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Investigating the determinants of firm performance

Firm
performance

A qualitative comparative analysis of insurance companies

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Abstract

Purpose – The purpose of this paper is to use tenets of the complexity theory in order to study the effect of various determinants of firm's performance, such as CEO's compensation and age, for the case of 72 insurance companies.

Design/methodology/approach – The authors identify the asymmetries in the data set by creating quantiles and using contrarian analysis. Instead of ignoring this information and use a main effects approach, all the available information in the data set is taken into account. For this purpose, the authors use qualitative comparative analysis to find alternative equifinal routes toward high firm performance.

Findings – Five configurations are found which lead to high performance. Every one of the five configurations is found to be sufficient but not necessary for high firm performance.

Originality/value – The research findings contribute to a better understanding of the determinants of firm's performance taking into account the asymmetries in the data set. The authors identify alternative paths toward high firm performance, which could be vital information for the decision maker inside a firm.

Keywords Complexity theory, Qualitative comparative analysis, Contrarian analysis, Insurance companies, Compensation

Paper type Research paper

1. Introduction

The performance of a firm is affected by a variety of factors including organizational aspects such as the size, the history and the structure of the firm; environmental aspects such as socio-economic background and technological framework; and human aspects such as individual characteristics, motivation and skills. There is a debate across the literature about the effect of human factor on firm's performance, especially the effect of top managers. The neoclassical economic theory considers top managers as homogenous and perfect substitutes with each other (Bertrand and Schoar, 2003), while the managerial talent hypothesis indicates that managers affect the performance of the firm (Hubbard and Palia, 1995). The top ranked manager of the firm is the chief executive officer (CEO) or managing director who is responsible for the firm's overall operations and performance. According to managerial talent hypothesis, the effect of the CEO's individual performance should greatly influence the performance of the firm.

The scientific interest focuses on the specific factors and characteristics of CEOs which affect the firm. Motivation is considered among the most important factors, with compensation[1] and bonuses as its key determinants (Cashman, 2010; Livne *et al.*, 2011). In addition, based on the

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principal-agent theory the principal (board of directors) decides the optimal level and composition of the agent's (CEO) compensation in order to better align their interest. Therefore, total compensation (compensation and bonuses) provide motivation and align the CEO's interests with the interests of the firm. Furthermore, the CEO's characteristics, such as age (Sturman, 2003) and tenure (Mousa and Chowdhury, 2014), also influence his decisions and, consequently, the performance of the firm. The decremental theory of aging suggests that older individuals tend to have declining physical and mental skills (Giniger *et al.*, 1983). Nevertheless, older individuals tend to be more experienced which is important for complex jobs such as CEO.

The majority of the previous literature regarding the CEO characteristics and firm performance focus on non-financial sector. The relationship between CEO pay and performance is at the center of this literature and the argument is that shareholders' interests and managers' interests are better aligned when CEO compensation is connected with shareholders' gains and losses. However, this relationship has been questioned in the financial sector, especially in the aftermath of the global financial crisis. Specifically, the argument is about CEO incentives and whether or not they are aligned with shareholders' and firm's interests (Fahlenbrach and Stulz, 2011). Furthermore, CEOs in banks receive lower compensation and fewer incentives, while the pay-performance relationship is more sensitive (Houston and James, 1995). Therefore, it is important to examine the effect of CEO pay on firm performance in the financial sector.

In line with the above, this study focuses on the effect of various determinants of financial firm's performance, including the CEO's total compensation and age, the size and the age of the firm. Specifically, we examine the case of seventy-two insurance companies. The contribution lies both in the empirical literature of CEO compensation in general and the key factors of firm performance in financial sector in particular. Although a great variety of studies focus on the effect of CEO compensation on firm performance and a number of studies on the effect of other factors such as firm size and CEO age, only a few of them explore this link in financial sector. Furthermore, this is the first study to explore all these factors simultaneously, which allows us to take a broader look regarding the performance of a firm.

The vast majority of previous studies applies multiple regression analysis (MRA) in order to examine firm performance and its determinants, therefore assuming a linear relationship (Sun *et al.*, 2013; Sheikh *et al.*, 2018). Another strand in the literature argues that this relationship is non-linear and found various types of asymmetries (Fong *et al.*, 2015; Matousek and Tzeremes, 2016). This study uses the complexity theory tenets in order to examine possible asymmetrical relationships between antecedents (CEO's compensation and age among others) and the outcome condition (firm's performance). These tenets suggest equifinality, which implies that more than one path can lead to the desired outcome (Wu *et al.*, 2014). Furthermore, this study applies contrarian case analysis by creating quantiles in order to shed further light on the asymmetrical relationship among the variables. Moreover, configural analysis is applied, which uses Boolean algebra in order to find which combinations of simple antecedents lead to a high outcome condition. In addition, we perform a predictive validity test using a holdout sample in order to check the validity of our findings.

The paper is organized as follows. Section 2 reviews the current literature about the relationship among the firm's performance and its various determinants, which include CEO's compensation and age, the size and the age of the firm. Section 3 presents the description of the variables used, the contrarian analysis and the outline of the configural analysis. The results of the approach are presented in Section 4, and Section 5 concludes.

2. Theory and hypothesis

2.1 Review of the recent literature

The previous empirical literature mainly focuses on the effect of CEO compensation on industrial firm performance. The results indicate a positive relationship, however, the exact nature of this relationship has caused some debate whether the effect is high, moderate or low,

and also if high compensation leads to high performance or the opposite, therefore, if the relationship is symmetrical or asymmetrical. Hall and Liebman (1998) studied the case of publicly traded US companies and found a significant relationship among pay and performance, and they rejected the hypothesis that CEOs are paid as bureaucrats. The case of 455 US firms for the time period 1996–2002 was studied by Nourayi and Daroca (2008). The authors examined the relationship among the CEO's cash and total compensation, and the firm's size and performance. The results showed a small positive but significant relationship among compensation and performance. Ghosh (2010) examined the case of 324 Indian manufacturing firms for the year 2007 and found a small positive but significant relationship among CEO pay and firm performance. Raithatha and Komera (2016) investigated the linear relationship among firm performance and executive compensation in India and found a positive relationship between accounting performance and compensation; however, this finding is not verified for the case of stock market performance. Similarly, Sheikh *et al.* (2018) examined the linear relationship among firm performance, executive compensation and corporate governance in Pakistan, and verified the positive relationship between accounting performance and compensation, and no relationship between stock market performance and compensation.

On the other hand, a number of studies found evidence of non-linear relationship between firm performance and CEO compensation. The practical limits of incentive pay were highlighted by Mishra *et al.* (2000) who investigated 430 firms over the period 1974–1988. The findings indicated a non-linear relationship among the CEO's pay and firm performance. Specifically, increasing pay sensitivity results in higher firm performance up to a certain point, beyond which the results turn to be negative. Nourayi and Mintz (2008) examined the pay–performance relationship for 1,446 firms for the years 2001 and 2002. The results revealed that compensation of inexperienced CEOs with under three years in the office was related to firm performance, while there was no relationship for more experienced CEOs. Bulan *et al.* (2010) investigated 917 manufacturing firms for the time period 1992–2003 and found a non-linear relationship between CEO pay incentives and firm productivity. The findings revealed that pay incentives do not always achieve their purpose and excessive incentives might lead to opposite results. In fact, it is quite possible that in the absence of a supervisory board, the CEO will manipulate the firm's strategy in order to achieve higher compensation. Fong *et al.* (2015) found a non-linear relationship among the CEO's compensation and long-term firm's market value for 582 non-financial non-utility US firms for the time period 1991–1999. Specifically, the relationship was initially positive up to a threshold, and beyond that point the relationship became negative. Furthermore, there are studies which link low firm performance with CEO turnover, even if the low performance is due to factors beyond the control of the CEO (Jenter and Kanaan, 2015; Bennett *et al.*, 2017).

A number of studies across the literature focus on the financial sector. Crawford *et al.* (1995) found a strong positive relationship between bank performance and incentives for CEO's compensation and wealth (salary, bonus, stock options and common stock holdings) in the post-deregulation period. Hubbard and Palia (1995) confirmed the positive pay–performance relationship for the case where the interstate banking is permitted. Houston and James (1995) examined CEOs in 134 commercial banks and 134 non-banking firms and found that there are structural differences among CEOs in banks and CEOs in non-banking firms in terms of their compensation. Specifically, the results reveal that CEOs in banks receive lower compensation and fewer incentives, while the pay–performance relationship is more sensitive in banks. Ang *et al.* (2002) investigated CEOs and non-CEO top executives in 166 US banks and found that the pay–performance relationship is positive and significant for CEOs. Cünat and Guadalupe (2009) examined banking and financial sectors and demonstrated that increased competition and deregulation increased the pay–performance sensitivity. John *et al.* (2010) studied CEOs in 143 bank holding companies and found that the link between compensation and performance lessens with the leverage ratio and strengthens with outside monitoring. Sun *et al.* (2013) tested the relationship among CEO compensation and firm performance, measured by efficiency, in

the US property-liability insurance industry for the time period 2000–2006. The findings revealed that revenue efficiency was related to cash compensation, and cost efficiency was related to incentive compensation.

On the other hand, a negative or non-linear relationship between firm performance in financial sector and CEO compensation was reported by a number of studies. Barro and Barro (1990) were among the first to study the connection of CEO compensation and firm performance in financial sector. They examined the total compensation (salary and bonus) of CEOs in large commercial banks. The results revealed a positive relationship between total compensation and the firm's performance; however, more experienced CEOs were affected less by compensation changes. Livne *et al.* (2011) studied 152 firms (mainly commercial banks) for the time period 1996–2008. The authors found that cash bonus and firm performance were positively related, while equity-based compensation was negatively related with firm performance. Matousek and Tzeremes (2016) examined the effect of CEO compensation on the bank efficiency levels and found a significant non-linear relationship among them. Furthermore, the results indicated that CEO salary and bonus affected differently the level of the efficiency. In summary, we expect the effect of the CEO's compensation on firm performance to be substantial and positive at the beginning, with a diminishing rate for higher levels.

There is also a strand in the literature which explores the link between various types of compensation structures and risk taking, which indirectly affects firm performance; however, the results do not indicate a clear relationship among them. Specifically, Chen *et al.* (2006) investigated commercial banks during the time period 1992–2000 and found that after deregulation the CEO compensation was significantly based on stock options. As a result, the authors noted that the structure of CEO compensation encourage risk taking. Bebchuk *et al.* (2010) and Bhagat and Bolton (2014) examined the case of financial institutions and found that managerial incentive pay matters. Furthermore, they recommend the use of restricted stocks and restricted stock options in order to handle the induced risk taking, while Bolton *et al.* (2015) suggested to link credit default swaps with compensation in order to tackle the issue. Gande and Kalpathy (2017) examined large US firms before crisis and found that equity incentives, which were tied to the CEO compensation resulted in risk taking and solvency problems. At the same time, higher incentive alignment moderated the problems. On the other hand, Houston and James (1995) found no evidence that bank CEO compensation induces risk taking. This result is confirmed by Acrey *et al.* (2011) for the case of the largest US banks, that is, CEO compensation is either insignificantly or negatively correlated with common risk variables. In a similar framework, Bai and Elyasiani (2013) investigated the link between CEO compensation and bank stability, and found a bi-directional relationship among them. King *et al.* (2016) found that management education allows the CEOs to better manage risk-taking activities and innovative business models in order to achieve higher firm performance.

The CEO's individual characteristics could also have a significant effect on financial firm's performance. Specifically, the CEO's age could be an important factor; however, the effect is not clear and the results are mixed. On the one hand, older CEOs are more experienced, and, on the other hand, their physical and mental skills are naturally declining (Giniger *et al.*, 1983) and also they are reluctant to risk, which could lead to missed opportunities and lower firm performance. Based on these contradictory effects, Sturman (2003) hypothesized that the relationship between age and performance is non-linear (U-shaped). The results did not support his hypothesis about a U-shaped relationship; however, the nature of the relationship was indeed non-linear and significant. Mishra *et al.* (2000) confirmed that age affects CEO's motivation. Specifically, they found that younger CEOs tend to take more risks than older CEOs. McClelland *et al.* (2012) extends this rationale by arguing that older CEOs have shorter career horizons than younger CEOs, which lead them toward more risk-averse decisions and consequently to the firm's lower performance. Nguyen *et al.* (2018) investigated Australian

firms for the time period 2001–2011 and found that CEO age is a significant and negatively related factor for firm performance, meaning that younger CEOs achieve better results than older CEOs. Therefore, we build on the premise that younger CEOs are more motivated than older CEOs, which led them to achieve higher firm performance. However, we expect this relationship to be non-linear due to the essential experience of older CEOs.

Based on the above analysis, we can summarize that many scholars found a positive relationship among CEO compensation and firm performance which is either non-linear or significant only for younger CEOs (Barro and Barro, 1990; Mishra *et al.*, 2000; Nourayi and Mintz, 2008; Fong *et al.*, 2015). Therefore, we would expect that high compensation would lead to high firm performance in a configuration which a younger CEO is present:

H1. High CEO compensation for a younger CEO lead to high firm performance.

Firm size is a contingent factor and lies within the contingency theory framework of organizational design (Donaldson, 2006). The number of employees and total assets in a firm are indications of its size. Large firms differ structurally from small ones in a variety of terms such as rules and regulations, manager levels, budget and scale of operation. Chow and Fung (1997) examined manufacturing enterprises in Shanghai and found that larger firms achieve better performance. Lundvall and Battese (2000) investigated Kenyan manufacturing firms in four sectors and the results revealed that firm size is a significant indicator of performance for two sectors. Diaz and Sanchez (2008) analyzed the case of Spanish manufacturing firms and verified the significant positive relationship among firm size and performance. Chandran and Rasiah (2013) found evidence that firm size affects various aspects of firm's operational activities, such as its performance. Evidently, we expect that larger firms which have a better position in the market would achieve better performance than smaller firms. In financial literature, firm size is considered as an important factor to control the pay–performance sensitivity. John and Qian (2003) hypothesized that larger firms should have lower sensitivity regarding the pay–performance relationship and confirmed the hypothesis for the banking industry. Furthermore, Hubbard and Palia (1995), Bliss and Rosen (2001) and Ang *et al.* (2002) found a significant connection among bank size and CEO compensation.

Based on the above, we would expect large size in terms of assets and employees to be present in most of the configurations:

H2. Large-sized firms achieve high firm performance.

Another contingent factor is the age of the firm. Throughout different life stages firms evolve in terms of systems, procedures and regulations. Firms in the youth stage tend to be innovative and flexible, they are willing to take higher risks, they expand and hire, and, ultimately, they are pursuing higher growth. They are in the process to adopt and develop a framework for rules and regulations and distinguish levels of management. Firms in the maturity stage have all the above in place, have an established place in the market and significant experience in their field. On the one hand, some empirical studies show mixed results regarding how the age of firm affects firm performance (Lundvall and Battese, 2000; Söderbom and Teal, 2004). Giachetti (2012) argued that the experience is a significant factor of firm's performance. On the other hand, another strand in the literature argues that newer firms focus more on innovation, which leads them to perform better (Hansen, 1992; Balasubramanian and Lee, 2008). In line with these findings, Moreno and Castillo (2011) found an inverse relationship between age and firm's growth.

It has been reported that younger CEOs tend to take more risks than older CEOs and they also tend to be more innovative (Mishra *et al.*, 2000). Furthermore, newer firms focus more on innovation which leads them to perform better (Hansen, 1992; Balasubramanian and Lee, 2008). Therefore, we would expect that a younger CEO will lead to high firm performance in a newer firm. On the other hand, an older CEO, who is more experienced and

risk-averse, will be expected to achieve better results in an older firm where the experience is a significant factor of firm's performance (Giachetti, 2012):

H3a. Younger CEO in a newer firm leads to high firm performance.

H3b. Older CEO in an older firm leads to high firm performance.

3. Methodology

MRA treats firm's performance as the dependent variable (Y) and the CEO's total compensation and age as the independent variables (X), along with other determinants of the firm's performance. MRA assesses if the effect of a single independent variable (e.g. the CEO's compensation) on firm's performance is significant (and positive or negative) after separating it from the effect of other independent variables (net effect). Such analysis investigates a symmetrical relationship among dependent and independent variables; high values of X associate with high values of Y and low values of X associate with low values of Y . On the contrary, asymmetrical techniques allow a number of values of X to have a counter effect than the observed net effect; for example, high values of X may associate with high values of Y , but low values of X could also associate with high values of Y (Woodside, 2013). Asymmetrical relationships are undoubtedly more often in real data set than symmetrical ones (Woodside, 2014).

3.1 Variable description and data

In this study, we investigate the determinants of the performance of insurance companies with special focus on the effect of the CEO's total compensation and age. Throughout the literature, it is a common practice to use sales as a measure of the firm's performance (Anthony *et al.*, 1992; Feltham and Xie, 1994). Cook and Hababou (2001) marked the intensification of the financial services industry and the significant role of sales as a measure of their performance. In this study, we choose sales (in billion dollars) as a proxy for the performance of the insurance companies and use it as the outcome condition.

The data sample contains the top 72 insurance companies from around the world. The data set was manually extracted from multiple sources; the Forbes Global 2000[2] database, Datastream, Bloomberg and salaries.com[3]. Forbes Global 2000 is an annual ranking for the top 2,000 public companies in the world published by Forbes magazine. From the top 2,000 companies, we selected the 72 diversified insurance and life and health insurance companies. Table AI contains information about the companies in our group: the country of origin, the name of the CEO and the date they were founded. Apart from the CEO's total compensation and age, we also use additional determinants for firm performance. We use firm's assets (in billion dollars) and labor (measured as the number of employees) as measures of firm's size and key aspects of the production process. In addition, we use the number of years since the insurance company was founded as a measure of firm's seniority. The reference year for all variables is 2013. Table I presents the descriptive statistics of the variables used in the analysis, and Table II demonstrates the correlations of the variables used. The correlation matrix shows that some variables are related, while others are not related. Therefore, the symmetrical correlation test (Pearson's correlation) yields mixed results, however we suspect that our set contains asymmetrical data. In the next section, we search for these asymmetries.

3.2 Cross-tabulation

This section presents a variable by variable analysis and searches for contrarian cases in the data. We construct the cross between sales (which is the outcome variable) and every one of the simple antecedent variables[4]. All the variables have been divided into

quantiles (Woodside, 2014); the first 20 percent of the observations are “very low,” 20–40 percent are “low,” 40–60 percent are “medium,” 60–80 percent are “high” and 80–100 percent are “very high.” Table III presents the cross of sales and total compensation. Each cell contains the number of observed cases; for example, the very low sales and very low compensation takes place five times. The percentage under the observed cases is the percentage within the row; 33 percent of the cases with very low compensation have very low sales. Furthermore, there are two rounded rectangles in every table. The one on the upper right-hand side shows the negative contrarian cases; the cases where the compensation is low and the sales are high. The other one on the lower left-hand side shows the positive contrarian cases; the cases where the compensation is high and the sales are low. In Table III, there are nine negative and eight positive contrarian cases. Furthermore, Somer’s *d* is provided in every table. This statistic is an asymmetrical test and it is used for the measurement of the association between two ordinal variables. In Table III, Somer’s *d* reveals that there is a significant association between sales and compensation[5].

Regarding the overall results of sales vs every other variable, there are 33 negative and 29 positive contrarian cases. Somer’s *d* shows that every variable, except the CEO’s age, has significant association with sales. The small Somer’s *d* for age indicates a small effect size, however we observe that contrarian cases are still present. The only combination of variables which has no contrarian cases is sales-assets. Rather than using symmetrical approaches which consider only positive or negative cases, we use fuzzy-set qualitative comparative analysis (QCA) which considers both positive and negative routes of the antecedents in order to reach a high outcome condition (Wu *et al.*, 2014).

3.3 Qualitative comparative analysis (QCA)

This paper employs QCA, which is a set-theoretic approach that uses Boolean algebra to investigate the relationships among the outcome condition and every possible combination of binary states (membership and non-membership) of the antecedent conditions (Longest and Vaisey, 2008). Since our variables are continuous, they need to be calibrated for the needs of the approach. QCA is naturally based on dichotomous variables with two states, membership and non-membership. Fuzzy sets allow the calibrated variables to range from 0

	Min.	Max.	Mean	SD
Sales (B\$)	1	138.9	25.71	29.99
Total compensation (\$)	65,178	7,651,345	2,024,571	1,730,414
Age (years)	45	79	57.5	6.84
Assets (B\$)	15	1,488.7	215.6	283.6
Number of employees	226	203,366	23,642	35,587
Operating years	12	231	91.4	56.88

Table I.
Descriptive statistics of the variables

	Sales	Compensation	Age	Assets	Employees
Compensation	0.433* (0.000)				
Age	0.017 (0.889)	0.066 (0.581)			
Assets	0.773* (0.000)	0.310* (0.008)	-0.050 (0.679)		
Employees	0.730* (0.000)	0.164 (0.169)	0.011 (0.927)	0.670* (0.000)	
Years	0.255** (0.030)	0.266** (0.024)	0.058 (0.629)	0.133 (0.266)	-0.030 (0.800)

Table II.
Correlation matrix for the variables used

Notes: *,**Significant at 0.01 and 0.05 levels, respectively

Compensation * Sales Cross-tabulation

		Sales					Total
		Very low	Low	Medium	High	Very high	
Compensation	Very low	5 33.3%	3 20.0%	3 20.0%	3 20.0%	1 6.7%	15 100.0%
	Low	5 31.3%	3 18.8%	3 18.8%	4 25.0%	1 6.3%	16 100.0%
	Medium	2 16.7%	3 25.0%	5 41.7%	1 8.3%	1 8.3%	12 100.0%
	High	1 7.1%	4 28.6%	2 14.3%	3 21.4%	4 28.6%	14 100.0%
	Very high	2 13.3%	1 6.7%	1 6.7%	3 20.0%	8 53.3%	15 100.0%
Total		15 20.8%	14 19.4%	14 19.4%	14 19.4%	15 20.8%	72 100.0%

Table III.
Cross-tab of CEO's
compensation
and firm's sales

Notes: Somer's d , 0.305; p -value, 0.001

(non-membership) to 1 (full membership) with intermediate thresholds (Ragin, 2000). The procedure of the calibration is analogous to z -scale transformation. According to Woodside (2013) the three breakpoints that need to be specified are: the original value covering the 5 percent of the data set which is the threshold for non-membership; the original value covering the 50 percent of the data set which is the median threshold for membership/non-membership; and the original value covering the 95 percent of the data set which is the threshold for full membership. Following Woodside (2013) and Beraha *et al.* (2018), this paper uses the fsQCA software for the calibration of the original variables into fuzzy sets[6].

After the calibration procedure, fsQCA uses every possible combination of simple and complex antecedent conditions to find every possible route toward a high outcome condition. A complex condition in Boolean algebra is made using the logical statement "and" which is equal to the lowest value of the simple antecedents which are used, and it is denoted as " \bullet " (Woodside, 2014). For example, suppose the simple antecedents A, B and C which have already been calibrated into fuzzy sets and their values are 0.08, 0.60 and 0.45, respectively. The complex antecedent $A\bullet B\bullet C$ means that all three simple antecedents must be present simultaneously and the value of the complex antecedent is 0.08. Furthermore, the symbol " \sim " means not present. For example, $\sim A$ means A is not present and its value is $1-A = 0.92$ (Woodside, 2013). Having established the above, we can define the property space of QCA, which includes every possible combination of

antecedents (present and absent) toward the outcome condition (Ordanini *et al.*, 2014). Since there are five simple antecedent conditions in this study, the number of every possible combination of them is $2^5 = 32$. Table IV presents the property space.

Two very important indices for QCA are consistency and coverage. Consistency measures the sufficiency of the configurations (see Table IV) for the outcome condition (sales in this case). Essentially, consistency indicates the degree to which membership in each solution term is a subset of the outcome condition and it is considered as analogous to a correlation index in statistical approaches (Wu *et al.*, 2014). It is calculated as:

$$Consistency(X_i \leq Y_i) = \sum \left\{ \min(X_i, Y_i) / \sum X_i \right\}, \tag{1}$$

where Y_i is the membership score of the outcome set for the case i and X_i is the membership score of the X configuration for the case i . The final task is to remove redundant simple antecedents from the complex configurations. For example, suppose two consistent configurations: compensation●age●years and compensation●age●~years. It is easy to deduce that compensation●age is equivalent with the above two configurations, since it is present for both older and newer companies (presence and absence of “years”). For each

Antecedents	No. of cases	% of total space
~Compensation●~age●~assets●~employees●~year	7	9.72
~Compensation●age●~assets●~employees●~year	7	9.72
~Compensation●age●~assets●~employees●year	4	5.56
Compensation●age●assets●employees●year	4	5.56
Compensation●~age●assets●employees●year	5	6.94
Compensation●age●~assets●~employees●year	3	4.17
Compensation●~age●assets●~employees●year	5	6.94
~Compensation●age●assets●employees●~year	3	4.17
~Compensation●~age●assets●employees●~year	4	5.56
Compensation●age●assets●employees●~year	3	4.17
Compensation●age●~assets●~employees●~year	2	2.78
Compensation●~age●assets●employees●~year	3	4.17
Compensation●~age●~assets●employees●~year	2	2.78
Compensation●~age●~assets●~employees●~year	2	2.78
~Compensation●~age●assets●employees●year	3	4.17
~Compensation●~age●~assets●employees●~year	2	2.78
Compensation●age●assets●~employees●~year	1	1.39
Compensation●~age●~assets●employees●year	1	1.39
Compensation●~age●~assets●~employees●year	2	2.78
~Compensation●age●assets●employees●year	1	1.39
~Compensation●age●assets●~employees●year	1	1.39
~Compensation●age●~assets●employees●~year	1	1.39
~Compensation●~age●assets●~employees●~year	1	1.39
~Compensation●~age●~assets●employees●year	1	1.39
~Compensation●~age●~assets●~employees●year	1	1.39
Compensation●age●assets●~employees●year	1	1.39
Compensation●age●~assets●employees●year	0	0.00
Compensation●~age●assets●~employees●~year	0	0.00
~Compensation●age●assets●~employees●~year	0	0.00
~Compensation●~age●assets●~employees●year	0	0.00
Total	72	100.00

Table IV. Configurations of binary states of antecedents that could influence firm performance

final configuration, coverage is calculated, which shows the proportion of memberships in the outcome that is explained by the solution. Coverage is considered as analogous to r^2 in statistical approaches (Wu *et al.*, 2014). It is calculated as:

$$\text{Coverage}(X_i \leq Y_i) = \sum \left\{ \min(X_i, Y_i) / \sum Y_i \right\}. \quad (2)$$

4. Empirical findings

4.1 Test for fit validity

This section conducts QCA using the fsQCA computer software. Following Ragin (2008b), we have captured over 80 percent of the cases by setting a frequency threshold of 2.00 and also adapted consistencies over 0.75 (specifically the smallest consistency is about 0.85). Table V presents the results. Each of the five rows shows a complex antecedent condition which is sufficient for achieving high firm performance. The five configurations explain about 80 percent high firm performance in our sample (total coverage = 0.803) and the overall consistency is high (0.8875). The complex antecedents are explained as follows:

$$\text{Compensation*} \sim \text{age*assets*year}.$$

This complex configuration, which is the final antecedent in Table V, means that a path for achieving high firm performance is a younger CEO with high compensation and a large-size firm (indicated by high assets), which is in the market for many years. At first, none of the simple antecedent conditions are present in every complex solution, which implies that none of them is necessary for achieving high firm performance. However, we can see that high assets and high number of employees, which are both indicators of a large size firm, are present in four of the five solutions. Furthermore, the five different equifinal routes reveal that although every single one configuration is sufficient for high firm performance, none of them is necessary. Regarding the five sufficient configurations, the fourth (high CEO compensation, high assets and high employees) achieves the highest level of unique coverage (0.0897) meaning that it is the path which explains the largest share of the outcome variable. The complex antecedent which follows is the fifth solution (high CEO compensation, a younger CEO and a large-size firm with many years since established) with unique coverage of 0.0425. This path explains the second largest share of firm performance.

An overall examination of the results confirms *H1* – that a high CEO compensation for younger CEOs affects firm performance – since it is present in the second solutions with the highest unique coverage. This finding verifies the results of Barro and Barro (1990), who found a positive relationship between total compensation and firm's performance; however, more experienced CEOs were affected less by compensation changes. *H2*, about the size of

	Raw coverage	Unique coverage	Consistency
~Age*employees*~year	0.42	0.03	0.87
Assets*employees*~year	0.47	0.04	0.98
~Age*assets*employees	0.55	0.01	0.98
Compensation*assets*employees	0.61	0.09	1.00
Compensation*~age*assets*year	0.43	0.04	0.92

Complex solution

Frequency cutoff: 2.00

Consistency cutoff: 0.858746

Solution coverage: 0.803021

Solution consistency: 0.887564

Table V.
Configurations
predicting high
firm performance

the firm, is validated in every configuration, since a larger size either in terms of assets or employees is present in every configuration, which is in line with the previous literature (Chow and Fung, 1997; Lundvall and Battese, 2000; Diaz and Sanchez, 2008). Furthermore, the results are contradictory regarding *H3*. Specifically, *H3a* – younger CEOs in newer firms achieve better firm performance – is verified in the first solution in Table V. This confirms the results of Nguyen *et al.* (2018) and is in line with the argument of Mishra *et al.* (2000) about the CEO’s age and motivation. However, *H3b* – older CEOs in older firms achieve better firm performance – is not verified. In fact, the last solution in Table V shows that younger CEOs can achieve high firm performance in older and larger firms.

The results provide valuable insights for the decision maker. First, a higher compensation seems to lead to high firm performance in the case of larger firms. Furthermore, larger firms in terms of assets and number of employees achieve better firm performance with a younger and more motivated CEO. Last, investment in expanding the firm in terms of either assets and/or number of employees should lead to higher firm performance in most of the cases.

4.2 Robustness check

This section conducts QCA but, instead of using sales, it used stock returns as a measure of firm performance. Core *et al.* (2006) and Li *et al.* (2015) argued that accounting-based variables are better proxies for firm performance and that it is a common practice for credit-rating agencies and banks. Furthermore, managers are often evaluated in terms of accounting-based indicators of firm performance. Furthermore, it can be argued that market-based indicators do not reflect the current firm performance, which can be addressed as an inverse cycle of production. An accounting-based indicator solves this issue. Various accounting-based indicators have been used across the literature such as return on assets (Matolcsy and Wright, 2011), return on equity (Li *et al.*, 2015), shareholder return (Ozkan, 2011). In this section, we follow Brick *et al.* (2006), Core *et al.* (2006) and Larcker *et al.* (2007), and use stock returns as a measure of firm performance.

Table VI presents the results. In this case, we have captured only the 66.6 percent of the cases by setting a frequency threshold of 2.00 and consistencies over 0.75. The coverage is smaller than the case of sales because there are more cases here with consistencies below the threshold of 0.75. Each of the five rows in Table VI show a complex antecedent condition which is sufficient for achieving high firm performance. The five configurations explain about 66.6 percent high firm performance in our sample (total coverage = 0.666) and the overall consistency is 0.687.

First, none of the simple antecedent conditions are present in every complex solution, which implies that none of them is necessary for achieving high firm performance. Furthermore, the five different equifinal routes reveal that although every single one configuration is sufficient for high firm performance, none of them is necessary. Regarding the five sufficient

	Raw coverage	Unique coverage	Consistency
Age*~assets*~employees*year	0.41	0.15	0.75
Compensation*~age*assets*employees	0.42	0.06	0.79
Compensation*~age*assets*years	0.39	0.02	0.77
~Age*assets*employees*year	0.37	0.01	0.78
Compensation*assets*employees*year	0.42	0.04	0.76

Complex solution

Frequency cutoff: 2.00
 Consistency cutoff: 0.751767
 Solution coverage: 0.666314
 Solution consistency: 0.687159

Table VI.
 Configurations predicting high firm performance: robustness check

configurations, the first (high CEO age, low assets, low employees and high number of years) achieves the highest level of unique coverage (0.145326), meaning that it is the path which more frequently leads to high firm performance. This solution means that there is a path for small firms (in terms of assets and number of employees) to achieve high firm performance, and that is if they have an older and more experienced CEO and they are in market for a long time period. The complex antecedent which follows is the second solution (high CEO compensation, a younger CEO and a large-size firm) with a unique coverage of 0.055732.

An overall examination of the results reveals that the new outcome variable does not contradict but at the same time does not reinforce previous results. Specifically, this confirms *H1* since it is present in the second and the third solutions in Table VI, which is in line with our previous findings. In contrast with the case of sales, we find evidence supporting the *H3b* but no evidence about *H3a*. Specifically, the first solution in Table VI, which is the solution with the higher unique coverage, supports that older CEOs in older firms achieve higher firm performance, even if the firm is small in size. There is also the fourth solution where younger CEOs achieve high firm performance in older and larger firms, but this solution has a significantly lower unique coverage than the previously mentioned. Last, *H3* is verified in all but the first solution.

Although there are various paths to firm performance, we can detect a pattern. A more experienced CEO seems to be a better solution for smaller firms while bigger firms should invest in younger more motivated CEOs which is contradicting with our hypotheses. A high CEO compensation and a long time period in the market seem to be good choices toward high firm performance since they are present in most of the solutions.

A comparison between the stock returns model in this section and the sales model in the previous section reveals that the later has a better fit in modelling terms. However, in terms of interpretation, they yield similar results. First, both of them support a higher CEO compensation toward high firm performance. Second, there is a solution (the best solution) in the case of stock returns which is different but not contradicting with the case of sales. This solution shows that smaller firms have indeed a path toward high firm performance. Apart from that solution, both of the models find that a younger CEO is preferred for larger firms and that a longer time period in the market is a good element for success.

4.3 Test for predictive validity

Figure 1 presents the *XY* plot of fourth and fifth configurations in Table V and the outcome condition (firm performance). Each dot represents one or more firms since two or more firms

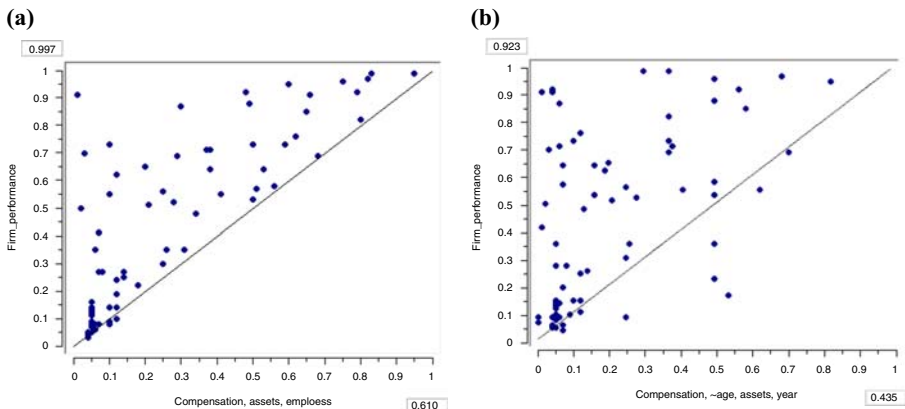


Figure 1.
XY plot of complex antecedents with outcome condition (firm performance)

may achieve the same score. Figure 1(a) represents the configuration with the highest unique coverage and Figure 1(b) the configuration with the second highest unique coverage. The *XY* plots of remaining three configurations and firm performance are similar with either Figure 1 (a) or (b). Every *XY* plot in our study reveals that the relationships are indeed asymmetrical. For example, Figure 1(a) indicates that high values of the complex antecedent lead to high values of firm performance; however, low values of antecedent lead to both high and low values of firm performance. Therefore, high values of *X* are sufficient for high firm performance but not necessary, since low values of *X* could also lead to high firm performance (Woodside, 2013). This is a strong indication of an asymmetrical relationship. This finding could be associated with the results of Sturman (2003), Bulan *et al.* (2010) and Fong *et al.* (2015), who found that the CEO's compensation and age have a non-linear relationship with firm performance. This valuable information would have been taken into consideration if we had used regression analysis or other symmetrical approaches.

According to Gigerenzer and Brighton (2009), it is important to test not only for fit validity but also for predictive validity. Following Wu *et al.* (2014), we split our sample into two subsamples. We use the first as a modeling subsample and the second as a holdout subsample. Table VII presents the results of the modeling subsample where the second configuration:

Compensation*assets*employees

achieves by far the highest unique coverage (0.1885). Notice that the same configuration also achieved the highest unique coverage in the whole sample in Table V. Next, Figure 2 presents the *XY* plot where we test the findings of the modeling subsample using the data from the holdout subsample. The results show that the model is highly consistent (0.996) with high coverage (0.557), supporting that our model has high predictive validity.

5. Conclusions

In this study, we have used tenets of the complexity theory, in order to study the effect of CEO's compensation and age on the firm's performance. Instead of using MRA or other symmetrical approaches, we identified the asymmetries in the data set using contrarian analysis. The results reveal the presence of both positive and negative contrarian cases. Rather than ignoring this valuable information and use a main effects approach, we chose to exploit all the available information in the data set. For this purpose, we used QCA to find alternative equifinal routes toward high firm performance.

The empirical findings revealed five configurations which can lead to high firm performance. The configuration which leads to higher performance more often found to be the one with high CEO's compensation and a large-sized firm (a firm with both high assets and high number of employees). Furthermore, we confirmed that no single antecedent

	Raw coverage	Unique coverage	Consistency
~Compensation*employees*~year	0.40	0.04	0.92
Compensation*assets*employees	0.65	0.19	1.00
~Compensation*~age*assets*~year	0.35	0.05	0.97
~Compensation*age*~assets*employees	0.27	0.01	0.93
Compensation*~age*employees*~year	0.39	0.01	0.95

Complex solution

Frequency cutoff: 1.00

Consistency cutoff: 0.905297

Solution coverage: 0.8208833

Solution consistency: 0.0941458

Table VII.
Configurations
predicting high firm
performance for the
modeling subsample

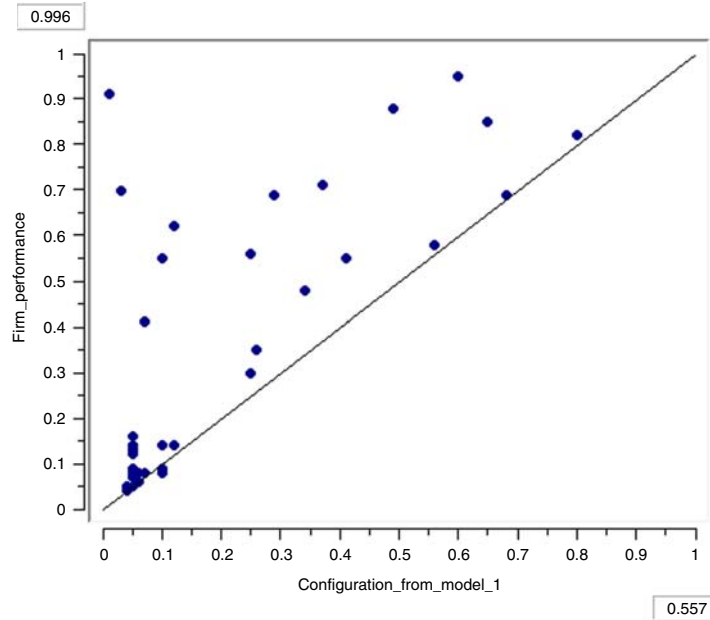


Figure 2.
XY plot to test for predictive validity using the second configuration from the modeling subsample and the data from the holdout subsample

condition leads to high firm performance and there is a need for complex antecedents (which are consisted by simple antecedents). Also, the results showed that every single one of the final five configurations is sufficient for achieving high firm performance; however, none of them is necessary, since the high outcome could be achieved with alternative configurations, even if they are less frequently used by the firms. Finally, we tested for predictive validity using a modeling and a holdout subsample.

The results reveal that the CEO's high compensation relates to high firm performance, especially for younger CEOs, which is in line with the findings of previous studies (Barro and Barro, 1990). Furthermore, larger firms in terms of assets and number of employees, achieve better firm performance with a younger and more motivated CEO. On the other hand, a more experienced CEO appears as a better solution for smaller firms. Last, investment in the size of the firm, either in terms of assets or number of employees, leads to high firm performance, which confirms the findings of Chow and Fung (1997), Diaz and Sanchez (2008) and Lundvall and Battese (2000). The results of robustness check, where stock returns replace sales as the outcome condition, verify our findings. Specifically, there is strong evidence regarding the hypothesis that high compensation for a younger CEO lead to high firm performance.

The results provide useful policy implications for the interested groups (among others shareholders, CEOs, investors). Achieving high firm performance is multi-dimensional in nature and cannot be achieved by focusing only on a single element (e.g. CEO compensation). Also, there is no perfect "recipe" toward high firm performance. On the other hand, there are multiple alternative routes that a firm can follow to achieve high firm performance, as long as it adopts the correct strategy mix.

5.1 Limitations

This section presents the limitations of our analysis. First, the reference year for our data set is 2013. The data were manually collected and some data were only available for a year.

If more years were available, it would be very interesting to examine lagged models. Specifically, we could analyze the impact of lags in configuration on outcome predictive accuracy. We believe that such an analysis would add great depth to our model and also valuable insights for the decision maker.

Furthermore, there is a limitation regarding the use of market-based indicators as a measure of firm performance. We have addressed this issue in Section 4.2. Specifically, we argued that accounting-based variables may prove to be better proxies for firm performance. In this essence, we used stock returns as a measure of firm performance to perform a robustness check of our results.

Notes

1. CEOs' compensation has attracted the research interest regarding many aspects of a firm, for example, risk exposure (Fahlenbrach and Stulz, 2011), regulation/deregulation (Cunat and Guadalupe, 2009), and mergers and acquisitions (Kroll *et al.*, 1990).
2. www.forbes.com/global2000/list/
3. www.salary.com/personal/executive-salaries/
4. Independent variable.
5. The other four tables with the crosstabs of sales and each one of the remaining four antecedents (age, assets, number of employees and years since establishment) are available upon request.
6. For a detailed explanation of the calibration technique, see Ragin (2008a).

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Appendix

Firm performance

Company	Country of Origin	CEO name	Founded
Allianz	Germany	Michael Diekmann	1890
AXA Group	France	Henri De Castries	1852
American International Group	USA	Robert Benmosche	1919
Ping An Insurance Group	China	Mingzhe Ma	1988
MetLife	USA	Steven Kandarian	1999
Zurich Insurance Group	Switzerland	Martin Senn	1872
Munich Re	Germany	Nikolaus von Bomhard	1880
Generali Group	Italy	Mario Greco	1831
Swiss Re	Switzerland	Michael Lies	1863
Allstate	USA	Thomas Wilson	1931
ACE	Switzerland	Evan Greenberg	1985
Aegon	Netherlands	Alex Wynaendts	1969
CNP Assurances	France	Frederic Lavenir	1959
Mapfre	Spain	Antonio Huertas Mejias	1933
Talanx	Germany	Herbert Haas	1903
Sampo	Finland	Kari Henrik Stadigh	1909
Loews	USA	James Tisch	1904
Ageas	Belgium	Bart De Smet	1824
Suncorp Group	Australia	Patrick J Snowball	1902
Hartford Financial Services	USA	Liam McGee	1985
XL Group	Bermuda	Michael Mcgavick	1986
Scor	France	Denis Kessler	1855
Bâloise Group	Switzerland	Martin Strobel	1864
Vienna Insurance Group	Austria	Peter Hagen	1898
Unipol Gruppo	Italy	Carlo Cimbri	1961
Everest Re Group	Bermuda	Joseph Taranto	1993
Reinsurance Group of America	USA	Albert Greig Woodring	1992
Assurant	USA	Robert Pollock	1969
Helvetia Holding	Switzerland	Stefan Loacker	1996
Ambac Financial Group	USA	Diana Adams	1971
Storebrand	Norway	Odd Arild Grefstad	1982
Uniq	Austria	Andreas Brandsetter	1922
Delta Lloyd	Netherlands	Niek Hoek	1807
PartnerRe	Bermuda	Constantinos Miranthis	1993
American Financial Group	USA	Carl Lindner III	1872
Direct Line Insurance	UK	Paul Geddes	1985
Cincinnati Financial	USA	Steven Johnston	1950
Axis Capital Holdings	Bermuda	Albert Benchimol	2001
Markel	USA	Alan Kirshner	1930
Assured Guaranty	Bermuda	Dominic Frederico	1988
E-L Financial	Canada	Duncan N R Jackman	1968
Cattolica Assicurazioni	Italy	Giovan Battista Mazzucchelli	1896
Erie Indemnity	USA	Terrence Cavanaugh	1925
American Natl Ins	USA	Robert Moody	1905
China Life Insurance	China	Feng Wan	1949
ING Group	Netherlands	Ralph Hamers	1991
Prudential	UK	Tidjane Thiam	1848
Aviva	UK	Mark Wilson	1908
AIA Group	Hong Kong	Mark Tucker	1919
Manulife Financial	Canada	Donald Guloien	1887

(continued)

Table A1. Companies information

Company	Country of Origin	CEO name	Founded
Aflac	USA	Daniel Amos	1955
Legal & General Group	UK	Nigel Wilson	1836
China Pacific Insurance	China	Guo fo Gao	1991
Sun Life Financial	Canada	Dean Connor	1865
Power Corp of Canada	Canada	Paul Desmarais Jr	1925
Standard Life	UK	David Nish	1825
Lincoln National	USA	Dennis Glass	1904
Prudential Financial	USA	John Strangfeld Jr	1875
Principal Financial Group	USA	Larry Zimpleman	1879
Unum Group	USA	Thomas Watjen	1848
Sanlam	South Africa	Johan van Zyl	1918
Mediolanum	Italy	Ennio Doris	1995
Phoenix Group Holdings	UK	Clive C Bannister	1782
Industrial Alliance Insurance	Canada	Yvon Charest	1905
Torchmark	USA	Larry Hutchison	1900
CNO Financial Group	USA	Edward Bonach	1979
MMI Holdings	South Africa	Nicolaas Kruger	1989
American Equity Investment	USA	John Matovina	1995
Symetra Financial	USA	Thomas Marra	1957

Table A1.

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