performance. In contrast, innovative effort is irrelevant for the financial decisions of the other two groups of companies. These findings support Proposition 2, which establishes that a few configurations lead to high corporate performance because fsQCA provides three equifinal configurations, not one, to achieve high corporate performance.

Proposition 3: Contrarian cases occur; that is, high scores in innovative effort lead to low scores for corporate performance (positive contrarian cases), and low scores for innovative effort lead to high scores for corporate performance (negative contrarian cases).

The findings for the total sample are not significant statistically (Table 1); however, the sample of 3,860 Spanish companies includes 29.36% contrarian cases, 14.59% (563 Spanish companies) cases with high/very high innovative effort and low/very low performance, and 14.77% (570 Spanish companies) with low/very low innovative effort and high/very high performance. Thus, almost 30% of total sample of Spanish companies shows two relationships counter to the symmetric relationship in which innovative companies are profitable companies, and non-innovative companies are unprofitable companies. The presence of contrarian cases may be explained because this expected positive effect of innovative effort on corporative performance may be influenced by other factors, such as the size and the age of the company (Acs and Audrestch 1988; Liao and Rice 2010; Eisenhardt and Martin 2000; Rosenbuch *et al.* 2011; Amit and Schoemaker 1993), just proposition 1 proposes. In this sense, the costs of an innovation project that does not produce the desired effect may not be offset by an enterprise that is small in size. With regard to the age of the company, we state that innovative

activities in established companies face greater difficulties than in small businesses because the latter are more flexible indicating that, as companies mature, a tradeoff occurs among greater specialization of resources, greater experience and greater flexibility. Overall, these findings support proposition 3, which establishes that contrarian cases occur because almost 30% of the considered Spanish companies showed results counter to the symmetric relationship between innovative effort and corporate performance.

Proposition 4: Causal configurations to predict a high score for corporate performance are not the mirror opposites of causal configurations to predict the negation of high scores for corporate performance (causal asymmetry principle). Table 3 shows four outcome models to predict the negation of high corporate performance, considering specific factors of the companies and external factors. These four obtained outcome models reflect the following conclusions. Sales growth can be present or absent in predicting the negation of high scores for corporate performance. Innovative effort and liquidity can be absent or irrelevant to predict the negation of high scores for corporate performance. Innovative effort is present in two of the four outcomes models, and liquidity is indifferent in three of four outcome models. The share of the company in its sector can be present or absent or irrelevant to predicting the negation of high corporate models. These findings support proposition 4, which indicates that causal configurations with specific and external determinants of corporate performance to predict high corporate performance are not the mirror opposites of causal configurations with the same attributes to predict the negation of high corporate performance (causal asymmetry principle).

6 Conclusions and limitations of the research

This paper aims to help improve financial decision making of Spanish SMEs in a context of a financial crisis and, above all, to test whether innovative effort is necessary and sufficient to increase the corporate performance of Spanish companies in a year of crisis. The study provides a new approach to the related literature to analyze the relationship between innovative effort and corporate performance because the combinations of different antecedent conditions of corporate performance are more than important than these antecedents considered individually (Ordanini *et al.* 2014). This approach is based the application of contrarian case analysis, configural analysis and fsQCA to test the main tenets of complexity theory in the context of corporate performance in Spanish companies. Three configurations of specific and external drivers of corporate performance are provided that allow us to distinguish three groups of companies: the first, which we could call “healthy companies”, are characterized by high sales growth and liquidity and low indebtedness; the second, which we could call “innovative and risky companies”, refer to those that have high sales net growth, innovative effort and

indebtedness; and the third, which we could call “small and productive companies”, include those that have high sales growth and a low share among the companies in their sectors. Therefore, innovative effort is neither necessary or sufficient to predict a high score for corporate performance. Moreover, almost 30% of Spanish companies do not show a symmetric relationship between innovative effort and corporate performance.

With regard to other considered determinants of corporate performance, sales growth is almost necessary to predict high corporate performance, but it is not sufficient because it must be combined with the other determinants, including innovative effort, indebtedness, liquidity and the share of the company in its sector, to achieve high corporate performance. Indebtedness presents an ambiguous influence because its presence or absence would be necessary to predict high corporate performance, depending on the antecedent with which it is combined. Therefore, high indebtedness may be present and conjoined with high innovative effort and sales growth because the innovative effort requires resources, above all in the initial phase of implementation of innovation projects, and it can increase indebtedness (innovative and risky companies). However, if it is absent, it is combined with high sales growth and liquidity (healthy companies). It appears that combinations of specific factors for the company would be more present in the making of financial decisions than those with factors external to achieving high corporate performance.

FsQCA is better than other methodologies because it considers all of the cases in the sample and not only the net effects. One of the main objectives is to predict the outcome condition, whereas other methods are more concerned about goodness of fit. However, use of caution applies to the conclusions obtained by applying fsQCA because this method is sensitive to the selected sample, antecedent conditions, and the measurements used to calibrate the original data (Schneider and Wagemann, 2010).

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